# **Plant protection in post-Soviet Kazakhstan:** ***The loss of an ecological perspective***

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**TO MY FAMILY**

# CONTENTS

# *Chapter 1*

# Introduction: The study of plant protection perspectives in Kazakhstan

## 1.1 Introduction

Problems related to pest control and pesticide use in agriculture can be found in similar forms across the world. Worldwide, crop production losses from agricultural pests[1] average 35-40% before harvest and 10-15% after harvest (e.g. Oerke et al. 1994, Struik and Kropff 2003). After the introduction of synthetic pesticides after World War II, agriculture in many countries became reliant on chemical pest control. In the 1960s, the environmental and health problems became apparent, as did the problems of pests becoming resistant to pesticides and the destruction of natural enemies leading to pest resurgence and secondary pest outbreaks. Farmers often use pesticides injudiciously, and find themselves caught on a pesticide treadmill,[2] which increases the social, environmental and economic costs of chemical control (Bale et al. 2008, Carson 1962, Kishi 2005, Palladino 1996, Perkins 1982, Pretty and Waibel 2005). These problems with pesticides gave way to the Integrated Pest Management (IPM) approach, which utilises ecological principles to manage agro-ecosystems in an economically and environmentally sustainable fashion (Kogan 1998, 1999, Morse and Buhler 1997, Struik and Kropff 2003). IPM has become an alternative approach to exclusive reliance on pesticides as the sole means of pest control (Van Huis and Meerman 1997). This change in approach has been quite widely accepted, although not universally.

This thesis explores the case of Kazakhstan where integrated pest management, once widely practised, has given way to an exclusive reliance on pesticides. IPM/ecology-based pest-control approaches were extensively developed and practised in the 1970s and 1980s in the USSR, which Kazakhstan was then part of. The USSR was an early adopter of IPM. This changed dramatically in Kazakhstan after 1991 with the fall of the Soviet system, when sustainable approaches to pest control were substituted by an exclusive focus on chemical pest control. This has given rise to indiscriminate pesticide use. The focus of plant protection research also shifted from IPM/ecology-based studies to pesticide testing. The starting point of this study is to examine this paradox that, at the moment, when Kazakhstan became more strongly incorporated in a world that sees sustainable production methods and ecologically-friendly pest control as an important priority the country abandoned an IPM approach to pest control. To date, no literature has addressed this shift and looked for reasons behind abandoning the ecological approaches for pest control developed and practised in the past. This paradox leads us to the central research question of this dissertation: Why did the shift occur from an IPM/ecology-centred to pesticide-centred pest-control perspective in Kazakhstan after 1991?

The hypothesis of this study is that the shift from IPM/ecology-based pest control to indiscriminate pesticide use is a consequence of the post-1991 socio-economic changes. This hypothesis suggests that the shift in pest-control perspectives cannot be explained by references to the internal dynamics in the knowledge domain, but may be strongly influenced by the political-economic changes. These changes occurred after the disintegration of the Soviet Union in 1991 when the government of Kazakhstan adopted a neoliberal system, in line with the advice of international financial institutions (e.g. World Bank 1993, 1994). This hypothesis informs the key sub-questions that are addressed: How did agrarian structures change and how did this impact upon the agricultural knowledge structure? And, under what conditions did particular pest-control perspective come to dominate farming practice and research?

To answer the research questions, this study specifically examines and compares the post-1991 farming structures and activities, pest-control practices and functioning of plant protection research and extension with those of the Soviet past. These are discussed in four empirical chapters (Chapters 2 to 5) of this dissertation. This dissertation will describe how within the wider knowledge system (farming, research, extension and policymaking) thinking about pest control changed and the essential elements of sustainable forms of pest management were abandoned in Kazakhstan after 1991. Crucial factors influencing pest-control perspectives that came to the fore in this study (and which will be discussed in detail in the various chapters) are the transformation of the agrarian structure, the destruction of the state/public level organization of pest management, the neglect of research and extension and the aggressive pesticide promotion campaigns. The thesis will discuss how these factors had negative consequences for those forms of pest control that require higher levels of social integration and sophisticated forms of knowledge, which have a long-term perspective and are able to deal with complexity, variability and uncertainty in open agro-ecosystems. The thesis also analyses the conditions that enable or restrict concerted action for pest control and the extent to which the plant protection domain, which developed and promoted ecologically sustainable pest control methods and technologies, is conceptualized as a public good.

The focus on one particular field of agricultural research and practice, namely plant protection, is instructive for exploring wider political, socio-economic and technological issues. The study of plant protection perspectives in Kazakhstan in two different socio-economic and political formations reveals the crucial role of state organization and public and market institutions in shaping pest-control perspectives. It puts upfront the issue as to which elements of scientific knowledge and knowledge/skill configurations have to be preserved when dramatic political-economic changes tend to undermine the dynamic development and application of science.

## 1.2 Conceptual framework

The conceptual focus of this thesis is mainly on transition, public goods, collective action, integrated pest management and knowledge. These topics will be elaborated in detail in the four empirical chapters (2-5) of this dissertation. This section introduces these concepts.

### 1.2.1 *Transition*

In the 1990s, the world witnessed an unprecedented scale of price liberalization, privatization and deregulation in the countries of Central and Eastern Europe and the former Soviet Union. After the collapse of the USSR in 1991, Kazakhstan became influenced by neoliberal ideology and was drawn into a transitional process towards a free market economy (World Bank 1993). The concept of transition was theoretically viewed as an economic, social and political transformation towards a free market economy and democracy (Sasse 2005, Spoor 2003, Svejnar 2002, Tanzi 1999). Markets appeared, though not in the form envisioned in theoretical prescriptions, and new political regimes emerged, though not necessarily democratic. The failure of neoliberal prescriptions (liberalize, privatize and deregulate) has become evident in many countries, where the invisible hand of the free market has not been able to regulate the economy for the benefit of its people and national interests have not been served (Harvey 2003, 2005, Henry 2008). Now, especially after the global financial crisis, from the autumn of 2008 onwards, it is increasingly accepted that only a visible state with well-defined functions is able to regulate the market so that it serves common interests. Currently, many societies are seeking a new balance between state and market institutions.

The process of transition from a state-centred to a neoliberal economic formation points to the importance of studying the extent to which the new socio-economic configuration that emerged after 1991 in Kazakhstan influenced changes in technological thinking and practices, such as plant protection.

### 1.2.2 *Public good*

This thesis conceptualizes the development and promotion of sustainable ecology-based plant protection approaches as a public good, even though many on-farm pest-control activities have to be dealt with privately. A public good is any good that, if supplied to anybody is necessarily supplied to everybody, and from whose benefits it is impossible or impracticable to exclude anybody (McLean and McMillan 2003). In other words, public goods are non-exclusive and non-rivalled (Kaul and Mendoza 2003, Scott and Marshall 2005). In most cases, the state provides a public good, e.g., national defence or a fire service.

This thesis identifies three reasons to support the notion that the development and promotion of ecologically sound methods and technologies for pest control is a public good. First, when national food and/or health security is at stake research on, and control of, highly harmful pest organisms, including quarantine and migratory ones, becomes the task of public institutions (e.g. Perrings et al. 2002, Toleubayev et al. 2007). Second, investment in, and the development and promotion of environmentally friendly pest-control measures, resolves several problems associated with chemical control – the pollution of the environment, health hazards during application and pesticide residues in food that affect the health of people (Kishi 2005). Third, considerable resources are necessary to develop and promote long-term ecologically sound methods and technologies of pest control and, to a large extent, only the state can afford this (Pretty and Waibel 2005). Hence, the concept of public good is essential for analysing the shift from an IPM/ecology-based perspective to one based on the use of pesticides in Kazakhstan after 1991.

Problems caused by agricultural pests are significant – from outbreaks of highly destructive migratory insect-pests (e.g. locusts) to crop diseases causing epiphytotics (epidemics) across vast cropping areas (e.g. stem rust). These pest organisms recognise no frontiers, can devastate thousands of hectares of crops and pose a threat to national food security. Individual farmers cannot monitor such pest organisms or develop ecologically sustainable and environmentally friendly preventive and/or protective measures against them. Thus, these activities very often require formalized knowledge systems and collective (concerted) action from government offices, researchers, extensionists and farmers.

### 1.2.3 *Collective action*

Collective action in the spheres of agriculture, environment and development can take various forms (e.g. Agrawal 2003) and there is disagreement about how to distinguish between different forms of collective action (Meinzen-Dick et al. 2004, Poteete and Ostrom 2004). Contemporary issues in this area largely focus on the management of common-pool resources, which are discussed in relation to processes of the decentralization of central state control over natural resources (Agrawal and Ostrom 2001, Acheson 2006), and the large-scale political activism of social movements (Edelman 2001, Hargrave and Van de Ven 2006). Collective action can emerge in situations where uncoordinated individual actions may not result in the best outcome (McLean and McMillan 2003).

One illustrative example is uncoordinated pest control in a farming community. If one farmer controls pests on his/her plot but the neighbour does not, then pest organisms accumulate on uncontrolled fields and subsequently re-infest adjacent plots where control measures were carried out. Thus the efforts of the farmer who carried out control measures fail. Equally if the timing of control measures is different on neighbouring fields this also may result in unsuccessful pest control, because one farmer carries out control measures too early and the other neighbour is too late in controlling pests. Therefore, an optimal control time needs to be set and neighbouring farmers should agree on appropriate control methods and synchronize their plant protection activities. In many cases, this requires the involvement of plant protection professionals. Furthermore, problems associated with agricultural pests and pesticides frequently require collective action at a higher level than that of individual farmers' fields.

Collective action involves a group of people with a shared interest who are prepared to take some kind of common action in pursuit of that shared interest (Meinzen-Dick et al. 2004). This thesis does not address many of the models or concepts, e.g. such as a game theory, prisoner's dilemma, free-riding or rational behaviour often associated with the term ‘collective action’ (Harding 1982, Olson 1971, Sandler 1992). Instead, it simply conceptualizes collective action as joint and concerted action from policymakers, plant protection researchers and practitioners, service and input providers and agricultural producers in order to deal with pest and pesticide problems. Equally, the phrase ‘loss of collective action’ is used in this thesis to imply the shift from an IPM/ecology-based to pesticide-based pest control, as happened in Kazakhstan after 1991.

### 1.2.4 *The knowledge-intensiveness of Integrated Pest Management*

One could argue that the concept of collective action underlies recent developments in participatory approaches to Integrated Pest Management (IPM), often through Farmer Field Schools (FFS), where farmers obtain knowledge about the ecology and functioning of their own agro-ecosystems (e.g. Norton et al. 1999, Van den Berg 2004, Van den Berg and Jiggins 2007).

IPM-based pest control needs to be incorporated into everyday farming routines through explicitly knowledge-based plans for action. Integrated pest management, as any knowledge domain, requires certain skills, often of a highly specialized nature, on the part of the practitioner and user of the knowledge (Holzner and Marx 1979). For this reason, the role of plant protection professionals and facilitators is very important in promoting IPM knowledge in farming communities (Flint and Gouveia 2001, Morse and Buhler 1997, Van den Berg 2004), particularly through FFSs. While it has the direct effect of reducing pesticide use and/or elevating yields, it also enhances farmers’ technical, educational, social and political capabilities (e.g. Bartlett 2004).

IPM is a multifaceted technological approach that incorporates a wide range of sustainable pest-control methods (e.g. biological, agronomic and physical) to manage agricultural pests in complex agro-ecosystems and to reduce pesticide use (Bale et al. 2008, Kogan 1998, Morse and Buhler 1997, Van Huis and Meerman 1997, Van Lenteren 1997). IPM is very knowledge-intensive (Flint and Gouveia 2001, Morse and Buhler 1997) and requires an extensive knowledge of agro-ecosystems. The knowledge-intensity of IPM is one key factor in explaining the decline in IPM/ecology-centred approach and the rise in to pesticide-centred approach to plant protection in post-1991 Kazakhstan.

## 1.3 Research methodology

This research has employed an in-depth qualitative account to study micro-processes within two different (Soviet and post-Soviet) political and socio-economic formations to generate data for comparative analysis. More specifically it uses a *technographic* approach to observe, describe and locate the technical facts (i.e. related to agricultural production and pest control) within the socio-economic contexts (Sigaut 1994). Richards (2001) suggests that ‘technography’ is a useful label to emphasize the importance of capturing the full complexity of social and biological worlds and to achieve contextual understanding of agro-ecosystem development. This thesis deals with the impact of post-1991 neoliberal reforms on an established sustainable pest-control system from the Soviet era, and a technographic approach was adopted as an analytical instrument to study plant protection in the context of agrarian and broader changes in post-Soviet era.

Interpretation of data of the specific case studies (Bernard 2002, Miles and Huberman 1994, Yin 2003) is presented in the four empirical chapters of this thesis, following the type of reasoning applied in the extended case method (Burawoy 1998), and combining this with the use of technical knowledge concerning crops, pest organisms and plant protection approaches. The extended case method takes the social situation and context as the point of empirical examination, to understand how micro-situations are shaped by wider structures and vice versa. It extracts the general from the unique, moves from the micro to the macro and connects the present to the past in anticipation of the future.

Data and information were obtained and cross-checked through open-ended and semi-structured interviews, participant observations and study of literature, documents and media (Bernard 2002, Mason 2002, Miles and Huberman 1994, Silverman 2001, Spradley 1980, Verschuren et al. 1999).

One potential weakness of the predominant use of qualitative methodology was the lack of quantitative indicators derived from own surveys (except for data on the research staff of the Kazakh Research Institute for Plant Protection in Chapter 4) to support the points made throughout the thesis. However, the quantitative findings of other scholars do support the qualitative findings of this study (e.g. Gurevich and Suleimenov 2006, Peabody et al. 2000).

### 1.3.1 *Interviews with research actors*

To understand the depth and complexity in people’s situated and contextual accounts and experiences, open-ended and semi-structured interviews were conducted. The interviewees were people who had worked and lived in Soviet collective farms, practising farmers and rural inhabitants, farmers’ representatives, current and former agricultural researchers, research managers, plant protection practitioners, university lecturers, local authorities, policymakers and input suppliers and service providers for the farming sector. In total 111 interviews were conducted, of which 58 were digitally recorded, providing 48 hours of recorded interviews - an average of 50 minutes per interview. All the digitally recorded interview files were stored in a computer and played back for transcription purposes, for clarification of points made by interviewees and/or for refreshing the researcher’s memory about a particular interview and the context in which it was carried out. Interviews were conducted in the Kazakh and Russian languages.

Being a Kazakh native speaker and fluent in Russian made communication with research actors unconstrained in terms of language. In most cases, interviews were conducted as ‘a conversation with a purpose’ rather than a ‘dry’ inquiry. Interview questions were open-ended and the interviewee had the freedom to elaborate on issues. But as interviewer I kept in mind a certain set of issues to ask about, discuss or clarify. In cases where people did not want the interviews recorded, I jotted down the main points during or immediately after the interview. Others asked to pause recording when they wanted to reveal sensitive information. An advantage of having a compact digital recorder is that it has twelve hours of non-stop high-quality mode of recording and can capture voices from a remote distance. This meant that, after asking permission to record the interview, the recorder could be placed out of the sight of the interviewee. In this way, the interviewee was not disturbed and the interview generally proceeded in a relaxed manner.

Depending on the context, situation and interviewee, I emphasized specific aspects of my background as a villager, agronomist, plant protection researcher and/or a doctoral researcher at a foreign university. This helped to gain the confidence of respondents, as someone who could understand their concerns and follow the points they were making.

### 1.3.2 *Participant observation*

I participated in numerous farming activities, research fieldtrips and meetings involving farmers, agricultural researchers, government bodies, input suppliers and/or service providers. The ways in which they communicated between each other were noted, photos of the activities were taken and any speeches made during these gatherings were recorded on a digital recorder.

### 1.3.3 *Archives and secondary data sources*

In this study, the archive of the Republican Plant Protection Station should have been a key resource in generating an overview of pre-1991 pest-control activities throughout Kazakhstan. However, its location could not be traced since archives in post-Soviet Kazakhstan have been neglected and some archives have been lost entirely. According to key informants, this particular archive was neglected in the 1990s, and lost when the Ministry of Agriculture moved from Almaty,[3] the former capital, to the new capital, Astana, in 1997-1998. Fortunately, it was possible to find archival documents, such as the annual reports of some Soviet collective farms and the plant protection stations that were located in the Almaty region, in the Almaty regional archive. However, it took some time to gain approval from the Head of the Archive to access and photocopy material. Documents from this archive were studied carefully to reconstruct past activities, and some of these archive items are referenced in this dissertation. The archive of the Kazakh Research Institute for Plant Protection was also studied to gather data on staff statistics and to review scientific reports and grey documents. Personal ties were important in gaining access to these documents; normally access would not be granted to an outsider.

Literature, documents, media and press coverage on the past and current state of the farming sector, agricultural research and the plant protection service in the Soviet and post-1991 periods were also reviewed.

Photographs were taken of deteriorated and dismantled farming and social infrastructures to provide 'material evidence'[4] for the arguments made in Chapter 2. Photos taken at village markets provide material evidence for Chapter 3 about the illegal pesticide trade in contemporary Kazakhstan. Pictures of Soviet era research equipment in the Kazakh Research Institute for Plant Protection were taken to provide material evidence for the points made in Chapter 4.

### 1.3.4 *Fieldwork period*

Formally, this PhD project started in January 2005. The fieldwork for this study took place in July-October 2005, April-September 2006 and May-August 2007. Thus, in sum, 14 months fieldwork was carried out during three years. In addition, I did a pilot study for this research in 2004 while being employed at the Kazakh Research Institute for Plant Protection. This allowed me to become acquainted with some research actors and sites, and allowed me to conduct preliminary interviews and make the first observations. Hence, before commencing the actual research, preliminary findings helped to compose the research design and develop a research strategy.

### 1.3.5 *Research sites and case studies*

This research was carried out in two regions of Kazakhstan: the Almaty region in the southeast and the Semey region in the northeast. There were two main reasons for selecting these two spatially separate regions. First, to have a broader research context for drawing inferences about certain socio-economic (e.g. land distribution or farm types), technological (e.g. farming practices) and natural phenomena (e.g. agro-climatic conditions). Second, a long familiarity with both regions saved time in becoming acquainted with the research sites and actors.

The selection of the cases for each empirical chapter had a purposive character (Bernard 2002, Mason 2002, Yin 2003), in order to reveal the situation on the ground and support a particular argument developed in the chapters in question. Three kinds of argument were developed throughout the empirical chapters, viz.: developmental (how something has developed), mechanical (how something works or is constituted) and comparative (how a social phenomenon is explained from a specified set of comparisons) (Mason 2002). The developmental argument was constructed to provide a detailed, contextual and multilayered interpretation of data, and to illustrate developmental processes (in particular, the process of post-Soviet transition in an agrarian context in Chapter 2 and the evolution of locust control system in Chapter 5). Second, the mechanical argument was used to focus on how certain phenomena and processes operate or are constituted in certain contexts (in particular, IPM and pesticide use in Soviet and post-Soviet context in Chapter 3, and plant protection research in the Soviet and the post-Soviet periods in Chapter 4). Third, the comparative argument aimed to draw explanatory significance from a specified set of comparisons (all chapters). The qualitative research was particularly useful here, since its sensitivity to context increased the opportunities for developing meaningful points of comparison between the material in the four empirical chapters.

Chapter 2 reconstructs the Soviet agricultural setting by using and cross-referencing information obtained from interviews, archival documents and the literature. This analysis benefited from rethinking personal observations made in the 1980s, when I lived in sovkhoz *Sotsialistic* (Socialist) in the Semey region. It was relatively easy to characterize Soviet farming setting because of its homogeneity, although rather more difficult to picture the extremely heterogeneous post-Soviet agricultural setting. In total, 21 crop production farms of various sizes were studied. They had different technological processes, infrastructure, division of labour and access to inputs and machinery. In this research, the sizes of farm fields used for crop production varied from one ha to 3,000 ha.[5] Farms with different amounts of arable land were purposively selected to compare the way in which different types of agricultural producers operate on and deal with pest problems.

Soviet era data on Integrated Pest Management in Chapter 3 were obtained from the archives of the Kazakh Research Institute for Plant Protection and the Alma-Ata Oblast[6] Plant Protection Station and its raion[7] branches. Moreover, a complete review was made of the contents of all the issues of the *All-Union Journal of Plant Protection* between 1935 and 1991. Information about the pest-control research and practices since 1991 was obtained through a study of recent issues of the journal *Plant Protection (and Quarantine) in Kazakhstan*,[8] interviews with farmers, plant protection researchers and practitioners and from own observations made in the Almaty and Semey regions.

The Kazakh Research Institute for Plant Protection (KRIPP) was selected as a case study for Chapter 4, to highlight the evolution of agrarian science and the pest-control research agenda before and after 1991. KRIPP is located in the Almaty region in the southeast of Kazakhstan. An internship in 1998 during my bachelor study and my employment at this institute since 2002 gave me a chance to establish a rapport with its personnel (most of whom I interviewed for this study) and to know the dynamics and conditions under which KRIPP has to operate. Sharing together grey and sunny days in the working environment and mutual support in informal situations allowed building a high level of trust and rapport with many employees. In addition, I established good relationships with managers and researchers of the Research Institute for Potato and Vegetable Farming and the Research Institute for Arable Farming in the course of joint projects, and this helped in carrying out unconstrained in-depth interviews for this study.

In Chapter 5, locust pests, namely the Italian Locust (*Calliptamus italicus* L.) and the Asiatic Migratory Locust (*Locusta migratoria migratoria* L.), served as a case study in order to examine from an interdisciplinary perspective the co-evolution of locust populations, land-use systems, knowledge about locusts, campaigns against them and institutions in Soviet times and in the post-Soviet period.

In general, all four empirical chapters are lined up to demonstrate that knowledge development, technological processes, farming practices and institutions related to pest control heavily depend upon the political and socio-economic situation, and cannot be explained through an exclusive focus on scientific aspects.

### 1.3.6 *Data analysis*

Data analysis was based on cross-checking information from documents, the literature, media, own observations and interviews. The analysis focused on the period 1967-2007 when interviewees witnessed events personally, so information obtained from them orally was important. Archival documents and literature sources gave insights into earlier periods, from the establishment of the Soviet state. Thus, in total, a period of about 90 years (1917-2007) was analysed.

A computer program (Atlas.ti 5.0) was used to assist with the qualitative analysis, by providing data storing, retrieval, structuring and processing. Most of digitally recorded interviews were literally transcribed and incorporated into Atlas.ti 5.0 for further analysis. A list of codes and related key words was composed to analyse the interviews, identify analytical categories and concepts and to compare and link them to each other (see Appendix 1.1 for illustration of an activated window of Atlas.ti 5.0).

Emotions expressed by interviewees during the interviews were also noted, and linked to various arguments made in the thesis. For instance, it was noted that interviewees were often inspired and passionate while talking about professional activities or livelihood in the Soviet past, but less enthusiastic when talking about the post-1991 period. These swings in the moods of interviewees can be regarded as ‘emotional evidence’,[9] which often points to institutional values among informants.

## 1.4 Agro-geographical profile of the Republic of Kazakhstan

Kazakhstan was one of the 15 constituent republics of the Soviet Union. It is located in Central Asia (sometimes known as Middle Asia). With a total area of 2.7 million square kilometres, Kazakhstan is the ninth largest country in the world. It stretches from the Caspian Sea and the Volga River plains in the west to the mountainous Altai in the east, and from the foothills of Tien-Shan in the south and southeast to the West-Siberian lowlands in the north. The country extends more than 3,000 km from east to west and 1,700 km from north to south. It has borders with Russia in the east, north and northwest (these two countries share one of the longest land borders in the world of 7,591 km.), Uzbekistan, Kyrgyzstan and Turkmenistan in the south and China in the southeast.

At the same time, Kazakhstan is one of the most sparsely populated countries in the world, with 5.6 people per square kilometre. As of December 2006, the Kazakhstan population was 15.4 million people (Agency for Statistics of the Republic of Kazakhstan 2007). About 57% live in urban settlements and the remaining 43% in rural areas. This makes agriculture a key activity for almost half the population. As of 2006, Kazakhstan administratively is comprised of 14 oblasts (provinces), while the oblasts are subdivided into 168 raions (districts).

Kazakhstan is a landlocked country that is equidistant from the Atlantic and the Pacific Oceans. Its remoteness from the oceans determines the climate of the country. The climate is sharply continental with long cold winters and comparatively short, yet hot summers. It is arid and semiarid with an uneven distribution of natural precipitation. The average temperature in January varies between -19ºC and -4ºC, while the average temperature in July fluctuates between +19ºC to +26ºC. The temperature may go down to -45ºC in winter and rise to +45ºC in summer. The cropping season lasts from 105 to 165 days, and is longer in the southern regions. Annual precipitation in the arable zones of the country is quite low, (only 150-320 mm) with the exception of mountainous areas, where it is between 460-880 mm per annum. Most of the precipitation falls during autumn, winter and spring, which means that during the cropping season in the summer there is a shortage of moisture in the soil.

In 2006, 18 million ha of land was used for arable farming (with about 3 million ha of this under irrigation), 5 million ha for haymaking and 188 million ha for grazing (most grazing land is natural pastures). Livestock husbandry is a traditional and important part of the agricultural sector. Sheep breeding is predominant, while cattle, horse and camel breeding are also well developed. Animal husbandry accounts for about half of the production value in agriculture and crop production for the other half. Kazakhstan is also one of the world's major wheat producers and exporters. Most wheat production is concentrated in the northern wheat-belt, where it is grown under rain-fed conditions. In 2006, Kazakhstan produced 18 million tons of wheat, exporting about 6 million tons. Other important crops grown in Kazakhstan are barley, rye, maize, rice, potatoes, soybeans, sugar beet, cotton, tobacco, sunflower, flax, buckwheat and vegetables. Orchards and vineyards are widespread in the southern part of the country.

With its large territory Kazakhstan has a great diversity of agricultural pests that reduce the quantity and quality of yield of these crops. There are about 50 species of polyphagous and more than 100 species of specialized insect-pests, more than 70 diseases and about 120 weed species that cause problems in crop production (Sagitov 2002:12). A broad range of pest organisms over vast territories makes plant protection an essential part of agricultural production in Kazakhstan.

## 1.5 Notes

[1] In this thesis, an agricultural pest is defined broadly, as a living organism (rodent, insect, mite, nematode, fungus, bacterium, virus or weed) that damages crops, affects crop development or reduces quantity and quality of yield before or after harvest. The terms 'agricultural pest', 'pest organism' and 'pest' will be used interchangeably.

[2] A pesticide treadmill – is a metaphor to express the process of pests becoming resistant to the effects of pesticides, which means that higher doses, or new and more potent, pesticides are required, to which pests sooner or later become resistant again. There is no end to this spiral.

[3] This city was named Verny (1854-1921), Alma-Ata (1921-1993) and Almaty (1993-now).

[4] 'Material evidence' (Paul Richards, personal communication, 16.02.2006).

[5] For the sake of indicative categorization according to farm size, I distinguish farms having 1-50 ha as small-scale, 50-500 ha as medium-scale and more than 500 ha as large-scale. In Chapter 2 various farm types and sizes in post-Soviet Kazakhstan will be discussed.

[6] Oblast [*in Russian*] – an administrative division of the territory of the country into regions/provinces. Alma-Ata oblast before 1991 occupied 105,210 square kilometres. It consisted of 11 administrative districts with 39 kolkhozes and 97 sovkhozes. Total cropping area was 839,556 ha.

[7] Raion [*in Russian*] – an administrative sub-division of the oblast; English equivalent – district.

[8] Since the collapse of the Soviet Union, the *All-Union Journal of Plant Protection* has become the *Russian Journal of Plant Protection*. Since independence in 1991, the *Journal of Plant Protection in Kazakhstan* was issued for the first time in 1997. It was renamed *Plant Protection and Quarantine in Kazakhstan* in 2001. Because of financial constraints, only 20 issues have been published between 1997 and 2007.

[9] 'Emotional evidence' (Paul Richards, personal communication, 16.02.2006).

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# *Chapter 2*

# Knowledge and agrarian de-collectivization in Kazakhstan

## 2.1 Introduction

The relative viability and efficiency of large-scale farming and smallholder agriculture is a topic of constant debate in agrarian circles. After the collapse of the Soviet Union in 1991, many observers hailed the opportunity to re-introduce family-farm agriculture in former communist countries, as this would improve efficiency. However, more than fifteen years later large farm enterprises continue to dominate the agricultural landscape and, in several countries of the former Soviet Union, they still control most of the arable land (Davydova and Franks 2006, Kitching 1998, Spoor and Visser 2001, 2004, Visser 2008, Wegren 2004, 2006, 2007).

This chapter examines the post-Soviet transformation of the farming sector in Kazakhstan. It first describes the transformation of the agrarian structure and the new ordering of large farms and smallholdings in the context of changing socio-economic, political and technological relations. This part of analysis follows a relatively conventional approach in explaining these changes by providing an historical description of major agrarian policies and the changing economic context. It identifies the major changes in land use, farm types and farm sizes and how state interventions influenced access to land and other inputs during the different stages of transition. The chapter then moves to an analysis of how different actors perceive the transformation of agriculture, livelihoods and social infrastructure in rural areas since independence, why they talk about this period in terms of crisis and chaos, and why many people have a feeling of nostalgia for the Soviet past. The chapter subsequently examines the role of knowledge and the remarkable loss of knowledge in the transition process. It describes the technological rationale and the organization of knowledge within Soviet agriculture and examines what has happened to those knowledge structures. It argues that the loss of knowledge and the lack of knowledge are the key elements of the crisis in agriculture after the collapse of the Soviet Union. Neoliberal ideology, which informed much of the policy changes in the transition period, has severely constrained the maintenance of essential crop protection knowledge required for sustainable forms of agriculture.

This argument is a preface for a discussion of the demise of knowledge-intensive IPM in Chapter 3, the collapse of the plant protection research system in Chapter 4, and the lack of interest in maintaining knowledge about complex ecological processes and pest problems that require collective action as elaborated in Chapter 5.

This argument about the fate of knowledge under neoliberal driven changes also has implications for theoretical perspectives on agrarian change. Our starting point for interpreting agrarian change begins with general macro-economic descriptions of larger and concrete formations but then descends to a more meso-level analysis of the conditions that structure these forms of production (cf. Friedmann 1980). The focus on knowledge employed here coincides with the work of several scholars who recognize that agricultural labour processes contain specific intrinsic structures (e.g. Benton 1996, Mollinga 1989, Veldwisch 2008, Veldwisch and Spoor 2008). The '*labour process*' approach includes studying the division of labour, the organization of work, tasks, hierarchy, control, technology, tools, knowledge, skills and the means of production (Thompson 1989). The Soviet agricultural labour process was organized around large-scale, highly mechanized and knowledge intensive farming systems. The labour process approach has been used to demonstrate the importance of analysing processes of deskilling and reskilling as a means of understanding agrarian change (e.g. Stone 2007). This chapter examines whether and how such processes occurred in the post-1991 transition period in Kazakhstan. This theoretical position means a departure from the notion that knowledge and skill are just another input (or external) factor that can be acquired in discrete units (Jansen et al. 2004). Rather, as will be argued below, one can have different degrees of access to relevant sources of knowledge. Practical knowledge implies not just blindly following given prescriptions, e.g. regarding pesticide or fertilizer application, but combining previous experiences with an interpretation of the existing situation to guide practices. Equally, skills owe their existence to a constant renewal through practical action and turning knowledge into skills always involves a learning period (Sigaut 1994). These aspects make it more difficult to assess the impact of knowledge and skills on efficiency or productivity than other, more measurable factors such as farm size, inputs and outputs levels of farms or the size of the labour force.

The importance of a better theoretical consideration of the relation between knowledge and skills and technology (and in particular agricultural labour processes) is illustrated by the exchanges between Griffin et al. (2002) and Kitching (2004). Griffin et al. (2002) defended the need for redistributive land reform on the grounds that small farms tend to be more efficient than large farms. In the empirical part of their paper, they associate the decline of agricultural output during the transformation of the former Soviet Union with macroeconomic imbalances, very high rates of inflation, falling rates of investment, a declining level of mechanization and falling labour productivity. According to Griffin et al. (2002) land reform really only occurred in name and collective or corporate farms continue to dominate and land continues to be cultivated collectively. The many smallholdings that exist are mostly a continuation of the former household plots, but these households lack proper support, access to credit or input markets. They argue that the failure of land reform is related to the absence of institutions (land market, state procurement, input markets, etc.) required by smallholders. Kitching (2004:167) disputes the land reform agenda put forward by Griffin et al. (2002), arguing that the division of labour in the later years of Soviet agriculture (producing basic grain crops and beef and dairy cattle on large farms and the bulk of horticultural crops and smaller animals on small farms) was '*sensible enough*'. Kitching (2004) makes the case for a dualist model of post-Soviet agricultural reform with (privately owned and managed) large farms producing basic grains and large animal products and small farmers producing other foodstuff.[1] He does not, however, qualify why he considers it 'sensible enough' that large farms continue to produce as large farms instead of splitting up, nor why it is difficult to let small farms benefit from redistributive land reform. We interpret the notion of 'sensible enough' as an implicit reference to what can be conceptualized as a mere technical element of the labour process: the knowledge and skills required to practise agriculture under given conditions. It is implied in Kitching's response (Kitching 2004) to Griffin et al. (2002) that this knowledge and skills is relatively fixed and cannot be readily changed in a transition of large-scale to medium or small-scale agriculture. A more explicit recognition of the core role of knowledge and skills in agricultural labour processes could help to resolve this controversy.

This chapter looks at changes in knowledge and skills in order to understand the constraints and possibilities facing the agrarian transition process in post-Soviet societies. It highlights how the knowledge and skills shaped the development of Soviet agriculture and have continued to shape post-Soviet agriculture in Kazakhstan. It also looks at what happened when some knowledge became obsolete as situations changed and when knowledge is lost or not maintained.

## 2.2 Agrarian transition in Kazakhstan

Agrarian change in Kazakhstan has evolved in parallel to political economic changes in Russia ever since Kazakhstan joined the Russian Empire in the 18th century and continued to do so throughout 70 years of a common Soviet heritage. Even in the post-1991 period, with a drastic reduction of agricultural exports to Russia and diminished support for the agricultural sector, the new Kazakhstani economic policies have closely followed Russian policy-making. In the Soviet era Kazakhstan, which specialized in cereal and meat production was, to borrow Laird and Chappell's (1961:326) words, 'Russia's agricultural crutch' (or to put it more precisely: USSR's agricultural crutch). Khrushchev's Virgin Land Campaign particularly targeted Kazakhstan. In 1960, Kazakhstan produced 0.7 million tons of meat and 10.5 million tons of cereals, 22.4% of the USSR's total production (Churin 1962:324). This increased significantly to 1.4 million tons of meat and 27.4 million tons of cereals in 1987 (State Committee for Statistics of Kazakh SSR 1989), a significant share of the agricultural output of the USSR. The collapse of the Soviet Union resulted in a crisis in agriculture. Crucial aspects of this crisis included: a disengagement of the state from the rural economy; the break up of the Soviet inter-republican trade links; a strong disparity between the pricing of inputs (liberated) and farm outputs (regulated and set at low levels); the unavailability of credit and an underdeveloped marketing infrastructure (Deberdeev and Idrisov 1997, Gray 2000, Kaliev 2003, Spoor 1999). The following sub-sections describe this agrarian crisis in more detail, together with the vacillating course of Kazakh agrarian policies in the transition period.

### 2.2.1 *Post-Soviet land policies and the farm privatization process*

After the disintegration of the Soviet Union in 1991, the government of Kazakhstan cut ties with the centralized planned economy and took a neoliberal course that sought to establish a free market economy. The government led the farm privatization and the top-down restructuring process, abolished subsidies and credits to agricultural producers, regulated farm output prices, liberalized input prices and removed protection from external market forces. Since the post-Soviet era Kazakhstan's agricultural policy has passed through three identifiable stages.

In the first stage, which started in 1992, privatization remained largely an intention on paper, with little actual change in farm structure and ownership. Former Soviet farms were legally registered as either 'collective enterprises' or 'private enterprises'. The revision of the Civil Code in 1995 abolished these categories and introduced three new legal statuses: 'Producer Cooperative', 'Economic Partnership' and 'Joint Stock Company'. The first transfer of control over land from the state to farming units was laid down in the Presidential Decree '*On Land*' of December 22, 1995, which included a provision for 99-year long-term land leases to individuals and legal entities.[2] Land remained state owned.

The second stage of restructuring started in 1997 and, in contrast to the first stage, involved not only an expanded privatization but also an incipient individualization of property. A law '*On the Peasant Farm*' issued in March 31, 1998 added the category of 'peasant farm' (see further in the text) to the three legally recognized forms of farm units. Local authorities were obliged to issue land title certificates and define property shares for farm employees. These property shares defined individuals' share in the property of former collective farm including livestock, farm machinery and equipment and buildings. The certificates generally did not demarcate the individual plots of land (Gray 2000) so individuals acquired entitlements to 'virtual' shares in the land within the farm entity rather than obtaining control over a defined piece of physical land. In practice, the plots of land were only demarcated when individuals decided to leave the larger entity in order to farm independently. Further changes in land legislation came with the law '*On Land*' of January 24, 2001, which reduced usufruct rights from 99 to 49 years. Article 124 of this law obliged holders of land titles to personalise, within three years, the specific land plots that were previously no more than a virtual share in the land stock of the collective. After demarcation and personalization, the land could be sub-leased to other agricultural producers or farm entities (such as large agricultural firms), with no obligation for the holder to be personally engaged in farming. This land law paved the road for a full transition to private ownership of land through a new land code, issued in 2003.

The third stage of the privatization process of farms was initiated with the introduction of private ownership for land within the new '*Land Code*' of the Republic of Kazakhstan, issued on June 20, 2003, which finally turned agricultural land into a commodity. The government set a deadline (January 1st of 2005) for land-titleholders to reach an agreement with the state over the purchase, or 49-year lease, of specific plots of land, for which a buyer would receive a '*Certificate of ownership*' and lessee would get a '*Certificate of lease*'. Individuals buying land had up to ten years to pay for the plots of land but they could only sell, lease, mortgage or do other legally permissible deals with the land once it was fully paid for. Individuals leasing land were obliged to be personally engaged in farming and had no rights to sub-lease, what was allowed previously. Owners and lessees can farm individually or contribute their land to the land-stock of other legal entities engaged in agriculture, with the lessee being employed by that particular entity. Hence, it was only after fourteen years of independence and a number of different laws and regulations that individual farming, combined with individual control over land, became a possibility. This long transition period reflects an ambivalence in policy about the desired structure and scale of farm units, and the bundle of rights that land owners could have over land. The origins of this ambivalence are less important to explore here than its consequences for the farming sector.

The top-down organized privatization of farm assets and land took place in a context of uncertainty about the direction and scope of the transition process, giving local administrators and former managers of collective farms a lot of room for manoeuvre. Interviews carried out for this research showed that rural dwellers from different parts of Kazakhstan saw the farm manager as playing a key role, with the redistribution of farm assets and land being critically dependent on the honesty and dignity of individual farm managers.

There were many stories told about farm workers who received nothing. In other cases, people had to push very hard to get their shares and some gave up demanding. The following quotation from an interview with a former kolkhoz worker in the Almaty region illustrates the key role of managers in the redistribution process (transcribed Interview 07/10/2005, with field note observations of expressions of emotions):

> Q: Who was redistributing farm assets and land?
> A: The farm management did as they wanted [*angry*]. The chairman of our kolkhoz [*gets very angry*]…such a…[*curses him with her right fist waving on the air* ] grabbed everything [*moves her arm as a child grabbing a toy when somebody wants to take it away*]. He grabbed everything, the milk farm with its cows, the land and the farm machinery. In our kolkhoz, the redistribution of farm assets and land was unfair. Everything depended on the manager. The manager of kolkhoz *24 PartSiezd* [*kolkhoz named after 24$^{th}$ congress of the Communist Party of the USSR*] fairly redistributed the farm assets and land among his workers. But ours…!!! [*again gets very angry*] grabbed everything and no one could do anything, maybe he has a strong 'krisha' [*'roof', meaning having personal ties with authorities*] that let him boldly grab everything. The same happened at sovkhoz *Tomarovskogo*, where farm workers were left without any share of land or assets. There was a big scandal. This sovkhoz was a very rich one, with vineyards, orchards, vegetable production, tobacco fields, numerous livestock and farm machinery. An uncle of my husband lived and worked there his whole life, and he received nothing. Their manager cheated them and sold all the farmland and assets to 'krutim' [*jargon - here, she means*

*'rich and powerful outsiders'*].
Q: What did farm workers do?
A: What can ordinary people do against 'krutikh'?[3]

Apart from illustrating the central role that farm managers played in the redistribution process this quote also highlights the importance of ties between the managers and the authorities. Equally, the reference to the manager who redistributed the land among *his* workers reflects the importance of personal and patrimonial relationships. Workers continued to consider themselves as a member of a collective rather than as individuals engaging in new contractual relationships that they had to negotiate and defend themselves. Incidents of maldistribution and appropriation, such as the scandal referred to in the quote, occasionally received national media coverage but never led to larger scale organized resistance.[4]

The central role of the farm manager in the redistribution process and the possibility of appropriation (part of what Harvey (2003:144) calls 'accumulation by dispossession') was confirmed by farm managers who had redistributed land and property more equitably. The concept of 'accumulation by dispossession' refers, in short, to the robbing of people's rights and resources. An instructive example is a former manager of a sovkhoz with 2,500 ha of arable land under mixed production who now owns a 55 ha peasant farm in the Almaty region. He remarked that he could have gotten more land by using his position and that other colleagues bit off 200, 300 or even 500 ha for themselves. However, he did not do so because he 'did not want to be cursed and hated by the villagers'. In 1996, he first redistributed land shares to the workers, each worker getting 1 to 10 ha depending on their employment history in the sovkhoz. His personal share was only 10 ha and his wife got 5 ha. He acquired the other 40 ha of his 55 ha farm plot by 'buying out' concession rights (*pravo ustupki*) from emigrating ethnic Germans, Polish, Russians and Ukrainians in 1996-1997.[5] This manager did not use his position for expropriation. However, he knew the needs and strategies of other shareholders, and maybe has used this information to buy their shares and entitlements at favourable times or rates. The top-down character of the privatization process, the information imbalance and the unequal distribution of land and property shares were also evident within a survey of 600 households carried out in northern and south-eastern of Kazakhstan (Peabody et al. 2000:185). Thirty nine percent of the households interviewed in this survey responded that they did not know what privatization meant and 29% said that privatization options and implications were never discussed with them. Thus, the privatization of the agricultural sector in Kazakhstan was developed and carried out without the involvement of a broad social base and with little effort made to inform rural people of their rights, opportunities and responsibilities.

### 2.2.2 *Bringing the state back in*

The neoliberal reforms to foster the transition of a planned economy to a free market economy turned out to be a shocking devastation in the farming sector.[6] Before 1991, Kazakhstan fully provided for its own food security, with domestic production of many agricultural products (e.g. wheat, meat, potato, eggs) sufficient to meet internal demand. By the end of the 1990's neoliberal economic policies had severely aggravated the crisis in Kazakhstan's rural economy and had done little to solve the supposed inefficiency in agricultural production inherited from the Soviet period (Baydildina et al. 2000, Kaliev 2003). The high share of the agricultural sector in the GDP – 24% in 1970 (Kembaev and Komlev 2004:54) and 34% in 1990 (Ziyabekov 2006:11) declined very rapidly to 8.7% in 2001 (Agency for Statistics of the Republic of Kazakhstan 2002a). The decline in the agricultural sector threatened the country's food security (Baydildina et al. 2000, Kurganbayeva et al. 2002, Satybaldin et al. 2001, Ziyabekov 2006) and recognition of this by the government led to a more interventionist stance, following Russia's steps (after 1998) to 'bring the state back in' (Wegren 2007:513). In the early 2000's the Ministry of Agriculture introduced a new set of policies designed to mitigate against the devastating effects of the transition policies, to make agricultural producers more competitive in the world agricultural market and to meet the country's food security needs. The starting document was the '*State Agro-Food Programme for 2003-2005*' ('Years of Village'), formulated in 2002. Its primary objective was to meet national food security by providing assistance to agricultural producers.[7] Further policy documents followed: the '*State Programme for Development of Rural Areas in 2004-2010*' and a policy document on '*On the Sustainable Development of the Agro-Industrial Complex of the Republic of Kazakhstan in 2006-2010*'. These documents reflected a new political view that the earlier restructuring of the agricultural sector had caused more harm than good (Cummings 2005). Legal instruments such as the law '*On the State Regulation of the Development of the Agro-Industrial Complex and Rural Areas*' (issued on 8 July 2005) further extended this interventionism. Interviewees in this study saw the first decade of the post-Soviet agrarian transition in Kazakhstan as a period of destruction, stagnation and demoralisation, and the years since 2003-2004 as the beginning of recovery from the shock of transition. Expressions such as '*nachali podnimat golovu*' (started to get up) or '*nachali prixodit v sebya*' (started to regain consciousness) were very common among farmers who survived the economic slump and institutional insecurity.

## 2.3 Emerging farm types

Agrarian transition was intended to transform the Soviet-era farms into something new. In 1937, there were 193 sovkhozes (soviet state farms) and 7,483 kolkhozes (collective farms) in Kazakhstan (Kembaev and Komlev 2004), but over time most of these kolkhozes were liquidated or merged into sovkhozes. By 1988, there were 2,125 sovkhozes and 391 kolkhozes (State Committee for Statistics of Kazakh SSR 1989).[8] Over time the organization, management and labour process in both farm types became so similar that there were few practical differences between them. This chapter therefore uses the term '*Soviet (collective) farm*' to describe both the sovkhoz and the kolkhoz. If there was a difference between these two types of farm it was in their allotted areas. The average size of a sovkhoz in 1961 was 107,100 ha, including pastures, grasslands and arable land, with an average 19,400 ha of arable land (Churin 1962:81). The average size of a kolkhoz in Kazakhstan was 37,000 ha, with an average 10,600 ha of arable land of (State Committee for Statistics of USSR 1988). Farms in Kazakh SSR were on average 2 to 3 times larger than in other Soviet republics. While policymakers were convinced that the Soviet type collective farms should be privatized, they were less clear about what to replace them with.

The privatization and restructuring of these Soviet collective farms was a long process from which a wide range of agricultural enterprises has emerged. At one extreme former farm employees have become independent agricultural producers, varying in size and income; at the other extreme, large Soviet farms have been transformed into large commercial farm enterprises that continue to employ their shareholders. By the end of 2006 there were 173,132 active agricultural enterprises in Kazakhstan, including 65 state farms,[9] 5,224 private agricultural enterprises – in the form of various economic partnerships, joint stock companies and producer cooperatives, and 167,843 peasant farms (Table 2.1). Despite the large number of peasant farms they only cover 36% of the total cultivated land in Kazakhstan, compared to the 62% covered by large agricultural enterprises (Table 2.2). Thus, a small number of large agricultural enterprises continue to occupy much more of the cultivated area, despite the large number of peasant farms. Table 2.1 shows that in 1990, before the collapse of the USSR in 1991, there were already some non-state agricultural enterprises and peasant farms in Kazakhstan, created in the wake of the perestroika reforms after 1985. The USSR had already constructed a basic legal platform for privatizing state enterprises and had endorsed economic diversification (via a number of legal documents such as *On private entrepreneurship*, *On state enterprises and their privatization*, *On private farm*, *On cooperatives* and *On land reform*). Most large-scale private enterprises were established in the first phase of the transition period and the majority of individual farmers started up in the early 2000s, mainly as a consequence of the 1998 law *On the Peasant Farm* and the 2003 *Land Code*.

In Kazakhstan (and in this thesis) the notion of 'peasant farm' is used quite differently from its standard use in the rural sociology literature. It is a much larger category than the classical object of peasant studies. According to Article 1 of the law *On* *the Peasant Farm* (issued on March 31, 1998) a peasant farm is defined as '*a joint family labour union in which individual entrepreneurial activities are directly linked with the use of land for agricultural purposes to produce, process and market farm outputs*'. The term 'peasant' here is an official translation into English of the term *шаруа/sharua* from Kazakh or *крестьянин/krest'yanin* from Russian. Many peasant farms are actually large farms: 13.9% of them have 50-200 ha of arable land, 5% have 200-500 ha and 2.7% have more than 500 ha (Agency for Statistics of the Republic of Kazakhstan 2002a). These areas can be much larger when grazing lands are included. One of the main reasons for legally registering as a peasant farm is that it brings a reduction in tax liability and the assent of the tax office for simplified bookkeeping and reporting schemes, which in turn permits greater flexibility in the way workers are paid. By way of example one peasant farm in the southeast of Kazakhstan visited during this research covers 1,000 ha and is owned by the former manager of a crop producing sovkhoz. Together with the chief agronomist of this sovkhoz, he retained and privatized most of the production infrastructure and machinery, bought out the land and property shares of many former sovkhoz workers, and hired the best workers.[10] Sharakhimbaev and Bildebaeva (2002) describe another peasant farm in the southeast of Kazakhstan with 1,400 ha of land, 47 oxen, 505 sheep and goats, 40 pigs and 27 horses and 6 tractors.

However, there are also many small peasant farms whose emergence can be best understood in relation to the evolution of cooperatives. For a time, collective farming through cooperatives proved to be an appropriate survival strategy for former Soviet farm workers facing an insecure market environment.[11] Joint labour, commonly owned farm machinery and relatively large fields (aggregated plots of cooperative members) allowed them to produce enough to stay in business. However, this changed after the new Land Code was issued in 2003 (discussed earlier in Section 2.2.1). While the Code was not intended to break up the joint farming, a deadline to arrange ownership or lease by January 2005 generated this unintended consequence. The responsible government offices did not properly inform the farming community about the new land legislation and assist with legal procedures to obtain a certificate about land ownership or lease. Rumours were spread that land-title holders must buy their plots at once, otherwise it would be withdrawn by the Land Committee and subsequently be sold to those, who could buy it immediately. In 2004, many rural title-holders, unfamiliar with legal matters, panicked because they did not have money to buy out their entitled plots. While they were hesitating over what to do, land-dealers were offering ready cash to moneyless rural dwellers and buying out their land at low prices. As a result of this 126 agricultural cooperatives collapsed in 2004 (Grigoruk 2006:44).[12]

**Table 2.1 Number of functioning agricultural enterprises in Kazakhstan**

| Type of agri-formations | 1990 | 1995 | 2000 | 2005 | 2006 |
|---|---|---|---|---|---|
| Total | 4,918 | 36,285 | 81,078 | 161,962 | 173,132 |
| *Including:* | | | | | |
| State agricultural enterprises | 2,223 | 1,405 | 74 | 65 | 65 |
| Non-state agricultural enterprises (includes economic partnerships, joint stock companies and producer cooperatives) | 2,371 | 4,095 | 4,631 | 4,919 | 5,224 |
| Peasant farms | 324 | 30,785 | 76,373 | 156,978 | 167,843 |

*Source:* Agency for Statistics of the Republic of Kazakhstan (2002a, 2007).

The emergence of different farm types has also been conditioned by environmental factors that favour particular production activities (e.g. crop, livestock or mixed production). The size of crop producing farms ranges from 1 ha farms in the south of Kazakhstan (producing fruit or vegetables) to 100,000 ha (wheat producing enterprises in the northern wheat belt).

Between 1990 and 2000 there was a dramatic fall in the area under cultivation. Table 2.2 shows that the area with cultivated land plummeted from about 35 million ha in 1990 to about 16 million ha in 2000 (with a slight increase in the following years). In Table 2.2 wheat, rice, potato and vegetables have been selected from the wider range of crops grown in Kazakhstan because these are the staple vegetative diet of the local population. Wheat occupies most of the cultivated area in Kazakhstan, with much of it produced by large agricultural enterprises (although the share of peasant farms has increased) and between a third and a half of this wheat is exported annually.[13] Rice is also mostly produced on large farms, but also increasingly on peasant farms. By contrast potatoes and vegetables are mostly produced on household plots, mainly for own consumption with some surplus being marketed. Households often store enough of these crops to consume them through the winter. Household plots remain relatively unchanged from the Soviet time and are not officially registered as farm enterprises (cf. Veldwisch and Spoor 2008, Wegren 2008). Many workers on large enterprises may have their own household plot, which produce a large proportion of the potatoes grown within the country. Care should be taken not to confuse these household plots with 'peasant farms', a legal entity, usually managed by one single family but sometimes by two, three or more families. This picture of different farm types, specializing in different production activities, coincides with Kitching's depiction (2004) of Russia where large farms produce grains and large animal products much more efficiently than smallholders, while a mass of small farmers continues to produce horticultural products. Medium size peasant farms in Kazakhstan produce grains, large livestock and horticultural crops.

It is not possible to predict the direction in which the agrarian structure will evolve, nor do we have sufficient data to draw firm conclusions about the relative efficiency of the different farm types (even if we assume constant conditions).[14] The data show that the different farm types have found diverse ways to survive and to provide a livelihood for managers, farmers and workers. The types of farms range from large entrepreneurial wheat farms in vertically organized firms (a successful strategy when most trade took place as barter; Peabody et al. 2000) to household plot cultivation of potatoes and vegetables. In these circumstances efficiency cannot be measured by a single standard as different logics are at play. Furthermore, analysing efficiency requires taking into account the interrelationships between different farm types, in terms of the supply of labour, renting inputs such as farm machinery, paying those workers who own a few livestock with fodder or marketing each other's outputs. We know these interactions have been important (cf. Gray 2000, Peabody et al. 2000, authors' observations and interviews) but we do not know their precise role in local agrarian dynamics.

**Table 2.2 Area (ha) of different crops cultivated by all categories of farms in Kazakhstan.**

| Year | 1990 | 1995 | 2000 | 2005 | 2006 |
|---|---|---|---|---|---|
| **Total cultivated land,** including: | **35,182,100** | **28,679,600** | **16,195,300** | **18,445,200** | **18,369,100** |
| **(Large) agricultural enterprises** | | | | | |
| | **35,011,500** | **27,316,300** | **10,855,400** | **11,137,200** | **11,391,100** |
| Wheat | 14,067,800 | 11,856,200 | 7,061,400 | 8,250,100 | 8,354,400 |
| Rice | 124,300 | 92,700 | 55,400 | 65,800 | 65,400 |
| Potato | 102,000 | 38,800 | 8,700 | 4,900 | 4,900 |
| Vegetables | 48,300 | 25,700 | 10,700 | 5,900 | 5,600 |
| **Peasant farms** | | | | | |
| | **13,900** | **1,111,400** | **4,847,800** | **6,871,300** | **6,655,100** |
| Wheat | 1,900 | 691,100 | 2,986,900 | 4,353,300 | 4,043,700 |
| Rice | - | 1,600 | 21,700 | 19,800 | 22,500 |
| Potato | 100 | 3,600 | 17,200 | 24,500 | 27,100 |
| Vegetables | - | 4,400 | 22,800 | 56,800 | 60,500 |
| **Household plots** | | | | | |
| | **156,700** | **251,900** | **492,100** | **436,700** | **322,900** |
| Wheat | - | 4,600 | 65,000 | 44,500 | 27,700 |
| Rice | 200 | 500 | 500 | 100 | 100 |
| Potato | 103,800 | 163,500 | 134,400 | 138,800 | 121,900 |
| Vegetables | 22,500 | 46,000 | 69,100 | 91,300 | 78,100 |

*Source:* Agency for Statistics of the Republic of Kazakhstan (2002a, 2007).

## 2.4 Feelings of nostalgia and identification with the Soviet collectivity

This overview of the how various farm types have come to emerge and co-exist in Kazakhstan has not yet elucidated the problems that many workers and small farmers faced in the process of restructuring. Before exploring how the transition period was a painful and difficult period for many people, and how it brought havoc in the agricultural sector, we first discuss how the crisis gave rise to a widespread feeling of nostalgia. This allows us also to describe some of the main characteristics of the Soviet collectivity to which these representations refer.

Kazakhstani people tell strongly nostalgic narratives about their lives in the Soviet past. These express a strong appreciation of social security, stability in incomes, low food prices and a sense of egalitarian communal life that they enjoyed in the Soviet past. These feelings are in stark contrast to the current environment of 'wild capitalism' (*dikii capitalism*) in which people have experienced a devaluation of their life savings, prolonged uncertainty, insecurity, social differentiation and a decline in their purchasing power (interviews from this study, Nazpary 2002, Werner 1998). The Soviet collective agricultural setting provided a form of social solidarity (in the Durkheimian sense), fraternity and cooperation.[15] Contemporary rural society in Kazakhstan is now far removed from the relative social cohesiveness that was provided by the farm community. Many interviewees talked with inspiration and passion about their livelihoods and professional activities in the Soviet past, but displayed much less enthusiasm and regularly became angry while talking about the post-1991 period. An old woman, who practices subsistence farming on a 1.5 ha plot in the Almaty region framed the difference between the old system and the current situation as follows (Field notes, Interview 07/10/2005):

> I worked for 40 years, never missing a single working day. Now I receive a pension of 9700 tenge [*about 65 US$*] per month. In the Soviet time with my 40 years of working record, I would get about 120 roubles [*before 1991, one rouble was about one US$*] of monthly pension. This would have provided me with a prosperous retirement. From one-month's pension I could buy a lorry of coal and a lorry of firewood and my food stock for the winter and still some money would remain for other things [*because prices in the USSR were very low*]. Now two months of my pension is even not enough to buy a lorry of coal [*because after 1991, prices were liberalized and everything became very expensive*]. If I had to rely on my pension alone, I would not survive. Now, instead of having a restful retirement, I still have to work. At least [*having a piece of*] land will not let me die of starvation and I will not beg for food.

Her neighbour who participated in the conversation added:

> In the Soviet time, we thought we were still building communism for a prosperous life. Now [*considering the severe hardship of the present situation*] we understand that we actually used to live in communism [*before 1991*].

These sentiments are very common among people who remember living under the Soviet system. One survey among rural dwellers in the late 1990s in Kazakhstan showed that 90% of the respondents considered that they lived better during the Soviet time (Peabody et al. 2000:198). Rural dwellers in Russia express similar nostalgic perceptions (Koznova 2004).

### 2.4.1 *Secure livelihoods in the Soviet collective system*

Narratives about a 'better' Soviet past seem to be informed by two elements. Firstly, many stories refer to the more secure livelihoods and the favourable socio-economic infrastructure of the Soviet collectivity. Secondly, individual farmers, farm managers and agro-technicians often mention the technological superiority of the Soviet farm. The unsurpassed description of economic, socio-cultural and political life in a Russian collective farm by Humphrey (1983) is equally applicable to collective farms in Kazakhstan, since the Soviet farm took the same form throughout the entire USSR. Humphrey analyses the collective farm as an economic institution and its role as an instrument of political and cultural integration. The collective farm acted as a 'microcosm of the state' (Humphrey 1983:3), or as one of our interviewees, a former sovkhoz director in the southeast of Kazakhstan, puts it *'the Soviet farm was the state within the state'* (Interview 05/04/2006). The ideology of uniformity produced similarities all over the USSR, as Humphrey (1983:17) argues:

> …constant efforts are made to try to bring about a state in which real conditions are equal. One result of these efforts is an astonishing and perhaps admirable uniformity in material life. In the most distant corners of the Soviet Union rural workers live in the same standard house, wear the same padded jacket (*vatnik*), eat the same brand of tinned sprats.

The similarity was not only material but also political, since all rural dwellers in the USSR were subject to the same 'code of ideological intent' (Humphrey 1983:17).

The typical Soviet farm in Kazakhstan was either one large rural settlement or consisted of several spatially scattered sub-settlements with a single farm administration. The farm community was made up of households whose members were employed in various capacities in the farm as farm management staff, agro-technicians, field workers, '*mechanisators*',[16] medical and education professionals and others.[17] Households had home gardens of up to half a hectare, 2-3 cattle, 5-10 sheep, goats and poultry ('domestic husbandry'). From spring to late autumn privately-owned livestock was grazing on communal lands. For the winter, the collective farm supplied its workers with hay and forage for their household livestock. The farm collective also provided basic social services to its dwellers: a kindergarten, school, small hospital or clinic, fresh water supply station, bathhouse, library, cinema club, amateur art activities club, food and miscellaneous shops, canteen and a sport stadium. The Soviet farms invested a significant part of their revenues in these social infrastructures. A former manager of the Soviet farm in Almaty region depicted the role of the farm collectivity as follows (Interview 05/04/2006):

> The sovkhoz dealt with all social, production or construction issues. From the sovkhoz budget we supported the local kindergarten, the school, the cultural house, the library, the bathhouse, the stadium and the swimming-pool. For example, our sovkhoz made a net profit of 1.5 million roubles at the end of the year and up to 70% of this money was invested in social infrastructure. Now nobody cares about social infrastructure, everything we built has deteriorated or has been dismantled. Today producers think only about production and profit; nobody cares about people and social life.

### 2.4.2 *Knowledge in Soviet agriculture*

The second storyline in nostalgic narratives concerns what people consider to be ‘good farming practice’ and contains two major themes: firstly, the organization of labour and the division of tasks in agriculture and, secondly, the level of mechanization of farming and the high levels of specialization and coordination within the knowledge structure. Together, these made it possible to run the Soviet farm as a large-scale, knowledge intensive farming system.

Farms consisted of several production divisions; each composed of several brigades, made up of several units. A mixed farm would specialize in meat or dairy production together with crop production. In such a setting one division, with its brigades and units would deal with livestock and other division(s) would be engaged in crop production, including fodder and hay production. Other farms, or divisions, specialized entirely in cereal, vegetable or fruit production. Farm specialization was supported by highly qualified professionals specialized to carry out specific tasks. The managers of farms and divisions were agro-technicians with a high level of agricultural education. The heads of brigades usually had received agricultural training at vocational schools and the head of units were usually experienced field workers. Although the number of workers varied from one production group to another, a typical composition could be a division of 200-300 workers with brigades of 60-80 workers, divided into units of 15-20 workers. Task assignment, responsibilities and reporting were organized hierarchically (worker, head of unit, brigadier, head of division, farm management, including chief agro-technicians and farm manager). In turn, the farm management was responsible to the district administration and the District Communist Party Committee. The Party had significant influence over the rotation, appointment and promotion of farm managers. Managers of successful farms were often used to replace managers of poorly performing farms, or were promoted to higher official positions at local, district and regional level. According to current narratives about the past, this structure ordered information, defined clear tasks, built trust in specialized technical knowledge and created the capacity to deal with technological complexity of the Soviet farming system.

The second theme conveys the central role of agro-technicians as the driving force of technological processes and the carriers of agricultural knowledge. On each farm a dozen highly educated agro-technicians (agronomists, vets and engineers) would lead and coordinate all the production activities. Internal sub-division based on specialized, technical knowledge was often emphasized by the interviewees, and is supported by archival data and own observations. As a former brigadier of a sovkhoz in the Almaty region recalls (Interview 02/09/2005):

> At that time our sovkhoz had 5 or 6 agronomists: a chief agronomist, a plant protection agronomist, an orchard agronomist, a vegetable agronomist, and a field agronomist.

In other situations a team of agronomists might also contain specialists in seeds and agro-chemistry.

Aside from specialization there was another crucial element: what was known as the 'technological map' (see Appendix 2.1 for an example). Every cropping season the chief agronomist and his team of agronomists and engineers made a complete technological map for each crop. It included all the required agronomic measures, the irrigation schemes and estimated the labour needs and costs of particular operations and inputs. The application of fertilizers and pesticides, in terms of volume, timing, method, required machinery (possibly including aerial spraying) and location, were planned in great detail. The map also set out the crop rotation schemes,[18] which were necessary to use soil nutrients effectively, to maintain and improve soil structure and fertility and to avoid pest and disease accumulation. One example of the role of specialization within the farm illustrates the intensive knowledge structure. Together with specialists of the District Plant Protection Station, the plant protection agronomist would develop plans to protect particular crops from particular insect pests, diseases or weeds occurring and causing damage on farm fields or orchards. This plan was based on monitoring pest organisms and forecasting their population dynamics. A phenological table of major insect pests was drawn up, that allowed them to plan the application of insecticides or bio-control agents at susceptible phases, to monitor population dynamics and to predict damage periods. The crop protection plan defined specific combinations of agronomic, chemical, and/or biological protection measures that would be carried out. The economic efficiency of crop protection measures was calculated, based on estimates of the costs of protection measures against the cost of saved yield. A range of integrated pest management measures was drawn up and implemented and the crop protection plan was incorporated into the master technological map for a particular crop (Chenkin 1974).[19]

The farm-level agro-technicians were well connected with the wider agricultural knowledge system. They had access to agronomic manuals, handbooks, and the recommendations of the All-Union, republican and regional research institutes relating to general or specific agronomic issues; which were either applicable to a wide range of climatic conditions found within the USSR or adapted to local conditions. They regularly received updated information on agronomic practices from agronomic journals. The farm agro-technicians collaborated with the research community of 32 agricultural research institutes directly or via 28 experimental research stations and 45 experimental farms established throughout Kazakhstan. Researchers and specialists from the various research institutes and agricultural research stations regularly invited farm agro-technicians to attend conferences, seminars and trainings, so they could transfer new knowledge back to their own farms. Every off-season period the chief agro-technicians organized trainings for their staff, inviting researchers from the research institutes, lecturers from universities and polytechnic institutes and specialists of the agricultural research stations to visit and share their knowledge.

However, the knowledge intensive character of Soviet farming was not necessarily a guarantee that agriculture would be successful. Some would argue that the investment in this knowledge structure was part of the inefficiency of agriculture as it was very costly. This view corresponds with representations of the crisis in Soviet agriculture that were constructed during the Cold War (e.g. Hedlund 1984, Osofsky 1974), which negatively depicted all aspects (institutional, structural, organizational, etc.) of the Soviet system and reduced all the developments to the effect of the brutal collectivization that occurred under Stalin. In somewhat different terms, one could contend that investment in the knowledge structure was part of the inherent drive of different levels of the production structure to procure resources (Verdery 2005).[20] To answer the question as to whether investment in an intensive knowledge structure was efficient would first require a discussion about what efficiency means under different conditions (as it is clear that the rationalities of capitalism and communism differ and that one cannot simply assess 'efficiency' in universal and neutral terms). Such an analysis is beyond the scope of this chapter. But we can at least recall here some arguments which suggest that neither the scale of agricultural production, nor its collective form, necessarily constrained the quality and quantity of agricultural production. Kazakhstani informants emphasized that there were periods of economic prosperity under socialized agriculture in the thirty years before the collapse of the USSR (1960-1990).

According to interviewees it was not primary production, the production of crops and livestock, which caused most problems but more the processes of storage, transportation, trade and distribution (retailing). Former vegetable agronomists spoke frequently of the spoilage of farm outputs in storage facilities. All of them said that their task was to fulfil the assigned quota by growing a certain amount and quality of vegetables, including potatoes. In many seasons, they exceeded these targets and received bonuses for that. At the end of the season, the state bought all the farm outputs at guaranteed prices and delivered them to fruit and vegetable storage facilities (*plodo-ovoshnaya baza*) located in the cities. The subsequent destiny of the farm outputs was not the concern of agricultural producers, but they knew about the spoilage of delivered outputs in storage facilities. Kaliev (2003:175) estimates that the USSR annually produced up to 80-85 million tons of potatoes of which, at maximum, only 56% were delivered to consumers. The remainder was spoiled. According to Kaliev, this was a result of the backwardness of technologies of storage, transportation and processing and the underdeveloped marketing system.

The view that collective farming was not 'unproductive' or technically backwards, as voiced by many interviewees, can also be found in parts of the literature. Brada and King (1993) conclude that the internal organization of socialized farm units did not make them inherently less technically efficient then private farms, as assumed by neoliberals. The American scholar Gale Johnson (1983:3) expresses a similar view:

> At one time I accepted the conventional explanation that the relatively poor performance of Soviet agriculture was due to the fact that most agriculture was socialized, organized into either collective or state farms, and to adverse climatic conditions for much of the agricultural area. However, I believe now that the socialized nature of Soviet agriculture is not the major source of difficulties. Many other aspects of Soviet planning, management systems, and pricing are far more important in limiting agriculture's performance than is its socialized character.

Former USSR President Mikhail Gorbachev, who served as Party Secretary for Agriculture during 1978–1985, also contests the notion that collective farming was unproductive (Gorbachev 1996:120):

> Statements claiming that agriculture was 'unprofitable' were found to be wrong. All data pointed to the fact that much more was siphoned off from agriculture than invested in it. And, of course, the nation's economic development had been achieved largely at the expense of the countryside.

The collective farm played a key role in legitimizing the single party system and state planning. It could only do so by supplying food to the urban population and exercising its political function in the overall system of communist surveillance (Walder 1994, Wegren 2006). Rural people in Kazakhstan remember the collective farm sector in the Kazakh Soviet Socialist Republic producing an ever-increasing amount of farm outputs and being important for the Soviet system. Today rural people still identify strongly with the collective farm and believe that it was a technically superior knowledge intensive agricultural system, which provided a good social infrastructure and secure livelihoods. The deterioration of the social and production infrastructures in rural areas after the collapse of the Soviet system, which will be discussed below, has strengthened, rather than weakened, this perception and people's attachment to the previous system.

## 2.5 The shock

What happened to *'the state within the state'* after the collapse of the Soviet Union? Those interviewed characterized the first decade of post-Soviet agrarian transition in Kazakhstan (1992-2002) with words such as *zastoi* (stagnation), *razrukha* (devastation), *upadok* (decline), *bardak* (chaos), *razval* (breakdown), *raspad* (disintegration), *razbombili* (destroyed) or *razderbanili* (torn apart). In the years after independence the liberalization of input prices and the control on farm prices led to low farm incomes, which together with continuing wage obligations, led many farms into debt (e.g. Gray 2000, Peabody et al. 2000). The incapacity to pay wages led to a reduction of the workforce and a decline in production. Access to credit was limited or absent and much machinery did not work due to a lack of, or interruptions in, the supply of spare parts, fuel and electricity. As other forms of marketing failed, barter (in many cases through units of livestock and grains) was often used as the last resort to keep production units operating. Payment to labour was often in kind as consumption goods (e.g. bread, meat, vegetables) or as inputs to household husbandry (e.g. fodder, hay). The influence of these economic constraints on the profitability and chances of survival of new privatized farms have already been addressed, to some extent, in the literature (e.g. Davydova and Franks 2006, Visser 2008). The following section discusses those aspects of the transition crisis that have received less attention.

### 2.5.1 *Dismantled infrastructure*

Crossing the Kazakh countryside, the collapse of Soviet farming is symbolized by the derelict skeletons of totally empty buildings, where only the walls remain. A visit to a former sovkhoz or kolkhoz can feel like travelling through the desolate built-landscapes pictured in the movies of Andrei Tarkovski, in which time and productive life seem to have vanished. Old people sadly point at heaps of stones or open spaces that once were local cinemas, libraries, clinics or bathhouses.[21]

The extent of this devastation can be seen as the base village settlement *Bokenshi* of the former sovkhoz *Sotsialistik* (Socialist), in the northeast of Kazakhstan, 36 km from Semey city.[22] It used to be a well performing sovkhoz (producing profits under the Soviet accounting system), specialized in meat, hides and wool production. The former farm accountant (Interview 02/10/2005), who worked there for 20 years, claimed that the sovkhoz was always profitable and the farm workers received luxury bonuses at the end of every year. Three divisions took care of the livestock and one division produced fodder crops and hay on 4000 ha of rain-fed area for winter fodder for the livestock. The sovkhoz reared 44,000 sheep in flocks of 500-700, more than 1000 cattle and about 2000 horses. Many of these were kept at remote satellite farms with barns to keep livestock during winter and a few houses for workers. These were located up to 40 km away from the base village. The sovkhoz's territory stretched up to 40 km with pastures for livestock to graze from early spring until late autumn. About 500 adults were employed in the base village *Bokenshi* (with more than 300 households) and a further 400 or so were employed in satellite farms. The base village had a production infrastructure, including a large machinery-tractor park with a garage and repair workshop, a gas station, storage for inputs and grain and administrative buildings. The social service infrastructure included a two-storey kindergarten, a three-storey school, a hostel for children of workers living at remote satellite farms, a small hospital, a post-office, a cultural club, a library, a food and miscellaneous shops, a fresh water supply station and a bathhouse. Except for the school, all these buildings were dismantled during the 1990s (see Appendix 2.2 for a photograph). Every useful material, the wood and brick walls were dismantled by hand and used as second-hand construction materials by local villagers or sold to city entrepreneurs. Visiting the site in 2006 all one could see was the ruins of some buildings and no sign at all of others that had once stood there. Today, basic services such as fresh water supply to households have ceased to function and people now have to manually pump salty groundwater. Much of the livestock was sold before 1995 to repay debts to the state for expensive inputs. In 1996, the remaining livestock and the machinery were divided among farm employees, as property shares. The moneyless workers then sold their shares to outsiders or to local and newly emerged peasant farms and the collective ceased to exist. A few agro-technicians based at the satellite farms set up livestock peasant farms, while other agro-technicians moved to Semey city.

A similar process of dismantling productive and social infrastructure took place in the neighbouring village *Dostyk*. This settlement of the former sovkhoz *60 Let Octiyabrya* (60 Years of October) is located 30 km from Semey city and 5 km from *Bokenshi* village. It specialized in crop production and used to grow potatoes, corn, sunflowers, peas, alfalfa and other crops on more than 5,000 ha of irrigated area. A team of engineers managed the irrigation scheme. They lived with their families in a separate small settlement of eight houses next to the Irtysh River near the water pumping-station.[23] When visiting the area in 2006, there was no sign of this settlement as their houses and the pumping station had been dismantled for construction materials (see Appendix 2.3 for a photograph). It was possible to trace the structure of the irrigation scheme by following the deep trenches made by excavators that had dug up the big irrigation tubes in order to sell them. As in many other places, people (outsiders and local villagers) had dismantled and sold irrigation devices made from non-ferrous metal to firms who melted them down for export. With the irrigation infrastructure gone 5,000 hectares of arable land has been abandoned and most of the inhabitants of the village have left as there are hardly any wage jobs in the local villages.[24] Most able-bodied people have moved to the nearby city of Semey and other places in search of employment. The remaining people survive thanks to some livestock, which graze in the vicinity of the village and are kept at night near the house and a small pension for elderly or people or invalids. The population of these villages is now less than half what it was in 1991. The collapse of most of the farming infrastructure and the deterioration of social infrastructure and population exodus is a widespread consequence of the transition that occurred throughout Kazakhstan.[25]

### 2.5.2 *The de-mechanization of agriculture*

Most of the farm machinery in use today in Kazakhstan dates back to the Soviet period. As such it is becoming outdated (interviews and own observations, Kembaev and Komlev 2004, Kurganbayeva et al. 2002, Satybaldin et al. 2001). Mechanics are trying to keep the machines alive by collecting second-hand spare parts from completely broken tractors dating back from the 1970s and 1980s.[26] The chairperson of a cooperative of agricultural producers in Almaty region described the state of farm machinery in his cooperative (Interview 02/09/2005):

> Our farm machinery was made in 1972, 1976 and 1978. We inherited it from the sovkhoz. This machinery has already become outdated and overused its potential. The only thing we can do is look for spare parts. We cannot afford new machinery. It is too expensive.

Nowadays having a brand new tractor is just a dream for the majority of farmers. The number of tractors used in Kazakhstan dropped by more than 80% between 1990 and 2005 (Table 2.3).

**Table 2.3 Number of tractors used in the farming sector in Kazakhstan**

| **Year** | **1990** | **1995** | **2000** | **2005** |
|---|---|---|---|---|
| Number of tractors | 243,333 | 184,243 | 52,084 | 44,116 |

*Source*: Agency for Statistics of the Republic of Kazakhstan (2002a, 2006).

The lack of machinery has had a major impact on agronomic practices. One effect is the improper timing of agricultural activities. Farmers lacking farm machinery have to wait their turn to be served by local entrepreneurs who provide such services; a friend who still owns a tractor or sowing-machine or a neighbour-farmer who owns a plough or pesticide spraying equipment. However, these people first cultivate or prepare their own fields. For example, an agronomist from the district agricultural department explained that the optimal period for sowing winter wheat in southeast Kazakhstan is between September 10 and October 10, but because of lack of machinery, sowing continues until mid-November (interview 10/06/2004). These delays affect crop development; crops become susceptible to diseases, pests and competition from weeds, all leading to yield losses.

Harvesting is also delayed, because of the scarcity of harvesting combines, again leading to significant yield losses.

Another effect is the shift from mechanized to manual farming. Many interviewed farmers deplore this change and are practising manual agriculture out of necessity, not as a new mode of 'peasant thinking'. Smaller and larger peasant farms share a preference for mechanized farming. The next quote from a new independent farmer expresses the frustrations of many farmers about the low level of mechanization (Interview 05/06/2006). This former Soviet-time agronomist grows vegetables on 30 ha, although in the past she managed 600 ha of highly mechanized vegetable production in the northeast of Kazakhstan.

> I cannot be proud of what you see now on this 30 ha because it is not a real agricultural production. *It is nonsense!* If you could see the hundreds of hectares of vegetable fields during the Soviet time, then I would be proud because I was managing all of them as the chief agronomist. We never did manual weeding; we had all types of machinery for all kind of agronomic operations.

The interviewed agro-technicians consider farming with manual labour as *dedushkini metodi* (grandfather's methods) or primitive farming; and do not recognize it as proper farming. These agro-technicians were employed at large-scale, highly mechanized Soviet farms for many years and it is not surprising that they are highly disapproving of the shift to manual labour.

### 2.5.3 *Depleted knowledge systems*

While the destruction of much of the material part of agricultural technology is quite visible and therefore much discussed, the loss of knowledge and the shaken knowledge structure is somewhat less visible although it also has grave consequences for agricultural production. This aspect may take much more time to recover. Today, there is a high demand for agro-technicians with specialized technical knowledge. Farm enterprises seeking to employ agro-technicians submit a request to the local agricultural departments, which help find them. A study of these requests revealed a demand for 1,462 agronomists, 2,031 vets and 749 agricultural engineers throughout Kazakhstan (Aubakirov 2006:71-72). Real demand, however, is probably much higher than these numbers since many farm enterprises do not submit such requests.

When interviewing the chairperson of a cooperative of agricultural producers about farm machinery and who repairs it, she said that there is only one mechanic for hay-pressing machines left in the entire Almaty region in the southeast of Kazakhstan (Interview 05/08/2005).[27] This mechanic used to work at the former Republican Farm Machinery Testing Station, which tested all sorts of farm machinery on trial fields before being mass manufactured or imported. Owners of hay pressing machines nowadays always look for him to fix their machines.[28] The Chairman of the Association of Kazakhstani Farmers commented on the critical lack of agricultural professionals as follows (14/09/2005):

> We have lost our agricultural cadres. There is an acute need for specialists. There are hardly any agricultural specialists available. My friend from Germany is running a project and looking for an agronomist but cannot find one. They bought new farm machinery but cannot find people to operate it. You see how big the problem is. Now young people study to become bankers, lawyers and so on. But we need agronomists, vets and other agro-technicians. For the time being farming is run by the old cadres, but they will not last forever.

Why is there a lack of agro-technicians? No survey to answer this question has been conducted, but several factors emerged from the interviews. Migrating or retiring agro-technicians were not replaced with newly trained people. A former brigadier of the former Republican Farm Machinery Testing Station emphasized the closure of training facilities; a consequence of the transition (Interview 05/09/2005):

> There are few *mechanisators* [operators of farm machinery] from the Soviet time left. I mean real *mechanisators*, not only those who can drive a tractor. Those who know how to plough, the types of plough and the depth of ploughing; those who follow all rules of soil cultivation and those who know how to operate all the farm machinery from A to Z. Many *mechanisators* from the Soviet time emigrated to Germany, Russia have retired or are at the cemetery. After the collapse of the Soviet system nobody trains and prepares such *mechanisators* for agriculture. The vocational schools were shut down. Now there is a deficit of these specialists.

Another interviewee, an agronomist in the Agricultural Department of the district administration for the Almaty region, related the lack of young agro-technicians to a general lack of interest in the agricultural sector and a shift of attention to other economic sectors, in particular the booming oil economy and new business activities (Interview 11/06/2004):

> In the near future we will have big problems with agro-technicians, even now there is a big demand for agro-technicians, but they are not available. The graduates of the Agricultural University after graduation go to the army, the police or go to business, not to agriculture. Or every young person wants to become an economist, an accountant and to sit in the office and make money. There is lack of technical school graduates, such as mechanics, operators of agro-machinery, zoo-technicians, agronomists, welders, electricians, metal turners and so on. Because many technical schools that trained these specialists were shut down. Soon the old generation will be gone; then there will a big problem with [the lack of] those specialists.

A number of processes seem to contribute to the scarcity of agro-technicians. First, the emigration of ethnic Germans, Russians, Ukrainians and other ethnic groups who supplied many of the agro-technicians to Soviet agriculture.[29] Second, the migration of agro-technicians from rural settlements to cities. Third, the ageing, retirement or death of agro-technicians who are not being replaced by the younger generation. Fourth, the unattractiveness of agriculture to younger generations (even to those who have studied at agricultural universities). Fifth, the vocational schools that previously produced mechanics, welders, operators of farm machinery, agronomists or veterinaries did not last long after collapse of the Soviet farming system (today there is hardly any school in Kazakhstan that provides training at this level). Finally, a substantial increase in supply is unlikely, as most agricultural producers who need their services cannot pay enough for their services. The remaining agro-technicians (mostly former Soviet agro-technicians) are employed by the most successful large farm enterprises.

The alarming scarcity of agricultural professionals in the farming sector limits agricultural development in Kazakhstan. A large number of farms are experiencing the consequences in the form of sub-optimal agricultural practices. In the transition period, the accumulated knowledge and skills of the Soviet agro-technicians have not been transmitted to the next generation. This substantial loss of knowledge and skills is one element of a broader and multifaceted process of knowledge loss, which also includes a depleted research infrastructure and capacity for innovation (Chapter 4, Toleubayev et al. 2007).[30]

## 2.6 Continuity and discontinuity in knowledge configurations

### 2.6.1 *Large-scale production in transition: Continuity in technology and knowledge*

A previous section described how former farm managers played a key role in the distribution of the assets of collective farms (often through a form of accumulation by dispossession). Paradoxically, the continued survival of the 'successful' farms was also highly dependent on the attitude of farm managers to their work rather than on a bottom up process managed by shareholders (former sovkhoz members with shares in land and property). As an example we can look at the recent history of *Prirechnoe*, a former sovkhoz located in the Semey region in the northeast of Kazakhstan, now established as a Partnership with Limited Liability. Many people in the Semey region refer to this farm as an 'oasis of welfare' compared to the surrounding deteriorated and collapsed farms. This farm continues to practice mixed production on 12,476 ha land of which 9,000 ha is grazing land used to rear 1,700 oxen for meat production. There is some 3,000 ha of arable land, 1,644 ha of it under irrigation; the remaining part is under fallow. While some observers have related farm viability to optimal production conditions (cf. Gray 2000, Kitching 1998) this farm shows that the relationship between two is not so simple. The farm is located in a region with an extremely harsh climate for agriculture, with long cold winters and short hot summers, which limits the cropping period to one short season from May to September. A low annual precipitation of about 280 mm and the very poor quality of the soil further constrain agriculture.[31] The poor soils of the area require a high input of chemical fertilizers, manure and a well-planned crop rotation scheme. In the Soviet era the land here received up to 100 tons of manure per ha of arable land. The collapse of livestock farms in the region means there is shortage of manure and currently between 50-60 tons manure is applied per ha, often collected from distant places. While the farm is located 10 km from Semey city, the proximity of a large market also does not guarantee continued survival. Other nearby sovkhozes (*60 Let Octiyabrya*, *Zhana-Semeisky* and *Semipalatinsky*) all collapsed even though they had similar, if not better, infrastructures and resources. Moreover, the farm nowadays markets its output to cities such as Pavlodar and Oskemen 350 km and 240 km away respectively.

The crucial factors in the survival of this farm, identified from interview data, are defending the existing infrastructure against dismantling, the continued use of the traditional 'technological map' and the existing division of labour and efforts made to retain knowledge and skills on the farm. The manager was able to maintain the old collective farm structure intact while, at the external level, new networks were built up in order to barter and market products, building on political ties from the Soviet era.

The preservation of the irrigation infrastructure was exceptional; almost all other farms in the region had used the same irrigation technology (a Soviet made mobile sprinkling devices called *Fregat*) but could not preserve it. *Prirechnoe* guarded its equipment day and night with armed guards and protected the network of pipes and the pumping-station (built in the early 1980s) that pumps water 4 km uphill from the Irtysh River and stores it in a reservoir, from where smaller pumps deliver water to the irrigation devices.

The 'technological map' as engineering tool, developed in Soviet time, was maintained as management saw it as being of critical importance. The agro-technician in charge of farm operations composes this map and says that the farm's technological practices and crop choices (potatoes 300 ha, alfalfa 300 ha, oats or barley 400 ha, corn 150 ha, carrots 60 ha, white cabbage 40 ha, onions 20 ha, red beet 10 ha) have not changed much since Soviet times. They still follow the Soviet style 7-field crop rotation scheme (year 1 – cereals, year 2 and 3 - alfalfa, year 4 - cereals, year 5 - perennial grasses, year 6 - potato, and year 7 – corn).

The management of *Prirechnoe* was able to keep sufficient expertise and skilled workers on the farm in contrast to other nearby farms, where people, especially the younger ones, left in search of employment in the cities. The managing agro-technician, now responsible for the entire range of crop production activities, was an agricultural engineer on this farm during Soviet times. The brigadiers of the production brigades are also experienced workers and have been employed on this farm for 20 to 40 years. The importance of accumulated knowledge and skill and of passing experience on to younger generations is illustrated in the following quote from the managing agro-technician (Interview 05/04/2006):

> We have *mechanisators* from the past. The old ones convey their knowledge and skills to younger specialists. Experience comes from the old cadres and develops through practice. We [the managing agro-technician and brigadiers] instruct the *mechanisators* about what to do in the field, but they do not need much supervision. They usually operate and fix the machinery independently, because they are experienced and know all the peculiarities of the farm machinery. All the field cultivation operations remain the same as in the past, so they have already mastered all of that.

The management had to make special efforts to fill expert positions. To find a replacement for their emigrated agronomist, they approached students close to graduation in agronomy at the Agricultural University in Almaty and found a female student who wanted to do her internship at this farm.

The farm management was also able to keep the agricultural workers, many of whom were also shareholders of property or land, attached to the farm. The continuation of the Soviet farm structure was important, as expressed by the deputy manager (Interview 05/04/2006):

> The only difference with the sovkhoz is that we are now a private independent enterprise. We were able to preserve our farm structure! We did not disintegrate, we did not split up, and that is why we did not collapse. Nowadays President Nazarbayev [President of the Republic of Kazakhstan] calls for agricultural producers to merge, to consolidate, but we are working as we worked in the past: as a large farm. Everything in our farm structure remains the same as in the past, farm management, the accounting unit, the farm machinery unit, the crop production unit, the livestock unit, housing and the communal services unit. Everything functions as it was, every unit has its own responsibility.

Most of the 250 people who work in the farm were employees of the sovkhoz. The farm hires an additional 150 people during the cropping season. In interviews, farm workers expressed appreciation for their employment on the farm and pointed out that they did not feel the hardship of post-Soviet agrarian transition in the same way as collapsed neighbouring sovkhozes, which faced high levels of unemployment. Here, we see the crucial role of the manager in preserving a farm from collapse. However surviving the transition has been imbued with ambivalence and contradictions. For the large-scale farm to continue, the former sovkhoz members had to keep their land and property shares in a common pool or pass their shares over to the management. At the same time, they depended on employment by the farm and were wage labourers (in the 1990s often paid in kind instead of cash; often with enormous delays in payment due to farm debts). The management controls all the technical as well as marketing decision making and, in most cases, shareholders or workers do not participate in this. Under such conditions, the organization of labour and keeping labourers satisfied (with low wages) required special skills from managers, which were not inherited from Soviet times. Moreover, farms had to cope with the challenge of maintaining the social infrastructure. *Prirechnoe* continues to support the social infrastructure of the settlement and spends some of its profits on the local school and the clinic, on maintaining the fresh water supply, streetlights roads, cleaning the streets and collecting garbage.

Successful farm managers had not only the skills to keep their labour force satisfied but also to build networks, by tapping into old political ties and by establishing new contractual relationships in the market arena. The farm manager of *Prirechnoe* uses the ties he already established in the Soviet era. Since 1994, he has served as a district delegate to the regional government. This has allowed him to further extend his socio-economic and political network. More recently, he registered the farm as a member of the Association of Potato Growers of Kazakhstan and in 2004 he signed a contract with Syngenta for pesticide supply. He also engaged the farm in business contracts, setting up a mini-factory for vegetable processing and producing potato crisps.

This case highlights the core role of farm management in continuing to exert control over the farm's technological infrastructure, both material (e.g. farm machinery) as well as the expertise and skills, to maintain control over labour and land and to make strategic use of political and economic networks. Only through the combination of these factors has it been possible to keep a large-scale farm viable.

In many ways, this analysis also seems to apply equally to the Cooperatives of Agricultural Producers (CAP) that have been set up since 1997. These emerged out of brigades and divisions of the former large collective farms, whose members decided to continue with collective farming (Box 2.1). This group of farms lie somewhere between continuing large-scale production (either privately or collectively owned) and small-scale private farmers. Members of the cooperative get a salary and/or payment in kind, according to the property and land share they contributed and their labour input. The chairperson of a cooperative plays a similar role to the farm manager of the enterprises discussed above. He or she often held a senior position in a sovkhoz. Keeping the land and the machinery together within the collective was once again a very challenging but essential task (particularly as the chairperson often has his/her own privatized property). When interviewed, the cooperative leaders stressed that they continued to follow the technological approach of the conventional Soviet farming style, although they face a number of different concerns: the high prices for inputs, low prices for produce and outdated machinery. Many of the cooperatives loan or exchange machinery with neighbouring farms.

The size of cooperatives has tended to decline, particularly since the Land Code of 2003, which made it possible to own and sell agricultural land as commodity. Crop rotation becomes more difficult to practise as the size of the cooperative land holding declines. Leaders of cooperatives used to emphasize that small farms are not viable because the impossibility of mechanization and of marketing the produce (the market infrastructure is built around large quantities). Many individual farms that have split off from the cooperatives still depend on the services of the cooperative (e.g. mechanized ploughing, harvesting, pesticide spraying, and so on) for their survival, but the paradox is that their splitting off endangers the viability of the same cooperative on which they depend.

**Box 2.1 Two case histories of cooperatives of producers: *Azat* and *Eldar***

According to Article 96 of the Civil Code, '*A Cooperative of Producers – is a voluntary union of citizens for a joint entrepreneurial activity, based on members own labour and a property stock built from the contributed shares of its members*'. By the decision made at the founding meeting of cooperative members, every member receives a document stating the type and size of the contributed share. The contributions of property and labour determine the size of a salary or in-kind payment that members of a cooperative will receive. Two CAPs (Cooperative of Agricultural Producers) in Almaty region were studied. CAP *Eldar* was formed by a brigade from sovkhoz *Leninski* and CAP *Azat* was based around a former division of the kolkhoz *Ilicha*. The chairpersons of these cooperatives are key figures who mobilized the workers in 1996-1997 to start joint farming by bringing together their land and property shares into the cooperative stock. Apart from the technicalities of farming, the chairpersons also have to deal with marketing issues, accounting, tax payments and labour management. As former agro-technicians from Soviet farms they claim to have no problem with farming technicalities such as ploughing the soil, rotating crops, calibrating the seeding machinery or spraying equipment, maintaining soil fertility, managing pests, controlling safety issues and assigning tasks to cooperative members. These technical aspects have not changed much from the Soviet era, except for the downsizing of the plots due to the loss of land that has been privatized. The exchange of machinery between farm entities is indispensable, since none of them have a complete set of necessary machinery: one has a harvesting combine and another has a seeding-machine, one has a hay-pressing machine, one a plough, one a spraying equipment and another a cultivator and so on.

CAP *Azat*

CAP *Azat* is a former division of a kolkhoz. Its joint assets consist of 8 tractors, 1 harvesting combine and 5 trucks; most of which are from the Soviet period. Each member of the cooperative owns about 2 ha of land. Only 80 of the 235 members who contributed their land titles and property shares to the cooperative in 1997 are employed by the cooperative; with others retired or engaged in non-farm activities, although they still receive payment for their shares. In 2005, CAP *Azat* had 410 ha, with cereals cultivated on 150 ha, potatoes on 70 ha, alfalfa on 70 ha, corn on 50 ha, sugar beet on 15 ha, soybean on 7 ha, onion on 3 ha, and the remaining area under fallow. Water for irrigation comes from a sophisticated irrigation scheme, called the Big Almaty Channel, built in the Soviet era (although half of this irrigation infrastructure has deteriorated because the collective farms that used to use and maintain it no longer exist).

Between 2003 and 2007 this cooperative lost half of its land (from 520 ha to

260ha), as a result of members selling off the land under the Land Code of 2003. The chairperson thought that the cooperative members, who sold their land, were short sighted (Interview 10/08/2007):

> Members who withdrew their land and sold it to land-dealers at low prices do not understand that land prices will increase. Moreover, farming is becoming a profitable business again because prices for farm products are increasing. Imagine, 1 ton of wheat today is worth 180 US$; that used to be 60 US$ a couple of years ago. Those who sold their land and wanted to be rich in one day now regret it because they have already spent their money, and have no other income.

He was also sceptical about the survival chances of individual small-scale farming business (interview 07/09/2005):

> Each member of cooperative owns around 2 ha. Who can individually run farming business on such plot? Nobody!

According to him, the cooperative survives thanks to its size, the volume of produce, the shared stock of machinery and the availability of labour (Interview 07/09/2005). He also pointed at the importance of his informal ties with officials in the District Agricultural Department (which date from the Soviet past) and his business network with pesticide and seed suppliers, processors and traders of agricultural commodities. Apart from the salary for their labour and payment for their shares, the members of this cooperative also receive, at the end of the cropping season, a share of the farm's outputs such as potatoes, alfalfa hay for livestock, grain, flour and sugar.

In 2007, many more people left the co-operative selling their land shares to outsiders, although about 60 members decided to stay and keep their land in its stock, which means that the cooperative will have about 120 ha of land to farm in 2008. The chairperson said it will be difficult to make profit on such an area but he is optimistic of generating some income for cooperative members (Interview 10/08/2007).

CAP *Eldar*

The chairperson of CAP *Eldar* was discouraged by the way that his cooperative had disintegrated following the introduction of the new Land Code in 2003 (Interview 02/09/2005):

> The President [of the Republic of Kazakhstan] calls farmers to consolidate, to farm jointly, but here on the contrary we are falling apart. Our cooperative land stock had 200 ha of 85 shareholders in 1997. Now I have only my 9 ha left and from next year [*2006*] I will farm individually. Legally I will run my farm as a peasant farmer. Most of the cooperative members sold their land to outsiders from the city. Have you seen the fields along the road covered with weeds? These used to be cooperative fields until last year; now these plots belong to outsiders. They have a lot of money, so they invested in land. Cooperative members, who sold their land titles, could not resist when ready cash was offered. Several members did not sell their plots, but what can they do individually on 2-3 ha?

Like the chairperson of CAP *Azat*, he was also sceptical about the ability of cooperative members to individually run a small-scale farming business. He thinks he can farm his 9 ha individually because he has the professional background as a horticulturist and knows all the farming technicalities. In 1998, he planted a 2 ha orchard with apples, pears, peaches and vines and is now marketing its output. In 2006, he used 5 ha of his land to grow alfalfa for his livestock and 2 ha to grow strawberries as a cash crop. According to him, he gets sufficient income from farming 9 ha. He bought a tractor, a hay-pressing machine and a lorry from the cooperative members during its disintegration. He was concerned about those who had not sold their 2-3 ha, but farmed individually. Their plots are now spatially scattered and cannot be cultivated jointly with other former cooperative members who still own land. When they came to him and asked what to grow, he advised them to grow alfalfa, because this crop is easier to manage and will produce hay for their livestock. He lends them his machinery. Now they also have to live on their plots during the cropping season to protect their crops from thieves and grazing livestock. When a cooperative, its members could take turns guarding the cooperative fields.

He recognizes that he is in an advantageous position as he bought a house with a barn from the sovkhoz when it was privatized. This infrastructure, which was used by brigade, is close to his land and he and his two hired workers stay there from early spring to late autumn. He was a member of the communist party and represented it in the sovkhoz party unit and also was the chairman of the trade union of the sovkhoz. He does not hide that through these positions in the past he came to know many people in the district administration and he used this to get subsidies for the cooperative, updated information, as well as personal privileges when the assets of the sovkhoz were privatized.

### 2.6.2 *Making up for knowledge loss: Technical expertise and building networks*

A focus on knowledge and skills, as key elements in the agricultural labour process, can increase our insight into why farms have failed in the transition process in Kazakhstan. It is clear that the transition from large-scale mechanized farming to small-scale manual farming, which requires a much higher level of integrative knowledge, has been unsuccessful for the smaller, individual farms. Constraints identified in the literature are inexperience, lack of finance and machinery, bureaucratic obstacles and the unfair redistribution of land and farm assets at privatization (Gray 2000, Peabody et al. 2000, Shreeves 2002). Many smaller properties face disadvantages, or cannot be used at all, because of their location (too far away from the village or scattered plots). Marketing channels for small-scale agriculture are limited and the supporting services do not function well. Some of our informants tried and gave up commercial farming because they did not have the necessary resources. They returned to subsistence household farming, became wageworkers at commercial farms or shifted to non-farming activities (cf. Spoor and Visser 2004, Sutherland 2008, Wegren 2008 for similar processes in Russia). Sixty nine percent of the respondents in a survey conducted among rural households in Kazakhstan (Peabody et al. 2000:205) did not want to be independent farmers. Neoliberal assumptions that Soviet farm workers would strive for land ownership and that individual, family-based, farming would become more efficient and produce more than the Soviet farm have proved to be erroneous (Kaliev 2003, Small 2007, Spoor and Visser 2001). It is argued here that the gloomy outlook for many small farmers is only partly explained by the processes of 'accumulation by dispossession' and the almost completely collapse of markets and service infrastructure. Another reason is the problem experienced by small farmers in using their existing knowledge and skills (which is both essential, yet not always appropriate given its roots in large-scale mechanized farming) and the difficulty acquiring or developing new knowledge and skills adapted to small-scale, manual farming (Box 2.2).

A comparison between the more successful small to medium size farmers and farmers who consider their situation as fragile or hopeless highlights this issue of technical expertise. The most dynamic post-Soviet commercial farms in Kazakhstan tend to be run by farmers with a professional farming background gained in the past, i.e. former agro-technicians (agronomists, vets, agricultural engineers) from Soviet farms. Why do these agro-technicians predominate in the farming business, and not farm workers, rural teachers, doctors or other rural dwellers, who also received land and property shares? These agro-technicians were able to bring together farm workers/shareholders for joint farming, to utilize their farming expertise to deal with farming technicalities and their socio-economic networks to support the farm enterprise. When they decided to run smaller scale individual farms, they could combine their technical knowledge and skills with insights generated by having access to a wide network of contacts and tapping into the knowledge available in this network (nodes of information and skilled knowledge). These networks largely originate from the Soviet time. Some examples may illustrate this. During an interview with a farmer, who was also a chairperson of a producer cooperative (Interview 30/05/2006 about pest control in his potato production) he used his mobile telephone to dial the pre-programmed phone number of the District plant protection officer to ask for the names of a particular pesticide and an insect-pest. The two knew each other from the 1980s and frequently met when she worked at the District Plant Protection Station and he as an agronomist of the kolkhoz. His manner of talking with her on the mobile phone was that of old friends. Another example of the importance of such Soviet camaraderie in shaping post-Soviet knowledge flows appeared during a visit to a horticulturist-farmer in the Almaty region in 2005. This former horticultural agronomist of a sovkhoz combines farming with a pesticide spraying business. He was involved in a long chat with a friend who was a former sovkhoz manager and who is now a peasant farmer with 55 ha of arable land. They were discussing an insect-pest that was severely damaging potato fields and the difficulties of controlling it. While it may seem obvious that these people exchange their knowledge, the point is that such interactions play a key role in explaining differences in farm survival. We encountered many occasions of such interactions between former agro-technicians, but no parallel interactions among most of the newcomer farmers. The former agro-technicians share their problems and engage their personal ties and business networks in the search for solutions. This puts farmers, who were agro-technicians, in an advantageous position when running a farm (whether as an individual or in a leadership position in a collective farm). For individual newcomer farmers (even if they may initially control a similar amount of material resources such as land, livestock and machinery) it is difficult to access such knowledge interactions, information exchange and the business networks enjoyed by former agro-technicians.[32]

This argument is reflected in some of the storylines from conversations. For example a former Soviet agro-technician, who is now a head of the successful peasant farm with mixed production in the Almaty region, commented (Interview 01/12/2004):

> Initially many rural dwellers thought farming would be a simple and profitable business. You just sow, harvest, sell yield and gain profit, but later they realized it is not that simple. If you did not study agriculture and have no professional background in farming then it is better not to engage in farming. As an agronomist, I am not going to teach children in a school or to treat patients in a hospital.

In addition, one amateur peasant farmer in Almaty region, a former economist in a sovkhoz, said (Interview 29/11/2004):

> We [newcomers into farming] are as just like newly born blind kittens. We are trying out and struggling with farming technicalities and this jeopardizes our ability to remain in farming business.

Doing fieldwork in Kazakhstan we encountered many inexperienced agricultural producers who lost their yields and money because of lack of farming expertise.

**Box 2.2 Knowledge and networks make a difference in small farms**

This case study illustrates how, in some situations, access to knowledge has more influence on the viability of a farm than access to land. This case is about two producers, one of whom owns 14 ha of land, and the other who rents 2 ha of land from the first one.

The land of the first farm is located about 4 km away from the village of the owner and 20 km from Almaty city. In the Soviet past, the owner used to work in a vegetable growers brigade of the kolkhoz where her husband worked as an agronomist. He started the 14 ha farm in 1997. When he died from a heart-attack in 2004 she took over the farm. She uses 1 ha to grow potatoes and vegetables for her own consumption and for in-kind payment to 2 or 3 seasonal workers; another 3 ha to grow alfalfa to feed her livestock; and 7 ha to grow white cabbage, the main cash crop. She sells it directly from the field to retailers at wholesale prices. In common with many interviewed producers, she complains about the low prices she gets for her cabbages. During harvest time, retailers sell them to urban consumers at 3 to 4 times the price paid and, in the winter season at a price 7 to 10 times higher. When asked why she does not sell directly to consumers, she mentioned the following obstacles: lack of transport, the high costs of hiring a car, the fees to be paid to the bazaar (market) administration and for storage facilities and the time to be spent on marketing. Therefore, she prefers to sell her cabbage from the field at a lower price. For her, cabbage is easier to manage than other vegetables. During the cropping season, someone has to stay round the clock on the field to guard the crops against thieves and livestock. She owns no machinery and cultivates everything manually except for ploughing, which is done with a hired tractor. Regarding profitability she remarked: '*By* *working on land you will not get rich, but you will not starve*'.

She has learnt what she knows about agronomic practices from reading the Soviet agronomic handbooks of her deceased husband, together with the knowledge and skills accumulated by working on a Soviet farm as vegetable grower for more than two decades. She experiments with new cabbage varieties on small plots before planting them on a larger scale. Her neighbour farmer, who rents 2 ha from her, gives her advice about the selection of new seeds, fertilizers and pesticides.

In contrast to the landlady, the tenant farmer makes a very profitable business on his 2 ha. By education a horticulturist, and now a lecturer at the Agricultural University in Almaty, he started to farm in 1999, in the midst an overall economic slump, to supplement his low lecturer's salary. He approached his old friend [deceased husband of landlady] and asked him to rent some land for farming. The business-minded university lecturer became a commercial farmer on 2 ha. Lecturing on vegetable crops, he had monitored new vegetable varieties appearing on the post-1991 agricultural market in Russia and Kazakhstan. He decided to grow spicy herbs (basilica, fennel, parsley, celery and so on) and 'exotic' vegetables (tomato, eggplant, marrow, pattypan squash, and so on, but of unusual sizes, shapes and colours). He figured out that there is a real market for exotic vegetables in Almaty – the largest city in Kazakhstan – and approached managers of expensive restaurants and supermarkets. They contracted him to deliver exotic vegetables and spicy herbs and paid prices 4 to 5 times higher than for ordinary vegetables. He is able to grow from March until October (using early, middle and late season varieties) by using plastic cover to protect seedlings from frost. He hires 3-5 seasonal workers who spend the season living on site in a small summerhouse he constructed. In this way, they can protect the crops against livestock and thieves. He visits the farm almost every day and takes part in crucial farming activities such as sowing, transplanting and fertilizer or pesticide application. He shows and instructs the workers what to do and how to take care of a particular plot and pays them in cash. He has made good contacts with foreign seed companies based in Almaty and his plots are used as demonstration plots for their potential clients, to personally see how certain varieties grow. Seed companies pay him for promoting their seeds. He did not disclose his profits, but he drives a 4WD Mitsubishi and his son a 4WD Chevrolet, suggesting that this combination creates a profitable business. Although this may be an exceptional case, it still is instructive. It shows that his professional expertise, the constant search for updated information about new varieties and the technicalities of their growth, establishing advantageous marketing channels and his entrepreneurial spirit are all key factors for establishing a successful small-scale farming business. Knowledge and networks do make a difference.

## 2.7 Conclusions

This chapter described the elements that contributed to the deep agrarian crisis in Kazakhstan after the collapse of the Soviet Union, which involved a large decrease in the cultivated area and in agricultural output. It argued that the crisis was not so much a crisis of collective farming *per se* but rather a result of inadequate transition policies, a weak state and a collapsed market. This created the conditions for two processes of 'accumulation by dispossession'. Firstly, many resources used within agriculture were appropriated, dismantled and sold (buildings, irrigation systems, machinery and so on). Secondly, de-collectivization and de-statization took place in an uneven way and led to an unequal distribution of the resources that did remain within the agricultural sector (land and some assets). This ‘accumulation by dispossession’ was accompanied by a decline in livelihoods, a decrease in social security and a collapse of the social infrastructure. Most new (and continuing) farm businesses are struggling for their economic survival. Together these factors have evoked feelings of nostalgia about the communist past among rural people; not only among the poor and former farmer workers but also among the former management and agro-technicians.

The study of these nostalgic storylines reveals another element that is crucial for explaining the nature of the agrarian crisis: the loss of knowledge and the lack of knowledge relevant to the new way of farming. Not only was the material and economic infrastructure of farming destroyed and depleted. The transition also transformed large-scale, knowledge intensive farming systems into small-scale, simplified farming. This involved a shift from highly mechanized farming to manually performed operations and a shift from a high degree of labour division in collective farming to one where individual farmers face the challenge of generating the multidimensional knowledge and skills needed to run a farming business. In this process, a large part of the knowledge and skills from former times was lost, since it was not passed to a new generation of agriculturalists. Equally many of the newcomer farmers lacked the knowledge and skills needed to survive in the harsh economic environment. The importance of access to and control over knowledge is highlighted by the key role that former agro-technicians play within the more dynamic farms. Their networks, largely rooted in the knowledge networks of the Soviet past, were also important in adapting their production systems to the new situation. This access to and control over knowledge and the circulation of knowledge in wider networks seems to be more important than the stock of land and machinery in influencing the success or survival of new farming arrangements. This study therefore suggests that knowledge is not an epiphenomenal element of the agricultural labour process but has to be conceptualized theoretically as a structuring component, equal to control over land (and other material means of production) and labour.

## 2.8 Notes

[1] Kitching also points at the absence of a mass of small farmers who would drive a massive redistributive land reform and benefit from it.

[2] This 1995 shift in land policy took place at a time when the power of the president was growing in relation to the legislature and judiciary (Cummings 2005).

[3] 'Krutikh' – 'krutim' [conjugation of word 'krutoi'] - here, she means 'rich and powerful outsiders'.

[4] Neither can one speak of post-communist peasants who opposed the privatization of land; an argument that some commentators have used to explain why full commoditization took so long (cf. Wegren (2006) for a critical discussion). Wegren (2004) argues that the lack of adaptive behaviour amongst former collective farm workers in Russia towards the new conditions should not be conceptualized as resistance. Likewise, the criticisms within this quote cannot really be referred to as a 'weapon of the weak' (cf. Jansen and Roquas 2002).

[5] This farmer himself is a Russian and does not intend to leave Kazakhstan. Officially, before 2003, it was not permitted to sell or buy land as physical asset. 'Concession right' officially meant that a person could give up his land entitlements to another individual farmer, farm enterprise or District Land Stock, on free-will, i.e. without receiving payment. This manager unofficially paid about 100 Euros per ha of land to the people leaving Kazakhstan. He also acquired a tractor and a plough from the farm property stock in a similar way. In 1998, he legally registered his 55 ha as a peasant farm under the new law '*On the Peasant Farm*'.

[6] Neoliberal reforms targeted removal of the state control over prices, withdrawal of state subsidies, trade liberalization and extensive privatization of publicly/collectively owned assets.

[7] The results of this programme are contested. Some Kazakhstani authors (e.g. Omarbakiev and Momynbaev 2006, Sabirova et al. 2005) and official reports claim its success but some members of parliament have questioned this [e.g. Abdrakhmanov on 28.03.2007: "I must say that discontent in rural areas is growing, where market reforms and 'Years of Village' initiated by the government did not reach its objectives."].

[8] Many of these crop production farms are relatively new, especially in the northern wheat belt. The 'Virgin Land' programme turned large areas of Kazakhstan's pasturelands into one of the major grain-producing regions of the Soviet Union. From 1954 to 1964, about 25 million ha of virgin lands were ploughed for cereal production, mostly by migrants from Russia, Ukraine and other parts of the Soviet Union. The programme also drew in a sizable population of Germans and other ethnic groups, officially labelled as 'unreliable', who were exiled to Kazakhstan during the Second World War.

[9] The remaining 65 state-owned farms are experimental farms belonging to public agricultural research institutes, farms breeding and multiplying local livestock and crop varieties and farms producing crop and livestock products for the government elite.

[10] This farm employs up to 70 workers, half of whom are employed permanently, even in the off-season partly to motivate them but also to maintain the farm infrastructure and the machinery and to prepare fields for the next cropping season. These hired workers are partly paid in cash, but mainly receive in-kind payment at the end of the season in the form of vegetables (carrots, red beet, cabbage and potatoes) and processed farm outputs (flour, sunflower oil and sugar).

[11] Cooperatives pay land tax and income tax. The employees of a cooperative receive a monthly salary, 10% of which is deducted for their pension fund. They may also receive an in-kind payment at the end of the cropping season. Collective work and relations within the cooperative still largely resemble the structure of Soviet farms (cf. Sutherland 2008 for similar cases in Russia).

[12] Ironically, since 2005 the Kazakhstan government has extolled the advantages of large-scale collective farming, in its dealings with farmers and its propaganda. It has been urging small-scale farmers to cooperate and merge their properties into larger entities in order to deal with market forces, to be competitive, and to contribute to national food security.

[13] Kazakhstan is among the top-ten wheat exporters in the world; the others being the USA, Australia, Canada, France, Argentina, Russia, Germany, the United Kingdom and India.

[14] A comparison of yields obtained in each farm type category is very difficult, if not impossible to obtain. Existing statistics and the data used in several studies, mainly within the discipline of economics, do not, for example differentiate between winter and summer wheat (with different yields) or take into account the heterogeneity of environmental conditions and the enormous variation in input use within each farm category. Moreover, private agricultural producers may submit figures to the District Statistics Office that seriously underestimate the yields obtained, to avoid paying tax on the profits from farm output. We have refrained here from presenting such misleading aggregations.

[15] Even access to consumer goods not supplied through the Soviet system (but through the 'grey-market') was mediated by kinship ties and patrimonial relationships and not purely through (grey) market mechanisms (Schatz 2004).

[16] '*Mechanisator*' is a category of farm workers who operate, maintain and repair farm machinery.

[17] Unemployment in the farm community did not exist in the Soviet past.

[18] The experimental stations of the agricultural research institutes used to develop model crop rotation schemes and recommend them to crop production farms.

[19] Data about the specialization and daily activities of Soviet farm agro-technicians were collected through interviews with agro-technicians, agricultural researchers and practitioners from experimental research stations and from reviewing professional journals and archival documents. The following summarizes the activities of some other key agro-technicians.

The agro-chemistry agronomist would develop a 'soil fertility map' and would regularly send soil samples from farm fields to a specialized laboratory to test the quality and quantity of available nutrients in the soil. Based on the results of the soil analysis the agro-chemist specified the type of fertilizers required for a particular crop on a particular field. Interviewed agro-technicians mentioned an annual application of up to 100 tons of manure per ha of arable land. The agro-chemist also would develop an optimal crop rotation scheme based on the nutrient uptake of a particular crop. The soil fertility map and the crop rotation scheme were then incorporated into the master technological map.

An agricultural engineer was responsible for the maintenance and efficient use of farm machinery. He led a team of *mechanisators*, i.e. tractor and truck drivers, field machinery operators and mechanics and coordinated their actions. These people were trained at vocational schools and followed special short courses if they were required to operate new machinery.

A seed agronomist was responsible for seed quality during storage and when seeding. He collaborated with the regional research institutes and experimental stations specialized in seed-breeding and with seed-multiplication farms to bring the best cultivars to his own farm.

[20] Verdery (2005) identifies a major difference between capitalism and Soviet communism, with the former being concerned about making profit by selling things, and the latter about procuring things.

In this sense it was rational for farm managers to procure adequate supplies (which included elements of padding and hoarding) in order to make production possible instead of focussing on reducing costs. She argues that this maximization of given capacity included maintaining a pool of labour (even though labour was often not employed 'profitably' in capitalist terms). We argue that this accumulation of resources also included maintaining the access to a pool of expert knowledge and skills.

[21] The photographs we made of ruins of buildings of former social and farming infrastructures provide material evidence of this (See appendix 2.2 and 2.3).

[22] The first author grew up in this village.

[23] The first author eye-witnessed the irrigation devices and the water-pumping station in operation throughout the 1980s.

[24] A similar collapse and deterioration happened in the next village Chekoman which used to be a dairy farm. The description of two cases, however, should be enough to support the argument.

[25] To our knowledge no inventory exists of the loss of farm infrastructure. These cases are therefore only a preliminary indication of the magnitude of the problem and the size of the task of rebuilding the agricultural sector. A recent study on rural-urban migration identified the agrarian crisis as the main reason why people migrate: yet in the city these people are mostly belittled as second class citizens (Yessenova 2005, see also Nazpary 2002).

[26] Whereas in communist Cuba ingenious mechanics keep old American cars from the capitalist past running, in Kazakhstan ingenious mechanics keep tractors and machinery of the communist past running in a capitalist economy. One informant delivered services to farmers (e.g. ploughing) and proudly showed the authors various new machines he had invented and built out of Soviet period materials.

[27] Almaty region covers 224,000 square km (8% of the total territory of Kazakhstan), with about 12 million ha of pastures and 1 million ha of arable land. As of 2006, there were 51,085 farm enterprises, 97% of which were peasant farms.

[28] Another example about the lack of agro-technicians with specialized technical knowledge was given in an interview with a brigadier from *Prirechnoe*, a large farm enterprise in the northeast of Kazakhstan (Interview 05/06/2006). This was the only farm enterprise in the whole region that maintained its (sprinkler-based) irrigation scheme. The previous irrigation engineer on this farm emigrated to Germany (he was an ethnic German, born in Kazakhstan who had worked for many years on this farm) and the farm manager had to spend a lot of time searching the entire Semey region to find another irrigation engineer. Finally, he found one who had used the same irrigation infrastructure and who had lost his job after the collapse of the sovkhoz where he worked. At time the job offer was made this engineer was engaged in other activities not involving his expertise. Now the farm manager pays him good salary to keep him working in this farm.

[29] The Kazakhstan population reduced from 16,463,000 people in 1998 (State Committee for Statistics of Kazakh SSR, 1989) to 14,819,700 people in 2002 (Agency for Statistics of the Republic of Kazakhstan, 2002b). Over 40% are rural dwellers. This reduction of about 10% of the total population is a result of mass emigration of ethnic Germans, Russians, Ukrainians and others.

[30] A similar process of knowledge loss resulting from post-Soviet transition is described in Uzbekistan by Evers and Wall (2006) and Wall (2006), who focus at the very local level.

[31] The soil *bonitet* across the farm fields scores 10-12 out of a 100 possible points, i.e. the soil is close to unfertile. This is a measure of soil quality based on a comparative assessment of several

indicators: humus horizon thickness, the concentration of nutrients and elements, pH, chemical composition, salinity. Land with a *bonitet* of less than 10 points is considered unfertile.

[32] This does not mean that all newcomer farmers fail. Some are very keen to learn the intricacies of farming and seek out former Soviet agro-technicians for advice; ask for farming literature from them; participate at farmers' gatherings and learn from their own and others' mistakes. This difference is not fixed and there is some mobility. But rather than contradicting our argument it supports the argument that gaining access to the networks through which technical knowledge flows is a crucial element of survival in the transition period.

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# *Chapter 3*

# From integrated pest management to indiscriminate pesticide use in Kazakhstan

## 3.1 Introduction

The fall of the Soviet system in 1991 and the subsequent process of neoliberalization in Kazakhstan had severe consequences for the public institutions involved in plant protection (Toleubayev et al. 2007, Toleubayev 2008) and, as we will show below, for the use of Integrated Pest Management (IPM). This chapter examines the impact of the shift to market-driven institutions on IPM practices in Kazakhstan. The term IPM is broadly used in English publications and the Russian equivalent - *Integrirovannaya Zashita Rastenii*- literally Integrated Plant Protection (IPP) has a similar meaning. This study uses these two terms synonymously. The IPM approach emerged in the 1960s as a response to the severe problems caused by the overuse of pesticides in northern America (Morse and Buhler 1997, Palladino 1996, Perkins 1982) and has since been continuously developed and promoted in many countries (e.g. Bruin and Meerman 2001, Morse and Buhler 1997, Sorby et al. 2003). Similarly, the Soviet Union prioritised, developed and practised the IPP-based pest-control approach throughout the 1970 and the 1980s to avoid environmental and health hazards (Fadeev and Novozhilov 1981, Shumakov et al. 1974).[1]

Since the collapse of the Soviet system pesticide spraying has become the main approach to pest control in post-1991 Kazakhstan (Sagitov 2002). At the same time, inspection of pesticide residues in produce disappeared or stopped being enforced and the use of environmentally benign pest-control methods ceased. This chapter asks the question: Why did the pesticide perspective become dominant both in pest-control practices and in setting the research agenda and why is IPM not in use anymore in post-1991 Kazakhstan? It takes an IPM-based pest control in the Alma-Ata oblast[2] of the Kazakh SSR[3] in the 1970 and the 1980s as a case study and examines the role of institutional support from the state in creating the conditions for implementing IPM. In doing so it argues that the IPM approach is knowledge-intensive and needs an institutional backup and concerted action for its implementation, conditions which are in short supply in contemporary Kazakhstan.

We start by presenting the methodology, defining the IPM approach and examining plant protection practices in Soviet collectivized agriculture. We then illustrate how pest-control practices changed after 1991 and conclude with a discussion of the problems involved in implementing IPM in the context of the fragmented agriculture that emerged after 1991.

## 3.2 Methodology and definition of Integrated Pest Management

Plant protection is a complex technological domain, where the interests of many stakeholders meet. To examine this domain we use a technographic approach (Richards 2001, Sigaut 1994) to position the technical facts related to pest control within a socio-economic context. According to Richards (2001:26,30), ‘technography’ is a useful label to emphasise the importance of describing social and biological worlds in their full complexity and to achieve a contextual understanding of sustainable agro-ecosystem development. Data were obtained through in-depth interviews with (former and current) plant protection practitioners, researchers, farmers, policymakers and pesticide dealers. These actors provided information about the technicalities of pest control and their professional experiences and interpretations of the nature and cause of pest problems (Jansen 2008). We conducted participant observation of meetings involving policymakers, practitioners, researchers, farmers and representatives of the pesticide industry and also observed pesticide application in practice on several occasions. Literature, archival documents, scientific reports and press coverage on plant protection issues were reviewed and the data from these different sources were cross-checked.

A major contribution of the IPM approach to agriculture has been to demonstrate the need to base all phases of crop production on sound ecological principles, with the ultimate goal of creating agro-ecosystems that are economically and ecologically sustainable. IPM emerged as a reaction to an overwhelming reliance on pesticides, which came to be recognized as a short-term solution that had far reaching negative consequences. Over the last four decades IPM evolved from a technical approach into a paradigm of long-term sustainability in agricultural production that incorporates environmental, economic and social aspects (Flint and Gouveia 2001, Kogan 1998, 1999, Morse and Buhler 1997, Norton et al. 1999, Struik and Kropff 2003, Van den Berg 2004, Van den Berg and Jiggins 2007, Van Huis and Meerman 1997).

The Soviet Integrated Plant Protection (IPP) system can be best characterised by the following definition chosen from a list of IPM definitions collected by Bajwa and Kogan (2002:14):

> Integrated Pest Management (IPM) for agriculture is the application of an interconnected set of principles and methods to problems caused by insects, diseases, weeds and other agricultural pests. IPM includes pest prevention techniques, pest monitoring methods, biological control, pest-resistant plants varieties, pest attractants and repellents, biopesticides, and synthetic organic pesticides. It also involves the use of weather data to predict the onset of pest attack, and cultural practices such as rotation, mulching, raised planting beds, narrow plant rows, and interseeding.

This rather technical definition of IPM captures the broad range of an interconnected set of principles and methods that were utilized in the Soviet crop protection system. The Soviet literature (e.g. Fadeev and Novozhilov 1981), recognised IPP as a complex approach incorporating biological, agronomic, physical and other methods to reduce pesticide applications while still effectively controlling agricultural pests.[4] Continuous monitoring and forecasting of the population dynamics of pest organisms and the application of pesticides based on economic thresholds[5] were at the core of pest-control activities in the IPP schemes. As illustrated below, the ultimate aim of the IPP approach in the Soviet crop production system was to integrate all the possible environmentally friendly and safe pest-control measures.

## 3.3 Plant protection practices in Soviet collective agriculture

In the Soviet past, the Plant Protection Service (PPS) was responsible for all crop protection issues nationwide (Toleubayev 2008). The unified PPS was set up in 1961 (after the decree of the Council of Ministers of the USSR №152, February 20, 1961). It emerged as a network of plant protection stations, including monitoring and forecasting units, spread across the Soviet Union and coordinated from Moscow. In the Kazakh SSR the Ministry of Agriculture hosted the Republican Plant Protection Station which then operated plant protection stations at the regional (*oblast*) and district (*raion*) level. By 1978, there were 15 oblast PPSs in Kazakhstan coordinating 206 raion PPSs. Overall there were 29 biological laboratories, 16 toxicological ones, 72 monitoring units and numerous specialised spraying teams (Kospanov 1978). The network of raion and oblast plant protection stations was closely linked to crop producing farms, the agricultural research institutes and the experimental stations within each region. Plant protection specialists fulfilled the role of extension agents in the Western sense. On November 2, 1970 the Ministry of Agriculture of the USSR issued a decree entitled '*State control of the crop protection activities in the USSR*'. This empowered the specialists of PPS with inspection authority to control all activities concerning plant protection, including pesticide use. They assisted researchers to introduce research recommendations on farms, discussed pest-control issues with farm agro-technicians and managed pesticide use. Plant protectionists, including researchers, promoted the principles of Integrated Plant Protection.

### 3.3.1 *The principles of Integrated Plant Protection*

The Integrated Plant Protection approach was widely used in the crop production system of the Soviet Union, including Kazakhstan (e.g. Shumakov et al. 1974, Fadeev and Novozhilov 1981, Beglyarov 1983, Chenkin et al. 1990; our review of the research compendiums of the Kazakh Research Institute for Plant Protection and archival documents of the Alma-Ata Oblast Plant Protection Station and the *All-Union Journal of Plant Protection*[6] 1935-1991). Some books by Soviet authors, e.g. *Integrated Plant Protection* (Fadeev and Novozhilov 1981) and *Biological Agents for Plant Protection* (Shumakov et al. 1974), promoting the IPP approach, have been translated from Russian into English by western publishers. This suggests that the western world had an interest in the IPM work of Soviet scientists. However, western authors barely acknowledge that Soviet researchers and practitioners widely promoted IPM in the countries of the Soviet bloc. For example, Oppenheim (2001) reviews the use of alternatives to chemical control, especially biological control,[7] in Cuban agriculture but makes no reference to the significant role of Soviet researchers and practitioners who promoted IPM in Cuba – even though Cuban plant protectionists acknowledge Soviet assistance in pest management issues (e.g. Perez and Spodarik 1982). Some of our interviewees from Kazakhstan worked for many years promoting Integrated Plant Protection in Cuba as well as in African countries aligned to the Soviet bloc.

Our in-depth interviews with a number of plant protectionists from the Soviet era reveal that IPP was an important part of the farming system in Kazakhstan. For instance, the following interview fragment with a senior researcher from the Research Institute for Arable Farming, who used to work at a raion plant protection station illustrates the organization of pest monitoring (Interview 21/10/2005):

> In the past, I managed the Monitoring and Forecasting Unit of a Raion Plant Protection Station. From early spring onwards we surveyed farm fields, estimated pest populations, monitored disease development and so on. Such monitoring was conducted on the fields in all the raions. Every week we sampled, observed changes and recorded what was happening. Then we submitted our data to the Oblast Plant Protection Station (OPPS). Afterwards the OPPS processed the information from all the districts and made a forecast on pest and disease development within the region. They sent this report to The Central Republican Plant Protection Station. Farms were notified to be ready to undertake control measures. …The specialists of the Plant Protection Service thoroughly knew how to survey, to calculate economic thresholds and when and how to control.

The quote shows how the unified plant protection service provided information for timely control measures against pest and diseases, despite the administrative borders between the collective farms and across districts and regions. Pest-control operations were based on data derived from the regular monitoring of pest population dynamics and resulted in concerted action of raion PPS specialists and farm plant protection agronomists. The case study below shows that the IPP approach, including biological control was widely practiced in Soviet collective agriculture and that this required an extensive knowledge base and institutional backup.

### 3.3.2 *Case study: Integrated Plant Protection in Alma-Ata oblast, Kazakh SSR*

The Alma-Ata Oblast Plant Protection Station (AOPPS) was one of 15 oblast stations of the Plant Protection Service in the Kazakh SSR. It was established in 1960 (under decree № 1126 of the Council of Ministers of the Kazakh SSR issued December 17, 1959), and was built on the facilities of and using staff from the former Pest-Control Unit of the Alma-Ata Oblast Department of Agriculture. By 1969, the AOPPS coordinated and was responsible for the activities of six raion PPSs, the Anti-Locust Unit, the Monitoring and Forecasting Unit, spraying teams and 47 plant protection agronomists based in the kolkhozes and sovkhozes within the Alma-Ata oblast. By 1983, the AOPPS was enlarged, with another four raion PPSs and with toxicological and biological laboratories to carry out the IPP-based pest-control activities. This structure continued to exist until the collapse of Soviet system.

The following sub-sections introduce the principles of Integrated Plant Protection employed in the Alma-Ata oblast, and how IPP was implemented through biological control, monitoring and forecasting, toxicological control of pesticide use and the concerted activities of plant protection specialists.

## Biological control

The use of biological pest control[8] in the USSR started in the beginning of the 1930s although Russian entomologists had already experimented with it in 1911 in the Tsarist period (Dysart 1973:165). Experiments carried out in 1933-1934 using the egg-parasitoid wasp *Trichogramma evanescens* to control the European Corn Borer *Ostrinia nubilalis* in the southeast of Russia proved the efficiency of biological control whereas the results obtained from chemical dusting were questioned (Zimin 1935). By that time researchers of the All-Union Institute for Plant Protection had already suggested broader use of *Trichogramma* spp. against lepidopterous pests of fruits and vegetables (Zimin 1935:70). Subsequently, a trial of Trichogramma on 22 ha of apple orchard in the Crimea reduced fruit damage by the Codling moth *Cydia pomonella* by 42% (Dirsh 1937).

In Kazakhstan, biological control became widely used in orchards, cotton and vegetable fields and greenhouses from the beginning of the 1970s onwards. Before that date, the chemical control approach dominated, and biological pest control was only present at an initial stage of development. In the Alma-Ata oblast, the first biological laboratory[9] was set up in AOPPS in 1972. By 1980, there were seven bio-laboratories in the oblast, including the bio-laboratory of the Kazakh Research Institute for Plant Protection (KRIPP). In the same year, there were 723 bio-laboratories throughout the USSR, which increased to 1,500 in 1985 (Figure 3.2).

Archival reports show that in 1973 *Trichogramma embryophagum* was released on 605 ha of apple orchards in the Alma-Ata oblast. In 1980, *Trichogramma* spp. were released on an area of 10,484 ha (Figure 3.1), including 1,539 ha of orchards (*T. embryophagum*, 5-7 releases per season) and 8,945 ha of field crops[10] (*T. evanescens*, 2-4 releases). With the installation of two automated new production lines in the AOPPS bio-laboratory in 1982 for mass rearing of Trichogramma and its laboratory-host the Angoumois grain moth (*Sitotroga cerealella*), production of *Trichogramma* spp. increased. This allowed the release of *Trichogramma* spp. on a crop production area of 16,517 ha on 26 farms in Alma-Ata oblast in 1983; an increase of 37% compared to 1980. After two to four releases during the 1983 cropping season, on crops such as cabbage, red beet, tomato, alfalfa, potato, maize, tobacco, soybean, carrot, onion, egg-plant and pepper, *Trichogramma* spp. parasitized 70-86% of the eggs of the polyphagous moths *Pieris* *brassicae*, *Agrotis segetum* and *Chloridea dipsacea*. The area treated with *Trichogramma* spp. continued to increase to 25,500 ha in 1987 (Figure 3.1). This increase was made possible because of extensive research, improved rearing and releasing technology and the installation of new automated production lines for Sitotroga and Trichogramma. The rearing process of Trichogramma was thoroughly recorded, i.e. how much was produced, used and exchanged; its quality under laboratory conditions was monitored and the economic and biological efficiency under real crop production conditions was evaluated.

An American entomologist Richard Dysart concluded from his 2-month trip to the Soviet Union in 1970 about Trichogramma use in the USSR (Dysart 1973:170,173):

> …the system apparently functions well and it certainly demonstrates that Trichogramma production need not entail costly and elaborate equipment. Furthermore, no one can ignore the fact that the system is producing enough Trichogramma to treat over 6 million acres of crops, without a trace of chemical residue or of "ecological backlash." … It seems rather likely that the Soviets are going to use these little [*parasitoids*][11] on an even larger scale in the years to come.

In 1985, Trichogramma in the USSR was used on 15.3 million ha of cropland (Nikonov 1986:3). Calculations by Dysart (1973:169) suggest Trichogramma was much cheaper then treatment with pesticides. Also Van Lenteren (1997) argues that the development, application and cost-benefits of biological control are many times cheaper than that of chemical control.

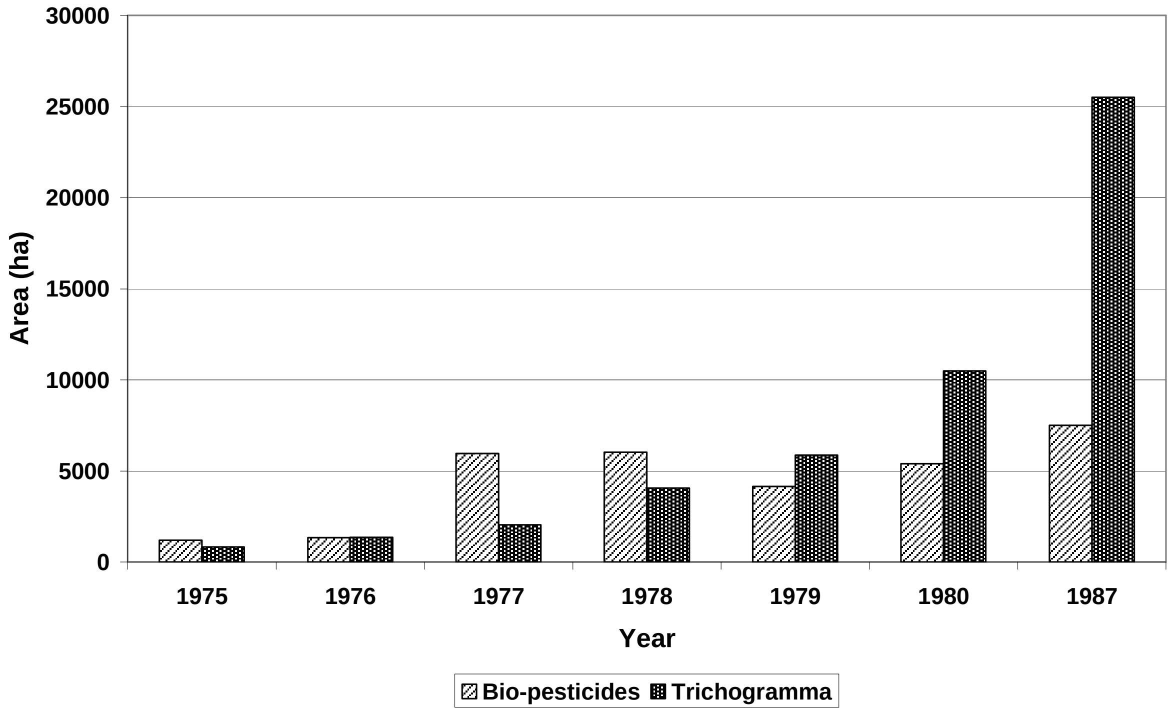


**Figure 3.1 Crop production area under biological control in the Alma-Ata oblast from 1975 to 1987**.

*Source*: Compiled by authors from annual reports of Alma-Ata Oblast Plant Protection Station produced in 1980 and 1987.

Apart from Trichogramma, bio-pesticides[12] were also an essential part of biological pest control. By 1977, bio-pesticides were applied on 5,960 ha of croplands in the Alma-Ata oblast (Figure 3.1).[13] In the same year, the USSR treated 4,200,000 ha of its croplands with bio-pesticides (Beglyarov et al. 1978:16).

Release of Trichogramma was combined with application of bio-pesticides based on viruses (e.g. *Virin-X*), bacteria (e.g. *Bacillus thuringiensis*) or fungi (e.g. *Beauveria bassiana*). The combined use of these bio-agents was estimated to kill 64-84% of the targeted pests (Annual reports of AOPPS 1973, 1980, 1983, 1988). Their use either eliminated or considerably reduced the need to apply synthetic insecticides. Releases of Trichogramma and applications of bio-pesticides were based on pest population dynamics data provided by the Forecasting and Monitoring Unit of AOPPS. Researchers of the biological laboratory of KRIPP and the specialists from the biological laboratories in the Alma-Ata oblast assisted farm agro-technicians to carry out biological control on the sovkhozes and kolkhozes.

Archival material shows that the fly *Phytomyza orobanchia* was used against the parasitic weed *Orobanche* sp. on 703 ha of tobacco plantations on two sovkhozes: *Alma-Atinski* and *Baltabaiski* in 1973. *Orobanche* sp. was one of the most difficult weeds to control and neither chemical nor agronomic measures were sufficient to control it. Although the biological and economic efficiency of *Ph. orobanchia* was not high, it formed part of an integrated scheme to control *Orobanche* sp. in the Alma-Ata oblast throughout the 1970s and the 1980s. *Orobanche* sp. is also diseased by a *Fusarium* fungus. *Phytomyza orobanchia* is able to carry *Fusarium* spores on its body while emerging from the pupae which develop inside the infested *Orobanche* sp. shoots. In this way the fly is not only a biological control agent itself but also transmits one, the *Fusarium* spores which infest *Orobanche* sp.. One plant protectionist indicated that this double effect in controlling *Orobanche* was purposely used in the Alma-Ata oblast (Interview 03/06/2006). In the USSR, *Ph. orobanchia* was applied annually up to 130,000 ha of cropland infested by *Orobanche* sp. (Kravtsov 1978:3).

Biological control was also widely used in greenhouses of the USSR, including those located in Alma-Ata oblast. In 1977, the predatory mite *Phytoseiulus persimilis* was used in greenhouses against the spider mite *Tetranychus urticae* on 1,550 ha in the USSR (Kravtsov 1978:2); and in 1980 it was used on 42 ha in the Alma-Ata oblast. The predatory mite eliminated up to 90% of spider mites and the application of chemical acaricides was no longer required (Annual report of AOPPS in 1980). In the Alma-Ata oblast, the bio-laboratory of the greenhouse complex *Alma-Atinskii* reared the parasitoid *Encarsia formosa* to control the whitefly *Lisiphlebus testaceipes*, the parasitoid *Cicloneda limbifer* to control aphids and the predatory mite *Amblyseius mckenziei* to control thrips. This bio-laboratory also produced a bio-pesticide based on an entomopathogenic fungus of the genus *Verticillium*. Integrated use of these bio-agents significantly reduced or eliminated the need to apply pesticides in greenhouses (Annual reports of AOPPS 1973, 1980, 1983, 1988).

In the whole of the USSR, the area treated with predators, parasitoids and bio-pesticides increased from 400,000 ha in 1965 to 33,100,000 ha in 1985 (Figure 3.2).[14]

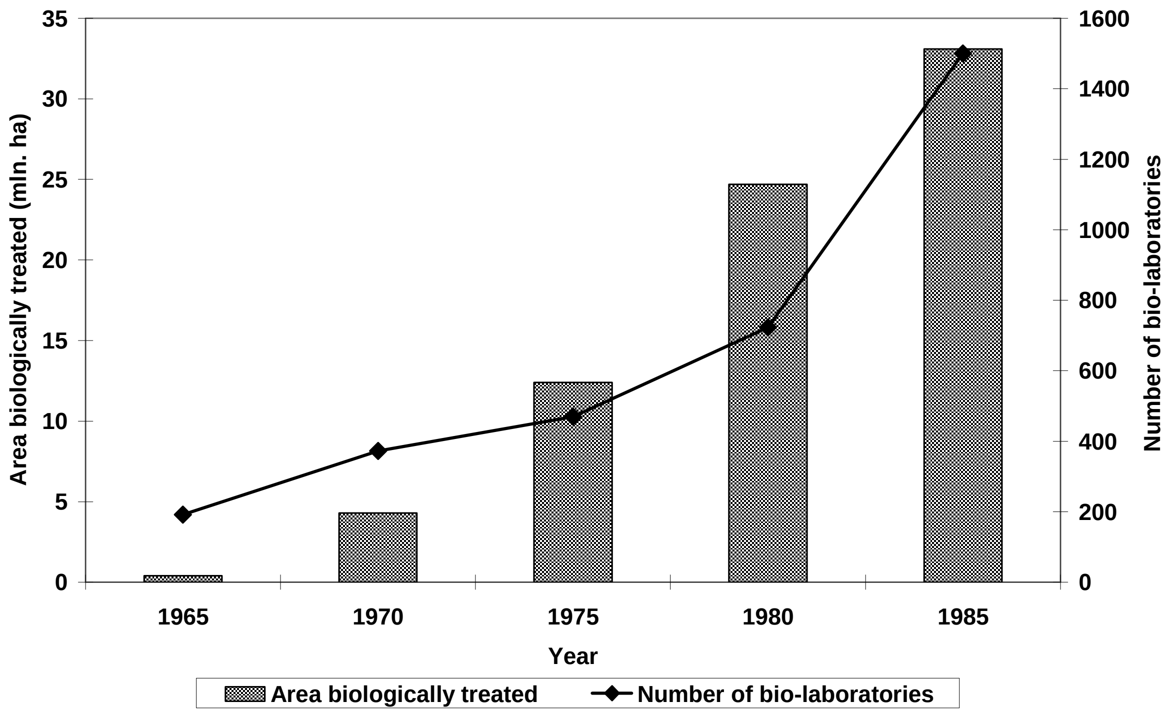


**Figure 3.2 Area treated with biological control agents (predators, parasitoids and bio-pesticides) and number of bio-laboratories in the USSR between 1965 and 1985.**

*Source*: Adapted from Nikonov (1986:3).

Archival reports of the biological laboratories and interviews with plant protectionists reveal that the economic or biological efficiency of bio-agents were sometimes lower than expected. This was due to unfavourable climatic factors in some years, differences in agro-ecological conditions and deficiencies in the mass production. Nevertheless, before 1991, up to 400,000 ha of crop production area in Kazakhstan were annually treated with biological control agents (Sagitov and Ismukhambetov 2005:6). There were continuous efforts by researchers and practitioners to make these biological controls more efficient. They formed an integral part of the integrated crop protection scheme to keep pest populations at manageable levels and to reduce pesticide use.

## Activities of the Monitoring and Forecasting Unit

Our review of archival documents and interviews shows that throughout the cropping season the specialists of the Monitoring and Forecasting Unit of AOPPS carried out phenological monitoring of crops and pest organisms. They composed distribution maps of pest organisms and calendars of the development of crops and their main pest organisms per season and area. They diagnosed crop diseases by monitoring early symptoms so as to conduct timely control. They alerted farm agronomists when the populations of pest organisms were about to exceed economic thresholds and indicated the optimal time for undertaking control measures. Data on pest occurrence and population dynamics collected throughout Alma-Ata oblast was sent to the Republican Plant Protection Station, which worked together with the Monitoring and Forecasting Department of KRIPP and analysed data across the whole of Kazakhstan, composing an annual review of pest occurrence and a forecast for the next season (see Appendix 3.1 for an example). Such reviews were issued every year from 1965 until the collapse of the centralized Plant Protection Service in 1991. The forecast data in these reports allowed plant protectionists to plan pest-control activities for the next season at the farm, raion, oblast, republic and even at the All-Union level for migratory pests. It included calculations of the expected demand for pesticides and/or bio-agents, machinery and labour and outlined areas, where control measures should to be first carried out. These annual forecast data were adjusted with actual data on development of pest organisms during the season and control measures were adapted to this situation. The Republican Monitoring and Forecasting Unit also accumulated data over many years to assess the patterns of population dynamics of the most harmful pests and to provide long-term forecasts.

## Work of the toxicological laboratories

Our review of annual reports of AOPPS and interviews with the plant protectionists of that period suggest that pesticide use was strictly controlled and crops, soils and water were subject to analysis for pesticide residues. These activities were carried out by the toxicological laboratories of the sanitary-epidemiological stations of the Ministry of Healthcare and the plant protection stations of the Ministry of Agriculture. A toxicological laboratory at AOPPS was set up in 1972.

Specialists from this laboratory collected samples of crops, particularly fresh vegetables and fruits, just before or after harvest, from sovkhozes and kolkhozes in the Alma-Ata region, and tested these for pesticide residues. For example, in 1980, toxicologists tested 675 samples of various crops collected from an area of 5,416 ha and from the bulk output of 53,460 tons produced by 25 farms in the Alma-Ata region. Of 675 samples, 15 had a concentration of pesticide residues above the maximum permitted level. As a result, this produce was withdrawn from the market and destroyed as unfit for human or animal consumption (Annual report of AOPPS in 1980). When excessive levels of pesticides were found among cereals, the seeds could be retained as planting material for the next growing season. In 1987, toxicologists analysed 1,066 samples of various crops, of which 23 samples contained pesticide residues above the norm. The managers of the farms concerned were heavily fined. These farms were unable to make their contribution to the state plan, as their harvests with pesticide residues above the permitted maximum were destroyed. Given the Soviet system of control and the mode of operation of the Communist Party, it was possible that these farm managers would be deprived of their Partymembership cards or that they would be dismissed for such a failure. This enforced farm managers to be personally engaged in ensuring that pesticides were judiciously used.

The staff of the Toxicological Laboratory also controlled the quality of seed treatments, tested the concentration of pesticide mixtures before application and monitored the quality of pesticides in stock. Plant protection inspectors supervised pesticide application activities at the farms and, together with farm agronomists, carried out training on safety issues for workers dealing with pesticides. In 1980, 257 farm workers in the Alma-Ata oblast were trained and instructed and received a certificate. Every person engaged in pesticide application also had to undergo an annual medical examination. The pesticide flow was strictly controlled. The farm plant protection agronomist was obliged to keep records on pesticides, i.e. how much was delivered, stored and used. Plant protection inspectors regularly visited farms and cross-checked records on pesticide flows. If plant protection inspectors discovered a discrepancy in records or violations of rules for pesticide storage, handling and use, then the responsible farm agro-technicians were sanctioned. All these strict pesticide control activities were intended to encourage the safe and sound use of pesticides at the farm level.

## Farm plant protection specialists

All crop producing farms were strongly recommended to have plant protection specialists (decree № 453 of the Council of Ministers of the Kazakh SSR issued in July 4, 1966). By 1973, there were 2,368 plant protection agronomists in Kazakhstan's sovkhozes and kolkhozes. In 1983, the Alma-Ata oblast had 55 plant protection agronomists employed on crop producing farms. In addition, more than 2,000 farm workers in the oblast were trained and engaged in crop protection activities. A farm plant protection agronomist collaborated closely with specialists at the raion plant protection stations in tackling routine crop protection issues. This organization of pest-control activities provided the crop production sector with necessary knowledgeable personnel to deal with agricultural pests in a concerted way.

The crop protection system described was not unique to Alma-Ata oblast, but was replicated across the other regions of Kazakhstan and the Soviet Union through the unified plant protection system. The IPM-based pest control was supported by the state through large investments in plant protection research and extension. Specialists were trained and bio-laboratories and technological lines for rearing beneficial arthropods and producing bio-pesticides were built. Above shows that IPM was widely used in Soviet collective agriculture and involved a high level of organization and coordination of pest-control activities above the farm level. The unified Plant Protection Service was involved in monitoring and forecasting and practised a wide range of pest-control methods, in which biological control played an important role and also strictly controlled the use of pesticides.

This illustrates the knowledge-intensiveness of the IPM-based pest-control approach which was intensively supported by state-facilitated institutional backup and collective action.

## 3.4 Pesticide use in Kazakhstan after 1991

After Kazakhstan became independent in 1991, the collective farming sector was individualized. By 2006, some 173,132 farm enterprises emerged from 2,500 Soviet collective farms (Chapter 2). These new farms differ from each other in terms of their legal status, size, socio-economic network, technological practices, labour regime and the access they have to inputs and machinery. Most of these farms are currently run by former employees of the Soviet collective farms: tractor or truck drivers, machinery operators, mechanics, milkmaids, teachers or accountants. They received a piece of land to farm, with some using it for subsistence and others for commercial farming. Only a small proportion of these farms are managed by former agro-technicians with an agronomic background (and occasionally by one with a background in plant protection). As a result many of these new farmers are unfamiliar with pest-control issues.

The post-1991 changes in farming structure and ownership, and neglect by the state, have severely affected the plant protection service and plant protection research in Kazakhstan (Khasenov 1999, Migmanov 1997, Sagitov 1997, Toleubayev 2008, Uakhitov 1999). The infrastructures of the plant protection stations and agricultural research institutes collapsed. Many plant protection stations and their biological and toxicological laboratories have ceased to exist. Pests were no longer monitored, and recommendations about pest control were no longer delivered. The buildings that hosted these stations were sold off, used for other purposes or dismantled (see Appendix 3.2 for an illustrative photograph). The number of personnel in plant protection service fell significantly from 3,000 in 1990 to 1,200 in 1997 and currently PPS has limited functions (Toleubayev 2008:165).[15] Today, farmers lack institutional support in the field of plant protection and have to deal individually with pest problems. In this situation using pesticides has become the dominant solution.

### 3.4.1 *Pesticide use*

Our observations and interviews reveal that many of Kazakhstan's new farmers consider pesticides as the only means to control pests and that they are unaware of the negative effects of injudicious and indiscriminate use of pesticides.[16] Pesticide use and residues in farm produce are no longer controlled by public authorities. New farmers still have little knowledge of their agro-ecosystem and the peculiarities of crop protection practices, e.g. the presence of beneficial insects, the concept of economic threshold, the phenology of pest organisms linked to crop development or climatic factors. Equally, most farmers have little or no access to information about crop protection. They mostly just follow the instructions given to them by pesticide retailers or contained in leaflets about pesticides. Only a few farmers have access to the informal knowledge networks of the Soviet agro-technicians who have some knowledge about how to deal with a particular pest problem (Chapter 2).

Our interviewees, who used to work in the Soviet plant protection system, were concerned about this bias and the resulting indiscriminate use of pesticides. One senior researcher from KRIPP was very passionate about this issue (Interview 17/09/2005):

> Farmers buy pesticides whenever possible! When I visited one farmer he said to me: 'I bought a pesticide against the Colorado potato beetle on the local market', and showed me a small bag with Chinese characters on it. He said with happiness in his voice: 'Very good pesticide! I sprayed only once and all the beetles died'. I asked him: 'How do you know what it is and how to use it since all the information is in Chinese? Maybe this is Mouse poison, and you sprayed it on eggplant, potato and tomato to control the Colorado potato beetle; people will be unaware of the dangers, when they will consume these crops'!
>
> It is very foolish that nowadays farmers focus only on pesticide use! Because pest organisms develop resistance and pesticides pollute the environment and pose a health risk. We should not allow farmers to be easily carried away by chemical control methods.

Another senior researcher from this institute summarized the situation in a few words: (Interview 07/12/2004): '*Nowadays crop protection for farmers means only pesticide application*'.

Other plant protection practitioners whom we interviewed also commented on the increased risk of pesticide poisoning after weakening of the state control over pesticide use in Kazakhstan:

> There are people selling pesticides without any permission, precaution, at any place and without taking any safety precautions … On vegetables there is an increased pesticide use. Nowadays, nobody monitors pesticide residues in crops. That is why I do not risk buying vegetables and potatoes from the market. I grow my own without using pesticides...We are arriving at the point when all these pesticide matters must be controlled again (Interview 21/10/2005).

> You know what one farmer told me: 'I sprayed my potato field, and I became so sick that I was in bed for 5 days'. I asked: 'What did you use for spray?' He said: 'those in the Chinese bags' (Interview 26/08/2005).

These passages describe how the state-controlled pesticide use has given way to unrestricted pesticide use. People who worked as plant protectionists during the Soviet era are concerned about the side-effects of pesticides: development of resistance, pest resurgence, secondary pest outbreaks and accumulation of pesticide residues in crops and the environment, affecting the health of people. However, these concerns are restricted to the circle of these plant protectionists and a few other groups, such as environmentalists[17] and the medical profession. These issues have not been taken up by the farming community, government or media. Farmers tend to neglect these concerns and opt for pesticides as the readily available, 'fast-fix' solution that supposedly helps them to protect their crops from pests and to stay in business. The government has done little to intervene. Plant protectionists, environmentalists and the medical profession do not have sufficient political clout to bring these issues onto the political agenda. In addition, many plant protectionists are themselves involved in promoting pesticides in the farming community in order to earn some money. Thus, it is unlikely that concerns about the injudicious use and negative effects of pesticides will become a major political issue in the near future.

The narratives of plant protectionists quoted above concur with our own observations during extensive fieldwork undertaken between 2005 and 2007 and previous experiences of the first author. Pesticides of an unknown nature are freely sold at village markets (see Appendix 3.3 for an illustrative photograph) and farmers frequently apply pesticides without protective clothing, sometimes sprinkling them on crops with a broom. Well-illustrated, colourful posters advertising pesticides, magazines or leaflets all present pesticides as the only remedy against pests and farmers tend to take this information for granted. Some literally follow the calendar spraying prescriptions provided; others start to apply pesticides when the crop damage by diseases or insects becomes highly visible. If the pesticide does not control the insects, diseases or weeds they immediately suspect the retailer of fraud (e.g. dilution of concentration, selling something different instead of supposed pesticide or outdated ones). They swear never to buy pesticides from this retailer or to purchase this particular brand of pesticide again. They hardly ever consider other causes: that the pesticide might have been applied too late (e.g. when the pest organism is at an unsusceptible phase of development); that the pest has become resistant to this particular group of pesticides; or that the application method was inappropriate. In many occasions they asked us if there are pesticides on the market that would 'kill all insects immediately'. In several interviews, plant protection officers and agro-technicians mentioned that pesticides (such as Dichloro-Diphenyl-Trichloroethane and Hexachlorocyclohexane) that were banned in the 1970s in the USSR are currently widely used in Kazakhstan. They think these banned pesticides have been retrieved from abandoned pesticide storehouses within Kazakhstan or smuggled in from neighbouring countries and distributed via black market channels.

We do not argue that pesticides must never be used, but our observations and interviews show that many farmers are unaware of the potential harm of the pesticides and this is why they are using them injudiciously and indiscriminately. Since 1991 hardly any study has systematically addressed the negative side effects of pesticide use by farmers in Kazakhstan, such as the development of resistance, pesticide residues in harvested and marketed produce and other health and environmental effects.

The following case study illustrates how indiscriminate pesticide use can potentially lead to the development of resistance in a pest organism and a secondary outbreak of previously insignificant pests. The case of the Colorado potato beetle shows the complexity of pest control and the high level of knowledge specificity required.

### 3.4.2 *The case of the Colorado potato beetle*

During our fieldwork we visited one former collective farm agronomist several times, who is now head of a cooperative of agricultural producers in the Almaty region (Visits 07/09/2005, 30/05/2006, 10/08/2007). This agronomist was confident about the agronomic technicalities of crop production because of his professional background from the Soviet past. We could see that the fields of the cooperative, with various crops, looked well-managed. But he told us about a serious outbreak of some worm severely damaging the potatoes and did not know what the cause of the problem was. When we asked for the specific name of this worm, he referred to the district plant protectionist, who identified it as cutworm *Agrotis segetum* (Interview 30/05/2006). In 2005, this farmer estimated that cutworm caused a 50% loss of his potato yield.

This farmer was using heavy applications of insecticides against the Colorado potato beetle[18] (CPB) *Leptinotarsa decemlineata* on his potato fields. For last three years he had been using Fipronil[19] to control CPB, although use of this insecticide on potato and vegetables is forbidden by the pesticide use regulations in Kazakhstan. He had previously used insecticides from the pyrethroid group but gave these up as they were inefficient and he knew that CPB had developed resistance to them. He was happy to use Fipronil because of its immediate effect in killing the larvae and imagos of CPB, and the beetle has not yet developed resistance during three seasons of its application.

When we suggested to him that indiscriminate pesticide use against CPB could have caused the outbreak of the previously insignificant cutworm he replied that he never heard or encountered such phenomenon in the 30 years of his background in crop production. It is possible that this farmer had encountered a secondary outbreak of *A. segetum*, because of the elimination of its natural enemies by three years application of Fipronil. Interestingly, this farmer could not control the cutworm by applying insecticides from different groups,[20] including Fipronil. As a result, for two years in a row he estimated losses up to 70% of potato yield from cutworm (Interview 10/08/2007).

This case shows that even a farmer with 30-years practical experience in crop production may not have sufficient knowledge about pest-control issues. It is likely that the level of knowledge of newcomers into farming is much lower than that of this farmer. This brings us back to the structure of the Soviet agricultural knowledge establishment discussed in Chapter 2. This farmer was specialised in field agronomy, while another agronomist in his kolkhoz specialized in crop protection and was responsible for pest control and pesticide use. This agronomist had not encountered the phenomenon of a secondary pest outbreak during 30 years of crop production, suggesting that pesticides were previously used more judiciously and problems of resistance and secondary pest outbreaks were not encountered.

### 3.4.3 *The intervention by the pesticide industry*

Today in Kazakhstan, the pesticide industry is actively promoting its products to the farming sector. In the Soviet past, pesticides were centrally supplied by the state to the collective farms. Pesticide companies (mostly foreign multinationals) had no direct involvement with agricultural producers and researchers in the USSR. Foreign pesticides[21] were purchased centrally and then distributed to the regions under strict control. After the disintegration of the USSR, the pesticide companies occupied the empty niches in the agricultural input markets of the newly established independent states (Moore 2008). Since then Kazakhstan's pesticide imports have grown almost every year (Figure 3.3).[22]

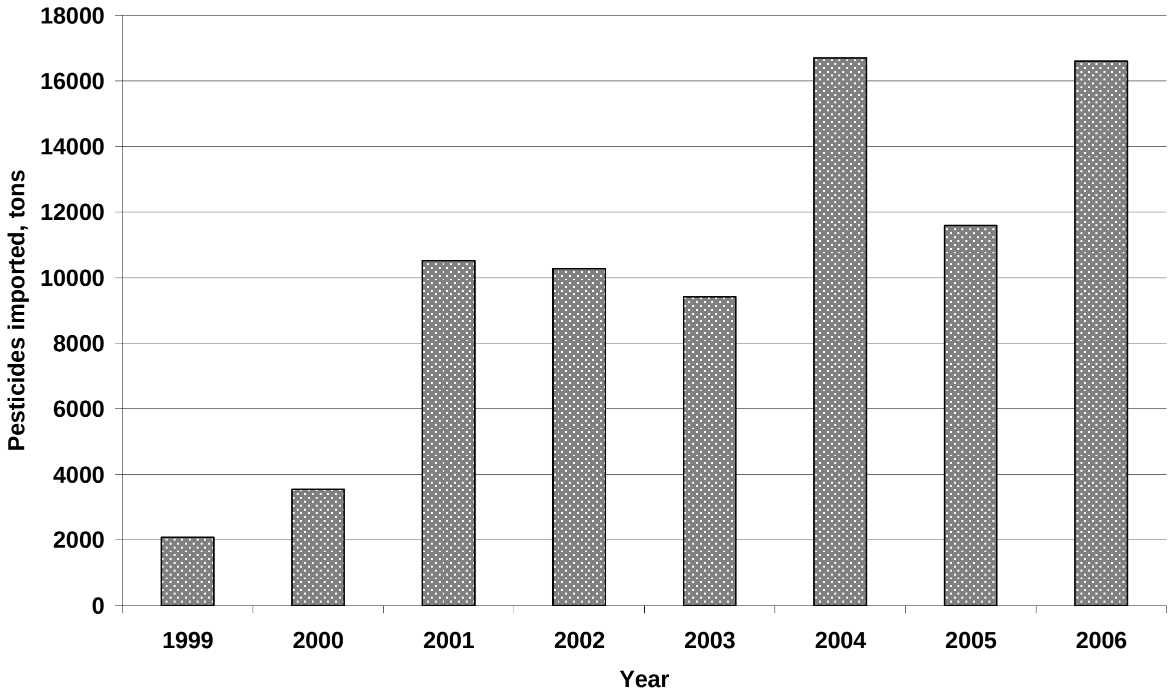


**Figure 3.3 Pesticide imports (tons) in Kazakhstan: 1999 to 2006.**
*Source*: Ministry of Agriculture of Kazakhstan.

The annual imports of pesticides into Kazakhstan has increased from 2,076 tons in 1999 to 16,600 tons in 2006, although this only takes into account those imported and sold through official channels (Figure 3.3).

Much of the market is occupied by well-known pesticide-producing multinationals, such as Syngenta and Bayer (Dinham 2005). They compete and promote their products by distributing colourful leaflets and posters and making presentations at farmers' gatherings. Since 2006 'Syngenta Kazakhstan' has issued a monthly magazine, the 'World of Syngenta' ('Mir Syngenta'), with colourful illustrations and glowing reports about company's products provided by Kazakhstani researchers or farmers. Syngenta provides pesticide packages to farmers, which include a range of the company's products for crop protection, backed up with advice and extension.

These large companies mainly target the large-scale farm enterprises, e.g. wheat producers. They also sell their products to the state, which is responsible for controlling quarantine and highly harmful and migratory pests.[23] In 2002, the state purchased 570,700 litres of pesticides (Khasenov 2003) and in 2004 it spent 1480.4 million KZT (about 11.3 million US$) on pesticides (Khasenov 2005). Some local retailers buy pesticides from these large companies at wholesale prices, repackage them in smaller containers and then sell them to farmers.

There are also many illegal dealers selling generic and surrogate pesticides of unknown provenance (e.g. from China as mentioned above) at cheaper prices. The approximate volume of pesticides smuggled into the country is not known. These chemicals are sold without registration or proper labelling, in violation of the existing regulations which specify that all imported products have to be registered, have clear instructions in the Kazakh and Russian languages, should be properly labelled and have a certificate of origin. These regulations were introduced only recently under the 2005 rules on the '*Certification of pesticide manufacturing, retailing and use*'. As with many other regulations, this is barely implemented in practice, and is effectively a dead letter. One reason for this failure is that there are not enough plant protectionists to monitor the thousands of pesticide users and the numerous retailers and service providers. Moreover, plant protection officers lack any officially assigned transport, so can barely cover their allotted, and often vast, areas of responsibility or fulfil their professional duties. Moreover, there is a weak enforcement mechanism to punish those who do violate pesticide use and retailing regulations.

In many ways pesticides have become the only option for the new individual farmers. They indiscriminately spray pesticides because of their ignorance of their negative effects on human health and environment. We also met several more experienced farmers who are aware of side-effects of pesticides, but who put their economic survival ahead of health and environmental concerns. They are being drawn into the pesticide treadmill. While some plant protectionists are concerned about the shift towards widespread and indiscriminate pesticide use their voices remain unheard. Controlling pests requires knowledge and an understanding of the complex ecological processes that occur in agro-ecosystems, and an awareness that indiscriminate pesticide use can lead to pest resurgence and secondary outbreaks. Farmers however want the 'quick-fix' solutions to pest problems and are readily supported by pesticide dealers.

## 3.5 Shifts in the knowledge network and the research agenda for pest control: The case of the KRIPP

Research into plant protection played a significant role in the development of IPM/ecology-based pest-control knowledge in the USSR (see Chapter 4). The Soviet government began to intensively support IPM research in the late 1960s and this may be another example of intellectual rivalry with the USA, which launched several IPM projects at this time (Palladino 1996, Perkins 1982). The Soviet state established two specialized research institutes to undertake research on biological control methods: the All-Union Research Institute of Microbiological Remedies for Plant Protection in Moscow (opened in 1968) and the All-Union Research Institute of Biological Methods for Plant Protection in Kishinev (opened in 1969). There were also numerous departments and laboratories for developing biological control methods located at research institutes throughout the USSR, including one at the Kazakh Research Institute for Plant Protection (KRIPP). Specialists from these organizations met annually at All-Union meetings dedicated to problems and perspectives of biological control. For example, in January 1970, a five-day seminar was organized in Moscow for 260 biological control specialists from all the republics of the Soviet Union; in 1972 a similar meeting was organized in Kishinev for 386 specialists. Researchers from KRIPP participated at these gatherings, and visited these two institutes and other research institutes in the USSR throughout the 1970s and the 1980s to gain and exchange experience in biological control methods.

Our interviews with plant protection researchers and practitioners and our reviews of the Soviet plant protection literature and archival sources show that, since the early 1970s, the IPM/ecology-based approach to pest control was at the core of all plant protection research and practice. A characteristic example is the development of an integrated protection scheme for apple orchards against their most damaging insect-pest, the Codling Moth (*Cydia pomonella*), by researchers of KRIPP. This was based on the results of experiments carried out between 1977 and 1979 in southern Kazakhstan (Lukin 1982). This scheme incorporated 4-7 releases of a local strain of the egg-parasitoid *Trichogramma embryophagum* and application of a bio-pesticide based on *Bacillus thuringiensis*, which minimized the use of synthetic insecticides to one application per season. Another example is the development of an integrated scheme for the protection of cabbage against the most damaging moths (*Pieris brassicae*, *Plutella xylostella* and *Barathra brassicae*) and the aphid *Brevicoryne brassicae*, which reduced insecticide use from 5-7 to 2-3 applications per season. In this scheme, economic thresholds were used for both the moths and the aphid. Against the moths only viral and bacterial bio-pesticides were used. Synthetic insecticides were only used against aphids when their population rose above the economic threshold. In addition, populations of predators were closely monitored (*Aphidoletes aphidimyza*, Coccinellidae *spp*., Chrysopidae *spp*., Syrphidae *spp.* and predatory bugs), and when they achieved a ratio of predators to aphid numbers of 1 to 10 or more, the insecticide application was cancelled. In 1977, following these kind of IPM schemes more than 5 million ha of crops being cultivated in the Soviet Union without the use of pesticides (Beglyarov et. al 1978:16). Chemical control was just one of the components of the IPM strategy and pesticide use did not dominate in the plant protection agenda during the 1970s and the 1980s, as it does today.

The disintegration of the Soviet Union in 1991 disrupted the contacts that existed between research institutes across the former USSR. The transformation of Kazakhstan to a neoliberal market economy severely affected public research institutes, including the Kazakh Research Institute for Plant Protection (Chapter 4). Public funding of science dropped significantly in the 1990s and IPM/ecology-based programmes stopped. KRIPP had to look for alternative sources of income. The foreign pesticide industry, which settled in the newly established agricultural input market, became one source of funding for KRIPP which was invited to test and promote its products. Pesticide testing has now become the most important part of plant protection research programmes.

A passage from Rachel Carson's book 'Silent Spring' (1962:211) colourfully describes a similar shift that occurred decades earlier in the USA:

> Most of those best fitted to develop natural controls and assist in putting them into effect have been too busy labouring in the more exciting vineyards of chemical control. It was reported in 1960 that only 2 per cent of all the economic entomologists in the country were then working in the field of biological controls. A substantial number of the remaining 98 per cent were engaged in research on chemical insecticides.
>
> Why should this be? The major chemical companies are pouring money into the universities to support research on insecticides. This creates attractive fellowships for graduate students and attractive staff positions. Biological-control studies, on the other hand, are never so endowed – for the simple reason that they do not promise anyone the fortunes that are to be made in the chemical industry.

Carson's view on plant protection research in the USA in the 1950 and the 1960s reflects what has happened to plant protection research in Kazakhstan since 1991. Carson's quote resembles a fragment of an interview with one senior researcher of KRIPP (Field notes, Interview 17/09/2005):

> Q: In your opinion, why are pesticide tests included almost in all research programmes?
>
> A: Because of financial interests! [*angry and passionate*]. There are many pesticide firms that promote their own products and they are sponsoring pesticide testing. Why X [for *ethical considerations the name of the person is not disclosed*] said on the scientific council that he has a good income of 700-800 dollars per month, because researchers of his group are engaged in pesticide testing. He is not interested in other research directions. Of course I do not want to blacken his reputation, he is a good specialist, but has chosen another research priority. His group should also monitor population dynamics and do research on some biological and ecological aspects. But they only test pesticides, or evaluate various cultivation technologies in combination with pesticide use. I understand there should be some evaluation of different technologies including pesticides, but in the past this kind of 'research' was conducted by agro-technicians. This is technical and not scientific work!

This quotation shows an increase in the influence of the pesticide industry over the pest-control research agenda in post-Soviet Kazakhstan, as happened in the USA half a century earlier. Although one may argue that developments in the USA took place in a different historical and socio-economic context, some parallels can still be drawn. Comparison of these quotations shows that the pesticide industry has a strategy of influencing the research agenda of public research organizations for their own interests, which has not changed over time. Engagement in the pesticide testing business became one of the main survival strategies for the plant protection researchers in Kazakhstan after the collapse of the Soviet scientific establishment (Chapter 4). The quoted researcher remains an adherent of IPM type research and does not want to be involved into pesticide testing and promotion. As a consequence she has to live on a very low salary.

An agricultural researcher, who worked for some time for one of the pesticide companies, commented on their activities in Kazakhstan (Interview 29/11/2005):

> Q: Maybe it is better that well known pesticide companies are operating in our market as their products will be of a better quality than pesticides of an unknown nature?
> A: No, they are stealthily approaching [*agrarian*] science. I mean stealthily because they do not invest money in our science but they use it. They are just using the difficult financial situation in the research institutes and give only small incentives for testing their products.
> If Kazakhstan would start investing in agrarian science again, then these pesticide companies would have difficult times, because pesticides will not be prioritized in the research agenda. People's awareness about the toxicity of pesticides should be increased. You know in Europe there are movements promoting ecologically safe and organic products. When will we reach that level? Only then will these companies such as Syngenta and Bayer see their market share in our territory diminished. At present, these pesticide companies have a strong position on our market; they manipulate the situation and significantly influence the research agenda. As I said, they have occupied a niche and it will be quite difficult to reverse this situation. What can we do, every country has gone through this. Scientists in Kazakhstan keep silent because they are not organized to speak up.

This quotation illustrates that multinational pesticide companies have come to occupy solid niches in the agricultural input market in Kazakhstan, and reoriented agricultural research towards their own interests. It confirms once more that under-financing of public research institutes (Chapter 4) pushes researchers to accept the incentives provided by the pesticide industry in order to keep the last bits of research potential alive. This interview quote also points out that public awareness about pesticide hazards is low in Kazakhstan and that the voices of researchers are hardly heard.

Pesticide testing and promotion has become a normal routine in post-Soviet academic research. Our content analysis of 'Candidate of Sciences' (C.Sc.)[24] dissertations related to crop protection since 1991 shows that they are full of the experimental results obtained from testing pesticides of certain companies. For example, one written in 1995 concludes:

> Data collected for insecticides A, B and C [*real names not revealed*] have been submitted to the State Pesticide Registration Commission for their inclusion into the 'List of allowed pesticides on the territory of Kazakhstan.'

Another C.Sc. dissertation written in 1994 concludes:

> Fungicides A, B, C, D and E have been tested.… It has been shown that most effective fungicides are A (0.25 l/ha) and B (2.0 kg/ha).

This pesticide testing for companies has became a pattern in practically all C.Sc. dissertations related to plant protection, which test and compare the efficacy of different pesticides against the target pest and against each other. Normally the efficacy of the dosages proposed by pesticide manufacturer is confirmed. The scientific value of such research is normally justified in the following way '*the following pesticides have not been tested before on a particular crop/pest in the specific conditions of Kazakhstan*'. However, this type of research is very technical and does not embody a real level of scientific inquiry appropriate for dissertations at this level.

In the Soviet past, researchers received royalties when they published scientific articles, books, monographs or recommendations for agricultural producers. Today, they have to pay out of their own pockets or look for sponsors to publish this kind of literature. Pesticide companies offer to pay the publishing costs of researchers whose findings contain positive assessments of their products. A typical example is Syngneta's sponsoring of the research recommendation from KRIPP '*Protection of apple and pear orchards against arthropod pests and diseases in Kazakhstan*' (issued in 2003) in exchange for the promotion and advertisement of its pesticides in this recommendation.

This analysis of the shift in research at KRIPP reveals a sharp contrast between the pest-control research agenda in Soviet and post-1991 Kazakhstan. The partnership with the pesticide industry became one of the main survival strategies for plant protection researchers after 1991, at the expense of IPM/ecology-based research.

## 3.6 Conclusions

This chapter has illustrated that the IPM approach widely used within the USSR in the 1970s and the 1980s required detailed knowledge of complex agro-ecosystems. It also required specific institutional support in the form of a strong research base, plant protection extension network and concerted action from involved actors. IPM was backed up by significant investments into plant protection research and extension, training of specialists, building bio-laboratories and technological lines for producing bio-agents. Pesticide use was kept at low levels by monitoring pest organisms, forecasting their population dynamics and using appropriate biological and agronomic control methods based on economic thresholds and predator/prey ratios. IPM was promoted and implemented under the institutionalised guidance of plant protection professionals, including researchers. Morse and Buhler (1997) note that IPM is a model of what crop protection should look like and represents an ideal that many more would follow if they could. This study showed that the Soviet system made substantial efforts in creating conditions conducive for IPM to work. In post-1991 Kazakhstan, hardly any of these conditions have been available.

With the end of collective farming (Chapter 2) and the budget cuts, plant protection research and extension was severely weakened (Chapter 4, Toleubayev 2008). Numerous individual farmers emerged, most of them newcomers, who did not have adequate knowledge and lacked the institutional backup to organize pest-control activities. This vacuum created an opportunity for the pesticide industry to make farmers think about crop protection solely in terms of pesticide spraying. The pesticide industry has succeeded in setting up an infrastructure to deliver information and pesticides to farmers, while knowledge and information on IPM has diminished or vanished altogether. The plant protectionists we interviewed referred to the non-agronomic background of the majority of current farmers as a main reason for poorly managed fields and inadequate pest-control activities. However, as was illustrated with the case of the secondary pest outbreak that ensued from indiscriminate pesticide spraying against the Colorado potato beetle, even those with a professional agronomic background may not always be able to grasp the complexity of pest control.

Advanced farmers (mainly former collective farm agro-technicians) do their best to control pests on their own fields by using pesticides or combining it with other agronomic practices. However, very often their attempts to control pests do not succeed because of poorly managed neighbouring fields, which serve as a source of pests. The problem of controlling pests on separate and individual farm fields is a consequence of the break up of the collective crop production system. In the past, the centralized public plant protection service monitored and controlled pest organisms across the country, irrespective of administrative borders between farms, districts or regions. Nowadays individual farmers have to deal with pest problems themselves at the level of their own fields and to rely on own resources. The majority of them do not possess sufficient intellectual, technical and financial resources to use the IPM approach. For this reason, Van Huis and Meerman (1997) suggest that renewing the practical value of IPM for resource-poor farmers implies focusing more on IPM as a methodology and less as a technology and on developing appropriate pest management strategies through self-discovery learning processes and participatory programmes. However the new farmers in post-1991 Kazakhstan are not engaged in participatory programmes and are struggling individually. The conditions for running such programmes and triggering learning process and concerted action for pest control among individual farmers have not been created. The more advanced farmers in

Kazakhstan recognize the importance and necessity of collective action for inter-farm pest control, but they lack institutional support to promote such initiatives. The type of institutional backup that existed in the past to serve the collective farms has collapsed, and a new institutional framework to support individual farmers (except for pesticide market) has not yet been established. Moreover, it is very difficult to establish such an institutional base for concerted pest control since public initiatives and collective action have been marginalised in post-1991 Kazakhstan.

This study also implies that there is an increased risk that the IPM knowledge developed locally before 1991 will be lost. IPM schemes need to be developed locally, taking the dynamics of particular agro-ecosystems into account. At the same time, however, the principles of IPM are universal and an institutional backup is needed to reintroduce IPM principles into practices of the new individualised farmers. This chapter shows that this reintroduction depends not only on developing and communicating appropriate knowledge but also on the socio-economic situation that is conducive to IPM approach. Kazakhstan's society would benefit if the government would create favourable conditions for fostering the required institutional changes that can challenge the dominance of the networks promoting pesticides.

## 3.7 Notes

[1] Another implicit reason for the wide-scale use of the IPM approach in the Soviet Union apart from the explicit claims about health and environmental concerns was to reduce dependence on pesticides imported from Western countries.

[2] Oblast - the English equivalent is province or region. Alma-Ata oblast occupied 105,210 square kilometres before 1991. It consisted of 11 administrative districts with 39 kolkhozes and 97 sovkhozes. The total cropping area was 839,556 ha.

[3] The Kazakh SSR (Soviet Socialist Republic) (Kazakhstan) was one of the 15 republics of the former USSR.

[4] In this thesis, an agricultural pest is defined broadly, as a living organism (rodent, insect, mite, nematode, fungus, bacterium, virus or weed) that damages crops, affects crop development or reduces quantity and quality of yield before or after harvest. The terms ‘agricultural pest’, ‘pest organism’ and ‘pest’ will be used interchangeably.

[5] The economic threshold is the density of pests at which control measures are required to prevent economic losses.

[6] This journal was a forum for discussion of plant protection issues of interest to plant protection practitioners, researchers and policymakers.

[7] Cuba still has 280 centres for producing entomophages and entomopathogens and some 700,000 ha of crops are biologically treated (Van Lenteren and Bueno 2003:132)

[8] Here ‘biological control’ refers to the control of agricultural pests by living organisms (insects, mites, nematodes, fungi, bacteria, viruses) or with products of their metabolism.

[9] Biological laboratory reared beneficial arthropods and produced bio-pesticides based on entomopathogenic microorganisms.

[10] Field crops: cabbages, red beets, alfalfa, maize, soybeans, tobacco, potatoes, tomatoes, carrots and peppers.

[11] In the original paper Dysart (1973:173) used the term ‘parasites’. Since Trichogramma is an egg-parasitoid the term ‘parasites’ has been changed to ‘parasitoids’ in the quotation to avoid confusion.

[12] Here ‘bio-pesticide’ is a preparation made from entomopathogenic microorganisms or products of their metabolism.

[13] In Chapter 1, it was mentioned that the archive of the Republican Plant Protection Station of the Kazakh SSR has been lost. For this reason, we were not able to compare data presented in Figure 3.1 for the Alma-Ata oblast with Trichogramma and bio-pesticides use for the whole of the Kazakh SSR.

[14] As the archive of the Republican Plant Protection Station of the Kazakh SSR has been lost, we are not able to give a ratio on biologically treated area and number of bio-laboratories in the Kazakh SSR against data presented in Figure 3.2 for the whole of the USSR.

[15] Many plant protectionists in 1990s were dismissed because of budget cuts. This led to emigration, retirement, going into private business (many were recruited by the pesticide industry), employment by large farm enterprises (those that survived the crises) and many remained jobless. A slight

increase in number of PPS staff by 2006 (up to 1,700 people) was linked to the post-1999 revival of PPS after a severe locust plague and the re-establishment of the Republican Centre for Phytosanitary Monitoring and Forecasting. However, there is now an acute shortage of qualified plant protection specialists in Kazakhstan. The PPS is still far from recovered because the majority of the newly recruited people do not have a background in plant protection. In the worst cases they do not have an agronomic or agricultural education at all. Of the 1,700 people employed in the PPS nowadays only 9% have a plant protection background. There are no educational organizations training plant protection specialists in Kazakhstan. In the words of a plant protection officer at the Department of Phytosanitary Safety of the Ministry of Agriculture of Kazakhstan: '*The plant protection domain experiences shortage of the staff / kadrovi golod* [in Russian]' (Interview 04/06/2007).

[16] In preparing this chapter it was startling to find that there has been hardly any published research on pesticide use by farmers in post-1991 Kazakhstan in either Kazakh, Russian or English.

[17] Terra Zher Ana: Special issue. 2002. (www.greenwomen.freenet.kz/pdf/terra-3.pdf ) [in Russian, access date 22/02/2009].

[18] In the 1980s, CPB used to be a quarantine insect pest in Kazakhstan and its distribution was limited. However, it has widely spread throughout the country in the 1990s (probably partly a result of the post-1991 collapse of the plant protection and quarantine service) and today it severely damages potato (and other host) crops all over the country. More recently it was taken off of the list of quarantine pests.

[19] Fipronil – a hazardous pesticide (Class II) according to the WHO Pesticide Classification List. It is legally only allowed to be used in Kazakhstan as a measure against locusts in non-cropping areas.

[20] This farmer even mentioned that he used the banned DDT (Dichloro-Diphenyl-Trichloroethane) obtained from a black market.

[21] The USSR imported up to 50% of the pesticides it required with the other half being domestically produced.

[22] Since the archive of the Republican Plant Protection Station of the Kazakh SSR has been lost, it was not possible to compare the amount of pesticides imported into the Kazakh SSR with data presented in Figure 3.3. Alternative sources of data on the amount of pesticides imported into Kazakhstan before 1999 could not be found.

[23] In 1993 the government issued a decree (№ 697, August 13) limiting the state's responsibility for crop protection to just those crops which were strategically important– in practice, wheat – against a defined list of highly destructive pest organisms, viz.: *Apamea anceps*, *Eurygaster integriceps*, gregarious locust species and diseases (*Puccinia* spp., *Septoria* spp.). However, poor financing of control activities in 1990s meant the state did not even keep these destructive pests at manageable levels. Since 2000 there has been an improvement in the financing of these activities (Toleubayev et al. 2007, Toleubayev 2008).

[24] 'Candidate of Sciences' – scientific degree in the former USSR, which is still in use in Russia and Kazakhstan and can be placed between M.Sc. and Ph.D. of western academia. Some equate this degree to western Ph.D., but after pursuing Candidate of Sciences degree one need another 4-5 or more years to pursue 'Doctor of Sciences' degree that equal to Ph.D. degree of western academia.

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# *Chapter 4*

# Plant protection research in Kazakhstan: The commodification of science and the loss of ecological thinking as a public good

## 4.1 Introduction

Many of the contemporary debates on research policy discuss the public – private relationships required to foster research and development (R&D). The study of the transition of the former Soviet Union republics from planned to market economies offers useful insights for reassessing the role of the public sector. Most of the existing studies in the transition period examine the case of Russia and focus on military and industrial R&D (e.g. Kontorovich 1994, Radosevic 2003). This study takes another entry point: a formerly more peripheral area of the USSR, Kazakhstan, and a sector that has received little attention: plant protection research. Plant protection research is a domain of agrarian science that aims to develop preventive and/or protective approaches to control pest organisms. Through this study we are able to discuss the consequences of the commodification of research on the delivery of what can well be considered as a public good: ecologically sound pest control.

The following sections discuss the public good characteristics of plant protection research and the extent to which plant protection research in the Soviet era met these public good characteristics. Then we will use the typology of Radosevic (2003) – developed for characterizing the post-Soviet R&D model in Russia – to analyse the transitions in Kazakhstan, using the concepts of 'preservation', 'diverse restructuring' and 'the survival strategies of R&D actors'. 'Preservation' refers to policies that aim to preserve the old form and capacity of science despite a reduction in funding. 'Restructuring' refers to reforms that introduce market-based economic principles into the R&D system. 'Survival' refers to the micro-strategies that institutes and researchers develop to cope with shrinking public R&D budgets. Finally we will discuss how the transformation of R&D from a state-led to a market-based model not only implied a change in the organization of research, but that it had a deeper effect on the content of the research itself. We argue that the shift in research organization contributed to the breakdown of research into ecologically sound pest control and supported a shift towards thinking about pest control solely in terms of pesticides.

## 4.2 Public good characteristics of plant protection research

The transformation from a planned economy to a neoliberal system affected the delivery of many public goods in Kazakhstan after 1991. A public good is any good that, when supplied to anybody, is necessarily supplied to everybody, and from whose benefits it is impossible or impracticable to exclude anybody (McLean and McMillan 2003). In other words, public goods are non-exclusive and non-rivalled (Kaul and Mendoza 2003, Scott and Marshall 2005). To understand the significance of the shifts in plant protection research policy we first address the extent to which plant protection research is, or produces, a public good.

While many forms of plant protection exist, in general one can distinguish between pesticide spraying based on industries' recommendations to farmers and the theory and practice of Integrated Pest Management (IPM), which is more knowledge intensive. The latter targets ecologically sound and environmentally safe approaches to controlling agricultural pests, which in turn, contributes to more sustainable agricultural production and benefits society as a whole (Bale et al. 2008, Van Lenteren 1997). In this sense IPM embodies many characteristics of a public good. The development of sustainable pest-control methods and technologies resolves several problems, including the reduction of pesticides in the environment, of poisoning incidents during application and pesticide residues in food, which affect people's health (Kishi 2005, Perkins 1982, Pretty and Waibel 2005). Moreover, the control of highly destructive pests (such as locusts) that can spread across large areas of agricultural land and potentially threaten national food security can also be seen as a public good. Plant protection research plays a crucial role here, as it is only through continuous studies of pest organisms that ecologically sound preventive and/or protective measures can be developed. Commitment from the state and resources from public funds are necessary to finance these socially beneficial interventions. In addition, the development of ecologically sustainable forms of pest control is relatively complex, knowledge-intensive and contingent upon a free exchange of knowledge (cf. Leeuwis 2004:347).

Some people view all research as a public good. Callon (1994:418), for example, states that all science should be considered as a public good and for this reason it should be protected from market forces:

> Science is a public good, which must be preserved at all costs because it is a source of variety. It causes new states of the world to proliferate. And this diversity depends on the diversity of interests and projects that are included in those collectives that reconfigure nature and society. Without it, without this source of diversity, the market – with its natural propensity to transform science into a commodity – would be ever more doomed to convergence and irreversibility. In the end, it would negate itself.

This reflects the global scientific community's reaction to the increased commodification of scientific knowledge and the privatization of science by market forces, which has occurred since the 1970s and which many scientists see as deleterious to public interest (Richards 2004). In many countries market oriented R&D and science and technology policies are transforming scientific knowledge into a commodity (e.g. Byerlee and Echeverria 2002, Owen-Smith 2003, Tijssen and Korevaar 1997) with an increasing emphasis on commercial application and profit, as opposed to discovery. This produces a short-termism in research agendas and a demand for immediate results that have a commercial potential. It also inhibits the free exchange of knowledge. This often occurs at the cost of sustaining long-term research with less immediately visible commercial spin-offs (Buhler et al. 2002). Clearly, research into sustainable pest-control approaches does not flourish in these conditions, since such approaches necessarily have to be applied to agro-ecosystems which are by nature open and complex and require careful long-term analysis (cf. Jansen 2009). The historical review of plant protection research in Kazakhstan during the Soviet era, contained in the next section, illustrates these points in a more concrete way.

## 4.3 Plant protection research in the Soviet era

Just two years after the revolution in 1917, the Bolsheviks founded the first entomological office within contemporary Kazakhstan's borders, in the city of Verny[1], in southeast Kazakhstan. This can be considered as the start of plant protection research in Kazakhstan. In the same year the Syr-Darya pest-control bureau was set up in the south of Kazakhstan, mainly to monitor and organize control activities against locusts. In time, a network of plant protection stations was established across the whole country. Plant protectionists in these stations were not only responsible for pest control, but also conducted studies dealing with the population dynamics, ecology, biology and taxonomy of pest organisms. Scientists from Russia assisted in this work.

In 1929, the agricultural research system in the Soviet Union was structured around the All-Union Academy of Agricultural Sciences Named after Lenin (VASKhNIL), an association of agricultural research institutes. The All-Union Institute for Plant Protection (VIZR), established in Leningrad as part of VASKhNIL in the same year came to lead plant protection research in the USSR.

The early Soviet period saw the publication of numerous scientific articles and reports on plant protection. From 1931-1934 these were published by VIZR in its scientific compendiums called *Sborniki VIZRa* (Compendiums of VIZR), and from 1935 onwards in compendiums called *Zashita Rastenii* (Plant Protection). Each year the number of publications on plant protection increased. In the first half of 1934 a total of 78 publications, in the format of methodological handbooks, monographs and recommendations related to plant protection were published in the USSR (list of publications in VIZR 1935:164-166) - a significant research effort. In the following year plant protection research by VIZR dealt with: (1) the spatial distribution of insect-pests and crop diseases in the Soviet Union and their ecological and economic importance; (2) the biotic and abiotic factors affecting the mass reproduction and outbreaks of pest organisms; (3) the composition and dynamics of biocenoses[2] in virgin and idle lands, so as to improve predictions of likely outbreaks of insect-pests and diseases; (4) economic thresholds and the development of pest management schemes for cereals in the *Chernozem*[3] belt; (5) yield loss assessment methods; and (6) biological methods for controlling insect-pests. For instance, research on biological methods carried out in southeast Russia focused on the control of the European corn borer moth *Ostrinia nubilalis*, using the egg parasitoid *Trichogramma evanescens* and this led to a questioning of the efficacy of chemical dusting in controlling this pest (Zimin 1935).[4] At that time researchers from VIZR had already proposed making wider use of *Trichogramma* spp. against lepidopterous pests of fruits and vegetables (Zimin 1935:70). This illustrates the extent to which ecologically sustainable pest-control methods were being developed and promoted early in the Soviet era.

This intensive research on ecologically sound pest management contrasts with a widespread opinion among Western observers that Soviet agricultural science was stagnant during the 1930s. Research in plant protection was carried out despite the control that Stalin's regime tried to exert over agricultural science as, exemplified by Lysenko. He theorized that the immediate environment directly influences the genetic characteristics of species and argued that the environment is more influential than genes, an argument that contradicted the theories of classical genetics. He managed to reformulate his biological theories in terms of dialectical-materialist philosophy and these theories were embraced by Stalin, as the theories of a 'barefoot scientist' – the epitome of the mythical Soviet peasant genius, and the only biological theories consistent with Stalinist-Marxist ideology. Lysenko contributions to 'advancing' agrarian science led him to be put in charge of the VASKhNIL in 1938[5] where he suppressed plant breeding research led by Nikolai Vavilov which ran counter to his theories. Lysenko's name has become synonymous with the adaptation and manipulation of science for ideological purposes (Harman 2003, Joravsky 1970, Medvedev 1969, Roll-Hansen 2008). However, Soviet science should not be evaluated solely on this one example. Plant protection research continued to develop at that time. Roll-Hansen (2008) shows that the practical needs of improving agricultural performance eventually sidelined ideology-driven theorizations. Moreover, at this time there was much research on conservation ecology, lead by botanists, zoologists and geographers in Russia (Weiner 1988, 1999). Hence, despite the theories of Lysenko and the subordination of science to ideology under Stalinism, much research that took place then is still of value today.

Plant protection research evolved in Kazakhstan throughout the Stalin era. Recognizing the need for a specialized research unit dealing with pest issues the Kazakh Research Institute for Arable Farming (KRIAF)[6] opened a Department of Plant Protection in 1935. The research staff consisted of entomologists, zoologists and phytopathologists, who mainly studied pest organisms damaging cereals (strategic crops), such as the Owlet moth (*Apamea anceps*), the Asiatic Migratory Locust (*Locusta migratoria migratoria*), rodent-pests (*Citellus pygmaeus* and *Lagurus lagurus*) and the diseases caused by smut fungi (*Ustilago* spp.). Plant protection research in Kazakhstan was part of the Soviet agricultural research system, since KRIAF belonged to the network of VASKhNIL.

Between 1941 and 1945 these research activities were suspended because of the war against Nazi Germany but continued after the war when pest-control research was put under the umbrella of the newly established Kazakh Republican Plant Protection Station (KRPPS) with a staff of 25 researchers and with departments of entomology, phytopathology and zoology. Content analysis of the research articles and reports produced by KRPPS during this time (1945-1953) shows that, from the outset, the research was driven by demands from the farming sector to deal with pest organisms damaging crops. Persistent problems with controlling certain agricultural pests in a particular region were brought to the attention of the researchers by the regional agricultural departments. Researchers were expedited to these regions to study the problem. Researchers monitored population dynamics of the pest, identified the core of the problem, developed new control strategies or improved existing control methods and produced recommendations in simple language for farm workers and agro-technicians. By this time, researchers had already started shifting their focus towards developing integrated schemes to protect particular crops against pest organisms (Dzhiembaev 1953).

A new era of plant protection research in Kazakhstan started in 1958 with the opening of the Kazakh Research Institute for Plant Protection (KRIPP) based on the former KRPPS. It initially consisted of eight departments: Entomology, Phytopathology, Agricultural Zoology, Forest Insect-Pests and Diseases, Toxicology, Taxonomy of Crop Insect-Pests and Diseases, Pests of Cereals and Cereal Products and Monitoring and Forecasting of Crop Insect-Pest and Disease Development. The number of departments at KRIPP changed during its 50-year existence: some were renamed or merged, others emerged and some were shut down. It varied from 12 departments with 89 researchers in 1973 to 5 departments with 34 researchers in 1999. Newly opened departments in the 1960s and 1970s were Weed Control, Biological Methods, Immunity, Isotopes, Bio-Physics and Locust Ecology. In the 1980s, the departments were reorganised so that they focused more on protecting particular crops, e.g. the Department for Protection of Cereals or the Department for Protection of Fruits and Vegetables. These departments were charged with developing and improving elements of the integrated crop protection schemes, which incorporated biological, agronomic and physical methods that would reduce the use of pesticides while controlling agricultural pests. The researchers of KRIPP produced numerous publications in the form of monographs, textbooks, scientific articles, handbooks and recommendations for the farming sector. Between 1971 and 1990 they issued 98 recommendations for agricultural producers (Figure 4.1) on how to protect a crop(s) against a particular or complex set of agricultural pests. Such recommendations were always a result of several years of experimentation (based on continuous monitoring and observation) and took the specific agro-ecological and climatic conditions of different regions in Kazakhstan into account.

KRIPP subsequently became the main coordinating centre of all plant protection research in Kazakhstan. Its researchers closely collaborated with regional plant protection stations to assist in monitoring and forecasting the population dynamics of pest organisms and defining economic thresholds. It formed liaisons with other agricultural research institutes, focused on specific crops, to conduct joint research related to pest-control issues, including the breeding of resistant crop varieties. KRIPP also collaborated with the plant research institutes of other Soviet republics and research institutes of All-Union significance, such as the All-Union Institute for Plant Protection, the All-Union Research Institute for Phytopathology, the All-Union Research Institute of Microbiological Remedies for Plant Protection and the All-Union Research Institute of Biological Methods for Plant Protection. Networking with, and exchange visits to, these research organizations located in

Moscow, Leningrad and other parts of the USSR, strongly stimulated the performance of KRIPP's researchers (interviews for this study).

The Soviet science was in principle not designed to advance global knowledge, but to help in solving domestic problems, i.e. political and economic pressures were always present (Graham 1975). The responsibility for the agricultural research institutes in the Soviet Union shifted several times from VASKhNIL to the Ministry of Agriculture and vice versa. These switches in management from one structure to another occurred because of different views about the applicability of agricultural research. The Ministry of Agriculture required agrarian science to be responsive to the needs of the farming sector. VASKhNIL favoured a more fundamental orientation of agricultural research. For these reasons, the Kazakh regional branch of VASKhNIL, set up in 1941 and transformed into the Kazakh Academy of Agricultural Sciences (KAAS) in 1957, was closed in 1962 and its research institutes were put under the Kazakh Ministry of Agriculture. In 1971, VASKhNIL regained its political independence and re-established its eastern regional branch in Kazakhstan and most of the agricultural research institutes (including KRIPP) were transferred back from the Ministry of Agriculture to the eastern branch of VASKhNIL. These shifts certainly influenced the research agenda and priorities in agrarian science, but plant protection research under both these management structures remained focusing on development and promotion of ecologically sound pest-control approaches and was adequately funded (interviews for this study). In 1990, just before the collapse of the USSR, the Eastern branch of VASKhNIL was transformed into the Kazakh Academy of Agricultural Sciences (KAAS). At this time KAAS had six departments with 32 research institutes, 28 experimental stations and 45 experimental farms. This network of research and extension units provided the farming sector with up-to-date information and technologies (Morgounov and Zuidema 2001, Pray and Anderson 1997).

This overview of the Soviet plant protection research shows a series of dynamic developments in this field of science. Considerable investments and improvements in the governance of scientific establishment made ecology-based pest-control research possible. This formed a sound basis for the IPM practices that were adapted in the farming system (Chapter 3) and for management of locust populations (Chapter 5). The question can now be raised what remained of this IPM/ecology supporting research infrastructure and research agenda after the disintegration of the USSR in 1991.

## 4.4 Science and technology policy in the post-Soviet era

On the 16th of December 1991 Kazakhstan became an independent state. The following month the '*Law on science and technology policy of the Republic of Kazakhstan*' was issued setting forth the Republic's science and technology (S&T) policy and the organizational structure for research. The main principles of this were: the selection and development of research priorities in accordance with public demand; the incorporation of international scientific knowledge; tax privileges for R&D projects; support for innovation activities; and the protection of intellectual property rights. However, the enactment of these principles was thwarted by the economic downturn that the country experienced in the 1990s. In 1992, the Ministry of Science and New Technologies was established to preserve the S&T potential of research enterprises and to assist them in developing market oriented research outputs (Kembaev and Komlev 2004). But with the severe budget cuts and a crisis in all sectors of the economy, these initiatives amounted to little.

The government looked for other ways to manage the scientific establishment. In 1996, the Presidential Decree '*On the improvement of state management of science in the Republic of Kazakhstan*', merged the National Academy of Sciences (NAS) and the Ministry of Science and New Technologies (MSNT) into one executive body, the Ministry of Science/Academy of Sciences of the Republic of Kazakhstan. This body became responsible for leading the state's S&T policy and financing R&D. It developed the '*Conception of national science and technology policy in the Republic of Kazakhstan*' by the end of 1996, together with a number of policy initiatives to optimise S&T policy. A lack of funds meant that none of these initiatives was implemented and this together with the lack of cooperation between scientists from NAS and the government bureaucrats from the former MSNT led to this executive body being disbanded in 1998, with its responsibilities being transferred to a newly founded Ministry of Education and Science. This change marginalized the scientific community and government bureaucrats became the managers of science. This conflict was not widely publicised and the new ministry was presented as a means of integrating academic science with higher education.

With the improvement in the Kazakhstan economy since 2000, the Ministry of Education and Science developed a new '*Conception of science and technology policy in the Republic of Kazakhstan*'. This served as a basis for the '*Law on science*' issued in July 9, 2001. The law aimed to provide a legal basis for funding projects from the state budget based on: open calls and competition; the integration of science, education and industry; the protection of intellectual property rights; and the accreditation of R&D enterprises. This law was followed by the Presidential Decree of May 17, 2003 on '*Strategy for industrial and innovative development within the Republic in Kazakhstan in 2003-2015*'. A Committee of Science was set up to coordinate public finance to R&D through the Science Fund and the National Innovation Fund. In June 20, 2007, the President of the Republic of Kazakhstan signed a National Programme '*the Development of science in the Republic of Kazakhstan in 2007-2012*'. The government assigned a budget of 43 billion KZT (about 361 million US$) to implement this programme, which aims to increase international competitiveness of science in Kazakhstan. This suggests that the government has good intentions to manage the national R&D domain, to develop effective S&T policies and to provide science with sufficient public funds. However, these numerous upper layer restructurings and policies have done little to improve the situation for grassroots researchers, particularly in agrarian science, as will be illustrated below.

### 4.4.1 *A niche for agricultural research?*

What happened to agricultural research in the course of this period of good intentions but few resources? Johnson (1993) discusses the restructuring of agricultural research in the former Soviet Union and outlines several strategies that could be adopted by agrarian research institutes as way of preserving research capacity in the former Soviet republics. The concepts of ‘preservation’, ‘diverse restructuring’ and ‘the survival strategies of R&D actors’ developed by Radosevic (2003) for characterizing the post-Soviet R&D model in Russia are very similar to those discussed by Johnson (1993). The concepts of Johnson (1993) ‘preservation’, ‘facilitating adaptation’ and the ‘import of technology’ will be discussed here to analyse the changing trends in agrarian science in Kazakhstan.

The first path for sustaining agrarian science in Kazakhstan was ‘preservation’, this involved attempting to maintain the pre-1991 agricultural research base with a much smaller budget. In 1996, the Kazakh Academy of Agricultural Sciences became the National Academic Centre for Agricultural Research (NACAR), part of the Ministry of Science/Academy of Sciences. NACAR contained 29 research institutes (including KRIPP), with a further 8 regional branches, 2 experimental forestry stations, 4 veterinary research stations, 12 field experimental stations, 31 experimental farms and the National Agricultural Library (KazGosINTI 2002:11). Initially it seemed worthwhile to try to preserve the agricultural research base in Kazakhstan through a period of uncertainty, with a serious shortfall in funding. This response continued for almost a decade after the collapse of the Soviet Union, but after this time it became evident that the approach was not feasible, as the research base was rapidly deteriorating and many researchers had left public research institutes due to a lack of funding.

The second path for sustaining and developing agrarian science was to ‘facilitate adaptation’, and re-allocate the available resources so they more closely matched the prevailing economic, structural and agricultural realities (Chapter 2). This strategy implied reorganizing the research institutes so that they were more aligned to the needs of the new types of agricultural producers. As a result all the research institutes (including KRIPP), experimental stations and experimental farms of NACAR were transferred to the Ministry of Agriculture at the end of 2002. NACAR ceased to exist as an organization. Ten regional agricultural research centres were established, merging the existing research institutes, their regional branches and the experimental stations. The research institutes within these new regional centres sought to maintain their independence. They had to compete for scarce budgetary funds and struggle with bureaucratic obstacles and excessive ministerial control. The Ministry of Agriculture required agricultural researchers to be responsive to the demands of new farmers and to be market-oriented. By contrast the researchers were still focused on the type of research that fitted with the large-scale, knowledge-intensive, highly-mechanized collective farming of the past, which was of little relevance to the reality of the post-1991 farming sector with numerous small-scale, individual and resource-poor farmers. Foreign companies were already actively recommending their packages of agricultural inputs (e.g. seeds, fertilizers and pesticides) which were widely available. In response policymakers abandoned the path of sustaining and developing a knowledge-intensive model of agrarian science.

The third stage in the development of agrarian science, 'technology import', was adopted in 2007 when the Ministry of Agriculture announced that future agricultural research in Kazakhstan would mainly focus on adapting imported technologies.[7] To this end a wholly state owned Joint Stock Company (JSC) *KazAgroInnovation* was established under auspices of the Ministry of Agriculture. Its purpose was to import foreign agricultural technologies, coordinate the activities of all the agricultural research centres, evaluate the quality of research outputs, increase the efficacy of agrarian science and control the finance of agricultural research. The agricultural research institutes were transformed from state enterprises, which had the right to engage in economic activities, into Partnerships with Limited Liability. These initiatives represented a semi-privatization of the agricultural research enterprises, as all their assets still belonged to the state and a significant part of their finances came from the state budget.

In August 2007, JSC *KazAgroInnovation* presented ambitious plans to build two Agricultural Research-Education Cities, one in the north and one in the south of the country by 2011-12 and to concentrate all the agricultural research and educational organizations in these Cities.[8] As a prelude to such concentration, JSC *KazAgroInnovation* reduced the 10 existing regional agricultural research centres into three regional research institutes for agriculture and four specialised research institutes (livestock breeding and veterinary, food and biofuels, forestry and wheat farming).

According to our interviewees from the research community, these initiatives were carried out in a top-down fashion, with little attempt made to solicit the views of the scientific community. Researchers complained that all these bureaucratic restructurings have constrained their activities and made it impossible for them to take independent decisions. The restructuring of research institutions added extra layers of bureaucracy to the research system (cf. Busch and Lacy 1983). According to Schweitzer[9] (2008), government bureaucracy is the major obstacle to the development of science and technology in Kazakhstan. Our evidence suggests that the bureaucratization of scientific management is one of the factors that has hindered the development of agrarian science in Kazakhstan in the post-Soviet era.

### 4.4.2 *Science under siege*

Science and the research community in post-Soviet Kazakhstan have faced many problems besides bureaucratization. To identify the key problems we used a critical review of the literature and media sources, field observations and the data of our interviews. The collected data point at the following key problems: low salaries, run-down and outdated research facilities, difficulties with recruiting young researchers and retaining the intermediate generation, weak state support and the poor quality of research outputs. These findings coincide with the results of a more general study carried out by Gurevich and Suleimenov (2006), among 701 researchers from 71 various research organizations located in 17 cities of Kazakhstan (Table 4.1).

**Table 4.1 Indication of the weakest aspects of (all) sciences in Kazakhstan by researchers (n=701).**

| Factor | Respondents, 100 % |
|---|---|
| Wage/income of researchers | 30.2 |
| Material and technical supply of research enterprises | 12.8 |
| Introduction of research outputs into practice | 11.4 |
| Inflow of young researchers | 10.4 |
| State support and regulation | 8.3 |
| Staff qualification of research enterprises | 6.0 |
| Staff training for research enterprises | 4.3 |
| Organization/management of science | 3.1 |
| Intellectual property rights | 2.7 |
| Expertise of researchers | 2.1 |
| International collaboration | 2.1 |
| Evaluation of researchers’ qualifications | 1.9 |
| Integration of science and higher education | 1.6 |
| Competition in research community | 2.1 |
| Information support | 1.0 |

*Source:* Gurevich and Suleimenov (2006).

The following short section from an in-depth interview with a former researcher (a man of 71 years)[10], who has dedicated all his life to plant protection research, identifies many of the issues facing agrarian science and echoes the views of many other agricultural researchers[11] (Field notes, Interview 24/03/2006):

> Today, there are many problems [*very upset*]. The research potential has become very weak. The research institutes cannot work at full gear because of a lack of finances [*exclaiming*]! For instance, this winter [*December 2005 – February 2006*] most of the research staff of KRIPP were sent on unpaid vacation [*otpusk bez soderzhaniya*] for 3 months, because there was no money to pay their salaries [*this has been ‘normal’ practice since 1992*]. But these 3 months are necessary to analyse what was done last season, write methodological handbooks, prepare a research programme for the next season, and so on [*he reflects what they did as researchers in the Soviet past during the winter months*]. Now it is [*spring*], time for fieldtrips, but they [*researchers*] cannot go because there is no money for this. A plant protection researcher without fieldtrips is not a real researcher [*exclaiming*]! There is no transport to visit the fields. In the past, if you visited a sovkhoz, you got a car, assistants… the farm administration or the regional plant protection stations provided everything you needed for your research. Nowadays you are alone, nobody cares. Plant protection research is entirely based on field observations. Without data from the field you cannot do much in the laboratory. It is nonsense [*exclaiming*]! Without trials in real

> field conditions your laboratory results are incomplete. For this you need to set up field experiments and to do observations. For example, locusts fly hundreds of kilometres, you have to follow and monitor the population dynamics, where they land, lay eggs, under what conditions they take off, which direction they go and so on…
>
> The financing of science became so horrible that... [*does not finish this sentence; pause; he cannot find words to express his frustration*]. Can you imagine the allocated budget for the research programme for developing the integrated protection schemes for all vegetables is 400,000 tenge [*about 3,140 US$*]. In total! This is mockery! [*getting excited and upset*] Moreover, you have to do it in one season [*a requirement of the Ministry of Agriculture which finances the research*]! You never can do that in one year! You need at least three years! But some researchers somehow manage to produce reports after one year. The principle is: *'you get what you pay'* [*this expression is often used in the research community*]. After this they [*policymakers*] claim that they allocated money for the research. Both sides are engaged in 'eye-washing' [*ochkovtiratelstvo*]. Researchers have to write that they developed these integrated measures in order to get paid. Next year money will be allocated for new research and the Ministry of Agriculture will ask for immediate results. At the end, all these research recommendations have a one-day lifespan and of no value. Today, in fact, everybody uses research recommendations developed in the Soviet time. Researchers just take the old ones and rewrite them as new. Nobody develops anything new anymore.

This quotation highlights that the current low quality of plant protection research conducted in Kazakhstan is because of the severe underfunding of research activities. Researchers are adapting their activities and outputs to meet unrealistic demands from the Ministry of Agriculture. Short-termism is undermining the long-term nature of plant protection research and practice. The quotation expresses the views and the frustrations of practically all the researchers we interviewed, all of whom were nostalgic for the way research activities were carried out in the Soviet past.

The new situation has dramatically changed the farming and agricultural research sector, but scientists have difficulties in overcoming nostalgia about the way things used to be. They have difficulties in taking the needs of the numerous new farmers into account. The following quotations from our interviews suggest that they have not yet recognised the need for change:

> Farmers must follow our recommendations, if they want to control pests on their fields. We cannot immediately tune up to their demands... [Interview 07/12/2004]

> … it is possible to implement research outputs on large farms because they have machinery and the necessary equipment… [Interview 14/12/2004]

> …small farmers are concerned about 2, 5, 7 hectares of fields. But our research recommendations cannot be applied on these small plots… [Interview 12/12/2004]

Following on from this, Figure 4.1 shows that only 12 recommendations were developed in the first ten years after the collapse of the Soviet agricultural research establishment. Analysis of their content shows that they are all reprints of Soviet recommendations that have been slightly altered. Thus, little or no new research is being conducted. At the same time research recommendations are still oriented towards large-scale, highly-mechanized and knowledge-intensive crop production systems, ignoring the heterogeneity of farm types, sizes and farming practices that now exist (Chapter 2, Toleubayev 2005).


**Figure 4.1 Number of recommendations for agricultural producers issued by KRIPP in the Soviet and Transition periods.**

*Source:* Compiled by authors from source material in the KRIPP archives.

Figure 4.1 illustrates the relatively high output of KRIPP researchers during the Soviet time and the significant drop in their performance after 1991. This is a combined result of a decrease in the number of researchers at KRIPP (Figure 4.2), the collapse of the Soviet agricultural research and production systems, a lack of incentives and significant budget cuts. Table 4.2 shows the extent to which (state) funding for R&D (in all sectors) has declined since 1991.

**Table 4.2 Gross domestic expenditure on all R&D in Kazakhstan.**

| Year | 1991 | 1996 | 1998 | 1999 | 2001 | 2002 |
|---|---|---|---|---|---|---|
| Expenditures for R&D from GDP, % | 0.80 | 0.30 | 0.22 | 0.18 | 0.22 | 0.26 |

*Source:* Adapted from Kembaev and Komlev (2004:134).

The economic crisis in Kazakhstan in the 1990s led to the funding of all science activities in Kazakhstan dropping by a factor of four after the collapse of the Soviet Union (Table 4.2). Since the economy started to pick, from 2000 onwards, there has been some improvement in the funding of science (Table 4.2 and Table 4.3).

**Table 4.3 Financing of agrarian science from the national budget in Kazakhstan.**

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|
| Expenditure on agricultural R&D from the national budget, million KZT[12], | 634 | 810 | 853 | 1,568 | 2,004 | 2,123 | 2,660 |
| including purchase of research equipment | - | - | - | 417 | 850 | 662 | 360 |

*Source:* Ministry of Agriculture of the Republic of Kazakhstan.

Table 4.3 shows that funding of agrarian science increased four fold between 2001 and 2007. This money was divided between 10 agricultural research centres and used to pay salaries, taxes, the expenses of research activities, maintain research facilities and infrastructure and to catch up with inflation. Official data from the Ministry of Agriculture shows that the average monthly salary of an agricultural researcher in 2002 was 12,196 KZT (about 80 US$) and rose to 34,500 KZT (about 290 US$) in 2007. While this seems a considerable increase in percentage terms, living costs (e.g. food, housing and services) increased significantly in Kazakhstan during this time. While the average salary of a researcher in Kazakhstan is far below that of a researcher in a developed country, their living costs are very similar.

Researchers express frustration about low wages and working in run-down research facilities. In one interview, a 29 year old plant protection researcher at KRIPP revealed the real situation on the ground (Field notes, Interview 27/10/2005):

> Q: You said that researchers do not make any headway. In what sense?
> A: We are doing, doing, doing, doing something, and even not knowing what we are doing, without a clear purpose [*upset and frustrated*]. We are copying reports written in the Soviet past, the research we are doing now was really done a long time ago. Every year we are doing and reporting the same things, only changing the wording in order to satisfy the authorities in the ministries. In fact we only do paper work. But the core of the problem

> is the same, we do not discover anything new and we are absorbed by routine. What is 'new' in our science actually comes from the distant past. 'New' Candidate of Sciences dissertations are defended and claim to have scientific novelty, but all these discoveries were made a long time ago [*in the Soviet past*]. We do not have the conditions to discover anything new because we do not have the infrastructure or the facilities to do the experiments which we would like to do. Our salaries are very low, and so is our motivation. We are not supported morally or materially. For example I do not even have an ordinary preparation needle or laboratory glassware to do simple experiments with. When I arrived from abroad after a 3-month research project at a laboratory at a foreign university, I was really enthusiastic to continue my experiments. But after a couple of weeks of experiencing that we have nothing to conduct experiments, I just dropped the idea. You know why young people are leaving science? Because of the poor working conditions and the low salaries. What is 20,000 tenge [*about 150 US$*] per month for a young researcher with a family? Of course they will go to private business where they can earn a lot more. I do not blame the young people who leave. I am thinking of leaving the institute myself to go to work for the private sector.

This quotation strengthens elements of the earlier quote: underfunding of research activities, low salaries, a drop in the quality of research outputs and how researchers are driven by bureaucratic requirements. But this is from a young researcher, who never worked in Soviet academia who just produces reports to please officials in the ministries as there are no opportunities or facilities to develop something new. The enthusiasm of young researchers rapidly declines in such situations. The main factor that holds young researchers, who have recently defended their dissertations at KRIPP, is a kind of obligation: personal ties and gratitude to the director of KRIPP and the supervisors who helped them attain their 'Candidate of Sciences' (C.Sc.) degrees.[13] But this gratitude cannot sustain them indefinitely and many leave the institute for higher paid jobs in the private sector after a few months or couple of years. The C.Sc. degree considerably enhances their employability.

The low wages, run-down research facilities and lack of goals in public research enterprises makes it difficult to recruit young researchers and the intermediate generation researchers are trying to find other jobs. The old generation of scientists continue to work after retirement[14] with some researchers of 75 years continuing to be involved in research activities. The younger generation (between 25 and 50) are readily employed by agri-business companies, selling pesticides, fertilizers, seeds and farm machinery. The President of the Republic of Kazakhstan raised these issues in a recent address to young Kazakhstani researchers (April 27, 2007) and outlined plans to increase R&D expenditure to 2% of GDP by 2010 and to bring the salaries of Kazakhstani researchers and research facilities up to average world standards. Following this address, policymakers responsible for R&D and S&T policies have made numerous claims in the media, about how science *will again become* prestigious, scientists *will again become* highly paid labour, how expenditure on science *will increase* dramatically and how the scientific domain *will again become* attractive for young people. These future-oriented expressions underline the point that underfinanced public science has lost prestige and become unattractive for young researchers.

## 4.5 Staffing and research infrastructure

### 4.5.1 *Staffing*

The main supplier of young researchers to KRIPP was the Plant Protection Faculty of the Kazakh Agricultural Institute in Alma-Ata. Before the collapse of the Soviet agricultural research and production system this faculty annually produced up to 75 highly qualified graduates in plant protection. They then went on to be employed as either researchers, agronomists for crop producing farms or employees with the Plant Protection Service. In 1996, after the Kazakh Agricultural Institute merged with the Kazakh Veterinary Institute, the Kazakh State Agrarian University (later renamed the Kazakh National Agrarian University – KazNAU – in 2001) was established, but the Plant Protection Faculty was closed. Only a few lecturers were employed to introduce plant protection, involving a few hours of teaching, to students of agronomy. The long list of specialized courses in plant protection was removed from the curriculum. Later on '*plant protection*' was removed from the Ministry of Education and Science's list of specialities for higher and vocational education. As a result, the number of professionals in plant protection has decreased and the expertise is disappearing.

In the Soviet past, the typical pattern of a scientific career in the agrarian research system was graduation from the agricultural educational institution, post-graduate (*aspirant*) study at one of the research institutes, followed by employment in a junior position at the same or another institute. However, it was not easy to get employed at the research institutes because of a thorough selection process. Scientific careers advanced slowly but steadily and it was common for scientists to only have been associated with one research organization in their lifetime. Scientists enjoyed higher salaries than people in most other occupations and had a high status, which also motivated them.[15]

The prestige of being a researcher faded rapidly after the collapse of the Soviet scientific establishment. Severe budget cuts and policy reforms forced a reduction of staff and the shutting down of complete programmes, departments and entire institutes. Many researchers emigrated or left the scientific world in search of better paid jobs in the private sector. The number of scientific researchers in Kazakhstan dropped from 31,250 in 1990 to 9,000 in 2000 (Kembaev and Komlev 2004:137). A similar pattern can be seen in the number of research staff employed at KRIPP – see Figure 4.2.

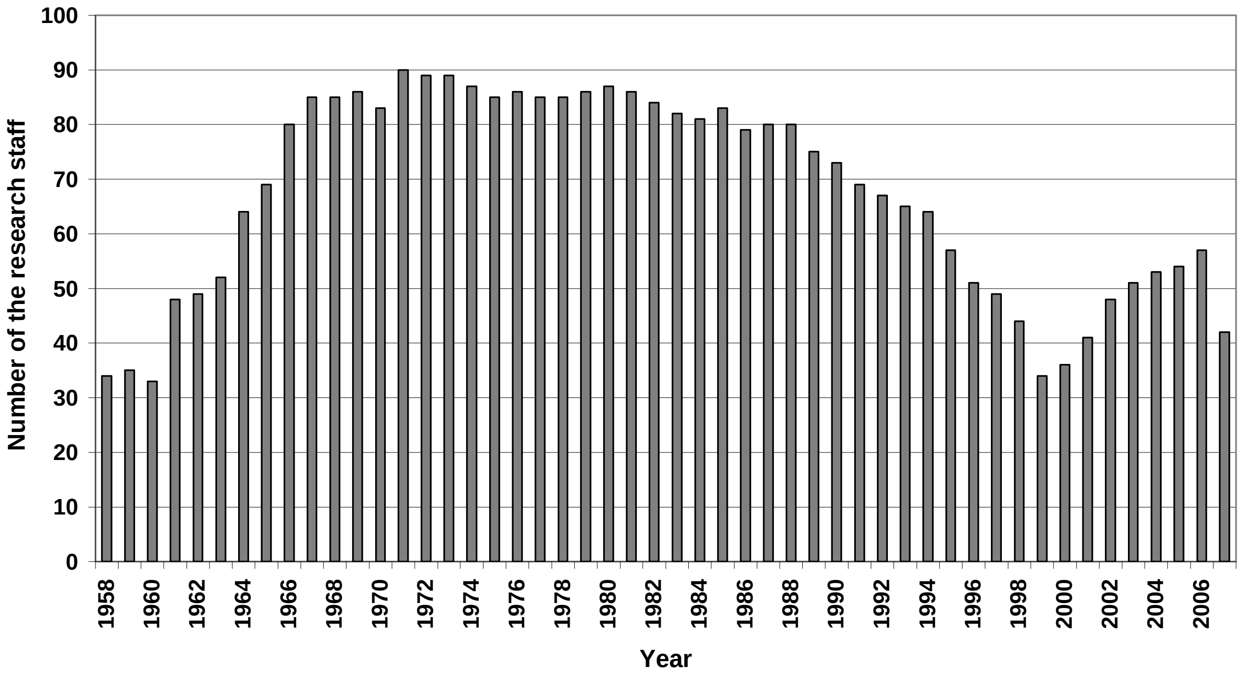


**Figure 4.2 Number of research staff at KRIPP since its foundation in 1958 till 2007.**
*Source:* Compiled by the authors from archive source material at KRIPP.[16]

When originally founded KRIPP had just over 30 research personnel, a figure that doubled by 1965. From 1966 to 1988, KRIPP had a more or less stable number of researchers, fluctuating between 80 and 90. Our interviewees from KRIPP considered this period as one of stability, when most of the scientific plant protection knowledge was developed in Kazakhstan. The number of research staff dropped significantly during the post-Soviet period, from 73 in 1990 to 34 in 1999. Apart from the reduction in number of the research staff, the age of research personnel rose dramatically during this period (Figure 4.3).

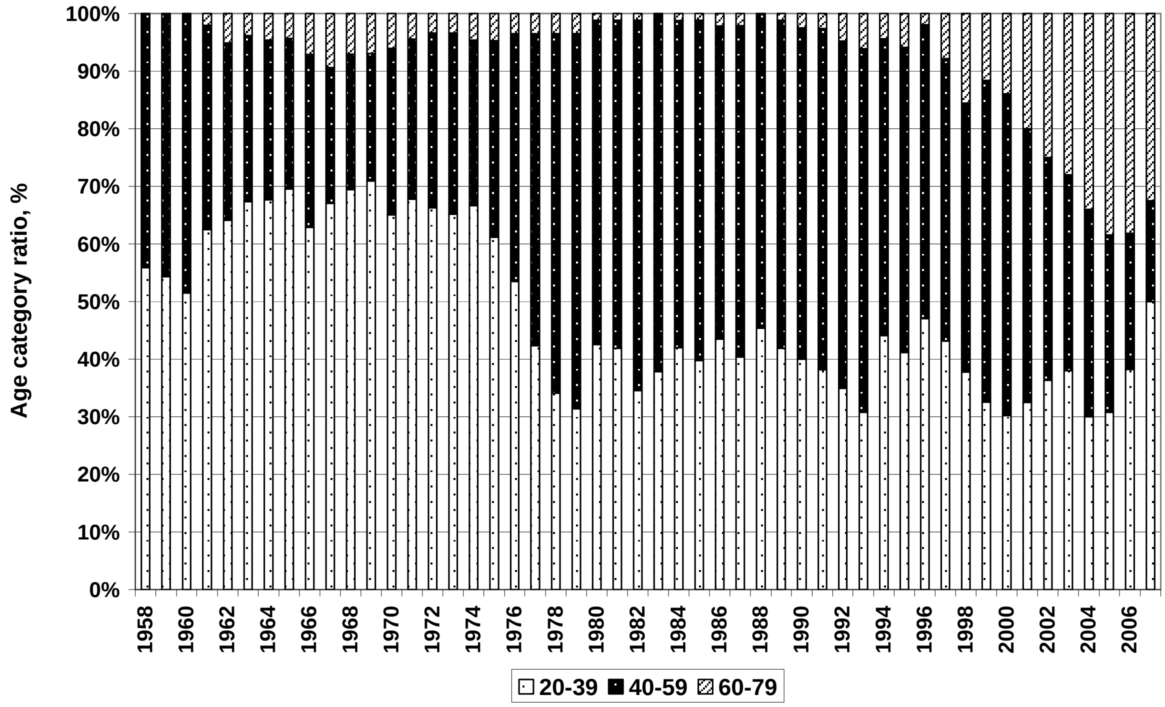


**Figure 4.3 Distribution of age categories of researchers in KRIPP over the period 1958-2007.**

*Source:* Compiled by authors from archive source material at KRIPP.

Figure 4.3 illustrates the number of researchers at KRIPP by age category: 20-39, 40-59 and 60-79. From 1996 onwards, there has been a steady increase in the proportion of researchers older than 60. By 2005, 38% of the researchers fell into this age category, compared to a maximum of 9% during the Soviet time in 1967. The next age category (40-59) accounted for the majority of researchers from 1977 until 2002. Its share dropped to an all time low of 17% in 2007, the lowest in the history of KRIPP, as many left KRIPP for better paid jobs in the private sector. Before 1991, younger researchers in age category 20-39 gradually aged into the intermediate category. One would expect retired researchers to leave their positions and be replaced by the intermediate generation, who would in turn be replaced by young generation and so on. However, the post-1991 collapse of the Soviet system affected this trend, with many researchers, especially from the intermediate age category leaving KRIPP. There were also problems with recruitment of young research staff, but the recruitment of young graduates from KazNAU by the fourth director of KRIPP played a role in rejuvenating research staff as explained below.

The major factors determining the composition of the workforce have been funding, S&T policies and organizational reforms. However, the managerial and leadership skills of directors of KRIPP also have played a role. Throughout its life KRIPP has been managed by just four directors: the first from 1958-1976, the second 1976-1980, the third 1980-2000 and the fourth from 2000 until now. Our interviewees characterised the first director as a founder of plant protection research in Kazakhstan, he was a leader in this scientific domain for more than thirty years from 1945 until 1976 and before 1958 was the head of the Republican Plant Protection Station. KRIPP prospered under his directorship. The interviewees were more balanced in their opinion of the second director, who was neither highly praised nor criticized. The third director received much criticism for bad management and ill treatment of his subordinates. During his directorship the number of researchers declined (Figure 4.2). While the decline after 1991 can be explained by the overall economic depression within the country and the severe budget cuts, there was also a 21% decline in the number of research staff during the first ten years of his directorship, in the Soviet period, when the funding of science was not so much an issue. Senior researchers, who left KRIPP during his directorship in the 1980s, said that they found his jealous and hostile attitude towards them intolerable. They believed that he was insecure that he might be replaced by better performing senior researchers, so he strategically undermined them or sought to get rid of them.

The fourth director was characterized as a saviour. He was appointed in 2000 at a time when authorities were attempting to close KRIPP. This coincided with a severe locust plague that lasted for three years from 1998 to 2001 (Toleubayev et al. 2007) and he argued the need for maintaining plant protection capability. KRIPP escaped closure but problems of resources persisted, with inadequate staffing levels (Figure 4.2). The new director made it a priority to bring back senior researchers, who used to work at KRIPP, although most of them were already retired. He also retained intermediate generation researchers, who were planning to leave the institute; and recruited young researchers, who were reluctant to work at public research institutes. He recognised the importance of maintaining senior and intermediate researchers who could pass their expertise and knowledge onto the young generation and the importance of attracting a younger generation to rejuvenate the research community. The new director personally recruited students from KazNAU at a time when other agricultural research institutes had problems with recruiting young graduates.[17] He was well positioned to do so as used to be the Chairman of the Plant Protection Group at KazNAU before he assumed the directorship of KRIPP. He was able to recruit some of his former students, provide them with accommodation (an attractive term of employment) and create conditions for them to earn additional income (to supplement their low salaries) by engaging them in various activities, such as pesticide testing for the private sector. His success in bringing retired researchers back to KRIPP was because his relationship with these colleagues went back to when he began his scientific career at KRIPP as a research assistant in 1968. He became senior researcher in 1976, was head of the Department for the Protection of Fruit and Vegetables at KRIPP until 1989, and then went to work at the Kazakh Agricultural Institute. The turnaround in KRIPP’s fortunes since 2000 is largely due to the specific networking activities of the current director.[18] The number of the researchers has increased from 36 in 2000 to 57 in 2006, an increase of 37% (Figure 4.2). Moreover, KRIPP has attracted new funds for conducting some research activities and to purchase new equipment. Thus recent years have been a period of revival for KRIPP, although external factors, such as structural reorganizations led by policymaker in the ministries, have limited the extent of this revival.

The success of the current director in strengthening human resources was later overruled by policymakers. In July 2007, JSC *KazAgroInnovation*, the ‘privatized’ branch of the Ministry of Agriculture, ordered all agricultural research institutes to cut staff by 30% by the end of the year, arguing that the percentage of technical personnel in agricultural research institutes was too high (on average 58%).[19] They categorized research assistants (which made up 31% of the research personnel in KRIPP in 2006) as technical personnel. If they were counted as research personnel, essential to carry out the research, a different picture of the ratio between research personnel and technical personnel would emerge. Obeying orders, the Director of KRIPP cut research staff by 26%, notwithstanding the scarcity of research personnel. This step by JSC *KazAgroInnovation* appeared to be part of a longer term policy, as in August 3, 2007 they presented further plans to the Ministry of Agriculture to reduce personnel involved in agricultural research from 3,054 people in 2007 to 2,000 in 2012 (Ministry of Agriculture 2007).

This review of the changes in staffing at KRIPP illustrates the discrepancies between reforms carried out by policymakers and the realities on the ground, particularly the shortage of research staff, the difficulties in recruiting young specialists, in retaining the intermediate generation and the ageing profile of the research community.

### 4.5.2 *Research infrastructure*

In Soviet times agricultural research institutes were designed as academic villages with a full research infrastructure - laboratories, greenhouses, a machinery park and experimental fields; as well as a complete social infrastructure - kindergarten, school, central-heating, housing, post-office, clinic, etc. - all serving the employees of the institute and their family members. This was similar to the production and social infrastructures of the Soviet farming system (Chapter 2). The Kazakh Research Institute for Plant Protection had all these facilities by the end of 1960s except for the school (as there were schools in nearby villages and Alma-Ata city). Most adult family members were employed in the institute as researchers, research assistants, or maintaining the research and social infrastructure of the academic village. The work-force included plumbers, electricians, heating-system technicians, drivers, carpenters and field workers. These workers and the kindergarten personnel were paid from the institute’s budget and were part of the general staff. For example, in 1983 the general staff list of KRIPP consisted of a total of 258 employees: 82 researchers, 62 research assistants, 28 ‘other’ personnel (accountants, secretaries, librarians, guards and cleaners), 64 workers and 22 kindergarten personnel. Housing was provided for every employee of KRIPP. The compound of the academic village had ten duplex cottages, 147 apartments and a dormitory. Housing opportunity was one of the strong attractions of employment with KRIPP and kept staff attached to the institute for long periods. When leaving the institute for another job employees had to give up their housing. This may partly explain the very low staff turnover at KRIPP during the Soviet era.

With the collapse of the Soviet scientific establishment and introduction of neoliberal reforms, drastic changes were made in the ownership of these infrastructures. The housing facilities and kindergarten were privatized and the institute lost control over them. KRIPP lost its experimental fields and the orchards located next to the main building, which the state sold to private developers to build houses to meet the expansion of Almaty city. The research infrastructure itself rapidly deteriorated because of budget cuts.

The budget available after 1991 barely covered salaries and tax payments, even though the run-down and outdated research facilities required significant investments. It was not until 2004, that the Kazakhstani government made any allocation to the agricultural research institutes to purchase research equipment (417 million Kazakhstan tenge - about 3 million US$, see Table 4.3). Previously KRIPP's laboratories had been furnished with state of the art equipment.[20] For example, in 1971 a brand new (made in the USSR) electron microscope was installed in KRIPP that was used for many years. In comparison, during the 1990s the simplest equipment, e.g. laboratory glassware, could not be acquired, due to lack of funds. Today, KRIPP has no advanced research equipment to do scientific research. Researchers are still using the equipment supplied decades ago during the Soviet era (see Appendix 4.1 for illustrative photographs). The current level of financing (see Table 4.3) is insufficient to bring agricultural research to the average world level or increase its international profile. For example, in the Netherlands, a country with more or less the same population as Kazakhstan, the Ministry of Agriculture, Nature Management and Food Quality annually allocates more than €850 million to knowledge and innovation programmes (Poppe 2008:15) compared to €8 million in Kazakhstan (Table 4.3).

These issues have seriously setback agrarian science in Kazakhstan, which has declined in both quality and quantity. Neither the strategies of 'preservation' or 'facilitating adaptation' managed to sustain agrarian science in Kazakhstan. It now has to be seen how the recently introduced 'technology import' path will unfold and whether it will strengthen agricultural research. The current reality is that agrarian science in Kazakhstan has still not recovered from the post-1991 crisis.

## 4.6 Plant protection research and the pesticide industry

To survive the shrinking public R&D budget that ensued from the post-1991 economic crisis, KRIPP developed a partnership with the pesticide industry (see Chapter 3), with pesticide testing providing an additional source of income for low paid researchers. Pesticide companies were obliged to test their products in local field conditions in Kazakhstan as a prerequisite for registering them in the state pesticide register, so they contracted the public agricultural research institutes to do this for them. The Ministry of Agriculture sets an annual plan for pesticide registration tests, which must be done by accredited public research institutes. Ties between managers of the research institutes and decision-makers in the Ministry and the pesticide industry influence who will be commissioned to conduct the tests. We attempted to raise the issue of the pesticide testing process with our interviewees but they often were reluctant to talk about it. Content analysis of the reports of these trials revealed only positive results and that the pesticides tested are always recommended for registration.

This process expedited the shift from an IPM research agenda to a pesticide focused research agenda. In the Soviet past, KRIPP did no research for the pesticide registration process and the pesticide industry had no influence over the setting of research priorities. The current research programmes still accept pest-control options without pesticides, but testing and recommending pesticides have become the core element. A content analysis of the post-1991 plant protection publications reveals that pesticides from particular companies are openly promoted by researchers from KRIPP.[21] An example is an article which bears the name of the company in the title: ‘The efficacy of fungicides of Syngenta against diseases of cereals’ published in the journal *Plant Protection and Quarantine in Kazakhstan* (Koishybayev et al. 2004). This article confirms the efficacy of several of Syngenta’s fungicides against cereal diseases. Pesticide companies regularly announce calls activities that will promote their products. For instance, in 2006, Syngenta announced a contest for researchers under the theme ‘*Crop production technologies in Kazakhstan that make use of Syngenta*’s *pesticides*’. The first three prizes were a laptop, a digital camera and a cellular phone. In 2007, Syngenta invited young researchers and students to submit research results on their products with prize money of 60,000 KZT (about 520 US$) for the best publication from a young researcher and 30,000 KZT (about 260 US$) from an undergraduate student (Syngenta Kazakhstan 2007:11).

These new funding arrangements represent a key survival strategy for the research community. They have kept the agricultural research institutes alive, but brought to an end the long-term development of ecologically sound plant protection policies, practices and research. Short-termism and commercialization have become the dominant drivers of today’s agrarian research agenda.

## 4.7 Conclusions

This chapter has examined the shift in plant protection research agenda in the Soviet and post-Soviet periods in Kazakhstan. Throughout the Soviet era, even in the middle of the difficult period of the 1930s, plant protection research served national interests. This research domain aimed to secure crop production against harmful agricultural pests, e.g. locusts (Toleubayev et al. 2007) and to develop the integrated pest management schemes minimizing pesticide use (Chapter 3). These characteristics of plant protection research faded away after 1991.

The shifts in research in Kazakhstan fit into the typology of strategies by Radosevic (2003): after a period of initial preservation the research organizations were restructured and developed a set of micro-strategies to survive. Our analysis shows that the restructuring of the agricultural R&D system did not lead to a dynamic system adapted to the new economic realities in the farming sector. What remained of the plant protection research infrastructure acted more as a buffer against any further erosion (cf. Radosevic 2003) exemplified through the adoption of a set of micro-strategies, specifically pesticide testing and promotion, as a way to cope with the shrinking research budget. The diminished and ageing research community has become pessimistic and sceptical about the top-down reforms from the government. Recent plans to increase R&D funding have not yet been translated into substantial increases of salaries or improvement of research facilities. Policymakers have turned agricultural research institutes, including the Kazakh Research Institute for Plant Protection, into research enterprises, which have to commercialize their research outputs, market them to end-users and become self-supporting in future. JSC *KazAgroInnovation* supports the importation of foreign agricultural technologies rather than strengthening and developing local knowledge.

Radosevic (2003) looked principally at the national level restructuring of R&D in Russia. We have examined a less studied region – Kazakhstan, and a less discussed sector – plant protection research. This has allowed us to make a more detailed analysis of the impact of restructuring and the emergence of a set of micro-strategies on the research agenda and the content of scientific work. The analysis shows that the commodification process and the ‘import of technology’ principle all too readily dovetail with a pest-control strategy based on using imported pesticides. These changes are incompatible, in their current form, with pest control based on IPM schemes or biological control agents, which require continuous examination of and adaptation to the specificities and complexities of local agro-ecosystems. Many elements of plant protection research before 1991 corresponded to the public good character of sustainable pest control. In post-1991 Kazakhstan, research in developing ecologically sound pest-control approaches is not recognized as a public good by policymakers. The risk is that further neglect will jeopardise the development and promotion of long-term, environmentally safe and ecologically balanced pest-control measures, thus threatening national food and health security.

## 4.8 Notes

[1] This city has had its name changed on several occasions: Verny (1854-1921), Alma-Ata (1921-1993) and Almaty (1993-now).

[2] Biocenosis (*pl.* biocenoses) – is a group of interacting organisms that live in a particular habitat and form an ecological community.

[3] Chernozem [*in Russian*] – is a black-coloured fertile soil containing a very high percentage of humus.

[4] Zimin (1935:69) wrote: ‘Until now we have not seen any published results about the efficacy of chemical dusting against the European Corn Borer’.

[5] Lysenko was the head of VASKhNIL between 1938 and 1956 and again between 1961and 1962.

[6] KRIAF is located in the Almaty region, in the southeast of Kazakhstan

[7] The importation of technologies was pioneered by private businesses in post-Soviet Kazakhstan between 1991 and 2007 and the private farming sector has become largely reliant on imported foreign agricultural technologies (seeds, fertilisers, pesticides, farm machinery, etc.).

[8] These plans are unlikely to be implemented as no budgets have been secured and there is no sign yet of any construction taking place.

[9] Glenn E. Schweitzer is the Chairman of the International Experts Council on Science and Technology established by the government of Kazakhstan in 2007.

[10] He is still working as a consultant for the pesticide retailing firm to earn some money to top up his low pension payment.

[11] During the fieldwork for this study we communicated with 47 (former and current) agricultural researchers (casual conversations, joint field visits, short interviews and so on) to obtain information about the historical changes in agrarian science in Kazakhstan. We conducted longer semi-structured interviews (with open-ended questions) with 21 of them. These interviewees were transcribed and analysed with computer software for qualitative analysis Atlas.ti 5.0. Material out this analysis is available from the first author.

[12] Average ratio of KZT to US$ in 2001-2007 was 140 KZT / 1 US$ (min 124 KZT / 1 US$ in 2007 and max 153 KZT / 1 US$ in 2002) http://www.oanda.com/convert/classic

[13] ‘Candidate of Sciences’ – scientific degree in the former USSR, which is still in use in Russia and Kazakhstan and can be placed between M.Sc. and Ph.D. of western academia. Some equate this degree to western Ph.D., but after pursuing Candidate of Sciences degree one need another 4-5 or more years to pursue ‘Doctor of Sciences’ degree that equal to Ph.D. degree of western academia.

[14] Retirement age for women is 58 and for men 63. Retired researchers willingly participate in research activities, as this supplements their meagre pensions.

[15] In the past, researchers were perceived as educated and noble people, doing something outstanding for the benefit of the society. When an agricultural researcher visited a Soviet farm she/he was welcomed with respect by the farm community.

[16] Sorting out the staff statistics from KRIPP archive was a painstaking and long process which took about two months. It involved reviewing piles of documents and sorting out inconsistencies in the records and crosschecking them on many occasions.

[17] Managers of the Research Institute for Arable Farming and the Research Institute Vegetable and Potato Farming revealed in that they faced serious problems in recruiting young graduates.

[18] Apart from networking within the research community (including his contacts with research organisations in Russia, Uzbekistan and Kyrgyzstan), this director also has ties with the Ministries of Agriculture and of Education and Science of Kazakhstan.

[19] Policy makers were not very careful in their analysis of staff statistics. From the total staff of the research institutes (including: researchers, research assistants, drivers, field workers, cleaners, plumbers, guards, accountants, secretaries, etc.), they subtracted the number of researchers and the others were defined as 'technical personnel', including research assistants, which gave the figure of 58%. But a research assistant is a subject-matter specialist with higher education, who assists researchers in their experiments and therefore should be categorized under research personnel.

[20] We photographed the manufacturers' labels on the research equipment made in 1960s, 1970s and 1980s as material evidence to support our arguments about the Soviet research establishment.

[21] We analysed content of the post-1991 plant protection publications that were produced by researchers from KRIPP and published in various magazines and newspapers, scientific journals, internal reports and dissertations.

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# *Chapter 5*

# Locust control in transition: The loss and reinvention of collective action in post-Soviet Kazakhstan

## 5.1 Introduction

In July 1999, migrating swarms of the Italian Locust (*Calliptamus italicus* L.) invaded Astana, the newly established capital of Kazakhstan. Billions of locusts swarmed along the streets of the capital, terrifying citizens and causing traffic accidents. They roosted on the brand new governmental buildings and entered the offices of high-ranking officials. Locusts also invaded agricultural fields, devastating crops and pastures. The plague that occurred between 1998 and 2001 was probably the worst one experienced in Kazakhstan in the 20th century and had serious economic and political consequences. As the country did not experience such plagues during the Soviet period, it makes sense to ask whether there is any relationship between locust plagues and state organization. This paper examines whether changes in the locust control system, resulting from the collapse of the Soviet Union and the subsequent Transition Period, contributed directly to this locust plague. The history of the changes in the locust control system provides grounds for advancing the theory of collective action in natural resource management. The paper illustrates the importance of the recent discussion about institutional arrangements in collective action theory (Acheson 2006). The results of our analysis suggest that local-level participatory management and market-driven approaches are both inadequate in solving locust problem.

In addressing these issues, this paper first examines the impact of land use changes, and changes in habitat, on locust populations. It then describes knowledge acquisition during the Soviet period and the loss of this knowledge in the Transition Period. The next section portrays how the intensive knowledge system in the Soviet era was coupled to an extensive monitoring and control system. The Transition Period that followed the collapse of the Soviet Union led to an almost complete disintegration of this system. The locust plague that gradually built up in the late 1990s illustrates how these institutional changes were related to the development of locust populations. When the locusts flew into the government offices, high-level policymakers realized the consequences of the almost total dismantling of the plant protection service and started to reconsider public intervention in locust control. The last part of the paper discusses the public good character of locust control and the optimal modes of collective action.

## 5.2 Methodology, definitions and theoretical framework

Data were obtained through semi-structured interviews with people involved in locust research and control activities, viz.: plant protection practitioners, researchers, ex-researchers, research managers, agricultural producers, and policy makers. We collected not only hard data on population dynamics and the technical characteristics of control of locusts, but also data on the background knowledge of actors involved in locust management and their specific interpretations of the nature and cause of pest problems and the adequacy of specific solutions (Jansen 2008). We also conducted participant observation of meetings involving policy makers, practitioners, and researchers, and we participated in several locust monitoring activities. Literature, documents, scientific reports, and press coverage on locust events were reviewed and the data from these different sources were cross-checked.

Locusts and grasshoppers belong to the order of *Orthoptera* and are members of the family *Acrididae*. Locusts differ from grasshoppers in that they have the ability to change their behaviour and physiology in response to changes in population density (FAO 2001). Locust populations have two distinct phases: the solitarious phase when population density is low; and the gregarious phase when population density is high (Uvarov 1966). Adult locusts can form swarms, which may contain thousands of millions of individuals and behave as one unit. Locusts in the non-flying nymphal stage are called hoppers, when gregarious they form cohesive marching bands (FAO 2001).

The following definitions, modified from FAO (2001), are used to distinguish the different states of locust populations:

- Outbreak is characterized by an increase in locust numbers through concentration, multiplication and gregarisation, which can lead to the formation of hopper bands and swarms.
- Plague is a period of one or more years of widespread and heavy infestation by hopper bands and adult swarms.
- Decline is characterized by the dissociation of swarming populations because of natural factors and human intervention.
- Recession is a period when locusts are normally present at low densities in restricted areas and do not cause noticeable crop damage.

The plague of 1998–2001 in Kazakhstan was caused by locusts and grasshoppers. The most destructive of these were the Italian Locust (*Calliptamus italicus* L.) and the Asiatic Migratory Locust (*Locusta migratoria migratoria* L.). These two species provide exemplary cases for examining the co-production of political order and the development of scientific knowledge, decision making and technologies dealing with locust control (Jasanoff 2004). The analysis of co-production in this paper uses two concepts borrowed from social theory: public good and collective action.

This study explores the extent to which locust control is a public good that requires collective action. Perrings et al. (2002) point out that the control of invasive alien species is a public good when the benefits from the control are neither rival nor exclusive. If one person benefits from such a public good, this does not affect its cost, nor does this reduce the benefits to others (Ostrom 1990). If left to the market, the control would be undersupplied (Perrings et al. 2002). The supply of public goods requires collective action; or in the words of Olson (1992:Foreword), who challenges Adam Smith's notion of the market as an 'invisible hand': '*...only a guiding hand or appropriate institution can bring about outcomes that are collectively efficient*'.

If locust control should be considered as a public good, as we argue below, then the subsequent question is how it can most effectively be provided through collective action.

There are many documented forms of collective action in the fields of agriculture, environment and development (e.g. Agrawal 2003). One important theoretical concern is the lack of agreement about how to distinguish different forms of collective action (Poteete and Ostrom 2004). Much of the current discussion on collective action pays relatively little attention to state-centred development of public goods, but primarily deals with concerted efforts by individuals or groups (Justino 2006). Major contemporary issues in this field include the management of common-pool resources, recently discussed in relation to processes of decentralization of central state control over natural resources (Acheson 2006, Agrawal and Ostrom 2001) and the large-scale political activism of social movements (Edelman 2001).

Since 1990, the concept of collective action has played a role in the development of participatory approaches to integrated pest management in order to improve local-level management and learning processes, often through farmer field schools (Norton et al. 1999, Van den Berg 2004, Van den Berg and Jiggins 2007, Van Huis and Meerman 1997). This approach has proved to be very successful in fostering resilience management (Walker et al. 2002) by farmers, who by learning through discovery come to understand better the agro-ecological relationships in their fields. The farmer field school approach transforms farmers from passive recipients of crop protection instructions to active, self-reliant practitioners of integrated pest management. Major successes have been obtained in protecting high value crops with a history of resurgence and secondary pest outbreaks (Morse and Buhler 1997).

Farmers have also attempted to combat locusts to protect crops. However, when locusts arrive *en masse* in agricultural fields they have already reached plague proportions and it is beyond the capacity of individual farmers to deal with them. Then farmers resort to prayer or turn to politicians for solutions (Lockwood 2004). Locusts from plagues originate from outbreak areas that are natural habitats in which they multiply and gregarise. When fully gregarious, they are capable of migrating in swarms to agricultural areas, where they can inflict considerable damage (Van Huis 2007). A preventive control strategy aims to control locusts in the restricted, often remote, and not properly monitored outbreak areas (Van Huis et al. 2007). Yet monitoring and controlling locusts in these areas is clearly beyond the capacity of individual farmers.

Collective action theory provides a framework to rethink the institutional successes or failures of market-driven, private-property regimes, government-controlled resources and interventions, and local-level management (Acheson 2006). This study of the transformations in Kazakhstan and the impact on locust and locust control illustrates the need for collective action theory to go beyond its current focus on decentralization and illustrates the need to rethink the role of governments in the delivery of public goods.

Scott's review of the literature on Soviet collectivized agriculture pictures it as an 'authoritarian' and 'high-modernist' system that failed in all its aims and incurred massive costs through stagnation, waste, demoralization and ecological disasters (Scott 1998:201). The Soviet system embraced the Baconian ideal of 'technoscience' (Busch 2000:34), in which humans are subservient to the findings of science and the innovations of technical engineers. This body of literature equates the centralist, authoritarian political order with a technoscience that functions to control the citizenry, but is unable to deal with ecology or the heterogeneity of environments. This paper does not disagree with the broad thrust of this analysis, but identifies that it has one shortcoming: that the scientific and technological past was not as homogeneous as portrayed. Our study reveals that a very complex and dynamic system of locust management was developed during the Soviet era. By understanding the interactions between a political order, scientific knowledge and technological practice we intend to contribute to a rethinking of the potential forms of collective action in providing public goods, such as locust control. To this end, and to identify the critical changes that occurred over time, this study examines how land use practices influenced locust habitats and population dynamics, how knowledge about locusts developed and how locust control was practiced.

## 5.3 Land use, habitats and locust populations

The effect of the anthropogenic factors, particularly of agricultural practices, on the population dynamics of locusts has been widely acknowledged (Chetyrkina 1958, Farrow 1987, Kopaneva 1987, Popov 1987, Uvarov 1962).

### 5.3.1 *Land use and the Italian Locust*

Chetyrkina (1958) carried out comparative quantitative surveys of populations of the Italian Locust in many habitat types in areas subject to mass outbreaks in eastern Kazakhstan. Although these surveys were conducted in the recession years of locust population they revealed striking differences in densities, which are related to land use (Table 5.1).

**Table 5.1 Mean adult densities of non-swarming populations of *C. italicus* in different habitat types in eastern Kazakhstan.**

| | Type of habitat | Number/m$^2$ |
|---|---|---|
| 1. | Virgin land; dense short grass (*Festuca sulcata*) | 3.5 |
| 2. | Patches of *Artemisia maritima* surrounded by short grass | 7.6 |
| 3. | Current year's cultivation, e.g., wheat, etc. | 0 |
| 4. | Early fallow, with some grass, sparse *Artemisia* and other herbs; bare patches | 20 |
| 5. | Older fallow, with tall weeds including *Artemisia* | 26 |
| 6. | Very old fallow, with dense grass turf (*Festuca sulcata*) | 0.25 |
| 7. | Overgrazed communal pasture, with *Festuca*, *Artemisia*, *Polygonum aviculare*, *Alyssum*, etc. | 20 |

*Source*: adapted from Uvarov (1977).

The Italian Locust occurs in low densities in undisturbed habitats and disappears completely when the land is ploughed up (Table 5.1: 1, 2 and 3). It occurs in high densities when land has been left fallow for four to five years and is invaded by *Artemisia*, (Table 5.1: 4 and 5). In the later stages of plant succession, when weeds are gradually replaced by secondary grass, densities of locusts are very low (Table 5.1: 6). On overgrazed and trampled communal pastures with weeds and much bare ground, the locusts are as numerous as they are on fallows (Table 5.1: 7). Thus, human patterns of land use, which affect soil structure and plant succession, affect the development of Italian Locust populations (Uvarov 1977).

### 5.3.2 *Habitat reconstruction and the Asiatic Migratory Locust*

The breeding habitats of the Asiatic Migratory Locust in Kazakhstan are linked to natural thickets of reed (*Phragmites australis*) along sea, lake and river basins (Antonov and Kambulin 1997, Sivanpillai et al. 2006), which provide a source of food. Such habitats cover an area of about 1,120,000 ha in the country (Tsyplenkov 1970). In plague years, swarms migrate an average of 500 km from these breeding habitats, destroying almost all the vegetation on the way. As such this species is one of the most harmful agricultural pests.

Natural periodic fluctuations of the water level in lake and river basins influence locust population dynamics: when the water level decreases the area for locust breeding increases, and vice versa. The mass construction of dams, irrigation channels and artificial reservoirs in the 1960–1970s, reduced the water level in the lake and river basins, favouring the intensive growth of reed beds and increasing the locust breeding area. For example, after the construction of Kapchagai reservoir halfway along the River Ili in 1971, the water inflow into Balkhash Lake diminished, and the water level gradually diminished (Kambulin 1992, Popov 1987), enlarging the locust breeding habitats. At the same time, reclamation of lands for rice and cotton production along river basins (e.g., in the lowlands of the Syr-Darya and the Amu-Darya Rivers) reduced the natural growth of the reed beds and created unfavourable conditions for locust breeding (Popov 1987). As soon as significant parts of these cultivated lands (including the irrigation infrastructure) were abandoned in the 1990s these areas became mass locust breeding habitats, and most likely contributed to the locust plague of 1998-2001.

### 5.3.3 *Impact of land use practices on locust population dynamics*

The 1998–2001 locust plague in Kazakhstan mostly involved the Italian Locust. A historical perspective can help explain why the plague developed. Locust problems started in the second half of 19th century onwards when large numbers of Russian settlers began to colonize and cultivate the territory of present-day Kazakhstan. From then on the cultivation of virgin lands, i.e., lands that had never been used for crop production, continued under the Tsarist regime, after the Bolshevik revolution, during Stalin's collectivization period and during World War II. By the end of 1940s the total area of reclaimed virgin and idle lands amounted to about 7,000,000 ha (Gossen 1998).

In 1953, the Soviet leader Nikita Khrushchev initiated the ambitious Tselina/Virgin Land programme to turn the traditional pasturelands of Kazakhstan into a major grain-producing region for the Soviet Union. From 1954 to 1964 about 25,000,000 ha of virgin and idle lands were ploughed for wheat production in Kazakhstan. Such extensive changes considerably reduced the natural habitats of the Italian Locust. As illustrated in Figure 5.1, the implementation of the Virgin Land programme between 1956 and 1965 made these cultivated lands unsuitable for the Italian Locust. From 1965 onwards, long fallow-wheat rotation systems became prevalent in Kazakhstan, and the large areas under fallow became important breeding grounds for the Italian Locust, which repeatedly invaded crop fields. This suggests that the recurrent pattern of serious infestations every four or five years might be connected with the periods when the fallow fields reached the succession stage (Table 5.1), which is the most favourable for the insect. Moreover, a reduction of pasturelands (now cultivated) increased the number of livestock per unit area, leading to overgrazing and land degradation. This created favourable conditions for an increase in the population of the Italian Locust (Table 5.1). The relation between plant type cover and occurrence of the Italian Locust is not only based on food preferences, but also on the physical properties of the soil (Chetyrkina 1958). They prefer moderately compact soils for egg laying, very compact (virgin) and very loose (recently broken) soils are less favourable for this. Thus the soil structure and vegetation of fallow lands in long fallow-wheat rotation systems presumably contributed to an earlier Italian Locust plague in 1970–1971 (Figure 5.1).

Ploughing up virgin and idle lands led to another agro-ecological problem, that of wind erosion. To deal with this problem anti-erosion cultivation systems were implemented in the beginning of 1970s, which involved disturbing the soil as little as possible and by sowing crops in strips. These new systems of soil cultivation seem to have increased the size of the habitats favorable for breeding of the Italian Locust, particularly since these areas were located next to the species' natural breeding habitats. This is likely to have contributed to the 1978–1982 plague (Figure 5.1).

After the break up of the USSR in 1991, vast areas of cultivated land were abandoned. Areas under cereals in Kazakhstan decreased from about 25,000,000 to 12,000,000 ha between 1992 and 1995 (Azhbenov 2000). These idle lands became a perfect habitat for the Italian Locust after 4–5 years of vegetation succession (Table 5.1), and may have caused a population increase that started in 1996, and led to the plague of 1998–2001.

Popov (1987) argues that in general, the population dynamics of swarming locusts, particularly the Italian Locust and the Asiatic Migratory Locust, depend on periodic climatic fluctuations, and that the outbreak periods of both species coincide (Figure 5.1). He also indicates that the scale of outbreaks depends on agricultural practices. His study of locust population dynamics in the USSR since 1925 reveals a pattern of a periodic increases and decreases in locust numbers.

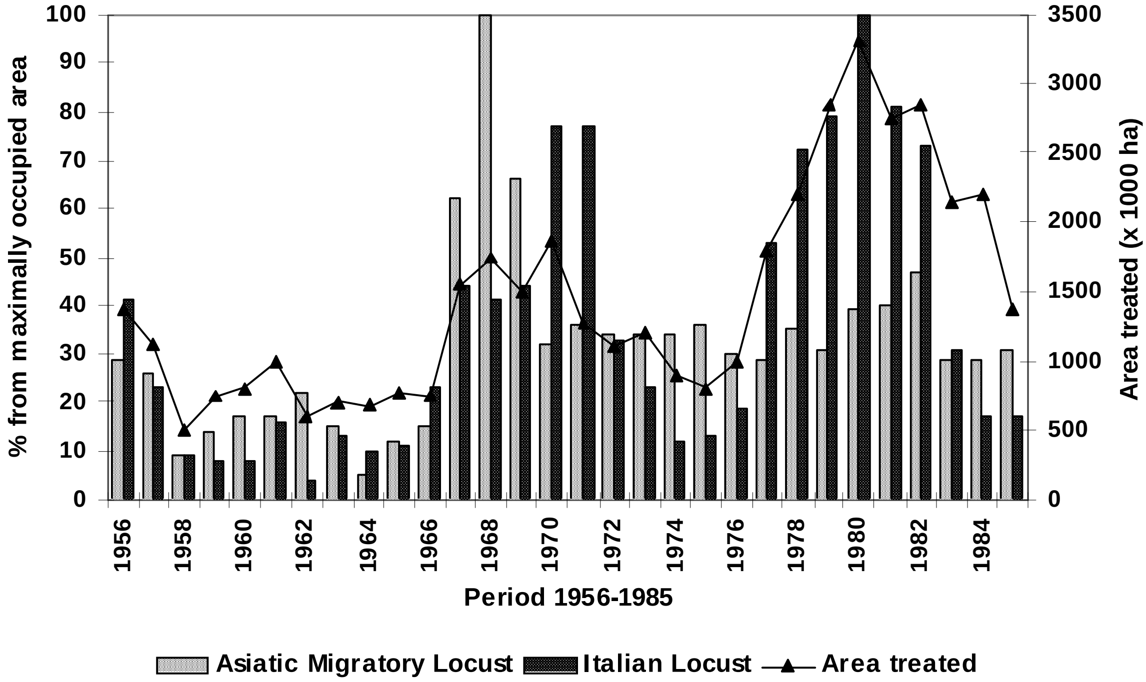


**Figure 5.1 Area (%) occupied by the Asiatic Migratory Locust and the Italian Locust, and area treated (ha) against all species of locusts in the USSR in 1956-1985.**

*Source*: Popov (1987) and Latchininsky et al. (2002).

Figure 5.1 shows that the infested area expanded over the years despite the locust campaigns, which only led to a temporary reduction in locust populations. This illustrates the influence of ecological and climatic factors, and agricultural practices on population fluctuations, but this does not imply that control is useless as it may be effective in protecting standing crops.

## 5.4 Locust knowledge and expertise

### 5.4.1 *Knowledge formation*

The branch of entomology studying grasshoppers and locusts is called Acridology. Its founder was Boris Uvarov (1888–1970), a scientist of Russian origin. After his graduation from Saint-Petersburg University in 1910 he worked as the senior entomologist for the Trans-Caucasian region and southeast Russia, where he set up one of the first entomological bureaus in Russia. In 1920, he emigrated to England and became a senior researcher at The Imperial Bureau of Entomology in London. But his interest in *Orthoptera* fauna of the Soviet Union did not vanish. He continued to keep in touch with colleagues from Russia, and published a number of books in the Russian language *Locusts and Grasshoppers* (Moscow 1925), *Locusts of the European part of the USSR* (Moscow 1925), and *Locusts of Middle Asia* (Tashkent 1927). Uvarov also became involved in research on the Desert Locust (*Schistocerca gregaria* Forsk.) after its plagues in 1929 in Africa and southwest Asia. In 1945, he established the Anti-Locust Research Centre in London, and managed it for 14 years until his retirement, during which time it developed an international reputation. His book *Grasshoppers and Locusts: A handbook of general Acridology* (Volume I 1966, Volume II 1977) became a standard reference book for acridologists worldwide. This book includes details about locust and grasshopper species in the Soviet Union and particularly Kazakhstan.

### 5.4.2 *Knowledge acquisition during the Soviet period*

During the Soviet period the biology, taxonomy, ecology and population dynamics of the locust and grasshopper species were the focus of study by many scientists. One comprehensive study on the Italian Locust coupled with control campaigns was carried out between 1945–1957 in central Kazakhstan by a large team of Soviet researchers and practitioners (Vasil'ev 1962). It monitored population recessions and outbreaks of the Italian Locust over a territory larger in size than Italy and England put together. The study identified the permanent breeding sites of this locust species, thereby contributing to future preventive control strategies.

In 1981, the All-Union Institute for Plant Protection (VIZR) initiated a research programme to develop a complex of effective and environmentally benign methods for locust control aiming at preventing mass breeding. The programme was based on research results obtained by VIZR entomologists, who had spent many years studying the locust species in the Soviet Union, and particularly Kazakhstan. Researchers recognized the drastic changes in the breeding habitats of the Asiatic Migratory Locust and the Italian Locust in Kazakhstan and concluded that this would lead to these locust species growing in significance as agricultural pests. The results of this research programme were published in the book *Locusts: ecology and control methods* (Shumakov 1987), which turned out to be the last comprehensive publication on locusts and grasshoppers in Soviet history.

### 5.4.3 *Knowledge loss after the collapse of the USSR*

In the wake of the collapse of the USSR, the plant protection system in Kazakhstan lost much of the knowledge and experience that had been acquired over many years, including that about locusts. There was little intergenerational conveyance of knowledge, because the older generation of researchers and practitioners retired or passed away, the majority of the mid-generation researchers and practitioners went into the private sector or emigrated, and only a few young people were recruited for public service.

In 1996, the Plant Protection Faculty at the Kazakh State Agrarian University was shut down and the intake of students specialized in plant protection was completely stopped. Previously the faculty annually produced 50–75 graduates specialized in plant protection. As a result the research and applied part of the plant protection domain was left without new recruits and continues to suffering from an alarming scarcity of staff.

The very few locust research projects that were carried out in Kazakhstan after the collapse of the Soviet Union were mainly based on the knowledge accumulated in earlier publications by Soviet authors. With the collapse of the Soviet Union’s academic networks, access to these publications became difficult, for instance, much of the locust literature is only available in libraries in Moscow or Saint-Petersburg. Academic libraries in Kazakhstan have not been acquiring new stock or modernizing, and possess only a limited amount of literature on locusts.

Modern locust information gathering, monitoring and forecasting technologies are all knowledge intensive, which require trained researchers and practitioners, who are currently not readily available in Kazakhstan. Although today there is ready access to international knowledge via the Internet, there is a significant language barrier, as very few researchers master languages other than Kazakh or Russian. Moreover, the differences in climatic and ecological conditions and locust species mean that the international knowledge is not always applicable to Kazakhstan.

It is generally assumed that knowledge increases over time, but as this study shows the production of knowledge in Kazakhstan was severely affected by the collapse of the Soviet system. In the past the science was well developed, and theory and practice were both applied in controlling locust populations, as elaborated in the next section.

## 5.5 State-planned science-based locust management systems

Locust plagues were one of the triggers for the Tsarist Government to set up plant protection units in Central Asia at the end of the 19th century. The first Entomological Station in Central Asia was founded in 1911 in Tashkent. After the Bolshevik revolution in 1917, massive outbreaks of locusts and other agricultural pests in Kazakhstan and other Soviet republics, led the Plant Protection Services to function as entomological units and plant protection bureaus, to secure food provision for the newly established Soviet State. Thus controlling locusts was recognized as a public good since the early days of the Soviet State. In the 1920s teams of Soviet researchers organized scientific expeditions to locust affected areas in Kazakhstan. They observed that outbreaks of the Asiatic Migratory Locust and the Italian Locust, tended to originate from relatively restricted areas with peculiar ecological conditions. This suggested that future plagues might be prevented by closely monitoring these outbreak areas. This would allow swarms to be identified while they were forming, and for them to be destroyed before they migrated to agricultural areas. Thus, from 1934 onwards, special technical organizations known as Anti-Locust Centres were established at Balkhash, Alakol, Syr-Darya and West Kazakhstan, all locust breeding sites. These Anti-Locust Centres were called 'Expeditions' (Tsyplenkov 1970:5), as in early days scientists were expedited to suspect areas. By 1950 there were nine such Centres in Kazakhstan (Figure 5.2): Gur'ev (1), West-Kazakhstan (2), Kostanay (3), Central Kazakhstan (4), Karatal–Alakol (5), Balkhash–Ili (6), Zhambul (7), South-Kazakhstan (8) and Kzyl–Orda (9).


**Figure 5.2 Anti-Locust Centres in Kazakhstan existing in 1950.**
*Source:* Compiled and drawn by authors from archival sources.

From 1960 onwards, the dynamics of locust populations were investigated by the Anti-Locust Centres, the Research Institute for Plant Protection, the Monitoring and Forecasting Service, and the regional Plant Protection Stations, all working together in a unified plant protection system. Scientists and practitioners worked in close collaboration on the anti-locust campaigns; researchers' expertise in biology, ecology and population dynamics of locust was combined with that of practitioners about local conditions, contributing to the success of anti-locust campaigns. The Monitoring and Forecasting Service worked in cooperation with the Research Institute for Plant Protection. Locust control operations in breeding areas were based on data from the annual monitoring and forecasting. Data on locust occurrence in remote areas were obtained from local herders and agro-technicians, trained in monitoring locusts. They informed the district plant protection stations. As one locust researcher said in an interview: '*...in the past, information on locust presence was collected literally from everywhere*'. This implies that information could be cross checked to make an evidence-based assessment of the locust situation for forecasting purposes.

The anti-locust teams consisted of permanent, regularly trained and skilled staff. During anti-locust campaigns they had spraying equipment, insecticides, machinery and aircraft at their disposal. Aerial pesticide application was first developed in the USSR in the 1920s and was applied in combating locusts (Pukhov 1931, Tsyplenkov 1970). In Soviet times, aircraft were available within 24 hours to any hot spot in any former republic of the Soviet Union during anti-locust campaigns.

In the 70 years of Soviet history the state provided a collective response to locust problems, which according to available data seems to have been successful. The collapse of the Soviet Union led to disintegration and abandonment of the locust control system, as illustrated below.

## 5.6 Transition period

A set of articles by influential practitioners and researchers in the domain of plant protection (Kambulin 1997, Khasenov 1999, Migmanov 1997, Sagitov 1997, Temirgaliev 1999, Temreshev 1997, Uakhitov 1999) identified the difficulties faced by the Kazakhstan Plant Protection Service in the 1990s, including the problem with locusts. Despite these expert views, the national agricultural development policy did not give sufficient attention to plant protection and quarantine issues. The government was engaged in a process of decentralization and liberalization, and prioritized reforms in selected sectors of the economy. The Plant Protection Service was abandoned as a state entity. The Central Plant Protection Station of the Ministry of Agriculture, responsible for the plant protection activities, almost stopped functioning as a result of severe budget cuts in 1990s, which led to a significant reduction in employees at both the central and regional level.

The locust plague of 1998–2001 can be traced back to 1996, when locust densities in wheat fields reached 135/m² in north Kazakhstan (Temreshev 1997). The few plant protection practitioners and locust researchers still active repeatedly warned the authorities about the danger of locust outbreaks throughout Kazakhstan (V. E. Kambulin, *personal communication*). In 1997, the Head of the Central Plant Protection Station, advised by regional plant protectionists and locust researchers, wrote to the Ministers of Agriculture and of Finance about the increase of locust populations. He stressed the need to purchase insecticides and spraying equipment, and to recruit the necessary personnel in order to control the incipient outbreaks. However, nobody in the Ministries reacted to those concerns, and it then became too late to stop the outbreaks from developing into a plague. As a result of this inaction, in 2000, the Government of Kazakhstan had to allocate 20,100,000 USD for the anti-locust campaign, which involved spraying 947,000 L of insecticides over an area of 8,100,000 ha (Figure 5.3) (Khasenov 2001). This was the largest and most expensive anti-locust campaign ever carried out in the history of the former Soviet Union.

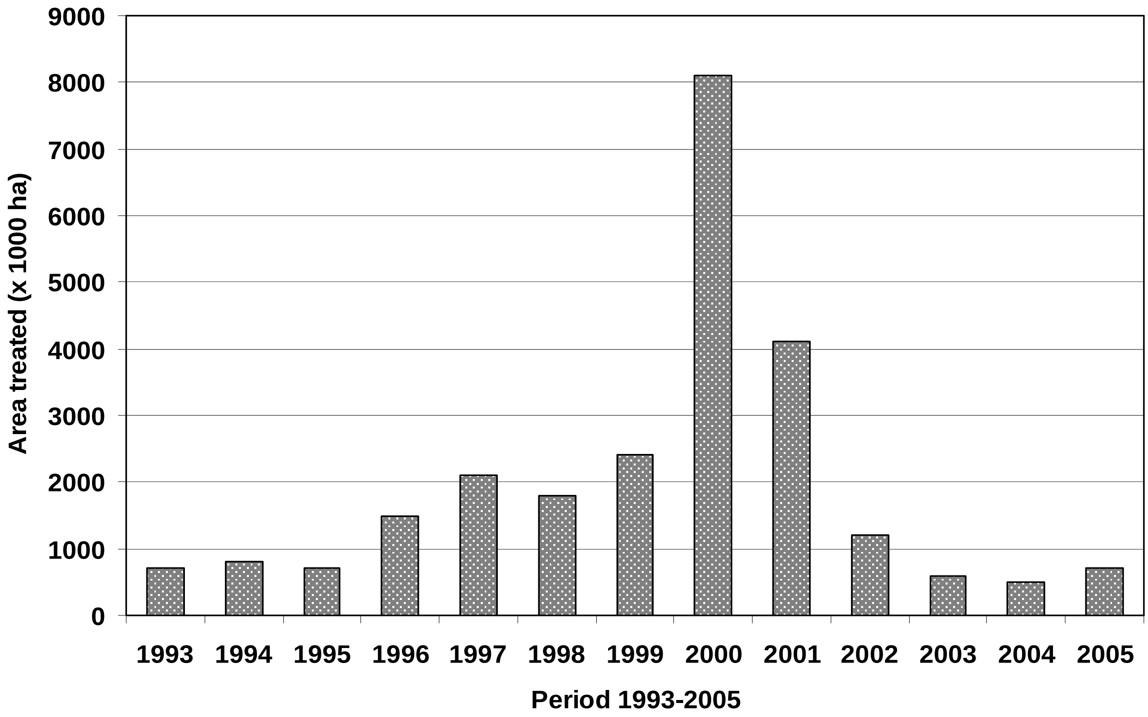


**Figure 5.3 Total area treated against all species of locusts in Kazakhstan from 1993 to 2005.**

*Source:* Compiled by authors from data from the Ministry of Agriculture of Kazakhstan.

The spectacular invasion of the capital by locusts in 1999 made the Minister of Agriculture lose his position, amid jokes about the Minister being gobbled up by locusts. After the large-scale anti-locust campaign conducted in 2000, the newly appointed Minister of Agriculture stated that they did not intend to eliminate locust as a species unless it was necessary, and he stated that they had the experience to do so. Such an assertion, that the problem of locusts could be solved in Kazakhstan was based on the success of the campaign that was temporary and only of local significance. Hundred thousands of litres of insecticides were spilled into the environment to suppress the locust plague. However, it is questionable whether the application of pesticides was a key factor in suppressing this plague. A number of environmental and ecological factors may have been responsible for the population decline: temperature, solar activity, rainfall, the water level in basins of lakes and rivers, the quality and availability of food plants, vegetation succession, soil type and so on (Antonov and Kambulin 1997, Berryman 1987, Kambulin 1992, Toleubayev et al. 2003, White 1976). Uvarov (1977) noted that there is no reason to expect that further organizational advances and technological improvements of locust control measures will, in themselves, provide a solution. However, it appears that decision makers prefer pesticide applications to protect crops from immediate destruction instead of investing in research, which would reveal the underlying ecological causes for locust outbreaks, and incorporating these findings into a locust preventive control strategy.

To effectively contain locust populations the outbreak areas need to be monitored. The discovery, during Soviet times, of outbreak areas of the Italian Locust and the Asiatic Migratory Locust in Kazakhstan showed that it is possible to prevent mass outbreaks. For some other locust species, the detection and destruction of gregarising populations in outbreak areas is the key to effective preventive control (Van Huis 2007). In north America the Rocky Mountain Locust (*Melanopus spretus* Walsh.) became extinct due to the destruction of its very limited breeding and outbreak areas, i.e., riverine habitats (Lockwood and DeBrey 1990). The preventive strategy is still recommended by researchers in Kazakhstan, but its implementation requires considerable resources and long-term commitment from the government. As Uvarov (1977:527) commented:

> ...the records of the preventive organisations show, however, that measures for the repression of incipient multiplication and gregarisation of locusts in their outbreak areas have to be applied very frequently. This means that the level of vigilance of these organisations and their continual operational readiness as well as the annual expenditure that may be needed for control cannot be lowered.

Failure to carry out monitoring and preventive control activities was one of the major causes of the locust plague of 1998–2001. In the process of decentralization and liberalization the government did not recognize that the resulting institutional degradation of the pest-control system would have an impact on the population dynamics of locust species. This recognition only came with the invasion of the capital of Kazakhstan by locusts in 1999.

## 5.7 Post 1998–2001 plague: Reinventing collective action

### 5.7.1 *Locust invasion of capital: A driver of institutional change*

Lin (1989) argues that the institutional changes driven by external forces often require collective action facilitated by the state. In our case, the locust invasion of Astana triggered a process of institutional change in the plant protection system. It led to the locust problem becoming a policy priority. The Government set up an Emergency Locust Control Headquarters in Astana and the Prime Minister personally supervised the locust problem. Locust issues were discussed in numerous government meetings and scientific gatherings. Government authorities, agricultural producers and plant protectionists increasingly collaborated to plan control measures. The invasion also brought about longer term changes. The president ordered the Ministry of Agriculture to develop a *National Programme on Preventive Measures against Plagues and the Spread of Destructive Pests and Diseases of Agricultural Crops* as quickly as possible. Key legislation about plant protection and quarantine was introduced, viz.: the *Law about Plant Quarantine* in 1999 and the *Law about Plant Protection in 2002*. In the latter, the state recognizes its responsibility for controlling migratory, highly harmful and quarantine pests, including the Italian Locust and the Asiatic Migratory Locust.

The policy and regulatory measures led to organizational changes in the plant protection system. The Kazakh case confirms Lin's observation that the processes of institutional change often involves the reconstruction of previously existing structures (Lin 1989). In 1999, the Government of Kazakhstan set up a Committee for Plant Protection in the Ministry of Agriculture, based on the remains of the former Central Plant Protection Station. The Plant Protection Service reacquired the status of a state entity that it lost early in the Transition Period. In 1999, the remains of the technical units of the former Plant Protection Service, including the Anti-Locust Centres, were united under a new state enterprise *Fytosanitaria* to monitor and control locusts. In 2003, a state entity called The Republican Centre for Phytosanitary Monitoring and Forecasting was founded on the remains of the former Monitoring and Forecasting Service.

These legal and organizational changes were supported by a substantial increase in government expenditure on locust control. In contrast to the early transition period, the expenditure for locust control is now included in the annual state budget at the request of the Ministry of Agriculture. For the anti-locust campaign in 2005, the Ministry requested 438,000,000 Kazakhstan Tenge, (approximately 3,300,000 USD) to treat about 700,000 ha of land, mostly occupied by the Italian Locust and the Asiatic Migratory Locust.

According to official statements, the newly established plant protection entities conduct regular locust surveys and treat local outbreaks. However, the interviewees still identify serious problems. Public procurement of goods and services is done on the basis of competitive tendering for which *Article 20*, *Clause 4* of the *Law about Public Purchases* (as of 2002) specifies '*...the customer [in this case, the Ministry of Agriculture] purchases goods, labour or services from the supplier who proposes the lowest price offer*'. This procedure applies to both the purchase of pesticides and the selection of private organizations to carry out the chemical spraying. In short, the government gives priority to price over quality and efficacy: low efficacy and environmental and health risks are generally not taken into account in the tender procedures. In addition, many of those we interviewed said that delays in releasing funds, due to complicated transaction mechanisms, led to failures in conducting timely control operations.

Today, there is still a shortage of funding and resources for a truly effective locust control system. Practitioners have to work with outdated equipment and are short staffed. There is still the need for a special locust unit with sufficient researchers and skilled technicians and readily available financial and technical resources.

### 5.7.2 *Locust as a transboundary pest*

Since locust swarms very often cross national borders, one nation's food security concerns can become that of another. In this sense, locusts can become a political issue, both creating conflicts between countries and also triggering international collective action. The incidents of migration of the Asiatic Migratory Locust and the Italian Locust from breeding habitats located on the territory of Kazakhstan to Russia, Uzbekistan and China, and vice versa illustrate this point. These countries have accused each other of allowing locusts to breed in mass on each others' territories and infesting neighbouring countries. Uvarov (1953:85) stated: '*Locusts recognize no frontiers*', and he added: '*...in many cases, the ability of locust swarms to cross frontiers is more readily admitted when they are entering a country than when they are leaving it for the neighbouring one*'. To solve this problem, these countries have signed a number of intergovernmental agreements. In June 2000, the Ministries of Agriculture of Russia and Kazakhstan signed an agreement on information exchange, monitoring and controlling locusts across frontiers. In August 2000, in Almaty, the representatives of Kazakhstan, Kyrgyzstan, Russia, Tajikistan and Uzbekistan signed a resolution at a round table meeting, organized by the Government of Kazakhstan and FAO. The resolution requested the FAO to study the possible creation of a Regional Locust Commission for Central Asia; comparable to the FAO Regional Commissions established for the Desert Locust. In February 2001, a round table '*Problems of combating locusts in Central Asia*' was organized at the Institute of Strategic Research in Kazakhstan. Participants included representatives of the Ministry of Agriculture, scientists and plant protection practitioners from Kazakhstan, Russia, Uzbekistan and China. In December 2002, Kazakhstan and China signed a number of intergovernmental agreements in Beijing, including one on mutual cooperation over anti-locust activities. In March 2006, the Ministries of Agriculture of Kazakhstan and Uzbekistan signed an agreement on mutual cooperation in controlling locusts along their shared borders. All these actions show the growing importance of the locust problem in the political agenda of the affected countries.

## 5.8 Discussion

This paper has identified several factors that support the thesis that locust control is a public good requiring collective action. Locusts breed and multiply in natural habitats after which they migrate to agricultural areas where they destroy crops during outbreaks and plagues. Agricultural producers are not able to control locusts outside their private plots. This is why many countries treat the control of migratory and highly destructive pests as a public service, comparable with emergency services such as the fire-brigade and the police. When faced with disasters or a common enemy, nations and international organizations, e.g., UN and NATO, often respond with collective action (Sandler 1992). International undertakings to control the Desert Locust exemplify the need for collective action: FAO Regional Commissions have been established in locust affected countries in Africa, the Middle East and southwest Asia. In addition, locusts induce international collective action when they cross interstate boundaries, leading states to develop institutions and rules to control this transboundary movement.

What can we learn from the history of locust control in the Soviet Union? The impact of Soviet technoscience is multifaceted. The literature documents periods of scientific stagnation, bureaucracy and the subsumption of the organization and content of science to political and ideological motives, exemplified by Lysenko's command of the Soviet Academy of Agricultural Sciences (Medvedev 1969). Furthermore, the impact of the virgin land campaign and the expansion of irrigated areas, i.e., typical high-modernist projects, had unforeseen consequences on the amount of land suitable on which locusts could breed.

However, the seventy years of Soviet history also show a collective response to the locust problem. An intensive knowledge system was coupled with an extensive monitoring and control system, which seems to have kept locust populations at manageable levels. Locust damage was largely prevented through substantial scientific research on population dynamics, considerable expenditure on control operations and the establishment of an extended network in which monitoring agencies, local practitioners and scientists collaborated to generate operational knowledge that led to an effective control strategy. Above, efforts were made to develop an ecological perspective on locusts and their control. Knowledge building, concerted action, habitat management, understanding ecological relationships and long-term analysis and planning were key features of these efforts. This does not mean that the system was in equilibrium. It changed continuously and there was a high level of model uncertainty (Peterson et al. 1997), i.e., many of the connections between forms of land use, climate, locust population developments, locust control measures and so on were uncertain. But for quite some time there was a substantial capacity for learning and adapting control strategies to ecosystem dynamics, which made the locust control system quite resilient (Walker et al. 2002).

However, this locust control system could not cope with a fundamental uncertainty (Peterson et al. 1997), i.e., its dependence upon an unstable political system. The transformation of the political system led to a new social-technical configuration, which gave very low priority to locust control and changes in the agro-ecosystem. This created more favourable conditions for the development of a locust plague in a less desired state of ecosystem services (Folke et al. 2004). This new political configuration, which swept away concern for delivering many public goods, including pest control, led to a new dilemma over collective action. The official hostility to public action and the glorification of individualist, profit-driven and market-oriented change during the Transition Period, contributed to the breaking up of the organizations and knowledge structures in the field of plant protection. The knowledge and capability to control locusts quickly disintegrated in Kazakhstan after the collapse of the Soviet Union and plant protection was left to individual farmers. However, it was not in their individual interest, and beyond their capacity, to invest in monitoring and controlling locusts. This resulted in a many more farmers being affected by the subsequent locust plague. In shifting to a market economy, the government did not recognize the dramatic impact that institutional collapse would have on the monitoring and control of locust populations.

The locust plague of 1998–2001 led to a reinvention of collective action. Once the locusts invaded the capital top-level decision makers started to realize that the dismantling and privatization of the plant protection service had unforeseen consequences. They became aware that locust control requires state intervention and some remnants of the Soviet knowledge structure were reinstated. Former chiefs of the regional Plant Protection Stations and influential scientists in the plant protection domain used this opportunity to revive the Plant Protection Service. Their work on locust control regained legitimacy, as did public expenditure to support it. The crisis also had other political repercussions (Hargrave and Van de Ven 2006). The reinstatement of some elements of the former locust control system raises the question of the extent to which this recent form of collective action builds on past forms and the extent to which it differs.

The rebuilt Plant Protection System has to operate with far fewer people than before and has to work with market actors, i.e., suppliers of pesticides and spraying services. However, from an ecosystems perspective there are other more fundamental differences. The latest policies tend to assume that the currently available stock of technology, basically pesticide applications, is sufficient to control locust plagues. Decision-makers even express the belief that it is possible to eradicate the locust, i.e., that total control of nature is possible. Past efforts to construct a more ecological view and to build knowledge and knowledge networks for understanding relationships between climatic variability, land use changes and locust population dynamics have not yet been taken up again. Furthermore, recent policy measures seem to be mainly incident driven and largely take a short-term perspective. If we consider ecosystem and locust population dynamics as a slow variables (Holling 2004) the collapse of the Soviet Union has made sustaining these variables more difficult. This is a major transformation in the sense of Holling (2004) since the interaction between structure and processes have become qualitatively different. The long time frame for responding to locusts, which was previously institutionalized in the long-term funding of plant protection services and knowledge building, career perspectives for scientists and the organization of a multi-agency monitoring network, has been not been re-established. The most recent transformations have, in fact, institutionalized the short time frame perspective that emerged in the Transition Period.

The reinvention of collective action cannot be seen as a pendulum effect between state provision of a public good and market-oriented approaches. Further development of collective action on locust control cannot lead to return to the previous social-technical system. We can learn from studying past collective action and use this to develop a critique of the present form of locust management, but it is not possible to derive a programme of adaptive management from it. This would require what Holling (2004) has identified as a third mode of learning, which refers to new forms of organization that transform the system by developing truly novel strategies and processes.

It also follows from our discussion of knowledge about locusts that locust control requires collective action at a higher level than the local level of, for example, farmer fields or single watersheds. National and even transboundary forms of management have to be established. There is little indication that independent civil society groups with an interest in locust control will emerge in Kazakhstan in the near future. Service companies have been formed that carry out the pesticide spraying at the regional level but, given their objective of trading in pesticides and spraying services, it is unlikely that these will soon convert into advocates for a sustainable, long-term and ecosystems perspective on locust control. Although local level participation may be crucial, as in the past when herders were part of the locust monitoring network. These participatory approaches to local level ecosystem management (Walker et al. 2002) and the current market-driven, short-term thinking about locust control in Kazakhstan are inadequate for developing a framework for rebuilding adaptive management of ecological services at a higher level and with a long-term perspective.

## 5.9 Conclusions

The comparison of the anti-locust campaign in 2000 in Kazakhstan under the neoliberal system, the largest ever undertaken, with the history of 70 years of centrally planned locust control history of the former USSR reveals the problematic impact of the transition upon ecological knowledge and sustainable locust control. Simplified representations of an inherently non-ecological and non-functioning Soviet system (Busch 2000, Scott 1998) need to be modified. Clearly, the large-scale land use changes resulting from high-modernist projects created favourable conditions for locusts. However, the Soviet system was also one that regarded locust control as a public good, built ecological knowledge and mobilized financial, technical and intellectual resources for monitoring and control. This system was better able to deal with locust problems than individualistic, purely market-led control based on the idea that an existing, single technology as pesticides can eradicate locusts.

Outbreaks of the Asiatic Migratory Locust and the Italian Locust periodically occur in Kazakhstan. It is only a matter of time before the country may face a locust plague similar to the 1998–2001 plague. This would test whether the recently reinvented collective action, organized around incidents and based solely around pesticides spraying, will provide effective control or whether collective action should be extended and reinstate important lessons from the past, regarding substantial knowledge building and concerted action based on a long-term perspective. We conclude that we cannot expect an effective and ecologically sustainable form of locust control either through market-mechanisms or local level ecosystem management through participatory methods with farmers and other local stakeholders. This has consequences for theory on collective action in agricultural development. Public goods such as locust control need a higher level organization for their delivery. Dissatisfaction with centralized, bureaucratic state command-and-control or market-driven organizational forms for delivering such public goods should not lower the level of action to individual actors or very local institutions. We argue that it would be more productive to discuss how higher level social-technical governance systems can be reshaped so that they are able to interact with and respond to the complexities and uncertainties within large-scale agro-ecosystems.

*Chapter 6*

# Conclusions: Back to the future in pest control for Kazakhstan

## 6.1 Introduction

In Kazakhstan a major shift in the political-economic-social contexts occurred after the fall of the Soviet Union in 1991, and this brought about a drastic change in pest management practices. While during the Soviet time ecological sustainable methods were pursued, the focus after the collapse of the Soviet system is almost exclusively on chemical pest-control practices. The aim of the thesis was to study why this happened. For that reason this thesis analysed the developments in the plant protection domain in Kazakhstan covering a period of about 90 years (1917-2007).

Crops are attacked by a number of pest organisms. Whether, when and how to control them has always been a concern for agricultural producers. With the appearance of organosynthetic insecticides in the early 1940s, a dramatic change occurred in pest control worldwide. Insecticides, because of their convenience and initial effectiveness, quickly became standard practice for pest control. Insecticides were used indiscriminately and injudiciously from the late 1940s through the mid-1960s. This over-reliance soon led to many significant problems such as pest resistance, environmental pollution and occupational hazards. Apart from these, pesticide residues have been discovered in the food chain that eventually affected health of people and animals. Additionally, density of natural enemy (predator and parasitoid) populations declined, leading to resurgence of primary pests and secondary outbreaks of pests. This was countered by using more pesticides in ever-increasing dosages, causing the (so-called) ‘pesticide treadmill’ in which the cost of chemical control became prohibitively expensive. It became apparent that another approach was needed. As a result, an integrated pest management (IPM) approach emerged in which biological and other means (agronomic, physical, resistant crop varieties, etc.) for pest control were combined to reduce pesticide use. Economic thresholds were established in order to determine when chemical control should be utilized to prevent pests from reaching the economic injury level. The Soviet Union, including Kazakhstan, adhered to this IPM approach throughout the 1970s and 1980s. Extensive research on natural enemy/pest biology, ecology, population dynamics and alternative management strategies received a lot of emphasis. Within this IPM framework, pesticides were only used as a last resort, and dosage and negative side effects were carefully monitored.

However, with the collapse of the Soviet system, the ecologically sustainable pest-control approaches were abandoned and a pesticide-centred perspective became dominant in Kazakhstan after 1991. Was this shift a consequence of the post-1991 transition to a neoliberal market economy? This chapter integrates the main findings and arguments from the preceding chapters in order to answer this question.

## 6.2 Change in socio-economic organization

Transition to a free market economy is generally supported by prescriptions to liberalize, privatize and deregulate, and by the idea that everybody will have an equal chance to prosper. After the fall of the Soviet Union in 1991, Kazakhstan embraced neoliberal reforms and abandoned the state-centred planned economy. Prices were liberalized, state assets were privatized and the economy was deregulated.

As a result, significant changes have occurred in the socio-economic organization of the rural sector. While Soviet era policies made the collective farm an economic production unit and a socio-political institution, post-1991 neoliberal policies aimed at the creation of private and independent individual farmers. By 2006, out of 2,500 sovkhozes and kolkhozes, more than 170,000 private farms had emerged (most of these farms were for subsistence rather than for commercial farming). However, the privatization and fragmentation of collective farms did not solve the supposed inefficiency of collective farming, as assumed by neoliberal advisers. This thesis has illustrated that collective farming was not the main cause of the inefficiency of Soviet agriculture, but rather shortcomings of the distribution system (storage, transportation, processing and marketing). The relatively high share of agriculture in the GDP (Gross Domestic Product) in Kazakhstan declined four times (from 34% in 1990 to 8.7% in 2001). The irony is that, after fragmentation of the farming sector through neoliberal reforms, the government of Kazakhstan has recently begun to intervene once again in the rural economy, and is urging fragmented farmers to farm collectively and merge their properties into larger entities in order to deal jointly with farming technicalities, input issues and marketing problems, and thus to contribute more to national food security.

During the first decade of the transition period (1992-2002) most of the production and social infrastructures of the Soviet collective farms deteriorated (resulting in the decay of resources built up over several decades in the Soviet era). Much of the physical infrastructures was dismantled and sold off as second-hand construction materials. Similarly, the infrastructural and other facilities of the agricultural research and extension service deteriorated during the transition period, including those designated for pest control, because of severe budget cuts. Subsequently, most of the surviving research and social infrastructure from the former academic villages was privatized. The plant protection stations and their biological and toxicological laboratories were shut down. The buildings that hosted these stations were privatized, primarily to be used for other purposes.

Narratives from the interviewees contributing to this study contradict the situation anticipated by neoliberal advisers, especially the notion that everyone would have an equal chance to prosper with the transition to a free market. But to the contrary, people in Kazakhstan after 1991 have found themselves in an environment of 'wild capitalism' (a chaotic economic situation) in which they have experienced devaluation of life savings, prolonged uncertainty, insecurity, social differentiation, a decline in their purchasing power and 'accumulation by dispossession' (the possibility of appropriation through the robbing of people's rights and resources). At the same time, people have become aware that the state is not a reliable source of support in the era of market relationships. For this reason, interviewees sampled in this study characterized the post-Soviet changes with strong words, such as neglect, stagnation, devastation, decline, chaos, breakdown and/or disintegration.

Hence, asking interviewees to reconstruct the previously existing socio-economic formation invoked nostalgia among the people who used to live and work under the Soviet system. Interviewees of this study were nostalgic not only about a relatively prosperous livelihood and welfare state but also about what they regarded as positive aspects of the labour process (division of labour, organization of work and the means of production), training and career opportunities and knowledge structure during Soviet era. This thesis has exemplified this set of perceptions through the study of the plant protection domain where specialists were trained, careers were made and sophisticated infrastructures (bio-laboratories with technological lines for rearing beneficial arthropods and producing bio-pesticides) and knowledge networks were built, conducive to development, promotion and use of an effective system of integrated pest management. A paradox which the thesis has attempted to grasp is that 'nostalgia' for the Soviet past is in this case also a solidly founded regret for a system of pest control that actually worked, and from which Kazakhstan could once again benefit, if the scientific system supporting it could be reconstituted. Several stories are told about post-Soviet chaos (Nazpary 2002), and this thesis has likewise added its quota to such accounts. But it has also asked 'what was lost'?

## 6.3 Change in the technological approach and pest-control perspectives

It is often assumed that progressive technological changes precedes and underpins positive socio-economic changes. The Kazakhstan case has illustrated a regressive technological change. The post-1991 socio-economic changes in the agrarian sector transformed the large-scale, highly mechanized and knowledge-intensive farming (using IPM) into a mainly small-scale and simplified farming technological system. The number of tractors used in the farming sector in Kazakhstan dropped by 80%, from more than 240,000 in 1990 to less than 45,000 in 2005. A common practice of using technological maps in the centralized crop production system that incorporated crop rotation, fertilization, irrigation and pest-control schemes was abandoned. Farmers after the break-up of the collective farming were disorganized and challenged to deal individually with a wide range of farming technicalities such as soil cultivation, seed selection, crop husbandry practices, soil fertility, irrigation and pest control. The farmers with professional farming knowledge and skills and with advantageous socio-economic, political and knowledge networks from the Soviet past had the best chances for the economic survival in the harsh market environment.

The collapse of collective farming and the unified plant protection system that went with it had a problematic impact on pest-control practices after 1991 and brought about a crisis in the IPM perspective. Before 1991 IPM was an essential part of the crop production system in Kazakhstan. This approach incorporated biological control technologies, monitoring and forecasting, and agronomic and other means to control pests and reduce pesticide use. Before 1991 up to 400,000 ha of cropping area in Kazakhstan, and more than 33,000,000 ha in the USSR as a whole, were protected against pests through biological means. This is an extraordinary fact that ought to be better known among 'western' conservationists and advocates of 'sustainable agriculture'. This effort required a high level of organization and coordination of pest-control activities both at collective farm level and higher.

Morse and Buhler (1997) argue that IPM is an ideal approach to crop protection but that it is not easily achieved in reality. This scepticism is based on awareness by these authors that IPM is a knowledge-intensive approach requiring a strong research base, extension network, highly qualified specialists and significant investments for its development, promotion and use. This thesis has demonstrated that this knowledge-intensiveness of IPM approach was characteristic of a more generally knowledge-intensive character of Soviet collectivized farming system. In those areas where it was widely implemented, IPM was backed up by an extensive research and plant protection service. The state-facilitated, science-based organization of plant protection activities made IPM work, and provided a concerted response to pest problems. Collective responses to pest problems were embedded in the centralized structure of the Soviet system. This was pragmatic, in the sense that the IPM approach was given priority over chemical control perspective, thus reducing negative health and environmental effects.

After the disintegration of the USSR the pesticide industry colonised the vacant agricultural input markets of the newly established independent states. The annual imports of pesticides into Kazakhstan increased from about 2,000 tonnes in 1999 to 17,000 tonnes in 2006. This only takes into account those chemicals imported and sold through official channels; the volume of pesticides smuggled into the country is not known while illegal outlets can be found in many towns. But point of particular concern is that the industry was able quickly to fill in the institutional gap in knowledge and infrastructure for pest control. The numerous fragmented farmers did not have a chance to pursue an IPM approach because the organizations that could have delivered the inputs (biocontrol agents) and the necessary knowledge (research and extension) were severely handicapped or had disappeared. The pesticide industry had the necessary know-how, funds and infrastructure to deliver its products to farmers. Its prime interest was to sell its products and not to provide the knowledge that would minimize the use of pesticides. Pesticide company representatives distribute colourful leaflets and posters and present easily understandable and rapidly implementable solutions to pest problems. Farmers literally follow the prescriptions provided. Moreover, farmers blindly use readily available pesticides, being afraid of losing cultivated crops and risking to become a bankrupt. Consequently, the pesticide use perspective has become dominant in the pest-control practices of individualized farmers in Kazakhstan after 1991.

## 6.4 Change in knowledge generation and ecological consequences

A sound scientific research base is necessary prerequisite for knowledge and technologies to proliferate. In the transition period, the research base in Kazakhstan has been severely eroded. Low salaries, deteriorating research facilities and lack of perspective in the public research institutes have made the recruitment of young researchers difficult. Many researchers have emigrated or left the scientific domain in search of better paid jobs in the private sector. The number of researchers in all research domains in Kazakhstan dropped more than 70%, from 31,250 in 1990 to 9,000 in 2000. Public science became an under-financed sector because of deliberate policy reforms and/or severe budget cuts. Expenditures for R&D (research and development) from GDP declined from 0.80% in 1991 to 0.18% in 1999. As a result, agrarian knowledge generation and technological development became ‘endangered species’ in contemporary Kazakhstan.

The government has recognised that loss of scientific and technological capacity is an important problem associated with post-1991 transition. Various S&T (science and technology) policies and R&D models have been tried out to ‘fill the gap’. Under one ‘model’ ministerial authorities in charge of managing the public research institutes have more or less forced researchers to commercialize their research outputs and market them to end-users in order to become financially self-supporting. In the pest-control field this had the effect of pushing public plant protection researchers to accept incentives provided by the pesticide industry in order to cope with periods of economic instability. The pesticide industry was able to make use of this situation and took over the human capital needed for a more rational IPM approach. As a result, plant protection research has become commercially-oriented through pesticide testing and promotion. In this way, plant protection research carried out according to ecologically sound principles on highly destructive pest organisms threatening national food security has diminished, and the development of sustainable pest-control approaches is now severely neglected. The thesis has demonstrated that the public good characteristics of the plant protection research have been replaced by market orientation and commoditization. The demand for immediate outputs in research has led to a policy culture dominated by short-term thinking, and the negative effect of this short-termism can be immediately seen in areas such as control of highly destructive migratory pests such as locusts.

This thesis has identified that the financial and ideological reasons for dismantling the existing pest-control system and knowledge structure did not recognize the potential impact of policy-induced changes on agro-ecological conditions, control practices and locust development. ‘Proof’ of this argument can be seen in the fact that an extremely harmful locust plague developed by the end of the 1990s in Kazakhstan. When locusts arrived in agricultural fields they had already reached plague proportions and it was beyond the capacity of individual farmers to deal with them. This resulted in a many more farmers being affected by the subsequent locust plague than might otherwise have been the case. This case (explored in Chapter 5) has shown the extent to which locust control depends on collective action and intervention at the level of the state (see Chapter 5). The thesis has shown that before 1991 a complex and dynamic system of locust management was developed. Knowledge building, concerted action, habitat management, understanding ecological relationships and long-term analysis and planning were key features of this system. Chapter 5 also revealed the extent to which market-driven mechanisms are inadequate to solve locust problems. The management of locusts cannot be handled by individual farmers, because control requires knowledge spread over vast territories concerning their biology, ecology, and population dynamics, resulting in effective control strategies that require to be implemented at both national and international levels. A problem now is how to recapture the initiative on a large enough scale to deal with the problem.

## 6.5 Governing pests – the future

This thesis has argued that pest control, as a strategically important sector of knowledge, requires a direct involvement of state institutions. This is not an easy or popular argument to make in a former Soviet country, where neoliberal enthusiasts assume that everything associated with the old state system must, by definition, have been bad. A new state order established in Kazakhstan after 1991 broke up the organizations and knowledge structures that had previously developed and promoted ecologically sustainable pest-control approaches. The farming sector also underwent significant socio-economic changes, resulting in the break up of the old collective farms and resulting in a highly fragmented agrarian sector. The damage that then resulted has been documented in this study. A question that remains is ‘what now is to be done’? Can elements of a positive legacy of ecological thinking associated with science under the Soviet system (Weiner 1988) be recovered and put back to work?

Under the current situation in farming sector, with fragmented and resource-poor farmers, implementation of IPM/ecology-based protection of crops will only be possible if it receives relevant institutional support (information, knowledge, training and facilitation). The experience with IPM, globally, is that it requires farmers to learn about their agro-ecosystems (e.g. via the farmer field school systems fostered by FAO), because ecological pest control is often counter intuitive at two levels. The first is that plants can tolerate quite some defoliation by herbivores before yields are affected. The second is that pesticides create pests because natural enemies are destroyed. Very often natural enemies are not recognized and showing their existence and actions serves as an eye-opener to farmers. This may help farmers to understand agro-ecosystems better, and thus lead them towards use of this knowledge in pest management strategies that are less reliant on pesticides. This focus-shifting from an exclusive pesticide perspective is a major challenge in Kazakhstan, considering the current ways in which policymakers think about pest-control issues at the farm, research, extension levels. Perhaps some exposure of policymakers to IPM initiatives in other countries using (for example) the farmer field school approach would be a useful starting point for changing attitudes.

At policymaking level the state has fulfilled the mission it defined, for itself, i.e. to facilitate the transition to a free market economy. Consequently, the state distanced itself from providing public goods in strategically important domains of research and practice, in particular the pest-control sector. After 1991 the state no longer supported development, promotion and use of ecologically sound and environmentally benign pest-control approaches and testing of pesticide residues in farm produce. A vacuum was created, with ample opportunity for the pesticide industry to influence the plant protection research agenda and to gear pest-control practices to an exclusive focus on pesticides, despite the manifest unsuitability of such approaches to major problems, such as locust control, facing Kazakhstan. There is probably now need to curtail this pesticide approach through emphasis on regulatory environments, e.g. legislation restricting pesticide imports and tight control of pesticide retailing and use. Also strict and enforced sanitary requirements on pesticide residues in farm produce (especially when driven by customer and consumer concerns) may help invoke more judicious use of pesticides, and make farmers look for alternative pest-control methods. Currently the public plant protection domain lacks the necessary resources to address the demands and opportunities of fragmented farmers and to develop and promote ecology/IPM-based pest-control approaches for a large mass of independent small holders. Bottom up approaches (as attempted in many developing countries) are still weak because farmers, largely, are not well enough organized to express their need for support.

This thesis has pointed to an urgent need to rethink and rebuild the role of the government in pest-control issues. Without stronger policy – less afraid to embrace positive aspects of the former Soviet pest-control system, highly destructive pest organisms will keep threatening national food security, and indiscriminate and injudicious pesticide use will continue to pose considerable hazards for human health and environment. It has been shown that plant protection is more than just getting rid of pest organisms at the farm level. Pest-control issues are deeply embedded in political-economic-social contexts via which the development and use of ecologically sustainable approaches and collective action for pest control can be either promoted or hindered. The government of Kazakhstan has a key function in supporting this long-term endeavour and creating conducive conditions for this to happen, as this will ultimately contribute to a more sustainable system of agricultural production and thus benefit society as a whole.

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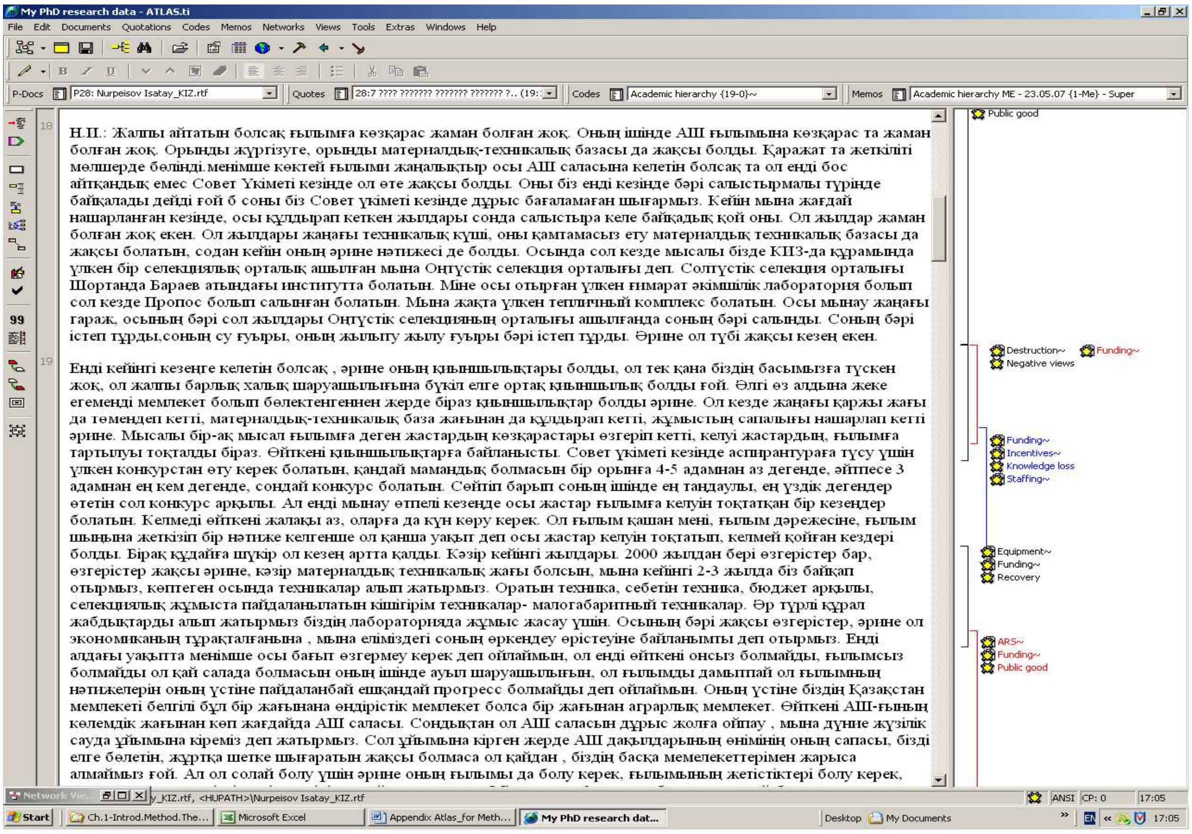
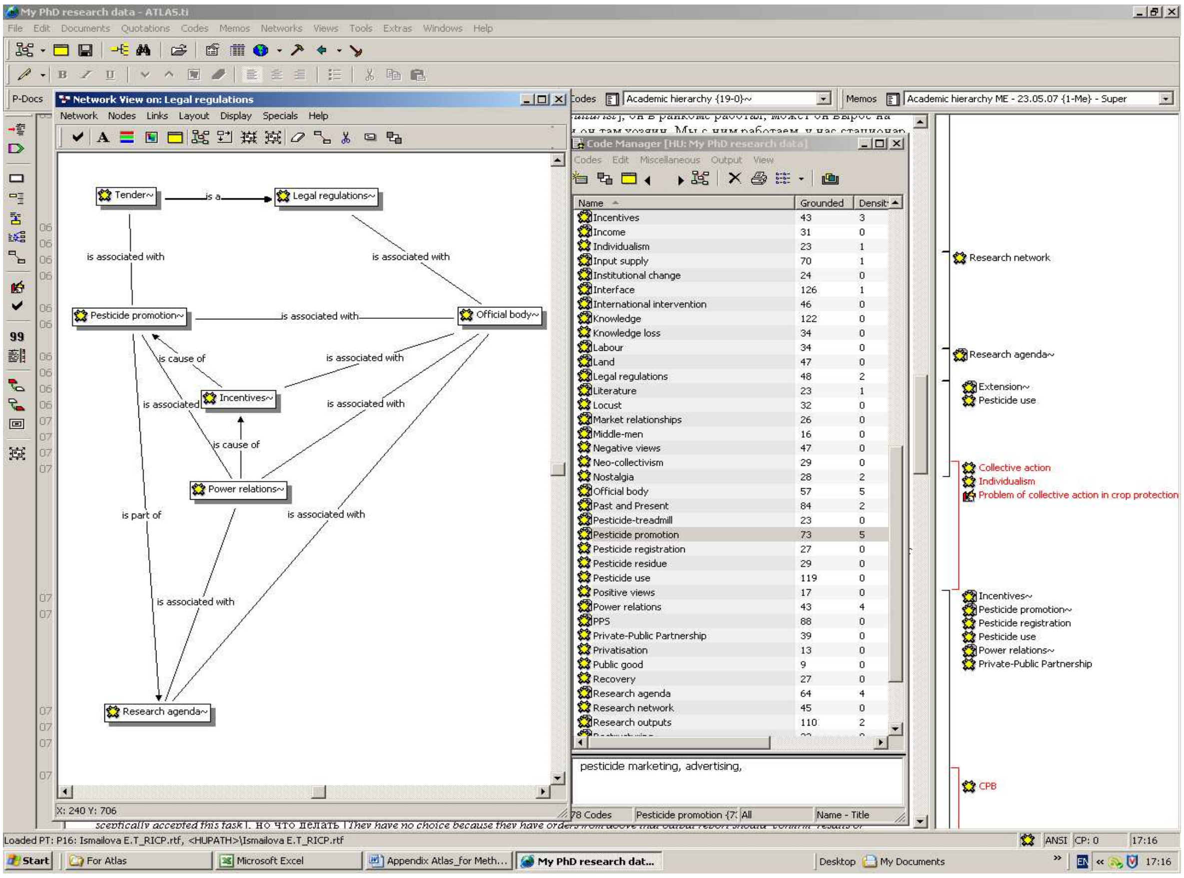
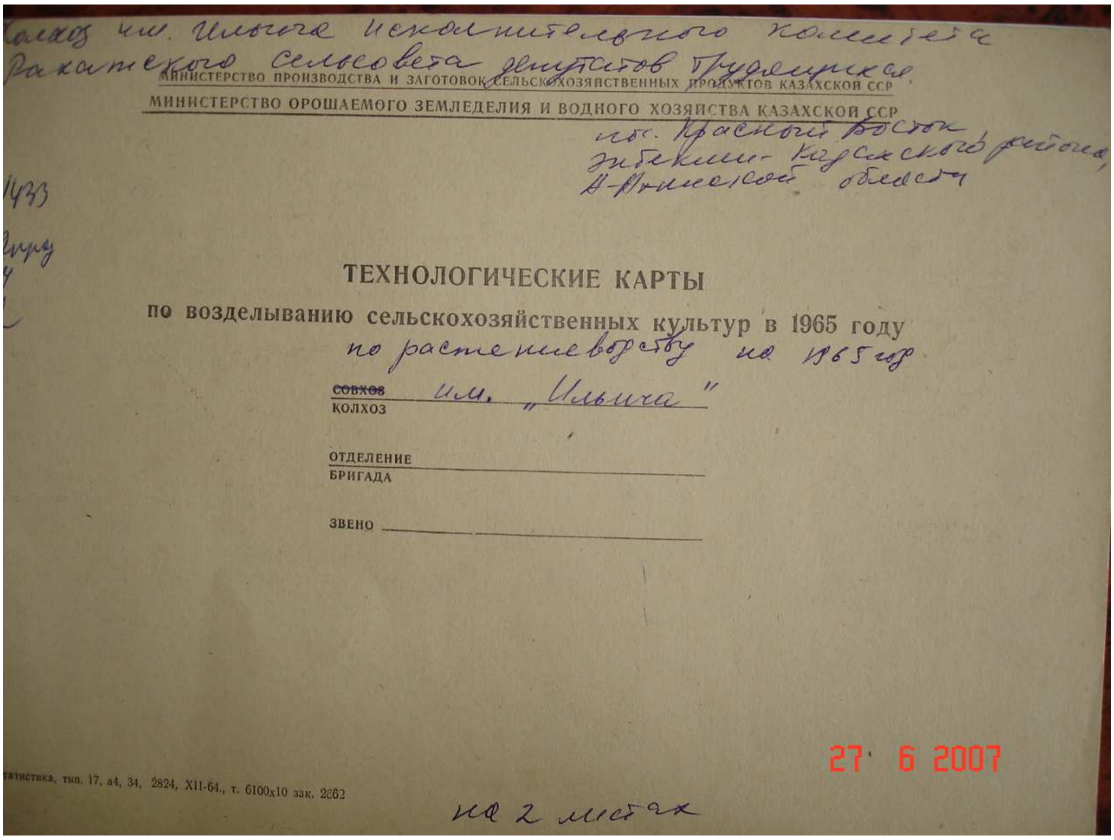
# Appendix 1.1

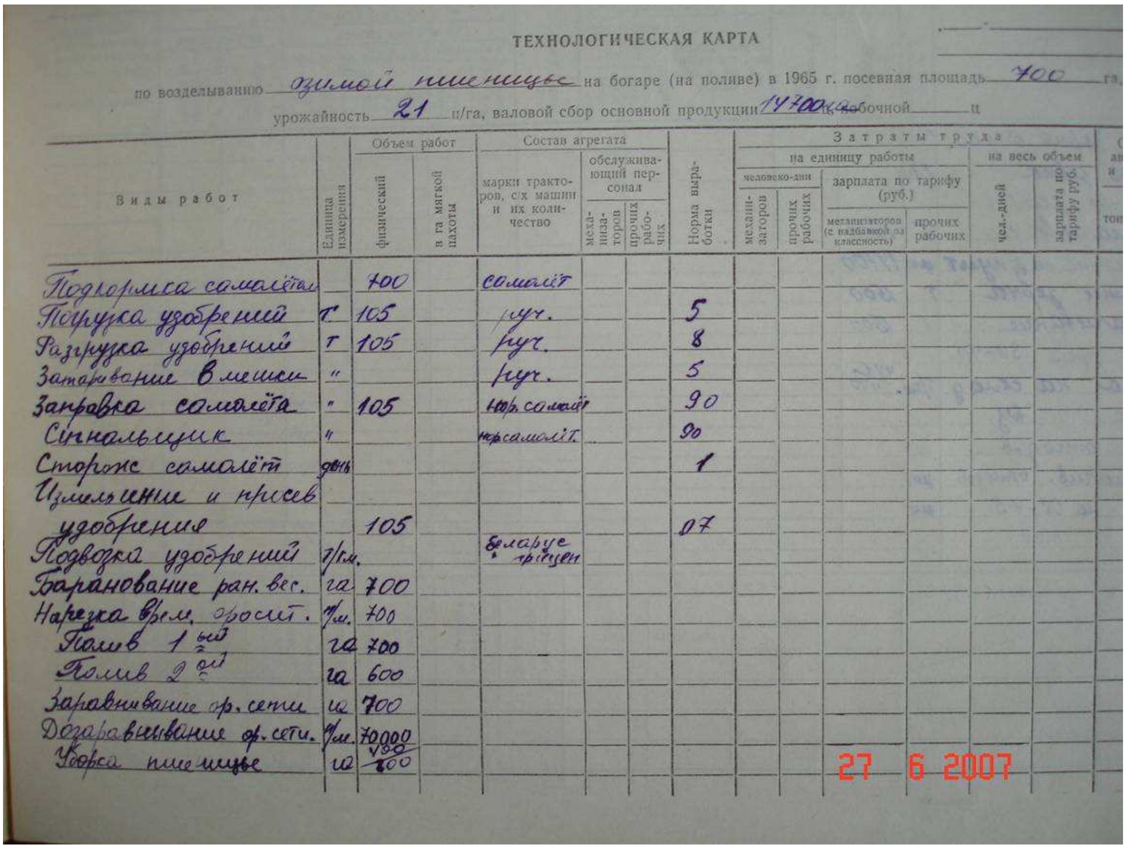



Activated windows of computer software Atlas.ti 5 for qualitative data analysis.

# Appendix 2.1




| Виды работ | Единица измерения | Объем работ: физический | Объем работ: в га мягкой пахоты | Состав агрегата: марки тракторов, с/х машин и их количество | обслуживающий персонал: механизаторов | обслуживающий персонал: прочих рабочих | Норма выработки | Затраты труда |
|---|---|---|---|---|---|---|---|---|
| Подкормка самолётом | | 700 | | самолёт | | | | |
| Погрузка удобрений | т | 105 | | руч. | | | 5 | |
| Разгрузка удобрений | т | 105 | | руч. | | | 8 | |
| Затаривание в мешки | " | | | руч. | | | 5 | |
| Заправка самолёта | " | 105 | | 100% самолёт | | | 90 | |
| Сигнальщик | " | | | на самолёт | | | 90 | |
| Сторож самолёт | день | | | | | | 1 | |
| Измельчение и присев удобрения | | 105 | | | | | 07 | |
| Подвозка удобрений | т/км. | | | Беларусь прицеп | | | | |
| Боронование ран. вес. | га | 700 | | | | | | |
| Нарезка врем. орос. | п/км. | 700 | | | | | | |
| Полив 1-ый | га | 700 | | | | | | |
| Полив 2-ой | га | 600 | | | | | | |
| Заравнивание ор. сети | га | 700 | | | | | | |
| Дозаравнивание ор. сети | п/км. | 70000 | | | | | | |
| Уборка пшеницы | га | 700/600 | | | | | | |

Technological map of kolkhoz named after Lenin composed for cropping season in 1965. (Archive of Almaty oblast, retrieved by author in June 27, 2007)

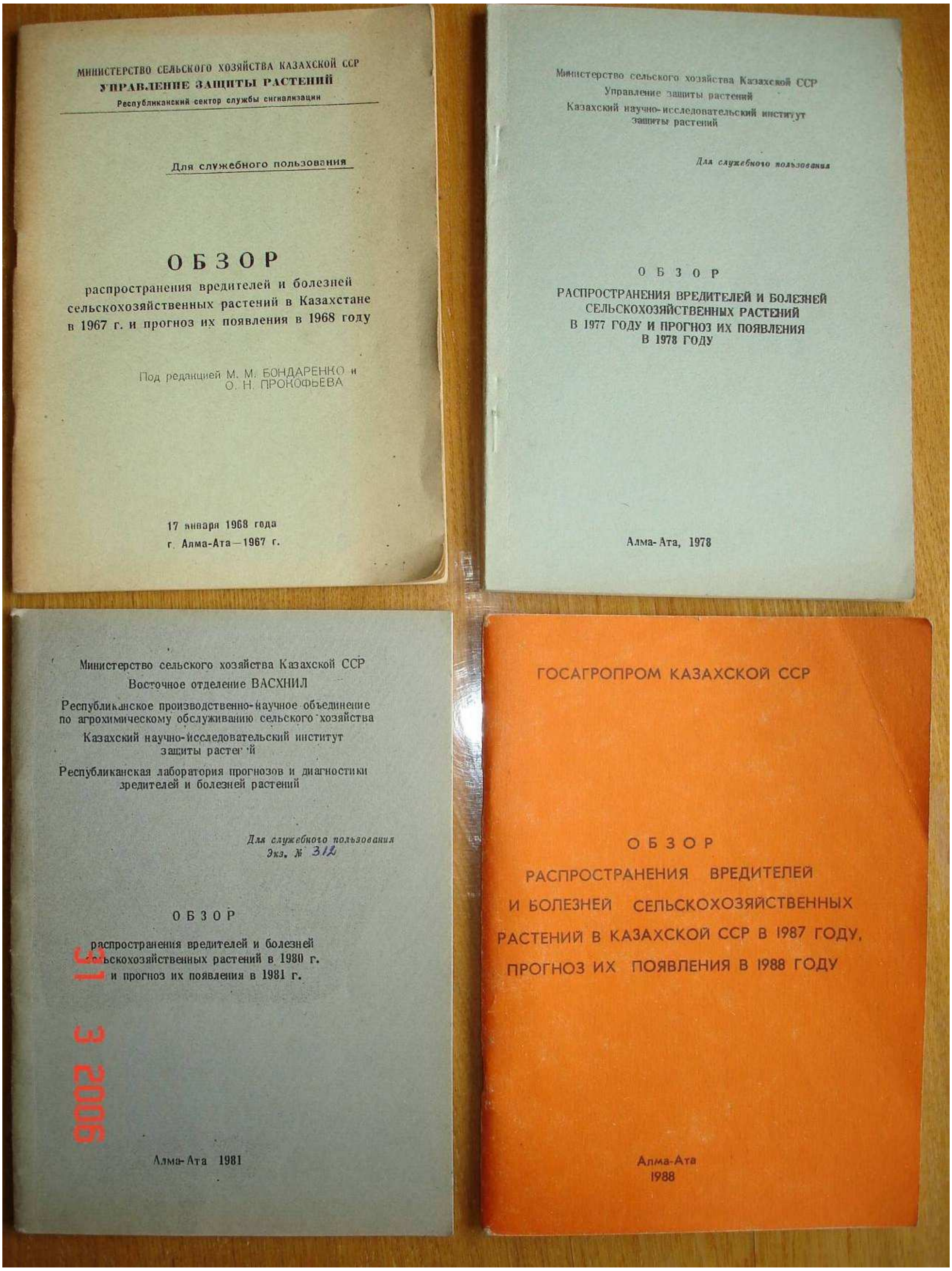
## Appendix 2.2

Dismantled two-storey kindergarten in the village 'Bokenshi', Semey region, northeast Kazakhstan. Dismantled parts were sold as second-hand construction material (photo by author June 05/06/2006).

## Appendix 2.3


Dismantled irrigation facilities of the former sovkhoz '60 Years of October', Semey region, northeast Kazakhstan (photo by author 05/06/2006). Dismantled parts were sold.

## Appendix 3.1




Annual reviews (1967, 1978, 1981 and 1988) of distribution of pest organisms in the Kazakh SSR and forecast for next year (photo made by author 31/03/2006).

## Appendix 3.2


Neglected and partly dismantled building of the former district Plant Protection Station in Esik town. (Enbekshi-Kazakh raion, Almaty oblast. Photo made by author 30/05/2006)

# Appendix 3.3



Chemicals of unknown nature in bags (with Chinese characters on them) sold as insecticides at village market. Bags of these apparently poisonous chemicals (with very bad smell, *personal experience*) lay next to bags with food spices such as black paper and bay leaves. According to the seller, she stores all items pictured on the table in one box at the end of the day (photos made by author 24/08/2005).

## Appendix 4.1



The Soviet time research equipment at the Kazakh Research Institute for Plant Protection (photos made by author 13/03/2006).

# Acronyms

| | |
|---|---|
| IPM | Integrated Pest Management |
| IPP | Integrated Plant Protection |
| Kazakh SSR | Kazakh Soviet Socialist Republic (equally used as Kazakhstan) |
| KRIPP | Kazakh Research Institute for Plant Protection |
| KZT | Kazakhstani Tenge (currency of the Republic of Kazakhstan introduced in 1993) |
| PPS | Plant Protection Service |
| USSR | Union of Soviet Socialist Republics (equally used as the Soviet Union) |
| VASKhNIL | [*Russian acronym for*] All-Union Academy of Agricultural Sciences named after Lenin |
| VIZR | [*Russian acronym for*] All-Union Research Institute for Plant Protection |

# Glossary

| | |
|---|---|
| *Candidate of Sciences* | Scientific degree in the former USSR, which is still in use in Russia and Kazakhstan and can be placed between M.Sc. and Ph.D. of western academia. Some equate this degree to western Ph.D., but after pursuing *Candidate of Sciences* degree one need at least another 4-5 or more years to pursue ‘Doctor of Sciences’ degree that equal to Ph.D. degree of western academia. |
| *Commercial farming* | Profit-driven farming. |
| *Kolkhoz* | [*in Russian*] Collective farm enterprise in the Soviet period. It differs little from *sovkhoz*, at least in the context of Kazakhstan. The difference can be in allotted area, *sovkhoz* had larger area than *kolkhoz*. Yet, this type of farm was introduced in earlier periods of the Soviet state than *sovkhoz*. [plural *kolkhozes*] |
| *Oblast* | [*in Russian*] Administrative division of the territory of the country into regions/provinces. |
| *Pest* | In this thesis, an agricultural pest is defined broadly, as a living organism (rodent, insect, mite, nematode, fungus, bacterium, virus or weed) that damages crops, affects crop development or reduces quantity and quality of yield before or after harvest. The terms ‘agricultural pest’, ‘pest organism’ and ‘pest’ will be used interchangeably. |

| | |
|---|---|
| *Raion* | [*in Russian*] Administrative sub-division of the oblast; English equivalent – district. |
| *Sovkhoz* | [*in Russian*] State farm enterprise in the Soviet period. It differs little from *kolkhoz*, at least in the context of Kazakhstan. The difference can be in allotted area, *sovkhoz* had larger area than *kolkhoz*.<br>[plural *sovkhozes*] |

# Summary

This thesis examines why and how plant protection issues are embedded in political, economic and social contexts. It analyses the domain of plant protection in Kazakhstan under two different socio-economic and political formations, namely the Soviet period before 1991 and the post-Soviet period thereafter. The study of plant protection in a country in transition demonstrates how the wider political and socio-economic structures shape this particular field of agrarian science and practice.

An in-depth, qualitative research approach was employed to study micro-processes in both periods, in order to understand how these processes are shaped by wider structures and to connect the present to the past in anticipation of the future. A technographic approach was used to describe social and biological worlds in their full complexity and to achieve a contextual understanding of sustainable agro-ecosystem development. Data analysis was based on cross-checking information from documents, literature, media, own observations and interviews.

This thesis illustrates how Integrated Pest Management (IPM)/ecology-based pest-control approaches were broadly developed and practised in the USSR, including Kazakhstan. It identifies a shift from a knowledge system aiming at sustainable pest control in the Soviet era to an exclusive focus on pesticides in post-1991 Kazakhstan. This shift – which contradicts the global trend towards sustainability – leads to the central question of this dissertation: Why did such a shift occur in Kazakhstan after 1991? This thesis argues that the transformation of the agrarian structure, the destruction of the state-led/public organization of pest control, the neglect of research and extension and the aggressive promotion campaigns of the pesticide industry changed the plant protection perspectives in Kazakhstan. This dissertation describes how, and explains why, thinking about pest control changed within the wider knowledge system, including farming, research, extension and policymaking. As a result, essential elements of sustainable pest-management approaches were abandoned in Kazakhstan after 1991.

The study shows that the Soviet system created conditions that were conducive to the functioning of ecological forms of pest control. The institutionalized plant protection system was able to facilitate broad-scale collective action to control pests locally and regionally. Plant protection research that developed and promoted sustainable pest-control approaches was seen as a public good. The neoliberal ideology that was introduced after the fall of the Soviet system undermined collective initiatives and the creation of public goods and brought the sustainable pest-control system into crisis. New farmers had little knowledge about plant protection. They also lacked the institutional backup and the technical and financial resources to practise sustainable pest-control approaches. The public plant protection domain was severely underfunded and dramatically reduced in size and capacity. Hence, IPM/ecology-based pest-control approaches were no longer developed, promoted or applied.

This thesis introduces the above-mentioned issues in Chapter 1 and synthesizes them in Chapter 6. These issues are discussed more in detail in the four empirical chapters (2–5), which are summarized below.

**Chapter 2** examines the post-Soviet changes in the farming sector in Kazakhstan. It describes the transformation of the agrarian structure and the new ordering of large farms and smallholdings in the context of the changing socio-economic, political and technological landscape. It identifies the major changes in land use, farm types and size and discusses how state interventions affected access to land and other inputs during the various stages of transition. The chapter analyses how different actors perceive the transformation of agriculture, livelihoods and social infrastructure that occurred in rural areas after 1991, why they talk about this period in terms of crisis and chaos, and why many people have a feeling of nostalgia for the Soviet past. Subsequently, it examines the role of knowledge and the remarkable degree to which it was lost in the transition process. This chapter also describes the technological rationale and the organization of knowledge within Soviet agriculture and examines what happened to those structures afterwards. The loss and lack of knowledge, in the context of rapidly changing conditions for practising agriculture, are key factors in explaining the agricultural crisis that followed the collapse of the Soviet Union. Neoliberal ideology, which informed much of the policy changes in the transition period, severely constrained the maintenance of the essential pest-control knowledge required for sustainable forms of agriculture.

**Chapter 3** illustrates the wide application of IPM approaches in the USSR, including Kazakhstan, during the 1970s and 1980s. It shows that IPM is a knowledge-intensive approach that requires a strong research base, a functioning pest-control extension network and collective action for its development, promotion and use. This chapter argues that the collapse of collective farming and the disintegration of a unified plant protection system had a problematic impact on post-1991 pest-control perspectives. It analyses why individual farmers became focused exclusively on pesticide use. It also examines why the research concentrated their efforts only on chemical control issues. The pesticide industry succeeded in filling up the knowledge and information gap in pest-control issues. It was able to set up the necessary infrastructure to deliver its products to farmers in Kazakhstan after 1991. The role of the plant protection service and research system that had delivered IPM-related knowledge and information was severely diminished.

**Chapter 4** shows that tremendous changes took place in plant protection research in Kazakhstan after 1991. It argues that plant protection research dealing with migratory pests and with IPM has the characteristics of a public good that needs to be adequately supported by the state. This is because highly destructive organisms such as locusts threaten national food security, while IPM deals with ecologically sound and environmentally safe pest-control approaches. The pesticide industry is governed by market forces that commercialize and commoditize pest-control knowledge and products. This chapter analyses how agricultural research institutes faced an alarming shortage and ageing of research staff. Recruitment of young researchers became difficult and middle-aged researchers could not be retained. Public science lost its prestige and became underfinanced and unattractive. Researchers in the public research institutes became nostalgic about the former Soviet scientific establishment, in which research facilities and infrastructure, the training and qualification of research staff and funding were all significantly better than in the post-1991 period. The weak management of science and numerous organizational and management shifts after 1991 increased feelings of uncertainty in the research community. The chapter discusses how the current short-termism in the research agenda and the demand for immediate results undermines the research on sustainable pest-control approaches.

**Chapter 5** examines the co-evolution of locust populations, land use systems, knowledge systems, campaigns and the institutional framework before and after 1991. It demonstrates that a very complex and dynamic system of locust management was developed during the Soviet era. Knowledge building, concerted action, habitat management, understanding ecological relationships and long-term analysis and planning were key features of this system. The biology, taxonomy, ecology and population dynamics of the locust species were the focus of study by many scientists. In the wake of the collapse of the USSR, the plant protection system in Kazakhstan lost much of the expertise that had been acquired over many years, including that concerning locusts. At the same time, the production of new knowledge was seriously diminished. The financial and ideological reasons for dismantling the existing pest-control system did not recognize the potential impact of policy-induced changes on agro-ecological conditions, pest-control practices and pest development. Nature hit back with an extremely harmful locust plague between 1998 and 2001. The locust invasion in 1999 of the newly established capital of Kazakhstan triggered a process of institutional change in the plant protection system. The Plant Protection Service was partly revived. This chapter provides further evidence that market-driven approaches fail to address pest-management problems like the locust problem effectively. Furthermore, agricultural producers are unable to control locusts outside their private plots. The locust case supports the argument that pest control has public good characteristics requiring collective action.

In conclusion, this thesis points to an urgent need to rethink and rebuild the role of the government in pest control. Without stronger policy, less afraid to embrace positive aspects of the former Soviet plant protection system, highly destructive pest organisms will continue to threaten national food security, and indiscriminate and injudicious pesticide use will continue to pose considerable hazards for human health and the environment. The study shows that plant protection is more than just 'getting rid of pests' at the farm level. Pest-control issues are deeply embedded in political–economic–social contexts, through which the development and use of ecologically sustainable approaches and collective action for pest control can be either promoted or hindered. The government of Kazakhstan has a key function in supporting this long-term endeavour and creating conducive conditions for this to happen, as this will ultimately contribute to a more sustainable system of agricultural production and thus benefit society as a whole.

# Samenvatting

(Gewasbescherming in post-Sovjet Kazachstan:
het verlies van een ecologisch perspectief)

Deze studie onderzoekt hoe en waarom issues rondom gewasbescherming zijn ingebed in de politieke, economische en sociale contexten. Het analyseert het domein van gewasbescherming in Kazachstan onder twee verschillende sociaal-economische en politieke formaties, namelijk de Sovjet periode voor 1991 en de post-Sovjet periode daarna. De studie van de gewasbescherming in een land in overgang toont aan hoe de bredere politieke en sociaal-economische structuren dit veld van agrarische wetenschap en beoefening vormgeeft.

Een diepgaande, kwalitatieve onderzoekbenadering is gebruikt om micro-processen te onderzoeken in beide periodes om te begrijpen hoe deze processen zijn gevormd door bredere structuren en om het heden te verbinden met het verleden in anticipatie op de toekomst. Technografie is de gebruikte benadering om de sociale en biologische werelden in hun volledige complexiteit te omschrijven en een beter begrip van de ontwikkeling van duurzame agro-ecosystemen te verkrijgen. Gegevensanalyse is gebaseerd op het kruislings controleren van informatie van documenten, literatuur, media, eigen observaties en interviews.

Dit proefschrift illustreert hoe benaderingen van Geïntegreerde Gewasbescherming (IPM, naar de engelse afkorting van Integrated Pest Management), dat wil zeggen op ecologie gebaseerde ziekte- en plaagbestrijding, zich hebben ontwikkeld en in de praktijk zijn gebracht in de USSR, Kazachstan inbegrepen. Het identificeert een verschuiving van een kennissysteem dat streeft naar duurzame gewasbescherming in het tijdperk van de Sovjet naar een exclusieve focus op pesticiden in post-1991 Kazachstan. Deze verschuiving – in tegenstelling tot de wereldwijde trend gericht op duurzaamheid – leidt naar de centrale vraag van dit proefschrift: waarom deed zich een dergelijke verschuiving voor in Kazachstan na 1991? Dit proefschrift beargumenteert dat de transformatie in de agrarische structuur, de vernietiging van de door de staat geleide (publieke) organisatie van ziekte- en plaagbestrijding, de verwaarlozing van onderzoek en verspreiding, en de agressieve promotie campagnes van de pesticide industrie de houdingen ten aanzien van gewasbescherming in Kazachstan hebben veranderd. Dit proefschrift omschrijft hoe, en verklaart waarom, het denken rondom ziekte- en plaagbestrijding veranderde met het gevolg dat essentiële elementen in de benaderingen van duurzame ziekte- en plaagbestrijding zijn afgeschaft in Kazachstan na 1991.

De studie toont aan dat het Sovjet systeem voorwaarden creëerde die het functioneren van ecologisch verantwoorde vormen van ziekte- en plaagbestrijding bevorderde. Het geïnstitutionaliseerde systeem van gewasbescherming maakte grootschalige collectieve actie van ziekte- en plaagbestrijding mogelijk op lokaal en regionaal niveau. Onderzoek naar methodes voor duurzame bestrijding van ziekten en plagen werd gezien als

gemeenschappelijk goed. De neoliberale ideologie, die na de val van het Sovjetsysteem werd geïntroduceerd, ondermijnde collectieve initiatieven en de verwezenlijking van publieke goederen en bracht het systeem van duurzame ziekte- en plaagbestrijding in crisis. Nieuwe boeren hadden weinig kennis van gewasbescherming. Verder hadden zij niet de institutionele ondersteuning en de technische en financiële middelen om te werken met benaderingen van duurzame bestrijding. Het domein van de publieke gewasbescherming kampte met een ernstig tekort aan financiële middelen en kromp dramatisch in omvang en capaciteit. IPM en op ecologie gebaseerde ziekte- en plaagbestrijding werden niet langer ontwikkeld, bevorderd of gebruikt.

Dit proefschrift introduceert de bovengenoemde kwesties in Hoofdstuk 1, en vat ze samen in Hoofdstuk 6. Deze kwesties worden in detail besproken in de vier empirische hoofdstukken (2-5), die hieronder zijn samengevat.

**Hoofdstuk 2** bestudeert de post-Sovjet veranderingen in de landbouw sector van Kazachstan. Het beschrijft de verandering van de agrarische structuur en de herordening van grote landbouwbedrijven en opkomst van kleine boerenbedrijven in de context van een veranderend sociaal-economische, politieke en technologisch landschap. Het identificeert de grote veranderingen in landgebruik, de verschillende types en grootte van boerenbedrijven, en bespreekt de gevolgen van interventie van de staat in de distributie van land en andere productiemiddelen gedurende de verschillende stadia van de transitie. Het hoofdstuk analyseert hoe verschillende actoren de transformatie van de landbouw, de wijze van levensonderhoud en de sociale infrastructuur beleefden en begrepen. Het onderzoekt waarom ze over deze periode na 1991 praten in termen van crisis en chaos, en waarom vele mensen nostalgische gevoelens koesteren ten aanzien van het Sovjet verleden. Daaropvolgend onderzoekt het hoofdstuk de rol van kennis en het opmerkelijke verlies hiervan gedurende de transitieperiode. Verder beschrijft dit hoofdstuk ook de technologische redenatie en de organisatie van kennis in de landbouw van de Sovjet en hetgeen er daarna is gebeurd met deze structuren. Het verlies en gebrek aan kennis, in de context van snel veranderende omstandigheden voor landbouwbeoefening, zijn belangrijke factoren in het verklaren van de agrarische crisis die volgde na de instorting van de Sovjet-Unie. De neoliberale ideologie, die voor een groot gedeelte bepaalde hoe beleid werd aangepast gedurende de transitieperiode, heeft het behoud van essentiële kennis van ongediertebestrijding voor duurzame landbouw ernstig beperkt.

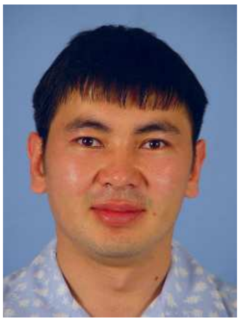
**Hoofdstuk 3** illustreert de grootschalige toepassing van IPM benaderingen in de USSR, inclusief Kazachstan, gedurende de jaren ‘70 en ‘80. Het toont aan dat IPM een kennisintensieve benadering is, die bestaat bij gratie van een sterke onderzoeksbasis, een goed werkende voorlichting, en collectieve actie voor de ontwikkeling, stimulering en gebruik van IPM. Dit hoofdstuk beargumenteert dat de ineenstorting van de collectieve landbouw en de desintegratie van een geïntegreerd gewasbeschermingssysteem een problematische impact heeft gehad op de opvattingen over ziekte- en plaagbestrijding na 1991. Het analyseert waarom individuele boeren zich uitsluitend gingen concentreren op het gebruik van pesticiden. Ook bestudeert het waarom onderzoek zich uitsluitend nog richtte op het gebruik van chemicaliën in ziekte- en plaagbestrijding. De pesticide industrie slaagde erin om de kennislacune over gewasbescherming op te vullen. Het was in staat om de nodige infrastructuur te creëren zodat de producten geleverd konden worden aan boeren in Kazachstan na 1991. De rol van de Gewasbeschermingsdienst en het onderzoek systeem dat IPM gerelateerde kennis en informatie verschaftte, was aanzienlijk kleiner geworden.

**Hoofdstuk 4** toont aan dat er enorme veranderingen plaatsvonden in onderzoek naar gewasbescherming in Kazachstan na 1991. Het beargumenteert dat onderzoek naar gewasbescherming gericht op migrerende plagen en IPM de karakteristieken hebben van een publiek goed dat voldoende ondersteund moeten worden door de staat. Zeer vernietigende organismen, zoals sprinkhanen, kunnen een vormen bedreiging voor de nationale voedselveiligheid. Het primaire doel van IPM is ecologisch verantwoorde en milieuvriendelijke benaderingen van ziekte- en plaagbestrijding. De pesticide industrie wordt beheerst door marktwerkingen die enkele elementen van dergelijke kennis en producten commercialiseren. Dit hoofdstuk analyseert hoe landbouw onderzoeksinstituten zich geconfronteerd zagen met zowel een alarmerend tekort aan, als verouderd onderzoekspersoneel. Het werd lastig om jonge onderzoekers te rekruteren en onderzoekers van middelbare leeftijd konden niet worden behouden. De openbare wetenschap verloor haar prestige, werd niet voldoende financieel ondersteund en was niet langer aantrekkelijk. Onderzoekers van publieke onderzoeksinstituten werden nostalgisch over de wetenschappelijk orde in de tijd van de Sovjet periode, waarin onderzoeksfaciliteiten en infrastructuur, de opleiding en kwalificatie van onderzoekspersoneel en de financiering significant beter was dan in de post-1991 periode. Het zwakke beheer van de wetenschap en de talrijke organisatorische en management veranderingen na 1991 zorgden voor een toename in gevoelens van onzekerheid in de onderzoeksgemeenschap. Het hoofdstuk bediscussieert hoe het huidige korte termijn denken in de onderzoeksagenda en de vraag naar onmiddellijke onderzoeksresultaten, het onderzoek naar duurzame ziekte- en plaagbestrijding ondermijnt.

**Hoofdstuk 5** onderzoekt de co-evolutie van sprinkhanen populaties, landgebruik, kennissystemen, bestrijdingscampagnes en de institutionele organisatie voor en na 1991. Het toont aan dat gedurende het Sovjet tijdperk een zeer complex en dynamisch systeem van sprinkhanenbeheer werd ontwikkeld. Generatie van kennis, gezamenlijke actie, habitat management, begrip voor ecologische verhoudingen, en lange termijn analyse en planning waren kerneigenschappen van dit systeem. Vele wetenschappers concentreerden zich op onderzoek naar de biologie, taxonomie, ecologie en populatiedynamiek van sprinkhaanrassen. Na de val van de USSR, is veel van de verworven expertise ten aanzien van gewasbescherming, evenals kennis omtrent sprinkhanen, in Kazachstan verloren gegaan. Tegelijkertijd is de generatie van kennis ernstig afgenomen. De financiële en ideologische redenen om bestaande systemen van ziekte- en plaagbestrijding systemen te ontmantelen erkenden niet het potentiële effect van de, door beleid veroorzaakte, veranderingen in agro-ecologische omstandigheden, praktijken van plaagbestrijding, en plaagontwikkeling. De natuur sloeg haar slag met een zeer vernietigende sprinkhanenplaag tussen 1998 en 2001. De invasie van sprinkhanen in 1999 in de nieuwe hoofdstad van Kazachstan bracht een proces teweeg van institutionele veranderingen in het gewasbeschermingssysteem. De Gewasbeschermingsdienst werd gedeeltelijk vernieuwd. Dit hoofdstuk levert verder bewijs aan dat benaderingen gedreven door marktwerking er niet inslagen om ongedierteproblemen, zoals de sprinkhanenplaag, effectief aan te pakken. Bovendien, zijn landbouwproducenten niet instaat om sprinkhaanplagen, die zich buiten hun eigen velden ontwikkelen, te controleren. Het gevalstudie van de sprinkhanen ondersteunt het argument dat ziekte- en plaagbestrijding collectieve karakteristieken heeft en collectieve actie vereist.

Samenvattend, dit proefschrift wijst op een dringende behoefte om de rol van de overheid in ziekte- en plaagbestrijding te heroverwegen en opnieuw op te bouwen. Zonder sterk beleid, dat minder bang is om positieve aspecten van het voormalige Sovjet gewasbeschermingssysteem te incorporeren, zullen destructieve plantenziekten en plagen de nationale voedselveiligheid blijven bedreigen. Tevens zal het onkritische en onverstandige pesticidengebruik de volksgezondheid en het milieu aan aanzienlijke gevaren blootstellen. Deze studie laat zien dat gewasbescherming meer is dan alleen 'het bestrijden van ziekten en plagen' op het niveau van boerenbedrijven. Kwesties van ziekte- en plaagbestrijding zijn sterk ingebed in politiek-economische en sociale contexten die de ontwikkeling en het gebruik van ecologisch duurzame benaderingen en collectieve actie ten aanzien van ziekte- en plaagbestrijding kunnen bevorderen of belemmeren. De overheid van Kazachstan heeft een zeer belangrijke functie in de ondersteuning van deze lange termijn onderneming en zo bij te dragen aan een meer duurzame landbouwproductie ten voordele voor de gehele maatschappij.

# About the author



Kazbek Toleubayev was born 21.06.1976 in the city of Semey, in north-eastern Kazakhstan. He graduated with distinction from the Kazakh State Agrarian University (KSAU) in Almaty in 1999 with a BSc in Agronomy, specializing in Plant Protection. In 2000, he visited Wageningen University, the Netherlands in the context of the European TEMPUS educational project between KSAU and Wageningen University. This visit gave him opportunity to enrol in a Plant Sciences MSc programme. In January 2002, he obtained his MSc diploma in Plant Sciences with specialization in Integrated Pest Management. He then returned to his country and was employed by the Kazakh Research Institute for Plant Protection, where his work emphasized integration of agricultural science in Kazakhstan with international scientific networks. For this reason, in 2004, he applied for and received a ‘Sandwich’ PhD fellowship at Wageningen University. There he started his PhD programme with the Technology and Agrarian Development Group (Department of Social Sciences) in collaboration with Laboratory of Entomology (Department of Plant Sciences) in January 2005. Since ‘Sandwich’ fellowships cover only part of the expenses of PhD study, Kazbek also applied for, and was granted, the ‘Bolashak’ (Kazakh for ‘Future’) fellowship of the First President of the Republic of Kazakhstan, which covered all other remaining expenses related to his PhD study. After completing his PhD, he will return to his motherland to actively engage in projects related to agrarian science, agricultural production and rural development in Kazakhstan.

## List of publications


1. **Toleubayev, K. 2008.** Plant protection service in Kazakhstan: pre-1991 making, post-1991 neglect, and post-1999 revival. Pages 161-186 *in* Sagitov A.O., editor. *Achievements and Problems of Plant Protection and Quarantine*. Proceedings of the International Conference dedicated for a 50-year jubilee of the Kazakh Research Institute for Plant Protection and Quarantine, 6-8 November 2008. Rakhat, Almaty, Kazakhstan.

2. Van Huis A., G. Woldewahid, **K. Toleubayev**, and W. van der Werf. **2008**. Relationships between food quality and fitness in the desert locust, *Schistocerca gregaria*, and its distribution over habitats on the Red Sea coastal plain of Sudan. *Entomologia Experimentalis et Applicata* 127(2):144-156. [*the peer-reviewed journal*]

3. **Toleubayev, K.**, K. Jansen, and A. Van Huis. **2007**. Locust control in transition: the loss and reinvention of collective action in post-Soviet Kazakhstan. *Ecology and Society* 12(2):38. [online] URL: http://www.ecologyandsociety.org/vol12/iss2/art38/ [*the peer-reviewed journal*]

4. **Toleubayev, K.M. 2005**. Shifted interface between farmer practice and agricultural research in Kazakhstan. *Bulletin of Agrarian Science of Kazakhstan* 8:29. [in Russian].

5. **Toleubayev, K.,** G. Woldewahid, A. van Huis, and W. van der Werf. **2003**. Effect of nitrogen content of the host plant millet *Pennisetum typhoideum* on fitness of the Desert locust *Schistocerca gregaria* Forsk. *Tropical Resource Management Papers* 48:107-122.

6. Zharokova, R.G., Z.A. Ospanov, N.S. Suleimenova, A.K. Ermagambetov, and **K.M. Toleubayev. 2002**. Optimal parameters for herbicide application to localize and eliminate the thickets of narcotic hemp at pre-sandy grazing zones of Shu valley in Kazakhstan. Pages 207-213 *in* Sagitov A.O., editor. *Actual Problems of Plant Protection in Kazakhstan*, Book 2. Bastau, Almaty, Kazakhstan. [in Russian].

7. Sagitov A.O., A.A. Dzhaimurzina, K.N. Tulengutova, R.D. Karbozova, and **K.M. Toleubayev. 1999**. System of preventive measures against Gall nematode (*Meloidogyne marioni*) via enhancement of soil in greenhouses. *Compendium of scientific articles of the Kazakh State Agricultural University* 2:113-116. Almaty, Kazakhstan. [in Russian].

8. Sagitov A.O., A.K. Ermagambetov, and **K.M. Toleubayev. 1999**. Rational use of herbicides against hemp in the restoration system of degraded pastures by re-grassing in the southeast of Kazakhstan. *Compendium of the Kazakh State Agricultural University* 2:124-126. Almaty, Kazakhstan. [in Russian].

9. Geshtovt N.Y., E.Z. Baimagambetov, A.A. Feaktisov, D.L. Galyapin, and **K.M. Toleubayev. 1999**. Perspectives of bio-pesticide production in Kazakhstan based on entomopathogenic fungi. *Compendium of the Kazakh State Agricultural University* 2:143-146. Almaty, Kazakhstan. [in Russian].

## Completed Training and Supervision Plan: Kazbek Toleubayev

| Description | Department / Institute | Month / Year | Credits |
|---|---|---|---|
| ***I. Orientation*** | | | |
| CERES Orientation and Tutorials and Development of Research Proposal | CERES / Utrecht University and Wageningen UR | April – June, 2005 | 11 |
| ***II. Research methods and techniques*** | | | |
| Socio-cultural Fields Research Methods | MANSHOLT - CERES / Wageningen UR | January 20 – February 11, 2005 | 3 |
| Technography, Researching Technology and Development | MSc Course TAD 30806 / Wageningen UR | March – April, 2005 | 6 |
| The Methodology of Fieldwork | CERES / Utrecht University | June 19 – 22, 2006 | 1 |
| ***III. Presentation of research results*** | | | |
| Presentation of the working paper *'The Post-Soviet Farm Restructuring in Kazakhstan: Implications for the Agricultural Research System'* | CERES Summerschool / ISS, The Hague | June 29, 2005 | 4 |
| Presentation of the published article *'Shifted interface between farmer practice and agricultural research in Kazakhstan'* | Conference *'Increasing competitiveness of agricultural sector in Kazakhstan'* / Almaty, Kazakhstan | November 4, 2005 | 4 |
| Presentation of the working paper *'Crop Protection Perspectives in Kazakhstan: A Paradigm Shift'* | CERES Summerschool / Wageningen UR | June 27, 2006 | 4 |
| Presentation of the working paper *'Post-Soviet Agrarian Changes in Kazakhstan: Farming Sector in Transition'* | Conference *'Current Trends in Development Studies'* / ISS, The Hague | June 6, 2008 | 4 |
| Presentation of the working paper *'Public Science in Transition: Plant Protection Research in Post-Soviet Kazakhstan'* | UNESCO Global Research Seminar, Paris | November 29, 2008 | 4 |
| Presentation of the preliminary findings, drafted articles and chapters of dissertation at TAD advanced seminars | TAD Group, Social Sciences Department / Wageningen UR | April 29, 2005<br>February 16, 2006<br>February 13, 2007<br>December 11, 2007<br>May 27, 2008<br>September 2, 2008 | 6 |
| ***IV. Academic skills*** | | | |
| Technology, Social Choice and Development | MSc Course TAD 30306 / Wageningen UR | March – April, 2005 | 6 |
| Project and Time Management | WGS / Wageningen UR | January 17, 31 and February 28, 2006 | 1 |
| English Scientific Writing | CENTA / Wageningen UR | February 1 – March 22, 2007 | 2 |
| **Total** | | | **56** |

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