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Kick the pesticide habit: forces affecting pesticide use and pesticide policy in the fringe of Hanoi and Nanjing, stakeholders' perspectives and policy recommendations

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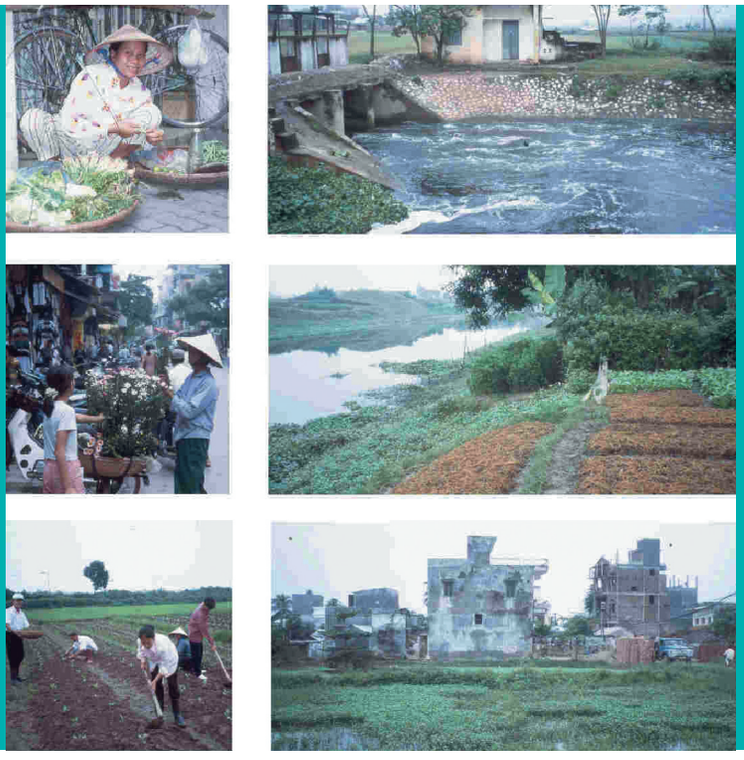

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Summary

Within the context of efforts to intensify peri-urban agriculture on a sustainable, environmentally sound basis, crop protection policies play a crucial role. This study intends to contribute in the effort to develop a more rational crop protection strategy and an environmentally sound production in the fringe of Nanjing (China) and Hanoi (Vietnam). This paper reports on the first results of a research project jointly executed in Vietnam and China by national research institutes together with institutes from two European countries respectively the Netherlands and Portugal. This study identified the institutional, political and price factors influencing current levels of pesticide use and identified the relative weight given to these factors in both cities by stakeholder groups (including farmers, consumers, policymakers, pesticide companies, extensionists). After identification of the stakeholders a first ranking of the relative importance of the different factors has been elaborated among researchers in Hanoi and Nanjing using an approach partly comparable to that of the Pesticide Policy Projects performed by the University of Hannover (UNI). Results from the above mentioned activities formed the starting point for identification of options for improvement in two pilot areas Dong Du and Suoshi in the fringe of respectively Hanoi and Nanjing.

The analysis of the vegetable production sector near both cities shows that the current political incentives encourage pesticide overuse. A situation has developed in which farmers in the fringe of both cities are likely to be locked in a pesticide intensive production strategy.

The stakeholders' opinions on the factors of pesticide use in Nanjing and Hanoi suggest four issues that should be addressed in a pesticide reduction programme: pricing (e.g. fiscal framework and impose of tax on pesticides), information environment, institutional framework (design of extension system), and adequate legislation (bans and enforcement related to the use and production of pesticides). Changing the information environment is considered to be one key scenario to improve crop protection in peri-urban agriculture. Peri-urban agriculture occurs in an urban-rural continuum rather than in an isolated area. Agricultural training and extension services, which at the moment are extremely limited, need to be enforced. Conclusions are:

The role of the different stakeholders needs to be clarified since addressees of the current policy are not clear. The crop protection policy is not yet comprehensive. Current crop protection approaches have been primarily shaped by isolated technical expertise without taking institutional and economic framework conditions into proper consideration. The actual economic framework encourages pesticide use level. The actual residue control and implementation of the legislation are not adequate enough.

The technical information in integrated pest management for farmers is too limited.

Introduction

Peri urban agriculture

The twentieth century has experienced dramatic urbanisation and in the coming 30 years the worldwide urban population is expected to double (World Bank, 2001). This development poses a tremendous challenge for the agricultural sector and the food supply industry (Waibel and Schmidt, 2000).
Also the importance of urban- and peri-urban agriculture in food security, health and nutrition has been underlined during many round table conferences (FAO, 1999; FAO, 2006).

The findings of national consensus and household surveys suggest that up to two-thirds of peri-urban households in developing countries are involved in agriculture (Dreschler et al., 2000). Peri-urban agriculture contributes to food availability and quality in cities and also food access through generating income for households involved in production processing, marketing and distribution. Generally, peri-urban agriculture refers to farms units close to town which operate intensive semi-or fully commercial farms to grow vegetables and other horticulture, raise chickens and other livestock and produce milk and cows (FAO, 1999). Under the conditions of rather unbalanced urban expansion as experienced in many Asian cities (UNDP, 1996) agricultural systems emerge among the gradients in the periphery, the wedges and the corridors of the cities.
Urban and peri-urban agriculture also have environmental implications which can have positive or negative effects on urban health. The risks from agricultural production systems in peri-urban areas to health and environment arise from the inappropriate use or excessive use of agricultural inputs which may leach or runoff into drinking water sources, air pollution. In particular, products (especially leafy vegetables) can be contaminated through overuse of chemical sprays (FAO, 1999). It is important to understand these implications in order to prevent and/or mitigate them.

Integrated pest management

Crop protection is a key area of concern. Over the last decades, while promoting peri-urban agricultural intensification, negative side-effects from chemical pesticides on human health, natural environment and biodiversity were neglected (Pimentel et al., 1980; Altieri, 1994).
The development of integrated systems (integrated pest management, IPM and integrated crop management, ICM) in combination with farmer participatory learning in Farmer Field Schools, have resulted in a better use of external inputs as fertilizers and pesticides (Pretty, 1995; Kenmore et al., 1995; De Jager et al., 2004). Analyses of IPM at the farm level show positive results in several regions in different crops (Power and Kenmore, 2002; Bandong et al., 2002). However, the trend towards market liberalisation in absence of specific policy frameworks has been negative for IPM (Williamson, 2003).

Whether integrated approaches will be successful depends on several factors including local and national policies, institutional frameworks, aid agencies, and donor organizations (Röling and Wagemakers, 1998; McCann, 2005). Pesticide policy studies carried out in various countries (e.g. Thailand, Indonesia, Costa Rica, China) showed a strong relationship between agricultural and environmental policies and pesticide use (Nyberg and Rozelle, 1999; Agne, 2000; Jungbluth, 2000).
Waibel et al. (1999) grouped factors decisive in explaining the situation of pesticide dependency in respectively price factors, state policy factors and information and institutional factors. The first group include e.g. below market price or free distribution of pesticides through government, direct support for the domestic pesticide industry, privileged exchange rates. Policy factors include e.g. the dominant role given to pesticides in government activities include lack of transparency in regulatory decision-making, lack of control of residues in food, and trade policies. Information and institutional factors include e.g. misinformation of farmers by chemical industries. Ideally, the direction and the relative strength of these factors should be known when planning a more sustainable urban and peri-urban agriculture.

This pesticide policy project was only a part of the SEARUSYN (Seeking East Asian Rural Urban Synergy). The project was carried out in the frame of the International Co-operation programme (INCO) (EU-RTD programme "Cooperation with third countries and international organizations"). The objective of the SEARUSYN project was to contribute to the synergy between urban growth and agricultural development in the urban fringe of Hanoi (Vietnam) and Nanjing (China) in order to improve the welfare of rural and urban communities. To achieve this objective, systems research was undertaken on the design of solutions to problems arising from the interactions between urban growth and changing horticultural production systems on the city outskirts.

According to political strategies accelerated growth of agricultural production is necessary in both countries to feed the growing urban population and in boosting overall economic development (Jansen et al., 1996). Linked to the intensification is the usually increased use of pesticides. To policy makers, the increased use of inputs like fertilizers and chemical pesticides often seems to be one of the most effective ways to increase production and food supply (Gerken et al., 2001). For a long time China and Vietnam have adopted the policy of keeping prices low for essential agricultural inputs. Low pesticide prices are supported by several forms of subsidy (Repetto, 1985; Dung et al., 1999; Hamburger, 2002). In both cities we see rapid urbanization where spatial and agro-ecological motivations play a limited role in decision-making (Guo et al., 2005; and Chuong et al, 2005). Environmental agencies mainly focus on industrialized and urban areas in China and Vietnam.

This study intended to contribute in the effort to develop a more rational crop protection strategy in peri-urban agriculture in both cities. In order to find options for solutions and improve the information basis for rational policy decision making, various tools were used to gather data, permitting stakeholders to identify the constraints and opportunities in environmentally sound peri-urban agriculture.
The research was built up according to a combination of Problem-in-Context, a framework for the analysis, explanation and solution of environmental problems (De Groot, 1997), and the Reform of Crop Protection Policy approach (Waibel, 1999). Accordingly to De Groots' conceptual structure the research work can be divided into three aspects: description of the factual situation, explanation of this situation and design of policy options and recommendations in a stakeholders group. The Reform of Crop Protection Policy includes a series of activities as stakeholder identification, stakeholders' interviews, and policy workshops to raise the understanding of technical, economic and institutional implications. which help to reach a consensus regarding the necessity to integrate crop protection policy into the overall agricultural and environmental policy frameworks and to overdue dialog of the national agricultural ministries with agencies and interest groups that stand for environmental and public health (Pesticide Policy Project, 2000).

Methodology

Technical survey: description of the actual plant protection in the pilot areas

To gain insight in vegetable farmers' pesticide use patterns and information systems in two study areas Dong Du (Hanoi, Vietnam) and Suoshi (Nanjing, China) were interviewed using structured questionnaires. The present survey focused on vegetable farmers' knowledge, perceptions and practices in pest management and how it was influenced by different sources of pesticide information. This quantitative and qualitative information on current pesticide use levels was expected to contribute to the discussions in the stakeholders' platform about more rational pesticide policies.

The two areas have been chosen after a Rapid Diagnostic Appraisal (RDA) performed by the College of Land Management, Nanjing Agricultural University and Centre for Agricultural Research and Ecology Studies (CARES) of Hanoi Agricultural University (HAU), Vietnam together with the European partners (Dang, 2005; Vu, 2005; Nguyen, 2005; Zhu et al., 2005; Chen C. et al., 2005; Wang et al., 2005). Pilot areas were selected based on a set of requirements (e.g. that at least 50 % of the area is in use for horticulture, see SEARUSYN Second Annual Report, 2004).
Dong Du is located on the East Bank of the Red River Delta in the Long Bien District and the total area of agricultural land is 210 Ha. Suoshi is located in the fringe of the East side of Nanjing near the Nanjing-Shanghai highway and the total area of agricultural land is 455 Ha. Both villages are located in high-yielding vegetable production zones.
Mostly farmers were interviewed in the field including detailed questions on pesticide products, application frequency and sources of information influencing farmers' decision-making related to pesticide use. Farmers were randomly selected based on lists of the village leaders. The content of the questionnaires and the type of questions asked were modified after being pre-tested on a small group of farmers in both pilot areas.
Documents on pesticide legislation were collected with the help of policy makers from the different ministries and municipalities.

Stakeholders' survey: identification of factors influencing pesticide use

To assess the current position in Hanoi's and Nanjing's crop protection policy related to the two pilot areas, a stakeholders' survey formed the kick-off for a stakeholders meeting. In December 2003 the stakeholder analysis resulted in an overview of relevant institutions and individuals related to peri-urban agriculture including representatives from government and non-governmental organizations, farmers and consumers (Ekamper, 2004; Guo et al., 2005). This formed the starting point for the selection of stakeholders to be interviewed.

Respectively 55 and 51 stakeholders in China and Vietnam (Table 1) were interviewed using the methodology developed in pesticide policy studies described by Agne et al. (1995). The stakeholders surveys consisted of questions related to actual national and local policy, personal assessment and opinions about the current policy and future development.
Experts representing different stakeholder organizations were asked to identify and assess factors that influence the current pesticide use levels (Farah, 1994). Scientists of the Department of Environment, Nanjing Agricultural University and representatives from several other institutions studied and discussed factors mentioned for other three countries, Thailand (Jungbluth, 2000), Ghana (Gerken et al., 2001) and Costa Rica (Agne, 2000). Altogether, in Nanjing and Hanoi respectively 20 and 24 factors which could influence the level of pesticide use were selected.
Stakeholders in Nanjing or Hanoi were interviewed and asked individually to rate the factors according to a scale -4 to + 4, a minus 4 indicating a strong discouraging and a plus 4 indicating a strong encouraging effect on pesticide use.
Finally the factors were divided into three groups, according the way they could affect pesticide use:
The first group were the price factors, e.g. tax exemptions for pesticides including tax exemptions from VAT or import duties, and subsidies at the farm level.

The second groups were those factors which are directly influenced by the state policy like effective implementation of the legislation, control of pesticide residues, funding of research and extension, promotion of intensive crops. The third group consisted of the institutional and information factors which have an indirect effect on pesticide use, mostly long term, e.g. information on residues, health and environmental issues, information on non-chemical pest control strategies. Per factor we calculated an average per stakeholders group and based on those averages we calculated the overall average.

Stakeholders' workshops

Factors that influence pesticide use in Nanjing and Hanoi were discussed and evaluated by 9 -11 stakeholders from ministries, national government organizations, extension and research institutions, consumers' organizations and from the private sector (pesticide companies) who expressed their opinions on these issues in the interviews. All those institutions which directly participate in the formulation and execution of pesticide policies in Hanoi or Nanjing were represented and, in addition, scientists and experts from international organizations.
The workshop' goals were: to widen the basis of participants in the policy discourse including other stakeholders than only policymakers, and providing accurate and comprehensive information on the existing situation which can help to raise awareness in the issues and the quality of the debate. In the second part of the workshop, the stakeholders were asked to developing policy options for reducing pesticide use and improving Integrated Pest Management.

Table 1. Interviewed stakeholders in Hanoi and Nanjing.

Stakeholders	Hanoi Vietnam	Nanjing China
Department of Agriculture	5 [1]	6 [1]
Department of Plant Protection	5 [1]	
Centre of Health Protection	3 [1]	
Extension Service	5 [1]	5
Farmers in pilot areas	12	5 + 11 [2]
Reporters	3	2
Researchers	?	4
Pesticide shop keepers	6	4
Pesticide companies	4	4
Consumers organic shop		2
Consumers conventional market		7
Owners organic vegetable shop		2
Owners conventional market place		3
People' Committee	1	
Consumers' Protection Association	2	
	46	55

[1] *Officials working at the municipality level.*
[2] *Five local farmers and 11 immigrant farmers.*

Results

Crop protection and pesticide use in the study areas: facts and values

Both areas are characterized by a smallholder vegetable farming sector. Most small-scale farmers grow between 1 and 7 different vegetable species and Chinese leek and leafy vegetables are the most widely grown crops in respectively Nanjing and Hanoi (Table 2).

In both areas, Diamond Back Worm (*Plutella xylostella*) was the most frequently mentioned pest by farmers irrespective of the crop (Table 2). Identification of pests and diseases and selection of the most appropriate pesticides are difficult for the farmers. Figure 1 shows that about 80% of the farmers relied on their own experience for pesticide choice, 40% on information given by pesticide sellers, 14 and 36% in respectively Hanoi and Nanjing on information given by extension officers, 45 and 29% on information by neighbours, and 15% and 29% on information given by media in respectively Hanoi and Nanjing. In Hanoi neighbouring farmers scored higher as information source in comparison with Nanjing. In Vietnam mostly the women in the households (70%) took the decision on pesticide applications. In Nanjing most farmers interviewed were immigrant male farmers living separated from their families and they usually took the decision on pesticide applications.

Table 2. Characteristics of surveyed vegetable farmers in the fringe of Nanjing (Suoshi) and Hanoi (Dong Du).

	Nanjing	Hanoi
Number of farmers interviewed in the pilot areas	21	30
Mean field size (Ha)	0.48 ± 0.13	0.22 ± 0.05
Total number of crop types in the pilot area	20	26
Number of crop types per farm	1-5	1-7
Most important crop	Chinese leek, coriander, leaf mustard, cabbage, tomato	Long coriander (*Eringium*), Buffalo spinach *(Enydra sp.*), Perilla (*Perilla frutescens*), Persicaria (*Persicaria sp.)*
Mean estimated yield (t/ha)	10.5 (Chinese leek)	17.6 (long coriander)
Most important pests	Diamond backworm (*Plutella sp.*) Imported cabbage worm (*Pieris rapae*), Armyworms *(Spodoptera sp.*), Aphids	Diamond backworm (*Plutella xylostella*), Armyworms *(Spodoptera sp.*) Thrips (*Thrips palmi*), White flies
Most important diseases	Mildew	*Phythophthora sp.*, *Xanthomonas campestris*

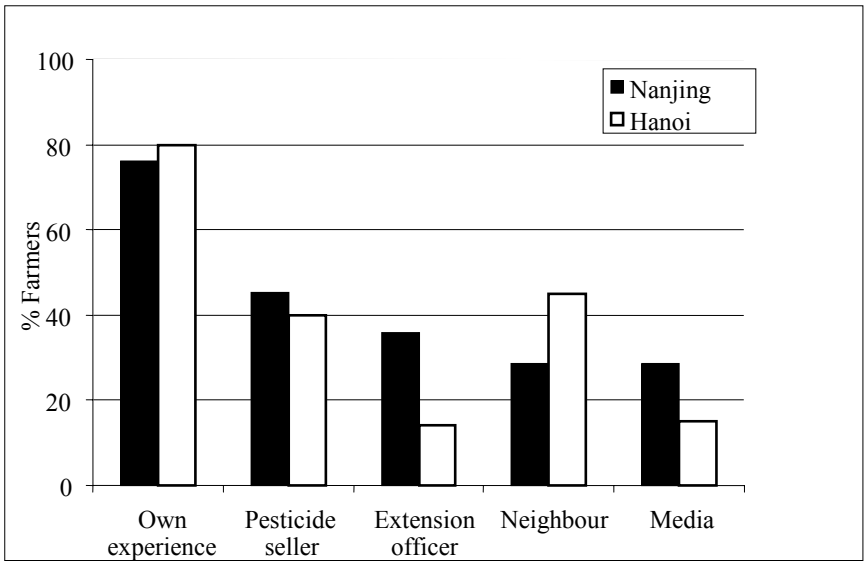

Figure 1. *Sources of information influencing farmers' decision-making related to pesticide use in two vegetable production regions near Nanjing and Hanoi.*

In both pilot areas about one-third of the farmers know about IPM and only 10% considered IPM as positive (see Table 3). Because of lack of information on integrated pest management, farmers see chemical control as the main possibility to control pests and diseases. Farmers preferred to use mixtures rather than to use single products. Most farmers (95%) sprayed the chemicals without protective clothing. About 55% of the farmers increased the pesticide use over the last two years, due to (in the farmers' perception) an increase in pest occurrence. Less than 10% of the farmers pay attention to the environmental consequences of pesticide use. In contrast to China were parathion still is used, in Vietnam no extremely hazardous pesticides were applied (using WHO hazard classification, 2005). In both pilot areas pesticides ranked as highly or moderately hazardous were used e.g. cartap, cypermethrin, methomyl and fenobucarb (WHO, 2005). Sometimes information on the type of active ingredient was missing on the product information.

Table 3. *Pest control characteristics of vegetable farmers in the fringe of Nanjing (Suoshi) and Hanoi (Dong Du).*

	Nanjing	Hanoi
% of farmers that know about IPM	35	33
% of farmer that consider IPM as positive	10	13
% of farmers applying cocktails	62	80
% of farmers with increased use of pesticides over the last two years	50	56
% of farmers that do not protect the face during spraying	95	97
% of farmers that pay attention to the environmental consequences of pesticides	0	8

Pesticide policy

In Table 4 an overview is given on actual pesticide legislation. Bans on persistent organochlorine and extremely hazardous organophosphate pesticides in the early 1980s resulted in a dramatic decline in insecticide production between 1980 and 1996. They were replaced by less persistent (but still highly toxic) alternatives e.g. methamidophos. Pesticide Management Regulation of both countries became effective at the end of the nineties and addresses pesticide manufacture, use and environmental impacts. At province and city level similar local regulations have been declared. However, although production of extremely hazardous organochlorine and organophosphate

pesticides were banned at the beginning of the eighties, it is still relatively easy for farmers to obtain and use them. In both countries interdepartmental coordination on control of production and use is very limited and different government agencies generally operate independently from each other.
Contradictory responsibilities exist within plant protection stations that are responsible for both selling pesticides and promoting ecologically based pest management.

Table 4. Examples of several different levels involved and type of authorities involved in pesticide legislation.

	Description	Source
Country level Vietnam	The National Plan for Environment and Sustainable Development (1991-2000)	Social Republic of Vietnam State Committee for Sciences, 1991
	Law for Environmental Protection (1993)	Le, 1998
	List of banned pesticides (since 1996)	MARD[1], 1996
Regional level Hanoi	Guidelines for safe vegetable production (2003)	DARD[2], 2003
Country level China	Pesticide use safety rule	MARD[1], 1982
	Pesticide Management Regulation of China	People's Republic of China (1997), revised in 2001
	List of banned pesticides (since 1983) revised in 2002	Wang *et al.*, 2005
	Measures on implementation of Regulation Pesticide use	MARD[1] (2002)
Regional level Nanjing	Regulation on Pesticide use in Nanjing	Nanjing Municipality (2001)
	List of banned pesticides for trade and use	Nanjing Municipality (2003)

[1] *Ministry for Agriculture and Rural Development.*
[2] *Hanoi Department of Agriculture and Rural Development: Department of Plant Protection.*

Stakeholders

The analyses of the stakeholders in peri-urban agriculture in Nanjing and Hanoi resulted in an overview of the groups of stakeholders involved in plant protection (Figure 2 and 3).
In both countries crop protection policy seems to be influenced by a wide variety of stakeholders including government organizations in the agriculture, environment, and health protection sectors; farmers' organizations; pesticide importers and retailers; exporters; consumers, and other non-governmental organizations at the national, city and local community level. Pesticide legislation in both countries falls under the jurisdiction of several different levels and types of authorities with the Ministry of Agriculture taking a leadership role (Table 4). Occupational safety is regulated by the Ministry of Health but like in other countries the Ministry of Agriculture is the dominant agency in the implementation of pesticide legislation. In China the Ministry of Chemical Industry provides production licenses while he National Institute for Control of Agrochemicals at the Ministry of Agriculture is in charge of registration and quality control of pesticides and at the regional level the Pesticide Management Stations are responsible for carrying out inspections. In China and Vietnam pesticide laws and regulations are reasonable strong and thorough, but implementation and control are weak.

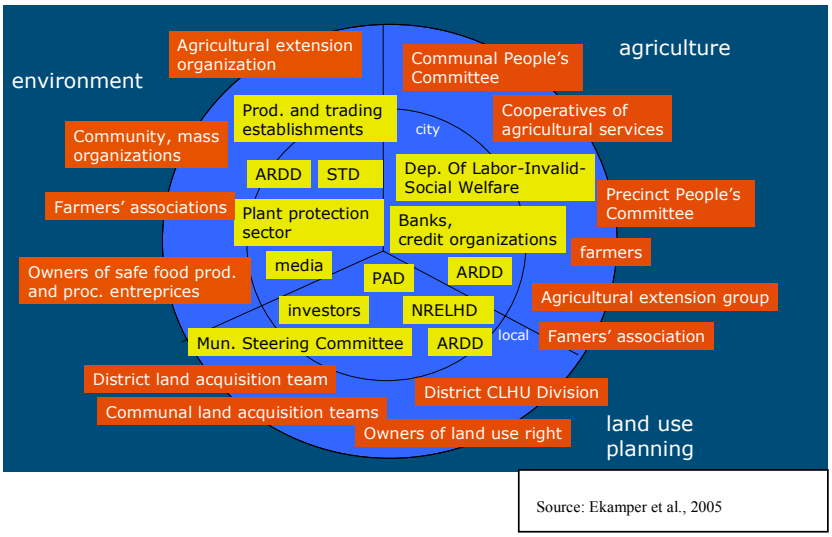

Figure 2. *Main stakeholders in Hanoi (Vietnam).*
ARDD = Agricultural and Rural Development Department (city level),
STD = Science and Technology Department (city level),
PAC = Planning and Architecture Committee (city level),
NRELHD = Natural Resources, Environment, Land and Housing Department (city level).

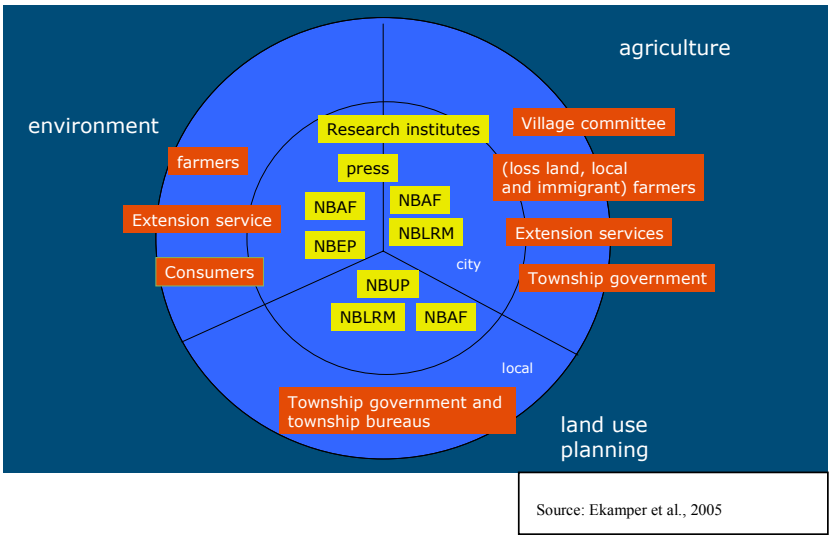

Figure 3. *Main stakeholders Nanjing (China).*
NBAF = Nanjing Bureau of Agriculture and Forestry (city level),
NBEP = Nanjing Bureau of Environmental Protection (city level),
NBLRM = Nanjing Bureau of Land Resource Management (city level),
NBUP = Nanjing Bureau of Urban Planning (city level).

Identification of factors influencing pesticide use: an stakeholder survey in Nanjing and Hanoi

Nanjing

Price factors

All stakeholders agreed that tax exemptions for VAT, for import duties as well as complementary inputs (e.g. knapsacks) stimulated the current level of pesticide application (overall averages respectively + 0.8, + 0.4 and + 0.8). Only the officials assessed the tax exemptions for complementary inputs as discouraging for pesticide use level (-1.3, see Figure 4).

By most of the stakeholders pest outbreak budgets were considered to stimulate the pesticide use (overall average is + 1.0), except the farmers in the pilot area and the pesticide dealers (0.0 and - 0.5).
The experts rating showed that all stakeholder groups considered the higher output prices for the vegetable products (not included in Figure 4) as a factor with highly encouraging pesticide use level in Nanjing (total average is + 1.3, minimum average is + 0.1 for the immigrant farmers and maximum average is + 3.0 for the journalists).

The overall average of all actual price factors together (+ 0.8) showed that these factors are considered as encouraging the pesticide use.

State policy

A more effective implementation of current pesticide legislation could have a clear discouraging effect (overall average is - 1.5 see Figure 4).
All stakeholders considered more stringent controls on residues in food as an effective way to control the level of pesticide use (- 2.0 on the average). The group of scientists showed the highest score (- 3.0) and the group of pesticide dealers the lowest score (- 0.8).
There were controversial assessments for the influence of the current public funding for education and extension. This probably reflects different viewpoints and experiences about the actual education and extension (overall average is - 0.10). The officials considered this factor as discouraging (- 1.3) while e.g. consumers in the conventional market and owners of a grocery considered this as an encouraging factor (+ 0.7).
Most stakeholder groups consider education and extension as a possibility to discourage pesticide use (overall average is - 0.7), except pesticide dealers and owners of an organic grocery (+ 0.3 and + 1.0 respectively).
Promotion of intensive crops was found to have stimulating effect on pesticide use by most stakeholder groups (overall average + 0.4).
In Nanjing according to the stakeholder judgement, the overall averages for all factors included in the government policy could have a substantial discouraging effect on pesticide use level (- 0.8).

Institutional framework and information

All stakeholder groups in Nanjing agreed that more information on the negative side effects as residues in food, health costs and information on environmental issues would have a discouraging effect on the level of pesticide use (overall average - 1.0, - 1.1, - 0.9, see Figure 4).
Most stakeholders expected a small discouraging effect in pesticide use when prices of pesticides are higher and products less hazardous (overall average - 0.4).
There were controversial assessments for the effects if information was given about resistance development in insects and costs/benefits. A part of the groups (trade companies, pesticide dealers and farmers) expect an encouraging effect on pesticide use if information was given on pesticide resistance development in pests (+ 0.5, + 0.3 and + 0.1 respectively) while other stakeholders assessed a discouraging effect (overall average - 0.3, average of the groups scientists - 1.8). Trade companies, officials and scientists expected an encouraging effect on pesticide use if information was given about costs of pesticides in relation to turnover (+ 1.0, + 0.3, + 0.8 respectively) while other groups e.g. consumers organic grocery, pesticide dealers and immigrant farmers assessed a discouraging effect (- 1.0, - 0.8, - 0.6 respectively).

There were also controversial assessments for the influence of the actual information given by pesticide dealers (overall average + 0.1). The pesticide producers as well as scientists and owners of a grocery considered that this information could encourage level of pesticide use. To our surprise all other groups assessed that current pesticide dealers' information given to farmers do not encourage pesticide use level.
Assessments on the effect of illegal pesticide trade differed. This probably reflects the different opinions whether there is illegal trade or not (overall average is + 0.3, but e.g. average of the consumers in the organic grocery is + 1.5). Most stakeholder groups assessed that urbanization could discourage pesticide use (overall average - 0.4).

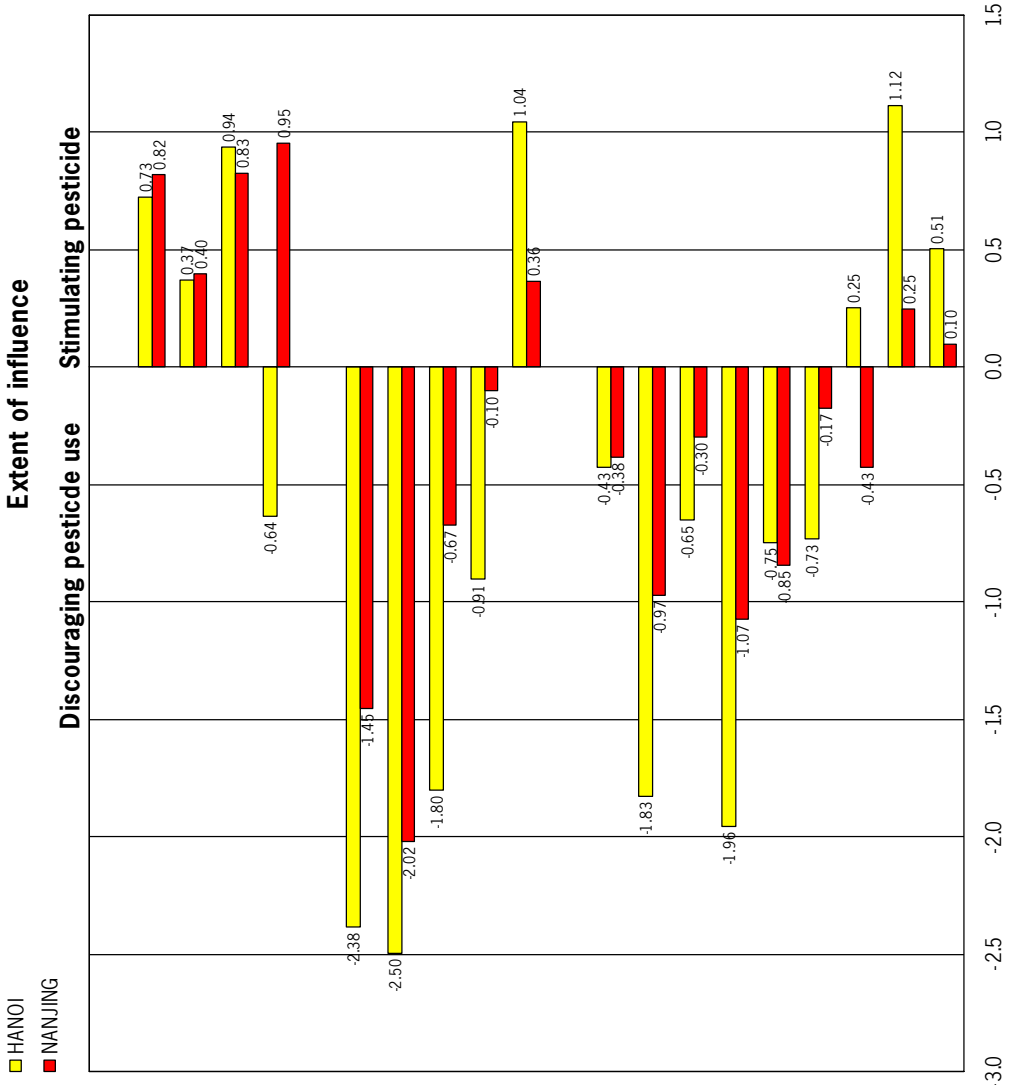

Figure 4. Extent of factors influencing current level of pesticide use: Findings of a stakeholders rating (mean score on a scale from - 4 to + 4).

The actual institutional environment and information are considered as encouraging pesticide use and antagonistic to the uptake of IPM practices. In general, more information given on the negative side effects on health costs, residues in food, water air, and environment and information given on costs and alternative control methods would have a discouraging effect on the level of pesticide use (- 0.6).

Hanoi

Price factors

The only difference with the results in Nanjing is that outbreak budgets were not considered to stimulate the pesticide use by most of the stakeholders in Hanoi (total average is - 0.6, see Figure 4).
Similar to Nanjing all stakeholders agreed that tax exemptions for VAT, for import duties and complementary inputs stimulate the current level of pesticide application (overall averages were + 0.7, + 0.9 and + 0.4) except the representatives from the consumers association (0.0). The removal of the subsidies for pesticides at the farm were seen as discouraging on pesticide use levels by most of the stakeholders (averages varied between – 0.3 and -1.0), except the pesticide industries and pesticide dealers (respectively + 0.8 and + 1.5).

State policy

Similar to the results in Nanjing control factors were qualified as the most important determinants of pesticide use. A more effective implementation of current pesticide legislation could have a major discouraging effect according to most stakeholders (see Figure 4, overall average is – 2.4, averages varied between - 0.8 for extensionists and - 4.0 for journalists). More stringent specification for residues is also seen as a very effective way to control the level of pesticide use by all groups (a discouraging effect of - 2.5 on the average). The group of officials and the consumers' association even showed a score of – 3.7 and - 1.5 respectively. The stakeholders considered effective education and extension also as an effective way to discourage pesticide use (overall average is -1.8). Current public funding of pesticide research and extension is expected to discourage the pesticide use (overall average is - 0.7) however there were controversial assessments e.g. extensionists assessed the current funding as an encouraging factor (+ 0.2) while policymakers considered this as a discouraging factor (- 1.1).
Similar to the results of Nanjing promotion of intensive high value crops is expected to have a stimulating effect on pesticide use by most stakeholder groups except the farmers (overall average is + 1.0).
The stakeholders' rating shows that the groups expect government policies to have a huge impact on pesticide use level. This refers to improvement of residue control as well as improvement of education and extension.

Institutional framework and information

Similar to the results of Nanjing, all groups of stakeholders agreed that more information on the negative side effects as residues in food, health costs and environmental issues would have a discouraging effect on the level of pesticide use (overall average respectively - 1.8, - 2.0, - 0.9, see Figure 4).
Most stakeholder groups expect a discouraging effect on pesticide use if information is given on pesticide resistance development in pests and also if there is information on costs/benefits (- 0.7).
All stakeholders assessed that current information given by the pesticide production companies and pesticide dealers' information given to farmers do encourage pesticide use level (+ 0.5), except the pesticide dealers themselves, extensionists and some officials and journalists (- 0.8, - 0.8, - 0.4, and – 0.7).
As could be expected all stakeholders are of the opinion that more information on alternative non-chemical methods could lead to a reduction of pesticide use (- 2.0).
Assessments on the effect of illegal pesticide trade differed. This probably reflects the different opinions whether there is illegal trade or not and the way how it will affect pesticide use level. Pesticide trade companies, pesticide sellers and farmers expect almost no effect from the level of cross-border illegal pesticide trade, while the other stakeholders see an encouraging effect on pesticide use (between + 0.3 and + 2.5).
There were controversial assessments for the influence of urbanization (overall average + 0.3). Farmers, extensionists and officials expect a discouraging effect (- 1.2, - 0.4, and – 0.6) while journalists and representatives from the consumers' association a small encouraging effect (+ 0.3, and + .2 respectively).

The stakeholders' rating shows that stakeholders in both cities judge government policies having a clear impact on pesticide use level. Particularly residue control in the crops and implementation of the legislation are seen as effective ways to bring down level of pesticide use. Stakeholders of both cities see tax exemptions for pesticides and for complementary inputs as encouraging factors in the pesticide use but of less important in comparison with the state policies.
In general, the stakeholders in both cities expect that more information on the negative side effects would discourage pesticide use level. Stakeholders in Hanoi see a stronger discouraging effect of information on negative side effects in comparison with stakeholders in Nanjing. This probably reflects different viewpoints and experiences with information for farmers, politicians and public. In Hanoi the stakeholders expected that broader information on alternative non-chemical methods could lead to reduction in pesticide use.

Stakeholders' workshops in Nanjing and Hanoi

Major issues that were discussed in both stakeholder groups were:
Legal and regulatory framework of pesticide policy, design of extension and research and consumers' awareness. Analyses of the opinions expressed by the stakeholders showed that there was quite some consensus with regard to the identification of important factors. Stakeholders in Hanoi tended to give the highest scores in either direction in comparison with Nanjing. In general in both countries opinions were most different among government officials.

At the final stakeholders' workshops on crop protection policy in Nanjing the following types of options for solutions were proposed:

Policy options mainly focussing on actors' options (see De Groot, 1997):
- education of farmers because the actual process of knowledge transfer to agricultural extension officers and farmers in IPM are considered as inefficient;
- increasing the number of potential options through development of additional non-chemical crop protection methods;
- decreasing the autonomy of actors (industry, retailers, farmers) through improvement of mechanisms of control and monitoring of selling banned products in the market (both pre-marketing and post-marketing).

Policy options focusing on actors' motivations:
- education of consumers: in consumers there is a lack of interest, information in consuming chemical-low products on one side, and a lack of trust in chemical-low products actually available in the market.

Discussion

Pesticides of various kinds have been used on a large scale in China and Vietnam to protect crops from damages inflicted by insects and diseases.
Reliance on pesticides as the primary and sole mean of pest control, has shown not to be the most profitable or sustainable strategy. A number of harmful side effects are known from both countries (Thiers, 1997; Dung et al., 1999; Hamburger, 2002).
Rapid industrialization, urbanization, changing diets and environmental constraints will combine to shrink agricultural land and increase demand. Governments and market will push farmers to intensify production further. Agricultural production development in urban and peri-urban areas is proposed as means to partially meet the job and food requirements of the increasing urban population. Peri-urban agriculture in Southeast Asia has traditionally contributed to the urban environment (www.cipota.org/urbanharvest). However despite these positive externalities generated by peri-urban agriculture production activities, it has often been ignored or overlooked by urban planning authorities in their urban development plans (Waibel and Schmidt, 2000).

In this study, in which we have focussed on the constraints on pesticide use and integrated pest management focussing on two pilot areas Dong Du and Suoshi near Hanoi and Nanjing respectively. We see rapid urbanization where spatial and agro-ecological motivations play a limited role in decision-making (Guo et al., 2005; and Trinh et al., 2005).
Identification of stakeholders showed that several institutions are involved in pesticide legislation, with the Ministry of Agriculture taking a leadership role. In both countries pesticide use in both cities falls under the jurisdiction of several levels and types of authorities. In both cities intersectoral coordination (see also van den Berg et al., 2003) is very limited, as well as supervision and assistance for farmers in the use of pesticides. Our research revealed dependence on pesticides and their overuse and improper handling inducing environmental and human health hazards (Moustier, 2002; Zhen et al., 2005)

Results from interviews show that stakeholders from different institutions in both cities see government policies stimulating pesticide use like in many other Asian countries (Jungbluth, 2000). Results showed that pricing factors, factors of the information environment and the institutional setting were considered to be decisive in explaining the situation of pesticide dependency. These results must be seen against the background that participants agreed that there is a general overuse of pesticides in the vegetable production in the fringe of both cities.

To reach a more adapted and effective crop protection policy stakeholders considered several factors. Residue control in the crops and implementation of the legislation are seen as the most effective ways to control level of pesticide use particularly among policymakers. Like the findings from other countries the effectiveness of control factors in reducing pesticide use are highly valued by policymakers.
Chinese and Vietnamese pesticide laws and regulations are reasonable strong and thorough at the national as well at the local level, but implementation and maintenance is weak. Our results show that still highly hazardous pesticides are used in both vegetable production areas, however the bans on use of these products. Hamburger (2002) already suggested to combine authority for controlling pesticide production and trade in one agency and to expand monitoring of pesticide residues in food and environment. Since monitoring systems for clean food is quite expensive an independent reliable certification party would help.

Stakeholders of both cities considered tax exemptions for pesticides and for complementary inputs as encouraging factors in the pesticide use but of less important in comparison with the state policies. Repetto (1985) in his general picture of how pesticides are subsidized in developing countries (he estimated an average rate of pesticide subsidy for China of 19%), showed that pesticide subsidies may be a serious impediment to the diffusion of less-chemical-intensive techniques. For countries with limited resources of revenue taxes on some pesticides may be particularly interesting. In Vietnam the Ministry of Finance tried to impose a tax on pesticides but the decision was reversed due to the opposition of the pesticide companies (McCann, 2005). Solid scientific and economic evidence is needed to address opposition.

In the fringe of Hanoi pesticide sellers was the most important information source for about 40% of the vegetable farmers, a similar percentage to that of vegetable farmers in the fringe of Nanjing. Most stakeholders assessed that current information given by the pesticide production companies and pesticide dealers do encourage pesticide use levels. Farmers are clearly trapped in a vicious circle: frequent applications, farmers' perceptions of pests increase over the last few years, actually even higher frequency of chemical use. Changing the information environment seems to be one key to successful pesticide reduction and to break this vicious circle. In general, the stakeholders in both cities expected that more information on the negative side effects would discourage pesticide use level. They were also of the opinion that broader information on alternative non-chemical methods could lead to reduction in pesticide use and more in general the improvement of the information environment, e.g. farmers' education could be a desirable step towards less biased decision making.
Increase of governments' investments in extension and research on non-chemical solutions to pest and disease problems are imperative.
In both cities agriculture extension services lack money, technology and knowledge to advise farmers (Guo Zhongxing et al., 2005; Trinh Duy Luan et al., 2005).

In the final policy workshops, the empirical information (however limited) on vegetable farmers' pesticide use patterns and information systems helped to raise awareness in the issue and the quality of the debate. Participants agreed that the situation of pesticide dependency versus a sound environmentally plant production and protection for Hanoi and Nanjing not only is a technical issue or only depends on the private decision at the farm level or the biophysical conditions at the farm. It depends also on the social and normative context. A critical valuation of forces and structures within the governmental procedures can be regarded as a crucial step. This implies not only a transition toward less toxic products but also a transformation in the way pest management technology is developed and extended (Hamburger, 2002).

With the decentralization of authority and diversification of incentives, policymakers must learn to balance central policy goals with the needs of the individual producers or producer groups. The rise of market oriented agricultural production (including e.g. certification) offers opportunities for the transition from chemical intensive to information intensive pest management strategies. Similar to other countries inadequacies in the existing legislation, information gaps and institutional rigidities created a bias in favour of pesticide dependent ways of pest control (Pincus et al., 1997; Hamburger, 2002). In order to promote sustainable, environmentally sound development in peri-urban agriculture, political and institutional framework conditions should be changed at various levels (GTZ Pesticide Policy Project, 2000; Mooney et al., 2005).

Peri-urban agriculture has to be seen as a permanent component of the urban system. City administrators and planners need to take into account the fact that agricultural production occurs in an urban-rural continuum rather than in an isolated area. It is therefore important that effective and efficient policies are designed that exploit complementary forces between urban development and agriculture.
It is important to design urban development plans that impose specific norms for the utilisation of soil, banning unauthorised pesticide use and creating large areas for vegetable and fruit production within sustainable systems including integrated pest management. Results from our study show that formal agricultural extension services in peri-urban agriculture in the fringe of Hanoi and Nanjing are extremely limited. Extension services can play a leading role in the advice on appropriate adjustment of input supply. IPM field schools, forums where farmers and trainers debate own experiences, have catalysed more sustainable production (Van der Fliert, 2003).

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