

**Changes in Agriculture
and Environment:
a Challenge for Higher
Education**

Post graduate education in agricultural and environmental sciences
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Introduction: History of agriculture in the Netherlands and the role of knowledge innovation

The agricultural crisis late in the last century that took place in Europe, partly due to the import of cheap wheat from the new world (USA) with steamboats instead of sailing boats, caused a different reaction from different governments.

The German authorities, heavily depending on the feudal structure in that country, propagated closure of frontiers. And so did France. The English government liberalized, and was able to do so as there was a strong pull for labour from the growing industrial sector. Farmers went bankrupt and farm size and structure were adapted, enabling competition with the new world. The Dutch and probably also the Danish were too dependent on international markets to close their frontiers (Holland was already for ages a trade nation). At the same time, however, both countries were facing the dilemma that liberalization would cause big problems as more than 50% of the population was working in agriculture and alternatives were at that time absent. Therefore, strengthening of the competitive ability was advised by a state advisory body headed by the renowned liberal leader Mr. Thorbecke. It recommended (1) improvement of the infrastructure (land reclamation, adapting farm structure etc.), (2) enhancement of farmers' participation in marketing (farmers cooperations, market organization structures etc.) and, last but not least (3), strengthening of a knowledge innovation system. Extension services, agricultural education and research were started or stimulated. At that time a school for higher agricultural training had already been established in Wageningen, although formal university status was attained only 75 years ago.

Reactions to subsequent crisis situations in agriculture have followed about the same patterns in the various countries. This was clear in the thirties and fifties of this century. The British liberalizing, the Germans and French promoting protection, and the Dutch and Danish governments promoting competitive ability. At present the discussions in the European Community (EC) on restructuring of the Common Agricultural Policy show the same type of debate with the same positions. Not surprisingly, that this is also the debate in the General Agreement on Tariffs and Trade.

What is the position of Dutch agriculture and agricultural policy? At the moment Dutch agriculture has a very powerful position in high technical agriculture (horticulture, dairy, seed potatoes, seeds etc.). The export value is very high (2nd in the world), the balance of trade in agricultural products is positive and the contribution of products that are

affected by the EC market policies is relatively small in comparison with other EC countries. With these products the Netherlands is market leader. However, changes in agriculture due to technological change, shifts in markets outside and within the EC, and the increasing importance of objectives other than the traditional drive for higher production (environmental, nature conservation and landscape, maintenance of employment in agriculture) affect agriculture and its environment. For the Netherlands and other European countries the EC-policy sets the scene for any development in rural areas. In this context, mention should be made of a study on options for use of rural areas in the EC (Rabbinge and van Latesteijn, 1992). Modern techniques of simulation and systems management, incorporating both technical information and policy views as input data, were used to generate different land use scenarios in accordance with prevailing political considerations. The subject matter of such a study is of interest to both policy makers and research managers concerned with the common objective of development and application of eco-technological innovations leading to high productivity in conjunction with minimal environmental side-effects. This brings us to the subject of knowledge innovation systems, on which we would like to share some thoughts with you in the following section.

Knowledge innovation systems

The capability to generate and utilize scientific and technological innovation is of vital importance in solving the problems facing our society. A conspicuous feature of agriculture in the Netherlands is that its innovation process, more than in other sectors of economic activity, proceeds in a very organized and structured system, provided by an effective functioning of the triad research/extension/training. The knowledge innovation system should thus be viewed holistically as a kind of pyramid in which primary education, vocational education, extension, university education and applied and basic research all are essential elements, the integration of which is prerequisite for a synergistic operation of the various components.

We will now have a closer look at the Dutch knowledge innovation system and see whether it is meeting the requirements of a balanced pyramidal structure. Relevant in this context are the results of a survey on assets and liabilities of current agriculture in relation to innovation, carried out by the Dutch Scientific Council for Government Policy. According to this study (Wetenschappelijke Raad voor het Regeringsbeleid, 1991), strong characteristics of the Dutch knowledge innovation system in agriculture are:

1. The high level of training of people working in agriculture.
2. A well-developed national cohesion as well as a physical and institutional infrastructure. Concentration in a ministry of agriculture of responsibilities for the infrastructure, the economical aspects and the educational system.
3. The direct influence of farmers and horticulturists and their organizations on extension and the adaptive and applied research. The efficiency- and efficacy-oriented attitude of the whole system to improve production and productivity.

4. Homogeneity regarding common objectives and norms among the various parties involved in agriculture. This is one of the major strengths for the whole field.

Some negative aspects, identified in the same study, are:

1. Other objectives than those which are production-oriented are neither sufficiently explicitized nor incorporated into research policies.
2. Insufficient possibilities to pick up signals from the outside world, the system is too closed.
3. The way of financing research; too much input- and too little output-financing.
4. Unclear division of tasks between the ministries of agriculture and of economical affairs, and between the ministries of agriculture and science and education.
5. The decreasing interest in basic research. A reduction in the duration of university study and a too slow implementation of the envisaged structure of advanced education (the so-called second phase of academic training).

General awareness of some of these negative factors has led to criticism that agricultural policies in the Netherlands are geared too much to the interests of primary production, at the detriment of attention to aspects affecting society at large, such as environmental issues, ethical dimensions of genetic manipulation, and consequences of modern production methods for food quality and safety. Here we move into problem areas which transcend mere technological considerations and our university should be alert to these trends and play an 'avant-garde' role in fomenting incorporation of such novel elements in the educational process.

Adaptation of knowledge innovation systems is a continuing activity. An illustrative example is the impact on academic training and research by the officially endorsed long-term strategic plan for crop protection. This prescribes a phasing out of chemical pesticides, resulting in an increased exploration of alternative methods of pest control and concomitant re-orientation of research and education in crop protection.

It thus appears that the success of the knowledge innovation system depends on its cohesion, its completeness, its flexibility and its responsiveness to the environment. One of the principal components of this system is the post-graduate education and in the following, concluding section, we want to discuss some features of the post-graduate education at Wageningen Agricultural University.

Post-graduate education in the agricultural and environmental sciences

1. Institutional orientation

Wageningen Agriculture University is unique in the sense that the 65 departments of such different disciplinary fields of study, such as Plant and Animal Sciences, Biosciences and Product Technology, Use of Land and Natural Resources, and Economic and Social Sciences, are all united in *one* faculty, the 'Faculty of Agricultural and Environmental

Sciences'. The added dimension 'Environment' reflects the need to consider agricultural practices in the comprehensive context of management of our total environment. This calls for strengthening of the interdisciplinary component in the university education. Particularly so at the post-graduate level, if we want our students to provide tomorrow's expertise as needed to develop agriculturally and environmentally sound production systems.

There is a clear need for better understanding of the processes that cause inefficiencies and pollution and we have the confidence that technological improvement in combination with changes in behaviour of individuals and institutions may help to develop ecologically and economically acceptable production techniques. Of course, scientific training is just one element, but it is a vital one.

2. Wide and deep

The combination of basic and applied research is essential for the quality of training. Wageningen is a combination of a university (mainly deep) and an experimental station (mainly wide). The pursuit of academic excellence is heavily permeated with the flavour of application, but a qualitative and quantitative understanding of the processes underlying manipulation and guidance of production systems is essential. Therefore, the role of basic sciences is vital and the bridge to application is laid by various interdisciplinary, 'supra-departmental' working groups. Experience has shown that tangible synergistic benefits accrue to such cooperation between various disciplines.

3. Quality standards and collaboration with other institutes

In Wageningen, advanced agricultural scientific training is provided and an outward look is prerequisite for maintenance of standards of performance. The quality of academic training is increased by cooperation and exchange of students with universities within the Netherlands as well as, more importantly, in other countries. As Wageningen is the only place for academic education in agricultural and environmental sciences in the Netherlands, academical interaction with comparable institutions abroad is of crucial significance. The promotion of student and staff mobility in the European Community may be very profitable for Wageningen and the only way to prove whether we deserve our claim on excellence.

Another recent tendency is the increase in applied research in the so-called junior colleges for agricultural training. It would be advisable for Wageningen University to provide training, jointly with the junior colleges, towards a so-called professional masters degree. Such training, emphasizing vocational aspects, would have to be distinguished from research-oriented MSc and PhD training programmes in the university.

4. Present situation in historical context

The disappearance of the internal borders in Europe of the ninetennineties results in intensified contacts, also in higher education. A common response to this development is internationalization, which entails the offering of comprehensive academic curricula,

leading to graduation, to qualified students from all over the world. But many universities, among which Wageningen, are still grappling with problems of trade-off between interests of internationalization on the one hand and preservation of national academic traditions, perceived as assets, on the other hand.

An illustration of the difficulties in this area can already be found in the very title of my talk, '*Post-graduate Education*'. Where is the transition between 'pre-graduate' and 'post-graduate'? In the Anglo-American system the 'Bachelor of Science' degree clearly marks the entrance into graduate studies. Here in Wageningen we don't have a BSc degree. Our first title is 'Ingenieur' (Ir) and we like to think that this is superior to a BSc. Awardance of the Ir degree represents according to the here prevailing opinions more than just the conclusion of undergraduate education. It also purports to include advanced elements which would put the degree on a par with the Master of Science.

Unfortunately, many of our overseas colleagues don't seem to agree with this assessment. In a recent survey on status assigned to our academic diplomas of 'doctorandus' and 'ingenieur' in England and the United States, Bolle (1991) found that in most cases these were considered equivalent to BSc rather than MSc. Such discrepancy raises various problems for international academic coordination in agricultural education. Firstly, it tends to put our own graduates at a disadvantage when they file applications abroad, be it for admission to post-graduate university studies or for employment. Conversely, for students from abroad entering Wageningen University, for example to participate in one of our international Master of Science programmes, it is sometimes difficult to determine the level at which they should join in because of this ambiguity on which constitutes the graduate phase of the study. To speak in agricultural terms, there is a compatibility problem in grafting the Anglo-American MSc-scion on our own academic rootstock. In this context, it was interesting for us to learn from one of the contributions at this symposium (Schmidt Nielsen, 1992) that in Denmark a similar problem of international adjustment is being solved by institution of a formal BSc degree. Here in Wageningen present thinking goes in the same direction, but we are not that far yet. We now have a so-called 'BSc certificate' in our curriculum which, however, does not yet have the status of a formal degree.

In Fig. 1 we have tried to present in schematic form the present set-up as well as a proposal for modifications which in our opinion would bring our system more in line with current national and international developments. This also includes creation of a 'Professional Masters' degree which, as mentioned in the preceding section, would be the joint responsibility of Wageningen University and junior agricultural colleges.

5. Perspectives for future development

What is the present status of our post-graduate education and where are we heading for?

Until recently such training only took place in more or less informally operating, loose

networks of PhD students and their supervisors. But during the last few years moves towards a better structuring have gained momentum. Extrapolating from current trends and considering required change, we may anticipate establishment, in the near future, of four or five formal graduate schools, corresponding with the subdivision of the Faculty in so-called sectors. Furthermore the process, already initiated, of capitalizing on areas of research strength within the university by creation of so-called 'centres of excellence' (in Dutch 'onderzoekscholen') will result in improved opportunities for advanced students' training. Such 'centres of excellence' transcend traditional university boundaries to include expertise from other national agricultural research institutions as well.

At present there are in Wageningen various proposals for centres of excellence. The centre of excellence in experimental plant sciences aims at an intensification of detailed research at the subcellular level to understand the functioning of growth and development in plants and may pave the way for application in plant breeding and crop protection. There is an intensive cooperation with other universities in this field.

The centre of production ecology aims at the integration of basic research on the one hand and its application on the other. At various levels of integration, from the subcellular/individual level up to the level of land use systems, studies are done to develop concepts of sustainable land use and production systems that are ecologically and economically feasible.

In summary, post-graduate education in Wageningen is still in a state of flux with respect to institutionalization within our national system as well as to developments relating to international integration. In both areas a number of problems still remain to be solved, but it is our hope and expectation that the future for the agricultural and environmental sciences is promising.

References cited

- Bolle, C.M. 1991. The evaluation abroad of diplomas in the higher education. (In Dutch). U&H - Tijdschrift voor wetenschappelijk onderwijs **38** (2): 71-88.
- Rabbinge, R. and H.C. van Latesteijn. 1992. Long-term options for land use in the European community. *Agricultural Systems* 40: 195-210.
- Schmidt-Nielsen, B. 1992. Danish agricultural education. A small country in an open market. Proc. European Conf. Higher Educ. Agric., Wageningen, April 12-15, 1992
- Wetenschappelijke Raad voor het Regeringsbeleid. 1991. Technology and government: a closer look at some sectors (in Dutch). Report to the Government nr. 39, 65 p. The Hague.

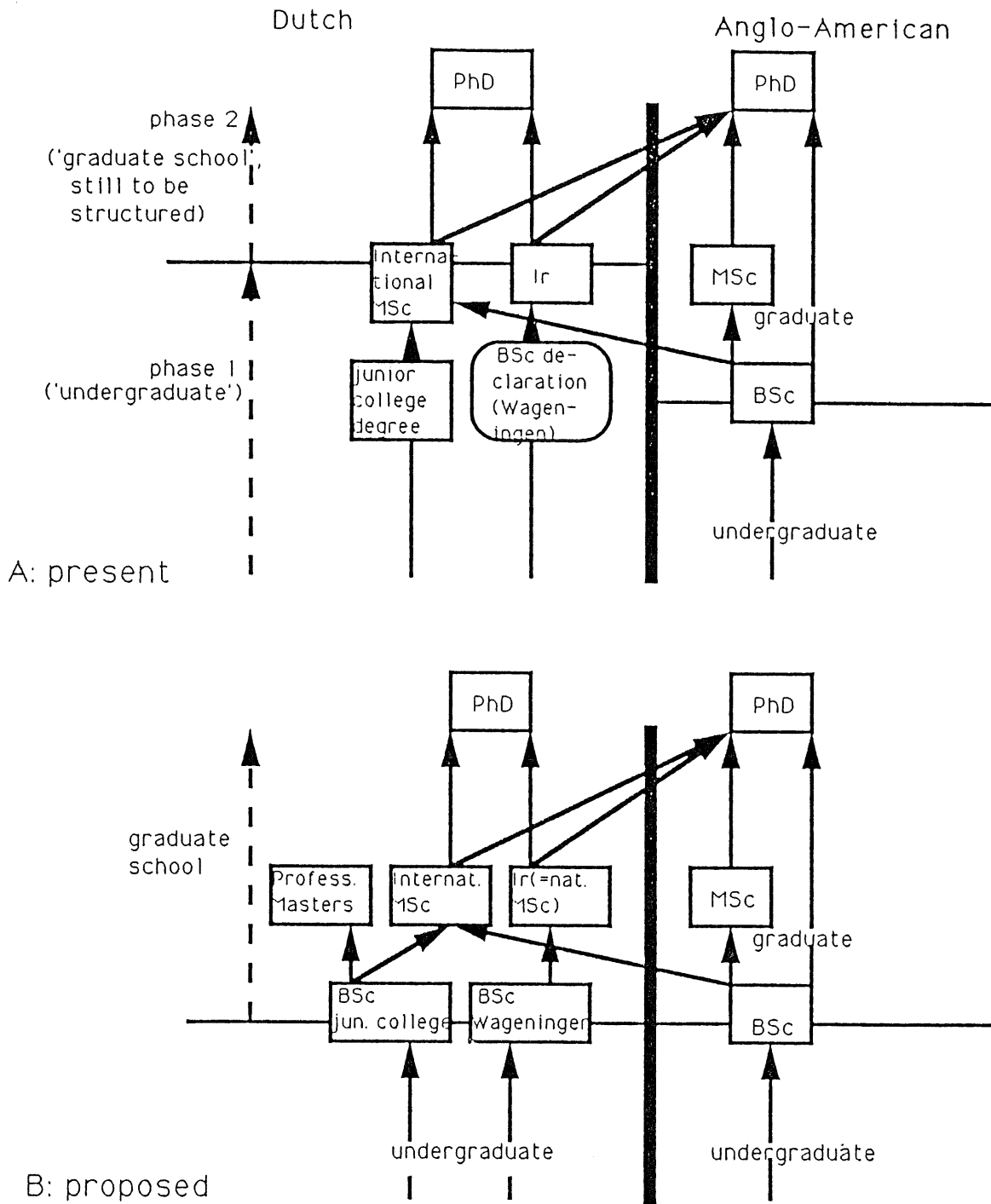


Fig. 1. Comparison between Dutch and Anglo-American higher agricultural education

A. Current situation

B. Proposed adjustments in Dutch system