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SUSTAINABLE AGRICULTURE AND EDUCATIONAL SYSTEMS, A DUTCH PERSPECTIVE

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Introduction

The FAO definition of sustainable agriculture and rural development (1986) is "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (In agriculture, forestry and fisheries sectors) conserve land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable".

Analysis of animal production systems requires, due to its complexity and multiple interactions, a systems approach. A basic element in this concept is the provision of food for coming generations, but not at all costs. This food will, among others, be based on livestock production systems with or without crop production being integrated in that system. Livestock production will be the major area of concern in this contribution to the workshop.

This contribution addresses the curricular profile at MsC level for students choosing the specialization of (sustainable) animal production systems within the context of animal sciences. Veterinary curricula will be scrutinized against this specialization.

Livestock production

Livestock production systems can be highly diverse, depending on e.g. geographical region, species involved, products delivered, functions operating, market potentials and political conditions. Classification of livestock production systems can be done according to animal versus crop based, scale of operation, resource requirement, utilization of output, level of development, source of feed (Kaasschleter etal., 1992). Intensive husbandry systems are different from extensive systems; systems can be migratory or sedentary; farm operations can be large or small, mixed or highly specialized. With such crude characteristics one may largely distinguish the systems in Western Europe from those in e.g. Latin America or Africa. Even within regions, a further characterization of production systems can be done, based on specifications such as ecological zone, cultural or religious traditions, political issues.

Around the world, the purpose of livestock production can be highly variable: from e.g. subsistence to draught power to social status, depending on the region of concern. Specifically in third world countries, livestock production

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fulfills many purposes than subsistence alone. Whereas in Western livestock production systems, which are highly specialized and intensified, the main or even only purpose is food production. Livestock development programmes over the last years have been focussing on a single product or function (e.g. increase of milk yield) without paying attention to relationships with social elements or biological/ecological elements (increased milk yield due to increased cow numbers, subsequently followed by overgrazing, erosion and health impairment). Breeding programmes often failed because they too much relied on western technology. Animal health care often failed because it was purely disease control based and not taking socio-economic or religion related aspects into account, set aside the political conditions. The over-use of insecticides has pushed away the immediate need for land use planning for the control of trypanosomiasis (Jordan, 1986). Sustainable livestock development in third world countries is hampered by the mass importation of cheap animal products from developed countries and by the trade barriers imposed against developing countries by the developed countries.

Intensive livestock production systems such as in Western Europe greatly depend on the importation and supply of feed commodities from other countries. Productivity has increased at the cost of undesired side-effects In the intensive production areas (ammonia emission, nitrate leaking, eutrophication, impaired welfare) and in the commodity supplying areas (soil depletion, soil quality loss, deforestation and erosion (De Jaeger, 1991). The Netherlands for example produce 5% of the world market dairy products on the basis of less than 0.05% of the world grassland areal. It has been calculated that for a balanced input/output The Netherlands should have at least 4 times more agricultural soil than now. The country produces so much that it ranks second on the world's exporting countries ranking list. High productivity could only be realized through high feed conversion ratios based on cheap imported feed commodities and proper management and a high health status of the animals. The latter was usually achieved by vaccination campaigns and veterinary zootechnical attention such as herd health service and extension programmes.

Food animal products

Food from animal origin is not indispensable in the diet but it has a valuable additional function in human groups such as children, pregnant and nursing women, diseased and elder people. About 23% of the per caput supply of protein originates from animal products; the variation is large between regions and cultures. For the period between 1982 and 2000 the FAO estimated an average annual increase of the need for meat, milk and eggs in developing countries of 3-4% (FAO, 1987). The last decades this need could not be fulfilled due to drawbacks in local animal productivity, resulting in increased importation. One of the possible starting points on the way to sustainable rural livestock development could be the increase of animal production per animal rather than an increase in number of animals. More liberal markets and a certain protection of third world food markets coupled to a reduction of western over-production could ultimately lead to a more balanced, sustainable livestock production (Barnett et al., 1995). Another option could be the change from intensification to extensification, or the change from bulk production to a production which would be more in balance with e.g. environmental or welfare issues (Francis at al., 1990).

Again another option is (Fresco. pers. comm.), that it could be more valuable to intensify production in smaller areas (with negative side-effects) than extensify production over larger areas (and have negative -though to a less extent- side effects). Question is, which option is most optimal for a given situation under given geographical, sociological and political conditions. More research, probably longitudinal in nature, should be performed to answer this question. On Western European intensive farm operations there is a growing

pressure from public opinion and politicians to pay more attention to the quality of animal products and production methods. This has a public health and safety implication as well as an animal welfare implication. The European territory proclaims the reduction in use of vaccines and antimicrobials in animal production, and the design and implementation of programmes to improve the overall health status of herds. The rationale behind this is based on public health issues, but also on the economics of trade and markets. Europe can be characterized by a dense network of transportation routes where both live animals and carcasses are involved. This represents a potential source and means of infection spread.

Education at university level

A regular, "classical" animal sciences curriculum comprises several stages: BSc (2-3 years), MSc (2 years) and PhD (3-4 years). The first level should lead to the mastering of theoretical and practical skills and basic knowledge in animal science and production, including elements of research methodology. Methodological and statistical education elements are an important part of this phase, next to general introductory elements such as agricultural orientation, introduction into animal production and production systems, and basic physiological courses.

The second level comprises the specialization in animal husbandry (health, reproduction, ethology), animal production systems, animal breeding or animal nutrition through theory courses and MSc thesis research. The courses are much more focussed on the area of specialization, while students can also amply choose optional elements. The thesis comprises a specific subject, design of the study, execution, statistical analysis and reporting, all within the field specialization. Additional thesis research can be done related to the specialization or related to other fields such as marketing, extension, economics, management.

A regular, "classical" veterinary curriculum is divided into 2 phases: Pre-clinical and clinical studies, covering about 5-0 years. Major field of concern is the diseased individual animal. Utrecht University has a more differentiated program, where several kinds of specializations are distinguished in the clinical phase; e.g. companion animals, food animals: in food animals not only the individual approach is followed but also the population approach (herd health), public health and hygiene of food of animal origin, although this is positioned in the final year only. There is a trend toward more specific-differentiated (cattle, pigs, poultry) and aggregation-level (individual versus popul.Liori) related education profiles. Veterinarians are trained for a profession in the field mainly. Relatively spoken, only a few will find a job in research, industry, management, policy.

The question to be answered right now is: **"how should a MSc course profile look like and why, if one has to integrate the concept of sustainability of livestock production into regular animal science and or veterinary curricula?"**.

The basis for the answer to this question can be found in the appendix, where the new MSc profiles for Animal Production Systems as elements in the education in sustainable livestock production for the Wageningen Agricultural University are listed. These profiles will become operational in the academic year 1995/1996.

MSc course profile

In the Appendix the overall study build-up for the animal science specialization in animal production systems, with an emphasis on sustainable development is given. There are 4 curricular profiles described, as a kind of optional subspecialization in this context.

The rationale behind these subspecializations is, that the chair of animal production systems (including the sustainability concept) is positioned within the animal sciences. Building on the conventional animal science profiles such as animal nutrition, animal breeding and animal

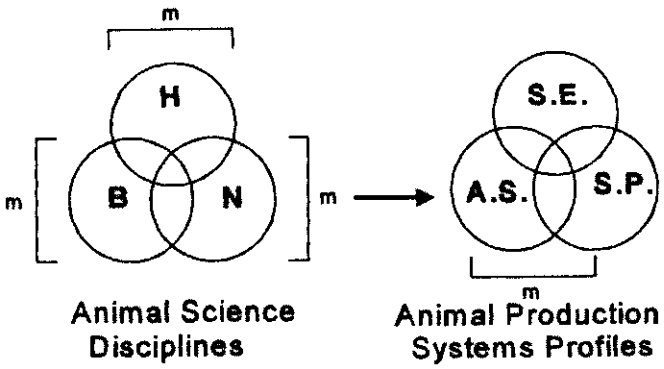

Figure 1 Schematic outline of the animal sciences disciplines, breeding (B). nutrition (N) and husbandry (H), as a basis for the profiles of animal productioin systems: socio-economics (S.E.), animal sciences (A.S.), soil-plant interactions (S.P.) and methodology (m).

husbandry, it superposes a higher aggregation level (Fig. 1). This higher aggregation level comprises socio-economic elements, soil and plant related elements, and the more methodological elements. The latter refers to one of the strong points of the Wageningen Agricultural University.

Each of these 4 subspecializations emphasize one field of systems analysis with respect to sustainability. For example, when analyzing livestock production systems its zootechnical or socio-economic issues can be highlighted. Or, as is the case in the 4-th subspecialization, the methodological aspects of production systems analysis are the major concern.

The input from veterinary science

It has been stated elsewhere, that diseased animals may represent indicators for poor performance or poor management. This is not only true at the level of the farm but also on a regional scale. The latter combines the diseased individuals with the population prevalence of disease in a region. The veterinarian may therefore play a substantial role in the early detection of disease, the curative treatment, and -more recently- in the prevention of disease. His expertise should comprise the area of risk analysis and disease prevention. He should provide the basic information needed for production systems analysis. This not only refers to animal diseases but also to public health.

On a regular basis however, a veterinarian is not trained in ecological principles nor in methodological analysis of problems or systems. Veterinary herd health and production management programmes, if applied at all, focus on health and productivity at the farm level, providing action and advice to the farmer. The region is not part of that approach. Ecological issues are not addressed.

Still, Nielsen (1990) emphasized the potentials of veterinarians, as epidemiological disease or risk investigators, in the field of the so-called ecosystems health approach. Analogous to the detection, treatment and prevention of health disorders in a population of animals, the same procedure could be followed for "disorders of ecosystems health". Yet, a lot has to be done then both at the veterinary education (epidemiology) and in adjustment of veterinary curricula with respect to sustainability concepts and methods, and ecology. The question is whether it is justifiable that a specific veterinary study profile is designed which will specifically focus on these issues. Probably not as a general rule, but possibly yes in cases where there is a need for these professionals.

Discussion and conclusions

Sustainability can be addressed from various points of view. The increasing number of publications point to the fact that the approach can be very different (Francis et al,, 1990, Barnen et al., 1995). There is no general consensus about definitions, interpretations and methodologies to measure sustainability. Therefore, choices have to be made if one desires to design an educational programma at the university level. These choices are

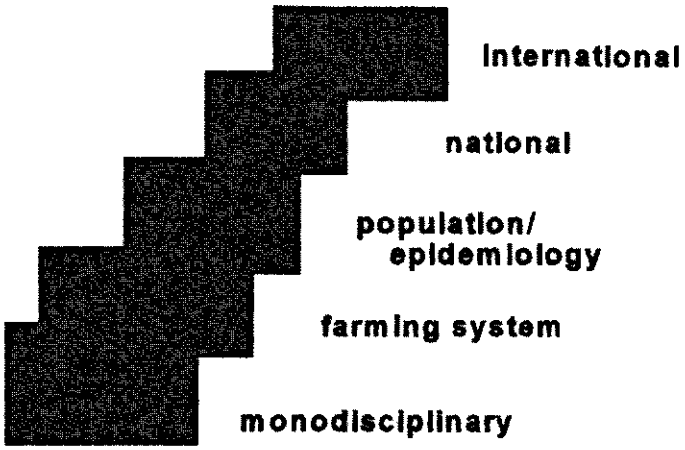

Figure 2 Hierarchical structure to research starting levels.

reflected in the study profiles listed in the Appendix for the Wageningen University.

Based on a long tradition of tropical animal production and husbandry in Wageningen, eventually the farming systems approach for the tropics has been integrated into the animal production systems approach which deals with both tropical and Western situations. Hierarchically seen, the situation is as pointed out in Fig. 2. The former approach in the tropics was disciplinary in nature, adapted to the farming systems approach (farm level) which is multidisciplinary in nature. Epidemiology including risk analysis and modelling is at the higher population level, while research into animal production systems starts at the national level. Hence it leaves room for expansion either downward or upward.

At the level of local universities the profiles may look completely different, because either the starting point toward sustainability is different (different interpretation of concepts) or the choices for the profiles are different (different needs).

One major aspect that cannot be omitted is the fact that the time component in research into sustainability is important: sustainability searches for long term evaluation, not short term -ad hoc- solutions: There seems to be a way that animal scientists and veterinarians can work together and also with other disciplines. However, the major changes in curricula seem to be warranted at the side of the veterinary schools if they desire to play a substantial role in the field of sustainable livestock production.

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Appendix

Propaedeutic year:

- conventional, basic and introductory elements of animal science
- inclusion of new elements: agricultural orientation
- introduction into animal production systems
- biology of animal production
- gastro-intestinal physiology

Common coat year:

- ll compulsory elements are (tie same for all specializations.

Specialization programma:
compulsory elements:

- design & analysis of animal experiments
- ecology. culture and agricultural society
- technology and society
- analysis animal science literature
- basic animal genetics
- feed stuffs
- analysis of livestock systems
- research thesis animal production systems

Optional elements:

- excursions
- excursions abroad
- integrated poultry science
- integrated dairy science
- integrated pig science
- tropical husbandry
- animal reproduction
- fisheries and fish production
- practical traineeship tropical husbandry
- practical traineeship animal production systems
- case studies tropical animal production
- case studies animal production systems
- grassland science
- tropical grassland science
- agriculture and crop systems
- environmental aspects of agriculture
- environmental technology

Pre-graduating year:

including **further optional elements.** MSc thesis research and a further specialization into western and non-western agriculture/livestock production. There are 4 study profiles distinguished which reflect the major areas of concern within the context of animal production systems and sustairiability:

Profile "animal science":

- this profile reflects the generalization and integration of the conventional animal science specializations such as animal husbandry (animal health, reproduction, welfare), animal nutrition, animal breeding, fisheries & aquaculture. The profile can be focussed on either a research or professional direction.

Profile "socio-economics":

- the following elements are **advised** as being supportive to the profile:
- agricultural and rural development
- agricultural sociology
- macro-economics and econometrics
- prospective scenario studies and environment
- economics of land use

economics of disease modelling

- Information technology and decision support
- environmental economy of farming
- application of quantitative models

Profile "soil-plant-animal interactions":

the following elements are **advised** as being supportive to the profile:

- application of quantitative models
- agriculture and cropping systems
- ecological agriculture
- soil science
- soil and landscape
- soil - plant interactions
- quantitative evaluation of soil fertility

Profile "systems analysis":

the following elements are **advised** as being supportive to the profile:

- optimalization techniques
- informatics
- prospective scenario studies and environment
- agricultural economic modelling
- informatics and decision support
- application of quantitative models
- systems analysis, simulation modelling
- modelling of soil processes.

Thesis research

Thesis research comprises one major and at least one minor thesis of 4-7 months and 2-4 months respectively. The major thesis should be in an area of subspecialization.

Major research areas of the department are: (1) the description and functioning of livestock production systems, (2) nutrients arid substrates flows, systems' input and output. (3) the utilization of locally grown and supplied feedstuffs. Commonly, a MSc thesis research will form part of these major research areas.

A thesis comprises the design. execution, analysis and reporting of the research. The latter refers to both written report and oral presentation.

A final exam should be passed for each thesis research.