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RESEARCH PRIORITIES FOR ANIMAL PRODUCTION IN MANY DEVELOPING COUNTRIES IN THE TROPICS

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ABSTRACT

Attention is focussed towards many areas in which better management of local feed resources can lead too much greater nutrient extraction from crop residues. Appropriate methods of feed evaluation, preservation, harvesting methods, upgrading and plant breeding were discussed. Attention was also given to aspects of total feed resource management with integration of monogastric animals and ruminants and the use of biogas from excreta and biogas slurry for fertiliser or nutrients for fish or crops in ponds.

INTRODUCTION

In recent years it has become clear to many developed countries in Europe and Asia that specialistic and intensive animal production system are neither sustainable from an environmental point of view nor desirable from public opinion point of view. Large super-markets in Europe begin to set standards not only for meat and food quality but also how the meat and plants are produced. They demand to know whether or not hormone implants have been used in the production or whether antibiotics have been used as growth promoters such as monensin or whether genetic manipulation in plants have been introduced. There are several difficulties occurring between Europe and Japan on the one hand and USA on the other, as animals from USA are almost all hormone implanted and feed on various forms of growth promoters including antibiotics and some feeds such as soya have been genetically manipulated. In most developing countries the use of hormone implants and use of growth promoters and indeed intensive animal production systems except for poultry are much less prevalent and it would be unwise to go that route both from the point of view of environmental sustainability and resources use and from the point of view of future public perception. In fact in many countries with high human density and often scarcity of land even intensive poultry production can be very vulnerable if they are based on imported feeds. Large currency fluctuation can virtually destroy such industries, as prices of poultry products cannot be increased in line with currency fluctuations. Indonesia has recently experienced such problems. It can also be influenced by political consideration as exporting countries can assist in establishing intensive animal production systems on which cities can become dependent. Such exporting countries can therefore exert power when the industry has been established. It is important therefore that research is carried out with the objective to maximise use of local feed resources. This has implications both for animals and feed resources. Matching animals and animal production systems to local feed resources is sustainable both economically and environmentally. In the following I will discuss some of the research issues that can contribute to better use of local resources and discuss also some aspects of total and sustainable feed resource management.

Evaluation of Roughages for Ruminants

Most western systems of feed evaluation are based on static measurements of digestible metabolisable or net energy and no account is taken of how much the animals can eat. These systems are excellent for concentrate feeds, which impose no physical limitation to intake but have limited value for systems in which roughages are the main source of feed for ruminants. New systems need to be developed both for farmers and planners of livestock production, which can give information on the intake potential as well as the energy value of feeds so that the

potential level of production from the feeds can be assessed. Some suggestions have been made about this subject Ørskov (1994) and this subject is also actively pursued at Gadjah Mada University in which description of feed potential is made from information on degradation characteristics measured by incubating nylon bags containing the feeds in the rumen.

Evaluation of Capacity of Different Breeds of Animals to Consume Roughages

In line with the above suggestions of investigating feed potential it is also essential to assess the capacity of animals to consume roughages. Uncritical importation of so called high potential or up-graded breeds of cattle in many parts of the world have created enormous problems since they are only high producing as long as they get large amounts of concentrated or very high quality feed. If the local roughages only are given these animals often perform poorer than local animals and since their potential for milk production or growth rate is high they will attempt to achieve their potential by using endogenous energy and protein. They cease cycling which obviously reduces fertility and due to depletion of protein they often reduce their immunity to local diseases. Often their gut volume and their capacity to consume roughages are low. There is however lack of data to substantiate these observations and we need critical comparisons of intake capacity of different types of cattle including buffaloes so as to better match animals to feed resources. It is generally not sustainable to do the opposite of adapting feed resources to match the animals.

Upgrading of Crop Residues

While much progress has been made in this field there is still room for much improvement. Huge amounts of crop residues particularly straws, stalks and stovers are under-utilised due to the fact that insufficient nourishment can be extracted from them. Treatment with urea as a source of ammonia has been very successful in some countries e.g. China where this technology is particularly useful for small farmers. For large scale treatment anhydrous ammonia has been equally successful. However in some areas urea may not be available at all times or too expensive in relation to the improvement in nutritive value.

Upgrading using microbial fermentation need to be further documented. If successful this can be accomplished with low organic matter loss then this is a very cheap process for improvement of the nutritive value of crop residues.

Selection for Better Quality of Crop Residues

There is a great deal of evidence to indicate that there are large variety differences in nutritive value of many crop residues including barley, wheat, triticale and oat straw (Tuah *et al.*, 1986) rice straw (Hermanto *et al.*, 1992) and millet (Kristianson 1998). Yet only little progress has been made. Plant breeders have so far shown very little interest in breeding for quality of crop residues even though the evidence so far indicate that selection for quality of crop residues can be pursued without loss of quality and yield of grain or seed. As nutritionists we now have much more rapid and reliable methods of measuring straw quality. Estimation of quality of crop residues can now be performed at an early stage in the selection process. Improvements of 10% in digestibility can make enormous implications on productivity. In Table 1 from Ørskov *et al.*, (1988) some examples of how differences in straw quality can influence animal performance are given - these differences are virtually free of cost.

There may also be possibility of botanical separation of leaf and stems as stems can be used for industrial purposes and leaves as animal feed.

Methods of preserving crop residues

Many crop residues from harvesting in wet seasons such as many crops of rice, are wet at harvesting and vulnerable to mould and rapid deterioration. Developing methods of preserving crop residues could be highly rewarding particularly in areas of feed shortage in dry seasons - such examples can easily be seen in Java where many dairy farmers have shortages of feed in dry seasons yet not very far from these areas a great deal

Table 1. Effect of variety of barley straw and ammonia treatment on digestibility and growth rate in steers receiving also 1.5 kg of concentrate.

Treatment	U - untreated A = ammonia treated.							
	Variety		Gerbel Igri		Corgi		Golden Promise	
	U	A	U	A	U	A	U	A
Digestibility (%)	40.9	48.7	41.2	45.5	48.4	59.6	45.2	50.6
Live weight gain (g/d)	106	359	126	332	400	608	198	602

of rice straw is wasted in the wet season. Technologies to assist in preservation of wet rice straw needs to be developed. It may be possible that cellulase enzyme additions can solubilise sufficient cellulose to glucose so that it may be possible to preserve rice straw as silage. Other alternative is to use ammonia also as a preservative.

Post Harvest Losses for Crop Residues

There, is remarkably little information available on post harvest losses in nutrients. In crop residues, rice is harvested by several methods sometimes the grain head is harvested and the straw while still green is left in the field for harvesting later. It would be important to provide information on the nutrient loses that could be avoided if the green straw can be dried or preserved by other means while green. This applies also to the maize and other grains.

Total Resource Management

In many areas of the humid tropics there are numerous examples of good total resource management. Examples are seen in countries like China and Vietnam and also Indonesia where for instance excreta from monogastric animals are given to ruminants, and where excreta from ruminants are used for biogas. Biogas slurry can be used to fertilise fishponds or vegetable production from ponds or used as manure. There are examples of fish and ducks interacting positively with rice in paddy field where they can consume weeds and harmful snails or other pests.

There is an urgent need to provide quantitative information or how nutrient flow via different route influences soil fertility and as a consequence plant production. What for instance is the effect of NPK supplied by artificial fertilizer, supplied by poultry manure after feeding to cattle or supplied by biogas slurry. These are complicated experiments requiring multi disciplinary teams of animal plant and soil scientist as well as microbiologist. The tropics offer so many more opportunities for flexibility in resource management than temperate zones. For instance small scale biogas units are difficult to sustain in temperate climates.

Looming peri-urban problems

In many developing countries intensive systems of animal production are increasing rapidly in peri-urban areas. This system relates mainly to poultry and pork production but also intensive beef and dairy cattle units are established. This invariably means import of vast quantities of food both from areas within the country and from other countries. It is important to remember that feeds also contain fertilizer in particular NPK. Some areas of the world notably Holland, Japan and Taiwan came to recognise potential problems with their type of animal production too late and after soil and water had become polluted with NPK. The nutrient balance can be very positive in such areas. There should be a great research priority not only to carefully monitor changes in nutrient balance in such areas but also to ensure that the feeds brought in are extracted for all nutrients. For instance poultry manure is less polluting if it is fed to cattle first and cattle require less concentrate if they are fed on poultry manure. Straw brought into the area can benefit from upgrading so that more production can be achieved from the same organic resource. Once polluted with excess P and K the soil is not easy to restore. There

are few models of such holistic approaches to nutrient cycling and its consequence to animal plant or fish production and indeed for soil fertility. However they are needed and offer fascinating new insight. Such studies are required both to maximize use of renewable biomass and to ensure sustainability. It is much more important to pay attention to biomass utilization than to genetic manipulation of plants.

If food production is limiting in certain areas of high human density e.g. South East Asia there is a possible option of achieving higher production from genetic manipulation of plants and we must keep an open mind for science. Unfortunately this route has at least 2 drawbacks. Firstly it benefits mostly the shareholders of companies producing such plants. Secondly higher yields can only be possible with high fertilizer input which can bring long term adverse consequences to soil fertility. Using feed resources better can benefit the environment, create more work and markedly increase human food production.

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