

KEYNOTE SPEECH OF THE INAUGURAL SESSION

Experiences with Agriculture in Asia with Emphasis on Sustainability

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Introduction

It is a nice occasion to visit Sri Lanka. Having had the privilege being involved in many rural development projects in about 40 countries in Africa, Asia, and South America, I would like to discuss some experiences and contrast the systems with western systems and seriously question whether western agricultural practices should be promoted taking into account environment sustainability and socio-economy.

Western Agricultural Systems

It is possible to write many books on western systems which mean that only generalization will be made here. The biggest change in direction took place after 2nd world war where due to inadequate food supplies governments in Western Europe, USA and to a lesser extent Australia and New Zealand put emphasis on increasing crop animal production. Due to the high cost of labour this gave rise to specialised crop and animal production. Until then animals were kept on almost all farms consuming some complete crops and crop residues and their manure from winter keeping was spread on the cropping areas.

Another perhaps even more important aspect was the low cost of fossil fuel relative to labour costs. Fossil fuel in effect became a substitute for labour with the high degree of mechanization supported by fossil fuel. Animals to a large extent became separated from the land in particular pigs and poultry but also to a large extent ruminants with indoor fattening in feed lots and large dairy units. Crop farms became separated from animal crop by products were under-utilized and in animal farm excreta became an expensive waste products while before it was considered as resource. There are now some controls of disposal of animal excreta in some countries to avoid pollution problems.

This whole emphasis on monoculture for crops became supported by techniques to sustain it as long as possible crop varieties were selected for main crop only with no emphasis on the value of crop by-products as animal feed. Though it was shown categorically that the quality of straw for instance, had no relationship to quantity and quality of grain (Tuah et al., 1986).

Varieties that could respond to the maximum amount of fertilizer were and still are chosen. Herbicides became a part of growing crops rather than achieving some control of weeds by crop rotations as was previously practised.

Agriculture in so called Developing Countries:

Complementary Multiculture:

This system is often seen in densely populated areas. In so called developing countries crops, such as cassava, normally harvested once/year are grown together with legumes eg. Groundnut and Soyabean etc. the leguminous crop, no doubt, contributes to the soil nitrogen economy. Such systems with different harvesting times are labour consuming, but as labour is generally not a limitation, labour saving devices provide no solution. Such systems are useful for soil fertility. A herbicide resistant monoculture, is certainly not a solution. In many areas leguminous trees eg. Sesbania, Caliantra, Glyricidia and Leucaena are grown on the edge of roads and edges between small fields of rice.

These trees have several functions. They accumulate N, and are thus likely to benefit the crops. Their branches are widely used as fodder for sheep and goats in the dry season, the wood is used for domestic fuel and other purposes and their roots contribute soil stability.

Multiculture with Rice, Ducks and Fish:

Another aspect of multiculture is illustrated in Table 1 from Minh *et al.* (2003). Here instead of using herbicides in the paddy fields ducks were introduced. The result was duck production as well as rice production. In fact there was no reduction in rice yield. After this fish (Carp and Tilapia) were also introduced together with ducks for growing, or egg laying. The rice yield slightly increased but the total benefit to the farmers increased by more than 20 times per unit area of land. No doubt, there was more labour involved, but an introduction of herbicide resistant rice would have eliminated the need for both fish and ducks and would have further increased cost. There are many options like this that can be explored with both environmental and socio-economic benefits.

Table 1 : Integrated system of rice, rice plus duck, rice plus fish and duck on net financial benefit to farmers
(Mill Vietnam Dong/ ha) (1 USD Approximately 15000 dong)

System	Rice	DuckRice	DuckFishRice	Layer Duck Fish Rice
Inputs				
• For rice	6.62	3.92	3.92	3.92
• For duck	-	8.70	8.70	52.92
• For fish	-	-	13.90	13.90
Total	6.62	12.62	26.52	70.74
Outputs				
• From rice	8.56	8.03	9.85	10.44
• From duck	-	14.50	14.50	68.02
• From fish	-	-	46.39	47.92
Total	8.56	22.53	70.74	128.38
Net benefit	+1.94	+9.91	+44.22	+55.64

Use of Manure for Biogas Slurry:

For many years Vietnam but also in China animal manure and indeed human manure and chicken manure is fermented and the has been used for domestic cooking. Such biogas fermentations are sometimes sophisticated but can simply be plastic tube may be 10m long and 1m wide. The biogas slurry can then be used to fertilize a fish pond and the water used for irrigation or a bit can be directed to a duck weed pond and fertilize duckweed which then in turn can be used as high protein feed for pigs and poultry. In fact sometimes the value obtained from manure can be greater than that obtained from the animals.

Increased Food Production by Small Farmers:

There can't be any doubt that, if at all possible, an increased urban demand for food must be produced by local farmers and in this process help to relieve rural poverty. If we accept this concept, which seems reasonable as it will help to achieve the millennium goals rather than adding further to disparity in wealth and contribute to agribusiness shareholders from other countries, then we must learn to understand the constraints of small farmers and how they can help to increase production when needed for urban population.

One of the most important issues to understand where we wish to stimulate small subsistence farmers to produce more is that poor people can't take risk or even a very little risk. This is the same all over the world. In many respects livestock is used to minimise risk rather than in market oriented systems where profit maximisation is important issue. The way to minimise risk depends very much on the production etc. There are so many examples of how small farmers sometimes react quickly fast to increase production if risks are minimised in fact more than large farmers do (see table 2).

Table2: Comparison of animal function in marked oriented and social value oriented systems

Particular Goals	Large farms market oriented	Small Farms social value oriented
Economic Goal	Profit maximisation	Risk management
	Cash generation	Family support
	Productivity	Stability and sustainability
Products	Single purpose	Multi purpose
Control of environment	Human control	Environmental control
Breeding goal	Homogeneity	Biological diversity
Philosophical approach	Specialistic	Holistic
Scientific approach	Single discipline	System discipline
Statistical emphasis	Mean	Variance
	Main effects	Interactions

Source: Ørskov and Viglizzo, 1994

For instance, when Zimbabwe gained independence from the UK, there was a lack of food, eg. Maize. The government there undertook to underpin or guarantee a minimum price for maize. This enabled the small communal farmers to make loans to buy fertilizer and the next year Zimbabwe was exporting maize due to the production from communal farmers.

Agricultural Education:

Being an agricultural teacher, of course I am biased here, but informed by external circumstances. For small rural subsistence farmers it must always be remembered that he is holistic not specialistic. His livestock must be seen in relation to soil and plants and the communities. Sometimes university teaching is very specialistic, so advice to farmers may be incorrect. There is seldom an agricultural system department. For instance, in Java multi-culture is

common on farms-Groundnut, Cassava, Corn, Soya, growing together. If you like to know about the combination, the farmers often know better than research people as they seem to be taught more about monoculture and single purpose animals while they often use complementary multiculture cropping systems which as mentioned before, may be more labour consuming than mono-culture, but it is generally good for soil quality and labour is not generally the limiting factor.

One problem is that university teachers are more often rewarded for publications in international journals than for doing research needed by local farmers.

Stimulation of Formation of Local Co-operatives:

The formation of local co-operatives when the farmers are producing similar products for sale be it livestock or crops, can also have great benefits. In effect a group of small farmers they can act like large farmers and be respected by traders. Local traders can't cheat small farmers when they can act like large farmers and be respected by traders. Local traders can't cheat small farmers belonging to cooperatives. The co-operatives can also help to standardise the quality of their products. It is essential that the co-operatives are bottom up and not top down. It must be controlled by local people. There are many examples of how small local operatives have helped to reduce poverty and create more stable prices and standard products.

A recent interesting discovery in Kenya was the ability of small farmers to get mobile phones. Middle men used to go and buy products from the small farmers and sell them at a profit to shops in the nearby town. Now the farmers can contact the shops and ask for prices of the products so the middleman has lost his job which of course is good for the farmers!

Animal Adaptation to Different Climates:

This is of course a very important issue; animals are adapted to suit the climate which is often ignored. For instance Friesian cattle have problems in hot climates. In hot areas the feed intake becomes limited by the heat dissipation capacity as at least 50% of intake of metabolisable energy has to be dissipated as heat. The yak cattle on the Tibetan Plateau in China are adapted to low oxygen as it is 3000m up. Take them to lowlands and they do not do well. Sometimes farmers in rich countries change the climate to match the animal need.

I have seen Frisian cattle in the tropics kept in air conditioned houses but on the whole it is better to have the animals adapted to the climate. Here of course could be another problem namely unpredictable climate changes which seem to occur more and more, creating many problems which needs also be discussed in more details. To what extent are humans responsible? Is the problem associated with more use of fossil fuel to cultivate fields rather than animals and humans?

Animals in Agroforestry: Grazing Under Coconut Trees:

Animals grazing under trees are of frequent occurrence, although such animals are thought by many to damage forests, mainly through browsing on the trees themselves. Seldom have measurements been made. I became involved in a joint project on grazing within coconut plantations.

This was a joint project with the Coconut Research Institute in Lunuwila As you know areas of Sri Lanka are covered with coconut plantations owned, both by large industries and by small farmers. Coconut trees do not form a dense canopy so it is always possible to grow other plants under the trees. In many instances cattle are seen grazing under

the coconut trees. Here it is often the case that the owners of the coconut trees are not the owners of the cattle. Cattle are owned by small poor farmers and usually the owner of the coconut trees lets them graze at no cost. An experiment was setup to graze cattle under the coconut at high stocking rate. In fact the animals were having much less food than they needed for maximum growth and reproduction.

The results are given in the table 3 from Pathirana *et al.* (1996). The animals were old at first calving, calving intervals were long and milk yield was low. Supplementing with imported rice straw improved the animals reproductive performance and if they were also given rice bran performance was further increased so that the calving intervals then normal at 13 months.

Table 3: Effect of grazing and supplementation on coconut yield, animal production and soil water holding capacity for six seasons (Pathirana *et al.* 1996)

Treatment	Coconut yield nuts/ Palms	Copra kg/ palm	Calves/ animal/year	Lactation kg/ Year	Lactation days/ year	Water holding capacity 0-10 cm mm/m
UG	41.1	11.1	-	-	-	16.9
G	47.9	13.3	0.3	181	201	18.3
GS	50.6	14.1	0.6	405	264	18.9
GSS	57.4	16.7	0.9	664	282	17.6
SEM	2.0	0.5	0.03	25	4	-

UG-Un-grazed, G-Grazed, GS-Grazed and supplemented with rice straw, GSS-Grazed and supplemented with rice straw and rice straw and rice bran, SEM- Standard error of the mean Just grazing increased coconut yield by about 15%. No wonder the owners of the coconut trees encouraged the small farmers to graze their animals under trees! The increased yield was probably due to a rapid turnover of biomass and to the effect on soil quality, recorded here as water holding capacity as a result of carbon sequestration.

Similar observations have been made with animals interacting with oil palms. Devendra (2004) reported that grazing of cattle and goats under oil palms always increased oil palm yield. In Sumatra, Indonesia it was found that even with full canopy of oil palms there was enough food including palm leaves and core from palm fronds to feed two cattle per ha and still increase palm production. There is insufficient data available to document the positive effects on soil and production of forest products when appropriate animals are integrated with such systems.

Conclusion:

There are many and often interesting issues to write and speak about but here are just a few for discussion.

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