APPROPRIATE AND INAPPROPRIATE BIOTECHNOLOGY FOR DEVELOPING COUNTRIES

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Content

Summary

In this chapter the aspect of appropriate or inappropriate biotechnology is discussed. It is concluded that in developing countries the present genetically modified (GM) crops have little or no place but serve mainly to cause dependence on agribusiness and totally inappropriate and generally aggravates rural poverty rather than contribute to poverty alleviation [see also – *Why Genetic Modification arouses Concerns – Social, Cultural and Political Impacts*].

It is argued that plant breeding need to focus on the best aspects of complimentary multi-cropping be it crops or grazing under trees or leguminous and not leguminous crops grown together and possibly harvested at different times to support soil fertility and the most appropriate crops to suit different climates and product demands and with future emphasis on crops for food, feed and fuel and with emphasis on total resource management [see also – *Conventiojnal Plant Breeding for Higher Yields and Pest Resistance*].. In some areas there may also have to be given attention to selection for more draught resistant varieties as a result of climate change

1. Introduction

It is of course a large subject. First of all what is the definition of a developing country? Somebody may define it on the basis of average gross domestic product (GDP) but this tells you little about the wealth distribution which may be more important than the average GDP. In this article we are concerned about agriculture and the place of biotechnology then immediately we have the question is the GDP the same in rural and urban areas? and here there are also problems. As a generalization rural poverty is much more prevalent in Africa and Asia than in South America. While there certainly are rural poor in several countries in South America such as Bolivia, Peru and Mexico, Argentina. etc. ; there is probably much more urban poverty due to the political development. People have migrated to the cities in search of work and many large cities

they have millions of poor people eg. Mexico City, Rio de Janeiro and many others.. In effect cheap fossil fuel became a substitute for labour through mechanization in latin America as in the developed countries There are many large farms in many South American countries and mostly very small farms in Africa and Asia.

In Africa and most of Asia by far the largest proportion of the population live in rural areas. In some dry areas where crops are not grown but where the people are nomadic or trans humance there is presumably little or no potential interest in biotechnology so in the following emphasis will be given to areas where crops form a large proportion of the food for humans. In this respect there are a few principles which are common and which must be understood in order to discuss the title I have been given for this paper.

1. Labour on the whole is relatively cheap and plentiful. The cost of labour relative to fossil fuel is generally such that large scale mechanization is not economical or suitable. In recent months this has further increased due to rapid increases in fossil fuel prices.
2. The farming system is generally mixed farming with appropriate livestock e.g. poultry, pigs, sheep, goats, cattle and camels interacting with soils, plants and people. Manure from livestock is important sources of fertilizer.
3. Multi-cropping is often used particularly in densely populated areas i.e. several crops often complementary crops grown at the same time e.g. cassava or maize gown along with groundnut or Soya and other crops. Harvesting at different times. Labour consuming but since labour is not a problem mechanized monocropping is not a solution.
4. Growing of rice is often combined with duck and fish production
5. Animal generally multipurpose e.g. cattle serve functions of security, draught power, manure, milk, meat etc. seldom single purpose animals as in so-called developed countries.
6. Small farmers grow food first of all for sustenance of family. To grow food for sale then risk management is very important. Farmers can generally produce more than they do but need sufficient infrastructure for marketing and stable prices and maybe underpinned prices so that they can take the risk of investment in more fertilizer etc., the biggest obstacles is sometimes WTO seem not to understand these principles.
7. Recently grain prices have doubled due to use of arable land for production of biofuel. Fossil fuel prices have increased which will have great consequences for future animal production . The limitation of fossil fuel in Cuba as a result of Sovjet union breakdown has already led to migration from urban to rural areas and increasing use of animals for land cultivation.

Given these principles where can such crops like herbicide resistant grain or other monocrops find a place? While these crops to a large extent are not allowed in Europe due to inadequate research into long term effects on human health, soil fertility etc. there is virtually no where a place can be found. It will only be suitable in systems of monocropping where the cost of weeding is high (see also 6.58.7.13 – *Farmers and Plant Genetic Resources).* In areas where multi-cropping is practiced the weeds are often fed to the animals. In addition to this farmers become dependant on agribusinesses to supply seeds. Even if such crops could theoretically yield more as

mentioned under 5 small farmers can easily produce more if infrastructure and marketing was improved with stable prices . The introduction of BT cotton to small Indian farmers have created large problems for small farmers as they are encouraged to buy BT cotton with high use of pesticides and compete directly with cotton farmers receiving large subsidies in the USA and has led to increased poverty. In situations where ducks and fish are combined with rice growing clearly introduction of herbicide resistant rice has no place.

Systems	Rice	Duck Rice	Duck Fish Rice	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**	**126.38**
Net benefit	+1.94	+9.91	+44.22	+55.64

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)

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 that fish, Carp and Tillapia were also introduced together with ducks for growing, or egg-laying. The rice yield may have been slightly increased and the total benefit to the farmers increased by more than 20 times per unit area of land. No doubt, there is a 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. Clearly introduction of herbicide resistant rice have not place.

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Biographical Sketch

Professor Ørskov has worked with many international organisations including FAO, IAEA, DFID EU and ILRI in project identification and evaluation in the area of feed resource management and rural development with emphasis on livestock nutrition. He worked for many years at the Rowett Research Institute in Aberdeen and more recently in the Macaulay land use Research Institute Aberdeen.

The International Feed Resource laboratory provided appropriate training to support the projects. Subsections of the International Feed Resourse Unit has now been established in Kenya Indonesia and Cuba. He has worked in many countries in Asia, including Indonesia, Mongolia, China, India, Philippines, Vietnam, Thailand, Cambodia, Syria, Iran and Turkey. In Africa including Egypt, Tunisia, Zimbabwe, Zambia, Kenya, Tanzania, Malawi, Mali, Nigeria and Ghana, in South America including Cuba, Peru, Argentina, Uruguay, Brazil and Chile and also in Eastern Europe including Poland, Czeck Republic, Slovakia and Hungary. He has also recently conducted nutrition courses in Indonesia, Thailand, Syria, Argentina, Sudan, Turkey, China, Vietnam and Uzbekistan.

He has published 5 books and author or co-author of over 550 scientific papers and popular articles on nutrition and feed resource management.