Intensification of crop diversification for regional food security

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Harvesting in Sri Lanka

Crop diversification can be a useful means to increase crop output under different situations. Crop diversification can be approached in two ways. The main form and the commonly understood concept is the addition of more crops to the existing cropping system, which could be referred to as horizontal diversification. For instance, cultivation of field crops in rice fields or growing various types of other crops in uplands have been defined as crop diversification.

However this type of crop diversification means the broadening of the base of the system, simply adding more crops to the existing cropping system by utilizing techniques such as multiple cropping coupled with other efficient management practices. The systems of multiple cropping has been able to increase food production potential to over 30 t/ha; with an increase of the cropping intensity by about 400-500%.

The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. This could be illustrated by using any crop species, which could be refined to manufactured products, such as fruits which are canned or manufactured into juices or syrups as the case may be. The vertical crop diversification will reflect the extent and stage of industrialization of the crop.

It has to be noted that crop diversification takes into account the economic returns from different crops. This is very different to the concept of multiple cropping in which the cropping in a given piece of land in a given period is taken into account. Besides the above, some other terminologies are also used to define crop diversification.

Crop nutrition

There are terms such as "crop substitution" and "crop adjustment". It is necessary to indicate here that crops substitution and adjustment are linked to the main concept of crop diversification and are strategies often used to maximize profit of growing/varieties of crops. The level of diversification will also be different in various countries. Diversification at farm level will involve growing of several crops for achieving self-sufficiency, but it may be totally different approach at the national level. Crop diversification at national level will demand more resources and require selection and management of a specific crop or a group of crops sold freshly or value added to achieve higher profits.

There are several advantages of crop diversification, which could be listed as follows;

. Comparatively high net return from crops
. Higher net returns per unit of labour
. Optimization of resource use
. Higher land utilization efficiency
. Increased job opportunities

To achieve above benefits, the process of diversification should be changed from very simple form of crop rotations, to intensive systems such as relay cropping and intercropping to specialization by diversifying into various crops, where the output and processing etc. could be different. This process could be similar at farm level and national levels.

As stated earlier, of primary constraint for achieving food security is the low yield per unit area, high population pressure, and negligible scope for expansion of the area of land for expansion of cultivation. Under these circumstances available options will be crop intensification and diversification through the use of modern technologies, specially seeds, fertilizer, irrigation, mechanization of agricultural production, post harvest processing, storage, marketing and development of new technologies by research.

Major contribution towards increased yield and sustained production could be achieved by using fertilizers and manures. The actual usage of fertilizers are generally lower in the developing countries than in developed countries and dangers of overuse as observed mostly in the highly industrialized countries has not been a problem. Organic matter usage has been less in most countries, but their incorporation into the agricultural systems will make the soils fertile and less degradable. Several problems exist in the use of organic manures such as the volume required, time, labour and opportunity costs.

Another recent development is in the development of crop rotations, a strategy towards diversification of agricultural systems to increase productivity and crop yields. These involve the insertion of green manure cover crops or other legumes to the farming systems as seen in several countries. The popular crop mixes are legumes in maize and other cereals.

The consumption of fertilizers in terms of plant nutrients is a reliable indicator of nutrient usage by different countries in the region. During 1973 - 1983 nutrient consumption increased from 17-35 m/mt. During 1988-1997 further increases have been recorded from 47-63 m. mt in developing countries of the Region, with an average annual growth rate of 3.7%. The countries using highest rates of fertilizer nutrients were China (36m.mt) and India (16m.mt). The developed countries of the region, Australia, Japan and New Zealand also recorded average annual growth rate of 9.3%.

Although the rate of fertilizer used had increased, per hectare consumption has been less impressive. Many of the developing countries use less than 20 kg. nutrients and this is regarded as a major reason for low yields. In 1997, the highest rates of fertilizer/ha has been used by Republic of Korea (471 kg) followed by China (266 kg), Vietnam (218 kg) and Malaysia (158 kg). Among the developed countries of the Region Japan has used the highest amount of nutrients 366 kg. followed by New Zealand (211 kg).

Agricultural mechanization

Further analysis of nutrient usage indicates that a large proportion of the fertilizer is used in rice cultivation and insignificant amounts for other field crops. It is necessary to increase the use of fertilizers and manures to ensure high crop responses to the applied nutrients. It is also necessary to encourage the use of organic fertilizers to renovate soils, and improve their physical and chemical properties and biological activity of soils. Slow release organic fertilizers are also used in some countries where about 80% of total nitrogen is present as organic nitrogen.

At normal soil temperatures 27 Centigrade, about 60% of this nitrogen is released over the first four months. The losses due to leaching and volatilization will be less, hence the efficiency may exceed that of mineral fertilizers in the locations, where these processes are likely to occur. However, these are not freely available in most of the developing countries of the region.

The farm power include, human, animal and mechanical resources. In developing countries 80% of the farm power comes from humans. There is a trend in the shift of labour from agriculture to industry in most of the developing countries. This has already taken place in the developed countries. This would mean that the few remaining in agriculture will be required to produce food for more and more people living in urban areas, showing 7% growth per year. Besides labour costs are escalating, accounting for a high proportion of the cost of production. For instance, in Sri Lanka approximately 50% of the total cost in rice production is accounted by labour. Sometimes, labour is not even available at a price during seasons and lands are left fallow due to shortage of labour.

On an average a farmer using his own labour could feed himself and three others, using draft power he can feed 6 persons and use of tractor could increase number to over 50. Hence, it will be futile to believe that the regional food demand could be met by traditional farming systems. Therefore mechanization will be an urgent need for all developing countries in the Asia-Pacific Region and benefits of machinery use in generally is apparent.

The use of appropriate farm machinery in the production chain will make farming more efficient and enable them to diversify cropping by growing more crops. In many countries mechanization at various levels has lead to improved yields and high labourer productivity. It is reported that in China use of mechanization has lead to 10% yield enhancement, and 15% if irrigation is included. Use of machinery for harvesting and processing increase yield by simply reducing crop losses. The post-harvest losses in developing countries are reported as 20 - 40%. Saving this amount is equal to increasing the yield without any added costs. Use of agricultural machinery shows an upward trend in the region.

The agricultural tractors in use have increased from 2.2 - 3.3 million over the period 1977 - 1987 showing a growth rate of 4.2%. Some countries of the region has developed local agricultural machinery manufacturing industries. Sri Lanka, has made remarkable advancements in the commercial manufacture of water pumps, paddy, threshers, driers, ploughs, puddle wheels, pruning shears, sprayers, milling machines etc. at prices affordable by the farming communities.

Irrigation

It is necessary to make realistic assessment of the use of machinery in the agriculture sector with adequate government support to develop an agricultural machinery industry in the Region, to counteract the labour shortages during the growing seasons.

Water which was considered a free resource in many countries has suddenly become a scarce commodity and major threat to food production and food security. According to Dr. D. Seckler, Director General of the International Water Management Institutes nearly 1.4 billion people, a quarter of the world population or third of those living in developing countries will face severe water scarcities in the first quarter of the century. While the regional water consumption is increasing rapidly the water supply is decreasing.

The increasing demand for water has several components, while agriculture uses a large proportion of water, non-agricultural water uses are also increasing. Urbanization and higher per capita availability are the main reasons for the increased water use. Per capita water availability is already is declining rapidly. In Asia water availability has decreased from 9,9600 m3 in 1952 to 3,300 m3 in 1999. It is predicted that water availability for domestic and industrial use will increase in developing countries from 13% to 27% in 2020. When water is rationed industry and domestic supply are protected and agriculture will have to make the best out of what is left.

In Asia - Pacific Region about 35% of the agricultural land is irrigated showing an increase of 6% from 1988 - 1997. The irrigated area as percentage of agricultural land in Pakistan is over 81%, DPR Korea 73%, Japan 63%, Republic of Korea 60%, while in the other countries, the figures vary from 45% - 1.1%. The figure for Sri Lanka is 32%. The total agricultural land under irrigation has increased from 130m. ha to 158m.ha. from 1988 - 1997. Large extents are in China (52m.ha), India 57m ha and Pakistan 17.6m. ha. In the other countries land under irrigation vary widely. There appears to be potential for further increases in irrigated land in most countries of the Region.

However due to the impending water scarcities in various countries some strategies and action plans may be required to alleviate any adverse situations. The following strategies could be used to overcome these problems as suggested by Dr. Nimal Sandaratne, Senior Research Fellow of the Postgraduate Institute of Agriculture:

. Ensure productive use of water in surplus areas for food production without being unutilized owing to adequate food supplies.

. Develop markets or international mechanisms for reallocation of food from surplus to deficit areas.

. Reduce pollution of surface and ground water due to unscientific irrigation practices.

. Construct reservoirs for harvesting excess water specially in monsoonal regions.

. Conserve water by better irrigation management practices such as drip irrigation. Reuse and recycle waste water.

. Transfer water from surplus locations as already practised in some countries of the region.

(To be continued)