

## **Strategies for increasing agricultural productivity in the 21<sup>st</sup> century**

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### **ABSTRACT**

Sri Lankan agricultural sector directly supports 40% of the population and over 70% are dependent on agriculture for their livelihood. The agricultural GDP has declined from 25% to 19% in the last decade, while the industrial and manufacturing sectors are contributing over 22% due to increased private sector investment. The natural resource base is also rapidly declining due to population explosion and urbanization. Further demands on the resource base are evident due to trade liberalization and investments by the industrial sectors. Future challenges to agriculture are immense and those challenges have to be faced if the future food demand is to be satisfied. The constraints are many, of which the major issues are: declining agricultural land and agricultural population, land degradation and declining per capita agricultural land, all of which pose a major threat to future productivity. Rising population, shrinking agricultural land, increasing demand on the water resources from the industrial and urban sectors further aggravate the situation. It is more and more clear that the traditional systems of agricultural production will not be able to cope up with the emerging demand for food supplies and diverse consumption patterns. The agricultural production has shifted from the earlier concept of increase in yield to the utilizable production that links the producers to the consumer. It has become necessary to develop value added secondary products as demanded by the consumer. In this context, the strategy for agricultural production has to be revisited and changes made to meet the competitive demands of the market. This requires the development of appropriate policies and strategies and institutional capability in order to implement such a plan effectively.

**Key words:** poverty, natural resources, modern technology, utilizable production,

At the turn of the new century, most developing countries, including Sri Lanka were facing two major problems - namely the lack of sufficient food and increasing environmental degradation. The International Food Policy Research Institute stated earlier this year, that each day, the world witnesses 800 mn. people that go hungry, and over 170 mn children under 5 years suffering from malnutrition. In overall terms, since 1970, the number of food insecure people in the developing countries has declined by 17%. However, this progress has been uneven across continents, and in South Asia which includes Sri Lanka, the number of food insecure people has increased by 1.5%, which is a reversal of the global figures. South Asia will be the home to half the developing world's poor which is projected to increase up to 40% in the first decade of the century, and will emerge as an increasingly important locus of poverty. The percentage of the population living on one dollar a day is 6.6 and the urban poverty is increasing due to migration into the cities. Presently, in Sri Lanka 35% of the children under 5 years are undernourished or malnourished. Therefore, the issues confronting the government are extraordinarily complex. Unless concerted efforts are taken, poverty is not expected to diminish much

in the near future.

The scenario of the food crisis in Sri Lanka at present is no better. Although identified as the most developed nation of South Asia, the food crisis has taken its toll in the island. Sri Lanka has been acclaimed the world over for its low rate of population growth in relation to other developing nations, however, the increments in food production has not kept pace with demand. Hence Sri Lanka, which was identified as the "Granary of the East" in ancient times, has over the last decade, become a food importing country, although 51% of its population is involved in agriculture and allied fields. The foreign exchange earning through other exports are used to import food. Thus in the year 2000, import value of sugar was Rs.10,777 mn., milk and milk products Rs.8,946 mn., rice Rs.286 mn. and wheat flour Rs. 561 mn.

Sri Lanka's domestic food production sector has lost its momentum over the past 20 years with little signs of improvement. The crop yields are low by all standards, land use intensity is far below average and farm family income is at the lowest ebb as never witnessed before in this country. The rising cost of production with low marginal returns has made farmers to virtually give up agriculture. The farm

gate prices have not kept pace with the rising cost of production. As a result, dependence on food imports have increased and this has further aggravated the situation. The National Development Council (1996) has identified some of the major policy issues that need consideration to uplift the agricultural sector. The major areas identified for development are as follows: seed and planting materials, land, irrigation, water, fertilizer, research, extension, credit, domestic marketing, incentives for the private sector and trade policy.

### **Status of agricultural production**

Since 1996, the situation has even worsened with more imports of essential food items. It is becoming clearer that farmers are unable to produce all the food needs of the country as in the past, without the capital and necessary facilities such as processing and marketing. The available traditional technologies are inappropriate to meet the demands of an open economy, their efficiencies are low and best alternatives have to be identified. This is obvious as all technologies developed in the past were oriented towards the small farmer and these are inappropriate for today's farming. Some technologies most essential, particularly for harvesting and processing and value addition are not even available. The market intelligence and alternate marketing strategies appear to be weak and producers face immense problems in disposing their produce. It is clear that the government alone is unable to provide the resources and the technologies to revitalize the agricultural sector. It is necessary to seek the assistance of both the public and the private sector to uplift the ailing agricultural sector. Therefore, to resolve the problems facing this sector policies have to be developed and structural changes have to be made taking into account the rural farming community and the private sector.

An analysis of the overall situation of the food crop sector highlights the following; low standards of management, high cost of production, lack of proper marketing channels, post harvest losses especially in perishable items, sub-optimal degree of land utilization and imbalanced trade policies. This dismal situation in the food crop sector has developed progressively over the years, and today, food has become a very expensive commodity for the middle and lower income groups of the nation, which constitute over 70% of the population. A recent survey highlights that the lower income groups spend on average some 80 -85% and the middle income groups spend 50 - 60% of their incomes on food.

It is in this backdrop of agricultural performance that the agricultural policy issues must be discussed. A much-improved agricultural performance is needed to support a higher rate of economic growth, increase rural incomes, reduce poverty, increase employment and contribute to both saving of foreign exchange as well as to earn foreign exchange. The National Agricultural Policy 2003 - 2010 formulated by the Ministry of Agriculture and Livestock is designed meet these formidable demands and to revitalize the agricultural sector. This policy has laudable goals and is expected to accomplish prosperity to the farming community by increased incomes, food security to the population, reinvesting surplus income from agriculture in other sectors and increase foreign exchange earnings through value added products.

### **Strategies for increasing agricultural productivity**

The overall strategy of increasing productivity of the domestic agricultural sector should focus on the following criteria: investment in human resources, improving access to productive resources and remunerative employment, improving markets, infrastructure and institutions, technology development through demand driven research and dissemination of technology to end users, sustainable natural resource management, pro-poor national and international trade and macroeconomic policies and good governance. Some of the direct measures that would help to increase productivity are discussed below:

An urgent need is the provision of inputs, particularly quality seeds and planting materials to farmers at the required time and at a reasonable cost. In most instances, farmers do not have access to high quality planting materials, and if available these are very expensive. Hence they resort to procure substandard material, resulting in poor yields. In most of the other countries hybrid seeds are used, while Sri Lanka continues to use the traditional non improved seeds and planting materials. Presently, some hybrid seeds are imported by the private sector and sold to the farmers at unaffordable prices. The availability of fertilizers and agrochemicals at a reasonable price is also another aspect that needs attention. In most instances, the pesticides are costly, thus farmers tend to use sub-optimal quantities. This leads to poor management of crops, thus lowering yields.

No development program in agriculture would ever be successful without adequate training and extension services. While the perennial crops are

serviced by the commodity research institutes, the rural farmers who provide the basic food commodities today have very little access to training and extension. Sri Lanka boasted of a well-developed agricultural extension service in the early 1970's, which reached out to farmers in all areas of the land. However, with changes in policies and directions, the rural extension service was restructured to perform administrative jobs, thus neglecting the services provided to rural farmers. The reorientation of this program as presently planned by the Ministry of Agriculture and Livestock would add considerable strength to enhance agricultural productivity. An integrated agricultural extension service should be developed to cover all crop and livestock systems.

Due to the failure of the government extension service to deliver the goods, private extension services are getting organized. Private extension services are in operation in organic agriculture, environment controlled agriculture and even in hybrid chillie production. The more progressive farmers and commercial entrepreneurs, given effective extension services may opt for them, hence this avenue is worth pursuing. Private extension services are very common in other Asian countries for many varieties of food and horticultural crops.

The issue of marketing has been an intractable problem. Government institution have failed and private sector efforts have been totally inadequate. Although the ultimate solution lies in making markets more competitive, interventionist measures may be needed to encourage such development. Unsatisfactory marketing conditions have been an important factor in increasing consumer prices, on the one hand, and reducing producer or farm gate prices, on the other. Lack of competition and monopolistic conditions are no doubt one of the underlying reasons. In addition spoilage, poor packaging, lack of grading and storage facilities, have contributed to the loss of agricultural produce. That in turn results in higher prices.

Therefore, the most important incentive for improving agricultural productivity is the development of suitable marketing channels, to enable the producer to obtain a reasonable price for the commodities. This is a key concept, as many farmers lose interest in producing crops if they cannot obtain reasonable prices. The produce must be marketed through proper channels, to ensure that both the producer and consumer get a fair deal. Today this is lacking, where both the producer and consumer are given a raw deal, while middlemen make the best of the situation. This needs radical restructuring and must be done quickly. Looking at

possibilities of developing marketing channels, one could identify the role of farmer organizations to transport the produce direct to the points of sale or consumption. The streamlining of supplies to wholesale units is another option, as in the Dambulla Market.

On long term, there are many strategies that could enhance agricultural productivity. Among these the most important is to provide producer based incentives for farming. This would remove the social stigma of farming, which offers a significant hindrance to many adopting agriculture as a livelihood. The message that agriculture is a business venture must go to the farming communities. This would help to maintain and possibly enhance productivity. Today, industries are provided with tax holidays and many other incentives to attract investment. No incentives are provided to educated and qualified youth to move into commercial, profit oriented agriculture. This trend needs to be changed, where agriculture and production is viewed as business enterprises.

Inadequate institutional credit has been a constraint to small scale agriculturists. Fifty-five years of institutional credit programmes have failed to deliver adequate credit at reasonable cost. Fundamental errors in design, unrealistic interest rate policies, an unsatisfactory credit culture, institutional incapacity and political interference have been responsible for this state of affairs. A non-governmental institutional credit scheme should be designed.

### **Technologies for improving agricultural production**

As a means to meet the food needs of the growing population, various attempts have been made at different times and technological breakthroughs have been achieved. In 1960s there was considerable interest in intensifying agricultural production using the existing natural resources. These intensive cropping systems which were known as multiple cropping were popular among the small farmers. On the basis of these several cropping patterns, relay cropping, intercropping, catch cropping etc; were developed for different regions. These systems similar to the intensive market garden system of Nuwara-Eliya were capital intensive but compensated with high yields. Under multiple cropping high yields were obtained due to the use of technological packages, yet system was unsustainable as the package was only production oriented but lacked post harvest processing, storage and marketing, hence the farmers lost interest in

these new intensive systems. More recently the farming systems approach, the development of a total farming system was tested but its acceptance has been insignificant. The integration of crops and livestock or crop-livestock based farming systems would be the best means to increase production in rural farms. The inclusion of animals, as that promoted by many non governmental organizations such as Bharathiya Agricultural and Industrial Foundaton (BAIF) in India, where one or two heads of cattle or goats are included into the existing farming systems, inclusion of swine into farming systems as practiced in Bhutan would enhance income generation, sustainability and productivity of farming systems. Fortunately, at present the agriculture and livestock are the responsibility of a single ministry, Ministry of Agriculture and Livestock. This is an excellent opportunity to develop crop-livestock based eco-regional farming systems.

The challenges that Sri Lankan agriculture will have to face in the next few decades will be formidable. While providing food for the increasing population, it will have to be competitive, market responsive and focus on future employment of youth in the agricultural sector. In the past several decades the agricultural programmes were developed and implemented to achieve self sufficiency in food grains, mainly rice which is the staple of the people. The green revolution in the 1960s was the turning point in grain production with the development improved high yielding rice and other cereal varieties. The green revolution, a pro - rich technology requiring high input use was ideal for rich farmers. Since then the global agriculture has taken a different turn and the future challenges will be to recognize these changes which are affecting Sri Lankan agriculture as well. The trend is in crop intensification and diversification rather than monocrop systems that were traditionally practiced. In mobilizing this change, the intensification of land and water use, efficiency in the use of key inputs such as fertilizers and other agrochemicals, increasing output per unit area, enhancement of quality, environmental impact, attractiveness as a means of employment, profitability with high profit margins should be considered. By these new technologies the green revolution of the past could be made evergreen. Recently two alternate farming systems, organic agriculture and environment controlled agriculture have been introduced with much success.

There is a growing trend for organic products world over, hence organic farming offers scope for farmers to produce healthy pollutant free foods and

products ( health foods) for the local and export markets. Cancer is a major disease in Sri Lanka and the world over, and the availability of pollutant free food would help to minimize exposure to carcinogenic materials. This is the trend in the west, specially in health conscious countries such as Denmark, Sweden and Austria, where over 40% of agricultural lands have been converted into organic systems. Organic farming in Sri Lanka is relatively new, yet the progress has been very rapid. At present there are 15 private sector organizations and more than 20 NGOs involved in organic food production. About 2000 ha are certified organic production areas while 2000 more ha are under transition. According to the Export Development Board presently there are 7500 farmers involved in organic food production. Desiccated coconut, spices, cashew and few fruits and herbs are the main exports, with tea as the major crop. The export value of organic tea has increased from Rs.115 mn -200 mn, cashew from Rs. 70 -72 mn and desiccated coconut from Rs.105 - 270 mn. from 1999 - 2000. The adoption of such specialized products in Sri Lanka and developing standards to certify the produce along the lines of international standards such as that of IFOAM would help enhance productivity of agriculture in the country. As health foods have global demand, nitche markets should be explored and information provided to the farmers.

Unlike conventional agriculture, controlled environment agriculture involves the scientific basis for crop production, it harnesses the genetic potential of crop varieties fully under controlled conditions which cannot be achieved under open field agriculture. The cost of this technology outweighs due to the high yield, better prices , higher incomes and ability to grow at least three crops per year. The risks due to disease and pest, and unfavorable condition are also minimized. The crops grown have high demand in the urban sector, particularly in the supermarkets, airline trade and the tourist industry. The main crops, bell pepper, tomato, broccoli, cucumber, lettuce, and strawberry grown so far locally yield heavily under this system. Thus the yield of tomato is about 300 mt/ha compared to 25m/t under open field culture. The return from a single crop of tomato is about Rs 150,000 compared to Rs. 14,000 under open field conditions. The main advantages are that significantly high yields could be obtained by growing several crops in the year, with better quality produce, high prices and incomes and ability to compete in the international fruit and vegetable market.

This technology has proven to be successful in many Asian countries. It has also been adopted

locally by the middle class agriculturists. The yield increases in some varieties range from 40 - 50% when compared to field grown crops under traditional agriculture. Thus, although the initial equipment would be costly, the return to investment over a period of time would indeed be profitable to the farmers.

Some of the constraints for the expansion of alternate agricultural systems are: access to and cost of hybrid seed, lack of properly integrated technology, lack of credit sources for small farmers, non availability of equipment to buy over the counter and lack of institutions, public or private, to take a lead role in promoting the technology, although there are many entrepreneurs who are willing to invest on this. This new trend in intensification of agriculture will be especially useful for the food, floriculture and foliage sectors.

Agricultural research is crucial for generation of appropriate technologies for the agricultural sector. The Departments of Agriculture, Export Agriculture, commodity research institutes and the university faculties of agriculture handle agricultural research. Basically, the Department of Agriculture focus on the food crops, horticultural crops and ornamentals. In rice tremendous achievement have been made in breeding of improved rice varieties suitable for different regions of the country. However, such advances have not been achieved in the case of other crops. Unlike in the neighboring countries such as Thailand, Malaysia and the Philippines, Sri Lanka has not produced any high quality varieties of vegetables, fruits or ornamentals. The Department of Agriculture was restructured in 1994 into three commodity based semi autonomous research institutes and several centres to achieve these objectives, but the results have been disappointing. The need for developing better varieties, post harvest processing and value addition, although most important for this sector for the local and export trade remains unattended which is a serious drawback. While other growing countries have embarked on exporting well processed and value added products, Sri Lanka yet exports raw products obtaining little foreign exchange. The universities also undertake considerable volume of research, but they are not in the mainstream of research as they are not directly linked to the implementing ministries. This is considered a serious deficiency as valuable research findings remain unutilized, hence integration of university research into the national research system is an urgent need.

Agricultural research is under-funded and present allocation is in the region of 0.4 % of the

GDP. It should be increased up to at least 1% if any positive impact is to be expected. Agricultural research and technological improvements are crucial to increase agricultural productivity and returns to farmers and farm labour, thereby reducing poverty and meeting future food needs at reasonable prices without irreversible degradation of the resource base. Accelerated investment in agricultural research is particularly urgent for Sri Lanka as it will not achieve reasonable economic growth and poverty alleviation without investment in research. As agricultural research is a broad field, priority setting is of prime importance. Due to inadequacy of funding and shortage of qualified and skilled scientific personnel, demand driven research on priority areas should be undertaken. In order to overcome the prevailing gap between academic know-how and field level do-how the agricultural education and research institutions should be linked as in the case of agricultural universities of India in which education, training and extensions are coherently linked.

Sri Lanka, like other developing countries is pinning great hopes on biotechnology to alleviate food, environmental, nutritional and even economic problems. Biotechnology seems to offer unlimited potentials for solving old and new problems. The biotechnological research and generation of new technologies are high cost and require highly trained manpower and infrastructure, the settings that are available only in the developed countries. Therefore biotechnology could be termed pro-rich. However, application of biotechnologies will not be too costly and should be within the reach of small farmers in the developing countries. The pro-poor features of biotechnology will be reduction in cost of production with the use of less expensive inputs, biological management of pests, detection of pathogens and their bio-control and applicability of biotechnologies over a wider range of conditions for dry and marginal lands; and saving on labour due to labour displacing herbicide resistant plant varieties.

These biotechnologies should be used in conjunction with traditional practices. These may lead to sustainable technology use promoting food security. Other technologies such as the use of microbial inoculates have also been used with success. These should be explored as innovative farmers have positive and favourable experiences. One should also think of the availability of genetically modified material (GMOs), to boost crop yields. Although there is much debate on the use of GMOs, one should take an objective view on their use. The higher yields of these products would mean greater benefits to the farmers today who are among

the poor fractions of the nation's population. The use of genetically modified crops if selected carefully could also offer some potential to increase production of selected crops, particularly those used as industrial raw materials. India has already introduced genetically modified cotton. The GMOs could play a useful role in modern agriculture to meet the future food requirements.

There has been a paradigm shift in the technology development for enhancing agricultural production. Agricultural production has now shifted from the earlier concept of increasing in yield to utilizable production of the whole chain that links the producer to the consumer. This could be attributed to several factors. The government is moving towards policy setting and infrastructure development role with liberalization of the economy. The objective is to reduce the transaction costs while encouraging private sector with greater accesses to resources, specially credit and information. A paradigm shift has taken place from primary production to development of secondary products as demanded by the consumer. This will bring better utilization of primary products, value addition and income generation at each stage of the production - consumption continuum. This approach will closely integrate the agro-industries to the production system, unlike in the past where agro-industry was considered a separate entity. Therefore, development technologies should focus on several crucial issues of which product development will be the most important. This will include biochemical characterization and other physical components affecting nutritive or industrial processing of primary products, developing genes involving such qualities, germplasm enhancement, post harvest mechanization, storage facilities, by product assessment etc; Therefore technologies should focus not only on yield increase, but on product utilization which generate income and employment. Therefore, a paradigm shift from technology development for the sake of it as done in the past has to be oriented to type and quality of product as determined by the market demand and not by the available technology.

### **Investment in human resources**

Human resources development is an essential component of agricultural development. There are several institutes that undertake agricultural education and training at different levels. At tertiary level there is a Postgraduate Institute of Agriculture and six Faculties of Agriculture in different regions. There are also Diploma awarding institutions and three Schools of Agriculture imparting agricultural

education and training at middle level. As agricultural education and training is crucial to the development of the agricultural sector, curricular revision and incorporating skills development programmes should strengthen these institutions. The faculties of agriculture and the training institutes of the line ministries should be linked together to make the training more realistic, meaningful and up to date. High level man power development in priority fields should be identified, with particular reference to precision agriculture and appropriate manpower with required skills should be developed. Some of these fields include plant breeding and genetics, biotechnology, irrigation technology, post harvest processing and storage and value addition. It is necessary for the implementing agencies to identify future human resource needs and prepare a comprehensive staff development plan.

### **Land use issues**

Land use in agriculture is another important issue. Land reform laws are not new to Sri Lanka. The first step in land reform came in the 1950's with the introduction of the Paddy Lands Act, which provided the cultivator rights to tenants. However, the most important and direct Acts of land reform were introduced in the 1970's with the initiation of the Land Reforms Act and the Land Reforms Commission. The objective of these were to redistribute the ownership among the landless by imposing restrictions on ownership. The final goal was to induce the landless to begin cultivating lands and thereby contribute to the overall food production in the country.

Looking back at this program, it could be stated be that the objectives were not met. The landless, removed most assets of the lands and then either sold them or built houses. The program did not contribute to the enhancement of productivity. Experience has shown that re-allotment or redistribution of ownership does not help under conditions of Sri Lanka, unless the government enforces Acts and laws that prohibit the resale of lands.

The worse scenario in land utilization is extensive land degradation due to lack of proper conservation measures. Due to unplanned use of land, they are heavily eroded. It is estimated that about 5 - 10 mm of top soil is lost every year. In the hilly terrain erosion is heavy, in seedling tea with no conservation up to 40 t of soil per ha. per year, in tobacco lands in the mid country as much as 70 t per ha. per year. The non adoption of soil conservation measures and the inadequacy of the Soil Conservation Act of 1951, and difficulties in

implementation has caused serious soil degradation. Therefore high priority has to be given for technology development for soil conservation and renovation. These should include mechanisms for organic matter additions to the soil through green manuring and establishment of agro forestry systems etc.

Due to the above shortcomings a National Land Use Policy has been formulated by the Ministry of Lands in 2002, based on three primary considerations. These are a) Agriculture and food security b) Land and people, and c) Land and nature. This policy document clearly recognizes the importance of agriculture in the economy of the country and addresses crucial issues such as :

- ◆ Agricultural land use will be oriented to achieve food security and income generation while ensuring sustainability.
- ◆ Diversification of agricultural land use will be encouraged only where productivity could be increased.
- ◆ Effective and suitable conservation measures will be a non negotiable pre-requisite for agricultural land use.
- ◆ All marginal and uncultivated land will be improved and converted to appropriate land uses.
- ◆ Prime agriculture land from paddy, coconut, rubber, tea and minor export crops will be identified and conversion of these into other uses will be discouraged.

There are several other favorable policies on land alienation and encouragement of the private sector participation and in land development. It is proposed to establish a National Land Use Commission to review, recommend and implement the national policy on land use and a National Land Information System (Land Bank) to provide information on land development, sharing of information and land management. It is expected that this policy when implemented will resolve the misuse of land and management of the land resource and provide for cohesive economic and social development. An aspect that needs immediate attention of policy makers is land consolidation, without which increases in agricultural production will not be achieved. The small land holdings do not permit mechanization which is needed for reducing the cost of production.

## **CONCLUSION**

The tragedy of Sri Lankan agriculture for the past

two decades is that it is performing well below its potential. If the yield gaps were reduced by even 50 % in the next five years, it would give a big boost to the economy of all crops. This must indeed be the prime objective of the national agricultural policy. The continuous efforts on the need to improve our agriculture have not been matched by a commensurate action plan. There has been a mistaken view in the last one and a half decades that agriculture's contribution for the country's development is no longer significant. Perhaps it is this mistaken view that has led governments not to take agricultural development as seriously as in the past. The fact is that if agriculture is neglected, it will place severe strain on the economy by requiring increased imports of food and inadequate foreign exchange earnings through exports to support economic development. Therefore it is necessary to develop a comprehensive plan for agricultural development in a very short period and put in place the resources and institutional capability in order to implement such a plan effectively.