

Sad plight of farmers in Sri Lanka

By Prasad Senadheera

The nation which lived in a prosperous land called "Granary of the East" in the past has become down trodden and about 30% of its future generation is suffering from malnutrition due to deprivation of quality and quantity in their meal, which is best indicated by per capita consumption of calories.

As a result of poor diet, low efficiency is pervading everywhere in our country retarding its development. In the recent past our food policy has been shifted from the focus of self sufficiency to dependant on precarious foreign sources for food items, including those that are easily cultivated in this fertile land. No sustainable long term plans to increase agricultural productivity were executed properly by any of the governments that came into power after D. S. Senanayake.

This has resulted in stagnation of yield at a threshold level and increase of cost of production. On the other hand, as a result of farsighted agricultural policy practised in India after Independence, the cost of production of agricultural crops including those that are growing here

is 5-8 times lower than that of Sri Lanka.

Today, our farmer is compelled to accept defeat in competition with imported food items and unlike in other countries, they have become a burden to the economy rather than a boost.

Governments that ruled this country after Independence must be blamed for their ignorance on the importance of agriculture for the development of our country. As a consequence, today we are prone to influences of several external forces to such an extent where the sovereignty and unitary nature of our country is in question.

It is quite clear that in order to ensure stable prosperity to our nation, a radical change of outlook to the current scenario of agriculture is essential. Now it is high time to adopt an effective, sustainable and farsighted food and agricultural policy for our country in order to get rid of this pathetic situation and incite rapid development.

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Farmers at work

modern technologies to mitigate them with minimum dependency on sources external to our country.

There is a great potential for applications of novel biotechnology in Sri Lanka, in combination with conventional biotechnology, to increase agricultural productivity in terms of quantity and quality to provide effective solutions for some of the existing problems. "Any technique that uses living organisms or part thereof to make or modify products to improve plant or animals or to develop microorganisms for specific uses" is simply considered as biotechnology.

This technology has unveiled many revolutionary possibilities in research and development of biological systems

such as plant, animal and microbes for specific function by applications of the advances of two major fields; cell and molecular biology.

One of the approaches to increase the quantity of agricultural produce is the expansion of area under cultivation. Due to various problems such as the smallness of our country, high population density and complications involved with cultivating marginal lands, there is limited opportunity in this approach.

Therefore, the best suited approach would be to increase yield by proper and effective utilization of available resources such as soil, land water, labour and genetic resources to maximize the productivity of existing

land. Further, this approach will reduce the pressure to expand fields into the wilderness, forests and marginal lands, which support biodiversity and vital ecosystems. Biotechnology provides effective tools for proper utilization of these resources to maximize the productivity.

Using novel biotechnology such as genetic engineering and modern plant breeding methods like marker assisted selection, existing plant varieties can be improved in a short time so to enhance yield, quality of produce (increased nutritional value) and performance in particular, the agro ecological zone.

Likewise, this technology can be used to improve some of our conven-

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BIOTECHNOLOGY CAN HELP

tional crops such as kurrakkan, meneri, and native tuber species by eliminating their unfavourable characteristics such as wild flavour, long cooking time, undesired texture, low yield etc. as nutritious supplementary food sources.

Apart from improving crops for specific market demand by eliminating undesirable traits, such technology, particularly genetic engineering, can be utilised to confer novel features to the crop plant such as expression of new proteins or vitamins, tolerance of extreme environmental conditions and resistance for disease and pest etc. by transferring genes from the wild or traditional species irrespective of the relationship of the two species involved.

Availability of a good source of genes in terms of high biodiversity (including agrobiodiversity) in our country provides good prospects for improvement of crop plants through genetic engineering.

Applications of tissue culture techniques are indispensable in improving crop plants. In vitro micro-propagation

technique facilitates production of large numbers of planting materials (seedling, artificial seeds etc.) identical in genetic composition and size in a relatively short period of time without climatic or spatial restrictions.

Also this technique helps to keep in check spreading of latent infections such as virus diseases with planting materials. In addition tissue culture techniques can be utilised to extract commercially viable metabolites in the plants such as flavouring, pharmaceuticals and pesticides through establishment of cell cultures. Further, this technique has high utility in conserving germplasm in all sorts of phenotypic variants of crops which is essential for future improvement of plants.

Performance of plants are not only dependent on hereditary factors which is manipulated through either conventional breeding programs or modern breeding programs including genetic engineering but also on other external constraints induced by both biological and physical factors.

One aspect of biological constraints is

plant pathogens and the other is weeds. Current methods of controlling plant diseases and weeds are solely dependent on the application of synthetic chemicals in forms of pesticides, weedicides (herbicides) or insecticides.

Long term use of these synthetic agrochemicals has proven to be harmful to both consumer health and ecosystem balance. In addition, several pests and weeds have developed resistance to these agrochemicals which in some cases, have created sudden out breaks of epidemics. This phenomenon also demands for continuous improvements to these chemicals making them more lethal to both target and user.

Biotechnology provides a range of alternative solutions to control these biological constraints and makes farming one of the riskiest occupations, a little more secure. They include the use of natural predators and pathogens of pests, use of biopesticides based on plant products, insects derived chemicals such as sex and alarm pheromones, neuropeptides and repellent to kill or deter plant

pathogens and pests.

Several crops such as maize, soybean and cotton have been successfully engineered by transforming bacterial gene (eg: Bollgard® insect-protected cotton) that produces toxins lethal to insects feed on plant and herbicide resistant genes (eg: Roundup Ready® soybeans) to use high dosages of herbicides at initial establishment stage of the crop to eradicate weeds.

These biotechnology crops are cultivated in commercial scale in countries like USA, Japan, India and China. These biological approaches not only bring about sustainable management of pests and diseases but also reduce cost of labour significantly by displacing labour intensive operations.

Biotechnology can also be utilised to overcome stress on plants by providing solutions against physical constraints such as low fertility of soil and lack of water. It has been shown that the use of synthetic fertilizers to overcome low fertility of soil accelerates further degradation of the soil. Potential alternatives to chemical fertilisers include fermentation sludge, manure, compost, microbic inoculations (cyanobacteria) and use of substances like chitosan from crustaceans. The prospects for such biofertilisers are promising since they are environmental friendly and economical. These biofertilisers not only increase productivity by supplying nutrient for plants but also conserve and renovate soil by im-

proving its chemical and biological properties. For example, the inoculation of rice with Mycorrhizal fungi (symbiotic fungi that colonize plant roots) and soil microbe (Alcaligenes faecalis) demonstrated that N₂ fixation rate could be increased by 15-20% and rice yield by 5-12%.

Another field where applications of biotechnology become vital is management of post harvest losses. In Sri Lanka, it is estimated that post harvest crop loss is as high as 40%. Using biotechnology, shelf life of a crop can be extended by either eliminating undesirable biochemical traits inherited or conferring resistance against biological and physical factors that contribute to post harvest losses.

It is a natural instinct to think that when new technology merges it can solve all the problems concerned. First, we must get rid of this attitude before drawing any plans to utilise novel biotechnology and then review backed by sound research should be carried out in advance of any specific application. Such pre-evaluation facilitates the refining of the technology to better suit the conditions of the country.

It would be more feasible if novel biotechnology is applied on a supplementary and complementary basis to the (existing) conventional (bio) technologies which have been evolved for a long time in association with particular a crop grown in particular area, rather than by replacing them.