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# Nutrition considerations in agricultural development programmes

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Development of agriculture is one of the keys to economic and social progress for a developing country. Unbalanced agricultural production leads to three forms of nutritional deprivations: (i) Inadequate food intake creates primary problem of extensive under-nourishment; (ii) the extra nutritional needs of infants, pre-school children, pregnant and lactating mothers are not adequately met; (iii) Some dietary patterns result in deficiencies of micronutrients like vitamin A, iron and iodine. It is well-established that malnutrition lowers the resistance to infectious diseases and raises mortality rate among children of one and five years. It retards mental and physical development, productivity and the span of working years. All of these significantly influence the economic potential of an individual.

Poverty and underdevelopment are the twin causes of malnutrition in the rural areas of developing countries. In the past, the approach had been on maximizing the production of goods and services. Now, there is growing realisation among the planners that economic growth as measured by GNP does not effectively deal with the problem. When nutritional status is used as an indicator, it is found that even when the Third World countries experience substantial economic growth, the proportion of malnourished people does not necessarily decline. In Chile, for example, inequalities in food consumption increased from 1930s to 1970, even though during that time Chile became a semi-industrialized country and its per capita income more than doubled. A study in Mexico revealed that while economic development led to improved nutritional status for some segments of population, it was of little or no benefit to the low income groups.

At this moment, the resources committed to agricultural development do not have a manifestable beneficial effect on nutrition and that any effect they do have is more by chance than intention. This consideration has prompted increasing demand for the introduction of nutrition consideration in project preparation, appraisal, monitoring as well as evaluation.

## NUTRITIONAL IMPLICATIONS OF FOOD HANDLING

An inter-relationship between food production, processing, storage and distribution is essential for nutritional improvement.

Inadequate transportation, lack of facilities for storage, marketing and processing of food have been identified as major nutrition problems. Thus for better nutrition, improvement of an inter-regional transport and storage system to move food supplies easily and at a lower cost from surplus to deficit areas is a must. For example,

- It has been observed that probably the major contribution to the solution of the regional families in India was the construction of the rail line.
- Peru has the largest per capita fish catch in the world but it is rarely much beyond the immediate fish-catch region. This suggests that provision of appropriate transport facilities to move the fish inland is a necessary investment for improvement of nutrition of the inland population.
- In Korea, there is a common seasonal shortage of certain nutrients in the diet. This has been linked to inadequate storage facilities.

At each step, as the food

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travels from the farmer to the consumer, there may be serious food losses. These have been calculated as high as 30 percent with nutritional implications during processing, storage or transportation. Prevention of these losses at the pre- and post-harvest stages would increase the availability of food and the income of the producer in rural areas.

An increased or adequate per capita food production has, *per se*, little impact upon nutritional status, unless it is supported by proper means of distribution. The distribution of the available foods may not only be unequal in different regions or socio-economic groups of society but also within the same family. It has been estimated that 20 percent of the population with the lowest income in Brazil, India and Tunisia has half the per capita energy intake of the top 10 percent. Unequal distribution of foods whereby some members of the family, particularly children and women, do not get sufficient food to meet their energy and nutrient requirements despite its availability in sufficient quantity, has far-reaching health consequences.

## NUTRITIONAL SITUATION IN PAKISTAN

Although Pakistan has a comparatively comfortable food availability, yet malnutrition, (protein-calorie), in children, pregnant and lactating mothers is a common phenomenon. One-fourth of children die before reaching school age and most of the survivors sustain physical and mental retardation. The mortality rate among the pre-school children is 40 times higher than Japan and 80 times higher than Sweden. Sixty percent of children are deficient in growth due to inadequate and imbalanced food, poverty, ignorance and ill health. The weight of an average Pakistani two years old child is only 75 percent of an American child of the same age. Malnourished children miss their school frequently and usually repeat their first school year. In Pakistan, 60 percent of first graders drop out before the end of the first year.

According to past dietary surveys, the diet of the population is based on cereal grain and food legume combination. Cereals provide 61 percent of the total calories and 65 percent of the total protein consumed by the population as a whole. Wheat is by far the most common foodgrain consumed, and contributes 83 percent of the total cereal intake. The food legumes are important and economical source of protein, calories, certain vitamins and essential minerals in human nutrition. However, the significant role they play in the diets appears to be limited by their scarcity, due to low yield, market price and defects in our food use qualities. Nutritionally cereals and legumes are complementary. Cereal grains are deficient in lysine but a good source of sulphur containing amino acids. Legumes contain twice as much protein as the cereal grains and are a rich source of lysine, although relatively low in total sulphur containing amino

An optimum nutritional combination is provided by a diet composed of 65 percent cereal and 35 percent legume. However, in Pakistan, the ratio of cereal to legume consumed is 22:1. The intake of dietary fat is also low, as it contributes only 11 per cent of the total calories as against the recommended levels of 20—30 percent. The indigenous production of edible oils and milk is low and the country has to import these commodities at a cost of 300 million and 40 million U.S. dollars, respectively, every year. The major nutritional problems are calorie deficiency leading to secondary protein deficiency, iron deficiency anaemia, vitamin A deficiency and goitre in some localised areas. The challenge of producing food of the desired quantity and quality can be met through plant breeding approaches.

## NUTRITION PRIORITIES IN CROP IMPROVEMENT

Keeping in mind the food situation, agricultural scientists have mainly focused their attention on raising the total production of cereals and food legumes. To achieve higher productivity, the scientists are trying to maximize the efficiency of the plant to utilize energy, carbon dioxide, water and soil nutrients. Attention is also being given to increasing the availability and efficiency of limiting soil nutrients and to such biological processes which can help control plant diseases and pests. However, in any major breeding programme, attention must not only be given to the quantitative aspects of production.

Overall, the more efficient use of available land has been defined by the following factors:

Yield (kg/ha): New varieties must be bred so as to give higher yields on the lands they

now occupy. They must also be adapted for other areas that can be economically explored for cropping.

- **Nutritive value**: Nutritional considerations such as protein content, protein yield/hectare and amino acid balance also contribute to improving the efficiency of utilisation of food.
- **Technological value**: This refers to the attributes related to consumer acceptance. In addition to yield and nutritional considerations, equal attention must be accorded to the selection of genotypes that meet consumer criteria in terms of grain size, colour, texture, milling and cooking characteristics.

## NUTRITIONAL OBJECTIVES IN CEREAL IMPROVEMENT

Although increased production must continue to be the most important objective, nutritional considerations are also important to improve the efficiency of utilisation of food produced. Besides an objective of higher production, concerted efforts by plant breeders are required to increase the protein quantity and quality in cereals low in protein and lysine content. This implies producing genetically higher levels of protein without sacrificing yield. In recent years, considerable progress has been made in wheat where variation concomitent with both increase protein content and increased grain yield could be found. With the exception of oat, prolamines and glutenins make up roughly 60—80 percent of the total grain proteins; whereas albumin and globulin account for the remaining part. As prolamines are deficient in lysine, followed by glutenins, globulins and albumins (in an increasing order of sufficiency), the general deficiency of lysine in cereals is essentially a consequence of low contents of albumins and globulins in cereals. Albumins and globulins have a high lysine content and exhibit a well-balanced amino acid composition similar to that of milk, meat and egg proteins. Therefore, it appears logical to believe that a consistent improvement in cereal protein can be accomplished by developing new varieties with low prolamine content. The results obtained uptil now in the selection of high-lysine cereal cultivars indicate that the breeders have mainly selected cultivars with higher contents of soluble proteins, even though they were not specifically looking for them. This is the most favourable situation for the improvement of nutritional value of cereal proteins without affecting the technological quality. The major portion of the total protein is located in the endosperm of cereals. Prolamines and glutenins being exclusively confined to the starchy endosperm, but albumin and globulin proteins are found to be present in the bran, embryo (germ) and endosperm. As the utilisation of bran protein is impaired by the fibre content, genetic methods to reduce it are desirable. The experts of advisory group of jointly FAO/IAEA (1977) have defined the following nutritional goals for the major cereal grains:

- Improve the content and availability of protein and the limiting amino acids of cereals.
- Increase the protein content of rice without adversely affecting yield and cooking quality.
- Increase the bulk energy density, protein content and utilisation of rice for use as a weaning food.
- Increase the content and availability of protein, lysine and possibly threonine in wheat for child feeding in developing countries.
- Further improve the protein quality of maize, sorghum and barley, without adversely affecting total yield, by reducing the proportion of prolamines.
- Recognise and reduce the levels of the anti-nutritional factors such as tannins, phytates, amylase and trypsin inhabitors, lecithins, glucans, resorcinols and adverse isoleucine/leucine ratios in the species in which they occur and for the end-use for which they are important.

## NUTRITIONAL OBJECTIVES IN LEGUME IMPROVEMENT

Breeders generally agree that the most important objective in pulse improvement is the increase and stabilization of seed yields. According to the Protein Advisory Group of the United Nations System (1973) and the International Working Group on Nutritional Standards and Methods of Evaluation for Food Legume Breeders (1977), the following factors should be emphasised in breeding improvement programmes:

*Protein concentration: This attribute should be increased or maintained, while efforts should be made to achieve

higher crop yields and to retain or improve protein quality.

***The first limiting amino acids:** These are usually methionine and cystine, which should be increased, if possible.

***Protein digestibility:** This varies to some extent depending on species and is not poor overall, but for some legumes it needs improvement. Removal of anti-nutritional factors which influence the digestibility of protein also need attention.

*Cooking quality and organoleptic properties that are of direct concern to the consumer must be at an acceptable level.

*Minerals (eg. Zn, Ca, Fe) and vitamins should be maintained at the highest possible level.

Because legume species are used in many different diets, it may be necessary to reorder the above priorities to fit a particular regional dietary need. Thus, where legumes are consumed with cereals it may be more important to improve lysine levels than methionine/cystine. It is imperative that any genetic changes introduced will not adversely affect other nutritional beneficial constituents or increase anti-nutritional factors.

## NUTRITIONAL OBJECTIVES IN OILSEED IMPROVEMENT

To utilize oilseed protein for direct human consumption, breeding efforts need to be directed towards improving oilseed crops with regard to flavour, colour, anti-nutritional factors and processing technology. The highly effective breeding work that resulted in the development of varieties of rapeseed with very low levels of erucic acid in the storage lipids of the seed is being followed up by attempts to increase linoleic acid and to reduce the linolenic acid content. An improvement in the quantity and quality of oil is also the nutritional goal of an oilseed breeding programme.

## CONCLUSIONS

Due to the importance and impact of agricultural production on food consumption levels and health of the population a consideration of the nutritional components in agricultural development programmes is manifest. Plant breeding is the cheapest way for the nutritional improvement of grains. An appropriate and scientific integration of conventional and emerging techniques of plant breeding can help in solving problems of under-nutrition and malnutrition.

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**PEEP INTO NEXT ISSUE**

The *Progressive Farming* of July/August, 1984, will be Special Number on Wheat. Eminent experts are writing articles covering all aspects of this crop of national importance.

# *Poorbi Raya*—a *Zaid Kharif* mustard cash crop

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Pakistan imports a huge quantity of edible oils annually to meet its requirement at home. During 1982-83, of the 840,000 tonnes of oil consumed in the country, 640,000 tonnes (over 76 percent) was imported at a cost of Rs. 3,670 million. To reduce this enormous burden on the national exchequer, it is stressed that the oilseed crops production at domestic level be increased. Since rape and mustard provide about 30 percent of the indigenous oil production, greater emphasis should be laid on growing these crops as *Rabi* and *Zaid Kharif* crops.

*Raya*, local name for brown or oriental mustard (*B. juncea L.*), has long been under cultivation in Pakistan-India sub-continent as a *rabi* crop. A *raya* variety, RL-18, normally takes 180 to 200 days to mature. A short duration variety of *raya*, *Poorbi Raya*, has been developed which takes only 95 to 115 days for maturity. The variety was approved for general cultivation in 1972. The name, *Poorbi Raya*, was coined to indicate that unlike most of the new varieties of various crops which mostly are evolved in or introduced from the West, *Poorbi Raya*, a high-yielding variety, was developed in the East (one of eastern countries i.e. Pakistan).

*Toria* (*B. campestris* Var. *Toria)* is also grown as a *Zaid Kharif* crop, but it is lowyielding and the production is further reduced due to its susceptibility to shattering. *Toria* Selection A, a common *Toria* variety, grown in Pakistan, has a potential yield of 1,844 kg/ha whereas *Poorbi Raya* has shown its potential up to 2,765 kg/ha. So *Poorbi Raya* has a clear advantage and can very well replace *Toria*. Its oil quality also is as good as a *sarson* oil. In addition to its high seed yield, being self-fertile, it can easily be kept pure and its yield does not depend on insect pollinators for good seed-set in contrast to *Toria* which is self-incompatible and its yield potential may not be achieved due to scarcity of insects, especially in cotton and rice-growing areas resulting from high pesticide application.

It can be grown as a cash crop in the areas where a *kharif* crop fails due to poor germination or insect attack, or after *kharif* fodder. The crop matures early enough, so wheat can be sown after its harvest. The crop also escapes aphid infestation and frost damage caused to *rabi* crop during winter.

## MAIN CHARACTERISTICS

*Poorbi Raya* was selected from an inter-varietal cross between T-21 (Type 21 from the Punjab) and a *Raya* strain (Dacca *Raya*, from former East Pakistan).

*Poorbi Raya* is self-fertile, dwarf with profuse branching, bold pods, short duration and very early in maturity (90 to 115 days), has wider adaptability and is tolerant to diseases, pests and drought.

## CULTURAL PRACTICES

*Poorbi Raya* can be grown very well in the areas where irrigation water is available and is suitable for cultivation i.e., in Kasur, Sahiwal, Sialkot, Gujranwala, Sheikhupura, Multan, Bahawalpur and Bahawalnagar districts.

As this crop is of about 115 days' duration, its proper agronomic and cultural practices should be done in time to get high seed yield.

## SOWING TIME

The sowing time of *Poorbi Raya* should be kept in view to obtain good growth and high

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