

enough in themselves, or have full-scale animal feeding tests to be carried out before a variety can be evaluated? It is hoped that in return breeders can provide nutritionists with a diversity of plant material which can be used to help to answer these questions.

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#### Concluding remarks

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The symposium has revealed that plant breeders are concerned with a number of problems of purpose when considering the objectives of their long-term programmes of plant improvement. A plea has been made to us as nutritionists to define what we think are the desirable nutritional attributes of crop plants, so that guide lines can be established for the improvement of the quality of crops. It has been only too apparent that it is of little value for nutritionists to attempt this without providing precise and preferably non-destructive methods of assessment of quality, which could be readily applied to the thousands of genetic isolates with which plant breeders deal. The symposium has also shown that nutritionists are reluctant to make precise specifications to which plant breeders could adhere during the period of many years which must elapse between the inception and completion of a breeding programme. As one discussant said: 'The guide lines at present, if they exist at all, are extremely fuzzy round the edges'.

Such reluctance arises for several reasons. Understandable caution is one, for, as Dr Kodicek reminded us, a programme of breeding maize rich in nicotinic acid was rendered rather useless once the role of tryptophan in the aetiology of pellagra was discovered, and the fact that the nicotinic acid in cereals is normally unavailable was recognized. Again, as Dr Carpenter pointed out, contexts of value change. The success of chemical and microbiological synthesis of amino acids on a commercial scale already implies that investment in the breeding of lysine- or methionine-rich grains could in retrospect prove as pointless as the view we would at present take of breeding grains rich in calcium. Supplementation of nutritionally inadequate grains may well prove a more sensible solution than attempts to produce a completely adequate nutritional package from every plant. We are not certain about the

extent of growth of food and feed processing and blending industries, but the implication of any increases in post-harvest processing would be that plant breeders should concentrate on augmenting yield per unit area per unit time, that is on purely agronomic features; they need have little concern with complete nutritional adequacy of the crop per unit weight. A view that yield per unit area will always be of over-riding importance and that quality may well be best imparted through new technologies is only tenable if yield is specified in terms of nutrients. This view is indeed that taken by sugar-beet breeders: the final criterion of breeding success is the industrial yield of sugar per acre per year. The view is not acceptable where complete diets are required. The breeding of forages for grazing animals is an example, and the opinion was expressed that to improve the nutritional status of some peoples in developing countries will, because of their strong traditions of food use, entail genetic improvement of the quality of the staples rather than industrialization of food provision. Whatever the relative emphasis to be placed on yield of nutrient per unit area or on concentration of nutrient per unit weight of crop, the presence of toxic materials, antimetabolites and unavailable nutrients in plants makes a programme of biological testing of breeder's materials essential. It is here that technical problems of scale are very real.

The symposium has succeeded in that nutritionists have been made aware of the formidable tasks confronting the plant breeder, and of the precision of their techniques of improvement. Plant breeders equally have realized the problems confronting the nutritionist and have seen the ways in which nutritional knowledge is being applied through food technology. Although no precise blue-prints for the future have emerged it is clear that this meeting marks but the beginning of a dialogue which is of inestimable importance.