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What is the size of the problem of meeting world food needs as a whole?

Nutritional requirements. If only the quantity of food in terms of calories is considered, for the present population an overall increase in consumption of only 1 per cent. perhaps would be enough. If the quality (the make-up of calories, proteins, &c.) is also taken into account, an increase of 5 per cent. might be required to meet nutritional needs.

Demand for food. On three assumptions, (1) an increase in world population of 45 per cent.; (2) an increase in *per caput* incomes of 40 per cent.; (3) an increase in *per caput* expenditure on food of 25 per cent., total world demand (desire backed up by purchasing power —quite a different thing from nutritional needs) is expected to increase the quantity of food consumption between 1960 and 1980 by perhaps 80 per cent.

These global estimates over-simplify the problem. Different countries may experience different rates of population growth—for example:

Latin America	69 per cent.
Asia and the Far East	52 ,, ,,
Europe	17 ,, ,,
North America	29 ,, ,,
Soviet Union	38 ,, ,,

Rates of growth of *per caput* incomes also may differ greatly, as well as the rates of growth of food production.

It appears likely that over the next twenty years the world as a whole will produce enough food, but that there will be shortages in

some countries and areas. These are chiefly Latin America, Africa and Asia. The food problems in these areas will be too great to be solved by international trade. About 90 per cent. of these problems will have to be solved by increasing indigenous production, and only 10 per cent. by international trade, chiefly on a commercial basis, and to a smaller extent by food aid programmes.

Protein shortages. The chief food problem in under-developed areas is shortage of protein. Animal protein is the most expensive. The severity of the problem would be reduced if economical all-vegetable foods could be developed, or if cereals and other vegetable foods could be enriched with the essential amino acids which they lack.

The Institute of Nutrition for Central America and Panama pioneered the development of an adequate all-vegetable protein mixture for human feeding. A food known as Incaperina (INCAP Vegetable Mixture No. 9) consists of the following ingredients:

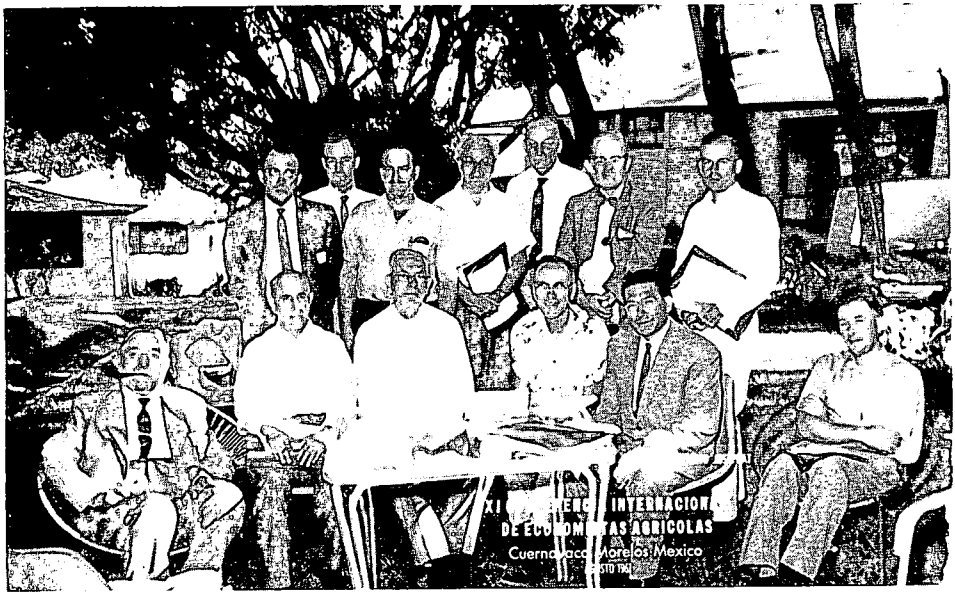
Cottonseed flour	38 per cent.
Yellow corn	28 ,, ,,
Sorghum grain	28 ,, ,,
Torula yeast	3 ,, ,,
Dehydrated leaf meal	3 ,, ,,

These ingredients are all grown in Central America. The cost of this protein mixture is in line with the purchasing power of Central American consumers.

Nutrition laboratories in other parts of the world are undertaking to develop adequate vegetable protein mixtures from locally grown plant foods.

In Ecuador, for example, experiments are being made with *cho-cho*, a lupine seed with 44 per cent. digestible protein. It has a bitter flavour, which the Indians for centuries have removed by putting it in a bag and leaving it in the river to wash out the alkaloids. Quicker methods are now being developed. In other countries, manioc, which has a very low protein content, can be fortified by the addition of manioc leaves, which have a high protein content. But they too are bitter, and special cooking techniques are needed to get rid of the undesirable flavours.

The second method of attack on protein shortages is to fortify vegetable food or feed by the addition of the essential amino acids that



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they lack. Two of these amino acids are now being produced commercially at a cost that in some cases is low enough to make it feasible to add them to food or feed. *Methionine* is widely used to enrich feeds. *Lysine* can be used to enrich wheat and other cereals so as to provide a protein quality equivalent to that in milk. Adding methionine and lysine to food for children may be a practicable means of overcoming protein deficiency in their diets.

In most countries, apart from the human values involved, from the purely economic point of view it costs less to put vitamins in the diet than to provide hospital care for those who suffer from the lack of vitamins. And productivity increases markedly, in some cases by as much as 40 per cent. In one case, a 10 per cent. increase in company cafeteria food costs resulted in a 30 per cent. increase in productivity and a substantial reduction in accidents.