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THE FOOD PRODUCTION POTENTIAL OF THE UNION IN RELATION TO THE FOOD REQUIREMENTS OF THE POPULATION

by

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SUMMARY

Although the production of food in the Union may not have given much cause for alarm as yet, seasonal shortages have not been entirely unknown in recent years. As the gap between production and consumption narrows with increasing population pressure, the effect of seasonal shortages will become more pronounced and the consequences of poor seasons more severe. That the population is likely to double itself in fifty years should be borne in mind, and this fact calls for a far greater volume of food production in the future than is being achieved at present.

The national food production pattern is such that sufficient carbohydrate and plant protein is being produced at the present time but too little animal protein. There is also a gross shortage of fats and, on balance, too little energy.

Whilst it is most desirable that animal production should be increased to provide more protein and fat from this source, it is unlikely that the poorer sections of the community will ever be able to afford all the food they need in the form of animal products. In these circumstances it is suggested that efforts should be made to encourage the production of a greater diversity of crops, and especially more legumes, in order to provide a full range of all the amino acids required for human nutrition from plant sources which are relatively cheap.

In order to raise the production of fats to a more satisfactory level, the question of producing more oil-seed crops should be considered or, alternatively, the possibilities of importation from neighbouring territories should be explored.

To remain nutrionally self-sufficient, the Union will have to take steps to increase food production very considerably in almost all categories. Possibly the greatest need is for expansion in arable production. To achieve this it would be necessary to extend the area under food crops and to raise the yields per morgen. In addition, an increase in animal production is required. This means greater efficiency in breeding, feeding, management and disease control, and more effective utilisation of the natural vegetation.

It is unlikely that these changes will come about of their own accord, without a serious time-lag, so that it would be expedient to take stock of the position now and to lay plans for the future accordingly, bearing in mind again that the population of the Union is increasing rapidly and that an abundance of cheap food is the way to health and happiness for millions of souls.

INTRODUCTION: Unless food is cheap and plentiful, a high incidence of malnutrition is not unexpected. Malnutrition may exist even in spite of an abundance of food, because it is too dear, because of ignorance of what is a proper diet, because of cramping tradition and established food-habits and other causes. But the fact remains that unless there is a sufficiency of cheap food to hand the people cannot be expected to be fed adequately.

Any country which is able to produce all the food needed by its people is indeed fortunate. Young countries are usually thinly populated; they are generally able to produce more food than they can consume and they are often able to export food to other countries. On the other hand, the older countries are relatively thickly populated; they are rarely able to meet all their food needs from local production, and much of their food has, perforce, to be imported from those more fortunate countries with surpluses. Because of these physical conditions, food is regularly exchanged between countries, and a vast world-trade in food has come into being.

At times of stress—during wars and economic disturbances—the survival-value of countries which are nutritionally self-sufficient is high. The ability of any country to produce its own food is a factor which contributes materially not only to national security, but also to national health and happiness.

The capacity to produce sufficient food is dependent on the natural resources of a country and the way these are husbanded on the one hand, and the food needs of its population on the other hand. Superimposed on the basic food pattern are questions of economic policy and political expediency. These latter considerations often overshadow the biological issues, and may lead to the well-known recurrent paradoxes of famine amidst plenty.

It is the expressed policy of the Union to be nutritionally self-sufficient as far as is possible, and the object of this paper is to discuss the present status of this important problem in South Africa. In this discussion both economic and political issues have been avoided purposely, and the main emphasis has been placed on the more fundamental biological aspects of the problem.

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FOOD PRODUCTION POTENTIAL OF THE UNION: Unlike the food requirements, which are either constant or which change in a regular manner in sympathy with changes in population numbers, food production is variable. It is influenced by droughts and other vagaries of climate, by pestilence, by prices and other economic factors and by factors which are slow to operate—such as changes in soil fertility and changes in methods of husbandry.

The volume of food produced in the Union varies from year to year. There are relatively large fluctuations about marked secular trends, so that in attempting to assess the production potential of the country these characteristics must be taken into account. Most of the published information relating to the food situation in the Union has been based on statistical information, either for a single year or for a relatively short series. Such studies reflect not so much the food production potential as the food supply position at a selected time. [See Haylett, 1939; Division of Economics and Markets, 1939; Fox, 1946].

A very comprehensive study of the food production structure of the Union, which has just been completed, was undertaken by Alvord (1949) and van de Wall (1949) under the direction of the writer. All the available statistical data for a period of twenty-nine years (1917-18 to 1945-46) were collected and analysed. The analysis was made in trade units (e.g. bags, tons, pounds) of each commodity and these units were converted into nutritional units, namely, protein, fat, carbohydrate and calories. The mathematical trends were fitted where possible. The tabulations included not only the total quantities of food produced in the Union each year—European as well as non-European production—but also data on export and import and estimates of allocations for animal feeding and for seed. An estimate of the food "available" for human consumption was also made by difference.

The trend analysis showed that there is a marked allround increase in production and consumption of foodstuffs during the period studied, that the consumption of fat exceeded Union production in later years and that in all cases the gap between production and total consumption was becoming less.

The average percentage contribution which the different categories of commodities made to the total supplies of protein, fat, carbohydrate and energy during the period under review are presented in the following table:—

AVERAGE PERCENTAGE CONTRIBUTION OF CATEGORIES OF AGRICULTURAL PRODUCE AND MISCELLANEOUS IMPORTED FOODS TO THE SUPPLIES OF FOOD AVAILABLE FOR HUMAN CONSUMPTION
(After van de Wall, 1949)

Category	Protein	Fat	Carbohydrate	Energy
	Per cent.	Per cent.	Per cent.	Per cent.
Plant Products	75·10	42·07	96·61	84·72
Cereal Grains	69·45	35·56	77·80	73·29
Legumes	3·12	5·59	1·07	2·20
Vegetables	1·95	0·27	2·37	2·14
Saccharine Materials	0·00	0·00	14·86	5·84
Fruit	0·58	0·65	0·51	1·25
Animal Products	22·23	55·76	1·23	12·89
Fishery Products	1·26	0·35	0·00	0·21
Miscellaneous Imports	1·40	1·81	2·16	2·18
TOTALS	100·00	100·00	100·00	100·00

Referring to this table, attention is drawn to the following:—

(*a*) Three-fourths of the protein was furnished by plant products, the bulk having come from the cereal grains, and only three per cent. from legumes.

(*b*) Animal products accounted for only twenty-two per cent. of the protein.

(*c*) Animal products accounted for fifty-six per cent. of the fat whereas plant products contributed forty-two per cent., thirty-five per cent. having come from the cereal grains, and the rest from legumes and oil-seed-bearing crops.

(*d*) Practically all the carbohydrate was furnished by the cereal grains and the sugar crop.

(*e*) Eighty-five per cent. of the energy was derived from foods of plant origin, of which the cereal grains represented seventy-three per cent. and sugar cane six per cent.

(*f*) Thirteen per cent. of the energy requirements were met by animal food products.

ESTIMATED FOOD REQUIREMENTS: The population of the Union is a heterogeneous one, consisting of four main racial groups—Europeans, Bantu, Coloureds and Asiatics. According to the latest available Census (1948) the total population in 1946 numbered 11,418,349 persons of which 2,372,690 were Europeans and 9,045,654 non-Europeans. The growth rates, as given in the *Official Year Book* (1941), were, for Europeans 1·86 per cent., for non-Europeans 2·29 per cent.

and for all racial groups combined 2·19 per cent. per annum.

The growth of the population conforms to the usual pattern represented by the compound interest law, and there is no reason to believe that the present rate of over two per cent. per annum will not be maintained—or even slightly increased—during the remainder of the present century. At the present time approximately twelve million people are being fed in the Union, and the demand for food is likely to increase at a rate equivalent to that of population increase, namely two per cent. per annum compound. In other words, the volume of food production must be increased by at least twenty per cent. every ten years, or doubled every half-century, to maintain the present level of nutrition and without increasing food imports.

Attention is drawn to the fact that populations the world over—under ruling political institutions of to-day—are not static, and the general tendency is for them to increase. In the course of time, therefore, a situation must arise when food will become more limiting than it is to-day. This applies not only to the Union but to all other countries with increasing populations.

It is a matter of simple arithmetic to calculate what amount of food is required to feed a population of twelve millions on any particular nutritional plane using a given selection of foodstuffs. In actual commodity units—such as bags of maize, pounds of fish and pockets of oranges—the variety of satisfactory diets which could be made up is infinite. Herein lies one of the greatest difficulties in estimating requirements in terms of conditions. On the other hand, it is known, biologically, how many calories, how much fat, protein, minerals, and vitamins a person should receive per day to keep him alive or to enable him to work, so that it is easier to estimate requirements in these general units than in specific commodity units. The kinds of food which would make up, say, a pound of fat are largely arbitrary, and need not be specified very rigidly. The exception to this general statement is in respect of protein. The nutritional value of a pound of plant protein, derived from say maize, is not the same as a pound of animal protein, derived from meat, so that a distinction, at least between animal and plant protein, should be made.

One of the first attempts to assess the gross food requirements of the population of the Union was made by Haylett (1939). Standards recommended by a Technical Commission of the League of Nations, as well as recommendations of other authorities, were used as criteria. These were considered adequate on the basis of European nutritional standards but were obviously on a higher plane than enjoyed by the non-European races of the Union.

Realising that a single standard, however desirable nutritionally, would not be applicable in practice to a heterogeneous community, Fox (1947) used three separate standards on which to base his calculations of food requirements. These were what Fox called diets A, B and C. The first two were suggested by Stiebeling and Ward, according to Fox, and diet C was based on a knowledge of the food-habits of the rural Bantu. Standard A was applied to the European group and B to all other racial groups excluding the the rural Bantu. Using data from the population census, Fox was able to calculate the national food requirements in commodity units. As commodity units are often interchangeable, the estimates of individual items were arbitrary and depended on the particular dietary standards adopted.

In his studies, van de Wall (1949) calculated the food requirements of the population on a purely biological basis, that is to say, in terms of protein, fat, carbohydrate and energy. He used the daily allowances of calories and protein recommended by the National Nutritional Council (Fox and Goldberg, 1944). In these standards it was recommended that one-third to one-half of the protein should be obtained from animal sources and the lomer limit of one-third was actually adopted by van de Wall.

On the assumption that from 20 to 35 per cent. of the calories should be provided in the form of fat, in order to reduce the bulk of the diet, van de Wall estimated the fat requirements indirectly from the calorie standards. For population groups with daily calorie requirements of up to 2,000, he assumed that 20 per cent. of the energy would have to be provided in the form of fat; for calorie requirements of 2,000-3,000 and 3,000 and over, it was assumed that 25 and 30 per cent. respectively of the energy would have to be provided in the form of fat. The carbohydrate requirement was calculated by difference, after subtracting the calorie contributions by the protein and the fat from the total calorie requirement.

In the estimate of gross nutritional requirements it was assumed, provided an adequate amount of a suitably mixed diet was consumed, that the minimum mineral and vitamin requirements would be met. The estimate was made for approximately 11½ million people taking into account differences in physiological requirements due to age, sex and work performed. It is reasonable to assume that for a larger population the estimated gross food requirements would have to be increased in proportion to the additional numbers involved. For purposes of prediction of future needs the proportionate increase to be allowed for would be approximately two per cent. per annum.

A rough check comparison indicated that, in the estimate of Fox (1946), the allowances of protein and fat were higher and the allowance of carbohydrate lower than in the estimate of van de Wall. This is to be expected, as the standards adopted by the two investigators were very different, that of van de Wall being the lower of the two.

COMPARISONS BETWEEN PRODUCTION AND REQUIREMENTS: It was possible to arrive at an estimate of the degree of nutritional unbalance between food actually consumed and requirements on the level adopted by van de Wall.

The salient features of this analysis are that—

(*a*) there was a deficiency of animal protein which amounted to over sixteen per cent., but this was offset by a surplus of plant protein of over twenty-one per cent., leaving surplus of all kinds of protein of about eight per cent.;

(*b*) there was a very large shortage of fats amounting to nearly thirty-six per cent.;

(*c*) carbohydrate supplies and needs were just about balanced, but owing to the great shortage of fats the energy requirements were not met, and the shortfall was over fourteen per cent.

DISCUSSION: Apparently the industries concerned with food production were successful—after various trade adjustments had been made—in furnishing all the carbohydrate and plant protein, but not all the animal protein necessary to feed the people on a minimal standard. They were not able to provide sufficient fat, so that the energy requirements were also not fully met. This, then, is the broad pattern of the food production structure: sufficient carbohydrates and plant protein, too little animal protein and a gross deficiency of fats and, on balance, too little energy. To improve the situation, two main weaknesses should be corrected: these are insufficient high-class protein and insufficient fat.

It was pointed out previously that the total amount of protein, derived jointly from animals and plants, was apparently adequate but only about twenty-two per cent. was of animal origin whereas it is considered that from one-third to one-half of the protein consumed should be animal protein. Most of the plant protein is derived from the cereal grains—mainly maize and wheat—and this protein is biologically poor in quality, being deficient in some of the amino acids essential for human nutrition.

The unsatisfactory state of the protein supplies could be overcome in two main ways:—

(*a*) by increasing the production of animal products; and

(*b*) by encouraging the production of a greater diversity of crops, especially legumes, in order to provide as many of the essential amino acids as possible in the form of plant protein.

The first alternative would involve the greater use of supplementary feeds, either by growing more feed crops or by withdrawing some foodstuffs from human consumption, by raising the efficiency of the livestock industry—by better breeding, feeding and management, and by more effective control of animal diseases. It is doubtful whether it would be wise to divert much arable production specifically for growing more animal feed, and in any case it is doubtful whether more animal products could be produced sufficiently cheaply to enable them to reach the poorer sections of the community.

The second alternative is worthy of consideration. Research in America has shown that, by balancing plant proteins on the basis of the specific amino acids which they contain, it is possible to reduce the total protein requirement very materially. This approach offers decided possibilities of dispensing with much of the animal protein now thought essential for satisfactory human diets. It is presumed that many of the indigenous races of Africa have to rely on plant protein for reasons of cost, so that research, with a view to finding ways and means of enabling plant protein to be substituted for the more expensive animal protein, appears to offer great possibilities. Such research would include studies of the amino acid complexes of food plants, of suitable combinations of foods derived from plants, and of the husbandry of food crops.

An increase in animal products would also augment supplies of fat, but it is unlikely that the very great shortage of fats could be increased economically by this means alone. It would be necessary also to encourage the production of more oil-seed crops but without restricting the production of other kinds of crops. If, however, it is found to be uneconomical to produce vegetable oils on a larger scale in the Union, it might be desirable and expedient to import these from other parts of Africa where the cost structure is lower and where climate and soil conditions are more favourable. In this respect, possibilities for co-operation with other African territories might well be explored. In the past large quantities of peanuts were imported both from Portuguese East Africa and India. For various reasons the latter source of supply has dwindled but other alternatives may be possible.

By encouraging the production of peanuts and sunflowers, the Union has been able to increase her supplies of vegetable oils very materially during the last year or two. Possibilities for further expansion in these directions have not yet been fully explored.

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