J.H. CLEAVE*

FOOD CONSUMPTION IN UGANDA

"Who doth ambition shun,
And loves to live i' th' sun,
Seeking the food he eats,
And pleas'd with what he gets,"
Shakespeare, *As You Like It*, II, v.

INTRODUCTION

In 1950, shortly after he relinquished his position as Director-General of the Food and Agricultural Organisation, Lord Boyd-Orr dramatically focused attention on the world's food situation with his statement that "a lifetime of malnutrition and actual hunger is the lot of at least two-thirds of mankind".[1] Boyd-Orr's statement was misleading. His definition of "hunger" was unusual and his conclusions were based on error both in the assessment of the requirements of food for human consumption, and the food production, both actual and achievable, in many of the developing areas. The impression remains, however, that developing countries are characterised by starvation conditions, and that they lack the ability to correct this situation themselves. Fortunately, this is not true in many areas.

This paper attempts to assess the food position in Uganda, one of the better endowed tropical countries, for the year 1963. Both the availability of food and the food requirements of the African population are examined. There have been earlier attempts to do this for Uganda, but for reasons similar to those which led to Boyd-Orr's miscalculation, the estimates have been highly inaccurate. Information now available enables a more realistic assessment to be made.

Although the best available information has been used to prepare the estimates in this paper, it must be emphasised at the outset that much of the data are still incomplete or subject to error or dispute. Consequently, the results presented here are still tentative, as are the results of any attempts to compile national estimates of food requirements or availability for areas of the world where agri-

*Formerly Senior Agricultural Economist in the Ministry of Agriculture and Co-operatives, Uganda. Valuable comment by Professor Bruce F. Johnston, Food Research Institute, Stanford University, is gratefully acknowledged.

[1]"The Food Problem. . . .", *Scientific American*, August 1950. p.11.

cultural and medical research relevant to such calculations are in their infancy. The sources of information are given and possible errors are outlined. The estimates of both food requirements and food availability have been made in such a way that both assessments appear as residual figures after logically following through the assumptions made in the intermediate calculations. It is stressed that the picture presented applies to Uganda as a whole and inferences for regions of the country or concerning seasonal conditions should be drawn with great caution, if at all.

Food Requirements

The factors to be assessed in estimating the average food requirements of a country in terms of calories are the body weights of the population, its age distribution and sex distribution, the level of human activity and the climatic characteristics of the country.

The best available evidence of the average body weight of the Uganda African is from a series of weighings carried out at Mulago Hospital in 1957.[2] The study shows weights by tribe varying from 54 to 61 kilograms for adult males. Allowing for the tribal composition of the population a mean body weight for adult males in the 20–30 year age group of 57½ kilograms has been assumed. Adequate data on the weight of adult women are not available and the assumption in this paper of a mean of 50 kilograms is based on the normal ratio between the sexes.

The age and sex distribution of the population was worked out following the 1959 Census of Population and data from the report on that Census have been used here.[3] The data are summarised in Table 1. Uganda has a very young population, with over 40 per cent of the total under 15 years of age—a reflection of the steep fall in death rates in recent years.

Table 1. Age Distribution of the Uganda Population (1959)*
(Percentages)

Age-Group	*Males*	*Females*	*Total*
Under 5	17·4	17·4	17·4
5–9	13·7	13·3	13·5
10–14	10·6	10·5	10·6
Total under 15	41·7	41·2	41·5
15–24	16·7	18·3	17·5
25–34	15·2	16·2	15·8
35–44	11·8	11·5	11·7
45–54	8·1	7·0	7·5
55–64	4·4	3·8	4·0
65 and over	2·3	1·9	2·1

*Based on data in Uganda, Min. Econ. Aff., Stat. Br., *Uganda Census, 1959, African Population (1962)*.

One of the most difficult factors to estimate is the level of human activity. It is probably this factor which, more than all else, is usually overstated in considering developing countries with largely rural populations.

[2]Ruth M. Coles, "The Relation of Height and Body Weight of Uganda African Patients," *East African Medical Journal*, December 1957.
[3]Uganda, Min. Econ., Stat. Br., *Uganda Census 1959: African Population (1962)*.

In attempting to estimate the calorie requirements for a theoretical African population, Clark and Haswell[4] assumed an average farm day for a farmer to be four hours, with a further hour spent in other work or active recreation. Preliminary evidence from farm surveys in Uganda indicates that a range of from three to four hours is a maximum allocation for field work although this average hides a wide variation in the seasonal distribution of farm activity. In order not to understate the food requirements of the population, which in Uganda is almost wholly a farm population, the higher figure of four hours per day for field work for both men and women has been adopted. Data are similarly sparse on the body's consumption of calories resulting from work in the field and the only specific figures noted are those computed by Phillips in West Africa and later adapted by Trowell in East Africa.[5] Even with these figures considerable interpretation is necessary to find a mean for the various farming activities. The figure finally adopted was 250 calories per hour.

The important climatic characteristic in determining the food requirements of a population is the mean temperature. This is a figure which often has little value as it hides large and significant variations and depends on the selection of reporting stations. But in Uganda, lying astride the Equator, variations in temperature are relatively small from season to season and year to year and diurnal range is fairly constant. A mean temperature of 68°F. has been selected after examination of the station data available and published maps of temperature distribution.[6] Due weight has been given to the heavy concentration of population in Uganda in the cooler lake-shore areas of the country.

In the calculations which follow, the report of the Second FAO Committee on Calorie Requirements has been the major guide.[7] This publication provides little help, however, for the allocation of calories by activity; use has therefore been made of the U.S. Food and Nutrition Board's Recommended Dietory Allowances.[8] Adjustments have been made from the U.S. reference man and woman to allow for the lower body weights and different work pattern of the Uganda population on the assumption that over the small range of adjustment required, calorie consumption is approximately proportional to weight. The assumed average daily activity for adults and the daily calorie requirement to meet this level of activity is shown in Table 2.

After adjustment for temperature the requirement of the Uganda reference man, that is, an adult aged 25 with a work pattern as indicated in Table 2, in a mean temperature of 68°F., is 2585 calories per day and for a woman of 50 kilograms and of the same age, 2270 calories per day. These are base figures which must then be adjusted to the age and sex distribution of the population as a whole.

These adjustments, together with an allowance for 180,000 live births per annum yield a total calorific requirement for the Uganda population in

[4]Colin Clark and M. R. Haswell, *The Economics of Subsistence Agriculture* (London, 1964)

[5]H. C. Trowell, "Calorie and Protein Requirements of Adult Male Africans," *East African Medical Journal*, May 1955.

[6]Uganda, Dept. Lands and Surveys, *Atlas of Uganda (1962)*.

[7]FAO, *Calorie Requirements* (Nutritional Studies No. 15, 1957).

[8]National Academy of Sciences, *Recommended Dietary Allowances* (Washington, 1964).

TABLE 2. ASSUMED AVERAGE DAILY ACTIVITY AND CALORIE REQUIREMENTS—UGANDA REFERENCE MAN AND WOMAN

Activity	Adult Male : 57½ Kilos			Adult Female : 50 Kilos		
	Hrs/ Day	Cals/ Hr	Cals/ Day	Hrs/ Day	Cals/ Hr	Cals/ Day
Sleeping	8	55	440	8	52	416
Fieldwork	4	250	1000	4	220	880
Walking	2	148	296	3	130	390
Standing	2	123	246	2	79	158
Sitting	7	74	518	6	57	342
Active Recreation	1	220	220	1	200	200
Total	24		2720	24		2386
Adjusted for Mean Temperature of 68°F			2585			2270

1963 of 2140 calories per head per day. (This figure is close to the theoretical estimate by Clark and Haswell of 2150 calories per head per day. However, this is partly co-incidental; although similar assumptions regarding weight and hours of field work were made, the temperatures used are different and the allowance for "other activities" has been altered. It also appears that Clark and Haswell have assumed an even younger population).

Two previous estimates of the per capita calorie requirements of the Uganda population have been made; by Gale in 1960, who estimated 2500 calories,[9] and Burgess in 1962, who estimated 2545 calories[10]. It would appear that a large part of the difference between the figures presented in this paper and those of Gale and Burgess is an assumption by them of an eight hour working day being typical for the rural population. If eight hours of field work per day is allowed for, but the other factors assumed in this paper held constant, the average requirement for the whole population would be 2440 calories per head per day.

Calorie requirements refer only to the estimated energy needs of the population. For health, the food supply of a country must also provide a sufficient level of protein and other essential nutrients. For Uganda it is particularly important to determine the protein requirements of the population and to examine these against availability. Satisfactory estimation of protein requirements poses many difficulties, and knowledge of the qualitative and quantitive needs of the human body is still incomplete. The Food and Agricultural Organisation has, however, provided a basis for calculating protein requirements per kilogram of body weight by age and stage of development,[11] and this approach has been used to attempt an assessment of the needs of the Uganda population. The calculations follow the exact form suggested by FAO for estimating a target protein supply and so are not reproduced in detail here. The requirement figure used is that provided for calculating average requirements and not target requirements. The effect of this is commented upon in the discussion below. The age distribution of the population has again been taken from the Report on the Census

[9]G. W. Gale, "Food Balance Sheets for the African Population of East Africa," *East African Medical Journal*, May 1960.

[10]A. P. Burgess, "Calories and Proteins Available from Local Sources for Uganda Africans in 1958 and 1959," *East African Medical Journal*, July 1962.

[11]FAO, *Protein* (World Food Problems No. 5, 1964).

of Population, 1959. No data are available on body weights of children in Uganda. It has therefore been assumed that there is a similar relationship between age, weight and sex among Uganda Africans similar to that given in Annex Table 1 of the FAO publication.[12] Allowance has been made for pregnant and lactating women, and the 10 per cent addition for loss of edible matter after the "retail" stage, used by FAO, has been included. The "biological values" (dependent on the amino acid content) and digestibility of tropical foods are not fully established and are subject to considerable variation. It is generally assumed that the nutritional values of proteins in tropical areas are lower than those for proteins normally consumed in temperate developed countries, and FAO suggests[13] that a net protein utilisation value (which is a measure of biological value and digestibility) of 60 to 70 is appropriate for developing countries. The lower value—which increases the protein requirement—has been used here; this reflects the dominance of cassava, plantains, millet and sweet potatoes in the national diet but may be slightly conservative.

The calculated requirement for the Uganda "reference man" is 57·5 grams of protein per day, and the average for the whole country 52·5 grams per head per day. If the FAO practice of allowing a figure of 20 per cent above the average as a target is followed, the requirement would be 63 grams per head per day. The latter figure is held to ensure that all except a small fraction of the population has an adequate protein intake.

Availability

The other side of the picture is the availability of food for human consumption amongst the African population of Uganda. "Availability" is used in the accepted meaning of the word in this context, and signifies the food value of the edible portion which normally reaches the kitchen. Plate waste and other post-preparation losses are not therefore taken into account. A modification of this interpretation is made in discussion of the food balance sheet which follows.

Calculations of food availability are even more uncertain than those of food requirements but they have attracted more attention in the past 15 years. Published estimates of calories available per head, calculated from the production side, are 5254 for 1959[14]; 4399 also for 1959; 4134 for 1958; 4037 for 1951[15]; and 3699 for 1957(9)[16]. The figure of 5254 calories per head per day for 1959 is not derived by working out a full food balance sheet, but it led the author to state that "taking Uganda as a whole it appears that the cultivators are producing approximately 60 per cent more food than is actually required to meet the needs of the population".

[12]FAO, *Protein* (World Food Problems No. 5 1964 Annex Table 1).
[13]*op. cit.*, p.10.
[14]A. S. MacDonald, "Some Aspects of Land Utilization in Uganda," *East African Agricultural and Forestry Journal*, October 1963.
[15]A. P. Burgess, "Calories and Proteins Available from Local Sources for Uganda Africans in 1958 and 1959," *East African Medical Journal*, July 1962.
[16]G. W. Gale, "Food Balance Sheets for the African Population of East Africa," *East African Medical Journal*, May 1960.

All the results quoted are high when related to the figure of requirements produced here or even in comparison with the estimates of food requirements made by Gale and Burgess. The question therefore arises as to whether the figures are reliable and if so why the Uganda farmer should produce such a large surplus.

An obvious rationale for some excess production is the risk of famine. If the farmer gears his cultivation to the assumption that there will be drought or flood or untoward attack of insect pests or plant diseases, then in a year when none of these scourges occurs a considerable over-production will result. It is, however, contended (without here arguing the justification for this view which is well documented and accords with experience) that the peasant farmer is rational, from the economist's viewpoint, in decisions of this nature where the facts are available for his consideration. It is to be expected, therefore, that the risks will be weighed against the effort involved in counteracting them. Drought, flood, pest attack all occur in Uganda. But in any one area the incidence of abnormal conditions is low and their consequences vary from crop to crop. As most cultivators plant a range of staple crops the consequences of a pest attack or weather variation which affects one crop can be immediately countered by the consumption of alternative crops. Further, the climate in most areas allows a catch crop such as sweet potatoes to be planted at most times of the year to fill any anticipated short-fall in requirements. Uganda also has a wide range of rainfall patterns, and a short-fall in one limited area can, at a price, be filled from others, even though inter-regional trade is still rudimentary. On balance it seems unlikely that major overproduction will take place under normal conditions, and any hedging against risk may be expected to take the form of a diversification of food crops, and the planting of crops yielding a high potential in calories for the effort involved. It is noticeable that in the areas where few farmers grow the resilient plantain most grow cassava even though the major staple in these areas is a grain crop. In most areas of the country by-laws exist requiring farmers to plant at least a quarter of an acre as a famine reserve. It is apparent that these by-laws are not obeyed in full but it is estimated that given a normal year some 35 per cent of the cassava crop is left in the ground.

If there is not reason for a large excess of production, it might be questioned whether the figures on which the production estimates were based were accurate. In all cases the estimates of production quoted above were based on the acreage estimates of the Department of Agriculture and an estimate of the average yield. Certainly these figures have, for some years, been the best available; but as early as 1959 doubts as to the validity of the acreage estimates led to a preliminary investigation which showed that acreages under crops were considerably misreported for nearly all crops and in all areas of the country with a tendency to overstate areas under the more important crops. Further investigations confirmed these early findings and led to the undertaking of a full Census of Agriculture under the Food and Agricultural Organisation's 1960 World Census programme. The results of the Census are now available[17] and they

[17]Uganda, Min. Agr. and Co-ops., *Report on the Uganda Census of Agriculture (1965–67)*.

confirm major discrepancies in the crop acreages which were used by earlier writers. A comparison of Department of Agriculture acreage estimates for 1963[18] and those produced by the Census is set out in Table 3. A direct comparison is not easy due to the different breakdown of the acreages. As a rule of thumb the most significant figure may be taken as the combined Census figures for pure stands plus the area in which the crop is the predominant crop in a mixture. (In the Census, enumerators were instructed to "regard the plot as mixed if there is a significant amount of a second ..... crop present".[19] Where a crop predominated in the mixture it was recorded in analysis as "mixed predominant" and where it was of secondary importance as "mixed, minor".)

TABLE 3. ACREAGES UNDER MAJOR FOOD CROPS IN UGANDA*

Thousand Acres

Crop	*Census of Agriculture*				*Annual Report*
	Pure	*Mixed, Predominant*	*Mixed, Minor*	*Total*	*All Planting*
Beans	143	80	539	762	651
Cow-peas	73	12	196	191	
Cassava	210	43	166	419	669
Groundnuts	166	128	86	380	582
Maize	111	100	473	684	367
Sorghum	335	46	240	621	616
Finger Millet	560	442	67	1069	1285
Field peas	43	(10)	—	53	39
Pigeon peas	31	9	89	129	171
Plantains	664	240	243	1147	1640
Sim-sim	126	49	82	257	215
Sweet potatoes	182	10	19	211	586

*Excluding Toro and Karamoja which were omitted from the Census.

The census programme also included an investigation into the yields of major crops and although the first results which are available are not wholly satisfactory, they indicate that the sources used by earlier writers considerably overstate the yields of food crops achieved on small farms in Uganda. The yields used in the estimation of production in this paper are shown in Table 4. The yield adopted represents a weighted average which takes account of yield variations by area and according to whether the crop is grown in pure stand, as the predominant crop of a mixture, or as a minor component in a mixture. Considerable subjective evaluation has had to be made, but the Census has provided a valuable guide to yields and the figures are thought to be considerably more reliable than the estimates used by earlier writers and a reasonable approximation to the actuality of 1963 which was a fairly typical year.

[18]Uganda, Min. Agr. and Co-ops., *Annual Report of the Agriculture Department, 1963* (1965).

[19]Uganda, Min. Agr. and Co-ops., *Report on the Uganda Census of Agriculture (1965-67)*, vol. 1. appendix II.

TABLE 4. CROP YIELDS: UGANDA. ESTIMATES FOR 1963
(Pounds per acre)

Crop	Range of District Average Yields for			Yield Adopted**	Census Standarised Form
	Pure Stands	Mixed, Predominant	Mixed, Minor		
Beans	600–800	400–700	300	400	Dry, threshed
Cow-peas*.....	400	300	100	230	
Cassava*	11000	8800	2200	6800	
Groundnuts	600–1000	500–1300	500	700	Dry, unshelled
Maize.....	600–1500	300–1600	400	550	Dry, on cob without sheath
Sorghum	400–900	200–700	200	500	Dry heads
Finger Millet.....	600–1500	300–1400	600	700	Dry heads
Field peas	500			500	Dry, threshed
Pigeon peas	80–120	80–120		120	Dry, threshed
Plantains	4400–10000	4200–10000	2200	5700	Fresh, bunches
Sim-sim	110–120	110–120		120	Dry, threshed
Sweet Potatoes	4300–7300	4200–7600	4000	5800	Fresh
Solanum*	6600			6600	

*Not included in Census estimates.

**The yield adopted is a rounded mean weighted by applying yields recorded in the Census in four or five districts for each crop to districts with broadly similar growing conditions, in the ratios found for "pure", "mixed predominant" and "mixed minor" stands. This yield is applied to total acreage figures of Table 3 to obtain certain of the production estimates, further comment on which appears in note (b) of the Appendix.

Although the major problem of estimating acceptably accurate acreage, and more reliable yield figures has been overcome, problems of interpretation and of estimating production of crops not included in the Census, and of regional variations in yield make any attempt at a food balance sheet tentative. Also data are lacking on the amount of waste between harvest and the food becoming available in the household, of seed use and of the amount of food used for various manufacturing purposes. It is also apparent that the calculation of food values for foods grown in tropical areas is still not wholly satisfactory. The major source of error in a food balance sheet calculated from production estimates is, however, likely to be the acreages and yields used, and the improvement in these justifies a further attempt at a food balance sheet. This is set out in summary form in Table 5 and is given in detail in Appendix 1. The sources of data and some of the problems encountered in the calculations are included in Appendix 1.

It is estimated that 2356 calories per head per day were available for the Uganda African population in 1963. This figure includes beer, an item which is always omitted from food balance sheets published by FAO. Without beer, average calorie consumption is about 2280 calories per head per day. As will be apparent the food balance sheet leaves out of account such food sources as insects, and fruits and other plants gathered wild, but in total these omissions are a far less important potential source of error than the conversion factors applied to the major staples—plantains, cereals, cassava and sweet potatoes.

The estimate of food (including beer) availability derived from this food balance sheet is considerably closer to the calculation of food requirements than were earlier attempts. It suggests an excess production of only 10 per cent above the requirement and part of this would be accounted for by plate waste

TABLE 5. SUMMARY FOOD BALANCE SHEET FOR UGANDA: 1963

Commodity	Production '000 M. Tons	Net Food Available '000 M. Tons	Calories per head per day	Protein per head per day
CEREALS				
Maize	162	108	150	3·9
Millet	335	210	269	5·3
Sorghum	154	77	102	3·0
Other	15	21	28	0·7
Total	666	416	549	12·9
ROOTS, TUBERS, PLANTAINS				
Cassava	1300	825	346	2·9
Sweet Potatoes	571	571	213	2·4
Plantains	3153	2138	470	4·9
Other	25	21	6	0·2
Total	5049	3555	1035	10·4
SUGAR	124	79	118	nil
PULSES, NUTS, OILSEEDS				
Groundnuts	123	68	143	6·7
Beans	143	130	171	11·1
Other	51	40	62	3·4
Total	317	238	376	21·2
VEGETABLES & FRUITS	150	142	19	0·6
MEAT	126	114	83	6·5
EGGS & MILK	186	101	34	2·4
FISH	70	70	28	4·0
OILS & FATS	20	13	44	**
BEER			80	n.a.
Total			2356	58·0

**under 0·05 grams.

for which Raymond[20] quotes a figure of 5 per cent. In fact the two figures are at first sight too close to allow a reasonable margin for risk and for maldistribution and suggest therefore that the Uganda population is under-nourished. However, in making the calculations it has been assumed that 35 per cent of the cassava planting was left in the ground, that because of localised seasonal excess production 10 per cent of the gross production of plantains was wasted in the field, and also that a high proportion of the cereal crops was devoted to the manufacture of beer which contributes less calories than the grain in its unbrewed form. The reserve represented by the cassava allows for an additional 190 calories per head per day if it were all utilised. A reduction in the proportion of plantains allocated to waste, which would certainly occur if a food shortage struck the country, could contribute a further 45 calories per head per day. In addition it would be reasonable to assume a reduction in the amount of brewing if hunger was general. This source could contribute a further net 130 calories per head per day. There is thus a potential emergency reserve which is immediately realisable of 365 calories per head per day representing 15 per cent of the food classified as "available".

[20]W. D. Raymond, "Minimum Dietary Standards for East African Natives," *East African Medical Journal*, Ocotober 1940.

It is suggested therefore, that the balance sheet figures are realistic. But although adequate food calories are apparently available in Uganda and there are land and labour reserves which, given time, could produce more food supplies should they be required, this should not be taken to imply that none of the population is ever short of basic calories and certainly does not pretend to state that there is no shortage of food in qualitative terms.

The protein apparently available on average is some 10 per cent above the calculation of average requirement, but it is below the figure which FAO would regard as a target. The significance of the protein supply is further discussed below.

Discussion

The calculation of food requirements and food available for a population is essentially an attempt to work out two equations which by definition should have similar values. Any difference should be broadly capable of explanation. The fact that similar answers are obtained to the two equations does not necessarily mean, however, that they are therefore satisfactory statements of food produced and consumed in the country. Indeed much criticism has been levelled at the food balance sheet approach to the assessment of food situations, and with good reason, for it is frequently abused and the results given an unjustified aura of accuracy. It is also clear that there is considerable uncertainty concerning the level and pattern of food intake required by the human body for healthy life; and even more for people of different ages, at different levels of activity. These uncertainties and the possible errors in data required for any assessment of food levels and patterns are accepted, and it is hoped that the area for error in the estimates for Uganda has been clearly shown.

It is sometimes claimed that a food balance sheet is more likely to reflect, with acceptable accuracy, the pattern of food availability in a country than the level of such availability. The reasoning behind this statement is that whilst levels of production are often suspect (and these are the major source of gross error in food balance sheet calculations made from estimates of production rather than consumer surveys), the range of food types available is known. Presumably it is also reasoned that errors in the calculation of production are similar, and in the same direction, for each type of food. It is questionable whether this line of reasoning is supportable in fact. Different crops give rise to errors in production estimation in separate and different ways: data for crops, livestock and livestock products, and fish are likely to be derived from different sources and have been obtained by different methods; knowledge of some sectors of the food economy is likely to be better than for others. There is no reason to suppose that the errors are consistent in direction or degree.

Whilst it is clearly impossible to quantify the errors of level or of pattern inherent in calculations of food need and availability, at least they may be examined for internal inconsistencies and against the observed social, economic and nutritional conditions in the country concerned. It is suggested that the figures produced here accord with observations of the food situation in Uganda

and with rather more certainty regarding the level of availability in relation to need than in the pattern of foods available.

Patently Uganda is not a starving country. Generally blessed with good rainfall, fair soils, abundant sunshine and plenty of land in relation to existing population, production is easy and on the whole reliable: famines have been rare and localised and with the sound transport system established over the past 60 years they may for practical purposes be regarded as a spectre of the past. A wide range of crops is available—several grains, several roots, tubers and plantains. Labour is not stretched to the maximum even with cash crops superimposed on the essentially subsistence economy; and even though at times working days are long to cope with seasonal peak demands, these peaks need not and generally do not cause food production to suffer. (It should however be noted that "field work" is not the only productive work in the day. Part of the time spent walking, standing and sitting shown in Table 2 will be devoted to such productive activities as marketing or fetching water; and additionally, time spent fulfilling social obligations is not regarded by the farmer as available for productive activity. Table 2 may therefore give a false impression of the labour available for further food production: but the fact remains that more time can normally be devoted to this activity should the need arise.) On the other hand, seasonal food shortages immediately before the main harvest are observed, although this is probably more in terms of variety than an overall shortage of calories. This, we may agree with Bennett, does not constitute a food problem[21]: it is an accepted mode of life reflecting the farmers' valuation of the costs and benefits of providing the additional effort that could alter this pattern. If the hunger becomes real, reserves are normally available to deal with the short-term problem, and in the longer term the potential in land and labour exists to provide more. It is popular to suggest that under-feeding saps the farmer of sufficient energy to put in the necessary work to provide extra food, which thus causes more undernourishment and so less food, creating a vicious circle. This may be a realistic appraisal of conditions in some countries less fortunate than Uganda; it certainly does not apply there, for there is no reason for the circle to start when one hour's work spent harvesting reserve cassava can feed the worker for 10 days or him and his family for 2. At present work levels then, the overall food supply in Uganda appears from observation to be sufficient without being excessive, and largely the result of positive production decisions made by the inhabitants. Moreover, should the need arise for a greater level of physical activity, as is to be expected in the process of development, there is no immediate technical reason why the further demands on food supplies should not be met.

It has been stated already that a food supply which is generally adequate for the "average" person in the population does not necessarily indicate that all received enough to eat and may still leave many seriously short of nourshiment. The greater is the range of levels of food intake within a population the greater must be the excess of total available food over average requirement if hunger

[21]M. K. Bennett, *The World's Food* (New York, 1954) p.203.

is not to exist in the country. In a country where virtually every family grows its own food needs and satisfies its hunger in direct relation to its own effort, differences in level of intake will tend to be small. Those with less will be the sick or widowed: and for these strong tribal customs of mutual help are likely to ensure enough if not plenty. It may, with justice, be pointed out that there is in Uganda as elsewhere in Africa a growing range in the size of real incomes among the population with senior African business men, civil servants and politicians receiving salaries which are influenced by, if not always completely equated with, the levels paid to expatriate Europeans whose remuneration was necessarily related to levels in their country of origin. This is true, and the standard of living of these leaders is considerably above the average. But they are a small minority. It is contended that for the vast majority of the country there is a heavy concentration around the mean: to a greater extent probably than in most developed countries—or than in the Uganda of the future. This concentration is increased by the mutual help commonly required by tribal lore which is still strong and which both reduces the number in serious need and spreads the wealth of the richer man. A rich man has many relatives, a fact emphasised in a recent issue of an East African news magazine.[22]

On balance it seems reasonable to anticipate that the food supply in Uganda will equate closely with the needs of the population; there is little reason to expect a large surplus in a year of normal conditions and even less to expect a major deficit, at least in terms of calories.

However, the quality of the food supply is not necessarily related to the quantity and a population which is not undernourished (i.e. has sufficient calories) can still suffer from malnourishment which is a function of the intake of protein and essential minerals and vitamins. It appears to be generally agreed that a community largely dependent on subsistence cultivation for its food needs, and consuming food in an essentially unprocessed form, does not usually suffer shortages of vitamins and minerals.[23] In the absence of evidence that vitamin and mineral deficiencies are important in Uganda, only the supply of, and need for, protein is considered here.

The calculation of average protein requirement gives an estimate of 52·5 grams of protein per head per day, assuming a Net Protein Utilisation value of the average protein available of 60. A target level of 63 grams per head per day would meet the FAO guide lines for ensuring that individual requirements of the majority of the population were met. The food balance sheet suggests that about 58·0 grams of protein are available per head per day: a figure midway between the requirement and target. If the figures on each side of the equation are reasonably accurate this is, at first sight at least, a satisfactory if not ideal situation. It is not one which on theoretical grounds might either be anticipated or cause surprise. For whereas the sensation of hunger is universally known and associated with an insufficient intake of food, and can therefore be provided against in even the most primitive communities, the relationship

[22]*Reporter* (Nairobi) Jan. 13, 1967.
[23]Colin Clark and M. R. Haswell, *op. cit.*, p.4.

between deficiencies in proteins and the ill effects which result is rarely appreciated and is far less proximate. The level of intake of protein is therefore more likely to be a result of exogenous factors rather than planning. A major factor of universal application is that a higher intake of protein is associated with a higher income, as superior protein is generally found in more expensive and more palatable foods, particularly in livestock products. It has already been suggested that inequalities in the distribution of real income per head are relatively small among the mass of the Uganda population and of minor account as an influence on observable maldistribution of food. A second factor is the pattern of agriculture as it differs between regions and tribes and directly influences the pattern of the diet, as it must inevitably do in a subsistence situation.

In Uganda, a country of diversity in tribes, soils, climate and crops, patterns of production vary greatly. There are at least five major staples—with very different protein values—and perhaps even more important, the attitude to livestock and the use of livestock products varies from area to area. In Buganda plantains, which have a low protein value, are overwhelmingly the dominant source of calories and this source is supplemented by maize which is nutritionally the poorest of the grains. Livestock holding per household in Buganda is under half the national average and one-third that of the Northern and Eastern Regions. Moreover, herds of cattle and even small stock are frequently kept on grazing grounds away from the farm and so the family receives little food benefit from them—this goes to the herdsman, usually not a Muganda. Busoga has a broadly similar agricultural pattern. In contrast, in Karamoja the staple is sorghum which for a cereal is highly rated as a protein source; and the major part of the tribe's subsistence comes directly from livestock which must provide a large proportion of the calories as well as protein. In Teso and Lango in Eastern and Northern Uganda respectively, grain crops are the staples and livestock are important. In West Nile cassava becomes the major staple and livestock holdings are below the national average. These brief generalisations serve to illustrate that contrasts in protein supply due to different crop/stock combinations could be considerable. A third possible cause of maldistribution of protein is the existence of tribal taboos against the consumption of certain types of foods by specific groups of the population, particularly women and female children. Thus among the Iteso, females over six years old are forbidden chicken, eggs and pork; the Banyankole forbid the same population group the same foods and also mutton and goat's milk, and fish is taboo to all; in Kigezi the women do not eat eggs, chicken, mutton, pork or fish.[24] It is noticeable that all the taboos, which are widespread, affect major sources of protein, and also are particularly likely to affect one major section of the population, the women, who are both the child-bearers and the group responsible for feeding the young.

There is thus reason to suppose that although the food balance sheet shows sufficient protein is probably available for the whole population of Uganda,

[24]H. J. L. Burgess, "Protein-calorie malnutrition in Uganda," *East African Medical Journal*, July 1962.

the average figure may hide maldistribution between areas and groups of the population. About this the food balance sheet at a national level can reveal little.

Lucid pleas that food balance sheets as sources of information on the food situation in a country should be supplemented by dietary and medical evidence of under–and malnutrition have on several occasions appeared in print since the food balance sheet approach was popularised by FAO. The need for and validity of this plea cannot be denied and a useful source of such evidence is available for Uganda. Between 1959 and 1962, under the guidance of a Committee on Human Nutrition, a series of surveys of protein-calorie malnutrition was undertaken in Uganda by the Nutrition Unit of the Ministry of Health. The results were published in the East African Medical Journal in 1962.[25] The survey did not cover the whole country, and had—as the reports take care to point out—some unsatisfactory features; but a good indication of the problem can be gleaned from them. The survey covered children under 6 years of age. The results suggest that in the areas surveyed plus Buganda some 10 per cent of the children up to six years old may be suffering from malnutrition of sufficient severity to make it clinically observable. There is evidence of considerable variation between districts and between tribes. About two-thirds of cases of malnutrition reported were diagnosed as Kwashiorkor, indicative of protein deficiency with adequate calories, and one-third as Marasmus a sign of shortage of both calories and protein. It is significant that the coverage was mainly of districts where the plantain is the major staple, plus Kigezi which has the severest population pressure in Uganda, and that the writers also expected to find malnutrition in Toro (also dominated by plantains) and West Nile (where cassava is important).

The report supplements the conclusions of the food balance sheet and supports the supposition that there is a maldistribution of protein. It could also probably be argued that if the food balance sheet/requirement equation grossly overstated the availability of protein, the incidence of Kwashiorkor especially and also of Marasmus would be even higher; but the existence of food taboos and marked contrasts in regional cultivation patterns makes opinion on the possibility of understatement less certain.

Whatever conclusion is reached on the total protein availability, it is apparent that a major problem is the need to break down harmful tribal taboos, to provide education in food needs and sources and then to develop the market structure to overcome regional shortages in the supply of protein foods which would be demanded as a consequence of a successful educational programme.

Summary

An estimate of the food requirement of the Uganda population has been made and this compared with an estimate of food availability. It is emphasised that considerable error is possible in both calculations but that the two independent

[25] *East African Medical Journal*, July 1962.

estimates are broadly consistent and, it is suggested, more realistic than earlier attempts to define the food situation in Uganda. The picture which emerges is consistent with observed conditions within the country. The supply of calories is adequate without being excessive and reserves exist which can be called upon should abnormal conditions prevail. Protein supplies are also adequate in the country as a whole but protein intake varies between areas of the country and sections of the population and as a result deficiency symptoms are observed.

Resources are available to meet the food needs of the Uganda population: the major obstacle to the elimination of protein-calorie deficiencies is the ignorance of the consumer.

Notes on Food Balance Sheet

(a) *Population:* Assumes the continuation of the intercensal rate of growth of 2½% per annum.

(b) *Production:* For major agricultural crops included in the census, derived from Tables 3 and 4.

Account is taken of double cropping. *Maize* deflated by 10% to give "as purchased" form: and *Sorghum* and *Finger Millet* similarly reduced by 5%. *Rice, Solanum Potatoes, Grams* and *Yams* derived from Department of Agriculture acreage estimates. Yield of *Cassava* from unpublished farm management survey data. The growing period for *Cassava* varies from 6–15 months and the crop may be left in the ground for over 2 years. This creates difficulties in estimating production from acreage and yield. The quicker growing varieties are however more palatable and the younger roots are those that will normally be consumed in non-shortage conditions. A growing period of 12 months has therefore been assumed here. *Sugar* production from returns published in the annual report of the Department of Agriculture.[26] *Vegetables* include indigenous green vegetables. Production is problematic. An F.A.O. estimate based on urban household surveys assumed 150,000 tons per annum. The level adopted represents 1½oz. per head per day. *Fruit* production is also unrecorded and the same F.A.O. source has been used as a guide.

For *Meat*, production has been estimated by multiplying estimates of slaughter by data on deadweight. The following figures were used:—

	Number Slaughtered	*% of stock Population*	*Dead-weight*	*Offal*
		%	*lbs.*	*lbs.*
Beef and Veal	632,800	20	262	78
Goats	1,150,000	46	28	10
Sheep	300,000	37	21	7½
Poultry	4,000,000	50	½	—

[26]Uganda, Min. Agr. and Co-ops., *Annual Report of the Agriculture Department* 1963, (1965).

In the case of *cattle*, *goats* and *sheep* the guide-line for slaughter has been the annual hides and skins return. Weights are from Bredon[27] and are the result of killing-out experiements. *Game* figures were supplied by the Game Department, Entebbe.

The production of *Eggs* assumes 4 million layers from the Census figure of 8 million head of poultry laying 100 eggs per annum: egg weight taken as 1 oz. without shell.

Milk production is from 1·2 million cows with 350 day lactations and 530 day calving intervals, producing 3 pints per cow per day during lactation. 55% of production is assumed given to calves. *Oils* and *Fats* production is calculated from sales to millers. *Beer* production is estimated from plantings of beer bananas and estimated diversion of grains to beer production, supported by subjective evaluations. Production represents 1 pint per head per day for adults.

Estimates for Toro and Karamoja Districts have been made, based on Department of Agriculture data, adjusted in the light of Census results. These two Districts were omitted from the Census.

(c) *Net Foreign Trade:* From the annual Trade Return of the East African Customs Department.[28]

(d) *Seed:* Estimates are for actual, not optimum use. Information is given by Tothill[29], Kerkham[30] and the official Agricultural Production Programme[31] amongst many sources, and generally scaled down. Allowance is made for the proportion of crops found in mixtures.

(e) *Manufacture:* Beer production, groundnut oil and starch (cassava).

(f) *Waste:* All figures are necessarily estimates depending on the storage characteristics of crops. Harvesting losses have been taken into account by the use of harvested yield figures. Cassava and sweet potato waste represents crop left in the ground as reserve and never harvested. Percentage losses assumed are: maize, finger millet, beans, cowpeas, sim-sim, vegetables and fruit; each 15%. Yams, plantains, pigeon peas, meat; 10%. Sweet potatoes, 15%. Cassava 35%.

(g) *Extraction:* For cereals, milling out-turn. For groundnuts, conversion from unshelled to shelled.

(h) *Calories per 100 grams and Protein per 100 grams:* Estimates vary. Platt[32] provides some figures from East African conditions, Bredon[33] gives some information and Burgess[34] uses a combination of figures. As the the various alternative sources could not be evaluated, use has been

[27]R. M. Bredon, "Food Production as Related to the Nutritional Requirements of the Population of Uganda" (mimeo., Animal Health Research Centre, Entebbe, 1963).

[28]East African, Comm. Customs and Excise Dept., *Annual Trade Report of Kenya, Tanganyika and Uganda for the Year Ending 31st December*, 1963.

[29]J. D. Tothill, ed., *Agriculture in Uganda* (Oxford, 1940).

[30]Uganda, Dept. Agr., *Notes on the Principal Annual Food Crops (1963).*

[31]Uganda, Dept. Agr., *Agricultural Production Programme, 1964.*

[32]B. S. Platt, *Tables of Representative Values of Foods Commonly Used in Tropical Countries* (London, 1957).

[33]R. M. Bredon. *op. cit.*

[34]A. P. Burgess, *op. cit.*

made of the most complete list, the F.A.O. Food Composition Tables[35], modified only in respect of plantains and fish where reliable information showed that the accepted edible portion was different from that used in the Tables. Two independent series of weighing experiments showed that the edible portion of plantains used for cooking was 50% by weight: and the Fisheries Department in Uganda have observed that the edible portion of Uganda fish is 75–80%. 75% has been adopted.

[35]FAO, *Food Composition Tables for International Use* (Nutritional Studies No. 11, 1954).

APPENDIX TABLE 1—FOOD BALANCE SHEET FOR UGANDA, 1963

Population, mid 1963: 7,108,000(a)

COMMODITY	Production (b)	Net Foreign Trade (c)	Available Supply	Disposal of available supply: Seed (d)	Manufacture (e)	Waste (f)	Gross Food	Extraction (g)	Net Food	Calories: Per 100 (h)	Calories: Per Head per	Protein: Per 100 (h)	Protein: Per Head per
	'000 Metric Tons							%	'000MT	gm	day	gm	day
CEREALS													
Maize	162	–21	141	3	15	7	116	93	108	360	150	9·1	3·9
Millet	335	–2	333	3	80	17	233	90	210	332	269	6·5	5·3
Sorghum	154	—	154	3	65	—	86	90	77	343	102	10·1	3·0
Rice	15	+5	20	1	—	—	19	72	14	359	19	7·1	0·4
Wheat Flour	*	+7	7	—	—	—	7	—	7	350	9	11·7	0·3
Total	666	–11	655				461		416		549		12·9
ROOTS, TUBERS and PLANTAINS													
Cassava	1300	*	1300	—	20	455	825	—	825	109	346	0·9	2·9
Sweet Potatoes	571	*	571	—	—	—	571	—	571	97	213	1·1	2·4
Solanum	15	+1	16	2	—	—	14	—	14	70	4	1·7	0·1
Yams	10	—	10	2	—	1	7	—	7	90	2	2·1	0·1
Plantains	3153	*	3153	—	700	315	2138	—	2138	57	470	0·6	4·9
Total	5049	+1	5059				3555		3555		1035		10·4
SUGAR (Cane)	124	–45	79	—	*	—	79		79	387	118	—	—
PULSES, NUTS and OILSEEDS													
Groundnuts	123	–5	118	10	5	—	103	66	68	546	143	25·6	6·7
Beans	143	–1	142	5	—	7	130	—	130	341	171	22·1	11·1
Cowpeas	20	—	20	5	—	1	14	—	14	342	18	23·4	1·3
Pigeon Peas	7	—	7	1	—	1	5	—	5	343	7	20·9	0·4
Field Peas	9	—	9	1	—	—	9	—	9	346	12	22·5	0·8
Sim-sim	14	–1	13	1	—	1	11	—	11	574	24	18·1	0·8
Grams	1	—	1	*	—	—	1	—	1	358	1	20·1	0·1
Total	317	–7	310				273		238		376		21·2
VEGETABLES	100	+1	101	—	—	7	94	—	94	22	8	1·4	0·5
FRUITS	50	*	50	*	—	2	48	—	48	60	11	0·8	0·1
MEAT													
Beef, Veal	75	–1	74	—	—	7	67	—	67	225	58	14·7	3·8
Goat	15	—	15	—	—	1	14	—	14	123	7	14·0	0·8
Sheep	3	—	3	—	—	—	3	—	3	241	3	11·9	0·1
Poultry	1	—	1	—	—	—	1	—	1	122	†	12·3	**
Game	3	—	3	—	—	—	3	—	3	104	1	18·0	0·2
Offal	29	—	29	—	—	3	26	—	26	143	14	16·0	1·6
Total	126	–1	125				114		114		83		6·5
EGGS	11	*	11	—	—	—	11	—	11	144	6	11·0	0·5
FISH	70	*	70	—	—	—	70	—	70	102	28	15·0	4·0
MILK	175	+11	186	—	—	96	90	—	90	80	28	5·5	1·9
OILS and FATS													
Cotton-seed	18	–8	10	—	—	—	10	—	10	884	34	—	—
Grounut	2	—	2	—	—	—	2	—	2	884	7	—	—
Butter etc.	—	+1	1	—	—	—	1	—	1	716	3	0·6	**
Total	20	–7	13				13		13		44		**
BEER											80		
TOTAL—ALL FOODS											2356		58·0

*under 500 metric tons.
†under 0·5 grams.
**under 0·05 grams.

BEDARF 2440 52.5 bzw. 63.0