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Food Production and Requirements of the Madras State *

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The food problem of a State is essentially one of feeding its population, firstly, to satisfy the primary needs of hunger and secondly, to ensure the supply of the various food constituents in adequate amounts to prevent demonstrable deficiency diseases. To attain these two important objects, reliance is usually placed on internal food production; whenever gaps or deficits are detected, they are attempted to be overcome by suitable imports, depending on the availability and willingness of food surplus States to export, and the financial resources of the importing States. There is, of late, a growing tendency, almost universal, to gear up agricultural production to self-sufficiency levels and to minimize as far as possible, if not to completely eliminate, food imports. The levels at which self-sufficiency may be attained cannot be stated in absolute or well-defined terms. Food needs for self-sufficiency at 'optimum levels', the ideal to be kept in view in formulating food production plans, would obviously differ from those needed for self-sufficiency at 'adequate levels'. It is well to remember in this connection that chronically under-fed people have impaired, and sometimes depraved, appetite and are almost insensible to their lack of food. But, they do not function normally, let alone function at their best; every attempt should be made to provide them with sufficient and wholesome food. In these endeavours, it is essential to know the quantum of food production in the State and to equate it in relation to the nutritive requirements of her population.

Figures of food production in a State can be ascertained by one of the following means: (1) ascertaining the average food consumption of an individual, determined through detailed diet surveys carried out on a large segment of the population representing the various cross-sections, and multiplying it by the total number of people in the State; (2) by pooling the various production figures put out by government agricultural departments, and (3) by a knowledge of the extent of cultivated land under the various food crops and of their normal yields. Of these three methods, the first is very laborious and time-consuming and yet not capable of yielding even a reasonably reliable estimate. The second process may be fairly trustworthy and may give satisfactory data in

* The "Madras State" here refers to the composite State as it existed before the 1st October 1953, when the partition of the Andhra State and cession of a major portion of the Bellary district to the Mysore State took place.

normal times. But in periods of relative shortage, with consequential governmental controls and procurements, there is likely to be a tendency on the part of the producers to underestimate and deliberately suppress their production figures for major items of foodstuffs like cereals and pulses, while production figures for less major ones like vegetables, fruits, etc., may not, to a large extent, enter into the picture at all. Such under-estimates and suppression of figures are not expected to be present or, if present, it will be minimal—in the data for the extent of cultivated land under the various food crops but figures for yield will suffer from the same handicap. Yields are usually given not in absolute figures but as a range between two figures, the average of which may be expected to reflect the yield in a large area in the State. Instead of employing the mean of this range, the adoption of the lower figures of yield worked out by the official agricultural experts would help in arriving at a safe and conservative estimate. This method may often err, but it will be comforting to know that it errs only on the safer side. Hence, it was adopted in the present estimate in preference to the other two methods outlined above. It was also felt that this method will introduce fallacies to a minimum extent.

The recent publication of the revised and enlarged edition of Wood's "Agricultural Facts and Figures" (1952) by the Madras Government prompted the present attempt to assess the food situation in the composite State of Madras. Such appraisal is desirable in view of the statements often made, sometimes alarming, about the food situation in the Madras State. In the present computation, it should be distinctly understood that the figures relate to a normal year without the visitations of such abnormalities as floods, drought, etc. Even so, the figures are to be considered only as approximations likely to be of help in shaping future agricultural policies. An assumption has been made that imports and exports of food, into and from the State, are considered negligible and may neutralize one another, and hence, do not seriously vitiate the calculations. This assumption may not be justifiable in the case of pulses, for which there is a fairly large scale import into the State. Even so, the overall intake of food will not be seriously altered. Further, these assumptions would appear extraneous to a study confined to the actual food production in the State.

The acreage under various food crops and figures for yields employed in the present computation of agricultural production are given in Table I. Assuming that the available food were equitably distributed among the entire population, the food available per 'consumption unit' per day was calculated and is also shown in Table I. In this calculation it was felt that data per 'consumption unit' would be more useful than the corresponding figures per head of the population. In the conversion of population figures into 'consumption units', various ratios have been suggested based on the age structure of population revealed by census data and the respective calorie coefficients of the age-structure. Mitra (1952) has worked out that a population of 10,000 would be equivalent to 7,310·5 'consumption units' or roughly 0·73 'consumption unit' per head of population. This ratio has been held by many to be too low; a critical assessment by others has shown that a figure of 0·80 per head of population would be a more reasonable one and hence this was adopted in the present calculations. The population of the Madras State is about 54 millions. The total 'consumption units' in the State would then work out on this basis to 43·2 millions.

It is also relevant to mention the following additional details which have a bearing on the construction of Table I.

Cereals: Though about a dozen cereals are stated to be grown and consumed in the Madras State, only the more important nine of them have been included in the table. Figures for acreage for the common millet (*Panicum miliaceum*), Sanwa millet (*Echinochloa frumentacea*) and Korali (*Setaria glauca*) are not available. Further their production and consumption may be expected to be relatively small and are hence not included. Their non-inclusion will be in accordance with the general aim of maintaining the estimate of production on a conservative basis.

Pulses: Only the major five have been included, omitting the relatively minor ones like field bean (*Dolichos lablab*), Cowpea (*Vigna ungiuculata*), soya beans (*Glycine max*), Pillipesara (*Phaseolus trilobus*), *Phaseolus sublobatus* and dew gram (*Phaseolus aconitifolius*).

Nuts and Oilseeds: The three major edible oilseeds, groundnut (*Arachis hypogea*), gingelly (*Sesamum indicum*) and coconut (*Cocos nucifera*) are only taken into consideration. It is presumed that the production and consumption of other nuts and oilseeds are not substantial enough to make any tangible contribution to food intake.

Condiments and spices: Though a large number of condiments and spices are produced and consumed in the state, account has been taken of only three of them chillies, onions and turmeric, which are produced in fair quantities. Though figures for the extent of cultivation in the State and yields are available for an additonal dozen or so condiments and spices, they are not included in the construction of the table as being inconsequential.

Fruits: Quite a large variety is grown and consumed, but for most of them, data are scanty. Some are too expensive to merit consideration in population-production data. Some are prolific yielders like the Jack (*Artocarpus integra*), pine apple, citrus fruits, guava, papaya, etc., and being not so expensive may contribute in a small measure to the total food intake. But, the absence of data on their production and consumption in the State precludes their inclusion in the present calculations. Only the two major fruits, cheap and relatively abundant, mango and banana (which includes the plantain) are taken into account. The non-inclusion of others, particularly the citrus fruits, will help maintaining a conservative estimate of fruit production and consumption.

Vegetables: Though a variety of vegetables are grown and consumed, authentic data are lacking for most of them. Being a tropical country with luxuriant vegetation, it is to be expected that a large number of them would be extensively grown and consumed. But diet surveys do not reveal a liberal consumption of vegetables by the bulk of the population. No record is available of the vegetables grown in many kitchen gardens and consumed both in the rural and urban areas. Any guess about their production and consumption would be so wide off the mark that it would be safe to omit them in the calculations of food intake. Data relating to two of the root vegetables, potato and tapioca, are, however, available and are included in the table.

Milk: Various estimate and 'guestimates' of milk production and consumption in the State are available. Most of them are in the neighbourhood of 3·5 oz. per head per day, all of which is not consumed as fluid milk. A fair proportion is used for the manufacture of butter and ghee. Hence, this figure of 3·5 oz. per head per day may be assumed to be the intake of a 'consumption unit'. This would allow for the consumption of butter-milk, some of which may be distributed free in establishments employing large herds of milch cattle or in creameries where butter is manufactured.

Other Foodstuffs: No account has been taken of the consumption of meat and eggs. While the majority of the population is non-vegetarian by faith, the economic situation is such as to preclude any large scale consumption of these articles of food. Data on their consumption are woefully lacking; where some figures were obtained as a result of detailed and pains-taking diet surveys, it was found that they were consumed in insignificant amounts. In an earlier computation it was found that the consumption of meat (including eggs) and fish in the Madras State amounted to only 0·133 and 0·29 Oz. respectively per "Consumption Unit" per day.* Figures for consumption of meat and fish today may not be expected to be very different. Any increase in production might have been offset by increased population. In view of this small intake, the nutrients furnished by them are not reckoned in the construction of Tables I and II.

* W. R. Aykroyd (1937): League of Nations Health Organization, C. H. 1253 (C) No. 2.

Betel leaves: The production and consumption of betel leaves deserve special mention. It is stated that 28,769 acres in the state are devoted to the cultivation of betel vine. It is a prolific yielder, giving an average of about 80 lacs of leaves per acre per annum. Even on a most conservating reckoning of 16 leaves to an ounce, the production and consumption of betel leaves is something quite significant. Little wonder then that the habit of chewing betel leaves smeared with slaked lime is wide spread. The ingestion of calcium through this means may be appreciable but as the amounts could not be correctly guessed, they have been omitted from the calculations of nutrient intake. An additional reason for omitting the calcium intake by this means is that betel-chewing is often accompanied by chewing of tobacco when salivation induced by the betel leaves and tobacco is mostly spit out and not taken in. There will then be no addition to calcium intake. Such a habit is prevalent only amongst the men-folk whereas the women, not normally addicted to tobacco chewing, consume in entirety the betel leaves smeared with slaked lime. With the latter, the addition to calcium intake by this means may be significant.

Table II gives the individual nutrients available per 'consumption unit' — protein, fat, carbohydrate, calcium, phosphorus, iron, thiamine, niacin and riboflavin — from the various foodstuffs as also the calorific value furnished by them. Figures for vitamin A activity and vitamin C have not been worked out, because production and consumption of even small quantities of leafy vegetables, and sometimes fruits too, would significantly inflate these figures.

Table III gives a consolidated statement of the various nutrients available per 'consumption unit'.

In working out the figures shown in Tables II and III, the analytical data given in Health Bulletin No. 23 (1951) were employed. The following assumptions have also been made. The chemical composition of rice has been calculated on the basis that the entire consumption of rice is in the raw, milled state. While it is obvious that rice is also consumed in its other states, viz., undermilled, parboiled, handpounded, etc., they have not been taken into account in these calculations as data on the amount of rice consumed in the different states are not available and as the aim of the present study is to obtain a conservative estimate; raw milled rice has a smaller content of most nutrients than other varieties of rice and hence its composition was employed for the construction of Table II.

In computing the nutrients furnished by the three oilseeds and nuts, it has been assumed that 90 per cent groundnut and coconut are crushed for converting into oil and only 10 per cent consumed per se. In the case of gingelly seeds, the entire production has been assumed to be utilized for conversion into oil. These assumptions are, undoubtedly, arbitrary, as no authentic data exist on the relative proportions of the oilseeds and nuts used for expression of oil and those used for direct consumption. However, it is presumed that the assumptions made would not be far removed from practices obtaining in the homes representing the different socio-economic strata in the Madras State.

The composition of foodstuffs given in Health Bulletin No. 23 represents percentages of the edible portion. Allowance should, therefore, be made for the wastage or non-edible portion, especially when the latter is present in significant proportions. The non-edible portion is not considerable with most of the items reckoned in Table II except in the case of the two fruits, mango and banana, which contain about 25 and 40 per cent respectively. Hence, the gross production figures for mangoes and banana have been converted into net values, representing the edible portion only. In the case of the coconut, production figures have been worked out on the basis of kernel weight only and not on the whole nut which will have considerable non-edible portion.

Discussion: It will be seen from the data in Tables II and III that the diet available for the population of the Madras State appears to be *quantitatively* adequate, supplying as it does 2,641 calories per 'consumption unit' against a recommended allowance of 2,600 calories for an adult employed in moderate activities. It does not allow sufficient margin for seed requirements and for the inevitable wastage during transit, distribution, cooking losses, etc. From the point of view of *quality*, the diet is somewhat defective, as nearly two-thirds of the total calories are furnished by cereals alone. The diet is over-weighted with carbohydrates which contribute about 70 per cent of the total calories. The protein content of the diet is somewhat low and could with advantage be increased by 25 to 30 per cent. The amount of animal protein available is very low and might profitably be bettered. Likewise, the amount of animal fat available for consumption could be increased, though the overall picture regarding availability of fat is not unsatisfactory. To effect these improvements, an increased production and consumption of milk, meat, fish and egg is desirable. With a long coastline, it should not be difficult to increase the intake of fish by those who have no religious objection to partaking of it.

The minerals available from the diet, calcium, phosphorus and iron, may be stated to be adequate except perhaps in the case of calcium. When this is considered in conjunction with the widespread habit of chewing of betel leaves smeared with slaked lime, notwithstanding its limitations, and the consumption of some leafy vegetables, the calcium requirements of the population may be deemed to have been fairly adequately met. As much as 28,769 acres are devoted to the cultivation of betel vine, producing over 4,00,000 tons of leaves rich in calcium, carotene and vitamin C. In addition to its being inherently rich in calcium, liberal amounts are employed for smearing the leaves, thus contributing substantially to total calcium intake, more especially in the case of those not addicted to chewing tobacco in addition. Calcium ingested through this means is physiologically available. Further, the intake of most vegetables, including leafy vegetables, has not been taken into considerarion, for lack of data. The leafy vegetables being rich in calcium and iron would make some contribution to total intake of these two elements. The intake of the cheap and easily cultivated leafy vegetables may with advantage be increased.

The amount of vitamins furnished by the diet is in general inadequate, more especially in vitamins of the B-group. The latter should nearly be doubled for ensuring satisfactory intakes, preferably by increased production and consumption of pulses. The supply of vitamins A and C has not been considered at all, as it is inextricably mixed up with the production and consumption of leafy vegetables and fruits, rich sources of carotene (pro-vitamin A) and vitamin C.

Notwithstanding these seeming deficiencies, the overall impression left in the mind after a critical appraisal is that the food situation in the Madras State is not so pessimistic or grave as is often made out in the lay press and elsewhere. Yet, it is definitely on the marginal side, allowing little or no provision for lean years and for natural calamities like drought, floods, etc., or for the inevitable inequalities of distribution. The food situation could and should be improved if the entire population were to be fed at nutritionally adequate levels. There is hardly room for complacency; in fact, complacency would be dangerous, especially in the context of the steadily growing population pressure.

TABLE I.

	Acreage (1,000 acres)	Annual yield per acre	Total annual production (million tons)	Available food per "consumption unit" per day (in ounces)
Cereals :				
Rice ..	10,500	1,000 lbs.	4·690	10·806
Sorghum ..	4,828	400 ,,	0·862	1·987
Cumbu ..	2,597	300 ,,	0·350	0·806
Ragi ..	1,748	1,000 ,,	0·780	1·797
Italian millet ..	1,543	600 ,,	0·413	0·952
Kodo millet ..	987	600 ,,	0·264	0·608
Samai ..	565	400 ,,	0·101	0·233
Wheat ..	12	400 ,,	0·002	0·005
Maize ..	58	1,200 ,,	0·031	0·070
	22,838		7 493	

	Acreage (1,000 acres)	Annual yield per acre	Total annual production (million tons)	Available food per "consumption unit" per day (in ounces)
Pulses:				
Red gram ..	337	900 ,,	0·1354	0·312
Horse gram ..	1,549	350 ,,	0·2420	0·557
Green gram ..	506	320 ,,	0·0723	0·167
Black gram ..	292	320 ,,	0·0417	0·096
Bengal gram ..	65	550 ,,	0·0160	0·037
	2,749		0·5074	
Oilseeds and Nuts:				
Groundnut ..	3,743	900 ,,	1·5040	3·466
Gingelly seeds ..	718	100 ,,	0·0321	0·074
Coconut ..	606	1,500 ,, (of kernel)	0·4058	0 935
	5,067		1·9419	
Condiments and Spices:				
Chillies (dry) ..	289·0	1,200 lbs.	0·1549	0·356
Onions ..	43·69	9,000 ,,	0·1756	0·405
Turmeric (dry) ..	33·612	4,000 ,,	0·0601	0·139
			0·3906	
Sugar and Jaggery:	203·0	6,000 ,, (jaggery)	0·5438	1·254
Vegetables:				
Potato ..	14·997	12,000 ,,	0·0804	0·185
Tapioca ..	25·475	6,000 ,,	0·0670	0·155
			0·1474	
Fruits:				
Mangoes ..	250·0	12,500 ,, (gross) and	1·3890 (gross) 1·0420 (net)	2·401
Bananas (including plantain) ..	150·0	15,000 ,, (gross) and	1·0000 (gross) 0·6000 (net)	1·382
Milk:	—	—	—	3·5
Betel leaves:	28·769	31,250 ,,	0·4013	0·926

TABLE II.

	Per cons. unit	Protein	Fat	Carbohy-drate	Ca.	P.	Fe.	Thiamine Int.	Nicotinic acid	Ribo-flavin	Calories
	Oz.	g.	g.	g.	mg.	mg.	mg.	Units	mg.	g.	
Cereals;											
Rice ..	10·806	21·61	1·08	237·74	32·42	335·00	3·24	64·84	3·24	248·55	1,069·84
Sorghum ..	1·987	5·96	0·99	41·73	15·90	156·98	3·57	65·58	0·99	206·66	200·71
Cumbu ..	0·806	2·66	1·13	15·41	11·29	79·85	2·50	25·00	0·72	—	82·27
Ragi ..	1·797	3·59	0·72	39·00	168·95	138·40	2·69	71·89	0·54	—	176·14
Italian Millet ..	0·952	3·33	1·24	16·37	7·61	78·06	1·71	52·36	0·19	—	90·43
Kodo Millet ..	0·608	1·46	0·24	5·23	6·08	42·59	0·91	18·86	—	—	52·93
Samai ..	0·233	0·51	0·31	4·22	1·40	23·33	0·46	6·54	—	—	21·70
Wheat ..	0·005	0·02	0·002	0·09	0·06	0·42	0·006	0·23	0·006	0·16	0·45
Maize ..	0·07	0·23	0·07	1·34	0·21	6·63	0·05	—	0·03	2·0	6·92
	17·265										1,701·39
Pulses:											
Red gram. ..	0·312	1·96	0·16	5·06	12·48	21·84	0·78	13·42	0·22	44·31	29·64
Horse gram ..	0·557	3·51	0·06	9·03	44·60	61·32	1·17	—	0·22	—	50·73
Green gram ..	0·167	1·13	0·06	2·68	6·67	13·33	0·40	7·33	0·10	18·33	15·83
Black gram ..	0·096	0 66	0·04	1·65	5·78	9·63	0·27	3·85	0·06	10·31	9·54
Bengal gram ..	0·037	0·18	0·06	0·65	2·00	2·52	0·10	1·04	0·03	5·39	3·81
Oilseeds:											
Groundnut ..	3·466	2·63	3·92	2·01	4·85	38·09	0·18	88.65	1·39	29·44	54·02
		(1/10)	35·25								317·27
Gingelly ..	0·074		0·91	—	—	—	—	—	—	—	8·17
Coconut ...	0·035	0·13	1·10	0·34	0·28	6·36	0·05	0·37	0·02	2·62	11·79
		(1/10)	9·94								80·42

TABLE II *(Contd.)*

	Per cons. unit	Protein	Fat	Carbohydrate	Ca.	P.	Fe.	Thiamine Int.	Nicotinic acid	Riboflavin	Calories
	Oz.	g.	g.	g.	mg.	mg.	mg.	Units	mg.	g.	
Condiments:											
Chillies (dry) ..	0·356	1·60	0·64	3·20	16·04	35·65	0·25	—	—	—	24·96
Onions ..	0·495	0·20	0·04	1·50	4·05	8·09	0·12	4 45	0·04	1·21	6·88
Turmeric (dry) ..	0·139	0·25	0·19	2·73	5·97	11·11	0·73	—	0·09	—	13·75
Sugar and Jaggery ..	1·254	—	—	35·60	—	—	—	—	—	—	142·42
Vegetables:											
Potato ..	0·185	0·09	0·02	1·20	0·60	1·67	0·04	1·11	0·06	0·60	5·18
Tapioca ..	0·155	0·03	0·02	1·68	1·55	1·55	0·03	0·62	0·02	4·33	6·95
Fruits:											
Mangoes ..	2·401	0·43	0 24	7·93	7·20	14·41	0 24	—	0·24	33·61	33·61
Bananas ..	1·382	0·42	0·14	9·68	4·12	11·06	0·14	—	0·14	66·36	41·44
Miscellaneous: ..											
Milk ..	3·5	3·15	3·50	4·90	119·00	87·50	0·35	17·50	0·35	199·50	63·00
Betel leaves ..	0·926	0·83	0·18	1·57	60·19	10·19	1·48	—	0·18	8·33	11·11
Total ..		56·62	62·252	452·54	538 30	1,196·58	21·466	443·64	8·876	881·71	2,640·91

TABLE III.

Showing available nutrients per "consumption unit" per day.

Protein	..	56·62 g.
Fat	..	62·25 g.
Carbohydrate	..	452·54 g.
Calcium (Ca)	..	538·30 mg.
Phosphorus (P)	..	1,196·58 mg.
Iron (Fe)	..	21·47 mg.
Thiamine	..	443·61 Int. Units.
Nicotinic acid	..	8·88 mg.
Riboflavin	..	881·71 mg.
Calories	..	2,640·91

Research Note

Variations of Soil Temperature at Coimbatore

Soil temperature has an important part to play in the maintenance of moisture status in the soil. Optimum level of moisture in the soil is very essential for successful crop production. Roots and shoots of plants depend on soil-moisture for their normal development.

To gain an idea of the variations of soil temperature due to depths and seasons, the soil thermogragh charts pertaining to the depths of 4", 6" and 24", maintained for a period of nine years, were examined and relevant data for intervals of two hours were culled out. The soil is of light black colour, best suited for the cultivation of cotton under irrigated conditions. Twelve sets of data were collected for each depth, each set comprising a period of nine years. Fisher's analysis of variance was used to study the variations in hourly and weekly temperature. By students 't' test the significance of the difference between the means at 4", 6" and 24" depths, taken in pairs, was tested. Finally by calculating the correlation coefficients of mean temperatures at these three depths, the degree of association was assessed.

Tentative Findings: (i) The soil temperature is maximum at the period 12–16 hours. There is no significant difference in the temperatures noted in this period.