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extent justified. Apart from chemical analysis and data collected by biological assay, it may be that the varieties behave differentially on cooking and have different flavour, both qualities that cannot be measured.

The biological values obtained for the local variety agree with those obtained by Niyogi *et. al.* (2) and confirm their observations.

Summary. Different varieties of Red gram obtained locally and from the hills have been compared for their relative nutritive values, and it is found that the local variety has a high protein content, and digestibility value.

Our thanks are due to Mr. V. Ramanatha Iyer, Cotton Specialist, who kindly supplied the samples required for the experiments, and suggested the investigation. Our thanks are also due to Mr. C. Balasubrahmanya Mudaliar who helped in the analysis.

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ECONOMICS OF WET AND DRY LAND CULTIVATION IN THE VIZAGAPATAM DISTRICT

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In Bulletin No. 40 of the Madras Agricultural Department on the economic condition of the ryot in the Vizagapatam district, and how to improve it", the net annual cash income from an average holding of about 5 acres supporting a family of 5 adults (2 children being considered equivalent to 1 adult) and consisting of both wet and dry land partly commanding facilities for well-irrigation was estimated at Rs. 137. Adding the value of food grains consumed, the total family income of an owner-cultivator works out to Rs. 237. To enable the productive capacity and the costs of cultivation of each kind of land to be judged, the economics of 5 acre holdings of wet and dry lands with and without a well, under normal cropping suitable for each, are now presented. Crop-var data were worked out in detail, as well as the croping schemes, the cost of cultivation and the estimated yield from each kind of holding. A summary of the figures therefrom is given in Table I for ready reference and comparative study. The family incomes which a lessee manager (one who takes land on lease and cultivates it entirely with hired labour), a lessee cultivator (one who takes land on lease but cultivates it with as much of his family labour possible supplemented by hired labour), an owner-manager and an owner cultivator respectively, derive from each kind of holding are shown therein. The family income of a lessee manager represents the net business income, all cultivation expenses and the lease amount (interest on the value of the land *plus* other equipment *plus* assessment) being deducted from the gross value of the produce. The family income of a lessee cultivator will be the above,

plus the wages of permanent labour saved by the cultivator's family working on the land. The owner manager's family income consists of the lessee manager's income *plus* the lease amount *minus* the assessment. The owner-cultivator's income is the above, *plus* the wages of the permanent labour saved.

TABLE I.

Particulars.	Land unprotected by wells.						Land protected by wells.	
1	2	3	4	5	6	7	8	9
	5 ac. Wet.	5 ac. Dry.	10 ac. Wet.	15 ac. Dry.	20 ac. Wet.	30 ac. Dry.	5 ac. Wet.	5 ac. Dry.
1. Cattle labour required day-pairs ...	97	83	194	249	388	498	152	158
2. Pairs of cattle to be maintained	1	1	2	2	4	4	1	1
3. Human labour required—								
(a) permanent labour day-men	179	146	358	438	716	876	375	427
No. of men to be employed in lieu of family labour } men	1	1	1	1	2	2	1	1
No. of men to be employed in lieu of family labour } boys	1	1	1	1	1	1	1	1
(b) Casual labour— men	72	21	144	42	288	84	110	45
Do. in lieu of permanent labour ...	—	—	59	138	118	276	75	127
(c) Women or boys ...	249	215	494	645	988	1290	411	400
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
4. Cost of permanent labour or value of own labour ...	135	135	135	135	225	225	135	135
5. Cost of casual labour ...	48	33	113	131	226	262	102	91
6. Cost of maintenance of cattle...	72	72	108	108	216	216	96	96
7. Other items of expenditure ...	88	25	176	75	352	150	169	103
8. Assessment	60	20	120	60	240	120	60	20
9. Interest on the value of land and other capital	115	65	220	170	440	340	170	170
10. Depreciation on stock ...	30	30	40	40	80	80	40	40
11. Total expenditure	548	380	912	719	1779	1393	772	655
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
12. Receipts from crops ...	459	284	918	852	1836	1704	945	851
13. Value of cattle dung and urine	9	9	15	15	30	30	12	12
14. Total receipts	468	293	933	867	1866	1734	952	863
15. Deduction for bad seasons ...	47	59	93	173	187	347	48	86
16. Net receipts	421	234	840	694	1679	1387	909	777
17. Net (item 16—11)								
Family income of a								
Lessee manager ...	127	146	72	25	100	6	137	122
Lessee cultivator ...	8	11	63	110	125	219	272	257
Owner manager ...	12	81	148	145	340	334	307	292
Owner cultivator ...	123	54	283	280	565	559	442	427
18. Net family income per acre of a								
Lessee manager ...	25	29	7	2	5	—	27	24
Lessee cultivator ...	2	2	6	7	7	7	54	51
Owner manager ...	2	16	15	10	17	11	61	58
Owner cultivator ...	25	11	28	19	28	19	88	85
19. Percentage to gross receipts of—								
Permanent or family labour ...	32·0	57·7	16·0	19·4	13·4	16·3	14·8	17·4
Other cultivation expenses ...	56·5	68·4	52·0	51·0	52·0	51·2	44·8	42·4
Assessment	14·2	8·6	14·2	8·6	14·2	8·6	6·6	2·6
Interest on value of land and other capital ...	27·3	27·7	26·4	24·5	26·4	24·5	18·7	21·9
Net profit or loss	30·0	62·4	8·6	3·5	6·0	0·6	15·1	15·7

2. In discussing the significance of the foregoing figures, it should be borne in mind that the incomes worked out are for good land which may be classed as of first *tharam* and under careful management. To provide for exigencies of the season an allowance of 10% on the value of gross produce in the case of wet land and 20% in the case of dry land unprotected by well irrigation and 5 and 10% respectively in the case of wet and dry land protected by wells has been made.

3. The figures in the summary show that while five acres of wet or dry land with wells may give an owner cultivator an annual family income of about Rs. 450 and which at the rate of Rs. 50 per adult (Rs. 20 for food grains and Rs. 30 for other expenditure) can support nine adults (or nearly 2 adults per acre) the same area of wet land unprotected by well irrigation gives to its owner cultivator a family income of only Rs. 123, which can support only 2·5 adults (2 children taken as equivalent to 1 adult). The case is much worse in the case of dry land without wells which yields a family income of only Rs. 54 and can support only a single adult. A lessee manager of a 5 acre holding of wet land with well can get an income of about Rs. 137 and support a family of 3 adults. The same area of dry land, if protected by a well, gives him an income of Rs. 122 with which the same number of adults can be supported though not perhaps on the same standard.

4. For an owner cultivator of wet-land without wells to support a family of five adults he has to possess a holding of 10 acres as is shown in column 4 of the summary. Similarly an owner cultivator of a dry land without wells has to possesss at least 15 acres as shown in column 5.

5. For a lessee cultivator to support a family of five adults he has to cultivate 30 acres of dry land. In the case of wet land without wells even 20 acres will not enable him to support such a family and he cannot manage a larger area with his family labour, for, out of an average family equivalent to five adults it may not be that more than $2\frac{1}{2}$ will be capable of working on the farm and the employment of permanent labour to cultivate the extra area leaves no further margin of profit to the lessee manager.

6. Item 19 in the summary shows the percentages of the different components of expenditure to the gross value of the produce from the different kinds of holdings after making a deduction for vagaries of season as already stated. The figures show that in the case of a 5 acre holding of dry land without wells, the value of the cultivator's own labour or permanent labour that may be employed instead and the other cultivation expenditure alone exceed the gross receipts, leaving nothing for the payment of even the assessment, let alone the interest on the value of the land or a profit to the cultivator to enjoy. In the case of a wet land holding of 5 acres without wells there is barely a margin for payment of assessment, but nothing against interest nor is any profit left. Five acre units are thus quite un-economic in both wet and dry lands without wells. A 10 acre holding of wet land and a 15 acre holding of dry land are the smallest economic units and show

considerable economy as compared with 5 acre holdings. The labour and other cultivation expenses work out to 68 and 70% respectively leaving a margin of 18 and 21% to the owner manager towards interest on the value of land, which at 5% comes to 26·4 and 24·5% respectively. In the case of holdings double the size of the above, the economy in labour due to the larger size of the holding is comparatively small. And larger holdings will not be more economic unless a different system of cultivation (with labour saving mechanical devices) which has yet to be demonstrated, is adopted. In the case of land protected by wells, the figures show a happy contrast to the above. Even 5 acre holdings of such land afford about 16% profit after deducting cost of labour and other cultivating expenses, assessment and interest on land. The first two items work out to about 59% in both cases and the assessment and interest to about 25%.

7. It is thus clear that land un-protected by wells or other sources of perennial irrigation cannot leave a margin of profit to the cultivator even if the holding is the best of its kind and of the optimum size. The cultivator at present barely gets his wages for his labour, and agriculture on such holdings is thus only a mere source of regular employment, which no other occupation can furnish to such a large percentage of the population.

8. What is the remedy for this state of things? This is a question that will naturally arise from the above study of the existing state of things. The best way to improve the condition of the ryot which naturally suggests itself besides popularising the improvements advocated by the Agricultural Department, is to create more sources of perennial irrigation, of course, without prejudice to drainage and thus enable the land to be more intensively cultivated than at present. For this purpose aiding the ryots in digging wells wherever possible by *Takavi* loans is a step that could be immediately taken up, while suitable irrigation projects may be undertaken in due course after proper invesitgation.

9. When intensive cultivation is thus encouraged on a large scale care has to be taken to plan the cropping in such a way that the produce is such as can be readily consumed locally or in the nearest town. For the sale of any produce that is not thus locally consumed, a proper organisation for marketing has to be set up. To enable produce to be marketed easily and at a reasonable profit its quality has to be improved, and the quantity produced per unit area increased, while the cost of production is minimised by the adoption of the improvements advocated by the Agricultural Department.

10. The problem of enabling the ryot to clear off his present debts and keep himself free from debts in future has received attention at the hands of the present Government and it is hoped that the new act will prove of considerable benefit to the agriculturists.

11. The reduction of the assessment on the land is also being considered by the Government and some relief has already been afforded. The figures as per item 19 of the summary show that even in the case of 20 or 30 acre holdings of wet or dry land un-protected by well irrigation, no margin of profit is left to the cultivator with the present rates of assessment.

As the Government however cannot forgo land revenue altogether, as much concession as possible has to be shown. The reduction of assessment should be at least such as to allow him to enjoy the full wages for his labour. A family equivalent to five adults requires at least Rs. 250 per year for maintenance at the rate of Rs. 50 per adult. If, as stated above, $2\frac{1}{2}$ adults equivalents of the family work on a farm, they should get at least this amount of Rs. 250 (which works out to Rs. 100 per adult) per annum as wages for their labour. In the estimates under discussion, wages to permanent labour have been calculated at Rs. 90 per annum and at least this has to be left to the cultivator as return for his toil. Now taking the wet land holding of 10 acres which is the minimum size of an economic holding, the assessment which is put down at Rs. 12 per acre has to be reduced by 60 % to wipe off the loss and let the cultivator get his full wages. In the case of a dry land holding of an optimum area of 15 acres the assessment which is put down at Rs. 4 per acre has to be similarly cut down by 40%. No reduction will be necessary in the case of lands commanding irrigation facilities throughout the year unless the present rates are un-reasonably high as in some Zamindaries.

12. Smaller holdings unprotected by wells cannot bear even this reduced assessment, unless they are consolidated to form such economic units. All possible measures have therefore to be taken to encourage consolidation of such small holdings and prevent further splitting up. If such consolidation is not immediately possible, at least their joint cultivation in economic units has to be encouraged by showing a further concession in assessment temporarily for a certain number of years on all small holdings thus jointly cultivated.

13. A reduction of assessment to the extent referred to above while leaving a margin for a four anna wage a day to the cultivator, allows the landlord interest at five per cent on the value of the land. Landlords who possess large areas and obtain a large income by leasing out their lands may be made to pay a reasonable tax on the income obtained above a certain minimum to compensate for the reduction of assessment on the smaller holdings to some extent.

14. The proportion of a share of the produce which a farm labourer may reasonably expect from a cultivator is another problem on which the figures worked out also throw some light. There was a demand at an agricultural labour conference held at Bezwada in July last, that half of the net profit out of the work contributed by the labourers should go to them; but it will be seen from the figures discussed above that there is no such profit left even in the case of an optimum sized holding of wet or dry land unprotected by wells. The labourer does well therefore to claim a minimum wage per day rather than a share. In the Vizagapatam district, the permanent labourer's annual emoluments, which he gets mostly in kind, do not exceed Rs. 45 or Annas 2 per day. A ryot who employs a permanent labourer pays even this low wage, not from the profits he earns but as a

penalty for his inability to do the work himself as he should, and at a sacrifice of his own income and comfort. The actual work turned out by a labourer who agrees to serve on such a meagre remuneration is also very poor, hard work being put in only on a few days of the year and the rest of the time spent on light jobs or mere tending cattle or watching crops on the farm yard. A casual cooly is usually paid better wages but he has to work hard and does not obtain employment for more than half the days in the year, except near a town or other industrial centre. In the case of lands protected by wells where intensive cultivation is practised, it is rare that permanent servants are employed, as the holdings are usually small and the owner has enough of his own labour to put in. On such holdings, moreover, the same degree of efficiency cannot be maintained as when servants are employed. If, on such holdings, it becomes necessary to employ servants it may be more advisable to engage them on the share system, according to the total number of hands—owners or servants—working on the farm; half of the net profit being distributed amongst them. If the owner does not himself work, this may be distributed amongst the servants alone but it is rare that sufficient profit to satisfy the servants is obtained on this system owing to their inefficiency.

EXTRACTS

The Relation of Growth Substances to Horticultural Practice. Much of our recent knowledge of plant hormones we owe to the Utrecht botanists, whose investigations led to the recognition of the nature and function of these substances. Earlier experiments carried out with seedling oats showed that the shoot apex produced substances capable of regulating growth, and that these substances could be transferred to other seedlings. A wide search was consequently made for a ready source of these compounds and they have since been found in small quantity in grain, pollen and leaves, while higher concentrations occur in urine.

At the Leicester meeting of the British Association, Prof. F. Kogl described the isolation and chemical recognition of auxin *a* and *b*. Their structure is complicated, but with these two compounds a third active compound hetero-auxin, was found which proved to be indolyl-acetic acid previously well known to chemists.

Small quantities (5 mgm.) of indolyl-acetic acid when applied in lanolin to the young stems of tomato plants growing vigorously cause, within 24 hours, twisting and bending of the petioles and stems, as unequal growth takes place on the two sides. This is a quick ready means of testing closely-related and other chemical growth-promoters. In a few days roots appear from the stem, root-initials also develop inside, and may be clearly seen by cutting the stem longitudinally. Similarly, the production of roots may be induced in several different portions of plants, and vegetative reproduction is thus greatly facilitated.

The paste method has been largely superseded by the use of dilute solutions. Herbaceous or woody cuttings are taken and their basal ends placed in the solution to a depth of an inch. After washing in water, the cuttings are then placed in sand in propagating frames.