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manifold if suitable guidance and assistance is provided for the adoption of improved technology. The MVP of the irrigated and unirrigated land at the existing levels of technology was found to be Rs. 617.17 and Rs. 274 respectively. The MVP of the irrigated and unirrigated land was found to be Rs. 3,205.90 and Rs. 609.44 at the improved levels of technology.

ADOPTION OF NEW TECHNOLOGY ON SMALL FARMS : THE ROLE OF CREDIT AND ITS REQUIREMENTS

K. V. Subrahmanyam*

Much of the advantages of the high-yielding varieties (HYVs) as a factor in the uplift of the economic condition of the small farms lies in their scale neutrality. This scale neutrality was exhibited by a number of people through their studies.¹ However, it was soon realised that the changed factor proportions required by the HYVs were not favourable to the small farms. This was due to the fact that the factor substitution permitted by it, *viz.*, capital for land rather than labour for land, was not conducive to the small farms, as the small farms are not only deficient in land area but particularly deficient in capital in the form of fertilizers, pesticides, etc., which are crucial to reap the full benefits of the new technology. This capital bottleneck places the small farms in a disadvantageous position regarding access to the supposedly scale neutral technology.

Several measures to alleviate the capital constraints have been suggested such as the supply of scarce resources like credit, etc. These are based on the assumption that once these facilities are made available, the small farmers will gain from the new technology. The present study is an attempt to evaluate the likelihood that such measures will succeed in alleviating capital constraints. In particular, the two main objectives of the present study are: (i) to investigate how far credit will help the small farmer in the adoption of new HYVs of paddy; (ii) to assess the credit requirements of the small farmers.

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1. See for example, Surjit S. Sidhu, "Relative Efficiency in Wheat Production in the Indian Punjab," *The American Economic Review*, Vol. LXIV, No. 4, September, 1974, p. 746 and also P. K. Bardhan and T. N. Srinivasan, "Income Distribution: Patterns, Trends and Policies," *Economic and Political Weekly*, Vol. VI, No. 17, April 24, 1971, pp. 877-882, where they write "There was some agreement that though the new agricultural technology might be neutral to the size of holding and.....", p. 881.

METHODOLOGY

The study was conducted in West Godavari district of Andhra Pradesh. The Intensive Agricultural District Programme has been in operation in this district since October, 1960 and the HYV programme was introduced in *kharif* 1967-68. Paddy is the most important crop of the district, occupying nearly 70 per cent of the cropped area in 1970-71. West Godavari was stratified into eight homogeneous zones—three deltaic and five upland zones based on the criteria such as cropping patterns, soils and irrigation facilities.² Eight villages were randomly selected representing each zone and five small farms (2 hectares and below) were selected from each village, giving a total sample of 40 small farms.³ Linear programming was used as the analytical technique to develop the optimum plans. The model used was one which maximizes the net returns subject to resource constraints, minimum requirements of cereals, for home consumption and fodder for animal maintenance, and maximum acreage restrictions on crops like banana and sugarcane. The activities comprised crop rotations with a number of processes to indicate varietal and input options.⁴ Provisions for borrowing capital and hiring labour were also provided in the models. One representative small farm holding was selected from each zone and was programmed under the following two situations for the optimum plans: Situation I: Optimum plans with limited available capital; and Situation II: Optimum plans with unlimited capital availability through a borrowing activity.

RESULTS AND DISCUSSION

The optimal crop plans developed under the above two situations are presented in Table I. The optimum plans under situation II has clearly brought out the fact that the provision of additional capital helps in bringing the HYVs of paddy into crop plans except in the deltaic zones II and III. In all the deltaic zones and the two upland zones, the HYVs could not find a place in the optimum plans with limited available capital. However, the relaxation of the capital constraint results in 12 per cent of the total cropped area being brought under the HYV paddy in deltaic zone I and 60 and 100 per cent in the upland zones IV and VIII respectively. The provision of additional capital could not help in bringing the HYVs into the optimum plans in the deltaic zones II and III as borrowing was found unnecessary. This was mainly due to the non-availability of irrigation facilities in the *rabi* season for most of the farmers in these zones and the non-suitability

2. For details of areas (blocks) included, number of villages and percentage of cultivated area of the district, see the appendix of the paper by K. V. Subrahmanyam and R. K. Patel, "Impact of Capital Availability on Farm Income and Demand for Short Term Credit in West Godavari District, Andhra Pradesh," *Agricultural Situation in India*, Vol. XXVIII, No. 3, June, 1973, p. 152.

3. The total sample consisted of other size-groups, *viz.*, medium and large farms also. The importance and necessity of credit specially for the small farmers compared to other size-groups was brought elsewhere, see K. V. Subrahmanyam and R. K. Patel, *op. cit.*, pp. 149-152.

4. For further matrix details, see K. V. Subrahmanyam: Resource Productivity and Optimal Allocation of Resources on Farms in West Godavari District, A. P., unpublished Ph.D. thesis, Indian Agricultural Research Institute, New Delhi, 1971.

TABLE I—OPTIMAL CROPPING PLANS WITH LIMITED (LC) AND UNLIMITED BORROWED CAPITAL (UBC) ON SMALL FARMS, WEST GODAVARI DISTRICT, (A.P.)

(hectares)

Crop enterprise	Deltaic zones								Upland zones								
	Zone I		Zone II		Zone III		Zone IV		Zone V		Zone VI		Zone VII		Zone VIII		
	LC	UBC	LC	UBC ^a	LC	UBC ^a	LC	UBC	LC	UBC	LC	UBC	LC	UBC	LC	UBC	
Food crops																	
Paddy (local)	1.28	0.58	1.01	—	1.22	—	1.22	—	0.12	—	0.84	—	0.36	—	—	—	—
Paddy (HYV)	—	0.30	—	—	—	—	—	1.22	0.10	0.18	0.78	1.62	0.25	0.61	—	1.83	—
Dry paddy + red gram mixture	—	—	—	—	—	—	—	—	—	—	—	—	0.61	0.61	1.78	1.83	—
Total food crops	1.28	0.88	1.01	—	—	—	1.22	1.22	0.22	0.18	1.62	1.62	1.22	1.22	1.78	1.83	—
Non-food crops^b	1.16	1.59	1.01	—	1.22	—	1.33	0.81	1.10	1.12	0.20	0.20	0.61	0.61	0.05	—	—
Total cropped area	2.44	2.47	0.02	—	2.44	—	2.55	2.03	1.32	1.30	1.82	1.82	1.83	1.83	1.83	1.83	1.83

a. Credit was found to be unnecessary as there was surplus capital in LC.
 b. Includes cash crops like sugarcane, banana, tobacco and fodder crop like sunhemp.

of HYVs for *khariif* cropping.⁵ This shows that the provision of adequate credit will certainly enhance the adoption of HYVs in regions where capital is the constraint provided irrigation and suitable varieties are available.

In the case of the upland zones V, VI and VII, the HYVs occupy nearly 7, 43 and 14 per cent of the total cropped area respectively, even in the limited capital situation. The provision of additional capital through the borrowing activity helps in bringing all the irrigated paddy area under the HYVs and for them to occupy 14, 89 and 33 per cent of the total cropped area of the farms in these three zones respectively.

The additional capital requirements for executing the optimum plans under situation II are contained in Table II. These requirements are based on the whole cropping plans of the farms as it is difficult to segregate the amount required by the HYVs. The maximum credit requirement represented a 200 per cent increase over the existing capital used on the farms for the upland zone VIII and the minimum requirement represented a 34 per cent increase for the upland zone VI. These varied requirements may be due to the initial capital level and the capital requirements of various crops grown in the different agro-climatic zones.

The additional capital requirements on a per hectare of cropped land basis in Table II give an idea of the credit requirements to achieve increased

TABLE II—CREDIT REQUIREMENTS OF SMALL FARMS IN WEST GODAVARI DISTRICT (A.P.)

Zone	Existing capital (Rs.)	Amount of credit*		Amount of credit as percentage of existing capital (per cent)
		Per farm (Rs.)	Per hectare of cropped area (Rs.)	
Deltaic zones				
I	2,117	1,415	573	67
II	725	—	—	—
III	957	—	—	—
Upland zones				
IV	1,383	647	319	47
V	1,803	866	666	48
VI	1,294	439	241	34
VII	961	679	371	70
VIII	598	1,203	658	201

* An interest of rate of 9 per cent per annum was used chargeable for only 6 months on the assumption that they can pay back after each crop season.

5. Similar findings have been reported by the studies of the Programme Evaluation Organization of the Planning Commission: Report on Evaluation of the High Yielding Varieties Programme, Kharif, 1969, whereas only 20 per cent of the farmers in the villages surveyed in West Godavari district used dwarf paddy as a *khariif* crop, 56 per cent used it as a *rabi* crop.

adoption of HYVs. These requirements ranged from Rs. 241 to Rs. 666 in the different zones. Excluding the deltaic zone I and upland zones V and VIII, the average additional capital requirements are nearly Rs. 300 per hectare of cropped land. This seems to be reasonable in view of the additional fertilizer requirements and plant protection measures required for growing the HYVs. The high requirements in the deltaic zone I and upland zone V may be due to the existence of capital intensive cash crops like sugarcane and banana. In the case of upland zone VIII the highest requirement is due to the fact that it is a tribal zone and the farming is more of subsistence nature. The per hectare gross returns in this zone is lowest compared to the rest of the zones in this district. These factors may to some extent explain the low capital base and hence the highest credit requirement.

CONCLUSIONS AND POLICY IMPLICATIONS

- (1) The provision of credit for the small farms in most cases results in the introduction of HYVs of paddy into optimum crop plans. This is subject to the availability of suitable technology (varieties) for the agro-climatic regions and other inputs like irrigation.
- (2) The provision of credit helps in increasing the area of HYVs of paddy on the farms where they are already grown.
- (3) Credit requirements differ between different agro-climatic zones due to differences in the cropping patterns and capital base. Credit policy should take this into account and consider credit requirements for the farm as a whole and not restrict it solely to the existing or prospective areas of HYVs of paddy.

IDENTIFICATION OF SMALL FARMERS IN CHANDAULI TEHSIL, DISTRICT VARANASI

B. N. Banerjee and A. S. Sirohi*

The majority of the Indian farmers have very small holdings and live near the subsistence margin. According to the 1971 Census, the number of operational small holdings of 2 hectares and less is 62 per cent of the total number, though the area cultivated by them is less than 20 per cent of the total. Any development plan for the rural mass should aim to enable all sections of rural population to reap its benefits. The participation of small farmers in the agricultural programme is essential both because they constitute a large number and the total area occupied by them is not insignificant

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