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Appraisal of Alternatives

A relative assessment of the three alternatives leads us to think that a reduction of input prices seems to be the most appropriate subsidy measure for making the farmers take the maximum risk. The demerits of the other two options are:

1. It is illogical to expect any further reduction in the interest rate as the gap between the co-operative rate of interest and open market rate of interest is already very wide.

2. Fixing a higher price for output will lead to the large farmers getting an extra-ordinary level of profit and a further perpetuation of income inequalities.

The foregoing analysis indicates that subsidy is the right instrument to maximize risk-taking. The reduction in input price is found to be the most appropriate form of subsidy. The policy makers may further choose to fix differential input prices as per the need of the particular category of farmers concerned.

IMPACT OF INPUT SUBSIDY ON INCOME AND EQUITY UNDER LAND RECLAMATION

P. K. Joshi and A. K. Agnihotri*

Subsidy plays a crucial role in the economic development of any developing country where it has a great bearing on production, employment and investment. Barker and Hayami[1] argued that to attain the goal of food self-sufficiency, government adopts short-term policies, such as support prices of products and input subsidy to stimulate the producers to increase their food production along existing production function. In fact, subsidy is necessary as a production accelerating catalyst for those new inventions, which are socially desirable but whose adoption needs huge capital and producers believe it to be risky investment.

Reclamation technology of salt affected lands[2] has a tremendous potential of increasing production, income and employment, but it requires large investment in the initial year. It has been observed in Haryana and Punjab that farmers do not adopt the reclamation technology unless any incentive or relief to cover risk is given. Therefore, Haryana Government has given

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1. Randolph Barker and Yujiro Hayami, "Price Support versus Input Subsidy for Food Self-Sufficiency in Developing Countries", *American Journal of Agricultural Economics*, Vol. 58, No. 4, November 1976, pp. 617-628.

2. It has been estimated that the extent of salt affected land in India is about 7 million hectares, which is gradually increasing due to faulty water management technique. I. P. Abrol and D. R. Bhumbla, "Saline and Alkali Soils in India—Their Occurrence and Management", in World Soil Resources, FAO Report No. 41, pp. 42-51.

a subsidy on gypsum[3] of 75 per cent to small and marginal farmers and 50 per cent to large farmers.

Scant attention has been paid in the past to determine the impact of gypsum subsidy on private and social benefits generated through land reclamation programme. The present study is an attempt to examine the direct and indirect benefits of subsidy on gypsum and its role in agricultural development. More specifically, the objectives are to (*i*) investigate the effect of subsidy on capital requirements, benefit-cost ratio and pay-back period of reclamation programme, (*ii*) study the direct benefits of subsidy in increasing agricultural production, income and employment through land reclamation, (*iii*) measure the indirect benefit of income redistribution generated through land reclamation programme, and (*iv*) project the social costs and benefits of subsidy for Haryana, Punjab and Uttar Pradesh.

METHODOLOGY

Sample and Data

The Central Soil Salinity Research Institute under its Operational Research Project (ORP) adopted during 1975-76 four villages, *viz.*, Kachwa, Sagga, Sambhli and Bir Narayana in Karnal district, Haryana, having specific problems of alkali soils. A comprehensive survey of all the 68 farmers in the four villages who reclaimed their land was conducted in 1975-76 on all aspects of farming. Cross-section and time-series primary data on soil characteristics, resource availability, inputs used and outputs obtained, marketing and prices of inputs and outputs, operational cost of reclamation and crop production were collected from 1975-76 to 1979-80. Two crops, paddy and wheat, were selected for the present analysis as it has been found that paddy-wheat rotation maximizes the income of farmers at existing resources on reclaimed land.

Analytical Tools and Techniques

Capital requirement, benefit-cost ratio, net present value and pay-back period were worked out at four different hypothetical levels of subsidy, *viz.*, 0, 25, 50 and 75 per cent for the year 1975-76. Tabular analysis was done to determine the capital requirement of reclamation programme. The benefit-cost ratio was worked out according to standard discounting procedures. The life span of the reclamation programme was assumed to be 10 years. Therefore, based upon the five years' time-series data, benefits and costs were extrapolated with the help of exponential functions. The net present value was estimated by subtracting the present value of cost from the present value of benefits at the four levels of subsidy.

To establish and estimate the functional relationship between capital requirement for land reclamation and area reclaimed, linear, Cobb-Douglas

3. Gypsum is the cheapest amendment for land reclamation technology. The share of gypsum in the total cost of reclamation programme is 75·29 per cent. The existing price of gypsum is Rs. 310 per tonne and about 10-15 tonnes/ha. is needed for reclamation depending upon soil type. P. K. Joshi and A. K. Agnihotri, "Capital Requirement and Production Potential of Land Reclamation Programme", in Workshop on Capital Requirement and Modernization of Agriculture at IASRI, New Delhi, 1982.

and quadratic functional forms were estimated. On statistical criteria, the Cobb-Douglas relationship turned out to be the most appropriate and was selected for discussion. The functional relationship estimated was:

$$\text{Log } Y_i = \log a_i + b_i \log X_i + W_i \quad \ldots\ (1)$$

where Y_i was the capital requirement (Rs.) at ith level of subsidy, X_i was the area reclaimed to ith level of subsidy, a_i and b_i were the unknown parameters and W_i was the stochastic term. This exercise was thought to be helpful in determining the bias, if any, of land reclamation towards affluent farmers, and the impact of subsidy on the bias.

Compounded annual growth rates were also worked out for variable costs, yields, net incomes and coefficients of variation of yield for paddy and wheat to examine the trend of these variables on reclaimed land.

The indirect social benefit of subsidy on gypsum through land reclamation programme was expected to improve income distribution among producers. Therefore, to explore the possible consequences on income distribution, an attempt has been made to measure the extent and magnitudes of income inequalities for initial and fifth year of land reclamation.

Eleven income classes[4] were formed to examine the income distribution among the farmers. The inequalities were mesured in terms of Gini concentration ratios (GCR) computed with the help of New Co-ordinate System Approach (NCSA).[5] According to NCSA, the Lorenz curve was defined as:

$$Y_t = a\, r_t^{\alpha}\, (\sqrt{2} - r_t)^{\beta} \quad \ldots\ (2)$$

or

$$\log y_t = \log a + \alpha \log r_t + \beta \log (\sqrt{2} - r_t)$$

where Y_t was perpendicular distance between the Lorenz curve and egalitarian line and r_t was the distance from the origin on the egalitarian line with reference to Y_t.

Total integration of right hand side of equation (2) yields:

$$GCR = \int_0^{\sqrt{2}} a\, r_t^{\alpha}\, (\sqrt{2} - r_t)^{\beta} \propto r_t \quad \ldots\ (3)$$

which in simplified form can be written as:

$$G = \text{Anti-log } (1.4142 \log \hat{a} - 0.9241\ (\hat{\alpha} - \hat{\beta}) \quad \ldots\ (4)$$

where G denoted the Gini concentration ratio and $\hat{a}$, $\hat{\alpha}$ and $\hat{\beta}$ were the estimated values of parameters shown in equation (2).

The normative aspects of income inequalities were also explored by means of Atkinson's Index (I).[6] This was computed as:

4. The annual incomes generated under land reclamation programme were arranged in an ascending order. The eleven income classes thus formed were: Rs. 0-300; 300-600; 600-900; 900-1,200; 1,200-1,500; 1,500-1,800; 1,800-2,100; 2,100-2,400; 2,400-2,700; 2,700-3,000; and 3,000 and above.

5. For detailed methodology, see N. C. Kakwani and N. Poddar, "Efficiency Estimation of the Lorenz Curve and Associated Inequality Measures from Grouped Observations", *Econometrica*, Vol. 44, No. 1, January 1976, pp. 137-148.

6. A. B. Atkinson: The Economics of Inequality, Clarendon Press, Oxford, 1975.

$$I = 1 - \left[\sum_{i=1}^{n} \left(\frac{Y_i}{\bar{y}} \right)^{1-\epsilon} . f_i \right]^{\frac{1}{1-\epsilon}} \quad \ldots\ (5)$$

where Y_i was the average income of the ith class, $\bar{y}$ was overall mean income, f_i represented the relative frequency of farmers belonging to ith income class, and ϵ was the distributional parameter[7] (inequality aversion factor). In the present analysis ϵ was computed as:

$$\epsilon = \frac{\lambda n\ 1/p}{\lambda n 2}; \text{ and } p = \frac{1-2\ GCR}{\bar{y}} \quad \ldots\ (6)$$

where p stood for proportion of average income ($\bar{y}$) which can be redistributed in order to bring about equality.

RESULTS AND DISCUSSION

(A) *Capital Requirement, Benefit-Cost Ratio and Pay-Back Period*

The capital requirement, benefit-cost ratio and pay-back period of land reclamation programme at four levels of subsidy on gypsum, *viz.*, 0, 25, 50 and 75 per cent are presented in Table I. The capital requirement for land reclamation was Rs. 2,545.41 per hectare at 0 level of subsidy, with a net present value of Rs. 10,905.25 per hectare. In spite of a large investment on reclamation programmes in the initial year, it pays Rs.1.34 for each rupee invested and the entire amount is repaid in 3½ years. In fact, a subsidy on gypsum gave an incentive and relief to the farmers and the investment on reclamation programme was paid back within 2 years at 75 per cent subsidy and within 2½ years at 50 per cent subsidy. These results reflected that the subsidy on gypsum favourably affected the benefit-cost ratio and returns from land reclamation programme, particularly for small and marginal farmers.

TABLE I—CAPITAL REQUIREMENT, BENEFIT-COST RATIO, NET PRESENT VALUE AND PAY-BACK PERIOD OF LAND RECLAMATION PROGRAMME AT DIFFERENT LEVELS OF SUBSIDY FOR 1975-76

Sr. No.	Level of subsidy (per cent)	Capital requirement (Rs./ha.)	Benefit cost-ratio	Net present value (Rs./ha.)	Pay-back period (P) (years)
1.	0	2,545·41	1·34	10,905·24	$3<P<4$
2.	25	2,024·49	1·37	11,488·67	$2<P<3$
3.	50	1,586·06	1.39	11,979.71	$2<P<3$
4.	75	1,023·92	1·42	12,609·31	$1<P<2$

In Haryana and Punjab there was negligible response for land reclamation programmes without any subsidy on gypsum. Therefore, a subsidy on gypsum in this context is an incentive to the farmers to accept the land reclamation technology and making farmers risk-seeking for exploiting the potential of their barren and uncultivated alkali lands.

7. ϵ played a crucial role in the determination of (I). It represented the weight attached by farmers to income inequality and ranged from 0 to ∞. A value of $\epsilon = 0$ inferred that the farm community was indifferent about inequalities while a value of $\epsilon = \infty$ revealed that the community concerned only with the lowest income class.

Table II presents the results of functional relationships between capital requirements and acreage of land reclamation at different levels of subsidy. Without any subsidy on gypsum, the capital requirement for land reclamation was neutral to the area. The same was true at 25 per cent subsidy. However, the capital requirement for land reclamation programme was non-neutral and biased towards the large farmers both at 50 per cent and 75 per cent level of subsidy. Therefore, to encourage the small and marginal farmers for reclamation programme, considering their poor resource endowments and risk bearing ability, a differential rate of subsidy for small and large farmers is justified.

TABLE II—FUNCTIONAL RELATIONSHIP BETWEEN CAPITAL REQUIREMENT AND AREA RECLAIMED FOR 1975-76

Sr. No.	Level of subsidy (per cent)	Constant terms (log)	Regression coefficient	R^2
1.	0	3.4177	0·96 (0·04)	0·95
2.	25	3·3213	0·95 (0·04)	0·94
3.	50	3·2849	0·76*** (0·10)	0·61
4.	75	3·0973	0·75*** (0·11)	0·59

(*a*) All regression coefficients were significant at one per cent level. Figures in parentheses are standard errors of estimates.

(*b*) To test the neutrality of capital requirement to area, the hypotheses framed were H_0: $b = 1$; and H_1: $b \neq 1$. It was tested by $t = \frac{b-1}{SE_b}$; *** Significant at one per cent level that the regression coefficient is significantly different from one, *i.e.*, H_1: $b \neq 1$.

(*B*) *Production, Income and Employment*

The results of productivity, income and employment for paddy and wheat rotation from 1975-76 to 1979-80 are presented in Table III. It may be seen from the table that the yields of paddy and wheat were increasing at an annual rate of 12.75 per cent and 17.26 per cent respectively, indicating thereby the tremendous potential of these barren and uncultivated lands after reclamation programme. The results further indicate that the yield variability,[8] between farmers was also declining over time. The coefficient of variation was declining at annual rates of 7.22 per cent for paddy and 14.68 per cent for wheat. This indicates the potential of land reclamation programmes to narrow regional variations by reducing yield gaps within the farming community over time.

The direct employment benefit of subsidy on gypsum was another significant contribution. The results reveal an impressive picture that land once characterized as barren and uncultivated had, after a successful reclamation programme, generated 124.28 man-days per hectare for paddy-wheat pro-

8. We propose to measure regional variation by means of coefficient of variation computed as the proportion of deviation around the mean.

TABLE III—COST AND RETURNS RELATED TO PADDY-WHEAT ROTATION FROM 1975-76 TO 1979-80

Year	Variable cost (Rs./ha.)		Yield (qtls./ha.)		Net income (Rs./ha.)		Employment (man-days/ha.)		Coefficient of variation of yield (per cent)		Income-cost ratio	
	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat
1975-76 ..	1,105·74	860·01	31·52	13·43	1,258·19	585·66	70·89	49·62	21·60	27·38	2·14	1·66
1976-77 ..	1,616·76	1,503·72	41·41	14·67	1,470·30	202·94	81·68	33·67	12·66	22·11	1·91	1·13
1977-78 ..	1,892·85	1,703·10	44·46	16·12	1,674·72	257·13	87·99	36·94	14·42	19·45	1·88	1·15
1978-79 ..	1,841·70	1,902·48	56·65	17·56	2,900·72	311·32	81·42	40·19	15·60	16·82	2·58	1·16
1979-80 ..	3,359·91	2,261·05	48·50	27·21	1,334·96	1,193·57	101·23	37·93	13·38	14·19	1·40	1·53
Compound annual growth rate (per cent)	26·53	24·22	12·75	17·26	8·31	20·34	7·10	—3·60	—7·22	—14·68	—	—

duction, besides 28.28 man-days per hectare for reclamation itself. The programme could thus help solve the problem of rural unemployment.

(C) Income Inequality

Table IV provides a comparative picture of 1975-76 and 1979-80 with regard to the percentage share of decile groups of farmers in the total income. The results show that in the initial year of land reclamation the share of bottom 50 per cent farmers in total income was only 30 per cent. This was raised to 36 per cent in 1979-80.

TABLE IV—PERCENTAGE SHARE OF FARMERS IN TOTAL INCOME UNDER LAND RECLAMATION PROGRAMME

Share of cotton (per cent)	During reclamation period (1975-76)	During post-reclamation period (1979-80)	Percentage change over the initial year (per cent)
10	2·5	5·0	2·5
20	7·5	10·0	2·5
30	14·5	17·0	2·5
40	22·5	27·0	4.5
50	30·0	36·0	6·0
60	39·5	47·0	7·5
70	51·5	57·0	6·0
80	65·0	71·0	6·0
90	80·0	84·5	4·5

TABLE V—ESTIMATED EQUATIONS OF LORENZ CURVES; GINI CONCENTRATION RATIOS AND ATKINSON'S INDICES AS MEASURES OF INCOME INEQUALITIES ON RECLAIMED LAND

Year	Lorenz curves: $Y_t = a\, r_t^{\alpha}\, (\sqrt{2} - r_t)^{\beta}$			Gini concentration ratio (GCR)	Weight attached by farmers to the income inequality (ϵ)	Atkinson's Index (I)
	Constant term (a)	Coefficients of r_t	Coefficients of $(\sqrt{2} - r_t)$			
1975-76	0·2017	0·8499***	2·020***	0·3064	12·2023	0·8250
1979-80	0·1398	0·7909***	1·9842***	0·1864	11·8740	0·6596

(*a*) *** Significant at one per cent level.
(*b*) The values of coefficients of determination (r^2) were more than 98 per cent for both the equations.

This was further investigated by estimating Lorenz equations for 1975-76 and 1979-80. The results are presented in Table V. They reflect two similar characteristics for both Lorenz equations: (*i*) both fall below the egalitarian line ($\hat{a} > 0$) and (*ii*) both were relatively skewed towards higher income classes ($\hat{\beta} > \hat{\alpha}$), thereby indicating higher income inequalities in the richer section of the society. The only significant difference, as expected, was the lower magnitude of parameters (*i.e.*, $\hat{a}$, $\hat{\alpha}$ and $\hat{\beta}$) of Lorenz curve for 1979-80. It was thus observed to be closer to the line of equality as compared to 1975-76. This shows a fall in the magnitude of

income inequalities during the five years of land reclamation. The Gini concentration ratios further support the finding that the income inequalities were reducing over time. Atkinson's Index revealed that only 66 per cent of the average income will be needed as an addition for an egalitarian society in 1979-80 in contrast to 83 per cent in 1975-76 required for the same purpose.

(D) Social Benefits and Costs of Subsidy through Land Reclamation Programme

It has been estimated that the extent of alkali soils in Haryana, Punjab and Uttar Pradesh is about 2.50 million hectares of which about 0.20 million hectares have been reclaimed till 1980-81. Thus, we have estimated the private and social benefits and the cost of land reclamation with 50 per cent subsidy on gypsum if only half of the salt affected area is to be reclaimed. Since the input-output coefficients cannot be assumed to be the same in Haryana, Punjab and Uttar Pradesh, the bias in the estimates is quite obvious, but they would provide an indication of costs and benefits to the society. The results of the exercise are presented in Table VI. About Rs. 284 crores would be needed by the private entrepreneurs for land reclamation at 50 per cent level of subsidy on gypsum and Rs. 420 crores for paddy-wheat production

TABLE VI—PRIVATE AND SOCIAL BENEFITS OF LAND RECLAMATION AND COST TO SOCIETY TO RECLAIM 50 PER CENT SALT AFFECTED SOILS

Item		Haryana	Punjab	Uttar Pradesh	Total
A.	Private and social costs				
	1. Capital requirement for reclamation with 50 per cent subsidy on gypsum by farm producers (Rs. crores)	62	71	151	284
	2. Capital requirement for paddy-wheat rotation by farm producers (Rs. crores)	91	105	224	420
	3. Cost to society due to subsidy on gypsum (Rs. crores)	40	46	99	185
B.	Private and social benefits				
	(*i*) Net private income/year (Rs. crores) ..	57	65	139	261
	(*ii*) Producers' surplus/year (lakh qtls.)	158	182	387	729
	(*iii*) Employment to society				
	1. Reclamation (lakh man-days)	72	83	176	331
	2. Crop production (lakh man-days) ..	314	363	773	1450
	(*iv*) Additional demand of seed/year				
	1. Paddy (thousand qtls.)	69	79	169	317
	2. Wheat (thousand qtls.)	250	289	615	115·40
	(*v*) Additional demand of fertilizer/year (lakh qtls.)	4·70	5·42	11·60	21·72

every year in Haryana, Punjab and Uttar Pradesh. The society has to pay about Rs. 185 crores at 50 per cent subsidy on gypsum. On the other hand, there are substantial gains in terms of producers' surplus and employment generation in the agricultural sector. It would also lead to an increase in the demand for fertilizers, irrigation, farm machinery and high-yielding variety of seeds. This would stimulate the non-agricultural sector by increasing the

demand for some of its products. Social benefits thus appear higher than the social cost of subsidy.

CONCLUSION

A subsidy on gypsum for land reclamation plays a significant role in increasing production, income and employment and in reducing income inequalities among farmers. As the gestation period is very short, a subsidy on gypsum motivates the producers to exploit the full potential of barren and uncultivated salt affected lands in both short and long run. The land reclamation programme with a subsidy on gypsum is lucrative for society. The programme can be justified also because it contributes to food production, rural employment and accelerates demand for farm and non-farm inputs. Another feature of the reclamation programme is that it narrows income inequalities and helps to attain the goal of social justice.

RATIONALE OF FODDER SUBSIDY: THE CASE OF KOLLENGODE DAIRY ECONOMY (KERALA)

T. P. Gangadharan and S. L. Kumbhare*

The goal of self-sufficiency in dairy production can be realised best through an improvement in physical and institutional infrastructure. However, because such programmes entail massive investments and long gestation periods, there is a temptation for governments to adopt short run policies, such as supporting product prices and subsidising dairy farm inputs. Kerala, like many other States, is faced with the urgent task of vitalising its dairy economy. The State is severely deficient in fodder resources. The tiny land holdings, vulnerability to nature's havoc and weak farm economic power are problems endemic to the dairy system of the State. As a measure to rehabilitate the dairy sector and to popularise scientific dairy husbandry, fodder subsidy is offered to dairy farmers in Kerala. Staunch criticisms, however, have been and are still being levelled against subsidies in general for various reasons, ranging from poor permeability and misappropriation to the demoralising effect on competitive entrepreneurship. We have some understanding as to how the restraints in land-labour system militate against the efficacy of subsidy schemes. This paper seeks to illustrate how the fodder subsidy is sensitive to the volatile labour market as well as to other specialities of the Kerala economy.

THE SCHEME AND DATA

Fodder subsidy scheme (FSS) offered by the Department of Dairy Development, Government of Kerala has been introduced in selected districts under

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