Vol XXI
No. 4

ISSN 0019-5014

CONFERENCE
NUMBER

OCTOBER-
DECEMBER
1966

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

INTENSIVE AGRICULTURAL APPROACH TO AGRICULTURAL DEVELOPMENT

HARPAL SINGH*

Assistant Economic and Statistical Adviser
Directorate of Economics and Statistics
Ministry of Food and Agriculture
Government of India, New Delhi

The essential logic underlying the idea of intensive agricultural programme seems to be that inter-related resources and inputs, when applied in strategic combinations yield more than the sum total of the output produced by the same amount of resources applied individually and in isolation with each other. This is a scientific proposition. And even the cultivator knows that water and fertilizer when applied together, yield returns greater than what is obtained by putting these two inputs separately and in two different fields. This evidently happens because of interaction effects within the factors of production themselves and the presence of complimentarity between the resources.

The intensive agricultural approach or, in other words, the input intensification approach assumes this gain but means a little more. Seen as a logical improvement on the general agricultural extension approach in the community development programme, this new approach implies concentration of inputs including organization and administrative in a limited area rather than their dispersal over too wide an area as has been the case in C.D. programme. The intensive agricultural area programme too follows the 'package' approach. "It is again based on the fact that our planning in agriculture before the package programme concept was adopted, was defective and less productive because of the dispersal of our resources on too many schemes over too wide an area."[1] Granting the soundness of the logic of applying farm inputs together, it is a moot point to consider whether the total aggregate return on the scarce resources is maximized by dispersing them over wide areas in smaller doses or by concentrating them in fewer areas in high doses. This is, however, only the technical part of the question. The other relates to the capacity of the Indian peasantry, even if selective, to accept and adopt concentrated doses of inputs. The time is short, doses are high, and his experience of such cultivation practically nil. The purpose of this paper is to search for an answer to these two questions which are of paramount importance in the present context when our stakes are too high and serious.

Let us take the technical question first. Total aggregate product to scarce factors of production, notably fertilizer can be maximized if their application is pursued to the point at which marginal returns from all the last units applied in different areas are equal. What is this point in different resource-mix production situations is difficult to answer. Generally, it is held that diminishing returns to certain selected factors of production in agriculture start much earlier than in

---

* The views expressed here are the personal views of the author and not necessarily of the organization to which he belongs.

1. Intensive Agricultural Programme, Farm Information Unit, Directorate of Extension, Ministry of Food and Agriculture, Government of India, New Delhi, August, 1965.

other branches of production. It is, however, believed that beginning at the present low levels of input application in agriculture, the fear of getting diminishing returns particularly to newer resources is not immediate, at least. Because, in the present resource-mix in Indian agriculture (although it is unrealistic to stylize in to one, the diverse levels and composition of inputs applied in the country), it is believed that inputs like fertilizer, pesticides, improved forms of implements, etc., are the limiting factors and, therefore, inclusion of such resources in the farm inputs will add to production at an increasing scale. While this proposition can generally find acceptance, it is difficult to assert if the same situation prevails in areas selected for intensive agricultural development. Because, these are the areas where farm production might have already covered the first stage, *i.e.*, the stage of increasing returns, and the production possibility curve is likely to enter into stage II marking addition to output at decreasing rate.

All these are academic conjectures. Some data have, however, become recently available which can throw light on the factor-product relationships obtaining in different areas of the country and at different levels of resource use. One of the important source of such data are the 'Studies into Economics of Farm Management' conducted in different regions of the country. The data used here were collected by the cost accounting method. These data are particularly useful for making inter-regional comparison because of the near uniformity in the method of investigation, sampling procedures, and principles of evaluation, apportionment and imputation of costs, although there are still left a few non-comparables. Since paddy and wheat are the two important crops in the country, and the intensive agricultural programme will concentrate particularly on these two crops, output-input data for these two crops available in the reports of the farm management study will be presented and analysed here.

Paddy

Output-input data for paddy as grown in different regions of the country, available in the reports of the farm management studies, are given in Table I.

TABLE I—INPUTS AND OUTPUT PER HECTARE OF PADDY

States	Districts covered	Total value of inputs (actual and imputed in Rs. per hectare)	Total output in quintals	Value of input per quintal of output in Rs.
Orissa	Sambalpur	257	11.6	22.2
Madhya Pradesh	Raipur	294	11.2	26.2
West Bengal				
Aus	Hooghly and			
Aman	24 Parganas	414	13.0	31.8
Bihar	Shahabad	420	15.4	27.3
Andhra Pradesh	West Godavari			
Unirrigated paddy		436	12.0	36.3
Irrigated paddy—Season II		730	19.5	37.4
Irrigated paddy Season-I		788	21.8	36.0
Madras	Coimbatore and Salem			
Irrigated paddy—Season II		677	21.8	31.0
Irrigated paddy—Season I		816	25.4	32.1
Kerala	Quilon and Alleppey	885	21.2	41.7

Table I shows that output increases with an increase in the value of input. But the additions to output are obtained at increasingly higher cost. Judged by the value of inputs, Kerala, Andhra Pradesh and Madras are doing most intensive cultivation. These are by and large the regions getting output at highest unit cost of input. This shows that under intensive use of inputs, output is obtained at an increasing cost and increases in output are not commensurate with the increases in input. More intensification of farming in these areas is, therefore, likely to be rewarded with lesser output. Instead Orissa, Madhya Pradesh and Bihar regions with less intensive farming offer more scope for intensification of agriculture at lesser per unit cost of additional output. It would be well to remember that resource-mix in the different regions compared in the above was not the same in physical terms. And hence they are not exactly comparable although they still provide an idea of how the product curve is likely to be in case inputs are further intensified in areas of low and high input intensification.

A refined method to study the factor-product relationships at different levels of factor use would be to compare the marginal productivities of the factors in different regions. A comparison is made in Table II.

TABLE II—MARGINAL PRODUCTS IN PADDY*

States	Districts covered	Geometric Mean Levels of Inputs				Marginal Products in Rs.		
		Land (acres)	Human and bullock labour Rs. per acre	Working expenses Rs. per acre	Capital assets Rs. per acre	Land (acres)	Human and bullock labour per Re.	Working expenses per Re.
Madras	Coimbatore and Salem	0.97	77.77 49.78	10.67	32.88	235.84	1.17	10.39
Orissa	Sambalpur	4.96	128.90 8.02			69.28	0.56 1.76	—
Kerala	Alleppey and Quilon	5.43	653.70	—	—	—	8.83	—
Andhra Pradesh	West Godavari							
A. Irrigated paddy		3.20 (for paddy zone)	64.0	2.74 (depreciation)	6.34 (Manure)		1.912 0.380	—2.308 (for manure)
B. Unirrigated paddy			50.4	3.98 (depreciation)	8.745	—	0.1495	2.013 (for manure)

*See Farm Management in India, A Study Based on Recent Investigations, Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi, April, 1966, p. 77.

The results of this production function analysis are to be interpreted with great caution. The table, however, shows that between Madras and Orissa, the marginal value productivity of land under paddy is more in the former than in the latter. Between these two, the higher mean level of human and bullock labour input is accompanied with lower MVP and vice versa. Between Orissa and Andhra Pradesh the mean level of human labour input is more in case of the former but the MVP is more in case of the latter. It would, however, have been better if the marginal products were given in physical quantities. In addition, there are a number of other anomalies in such a straight comparison. We have, however, got a feel of suspicion that the high level of input use has not been associated with a high marginal productivity.

A more fruitful exercise would perhaps be to compare the increases in output consequent upon increases in input in the same district. For purposes of illustration, output at different levels of input has been computed for West Godavari district and given in Table III.

TABLE III—OUTPUT-INPUT PER ACRE OF IRRIGATED PADDY* (1957-58)

Range of value of input (Rs.)	No. of holdings	Average value of inputs (Rs.)	Average value of output at constant prices for all the holdings	Output-input ratio
0-100	2	100	101	1.01
101-200	9	169	178	1.05
201-300	31	257	263	1.02
301-400	19	349	367	1.05
401-500	21	448	393	.88
501-600	4	522	482	.92
601-700	2	657	187	.28
701 and above	1	823	533	.65

* The data have been computed from Part II holdingwise tables of the Study into the Economics of Farm Management in Andhra Pradesh for the year 1957-58.

Table III shows that barring a few minor exceptions, the output obtained per unit of input in Andhra Pradesh is higher at low levels of input application. And although the output increases with an increase in the input levels, the increases become costlier and demand greater and greater sacrifices of inputs per unit of output. Surely, the phenomenon of diminishing return has already set in. Any further intensification is likely to further lower the output-input ratio.

The above data in case of paddy although far from sufficient, provide some evidence to suspect that higher levels of resource inputs are not associated with higher output per unit of resource input. Although the evidence is not very conclusive and consistent over regions and is also bedevilled by non-comparability, the data computed for Andhra Pradesh in Table III and for different regions in Tables I and II suggest that in some areas of high input use, production has already

entered into stage II, *i.e.*, the stage of decreasing return. If intensification in these areas is further pursued, the marginal product is likely to show decline.

Wheat

A similar analysis of output-input data for wheat is also attempted to search for any evidence, which could shed light on how the output behaves when input is increased. Table IV gives the output-input data in different regions of the country.

TABLE IV

States	District covered	Cost incurred in Rs. per hectare (I)	Total cost incurred+imputed per hectare (C)	Output in quintal	$\frac{O}{I}$	$\frac{O}{C}$
Maharashtra	Ahmednagar	169	288	6.4	0.04	0.02
	Nasik	217	378	5.4	0.02	0.01
Punjab	Karnal, Rohtak and Jind Tehsil	196	510	13.8	0.07	0.03
	Amritsar and Ferozepur	244	424	11.1	0.05	0.03
Uttar Pradesh	Meerut and Muzaffarnagar	348	418	10.5	0.03	0.03

The table shows that output per unit of input in Punjab and Uttar Pradesh remains almost the same over the total input range of Rs. 418 to Rs. 510 per acre. In Maharashtra, however, output-input ratio shows a decrease from 0.02 to 0.01 quintal per rupee when total inputs are increased from Rs. 288 in Ahmednagar to Rs. 378 per hectare in Nasik.

Since comparison over space is riddled with a number of non-comparables, comparison of output-input ratios at different levels of input use in the same region would be particularly useful. The data are presented in Table V for Uttar Pradesh as an illustration.

TABLE V—OUTPUT-INPUT RATIO AT DIFFERENT LEVELS OF INPUTS IN WHEAT IRRIGATED IN UTTAR PRADESH

Total input range in Rs. per acre	No. of holdings	Average total input in Rs. per acre	Average value of output in Rs. at constant prices for all the farms	Output-input ratio
0-200	19	123	123	1.0
201-400	25	308	382	1.24
401-500	9	449	568	1.27
501-600	7	557	513	0.92
601-700	5	651	492	0.77
701-800	3	747	562	0.75
801 and above	10	1,095	1,299	1.19
	78			

Source : The data have been computed from Part II holdingwise tables of the Study into the Economics of Farm Management in Uttar Pradesh for the year 1955-56.

The table shows that output per unit of input at first increases with an increase in the inputs per acre, then it continues to decrease until the highest input level of over Rs. 800 is reached. In this table, total input, both imputed and actually incurred, have been considered. Table VI gives the output-input relationship on the basis of actual cost incurred.

TABLE VI

Input range in Rs. per acre	No. of holdings	Average input incurred in Rs. per acre	Average value of output in Rs. at constant prices for all the farms	Output-input ratio
0-150	17	86	200	2.33
151-250	15	195	290	1.49
251-350	14	299	442	1.48
351-450	8	398	513	1.29
451-550	10	507	532	1.05
551-650	4	613	691	1.13
651 and above	10	945	1,179	1.24

Source : See footnote to Table V.

The table clearly shows that as the actual incurred cost is increased, output increases at a decreasing rate. Additions to output become costlier even at the actual incurred cost.

Difficult though somewhat it is to summarize the results of analysis given above, in case of paddy and wheat, the impression that decreasing and constant returns to added inputs prevail in our agriculture is difficult to erase. Equally important it is to recall that in the same district higher inputs in paddy and wheat were found to be associated with lower average output. If this is so, then there is a case for having a second look at the desirability of using the input intensification approach to maximize production when resources are scarce.

A most pertinent objection, however, can be that how far the production relationships obtained by the use of mostly traditional inputs can hold true when the form and the composition of factors in the new approach to agricultural development undergo change? The relationship analysed above, it can be pointed out, has been obtained in the context of mostly traditional farm technology. When the newer inputs, for example, high yielding strains of paddy and wheat, use of antibiotics and systemics to fight plant diseases and fertilizer, etc., are used, the whole production surface changes. The production curve expected to be obtained in the new set of technological context and input, it can be argued, will be much different than the one obtained on the traditional input-base of the type discussed earlier. This is true. But the question is: will intensive agricultural approach have

a completely different technological context and an altogether different production surface ? It is useful to recall, here, that while planning in democracy has the advantage of proceeding with the willing sanction and consent of the people, it imposes certain restrictions. After all who will adopt this new approach and wherefrom the additional production will come. Sometimes, in our preoccupation with the technique, we are apt to forget that the new approach or the 'impact programme' along with the new technology associated with it, will have to be adopted by the multitude of the farmers on their holdings scattered all over. It is for certain that the intensive approach will have to be planted on the old technology. It is difficult to ask the farmer to shift from one production surface to another completely. What needs to be realized is that change is a continuous, and gradual and step by step process. It is not abrupt, sudden and whole-hog. Therefore, the intensive agricultural programme will have to reckon with the continued existence of traditional environment including the structure of farm. In the short run, the level of technology, farm structure, management skills and various other factors affecting input-output relationship will remain fixed. The new intensive agricultural programme, will, therefore, have to be planted in the traditional soil or the one which is mixed. It is in this context, that the relevance of output-input relationship obtained in the traditional context has to be viewed and understood. Nevertheless, the evidence available on the response curve of the fertilizer suggests that the rate of increase in yield diminishes with larger doses of fertilizer application.[2] Sufficient experimental and field data on the high yielding varieties programme, which is the core of the new approach are not available to derive a clean and convincing response curve. Whatever data have become available (for example, the one submitted to the Wheat-breeders' Seminar held at Ludhiana in 1965) seem to support the view that decreasing returns to the higher doses of fertilizer prevail even in case of newer high yielding strains of paddy and wheat.[3] When this is the case at the experimental stations, nothing better could be expected in the farmers' fields.

The new intensive agricultural development approach, therefore, has still to find a sound technical base. Then, the intensive agricultural approach is not just a programme of assembling certain physical and technical inputs to yield some pre-determined output. The human element is very much involved. The very speed, sharp departure and the high doses of inputs contained in the programme, will preclude any active and thorough participation of the farmers. And to add to this, there is the problem of high mortality rates of innovations in an underdeveloped country like ours. Because of the urgency and enthusiasm to increase output and lack of adequate finance, sometimes inputs and practices, which have not been adequately experimented with, are likely to be released for general adoption. Such innovation have high rate of mortality. This danger can be there in the new approach as well. Lack of adequate and precise data on agronomic practices which should accompany the new approach, notably the cultivation of high yielding varieties with intensive application of other inputs, is another big problem. The dangers inherent in such a situation are real indeed. Because the farmers now refuse to be treated as guinea-pigs for everything new.

2. V. G. Panse and R. C. Khanna, "Response of Some Important Indian Crops to Fertilizers and Factors Influencing this Response," *Indian Journal of Agricultural Science*, Vol. 34, No. 3, 1964, pp. 172 and 202.

3. B. S. Minhas and T. N. Srinivasan, "New Agricultural Strategy Analysed," *Yojana*, Annual Number, January 26, 1966, pp. 20-24.

To conclude, the existing evidence on the production relationship does not indicate increasing returns to higher levels of inputs, including the newer ones like fertilizer and high yielding varieties. The possibility of changing the entire production surface (which cannot be changed on the strength of few inputs alone) is not more than academic in live field situation at the moment. A continuum of traditional and new technology is sure to prevail. Further, the mortality rate of innovation in agriculture is high because of inadequate screening at the experimental stations and also because of the inadequate knowledge of the varying situations to which an innovation will be required to suit. Considering all these factors, there is a need to observe some caution in the 'input intensification' or the impact programme approach.

INTENSIVE AREA DEVELOPMENT APPROACH—A VILLAGE LEVEL PLAN FOR AGRICULTURAL DEVELOPMENT

P. D. SAIKIA

Research Officer
Agro-Economic Research Centre
Jorhat (Assam)

INTRODUCTION

The intensive area development approach is the concentrated efforts in agricultural development in specially selected areas, having minimum natural hazards. Such an effort is distinct from the general approach to agricultural development, because the efforts are intensified at the micro level for quick results. The general approach is essentially an approach at the macro level, when the efforts are spread over a wide area. The area approach like IADP and IAAP are short term programmes for food production, but the general approach is an attempt for gradual improvement of agriculture.

FARMERS' RESPONSE TO AGRICULTURAL DEVELOPMENT PLANS IN ASSAM

The agricultural growth rate in Assam is very disappointing. In the last decade, the annual agricultural growth rate in the State is calculated at 1.3 per cent,[1] which is the lowest rate of agricultural growth amongst all the States of India. The annual growth rate of food crops is still lower and is only 0.5 per cent. It is surprising to note that the productivity of land has decreased during 1951-52 to 1961-62 in all the districts of Assam except Cachar.[2] Increase in production is due to an increase of area under crops.

---

1. Growth Rates in Agriculture 1949-50—1964-65, Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India, New Delhi, March, 1966.
2. Estimates of Area and Production of Agricultural Crops, 1951-52 to 1961-62, Department of Economics and Statistics, Government of Assam.