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THE ECONOMIC RESULTS AND POSSIBILITIES OF IRRIGATION

By

Harold H. Mann

The primary problem in the economic development of India is the increase in production from the land. At present there seems a race between the increase in population and production, and one often feels that the former is going ahead at a greater rate than the latter. In fact, in the latest study of the subject with which I am acquainted, that of Thorner and Blyn¹, it is suggested that the annual production of food crops is tending to decrease, and though this is compensated for by greater yields from commercial crops, yet the position is that what is obtained from the land *per head of population* is much less than fifty years earlier. These figures only took the records to 1945-46 and there has been a substantial increase in production since then, yet the fact that in the present season there has been a large shortage of home produced foodgrains must give rise to much anxiety for the future. It is idle to talk about raising the standard of life of the people when the actual production of the country per head of population is stagnant or declining.

Increase in production from the land can, as has been emphasised by many authorities, be reached by many methods. It can be achieved by extension of the area of cultivation, by improved seeds, by the more extensive use of fertilisers, by improved methods of cultivation, and by irrigation. In the present article I propose to consider the question of benefits which accrue in the matter of increase of crop yields by the use of irrigation, and also of other favourable or unfavourable results which may follow the introduction of any system of using water on the land.

MEAN EFFECT OF IRRIGATION ON CROP YIELD

At first sight it would seem obvious that in a country with such a variable rainfall as occurs in the greater part of India, yields must increase to a very considerable extent if the supply of water can be made secure. It is difficult to determine to what extent such an increase actually occurs, but perhaps the general result can be best judged by figures given in the reports on the average yield per acre of the principal crops. The latest edition of these figures relates to 1946-47 and a summary of the results there shown for some of the staple crops in some of the principal provinces is given in the next page.

I am not sure how far these figures can be relied upon, but as they stand they suggest that the effect of irrigation is far greater in Madras and Bombay than in the provinces of northern India. Taking all the above quoted crops together they would make the increase in crop due to irrigation, on the average, as follows :-

Madras	164 %
Bombay	159 %
Uttar Pradesh	44 %
Punjab	53 %

1. Thorner, D. and Blyn, G. : Long Term Trends in Output in India (contained in "Economic Growth : Brazil, India, Japan," Durham, N. Carolina, 1955).

YIELD PER ACRE

Crops	Madras		Bombay		Uttar Pradesh		Punjab	
	lbs.	In-crease %	lbs.	In-crease %	lbs.	In-crease %	lbs.	In-crease %
Rice { Unirrigated (No irrigation)	873)		—)		800)		806)	
Irrigated	1202)	38 %	1250)	?	1050)	27 %	1170)	47 %
Wheat { Unirrigated (No irrigator.)	—		502)		750)		614)	
Irrigated	—		1238)	147 %	1100)	47 %	1037)	69 %
Jowar { — (No irrigation)	480)		602)		—		307)	
Irrigated	1247)	160 %	1389)	131 %	—		553)	80 %
Gram { No irrigation	—		408)		750)		520)	
Irrigated	—		1153)	183 %	900)	20 %	806)	52 %
Cotton { No irrigation	78)		113)		120)		(D)130	
Irrigated	286)	295 %	311)	175 %	220)	83 %	(D)196	51 %
No irrigation							(A)115	
Irrigated							(A)135	17 %

D is Desi cotton. A is American cotton.

Thus, we may say that, if these figures are at all reliable, in South India irrigation will at least double the output of our staple crops while in the Indo-Gangetic plain it will only increase crops by 50 per cent. But the figures given are only averages and they confound together results which may be great in some parts of a province with what may be a minimum advantage in another part of the same area.

EFFECT OF IRRIGATION IN MARGINAL TRACTS

The figures, in fact, very much over-simplify the situation, for it seems certain that under normal seasonal conditions there are many areas, both in South and North India, where irrigation will not increase the yield at all. In fact, in such tracts the most that can be said for irrigation is that it is an insurance against drought and would be rejected in a normal season by the cultivators at least for staple crops. This is certainly the case in the eastern Bombay Deccan and I believe it is also the case in the lower reaches of some of the canals in Uttar Pradesh. In fact we may divide, as the early irrigators in India did, irrigation schemes into those which are used to get a crop where such a crop could not be otherwise obtained and those where the means of irrigation are merely an insurance against drought. The tendency of those who finance work on irrigation canals, whether these be from rivers, from reservoirs, or from tanks, is to concentrate on the former type of irrigation where large yields of special crops can be certainly obtained but which do not do very much to raise the general level of land production. The tendency, in fact, has been even to convert what were originally designed as protection against famine into sugarcane canals where water is very largely used for cash crops which could not be grown without canal or other irrigation water. Such

crops are profitable to the providers of water as well as to the cultivators of such crops, but they furnish only a small contribution to the question of the increase of the produce of the country.

I want to make a special point of the fact that in many cases irrigation is likely to make only a small contribution to this increase because it has been ignored by most of the writers about the benefits of irrigation. In one most valuable report, however, by Gadgil² the conditions prevailing in a Deccan district are discussed and it is claimed that, as a group, the owners of dry farms were distinctly better off than those with irrigation. The authors say, in fact, as follows :— "The non-irrigated farms have not only a better representation than the average in the net profit classes but have also a much smaller proportion of their numbers in the largest loss classes than the average." The writers of this report deal with the profit to the cultivators and not with the effect of irrigation on the production of the land, but my own experience in the eastern Bombay Deccan has been that there, in the growing of *rabi* crops, the people have often, if not usually, stated that the application of water for the staple crops generally grown (*jowar*, etc) is of no advantage and may actually diminish the yield.

Such conditions may be and probably are exceptional and would prevail most largely in the black cotton soil areas, particularly where this is deep and not early drained. But, in general, I think that in what may be called marginal areas, the benefit of irrigation for the usual crops which are required for food or for sale has been exaggerated. It is very much to be desired that in such areas irrigation should be regarded chiefly as an insurance against drought and so the charge for water should be very low or only made when the water is actually used. This would mean that in such places water would not be used in many years for the staple crops and, to that extent, the capital invested in making water available would lie idle or be only used to a minimum extent. In a famine year, on the other hand, such possibilities of irrigation would be invaluable. When I was Director of Agriculture in Bombay during the famine of 1918, the existence of sources of irrigation, even when the reservoirs only filled to a very partial extent, was beyond price. In other seasons water was hardly wanted except for garden crops or, to a limited extent, for those like sugarcane which cannot be grown without irrigation water.

EFFECT OF SOIL ON IRRIGABILITY

The extent to which irrigation water *can* be obtained and used varies very much in different parts of India, owing to the very different conditions of the water supply and, perhaps, even more to the character of the soil. It is generally recognised, for example, that deep black cotton soil cannot be profitably irrigated owing to inevitable waterlogging even when every effort is made at drainage. In consequence the black cotton soil areas are those where the proportion of the cropped land which is under irrigation is the smallest in the country. The actual proportion of the cropped land which was irrigated in 1953-54 in several of the Indian States is shown below.³ The figures given include the area under rice cultivation, though this stands on a rather different footing from that for other crops. I have, however, left the figures as they stand.

2. Gadgil, D. R. and Gadgil, V. R. : Survey of Farm Business in Wai Taluka, Poona, 1940.
3. Abstract of Agricultural Statistics, 1953-54, Delhi, 1955.

PROPORTION OF CROPPED AREA—IRRIGATED

	<i>Per Cent</i>
Bihar	16.7
Bombay	5.3
Madhya Pradesh	5.9
Madras	26.7
Punjab	35.8
Uttar Pradesh	24.9
West Bengal	18.6

It will at once be seen that in the States which have predominantly black cotton soil, the areas now irrigated are far smaller in proportion than elsewhere where other soils prevail. Such States are Bombay and Madhya Pradesh as they were before the rearrangement of State boundaries. In Bombay, for example, the proportion of the cropped land which is under irrigation is only 4.9% in Gujarat and 4.3% in the Karnatak, while in the Deccan, in spite of the great extension of canal irrigation in recent years, it is only 7.4%.

As already stated, this deficiency in Bombay and Madhya Pradesh is partly due to the difficulty of getting water on to the land and partly to the unsuitability of the land for irrigation. As regards the former it is perhaps not realised that in the Bombay Deccan, if all known sources of possible water supply were utilised, about 86% of the cropped area would still have to be cultivated under dry crops. This is not to suggest that there is not very great scope for the extension of irrigation whether from wells, tanks or canals, but to indicate that such extension must take account of (1) the requirements of water for the staple crops in normal as well as in famine seasons, (2) the character of the soil, its depth and its drainability, and (3) the accessibility of water.

GENERAL IRRIGATION POLICY

From the point of view of increasing the total production from the land, the tendency to make canal irrigation primarily irrigation for sugarcane and garden crops has perhaps been a mistake, at least in part. Areas which have been successfully converted to sugarcane and similar crops have become prosperous, and have been a source of great profit to the cultivators of those crops and also to the irrigation departments concerned. My own connections have been with the Deccan canal areas and notably those under the Nira and Mutha canals. The economic effects of irrigation in such areas have been vividly described by Gadgil⁴ and no one who has visited them can help feeling that the supply of water there has been to bring prosperity to districts which were formerly very poor, and, so far as the watered areas are concerned, to increase vastly the production per acre. But this local prosperity has been achieved with both agricultural and social consequences to which comparatively little attention has been hitherto given.

I do not wish to stress here, however, the danger of the development of waterlogged and salt land as a result of canal irrigation in such areas. A good deal of

4. Gadgil, D. R.: *Economic Effects of Irrigation*, Publication No. 17, Gokhale Institute of Politics and Economics, Poona, 1948.

attention has been focussed on this point in the recent past, and it is almost a criminal offence, with existing knowledge, to put in canal irrigation without arranging for adequate drainage *at the same time*. This was neglected in the early days of canal irrigation, with the result of making a good deal of the area, which gave the best results when water was first given, becoming permanently barren. I say *permanently* barren because in the Nira Valley we found that the subsoil of such water-logged patches was stinking with sulphuretted hydrogen owing to the expulsion of oxygen from the lower layers of the soil by excess of water.

But another agricultural result has followed in these Deccan canal areas in the draining of the manurial resources of the surrounding dry country into the watered region. The growing of sugarcane demands a very high degree of manuring, and every source for manures must be tapped, apart from the oilcake and artificial manures which are bought by the sugarcane growers. For quite a large region round the Nira canal area (and I doubt not that the same has occurred round the Godavari and Pravara canals) cattle manure and other similar materials have been drawn into the watered zone with the result that the dry crops there have been to that extent starved of the manures which they might have had. There are no available data to show to what extent this has taken place, but if the high productivity of the irrigated land (chiefly with sugarcane) is secured by a reduction of the yield of staple crops grown without water, it must be placed to the debit of the canal irrigation.

The social result of the introduction of canal irrigation in the Deccan areas is a very striking one, at any rate under the older canals. The lands which were formerly owned and worked under dry cultivation by landowning Maratha cultivators has to a very large extent passed into the hands of invaders who, used to irrigation practice, have taken over the suitable plots, while the former owners have largely disappeared as landowning cultivators. What has become of the former owners who worked the land, I do not know. Have they become landless labourers or have they moved to other parts of the country? On this point we have no evidence and the census returns do not help us much in the matter. But if the phenomenon is more widespread it becomes important. I can quite believe that a cultivator who has been accustomed to grow *jowar* or similar crops on unwatered land, may not be able to accommodate himself to the more arduous work of growing sugarcane and its associated cultivations. Even in the dry regions, there is usually a certain growing of garden crops irrigated from wells, but this is a very different matter from the large scale cultivation of sugarcane and the change over seems to have been too much for the average Maratha cultivator. I am not sure how far the same change has taken place in the more recently irrigated tracts, but it is a social development which cannot and should not be ignored.

SUMMARY

To summarise the points which I have tried to make in this paper, it would seem that

(1) The increase of crop yield which may be expected as a result of the introduction and extension of irrigation varies a good deal in different parts of India and is probably a good deal less in the alluvial tracts of northern India than in the Peninsula areas.

(2) Such increase as is obtained will vary very much with both climatic and, soil conditions. When climatic conditions are favourable for crop growing, and soil conditions are unfavourable for irrigation, the introduction of canal irrigation may even lower yields and water must be looked upon only as an insurance against drought, with the consequence that, as regards staple crops, the capital invested can hardly give a regular annual return but may be invaluable when a famine occurs.

(3) The tendency to encourage the use of irrigation water for the intensive cultivation of sugarcane and garden crops to the detriment of its use for staple crops, while leading to very great increase in production and in profit in local areas does very little to increase the total production of the land, taking the country as a whole. It is a convenient method of using water and a profitable one for both the sugarcane growers and for the providers of water, but its effect on the national production per head of population is only small.

(4) Without laying stress on a subject which has already been much debated, namely the effect of heavy irrigation on the development of waterlogged and salt land, I would urge, as I have often done before, that no new irrigation scheme should be even entertained which does not provide adequate land drainage at the same time as a fresh supply of water is given.

(5) There is a case for the close study of the effect of the introduction of a new source of irrigation on the agricultural results in the surrounding dry areas. It is almost certain that the demand for manures in the irrigated tracts has, in the past, tended to lower the standard yield of crops in such dry areas.

(6) There has been little study of the social results of the introduction of canal irrigation on the inhabitants of the area to which water is supplied. In certain irrigated tracts these have been very considerable with the displacement of the traditional landowning cultivators by invaders who are more used to the growing of intensively irrigated crops.