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ECONOMIC EFFECTS OF IRRIGATION

Report of a Survey of the Direct and Indirect Benefits of the Godavari and Pravara Canals

BY

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PREFACE

This publication comprises the report of a survey undertaken by the Institute for the Government of Bombay and conducted during 1939 and 1940, together with an introductory note. The report was submitted to Government in October 1942. As the survey had been undertaken on behalf of Government, it was expected that the report would, in due course, be published by Government. This did not, however, happen, and as it was felt that publication of the report would prove useful, government was approached last year to permit the Institute to publish the report in its own series of publications. This permission was duly granted by Government. Though the survey was undertaken on behalf of Government the Institute bore sole responsibility for its conduct and planning and the writing of the report. The Government of Bombay is, therefore, in no way responsible for the data, findings or opinions contained in the report.

The report of the survey is here printed almost in the same form in which it was submitted to Government in 1942. Occasion has, however, been taken to correct certain minor errors of calculation that were later discovered and to recast, in many instances, the phrasing of the comment. An introductory note has also been specially written for the publication. The note was written in the early months of 1948 but is based chiefly on materials gathered at the time of the planning and conduct of the survey and the writing of its report. As the introductory note makes clear, the report of the survey may be found useful not only because it contains the results of a particular enquiry but also because it deals with a subject connected with a wide group of investigational and analytical problems. It would, in addition, be found that the report throws a great deal of light on the quantitative relation between different economic activities in Indian rural economy and on important problems of the results of investments on employment and distribution of income. It would also be found to furnish data regarding not only many aspects of farm-

ing, dry and irrigated, but also a number of aspects of non-agricultural economic activity not usually covered by Indian rural surveys.

The Institute is thankful to the Government of Bombay for granting permission to publish the report. I would also place on record our gratefulness to the authorities of many Government departments, central, provincial and local and of many private companies and to the many officials who actively cooperated in the work of the survey. The conduct of the survey would not have been possible but for the ready welcome and the ungrudging help given by leaders of public opinion and a host of others, engaged in all walks of life, in the tract surveyed. To all these our heartfelt thanks are due.

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NTRODUCTORY NOTE

The immediate aim of the survey whose report is now being published was to assess the total direct and indirect benefits due to a particular irrigation project. The problems involved in the investigation, the methods adopted for it and the assumptions that had to be made in carrying it out have, however, an interest much beyond the results of the particular work. The investigation is closely related to the general problem of assessing results of all kinds of irrigational or reclamation projects. The assessments of the results of irrigation projects has been attempted by many in the past, both in India and in other countries. Results of some pioneer attempts in this direction are contained in an official publication entitled *Reports on the Direct and the Indirect Effects of the Godavery and Krishna Annicuts* published in Madras in 1858. This comprises a number of reports by various individuals and bodies on the effects, in particular regions, of specific irrigation projects. One may refer to the two reports by Mr. Taylor on the direct and the indirect effects of the Godavery Annicut in the Rajahmundry District to illustrate the treatment of the subject in this publication. (*pp. 19–80*). Mr. Taylor addresses himself primarily to discovering the increase in the revenue collections, of Government in specific areas, which could be attributed to the construction of the annicut. He, however, points out that " the employment of many thousands of people when they could not have found work elsewhere opened out to the labouring class a new and profitable means of livelihood and secured to the ryot, the tradesman, and the merchant, a large and certain market for agricultural products and merchandize of all kinds." (*Page 23.*) He also refers to particular instances of changes in seasons of sowing and cropping which result in greater security and production and the introduction of new crops which are profitable. An attempt is made by Mr. Taylor to compare the expenses of and returns and profits from crops on dry land with those on wet land, as also the difference in rentals between the two. The change in the composition and volume of exports and imports

from a region following on the introduction of irrigation is also noted and finally it is pointed out that "the stimulus imparted to the industry and productive resources of the Province by large establishments like the Rajahmundry Sugar Factory must not be overlooked." (*P. 53.*) Mr. Taylor thus refers to almost all the aspects of the effects of irrigation, efforts at the measurement of which have been made in the following pages. However, the concrete measurement in Mr. Taylor's reports, as in other reports contained in this early official publication, was undertaken chiefly in terms of the collection of revenue by Government. This measurement also was mostly confined to the collection of land revenue; only in few cases was it extended to sources of revenue other than land revenue or water charges. The only statistical data other than collections of taxes, charges, etc. contained in these papers relate to figures of trade i. e. mainly of values of exports and imports from and to specific regions.

Subsequent writing on the subject in India has not gone much beyond what is contained in these early reports. As a matter of fact, there seems to have been, in later times, an undue emphasis on the revenue receipts from irrigation projects and most estimates and calculations in connection with the construction of irrigation works concerned themselves with the direct return on investment. Even when, in recent years, there has been an appreciation of the wider view, little systematic effort has been made at a measured estimate of the indirect and cumulative benefits. From papers relating to recent practice in the most intensively developed area, the Punjab, it would appear that chief among the indirect receipts for which calculations were made in the Punjab were those from Crown Waste. Mr. Kanwar Sain's paper on the finances and economics of irrigation projects refers to the increased return to the cultivaltor from irrigation from (i) increased land values and (ii) additional income from farm products; and he mentions the suggestions now made that methods should be devised for crediting irrigation projects with part of the increased land values. However, to our knowledge no attempt has so far been made in India either at assessing ncreased land values due to irrigation or at aquiring them,

at least partially, for the State. Similarly no investigations seem to have been undertaken, before this project, either for estimating the total direct and indirect receipts of government or at estimating the increase in the value of agricultural production or in the volume of other activities based upon it.

For the U. S. A., reports of the Bureau of Federal Reclamation and other official agencies contain a wealth of data. These indicate problems very similar, in many respects, to those encountered in India. The general practice in regard to assessment of benefits, etc. may be illustrated by reference to the report of the Committee appointed by the Secretary of the Interior for a study of the success and soundness of federal reclamation policy.[1] The report notes that the crop values, for different years, of annual production of the projects averaged nearly one-third of the Government's total investment in irrigation works and that therefore, the current creation of wealth through the projects was large. Reference is also made to data specially collected to assess the effect of reclamation on business. These data represented records of the expenditures for purchases outside the local trade territory by representative farms covering a period of 7 to 10 years. They showed that 75 to 80 p. c. of farm income was spent on purchase of commodities produced in the industrial sections of the U. S. A., "in other words, only about one fourth of the farm production income was used for irrigation operation, tax payments, labour and local supplies." (*p. 64.*)

The Report of the Special Repayment Commission (1938) cites the following among the major accomplishments or encouraging features resulting from reclamation programmes of the United States. (1) creation of a large number of irrigated farms (2) providing homes and means of livelihood for persons on farms within the reclamation project areas (3) establishment, stabilisation and business of cities and towns on or dependent on reclamation project areas (4) contributing a major part to the support of public schools, churches, banks, etc. within the project area (5) stabilised agricultural condition and production on project farms (6)

1. *Report on Federal Reclamation*, J. W. Haw and F. E. Schmitt, 1934.

the stabilising influence of water supply provided by Federal Reclamation works for agriculture in the West and as market for non-Western products (7) the value of crops produced on reclamation projects since 1906 approximately 10 times the overall costs of irrigation works serving those lands (8) large increase in the average value of lands, inclusive of buildings (9) large increase in assessed values of lands (10) importance attached to the construction, maintenance and development of projects as a market for non-Western products by manufacturers, rail-roads and other transportation agencies (11) the volume of non-Western products shipped into the reclamation area exceeds the agricultural products of reclamation projects shipped East in a ratio of more than 8 to 1 (12) the reclamation programme was a pioneer in the public development of Hydro-Electric power in the West through multiple-purpose use of water resources (13) the grading of irrigated farms compares with that of other farms so far as the relative productive value is concerned. These various claims, which are not mutually independent or exclusive, indicate the many aspects of the results of irrigation and the directions in which direct and indirect benefits may be traced.[2]

2. Cf. also the following two extracts. "There is no way of measuring accurately the full contributions these enterprises have made to the business and social life of the States and communities in which they are located, and to the national wealth, but the following facts are pertinent: They have greatly aided commerce as the residents of the projects are buyers and sellers of a vast amount of goods and products. The projects have brought about improvement and increase in both highway and rail transportation. They have provided huge revenue tonnage for transcontinental carriers through regions of otherwise sparse traffic, and thus to an appreciate extent have lowered the rate levels on other commodities moving over their entire systems. They have contributed to education and to local government by the payment of taxes. They have made it possible to utilize fully adjacent ranges and to stabilize the livestock industry and dry-land agriculture of the West. They are the main source of food supply for many mining and lumbering camps." *Report of an Economic Survey of Certain Federal and Private Irrigation Projects*, 1929, Bureau of Reclamation, p. 2.

"To determine the economic justification of a proposed reclamation project requires that a definite equivalent for the distributed benefits be

(*Continued on next page*)

While the emphasis is on increased production in measuring the advantage to the community, land values have been held to be specially significant in assessing the repayment capacity of the individual operator. In the U. S. A. the irrigation system is not looked upon as a completely state owned capital work and part of the capital cost is usually recovered from the operator. Land values and land speculation have become specially important problems in this connection. Progressively, the idea has gained ground that speculative increase of land values is a hindrance to proper development under irrigation projects and that, therefore, some means should be adopted to eliminate it. In the 1929 report Johnson had already laid down that in so far as government was pursuing a policy of settlement, it ought to extinguish every private title before encouraging a project and that the only significant objective for a reclamation policy was community building.[3] The Haw and Schmitt report considered the increase in farm values as the best index of the payment that the farmer could be fairly asked to make.[4] It favoured a method of controlled sale after official appraisal to eliminate land speculation. The 1938 Special Repayment Commission recommended, on the other hand, that the procedure for determining water right

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(*Continued from last page*)

fixed. Unfortunately, no factual basis for quantitative appraisal of regional, State, and national benefits is now available, as already stated. The benefits likely to be derived by nearby towns and by associated industries and utilities can often be appraised at least approximately, but the general community benefits to State and Nation are less tangible. Some estimates of values created by existing projects, and increased business and traffic volume, have been attempted, but the interpretation of the figures is open to serious question. In any event, the appraisal of such benefits in advance of development would involve large uncertainties. At best only calculable money benefits could be determined, while developmental and social values such as those that lie in the creation of additional homemaking opportunities and stabilization of economic life are not reducible to money terms." Haw and Schmitt, *Op. cit.* pp. 99–100.

3. A. Johnson: *Economic Aspects of Certain Reclamation Works* (1929), p. 14 and p. 16.

4. "The farmer's repayment should be fixed at the irrigation value. In addition, the farmer should be able to obtain the land title at unirrigated value, free from speculative increase." *Op. cit.* p. 99.

payments for reclamation projects should be worked out by taking into consideration factors influencing ability to pay, particularly the efficiency of the project irrigation system, the right use of land and water, the uncertainties in agricultural production, the means of effective marketing, and should provide for adjustment of repayment contracts from time to time.[5]

In most reports dealing with the economic effects of particular projects benefits of irrigation are sought to be measured by assessing net returns of farms and by comparing net worth at the time of settlement with net worth later. In reports on projects under consideration estimates may be made of investments and expenses, deficits and surpluses, and capital and credit requirements on specific types of farm businesses expected to be established under the projects. Economic limits of irrigation water assessments may be calculated and indirect benefits may be sought to be assessed by demanding that as existing urban centres would stand to gain by particular projects they should bear part of its cost.[6] General studies of the economic and social aspects of irrigation cover a broad and varied field and may include such subjects as the effects of irrigation on industry and trade especially retail and to such aspects as the influence of irrigated agriculture on county government and of increased population density to school costs.[7] While the numerous reports and investigations, official and non-official, in the U. S. A. have thus drawn attention to a variety of the effects of irrigation works, investigations do not appear to be undertaken to study, in the case of any completed project, the effects of a particular scheme in considerable detail and to attempt to measure them in a variety of directions. Most indices of effects are related to the increase in land values or to the value of gross production and indirect effects are mostly indicated by pointing to the availability of a market for labour and for the products of industry.

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5. *Op. Cit.*, p. 36.

6. Cf. W. W. Johnston, *Land Classification and Economic Report, Casper—Alcova Project*, 1931, p. 35.

7. Cf. Slavsgold and Matthews: *Some Economic and Social Aspects of Irrigation in Montana*. 1938.

Irrigation does not play the part in the countries of Europe that it does in India or the U. S. A. However, problems similar to those raised by irrigation in India are met with in connection with schemes of land reclamation and improvement in many countries of Europe. In these countries also an increasingly comprehensive view of the objectives and results of such schemes has been taken in recent decades. "Land reclamation is no longer judged from the simple point of view of economic profit, of a favourable balance of expenditure and receipts; but on the basis of the whole of the advantages derived from it, which go far beyond the narrow idea of the return to the private operator. The consideration is the increase in the aggregate return accruing to the farming and also the non-farming classes, throughout the country, from the fact of the increase in production, from the larger possibilities of employment and from the impulse given to internal land settlement."[8] The land reclamation projects undertaken by European countries during the interwar period were, it would appear, comprehensively planned and judged by their overall results. In the Italian so called 'integral' land reclamation, reclamation did not end with drainage and levelling operations but was linked and coordinated with correction of water courses, irrigation works, organization of communications, erection of dwellings for workers, formation of rural centres, distribution of electric power, establishment of agricultural industries and finally the campaign against malaria. Even in countries where it was not necessary to plan land improvement works so comprehensively, because the areas in which they were undertaken were already fairly well developed, a number of supplementary measures may yet be found necessary to reap fully the results of expenditure on the improvement scheme. For instance, in Germany the work of land improvement was closely associated with the consolidation of farm holdings.

In assessing the results of these schemes in Europe the main index used was increased productive capacity. The assess-

8. G. Constanzo, *Land Reclamation and Improvement in Europe*, Monthly Bulletin of Agriculture and Sociology. Rome 1938—No. 10, P. 454 E. Most of the following account of European conditions is based on this article.

ment was made in terms of areas of improved or reclaimed land and the increase in gross production or net return due to the effort of improvement and reclamation. In general, no efforts seem to have been made at finding ways of assessing in concrete terms the indirect and secondary effects flowing from the work of improvement. However, in specific cases, especially when an objective other than that of increasing production was also aimed at by the project, an attempt may be made to set up other measures. Among the objectives of the Italian schemes of integral land reclamation the employment of workers and their settlement on land were specially emphasized. The following were included in the stated objectives of these schemes: (1) Employment for the maximum number of workers, thus reducing unemployment; land reclamation works, apart from their intrinsic utility, are undoubtedly of great value in this respect. (2) Conversion of an increasing number of casual labourers into permanent cultivators, or farm settlers, thus encouraging internal land settlement. Because of these special objectives inquiries undertaken to gauge the extent of the economic results of "integral" land reclamation assessed them in terms not only of value of production and an index of gross production available for sale but also in terms of the amount of labour employed per unit of land and the percentage of job labour in total labour employed. The index of total labour employed per unit of land was devised to indicate the extent of the increase in total employment brought about by schemes of reclamation and the index of the percentage of job labour was meant to show how job labour might be progressively eliminated. It was noted that the index of job labour tended to diminish in a varying degree, sometimes reaching zero; the interpretation of this was that the farm worker had in the end settled definitely on the land. These special indices were compiled in the Italian survey because of the emphasis on the settlement of labour in Italian reclamation policy. Even in the Italian survey, however, the main index used was of the increase in total production. The indices of labour employment and job labour related evidently to the amount of employment in agriculture under the reclamation schemes and did not refer to employment resulting from the indirect or the secondary effects of those schemes.

A set of analytical writings which have an indirect bearing on the problem considered in this publication are to be encountered in the field of business cycles, particularly in relation to the problem of public works policy and its effects in counteracting forces of depression. However, most of this writing is concerned with theoretical models and, in quantitative expression, use has been made in it mostly of hypothetical figures. Though new terms with a quantitative significance, such as the multiplier, have been brought in, concrete investigations which would indicate the methods of assessment of these and the difficulties in the way of carrying it out are not met with. This set of writings is specially suggestive in connection with the indirect and secondary effects of capital investment.[9] Use has been made of them by us in connection with the classification of the various stages at which effects might be assessed. The assumptions under which the discussion of these effects is carried in connection with business cycle theory are, however, widely different from the conditions under which the direct and indirect effects of irrigation were to be estimated by us. Therefore, no attempt has been made to establish in this investigation any direct connection with either the concepts or subjects of the Public Works Policy and Multiplier controversies.

In recent years another problem has become prominent owing to the concern in planned economic development shown by govenments. The problem is essencially that of estimating the results of the impact of a set of initial investments on other parts of the economy through their direct and indirect and secondary effects. It may be met with in a series of different contexts, such as definition of the conditions of general economic progress or plans for balancing the economy of a region or the industrialisation of backward areas. In most instances the problem has yet been studied in terms of project plans, more or less complicated; and there has been little specific investigation of effects of measures of investments undertaken in the past.

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9. Cf. J. M. Clark *Economics of Planning Public Works* (1935), Chap. 9, Cumulative Effects of Public Expenditures.

Among the concrete measures that have been used for estimating direct effects two stand out with great prominence. These are the indices of (i) increase in land values and (ii) increase in gross produce from land. The land or farm value index is obviously an indirect index; land values are ultimately dependent on the increased return from land to its owner. The rise in land values would be based obviously on the expectation of the increase in the average return from land over a series of years; and this would, in the main, depend on the improved productive capcity of the land. Measurement of total effects through increase of land values may be attempted and preferred because (1) this increase might be more easily and accurately ascertained than the increase in produce and (2) it might be argued that land value figures, in so far as they reflected expectations, would give an indication regarding average long term results and not results relating to a particular year or time. However, the land value index would not necessarily reflect the unmixed effects of the average increase in the expectation of return from the land in question. For, it is liable to be influenced by many factors which may have nothing to do with the particular scheme or area under consideration, or even with agricultural operations in general. Fluctuations in the level of land prices as a whole, the general price level, the rate of interest, may all affect to a significant degree prices of specific lands under consideration independently of variations in their productivity. Again, the index of land values may contain a speculative element unrelated to existent facts and would depend among other things on the legal, etc. structure of land ownership rights and on restrictions, if any, laid on the rights of the owner of land to alienate land. All these considerations make the land values index a less satisfactory measure of the total effects of schemes of irrigation and land improvement than a direct measure such as that of increased production. In case the problems of estimating increase due to land improvement in production are successfully got over the direct effects in any given set of conditions could be most satisfactorily measured by this index.

The measurement of increased production and its valuation would, of course, reflect the particular circumstances of

the period chosen for investigation. Agricultural yields may vary from season to season and prices are liable to fluctuation. Therefore, any estimate made for a particular period may not be representative of average conditions. It is, however, possible to estimate average results in the light of data relating to the range of seasonal fluctuations in yields and of records regarding prices in the past and estimates in the future.

Something may be said in passing regarding the indices of gross and net production in connection with the problem of measurement. Gross production would, of course, mean total production from any particular activity, such as agricultural exploitation of land surface, during a period of time, without any deduction on any account. In connection with the enquiry under consideration the term net would most significantly be used by allowing for a return on the capital, and for the cost of working and maintenance of the work under consideration as a deduction from the gross figure. The net benefit from capital works would thus represent calculation of the product over and above the addition which would go as a set off against the current and capital cost entailed by the work. Net product as defined in this manner would be arrived at through estimates of the gross product and calculations relating to the annual charge on account of capital cost, maintenance and operation. The latter calculations have little direct connection with any part of the investigation, in the actual field, of the effects of capital investment. The aim of the investigation is itself, therefore, usually confined to the estimation of gross production. Net product in other senses of the term i. e. as the excess of income over outlay in a particular economic activity or as the share available for distribution apart from expenditure on materials, defined sometimes as social income, have no direct relevance to the general problem under consideration. It will appear that some use of these other concepts of net product is made in specific contexts in the report.

Another point needs emphasis in a preliminary discussion. The effect of a capital work may, in the early stages, be the compounded effect of the work in the course of its construction and of the permanent increase in activity arising out of

the completed work. The elaboration of the concept of the multiplier was largely concerned with the effect on the economy of expenditure in connection with public works in process of construction. In a number of investigations and writings on irrigation and reclamation works, the effect of the process of construction and the effects after construction, following on the functioning of the work as a completed work, are sometimes discussed together. This report give no consideration to effects during the process of construction of the work. It is concerned entirely with the effects of the whole work after it has been completed.

In this connection it is also necessary to distinguish between actual and potential results and between short term and long term results. The full exploitation of a capital work may be dependent on undertaking a large number of subsidiary works of all kinds. This may mean considerable capital outlay. Apart from this necessary supplementary activity, full exploitation may not be attained before a minimum period of time which may be required for, say, the settlement and building up of a community of farmers. It has, for example, been noted that from 30 to 50 years are needed to bring an irrigation community to full and stable development.[10] Some attention has been paid in the report to costs incurred by government or by private enterpreneurs in clearing and developing, etc. the land and making full use of irrigation. No consideration was, however, given to the problem of community building. The investigation was undertaken more than 20 years after irrigation from works began. However, no systematic efforts at exploitation of the area under command had been made, and government had adopted an attitude of complete *laissez faire* towards the problem of the development of farming communities. Therefore, progress had been uneven and not very rapid. When ultimately depression forced Government to consider means of stimulating the demand for water

10. Haw and Schmitt. *Op. Cit.* P. 67. In recent studies of the Bureau of Reclamation the types of farm economy best suited to a project area during the period of development are indicated separately from the types at the mature stage. Cf. *Columbia Basin Joint Investigations*, Problem 2 (1945).

attention was directed not towards the creation of communities of farmers with adequate resources and knowledge to practice intensive irrigated farming but to giving special concessions to sugar companies to induce them to settls and acquire the land. Thus, as would appear from the report, in some areas full effects of irrigation were not at all apparent at the time of the survey while in others the stage of development reached might well be termed mature. No attempt is made in the report to arrive at any estimate of total potential effects and the extent of unrealised potentiality. The investigation was confined to finding out the actual results that appeared to have been obtained.

The problem of the extent to which unutilised or idle resources are available for exploitation of the opportunities opened by capital works is relevant to this survey. The consideration of the possibility of employing idle resources is of great importance in the multiplier approach. It would have been of special relevance in our investigation if instead of estimating the effects of works at the stage of maturity the pace of the process of development had been studied. For, in that case it would greatly matter at what rate and from what source the additional capital and labour resources required for the exploitation and development of opportunities were made available. The findings of the survey definitely indicate the fact of a considerable under-employed population on the fringe of the irrigated tract. But the investigation did not bear at all on the availability of capital resources within or without the tract. Therefore, it paid no attention to the important problem of the process by which a farmer in the tract could go on to increasingly intensified capitalistic exploitation of land after water supply became available. This process has two aspects. The first is knowledge of and familiarity with the technique of irrigated agriculture, which would be lacking in a community of farmers brought up and trained to dry farming methods. The inflow of trained elements from other irrigated communities into the region surveyed was, under conditions of complete official indifference, a necessary consequence. The other aspect concerns the capital resources required to practice intensive irrigated farming. These might either be wholly borrowed from out-

side ; or else with a minimum initial start the area and degree of intensity may grow at an increasing pace through the increasing surpluses available as a result of the progressive exploitation of a business itself. The pace of the latter process would depend to an important extent on the phases of the cycle of prosperity and depression encountered.

One feature which differentiates the irrigation works of the Deccan from those of the Punjab or most Federal Reclamation Works in the U. S. A. is that they did not affect, in the main a region that was previously undeveloped. The lands watered by the Godavari and Pravara Canals system had been developed for centuries past and bore well-organised and fairly populous farming communities before the advent of irrigation. Irrigation resulted not in settling a new region but in changing the aspect of a farming area. Therefore, a survey of this region was calculated to bring out fully the results of the transition from dry farming to irrigated farming. Data for such aspects as farm equipment, production, population and trade were, in this region, available for a matue dry-farming economy and could be used for a fruitful comparison between the two different types of farming. Material for such detailed comparison could obviously not be available in areas where irrigation works developed unsettled or very sparsely populated land. It is for this reason perhaps also that similar surveys have not been attempted elsewhere.

It is not necessary to call attention, at this place, to the general features of the results of the survey. One aspect of the conclusions appears, however, to have specific importance in connection with the problem both of the multiplier and the progress of industrialisation or economic development. It is, that the indirect and secondary effects of investment depend greatly on technical possibilities inherent in the new product independent of the volume of additional production which may be the direct effect. The extent of the direct effect itself is determined to a large extent by physical conditions and possibilities of exploitation in the field and cannot be simply related to the total volume of investment. For the same volume of investment, the extent of the direct effect may differ widely because of differences of physical conditions and technical possibilities.

Moreover, for the same volume of additional production the indirect and secondary effects may differ widely. These effects, especially the secondary effects, may depend not on the volume of additional production but on the extent to which it was capable of, or required being, worked up. The difference made by this factor could be very large; it might vary all the way from new production being all in terms of a consumption good which required not even primary processing, to its being a raw material which served as the basis of a very complex industry. The difference made to the employment and other structure of a region by such factors is clearly shown in the report of the survey by the differences in the effects between the fruit orchard and the sugar cane regions. This would seem to render infructuous any attempt at postulating average quantitative relations between the volume of investment, the added product and the area and extent of indirect and secondary effects in general terms. The relations in each case could be known or estimated only on a complete study of the physical and technical conditions of the particular region in which economic development was planned or was taking place.

REPORT OF THE SURVEY

Initiation, Planning, and Conduct of Survey.

The enquiry whose report is being submitted to Government originated in a D. O. letter by Mr. T. A. Andrews, Secretary to Government, P. W. D. dated 2nd July 1938 addressed to Mr. D. R. Gadgil enquiring of him whether he would be prepared to undertake the investigation into the improvements effected by the existence of irrigation in a tract, with reference to the Godavari and Pravara canals. Mr. Gadgil replied[1] expressing readiness to undertake the enquiry if it was entrusted to the Institute and laying down briefly the lines on which the enquiry could be conducted. The proposals contained in Mr. Gadgil's letter were accepted by Government and provision was made for the sanctioned amount in the years 1939–40 and 1940–41. The first instalment of the budget allotment was paid to the Institute in September 1939 and the preliminary work on the survey was immediately undertaken. The investigations were conducted with the help of a staff of four fieldmen stationed at four different rural centres. The work of the fieldmen was supervised by an investigator whose headquarters were placed at Kopergaon. The fieldmen were entrusted with the work of farm surveys and with the collection of related information in their area. The Investigator, apart from supervising the work of fieldmen, undertook the trade, industrial and labour enquiries and was specially entrusted with the survey of orange orchards. Regular work on the investigations began in December 1939 and took one full year for completion. The work of tabulation of the data was begun in December 1940 and also took one full year to complete. After studying the actual conditions of the tract, it was felt necessary to almost double the extent of investigational work originally contemplated in Mr. Gadgil's letter dated 14th July 1938. The consequent increase in the data to be collected and their complicated nature led to an increase in the time required both for the investigation and the tabulation. After

1. See Appendix.

the tabulation was completed the writing of the report was somewhat delayed owing chiefly to delay in obtaining certain vital information from Sugar Companies. After this had been obtained the final report was prepared. It is divided into two parts. The first part deals with the effects of the irrigation system from the broader point of view of the whole community. The second part deals with an estimate of the total income received directly or indirectly by the various State authorities as a result of the changes following upon the construction of the system of irrigation in the tract.

PART I

EFFECTS ON ECONOMY OF THE REGION

Definition of the Problem.

The construction and maintenance of an important capital work like a canal system have far-reaching effects on the economic life of the community living within a region and also to some extent on the community living without it. These total effects cannot be gauged from calculations of increased tax or revenue yields. Estimating the nature and extent of the effects of irrigation on the whole community is the really important problem and our investigation was mainly directed towards this larger problem.

The problem may be stated in the following terms. An act of investment which brings into existence and operation a continuously functioning capital instrument leads to the creation of new or additional productive activity and new or additional production. If the construction, maintenance and operation of the capital instrument leads by itself to additional production this may most properly be called the direct effect of the construction. Ordinarily, however, the maintenance and operation of the capital instrument does not create by itself much additional production; usually, the opportunities created by the capital work are properly and fully utilised only by undertaking further investment for launching new productive activities or expanding old activities in the area affected by the capital instrument or work. This further investment involves the employment of additional capital and labour resources—additional i. e. other than those required for the construction and maintenance of the original capital instrument. The added production is thus the joint result of the operation of the original capital instrument and the employment of these additional resources. This added product, which is the joint result of the original investment and the employment of the new capital and labour resources which are required to exploit the capital instrument, may be said to represent the direct results of the investment.

An uninterrupted flow of the direct results depends on the continued maintenance of the new or added activities, which are necessary to utilise the opportunities created by the original capital investment. The continued maintenance of these activities would be dependent on supplies of a set of commodities and services, and would result in creating a demand for them. The demand for these commodities and services may lead to the expansion of opportunities of employment for or the diversion from old employment of certain resources of capital and labour. This effect on the pattern of resource use, flowing from the need to maintain primary productive activities giving rise to the direct effects might be termed the indirect effects of the original investment.

The primary effects, direct and indirect, are connected with the immediate utilisation of the opportunities created by the capital instrument. As a result of this utilisation new production comes into being. A number of consequences may flow from the emergence of this new production. These might be called the secondary effects of the original investment. Attention might be drawn to two distinct types of secondary effects. The two types of secondary effects represent two aspects of the increased production which is the direct effect. Increased production means additional produce which has to be processed, traded in, transported, etc. and increased production also means increased incomes in the hands of producers which may be spent in a variety of ways. The original investment and its exploitation result primarily in the creation of a volume of new production. If the new product is directly consumed no further repercussions on economic activity might follow. But if it is not so consumed–as it usually is not–then it could become the basis of a series, short or long, of economic activities necessitating the employment of further capital and labour resources. This is one type of secondary effect. Secondly, additional production is ordinarily reflected in the accrual of additional incomes to various categories of persons. These persons may utilise this income in a variety of ways. The outlays by receivers of income would lead to the creation of a new demand for goods and services which would, in its turn, lead to the employment of other capital and labour resources.

This is another type of secondary effect. It is obvious that the line of reasoning can be followed indefinitely tracing primary direct, indirect and secondary effects from almost every act of investment and employment. However, the further one moves away from the originating impulse the less powerful and specific are its effects ; and they tend to be spread over a wide area, making it difficult to trace or measure them. Moreover, usually at each remove factors in the situation other than the original capital investment become more and more important. It should be noted that in this analysis we have started with the new capital instrument as being in full operation and have not been concerned with the effects of the act of its construction. That is, in the particular context, we do not take into consideration the effects of the original construction of the canal system but confine ourselves to the effects of the working of the fully-developed system.

We may now formulate the specific problems with which we have to deal in this enquiry in the light of the above discussion. The main direct effect of the working of the canal system is to put previously cultivated lands to new uses or to make them more productive in former uses or to bring new land under use for the first time. All this is made possible only by the employment of additional capital and labour resources and the resulting new or increased produce we term the direct effects. The new type of exploitation itself requires, say, fertilisers, and implements and their transport and the transport of labour, etc. These represent indirect effects. The new or increased produce may be consumed by the producers themselves ; but if it is not so consumed it requires to be transported, sold, processed, transformed, etc. These activities are one type of secondary results. All economic activity having increased in the region total production and income increases and the receipients of the incremental incomes make demands in respect of consumption goods such as clothing, housing, entertainment, etc. and in respect of capital goods to utilise their savings, and their expenditures in these various directions give rise to activities which represent another type of secondary effects. In a similar manner the further effects of the indirect or secondary activities might be traceable up to

a point. We shall now proceed to deal with each of the stages in the order indicated above.

Direct Effects

Plan of Investigation—The measurement of the direct effects formed the most important part of our investigational project. It was not possible to attempt to measure directly the total of even the direct effects over the whole area affected by the canal systems. All that we could do was to conduct investigations relating to specific sample areas and activities and to plan these investigations in such a manner that their results could fairly be made the basis for estimates of the total direct effects.

The canal systems under consideration differ radically from such projects as those of the Punjab or those undertaken by Federal Reclamation in the U. S. A. in so far as their main result was not that of bringing new lands under cultivation. They brought instead a plentiful and secure water supply to lands previously dependent on an uncertain rainfall and made possible a change in the character of the cultivation and the degree of its intensity. The main direct effects in this area are, therefore, those due to new and more valuable crops being grown under irrigation and also the greater productivity, because of it, of crops previously cultivated. Our major investigations were directed, towards measuring this increment.

Before proceeding further it is necessary to indicate in brief the manner in which these investigations were planned and carried out. The main problem confronting us was the measurement of the difference made by irrigation to agricultural activity and production. This could be done only if comparable data were available relating to results of agricultural operations on lands with and without the supply of water from canals. The data to be compared might conceivably be those indicating the nature and results of farm business as carried on in the villages before they received canal water and the business as it is carried on today with its help. A comparison of this sort could, however, not be attempted. The data relating to the past were not available

and could not be gathered in the present. Moreover, even if these data had been available they could have been used only after making allowance for the difference made to the productivity or profitability of farming during the intervening period, by other factors—such as technique, prices, etc. It would, of course, be possible to shorten the time interval between the two sets of data compared by confining the study to tracts where canal water had been supplied only recently. However, it usually takes a considerable number of years for the full effects of irrigation systems to work themselves out and, therefore, such a procedure would not yield results valid for our purpose. It is thus clear that a comparison between results of the same farm business operating with and without canal water cannot be directly instituted. What was possible to attempt instead was to compare the results of operations of farms using canal water with the results of operations of farms which while not able to obtain canal water were otherwise working under comparable conditions. A canal system distributing water by gravity, brings under its command all adjacent areas which are at a level lower than the level of the line of the main canal. In the Bombay Deccan this usually means that lands lying on the side of the downward slope of the river valley obtain water while those on the side of the upward slope are not irrigated. The division between lands under command of canals and those not under command is thus brought about by factors determining the route of the main canal and does not conform to any difference in pre-existing agricultural conditions. In the circumstances, a study of farm businesses in two adjacent areas one of which is under command of the canal system while the other is not should reveal differences made chiefly by the single factor of the availability of water supply. In a study conducted simultaneously in both areas considerations such as those of season, prices, technique, etc. would not affect the comparison and actual conditions obtaining at any time in tracts adjacent to the canal but not commanded by it might be taken fairly to represent the conditions that might have obtained in the irrigated area in the absence of canals. It should be made clear that this assumption is valid chiefly in respect of physical productivity. In other respects such as price and labour

structure the advent of the canal modifies the economy even of the adjacent non-irrigated tracts. This fact has to be borne in mind in interpreting the comparative data but there is no way of avoiding or eliminating its results.

The effects of irrigation are not uniform over the whole area affected by it. The supply of water from canals may be less secure or less plentiful in some areas than in others. The length of period over which water has been made available and other factors such as the capital or technical resources of farmers might make a difference in the intensity of exploitation in various parts. The configuration or the quality of land might make a difference in the uses to which water is put; also conditions such as the degree of aridity, the availability of well irrigation, etc. existing in the pre-canal period would determine the net gains obtained by the use of canal water in particular areas. In order to provide a complete picture it would be necessary to obtain comparative data relating to all the major types of different effects. In the tract under consideration it was held necessary to obtain five sets of comparative data relating to farms under command of canals and those not under command. The data relating to four comparative sets were obtained by conducting farm business surveys in four pairs of adjacent areas. The distribution of these surveys was as follows. Two were in the Kopargaon Taluka to sample conditions in the area in which irrigation was most concentrated, one in Nevasa to illustrate conditions towards the tail-end of the canal system where water supply was not guaranteed for the entire twelve month period and the fourth in the Niphad Taluka on the Kadwa canal system which was specially included in the investigation to study conditions on second class works in an area where well irrigation was also fairly common.

Rahuri Taluka has the largest area under irrigation next to Kopargaon. The special feature of this Taluka is the large area under oranges. In this area no farm business surveys were conducted. The cycle of most crops under irrigation is completed within the period of one year. In sugarcane and lucerne the period is longer, but not longer than two years. A survey covering a two year period could thus deal completely

with all irrigated crops. It is also not difficult to draw up a statement of annual production and profits from such a survey. An orange orchard stands on an entirely different footing. In the initial period capital has to be invested in it without any substantial returns being received. Later, the orchard yields income over a series of years while involving only a limited amount of recurrent expenditure. The economics of such orchards cannot, therefore, be studied by a survey which records the results of its working within the period of only one or two years. It requires collection of data which relate to a large number of years and cover the different types of periods in the life-history of the orchard. Therefore, in Rahuri taluka we instituted a special enquiry into the economics of orange orchards.

Farm Business Surveys—Each set of farm business surveys covered farmers in four nearby villages. Two of the villages were under command of the canals and the other two villages were in a contiguous area which was not under command. The technique and the methods adopted in determining the sample, in collecting and tabulating the data, and in compiling results of this survey of farm business, were, identical with those evolved by us in the Institute's Wai Survey.[12] No comments are offered in this report on these matters. In all centres, except the Ozar centre—the data collected related to the two years 1938–39 and 1939–40. In the Ozar group, owing chiefly to the highly diversified nature of the crops, it was possible to collect data only for 1939–40. The villages from which farmers were selected and the number of farmers included in the surveys are indicated below.

12. D. R. Gadgil and V. R. Gadgil, *Survey of Farm Business in Wai Taluka*, G. I. P. E. Publication No. 7, (1940) Part I.

S. No.	Irrigated Groups.				Dry[2] Groups.			
	Group	Symbol	Total No. of farms surveyed in group.	Villages & the number of farms surveyed in each village	Group name	Symbol	No. of farms surveyed in the group	Villages and the number of farms surveyed in each village.
1	Ozar	I 1	51	(i) Ozar 11; (ii) Mauje Sukene 15; (iii) Kasbe Sukene 25.	Chandori	D 1	50	(i) Chandori 30; (ii) Umberkhed 20.
2	Yesgaon	I 2	45	(i) Yesgaon 23; (ii) Takali 22.	Pimpalgaon	D 2	50	(i) Pimpalgaon 20; (ii) Nimgaon 30.
3	Rahate	I 3	45	(i) Rahate 25; (ii) Shirdi 23.	Korhale	D 3	50	(i) Korhale 25; (ii) Kakadi 25.
4	Belpimpalgaon	I 4	52	(i) Belpimpalgaon 32; (ii) Takalibhan 20.	Jalke Khurda	D 4	48	(i) Jalke-Khurda 28; (ii) Handi Nimgaon 20.
	Total		193		Total		198	

We now proceed to present the results of the survey in a series of tables dealing first with the area held or operated and its classification together with equipment and investment of each operator and later with the results of the farm business during the particular years.

Cultivated Area:

Table No. 1 indicates the distribution of the acreage under cultivation in the various irrigated and dry groups. We attempted to constitute these groups, as far as possible, in a

2. The term "dry" used for the groups and elsewhere in this publication implies only that the area did not obtain supply of canal water. Well irrigation was practised to a large or small extent in all the "dry" groups.

TABLE NO. 1 *Classification of operated*

Group	No. of farms	Classification of operated area by tenancy				Classification of cultivated			
		Owned	Cash rented	Share rented	Total	Dry	Irrigated		
							Well	Canal	Mixed
1939-40									
I—1	51	1,531·6	383·2	280·2	2,195·0	1,334·7	84·5	195·9	187·4
I—2	45	1,353·1	349·2	80·5	1,782·8	944·8	83·5	476·9	...
I—3	45	1,333·3	347·2	180·2	1,860·7	967·9	35·2	662·1	28·5
I—4	52	1,208·5	121·8	481·5	1,811·8	1,385·5	22·6	194·5	...
Total ...	193	5,426·5	1,201·4	1,022·4	7,650·3	4,632·9	225·8	1,529·4	215·9
P. C. ...	...	70·9	15·7	13·4	100	60·6	2·9	20·0	2·8
D—1	50	921·1	224·4	74·6	1,220·1	954·1	164·3	...	...
D—2	50	936·6	401·2	344·1	1,681·9	1,528·6	74·8	...	...
D—3	50	2,149·2	112·1	573·8	2,835·1	2,004·2	53·3	...	...
D—4	48	1,347·2	163·5	484·6	1,995·3	1,706·6	35·6	...	...
Total ...	198	5,354·1	901·2	1,477·1	7,732·4	6,193·5	328·0	...	...
P. C. ...	...	69·2	11·7	19·1	100	80·1	4·2	...	...
1938-39									
I—1	...	...	...	...	...	...	...	...	...
I—2	45	1,397·4	326·8	66·9	1,791·1	982·7	61·0	451·4	1·5
I—3	45	1,324·3	298·5	118·1	1,740·9	1,017·0	31·7	529·4	2·0
I—4	52	1,185·1	100·1	337·4	1,622·6	1,375·0	6·0	32·1	...
Total ...	142	3,906·8	725·4	522·4	5,154·6	3,374·7	98·7	1,012·9	3·5
P. C. ...	...	75·8	14·1	10·1	100	65·5	1·9	19·6	0·1
D—1	...	...	...	...	...	...	...	...	...
D—2	50	936·6	413·1	245·0	1,594·7	1,454·0	72·9	...	...
D—3	50	2,112·7	112·1	496·4	2,721·2	2,161·8	47·9	...	...
D—4	48	1,381·9	119·1	351·8	1,852·8	1,548·8	18·6		...
Total ...	148	4,431·2	644·3	1,093·2	6,168·7	5,164·6	139·4	...	...
P. C. ...	...	71·8	10·5	17·7	100	83·7	2·2	...	...

area (Acres).

area by type of cultivation		Classification of uncultivated area					
Total Irrigated	Total Dry and irrigated	Fallow		Waste	Under trees, houses etc.	Water-logged	Total uncultivated Area.
		Current	Grazing				
467·8	1,802·5	72·5	294·4	18·9	6 1	0·6	392·6
560·4	1,505·2	21·4	41·9	22·9	14·7	176·7	277 6
725·8	1,693·7	80·0	...	17·7	17·1	52·2	167·0
217·1	1,602·6	167·2	28·6	4·3	1·8	7·3	209·2
1,971·1	6,604·0	341·1	364·9	63·8	39·7	236·8	1,046·3
25·8	86·3	4·5	4·8	0·8	0·5	3·1	13·7
164·3	1,118·4	4·6	75·9	11·9	9·3	...	101·7
74·8	1,603·4	20·3	37·4	20·7	0·1	...	78·5
53·3	2,057·5	667·7	...	106·3	3·6	...	777·6
35·6	1,742·2	215·5	16·5	19·8	1·3	...	253·1
328·0	6,521·5	908·1	129·8	158·7	14·3	...	1,210·9
4·2	84·3	11·7	1·7	2·1	0·2	...	15·7
...	...	...	...	...	...	...	...
513·9	1,496·6	43·9	39·9	23·4	7·8	179·5	294·5
563·1	1,580·1	81·5	...	16·2	7·9	55·2	160·8
38·1	1,413·1	176·2	20·5	3·8	1·8	7·2	209·5
1,115·1	4,489·8	301·6	60·4	43·4	17·5	41·9	664·8
21·6	87·1	5·9	1·2	0·8	0·3	4·7	12·9
...	...	...	...	...	...	...	...
72·9	1,526·9	13·6	33·5	20·6	0·1	...	67·8
47·9	2,209·7	406·6	...	102·3	3·6	...	511·5
18·6	1,567·4	249·1	16·5	18·5	1·3	...	285·4
139·4	5,304·0	668·3	50·0	141·4	5·0	...	864·7
2·3	86·0	10·1	0·8	2·3	0·1	...	14·0

closely similar manner to facilitate comparisons. It was intended that each group should finally include 50 representative farmers from each area. The initial number of farmers in the survey was, therefore, placed at a little higher than 50. In the result the number of farmers in some of the groups is, slightly less than 50 and in some slightly more ; this is due to data relating to a varying number of businesses originally included in the list not being retained in the final tables owing to many reasons. The distribution of the cultivated acreage into owned and tenanted is not very important for the purpose under consideration. It will, however, be observed that the bulk of the land included is owned land. For obvious reasons the irrigated groups show a major portion under cash-tenancy, while the tenancy in the dry groups is for the greater part on crop-share basis. The size of farms is comparatively large. In the irrigated groups the average size does not vary much from group to group ; the smallest for 1939–40 being about 35 acres in irrigated group I 4 and the largest about 43 acres in Group I 1. The variations in the dry groups are, however, considerable ; while group D 1 has an average farm of less than 25 acres, the average farm acreage in group D 3 is larger than 56. It is interesting to observe that the average size in 6 out of the total 8 groups falls within the range of 30 to 45 acres.

The irrigated acreage has been divided into 3 classes. Canal irrigated, *Motasthal*[3], and Mixed. *Motasthal* is comparatively important, even in irrigated groups I 1 and I 2. It is negligible in irrigated group I 4. The area irrigated by canals is large in groups I 2 and I 3. It does not amount to as much as 4 acres, on an average, per farm in groups I 1 and I 4. It should here be pointed out that for the year 1938–39 irrigated group I 4 is really representative of conditions of dry farming. This is the result of the very considerable variation from year to year in the water supply taken by cultivators at the tail-end of the canal. The water supply taken up does not vary only for the village as a whole, on account of seasonal factors, but varies also for individual cultivators from year to year. Our sample of farmers was chosen with reference to the conditions of the

3. *Motasthal* : " Well-irrigated land. "

year 1939-40. And it happened that these farmers had received little water for irrigation purposes during the preceding year. In the dry groups, *Motasthal*, which is here the only form of irrigation, is very important in group D 1; it declines in importance considerably in group D 2 and this further diminishes in groups D 3 and D 4. Grass lands constitute important acreages only in the first area groups, I 1 and D 1 of both dry and irrigated areas. Annual fallow is fairly considerable in groups I 4, and D 4, and is definitely large in group D 3. It is also in this latter group that *Potkharab* is important. A special feature of the irrigated groups is land which is recorded as fallow owing to waterlogging. Group 1 which represents conditions under second class irrigation has almost no such fallow. Group I 4 towards the tail-end has little of it. It is most in evidence in group I 2 and fairly considerable in group I 3.

Crop Acreages :

Table No. 2 shows, how the sample groups selected by us represent various important types of agricultural economy in the tract. The original economy of this tract was for the most part subsistence economy. Except for the recent advance of cotton, chiefly in Nevasa, no important dry cash crop was grown in the area. Wheat, where it could be grown, took the place of the cash crop to some extent. Otherwise bajri, jowar and pulses with only a limited area under oilseeds occupied the whole tract. The various dry groups under investigation bring out all these conditions. The first group reveals the presence of *Motasthal* and of a considerable area under wheat; the second being less favourably situated has less *Motasthal* as well as less wheat. The third group presents a sample of an almost one-crop economy, being wholly dominated by bajri. The fourth, with the least *Motasthal*, presents an altogether new type. Bajri takes here a definitely inferior position to jowar and cotton is an important crop. The irrigated groups present a variety of types also. In the first group there is a considerable emphasis on garden produce, the result of irrigation conditions as well as the nearness of the railway and the Nasik market. The second and third represent typical heavy irrigation agriculture with sugarcane

TABLE No. 2:—*Classification of*

Group	No. of Farms	Irrigated Crops							
		Sugarcane	Groundnut	Cotton	Onions	Chillies	Methi	Other Vegetables and root crops	Bajri
1939-40									
I-1	51	146·3	51·3	...	148·5	4·9	15·1	18·6	26·6
I-2	45	334·5	42·1	0·5	...	...	51·7	3·0	90·3
I-3	45	438·4	4·0	62·4	1·9	...	20·9	2·2	21·9
I-4	52	...	17·8	...	2·1	1·0	...	1·1	18·6
Total	193	919·2	115·2	62·9	152·5	5·9	87·7	24·9	157·4
Percentages	...	12·5	0·6	0·9	2·1	0·1	1·2	0·3	2·1
D-1	50	23·1	12·3	...	81·5	4·9	2·6	3·2	8·9
D-2	50	11·2	2·	...	4·3	6·5	0·4	2·8	5·6
D-3	50	19·9	0·5	...	...	7·0	...	0·5	...
D-4	48	...	...	...	2·4	2·5	...	1·1	...
Total	198	54·2	15·3	...	88·2	20·9	3·0	7·6	14·5
Percentages	...	0·8	0·2	...	1·3	0·3	0·0	0·1	0·2
1938-39									
I-1	...	...	...	...	...	...	...	...	...
I-2	45	258·3	69·3	1·0	...	...	50·5	...	92·9
I-3	45	319·8	20·1	49·3	1·0	...	30·4	1·2	25·9
I-4	42	...	2·7	...	2·0	...	1·1	2·1	...
Total	142	578·1	92·1	50·3	3·0	...	82·0	3·3	118·8
Percentages	...	11·5	1·8	1·0	0·1	...	1·6	0·1	2·4
D-1	...	...	...	...	...	...	...	...	...
D-2	50	4·0	...	...	4·1	4·2	...	0·3	14·6
D-3	50	18·6	...	...	0·3	5·8	...	0·5	2·7
D-4	48	...	...	...	5·6	2·0	...	0·5	...
Total	148	22·6	...	...	10·0	12·0	...	1·3	17·3
Percentages	...	0·4	...	...	0·2	0·2	...	0·0	0·3

Cultivated Area (Acres)

Irrigated Crops

Jowar	Wheat	Gram	Tur	Safflower	Linseed	*Tag*	Lucerne	Other, pulses etc.	Fodder	Total
0·8	44·5	28·2	...	...	...	0·7	31·3	2·6	1·7	521·1
35·7	42·4	35·4	0·5	...	...	64·5	56·6	5·8	32·1	794·5
101·7	47·9	53·4	...	8·1	0·8	10·4	44·3	2·3	48·5	868·8
98·9	25·3	40·6	...	12·7	...	...	...	1·0	10·3	229·4
237·1	160·1	157·6	0·5	20·8	0·8	75·6	131·6	11·7	92·6	2,413·8
3·2	2·2	2·1	0·0	0·3	0·0	1·0	1·8	0·2	1·3	32·8
2·0	2·2	8·7	...	...	...	3·1	20·7	...	6·6	179·9
...	26·5	0·9	...	0·7	...	...	4·9	5·6	6·0	78·1
10·2	6·2	0·4	...	0·1	...	...	6·8	3·2	5·5	60·1
25·3	...	4·0	...	0·3	...	...	...	...	...	35·6
37·5	34·9	14·0	...	1·1	...	3·1	32·4	8·8	18·1	353·7
0·6	0·5	0·2	...	0·0	...	0·0	6·5	0·1	0·3	5·3
...	...	...	...	...	...	...	...	...	...	...
31·0	57·8	32·2	1·0	0·3	...	34·7	35·0	15·1	23·7	702·7
73·1	10·0	36·9	1·0	2·5	...	2·0	33·8	1·0	37·3	645·3
12·5	13·6	1·9	...	2·3	...	...	...	...	0·8	38·9
116·6	81·4	71·0	2·0	5·1	...	36·7	68·8	16·1	61·8	1,386·9
2·3	1·6	1·4	0·0	0·1	...	0·7	1·4	0·3	1·2	27·5
...	...	...	...	...	...	...	...	...	...	...
0·9	30·9	0·5	...	1·7	...	...	3·7	1·3	8·8	74·9
3·9	9·2	...	...	...	...	...	5·3	...	5·0	51·2
3·6	2·3	4·0	...	0·6	...	...	...	...	...	18·6
8·4	42·4	4·5	...	2·3	...	...	9·0	1·3	13·8	144·7
0·2	0·8	0·1	...	0·0	...	...	0·2	0·0	0·3	2·7

TABLE NO. 2:—*Classification of Cultivated*

Group	Dry Crops							
	Groundnut	Bajri	Jowar	Wheat	Gram	Tur	Safflower	Linseed
1939-40								
I-1	11·3	688·9	28·7	517·4	23·8	39·0	2·2	71·3
I-2	2·9	351·7	163·8	333·1	19·8	1·0	33·6	4·7
I-3	49·4	303·4	323·6	287·3	68·0	0·5	30·4	6·1
I-4	32·3	379·0	649·0	75·0	60·2	10·5	87·9	35·6
Total	95·9	1,723·0	1,165·1	1,212·8	171·9	51·0	154·1	117·7
Percentages	1·3	23·4	15·8	16·5	2·3	0·7	2·1	1·6
D-1	1·0	356·4	7·2	515·2	62·0	17·5	8·3	18·9
D-2	13·5	687·8	320·0	396·6	1·8	1·9	44·3	25·3
D-3	78·2	1,466·0	298·7	2·3	1·5	0·3	27·2	...
D-4	18·2	322·1	707·4	144·1	30·0	22·9	99·9	80·4
Total	110·9	2,832·3	1,333·3	1,058·2	95·5	42·6	179·7	124·6
Percentages	1·7	42·8	20·1	16·0	1·4	0·6	2·7	1·9
1938-39								
I-1	...	...	...	...	...	...	...	...
I-2	8·7	248·4	139·4	472·7	43·3	1·0	47·5	15·4
I-3	44·2	386·0	262·6	353·8	92·0	...	30·5	6·4
I-4	12·1	318·6	584·0	130·5	40·6	6·7	86·5	34·4
Total	65·0	953·0	986·0	957·0	175·9	7·7	164·5	56·2
Percentages	6·3	18·9	19·6	19·0	3·5	0·2	3·3	1·1
D-1	...	...	...	...	...	...	...	...
D-2	12·1	519·5	202·0	625·4	...	4·6	49·6	8·5
D-3	52·7	1,460·5	462·4	18·3	0·4	...	38·2	...
D-4	30·3	276·5	547·6	197·1	20·0	21·2	85·8	55·2
Total	95·1	2,256·5	1,212·0	840·8	20·4	25·8	173·6	63·7
Percentages	1·8	42·2	22·7	15·7	0·4	0·5	3·2	1·2

Area (Acres) Contd.

Dry Crops					Total cultivated	Minus Double Cropped	Net cultivated
Other pulses etc.	Other fodder	Cotton	*Tag*	Total Dry			
41·3	...	..	...	1,423·8	1,944·9	142·4	1,802·5
51·4	2·2	...	25·3	989·5	1,783·9	278·7	1,505·2
21·4	...	...	28·2	1,118·7	1,987·5	293·9	1,693·7
70·1	...	12·0	12·2	1,423·9	1,653·3	50·6	1,602·6
184·2	2·2	12·0	65·7	4,955·8	7,369·6	765·6	6,604·0
2·5	0·0	0·2	0·9	67·2	100		
12·3	...	...	...	998·9	1,178·9	60·5	1,118·4
42·1	...	...	1·6	1,535·0	1,613·1	9·6	1,603·5
148·2	...	1·8	0·1	2,024·1	2,084·2	26·7	2,057·5
62·8	...	222·8	..	1,710·6	1,746·2	4·0	1,742·2
265·4	...	224·6	1·9	6,268·7	6,622·4	100·8	6,521·6
4·0	...	3·4	0·0	94·7	103		
...	...	...	...	...	...	...	...
50·7	11·9	...	21·8	1,060·8	1,763·4	266·8	1,496·6
11·1	...	...	18·7	1,205·4	1,850·8	270·7	1,580·1
59·4	...	108·1	...	1,380·9	1,419·8	6·7	1,413·1
121·2	11·9	108·1	40·5	3,647·1	5,034·0	544·2	4,489·8
2·4	0·2	2·1	0·8	72·4	100		
...	...	....	...	...	...	...	...
39·8	...	...	2·0	1,463·5	1,538·4	11·5	1,526·9
155·1	...	...	0·1	2,187·8	2,239·0	29·3	2,209·7
63·3	...	255·9	...	1,552·8	1,571·4	4·0	1,567·4
258·2	...	255·9	2·1	5,204·1	5,348·8	44·8	5,304·0
4·8	...	4·8	0·0	97·3	100		

dominating the farmer's economy. The fourth with a water supply not completely assured shows a variety of the ordinary dry crops grown under irrigation.

Investment :

The differences in investments (Table No. 3) follow the differences in types of cultivation. *Motasthal* cultivation and garden produce make demands on storing space, cattle and implements not largely different from those made by agriculture under canals. Hence the differences between the dry and irrigated groups in groups I are not striking.[4] In irrigated group I 3 there is quite a large proportion of farmers who crush their own cane in bullock driven crushers and prepare their own *gul*. Hence the investment in buildings and implements is much larger here than in the other sugarcane group i. e. irrigated group I 2. In group I 2 a considerable number of farmers get their *gul* prepared at power crushers owned by others. The incomplete character of the transformation from dry to irrigation economy towards the tail-end of the canal system is shown by the fact that the average investment per farm business in the irrigated villages in this area, I 4, is not markedly larger than that in the neighbouring dry villages D 4.

Livestock Numbers :

Table No. 4 gives details of the livestock maintained on farms in the various groups. Irrigated farming requires greater bullock power than dry farming. Irrigated groups I 2 and I 3 have on an average nearly 5·5 working bullocks per farm. In irrigated Group I 1 the figure is nearly 5. Irrigated group I 4 which approximates to dry farm conditions and all the dry groups excepting group D 3 have, on the other hand, an average equipment of only about 3·5 bullocks per farm. The largest bullock equipment among these groups is naturally in the group which has most land under well-irrigation i. e. D I. Dry group D 3 has nearly 4·5 working bullocks per farm. This is evidently necessary on account of the

4. In both the dry and irrigated samples onion is an important product and requires special storing arrangements.

TABLE NO. 3:—*Investment.*

Group	No. of Farms	Buildings	Implements	Livestock	Total
		Rs.	Rs.	Rs.	Rs.
1939–40					
I–1	51	6,866	7,741	17,282	31,889
I–2	45	3,829	3,783	14,568	22,180
I–3	45	8,284	8,409	13,290	29,478
I–4	52	1,274	2,193	8,011	11,478
Total	193	20,253	22,126	53,151	95,530
Percentages	...	21·2	23·2	55·6	100
D–1	50	2,554	4,294	10,958	17,806
D–2	50	2,101	1,539	8,510	12,150
D–3	50	1,221	1,971	8,739	11,931
D–4	48	1,284	1,601	8,166	11,051
Total	198	7,160	9,405	36,373	52,938
Percentages	...	13·5	17·8	68·7	100
1938–39					
I–1	...	...	...	...	...
I–2	45	3,492	4,346	13,310	21,148
I–3	45	8,369	7,078	12,034	27,481
I–4	52	1,496	2,559	6,735	10,790
Total	142	13,357	13,983	32,079	59,419
Percentages	...	22·5	23·5	54·0	100
D–1	...	...	...	...	...
D–2	50	2,192	1,816	7,971	11,979
D–3	50	1,394	2,491	7,679	11,564
D–4	48	1,327	2,089	6,773	10,189
Total	148	4,913	6,396	22,423	33,732
Percentages	...	14·6	18·9	66 5	100

TABLE NO. 4:—*Income from*

Group	No. of Farms	Milk							
		Buffalo		Cow		Goat		Total Milk	
		Sold	Unsold	Sold	Unsold	Sold	Unsold	Sold	Unsold
1939–40									
I–1	51	210	370	96	879	...	28	306	1,277
I–2	45	2,584	2,170	311	1,170	...	36	2,895	3,376
I–3	45	1,067	1,017	167	1,021	...	148	1,234	2,186
I–4	52	101	131	360	2,029	...	66	461	2,226
Total	193	3,962	3,688	934	5,099	...	278	4,896	9,065
Percentages	...	19·3	18·0	4·6	24·9	...	1·4	23·9	44·2
D–1	50	243	660	15	625	...	30	258	1,315
D–2	50	274	331	291	691	13	117	578	1·139
D–3	50	11	205	...	799	...	315	11	1,319
D–4	48	280	356	84	852	...	183	364	1,391
Total	198	808	1,552	390	2,967	13	645	1,211	5,164
Percentages	...	7·8	15·0	3·8	28·6	0·1	6·2	11·7	49·8
1938–39									
I–1	...	...	...	...	...	...	...	...	...
I–2	45	2,305	2,003	211	964	...	36	2,516	3,003
I–3	45	409	700	90	769	...	133	499	1,602
I–4	52	...	75	145	920	...	34	145	1,029
Total	142	2,714	2,778	446	2,653	...	203	3,160	5,634
Percentages	...	20·1	20·6	3·3	19·7	...	1·5	23·4	41·8
D–1	...	...	...	...	...	...	...	...	...
D–2	50	296	288	195	485	12	85	503	858
D–3	50	39	181	...	606	...	337	39	1.124
D–4	48	44	172	319	722	...	123	363	1,017
Total	148	379	641	514	1,813	12	545	905	2,999
Percentages		5·6	9·5	7·6	26·8	0·2	8·1	13·4	44·4

Live-stock. (*Rs.*)

Total	Eggs	Manure			Hides, Wool, etc.	Total Livestock Produce		Live-stock born during the year	Total Earnings from livestock
		Sold	Unsold	Total		Sold	Unsold		
1,583	47	6	1,017	1,023	...	312	2,341	81	2,734
6,271	...	...	1,712	1,712	8	2,903	5,088	82	8,073
3,420	...	...	2,646	2,646	...	1,234	4,832	67	6,133
2,687	33	39	725	764	...	511	2,973	82	3,566
13,961	80	45	6,100	6,145	8	4,960	15,234	312	20,506
68·1	0·4	0·1	29·7	30·0	0·0	24·2	74·3	1·5	100
1,573	51	5	838	843	...	288	2,179	92	2,559
1,717	...	182	857	1,039	5	765	1,996	105	2,866
1,330	19	...	927	927	34	38	2,272	250	2,560
1,755	1	...	420	420	12	376	1,812	206	2,394
6,375	71	187	3,042	3,229	51	1,467	8,259	653	10,379
61·4	0·7	1·8	29·3	31·1	0·5	14·1	79·6	6·3	100
...	...	...	...	...	...	...	...	...	...
5,519	...	...	1,553	1,553	8	2,524	4,556	86	7,166
2,101	...	...	2,428	2,428	4	499	4,034	61	4,594
1,174	27	...	484	484	...	156	1,529	34	1,719
8,794	27	...	4,465	4 465	12	3,179	10,119	181	13,479
65·2	0·2	...	33·1	33·1	0·1	23·6	75·1	1·3	100
...	...	...	...	...	...	...	...	...	...
1,361	...	169	822	991	10	682	1,680	99	2,461
1,163	19	...	916	916	34	71	2,061	246	2,378
1,380	...	...	388	388	6	369	1,405	145	1,919
3,904	19	169	2,126	2,295	50	1,122	5,146	490	6,758
57·8	0·3	2·5	31·5	34·0	0·7	16·6	76·1	7·3	100

TABLE NO. 5:—*Animals and*

Group	No. of Farms	Animals on Farm						
		Bullocks	He Buffaloes	Cows	She Buffaloes	Calves Males	Buffalo Calves Male	Calves Female
1939–40								
I–1	51	252·0	6·0	156·0	20·0	73·5	1·0	113·5
I–2	45	249·0	...	135·0	44·0	64·5	2·0	72·5
I–3	45	248·5	...	150·5	23·0	46·0	6·0	114·5
I–4	52	167·0	0·5	86·0	5·0	41·5	...	69·0
Total	193	916·5	6·5	527·5	92·0	225·5	9·0	369·5
D–1	50	178·5	6·5	74·5	20·0	27 0	4·0	69·5
D–2	50	172·0	...	119·0	9·0	31·5	...	54·0
D–3	50	226·0	...	103·0	3·5	24·5	1·0	85·5
D–4	48	169·0	...	70·0	15·0	40·5	2·0	42·5
Total	198	745·5	6·5	366·5	47·5	123·5	7·0	251·5
1938–39	...							
I–1	...	...	...	...	...	...	...	...
I–2	45	234·0	...	129·0	32·5	36·5	...	57·5
I–3	45	237·5	...	148·5	16·5	29·0	4·0	71·5
I–4	52	149·5	...	81·0	1·5	31·0	...	43 0
Total	142	621·0	...	358·5	50·5	96·5	4·0	172·0
D–1	...	...	...	...	...	...	...	...
D–2	50	166·5	...	122·5	8·0	21·0	...	26·0
D–3	50	211·5	...	103·0	2·5	4·0	...	63·0
D–4	48	148·5	...	68·5	9·5	25·0	0·5	29·0
Total	148	526·5	...	294·0	20·0	50·0	0·5	118·0

Animal Units

(Number)					Total	Total Animal Units*
Buffalo Calves Female	Goats	Sheep	Fowl	Horses		
13·0	19·5	27·0	30·5	1·0	713·0	476·97
23·5	35·0	...	...	...	625·5	459·74
12·0	24·5	...	...	...	625·0	451·06
4·0	84·5	...	19·0	...	476·5	291·98
52·5	163·5	27·0	49·5	1·0	2,440·0	1,679 75
28·5	39·5	...	28·5	...	476·5	313·98
4·5	50·0	...	...	...	440·0	304·44
9·5	79·5	112·0	9·0	...	653·5	372·25
8·5	114·5	80·5	0·5	...	543·0	300·55
51·0	283·5	192·5	38·0	...	2,113·0	1,291·22
...	...	...	...	...	...	...
11·0	34·0	...	...	...	534·5	402·77
9·0	22·5	...	...	...	538·5	404·95
2·5	50·0	...	17·0	...	375.5	248·48
22·5	106·5	...	17·0	...	1,448·5	1,056·20
...	...	...	...	...	...	...
1·0	44·5	...	...	...	389·5	284·70
1·0	66·0	94·0	9·0	...	554·0	330·71
3·5	77·0	63·0	...	...	424·5	249·20
5·5	187·5	157·0	9·0	...	1,368·0	864·61

large size of the average farm in this group. The number of milch cattle is small both in the dry and irrigated groups The largest number of milch buffaloes is to be found in irrigated group I 2 where the average is a little less than 1 per farm. In most other groups, dry and irrigated, the number of milch buffalloes does not amount to as much as 0·5 per farm; the average in the irrigated groups is a little higher than in the dry groups. Milch cows are comparatively more plentiful. The average holding of these in the irrigated groups is consistently higher than the average holding in the dry groups. But this should be interpreted as indicating not the increased size of dairying in the irrigated area but as being due to the greater requirements of draught cattle in irrigated farming. No comment need be offered on the holding of any other livestock which is negligible throughout.

Livestock Receipts :

Table No. 5, indicating the income from livestock, makes it clear that dairying is not important as a business in the farm economy of any group. The extent to which cow's milk is sold is insignificant in all groups, dry and irrigated. The sales of buffallo milk are also not considerable in any of the dry groups and in the irrigated groups I 1 and I 4. The proceeds from the sales of buffallo milk amount on an average, to more than Rs 50 per farm per annum in group I 2. In group I 3 they are substantial only as compared with the other groups, but do not amount to even as much as Rs. 25 per annum per farm. The total income from milk production, the bulk of which is everywhere consumed on farm, varies naturally from group to group according to the holding of milch cattle. The only other substantial source of income from livestock is manure. The production of manure is in a similar manner dependent on the total holding of livestock. It is noteworthy that almost no manure is sold by farmers in any of the groups dry or irrigated.

Crop Receipts :

The value of the production of important crops (Table No. 6) shows variations between the irrigated and dry groups

which are much greater than those revealed in the receipts from livestock. These are best considered separately in respect of (1) the commercial or cash-crops and (2) the fodder and grain crops. All irrigated groups record very substantial incomes from the sales of sugarcane and *gul*. In group I 1, however, this source of income is not so dominant as it is in groups I 2 and I 3. Even in the group I 1, however, it is the most important single source of income. Other sources of cash receipts that are important in this group are onions, wheat, lucerne, and groundnut. The small area under jowar, in this group makes the value of the production of fodder much less in this group than in the other irrigated groups. In groups I 2 and I 3 the cash-economy is dominated entirely by the production of sugarcane. In both these groups the only crops of any considerable value other than sugarcane and consumption grains and fodder are lucerne and wheat. But the total income even from lucerne amounts to a small fraction of the income from sugarcane and *gul* in both these groups. As has already been remarked, group I 4 though irrigated has in the main the structure of subsistence dry farming. In this group practically no cash-crop is of any importance. Wheat and gram are sources of fairly substantial receipts and some income is derived from groundnut, linseed and safflower.

As regards consumption grains and fodder all groups naturally show a substantial production of both these. It is to be noted that even in the most intensively irrigated groups a certain minimum level of production of both jowar and bajri is maintained. Apart from the fodder from jowar and bajri, special fodder under irrigation is raised in all the irrigated groups and this practice is followed to the greatest extent in groups I 2 and I 3 where irrigation is most intense. Whereas the total production of consumption grains and fodder does not vary from group to group it is obvious that in those groups in which the receipts from cash-crops mount to very high figures the proportion of total income in terms of value received by the raising of these crops, becomes proportionately very small. And this is the main difference in the farm economy of dry and irrigated groups, as will become clear when the corresponding figures of the dry group are taken into consideration.

TABLE NO. 6:—*Value of produce of important*

1939-40

Group	I 1	I 2	I 3	I_4	Total	p. c.
Total Farms	51	45	45	52	193	
Gul	18,879·9	108,039·3	124,272·9	...	252,192·1	54·1
Lucerne	7,807·0	18,460·0	14,895·0	...	41,162·0	8·8
Wheat	8,391·4	8,912·1	8,650·7	1,902·8	27,857·0	6·0
Bajri Grain	8,751·4	8,155·2	6 693·2	2,694·9	26,294·7	5·6
Sugarcane	6,128·5	10,592·0	7,460·0	...	24,180·5	5·2
Jowar Grain	61·8	4,861·0	7,082·3	8,721·6	20,732·7	4·5
Jowar Fodder (*Kadba*)	65·4	2,340·0	4,397·5	6,111·3	12,914·2	2·8
Onions	8,367·4	...	120·0	50·5	8,537·9	1·8
Groundnuts	3,534·4	1,824·5	885·0	1,251·6	7,495·5	1·6
Gram	1,167·6	1,686·1	2,164·4	2,308·6	7,326·7	1·6
Bajri Fodder	2,357·2	1,646·0	1,622·0	1,411·6	7,036·8	1·5
Fodder (*Kadwal*)	69·0	452·0	3,478·0	825·0	4,824·0	1·0
Tag	14·0	2,693·0	1,150·3	182·0	4,039·3	0·9
Methi	83·6	1,596·0	346·0	...	2,025·6	0·4
Cotton	...	52·5	1,474·0	253·0	1,779·5	0·4
Fodder (*Khonde*)	...	1,614·0	120·0	...	1,734·0	0·4
,, (*Nilwa*)	...	1,162·0	320·0	...	1,482·0	0·3
Safflower	41·8	452·8	358·7	498·5	1,351·5	0·2
Linseed	625·3	49·0	69·4	397·6	1,141·3	0·2
Tur	639·3	27·0	10·0	18·3	694·6	0·1
Mataki	10·0	411·0	102·0	41·6	564·7	0·1
Chillies	410·0	...	...	150·0	560·0	0·1
Total					4,55,926·8	97·9
Grand Total of all Crops	73,875·0	177,236·0	1.87,234·0	27,598·0	4,65,943·0	100·0

Crops (in Rupees).

1939-40					
D 1	D 2	D 3	D 4	Total	p. c.
50	50	50	48	198	
1,451·2	1,657·8	4,407·0	...	7,516·0	6·4
4,408·0	1,740·0	1,975·0	...	8,123·0	6·9
9,453·6	7,028·0	290·7	3,691·6	20,463·9	17·3
4,055·7	6,384·0	12,295·7	2,047·8	24,783·2	20·9
625·0	140·0	380·0	...	1,145·0	1·3
48·6	2,607·0	1,257·4	11,160·3	15,073·3	12·7
16·9	1,960·0	1,151·0	4,381·8	7,509·7	6·3
3,557·9	166·8	...	101·3	3,826·0	3·2
822·3	308·3	1,038·5	363·7	2,532·8	2·1
871·5	66·0	26·2	721·9	1,685·6	1·4
1,169·7	1,275·0	3,033·4	827·3	6,305·4	5·3
264·0	...	50·0	...	314·0	0·3
62·5	52·5	...	...	115·0	0·1
...	...	...	...	...	...
...	...	48·0	4,580·0	4,628·0	3·9
...	602·5	475·0	...	1,077·5	0·9
...	...	...	...	...	...
277·3	748·8	98·1	873·9	1,998·1	1·7
221·9	337·5	...	793·7	1,353·1	1·1
486·2	40·5	8·0	215·9	750·6	0·6
3·8	904·8	368·0	28·0	1,304·6	1·1
403·8	305·3	304·0	104·0	1,117·1	0·9
				1,11,621·9	94·3
31,146·0	27,872·0	28,553·0	30,789·0	1,18,360·0	100·0

TABLE NO. 6:—*Value of produce of important*

1938-39

Group	I 1	I 2	I 3	I 4	Total	p. c.
Total Farms	...	45	45	54	142	
Gul	...	68,170·0	1,02,685·2	...	1,70,855·2	54·4
Lucern	...	10,840·0	10,672·0	...	21,512·0	6·8
Wheat	...	10,627·3	7,745·4	2,372·0	20,744·7	6·6
Bajri Grain	...	6,502·5	6,736·1	1,750·3	14,988·9	4·8
Sugarcane	...	15,710·0	10,484·5	...	26,194·5	8·3
Jowar Grain	...	3,084·0	5,410·5	5,444·3	13,938·8	4·4
Jowar Fodder (*Kadba*)	...	1,469·0	2,948·0	4,119·1	8,536·1	2·7
Onions	...	...	80·0	80·0	160·0	0·1
Groundnuts	...	3,332·5	1,736·0	444·6	5,513·1	1·8
Gram	...	1,876·5	1,668·3	657·5	4,202·3	1·3
Bajri Fodder	...	1,318·0	1,724·0	1,038·4	4,080·4	1·3
Fodder (*Kadwal*)	...	646·0	2,904·0	30·0	3,580·0	1·1
Tag	...	1,694·3	621·0	...	2,315·3	0·7
Methi	...	1,565·0	717·0	...	2 282·0	0·7
Cotton	...	60·0	1,658·0	1,253·5	2,971·5	0·9
Foddar (*Khondo*)	...	1,320·0	120·0	...	1,440·0	0·5
,, (*Nilwa*)	...	876·0	...	...	876·0	0·3
Safflower	...	590·6	214·0	443·9	1,248·5	0·4
Linseed	...	225·4	58·5	367·3	651·2	0·2
Tur	...	44·3	16·0	107·3	167·6	0·1
Mataki	...	236·6	76·0	86·0	398·6	0·1
Chillies	...	...	...	...	...	...
Total					3,06,656·7	97·6
Grand Total of all Crops.	...	1,33,269·0	161,930·0	19,042·0	3,14,241·0	100·0

Crops (in Rupees) (Contd.)

1938–39					
D 1	D 2	D 3	D 4	Total	p. c.
...	50	50	48	148	
...	596·4	3,530·0	...	4,126·0	5·8
...	1,008·4	1,465·0	...	2,473·0	3·4
...	8,059·4	659·3	3,586·1	12,304·0	17·2
...	5,377·5	12,593·2	1,619·2	19,589·9	27·3
...	40·0	356·0	...	396·0	0·6
...	1,590·5	2,061·5	5,560·6	9,212·6	12·8
...	958·5	1,209·0	2,908·6	5,076·1	7·1
...	221·3	2·0	113·0	336·3	0·5
...	221·3	838·5	749·1	1,808·9	2·5
...	11·0	...	525·5	536·5	0·7
...	1,109·3	2,938·5	608·1	4,655·9	6·5
...	...	75·0	...	75·0	0·1
...	60·0	...	...	60·0	0·1
...	...	...	...	...	...
...	...	...	1,970·5	1,970·5	2·7
...	880·0	412·5	...	1,292·5	1·8
...	...	...	...	...	...
...	701·6	140·0	552·8	1,394·4	1·9
...	56·0	...	569·4	625·4	0·9
...	87·8	...	453·8	541·6	0·8
...	691·3	543·0	74·0	1 308·3	1·8
...	210·1	269·2	95·0	574·3	0·8
				68,357·6	95·3
...	23,000·0	28,331·0	20,396·0	71,727·0	100·0

Dry group D 1, on account of its large *Motasthal* area, records fairly substantial receipts from a number of cash-crops such as lucerne, onions, sugarcane, groundunt and chillies. The value of its production of wheat is very large and is more than double the value of the production of its main consumption-grain, bajri. In group D 2 barring some income from lucerne and sugarcane there is almost no source of substantial receipts other than wheat. In this, as in group D 1, wheat is the most important single source of receipts. In group D 3 the consumption grain, bajri, entirely dominates the picture; the receipts from bajri and its fodder being larger by far than the receipts from any other crop. With its small area under *Motasthal* being devoted almost entirely to sugarcane, the receipts from this crop form a higher proportion of the total receipts in this group than in any of the other dry groups. Other important sources of cash-income in this group, D 3, are lucerne and groundunt. Group D 4 presents a strikingly different picture. Its main dependence for subsistence is on jowar and jowar fodder. Bajri production is of much lower value than in any other group. The value of wheat production is also much less than in groups D 1 and D 2. This group does not depend for its cash receipts on any of the irrigated crops common in the other groups. In this respect its stand-by is cotton. This is by far the most important cash crop. Fairly substantial receipts are, however, also noted under safflower and linseed. The large part played by subsistence economy in dry farming is shown by the proportion of the value of the production of subsistence grains and fodder, in the total value of all crop production. This feature is brought out especially forcibly by the analysis given in Table No. 12 of the proportions sold and unsold of the different crops.

Farm Expenses:

Table No. 7 indicating expenditure on various items shows differences which naturally follow on the differences in the characteristics of the farm economy indicated so far. The charge for water is an item which is substantial in all the irrigated groups varying, however, with the intensity of irrigation. Obviously it is not to be found in the items of expenditure for the dry groups. The greater intensity of farming in

the irrigation groups is indicated by the greater expenditure on seeds and plant and manure as also on hired labour of all kinds. The expenditure on feed for live-stock is greater even than the proportionate difference between live-stock numbers, indicating that livestock on irrigated farms is worked through the whole year and is also fed much better than on the dry farms. It should be noted that in this, as in a number of other respects the difference is also partly due to difference in prices. In the sugarcane area, for example, the demand for fodder, manure, labour, etc. forces up their prices to levels much higher than in other areas. The expenditure on seeds and plants is specially large in the sugarcane areas, and this applies also to the expenditure on manure. The need for converting sugarcane into *gul* before the crop is disposed of, makes for very substantial transformation and processing expenses in irrigated groups I 2, and I 3. The unchanged character of the economy of the irrigated group I 4 is indicated by the great similarity that the proportions of its expenditure on various items show to the corresponding proportions in the dry groups. Within the dry groups themselves the expenditure on seeds and plants and manures varies chiefly in relation to the area under well-irrigation. The variations in most items are, however, not considerable. It may be noted that in dry group D 3 in which irrigation is much less possible than in other dry groups, the expenditure on hired labour is very much less than in the other groups.

Value of Gross Production:

The total effect of irrigation on production activity is indicated by the comparative figures of the value of gross production. Gross receipts, of course, depend on the price level in each year. The year 1939-40 was, in this connection, specially favourable to certain types of irrigated farming. An allowance for the price factor has thus to be made in considering the average effects over a long period. For the moment we shall confine our attention to the value of production in 1939-40 for which information is available for all the groups. Irrigated group I 1, which is under second-class irrigation, gives an average value of gross receipts in the neighbourhood

TABLE NO. 7:—*Farm*

Group	No. of Farms	Taxes			Rent			Fodder&Concentrates		
		Land Revenue	Water charges	Total	Rent (cash)	Share Rent (in kind)	Total	Purchased	Farm Produce	Total
1939-40										
I—1	51	3,277	2,721	5,998	3,314	3,625	6,939	1,234	12,769	13,993
I—2	45	2,036	11,302	13,338	4,790	1,044	5,834	2,259	23,002	25,261
I—3	45	2,456	15,136	17,592	3,539	1,685	5,224	3,094	25,998	29,092
I—4	52	1,120	1,295	2,415	348	2,518	2,866	895	7,352	8,247
Total ...	193	8,889	30,454	39,343	11,991	8,872	20,863	7,482	69,111	76,593
P. C. ...	...	2·4	8·3	10·7	3·3	2·4	5·7	2·0	18·8	20·9
D—1	50	1,947	...	1,947	1,986	786	2,772	1,402	7,251	8,653
D—2	50	1,666	...	1,666	1,444	1,766	3,210	528	5,229	5,757
D—3	50	1,443	...	1,443	123	2,013	2,136	374	6,983	7,357
D—4	48	1,014	...	1,014	504	3,237	3,741	980	4,788	5,768
Total ...	198	6,070	...	6,070	4,057	7,802	11,859	3,284	24,251	27,535
P. C. ...	...	7·2	...	7·2	4·8	9·2	14·0	3·9	28·6	32·5
1938-39										
I—1	...	...	...	...	...	...	...	...	...	...
I—2	45	2,077	9,508	11,585	4,303	699	5,002	2,104	15,540	17,644
I—3	45	2,440	10,074	12,514	2,997	936	3,933	2,648	19,133	21,781
I—4	52	1,076	174	1,250	208	1,408	1,616	620	5,033	5,653
Total ...	142	5,593	19,756	253,49	7,508	3,043	10,551	5,372	39,706	45,078
P. C. ...	...	2·3	8·2	10·6	3·1	1·3	4·4	2·2	16·6	18·8
D—1	...	...	...	...	...	...	...	...	...	...
D—2	50	1,591	...	1,591	1,499	1,230	2,729	567	4,003	4,570
D—3	50	1,416	...	1,416	122	1,967	2,089	319	6,364	6,683
D—4	48	1,011	...	1,011	325	1,811	2,136	759	3,794	4,553
Total ...	148	4,018	...	4,018	1,946	5,008	6,954	1,645	14,161	15,806
P. C. ...	...	8·1		8·1	3·9	10·0	13·9	3·3	28·4	31·7

Expenses (Rs.)

Seeds and Plants			Manure			Paid Labour			
						Casual and Contract labour			Farm
Purchased	Farm Produce	Total	Purchased	Farm Produce	Total	In cash	In kind	Total	Cash
1,199	5,047	6,246	4,022	1,021	5,043	4,973	1,420	6,393	4,562
3,116	7,259	10,375	24,647	4,126	28,773	15,295	1,233	16,528	7,339
3,266	6,212	9,478	30,209	3,316	33,525	12,591	1,666	14,257	7,642
820	183	1,003	121	643	764	191	1,776	1,967	1,467
8,401	18,701	27,102	58,999	9,106	68,105	33,050	6,095	39,145	21,010
2·3	5·1	7·4	16·1	2·5	18·6	9·0	1·7	10·7	5·7
807	2,282	3,089	459	900	1,359	1,205	655	1,860	863
668	1,202	1,870	365	730	1,095	758	1,142	1,900	1,412
385	732	1,117	333	726	1,059	654	780	1,434	770
551	309	860	130	417	547	646	1,609	2,255	1,155
2,411	4,525	6,936	1,287	2,773	4,060	3,263	4,186	7,449	4,200
2·8	5·3	8·2	1·5	3·3	4·8	3·8	4·9	8·8	5·0
...	...	...	...	...	...	...	...	...	...
3,376	7,139	10,515	23,844	2,998	26,842	11,685	1,175	12,860	6,451
2,825	7,013	9,838	27,398	2,537	29,935	9,304	1,639	10,943	7,307
624	131	755	37	439	476	211	1,088	1,299	1,095
6,825	14,283	21,108	51,279	5,974	57,253	21,200	3,902	25,102	14,853
2·8	6·0	8·8	21·4	2·5	23·9	8·8	1·6	10·5	6·2
...	...	...	...	...	...	...	...	...	...
415	1,698	2,113	235	573	808	394	929	1,323	1,349
564	773	1,337	289	720	1,009	598	756	1,354	422
611	289	900	62	353	415	456	917	1,373	1,102
1,590	2,760	4,350	586	1,646	2,232	1,448	2,602	4,050	2,873
2·2	3·5	5·7	1·2	3·3	4·5	2·9	5·2	8·1	5·8

TABLE No. 7:—Farm

	Paid Labour					*Baluta* Payments			Miscell-	
	Servants		Total							
	Kind	Total	Cash	Kind	Total	Cash	Kind	Total	Materials and Stores	Godown Rent
1939-40										
I—1	3,609	8,171	9,535	5,029	14,564	26	1,743	1,769	865	494
I—2	1,891	9,230	22,634	3,124	25,758	...	1,446	1,446	1,316	3,830
I—3	1,606	9,248	20,233	3,272	23,505	...	1,904	1,904	1,208	5,311
I—4	535	2,002	1,658	2,311	3,969	...	800	800	333	62
Total ...	7,641	28,651	54,060	13,736	67,796	26	5,893	5,919	3,722	9,706
P. C. ...	2·1	7·8	14·7	3·7	18·5	0·01	1·6	1·6	1·0	2·6
D—1	936	1,799	2,068	1,591	3,659	...	1,996	1,996	617	28
D—2	749	2,161	2,170	1,891	4,061	...	862	862	734	244
D—3	339	1,109	1,424	1,119	2,543	...	1,275	1,275	686	100
D—4	185	1,340	1,801	1,794	3,595	...	580	580	284	74
Total ...	2,209	6,409	7,463	6 395	13,858	...	3,813	3,813	2,321	446
P. C. ...	2·6	7·6	8·8	7·5	16·3	...	4·5	4·5	2·7	0·5
1938-39										
I—1	...	...	...	...	...	...	...	...	...	...
I—2	1,451	7,902	18,136	2,626	20,762	...	1,365	1,365	1,198	3,175
I—3	1,670	8,977	16,611	3,309	19,920	...	1,895	1,895	1,190	3,444
I—4	503	1,598	1,306	1,591	2,897	...	683	683	311	47
Total ...	3,624	18,477	36,053	7,526	43,579	...	3,943	3,943	2,699	5,666
P. C. ...	1·5	7·7	15·0	3·1	18·2	...	1·6	1·6	1·1	2·4
D—1	...	...	...	...	...	...	...	...	...	...
D—2	671	2,020	1,743	1,600	3,343	...	758	758	591	194
D—3	192	614	1,020	948	1,968	...	1,191	1,191	674	53
D—4	185	1,287	1,558	1,102	2,660	...	512	512	257	58
Total ...	1,048	3,921	4,321	3,650	7,971	...	2,461	2,461	1,520	305
P. C. ...	2·1	7·9	8·7	7·3	16·0	...	4·9	4·9	3·0	0·6

Expenses (contd.)

aneous										
Rent of Implements	Lubricants & Kerosene	Manufacture of Gul	Repairs	Miscell-aneous	Total	In cash	In kind	Depreciation on Implements	Depreciation on Livestock	Total Expen-diture
643	204	3,006	1,125	726	7,063	5,902	1,161	2,299	223	64,137
28	170	11,679	464	194	17,690	17,515	175	853	717	1,30,045
1,829	1,508	16,130	620	642	27,248	26,623	625	2,307	632	1,50,505
78	53	...	387	275	1,188	906	282	771	92	22,115
2,578	1,935	30,815	2,596	1,837	53,189	50,946	2,243	6,230	1,664	3,66,802
0·7	0·5	8·4	0·7	0·5	14·5	13·9	0·6	1·7	0·5	100·0
103	59	293	385	515	2,000	1,414	586	1,277	178	26,030
147	31	16	166	185	1,523	1,343	180	501	299	20,844
236	81	418	175	416	2,106	1,691	415	693	306	20,035
65	58	...	395	235	1,111	879	235	597	116	17,929
545	229	727	1,121	1,351	6,740	5,327	1,416	3,068	899	84,858
0·6	0·3	0·9	1·3	1·6	7·9	6 3	1·7	3·6	1·1	100·0
...	...	...	...	...	...	...	...	...	...	...
25	160	5,201	450	177	9,386	9,221	165	820	791	1,04,712
1,429	412	10,532	503	633	18,143	17,518	625	1,434	458	1,19,858
54	51	...	332	275	1,070	789	281	775	79	15,254
1,508	623	15,733	1,285	1,085	28,599	27,528	1,071	3,029	1,328	2,39,816
0·6	0·3	6·5	0·5	0·5	11·9	11·5	0·4	1·3	0·6	100·0
...	...	...	...	...	...	...	...	...	...	...
75	24	8	138	183	1,216	1,036	180	476	268	17,872
121	66	121	134	409	1,576	1,168	408	697	285	18,251
50	51	...	333	220	969	749	220	604	23	13,783
249	141	129	605	812	3,761	2,953	808	1,777	576	49,906
0·5	0·3	0·3	1·2	1·6	7·5	5·9	1·6	3·6	1·1	100·0

TABLE NO. 8:—*Total Farm*

Groups	No. of Farms	Crop Produce (including Fodder)					
		Sold	Payment in kind to			Total paid in kind	Retained at home
			Bahita	Landlord	Labour		
1939–40							
I–1	51	37,123	1,743	3,625	1,420	6,788	29,961
I–2	45	131,838	1,446	1,044	1,233	3,723	41,675
I–3	45	123,393	1,901	1,685	1,666	5,255	58,586
I–4	52	5,830	800	2,518	1,776	5,094	16,674
Total	193	298,184	5,893	8,872	6,095	20,860	146,899
Percentage	...	60·1	1·2	1·8	1·2	4·2	29·6
D–1	50	9,785	1,096	786	655	2,537	18,824
D–2	50	11,614	862	1,766	1,142	3,770	12,388
D–3	50	7,227	1,275	2,013	780	4,068	17,258
D–4	48	10,707	580	3,237	1,609	5,426	14,656
Total	198	39,433	3,813	7,802	4,186	15,801	63,126
Percentage	...	29·3	2·8	5·8	3·1	11·7	46·9
1938–39							
I–1	...	...	...	...	...	...	...
I–2	45	98,910	1,365	699	1,175	3,239	31,120
I–3	45	113,304	1,895	936	1,639	4,470	44,156
I–4	54	4,825	683	1,408	1,088	3,179	11,038
Total	142	217,039	3,943	3,043	3,902	10,888	86,314
Percentage	...	65·2	1·2	0·9	1·2	3·3	25·9
D–1	...	...	...	...	...	...	...
D–2	50	9,866	758	1,230	929	2,917	10,217
D–3	50	7,254	1,191	1,967	756	3,914	17,163
D–4	48	7,074	512	1,811	917	3,240	10,082
Total	148	24,194	2,461	5,008	2,602	10,071	34,462
Percentage	...	29·1	3·0	6·0	3·1	12·1	45·1

Receipts (Rs.)

Total unsold	Total Crop Produce	Income from Livestock			Miscellaneous	Receipts from Landlord	Total Farm Receipts
		Live-stock Produce	Appreciation	Total			
36,752	73,875	2,734	1,217	3,951	1,479	1,328	80,633
45,398	177,236	8,073	465	8,538	1,808	138	187,720
63,841	187,234	6,133	651	6,784	768	258	195,044
21,768	27,598	3,566	664	4,230	762	325	32,915
167,759	465,943	20,506	2,997	23,507	4,817	2,049	496,312
33·8	93·9	4·1	0·6	4·7	1·0	0·4	100·0
21,361	31,146	2,559	619	3,158	408	202	34,934
16,158	27,872	2,866	532	3,398	495	381	32,146
21,326	28,553	2,560	639	3,199	823	400	32,975
20,082	30,789	2,394	784	3,198	408	275	34,650
78,927	118,360	10,379	2,574	12,953	2,134	1,258	134,705
58·6	87·9	7·7	1·9	9·6	1·6	0·9	100·0
...	...	...	...	...	...	...	...
34,359	133,269	7,166	294	7,460	1,777	94	142,600
48,626	161,930	4,594	821	5,415	286	341	167,972
14,217	19,042	1,719	677	2,396	633	162	22,233
97,202	314,241	13,479	1,792	15,271	2,696	597	332,805
29·2	94·4	4·1	0·5	4·6	0·8	0·2	100·0
...	...	...	...	...	...	...	...
13,434	23,000	2,461	618	3,079	514	273	26,866
21,077	28,331	2,378	541	2,919	885	362	32,497
13,322	20,396	1,919	772	2,691	454	188	23,729
47,533	71,727	6,758	1,931	8,689	1,853	823	83,092
57·2	86·3	8·1	2·3	10·5	2·2	1·0	100·0

of Rs. 1,500 per annum per farm. The next two irrigated groups, both dominated by sugarcane, show receipts falling between Rs. 4,100 and Rs. 4,400 per annum per farm. In this, as in other respects, irrigated group I 4 is essentially like dry farming business. The average annual value of its individual farm receipts is less than Rs. 650 for the year. The dry groups show very close similarity in results. All the first three groups have gross receipts per farm approximating Rs. 650. In the fourth group the level is distinctly higher, being approximately Rs. 725. This is obviously the result of the favourable prices for cotton ruling during the period. Reference to 1937–38 figures show that in that year the average gross receipts in group D 4 were less than those in groups D 2 and D 3 (Table No. 8).

The total value of all produce of the farm (crops and livestock) is a good index of the increased size of business activity made possible by irrigation. This, in effect, is the measure of the total direct effects of the public investment in the canal system together with the private investment in irrigated farms. There is no means of separating the effects of the public investment from those of the private investments. The public investment is, no doubt, antecedent. And it alone makes possible the later private investment. The private investment, however, is necessary to exploit the opportunities created by public investment and the immediate direct effects in terms of the greatly increased value of agricultural production is the joint result of the two. Broadly our survey shows that the construction of the canal system made possible an increase in the size of agricultural business from the neighbourhood of an average of Rs. 650 in a typical dry unit to round about Rs. 1,500 under second class irrigation and to Rs. 4,000 in intensive irrigation dominated by sugarcane. This increase was, of course, dependent on increased investment both in permanent and working capital on the irrigated farms. It is also clear that at the tail-end of the canal the effect is almost nil in terms of the actual increase in production in any particular year. The effect in this area would rather have to be measured in terms of averages over a longer period, as it is

only in this manner that the element of the added security of annual production might be revealed in the statistics.

These results of the survey then present a series of generally comparable pictures and yield direct concrete measures. As we shall see in a later section, certain, allowances for various other factors may have to be made in assessing the benefits over the whole area. It cannot, for example, be necessarily assumed that the value of the receipts from dry farming would have been the same in the present irrigated areas as on the dry farms in our sample. Again the variations in crop averages from tract to tract and year to year must also be taken into consideration. These calculations for the total area will be later attempted. At this stage, however, it is permissible to say that the comparison yielded by the values of gross receipts of these sample units of farms, gives one of the best concrete indices available for the direct effects of irrigation on agricultural production.

Having obtained a preliminary idea regarding a measure of the total direct effects it is necessary to enquire into the manner in which the incremental return is distributed. It is only through such a study of the distribution of the return that we could ascertain which classes are benefited and which activities stimulated as a result of the construction of the canal system. For the purposes of this study it would be useful to follow the lines of the analysis of what is sometimes called "social income". In this analysis the gross receipts or return of farm operations are divided into two classes called (i) Farming Expenses and (ii) Social Income—farming expenses comprise that part of the gross return which is laid out in the purchase of materials, etc. and which cannot, therefore, be counted as direct income of any organisation or person. The remaining, which is paid out to institutions and persons and becomes directly a part of their income, is termed social income. The economic consequences of farming expenses or outlays are not directly observable. On the other hand, an analysis of social income reveals what persons or classes obtain a portion of the incremental return and to what extent it accrues to them.

Social Income And Its Distribution :

Table No. 9 shows the gross returns classified into farming expenses and social income for all the irrigated and dry groups. The social income is further subdivided into (i) taxes, (ii) rent, (iii) wages of hired labour, etc. (iv) unpaid family labour, and (v) farm investment income. We proceed to comment briefly on each of the subdivisions of Social Income so as to bring out and measure elements in them which could be attributed to the construction of the canal system. Before it is possible to analyse the figures of gross receipts in this manner it is necessary to eliminate an element of double counting that is present in the statistics It was necessary for us to include, in both farm receipts and expenditure, the values of fodder, manure, seeds and plants, etc. which were produced and also consumed on the farm. Such counting gives a complete picture of the farm business and it is also necessary for attaining proper accuracy in the investigation. At the same time it is obvious that that part of productive activity whose results are consumed in the business itself has no effects outside the business. Thus while the increased fodder production of the irrigated farms might enable them to feed a larger complement of livestock at the higher standard of consumption necessitated by the more strenuous work involved in irrigation farming, this additional fodder fed to cattle on the farms does not affect the supplies of fodder or any other produce in any direct manner. In considering the distribution of the increased produce and the indirect and secondary effects flowing from the increased size of business, we have to eliminate from the value of gross production the value of all produce which is consumed in the course of productive activity on the farm itself. This element of what might be called double counting measured in terms of value varies from group to group. The figures for the year 1939–40 show that while in all dry groups as well as in irrigated group I 4 it varied from about Rs. 120 to Rs. 200, it went upto Rs. 350 in irrigated group I 1 and to between Rs. 750 and Rs. 800 for irrigated groups I 2 and I 3.

There is another element in our calculations which must also be considered by itself. This is represented by our calcula-

tions regarding depreciation and appreciation. Depreciation has been calculated in respect of buildings and equipment. In respect of livestock, calculations have been made for both appreciation and depreciation. The figures of depreciation and appreciation are, however, calculations not necessarily represented by any actual receipts or outgoings during the particular year. They attempt to give a measure of the average annual charge of revenue in particular directions. It is necessary to arrive at these annual measures for general accounting purposes. We have taken note also of what might be called expenditure on capital account in the particular years. The actuals for these years have been tabulated separately and are utilised in indicating the extent and nature of outlays in such directions as purchase of live-stock, implements and other equipment and the construction of buildings.

The payments made directly out of the farm produce to the state are: (i) consolidated land revenue including the Local Board cess and (ii) the consolidated water charge which also includes a cess on account of the Local Authority. The charge on account of consolidated land revenue is levied in the same manner in the irrigated area as in the dry. The standard rates of assessment are fixed for whole groups in a taluka and are the same for dry land and for land under canal irrigation. The Revision Settlement Reports of talukas in which the revision was made after the completion of the canal system reveal some influence of the fact of the construction of canals. Canal construction is put forward in these reports as a factor making for improved economic conditions in the tract and helping farmers even in dry areas to obtain more continuous employment. The enhancements of rates of assessment recommended are justified mainly on grounds other than the operation of the canal system but the latter is a factor in determining the particular pitch of assessment. A part of the enhancement, therefore, might be attributed to irrigation. However, there is no special taxation of the income from lands under irrigation and the revenue is assessed uniformly on lands under dry and irrigated farming. The increased receipts under this head are better considered to be an indirect effect of irrigation which enables Government to levy taxation at

TABLE NO. 9—*Investment Returns and*

Group	No. of Farms	Total Farm Receipts	Total Farm Expenditure	Farm Income	Farm Investment Income	Taxes		Net Rent*	Ex-
						Land Revenue	Water Charges		Fodder and Concentrates (Purchased)
1939-40									
I 1	41	80,633	64,137	16,496	9,183	4,667	2,721	4,221	1,234
I 2	45	1,87,720	1,30,045	57,675	50,185	2,422	11,302	5,310	2,259
I 3	45	1,95,044	1,50,505	44,539	35,005	3,076	15,136	4,346	3,094
I 4	52	32,915	22,115	10,800	5,187	1,485	1,295	2,176	895
Total	183	4,96,312	3,66,802	1,29,510	99,560	11,650	30,454	16,053	7,482
D 1	50	34,934	26,030	8,904	1,335	2,502	...	2,015	1,402
D 2	50	32,146	20,844	11,302	5,700	2,403	...	2,092	528
D 3	50	32,975	20,035	12,940	2,671	1,752	...	1,427	374
D 4	48	34,650	17,929	16,721	11,728	1,415	...	3,065	980
Total	198	1,34,705	84,838	49,867	21,434	8,072	...	8,599	3,284
1938-39									
I 1	...	...	...	...	...	...	...	...	...
I 2	45	1,42,600	1,04,712	37,888	30,915	2,423	9,508	4,562	2,104
I 3	45	1,67,972	1,19,850	48,122	38,399	2,921	10,074	3,111	2,648
I 4	52	22,233	15,254	6,979	949	1,322	174	1,208	620
Total	142	3,32,805	2,39,816	92,989	70,263	6,666	19,756	8,881	5,372
D 1	...	...	...	...	...	...	...	...	...
D 2	50	26,866	17,872	8,994	3,637	2,278	...	1,769	567
D 3	50	32,497	18,251	14,246	3,986	1,686	...	1,457	319
D 4	48	23,729	13,783	9,946	4,313	1,310	...	1,649	759
Total	148	83,092	49,906	33,186	11,936	5,274	...	4,875	1,645

* Represents net receipts of landlords, arrived at by deducting from the
and (ii) payments made by landlords to tenants.

analysis of distribution of farm produce

penditure on Materials etc.					Labour				
Seed and Plants (Purchased)	Manure (Purchased)	Marketing and Processing	Miscellaneous	Total	Paid Labour Cash and Kind	*Baluta*-Payments Cash and Kind	Value of Unpaid Family Labour	Total	Depreciation (Calculated Charges)
1,199	4,022	3,500	3,563	13,518	14,564	1,769	7,313	23,646	2,522
3,116	24,647	15,518	2,172	47,712	25,758	1,446	7,490	34,694	1,570
3,266	30,209	21,441	5,807	63,817	25,505	1,904	9,534	34,943	2,939
820	121	62	1,126	3,024	3,969	800	5,613	10,382	863
8,401	58,999	40,521	12,668	1,28,071	67,796	5,919	29,950	1,03,665	7,894
807	459	321	1,679	4,668	3,659	1,096	7,569	12,324	1,455
668	365	260	1,263	3,084	4,061	862	5,602	10,525	800
385	333	518	1,588	3,198	2,543	1,275	10,269	14,087	999
551	130	74	1,037	2,772	3,595	580	4,993	9,168	713
2,411	1,287	1,173	5,567	13,722	13,858	3,813	28,433	46,104	3,967
...	...	...	...	...	...	...	...	...	...
3,376	23,844	7,376	2,010	38,710	20,762	1,365	6,973	29,100	1,611
2,825	27,398	13,976	4,167	51,014	19,920	1,895	9,723	31,538	1,892
624	37	47	1,023	2,351	2,897	683	6,030	9,610	854
6,825	51,279	21,399	7,200	92,075	43,579	3,943	22,726	70,248	4,357
...	...	...	...	...	...	...	...	...	...
415	235	202	1,014	2,433	3,343	758	5,357	9,458	744
564	289	174	1,402	2,748	1,968	1,191	10,260	13,419	982
611	62	58	911	2,401	2,660	512	5,633	8,805	627
1,590	586	434	3,327	7,582	7,971	2,461	21,250	31,682	2,353

gross receipts of landlords, (i) payment of land revenue by landlord

slightly enhanced rates all over a tract. They are not a levy made directly on the increased production due to irrigation.

The shorter limits to settlement laid down in some irrigated areas stand on a similar footing. Short-period revisions enable Government to increase standard rates within a smaller space of time than would be possible with the normal 30 year period of guarantee. In this case also the earlier revision would affect the incidence of taxation in a taluka as a whole and there would be no special taxation of irrigated lands, though irrigation was mainly responsible for the shorter period of settlement. It is difficult to separate the slight contribution made by these considerations to the total figure of revenue payment. The one important instance of a short guarantee leading to earlier increase occurred in Kopargaon when a revision of rates took place in 1924 even though the previously revised rates had been introduced only in 1914. The short periods of settlements declared in other instances have not yet led to the imposition of increased revised rates. For all practical purposes, therefore, no difference may be considered to have been made by irrigation to the amount paid in land revenue by irrigated farmers as such.

The differences shown in the table in the total and average payments of land revenue by dry and irrigated farms are due to a variety of factors. The sample farms belong to different talukas in which settlements took place at different times and for which the standard rates differ. Within a taluka also the farms might belong to different groups. But even more important than this is the difference made by soil classification. The actual incidence of land revenue on particular survey numbers depends mainly on this. And when the lands of a village as a whole or those held by farmers in particular samples are of good quality their average assessments would be considerably higher than those of others less favourably situated. This is well brought out in the difference between the per acre assessment paid by farms in irrigated groups I 3 as compared with that paid in the nearby villages in dry group D 3.

The total primary income of the local authority from the area consists of the income from two cesses: (i) The cess on the land revenue, and (ii) The cess on the water charge. The

former cess is entirely on a par with land revenue taxation and need not be considered further. The latter cess, levied at the rate of one anna per rupee of the water charge, is leviable only from irrigated lands. It stands, however, on a different footing from the water charge levied by the Provincial Government. The water charge made by the Provincial Government is in the nature of payment for the water supply. The Local Board on the other hand offers no service or commodity in return for the cess and has also made no previous investment. The Local Board cess on the water charge is in the nature, therefore, of a pure tax. The construction of the canal system leads to much more intensive agriculture with a rapidly growing population and makes demand on the local authorities for better communications, more schools, more expenditure on public health, etc. It is to meet this demand that the extra cess has to be levied and the income from it may be considered as meeting the Local Board's outlay on the additional capital and repair charges, and expenditure on materials and employments of various types rendered necessary by the development of the tract.

The income from the water charge is income due directly to the irrigation system. The water charge is not a tax but is akin to payment for the service of water or rather for the commodity water. It might, therefore, be properly considered with farm expenses. However, the payment is received by the State and the policy of the State in determining specific water charges is widely different from that followed by commercial undertakings. The water charges levied by the State in India might and usually do contain an element of either taxation or subsidy. Hence the charge is considered here together with tax receipts of State authorities. The income from water charges is, in the main, used for the maintenance and operation of the canal system. A large part of this income is distributed in payment of salaries, etc. to employees of the department stationed in the tract as also for materials, etc. for the maintenance of the system. The portion remaining after meeting the maintenance and operation charges is credited to Government as income on its investment. The effect of only a part of the water charge income can,

therefore, be independently observed. This is the effect of the income accruing to employees of the department in the tract itself. It is arguable that the expenditure on maintenance and operation of the system should be treated not so much as an effect as a condition precedent of the increased production. While from one point of view it would be convenient so to treat it, it is clear that from another it is proper to recognise the fact that the present maintenance and operation of the system is made possible by the increased production which flows from it.

The second category of incomes under Social Income is rent. The column represents net rental receipts, that is, the income received by the landlord after deducting the consolidated land revenue due to be paid by him. It should be made clear that the data regarding rented lands and rents in our sample are not necessarily representative, that is, in choosing the farmers included in our samples no special attention was paid to the operator's tenure status. This does not create a material difficulty because it is not necessary for our purpose to separate the income accruing to pure rent receivers from that accruing to landlord-operators. The cultivation of owned lands is a common phenomenon in the region and rental income is, in the main, not separated from the other income of the operator. We have also made no attempts to calculate separately the rental income arising in respect of the owned lands of the operators in our sample.

It would be noticed that the rates of rent per acre of lands in irrigated farms are on an average much higher than the rates in the dry groups. This increased level of rents, which is in the main due to the construction of the canal, represents a purely unearned income. The landlord has to incur no additional charges or to undertake no fresh investments in order to earn the increased rents. He is not a partner, even in a small way, in irrigated enterprises. The practice, quite common in *Motasthal* farming, of the landlord furnishing part of the equipment and working capital in a crop share system does not find place in intensive irrigation of the sugarcane tract. A reference to the column giving information regarding the contribution made by the landlord in the various groups, dry and irrigated, will make this clear.

The third subdivision of social income is the remuneration to labour employed by the farmer. This total remuneration can be further classified into (i) wages of farm servants, (ii) payments to contract and casual labour and (iii) *baluta*[5] dues. Farm servants are labourers employed for agricultural work on a comparatively long period basis. The usual period for the employment of farm servants is one year. The number of farm servants is considerably larger on the irrigated farms than on the dry ones. Ordinarily the dry farmer has no need to employ a farm servant for the whole year. The average dry farm gives employment for the larger part of the year only to members of the farm family. It is only at particular seasons that it has to employ hired labour. The farm servants in the dry area are found mostly where either there is not enough adult male labour available in the operator's family or where the holding of the operator is much larger than the average. Also farm servants may be necessary where the extent of well-irrigation is very large. On the other hand, in the irrigated groups employment of farm servants is the rule on the average farm rather than the exception. Table No. 10 giving the number of farm servants in the irrigated and the dry groups indicates the difference made.

An important consideration which throws light on the availability of labour in the different tracts relates to the distribution, by locality of origin, of farm servants. A detailed enquiry conducted during the investigation into the normal residence of farm servants revealed that in irrigated villages the large majority of farm servants came from outside the village, and that in the dry villages they were almost always from the village itself. Farm operators in an irrigated village are more continuously and intensively occupied than in a dry village. Therefore, no labour for continuous employ as farm servants would be available in such villages from among families of agriculturists. Labour from landless families in the village would also find employment continuously within the village on

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5. *Balutedars* are certain village artisans and functionaries, entitled to receive a share of crop at harvest and *Baluta* is the due received by them.

TABLE NO. 10:—*Classification of Permanent Farm Servants according to their Native region*
(1939–40)

Group	Total Number of Farm Servants.	Local	Native Region					
			Khandesh	Dang	Other parts of Nasik District	Nizam's territory	Others and unclassified	Total Non-Local
I 1	73	50	...	23	...	...	...	23
I 2	83	30	3	...	35	15	...	53
I 3	82	19	...	...	...	...	63	63
I 4	27	26	...	...	...	1	...	1
Total	265	125	3	23	35	16	63	140
D 1	21	21	...	...	...	...	...	...
D 2	26	26	...	...	...	...	...	...
D 3	12	12	...	...	...	...	...	...
D 4	17	17	...	...	...	...	...	...
Total	76	76	...	...	...	...	...	...

TABLE NO. 11:—*Unpaid family Labour (Units).*

Group	No. of Farms	Man Units	
		1939–40	1938–39
I 1	51	77·38	...
I 2	45	66·10	63·88
I 3	45	87·67	88·49
I 4	52	62·37	67·00
D 1	50	83·60	...
D 2	50	51·87	49·61
D 3	50	95·08	95·00
D 4	48	55·48	62·60

contract or casual work and this would be more remunerative than employment as a farm servant. (These conditions would be more intensified the more intensive the farming in a tract; so that regions of the most intensive cultivation would have to go the farthest afield for their supply of farm servants.)

Both casual and contract labour is employed to a very much greater extent in irrigated farming than in dry farming. Family labour and labour of farm servants is available to the farm for regular work throughout the year. With increased intensity of farming a considerable part of the time of the farmer or of other adult male members of the family is occupied in directive and supervisory duties. Farm servants are engaged largely in looking after the cattle and other routine work. For all occasional small scale jobs arising throughout the year casual labour is employed mostly on daily wages. Large jobs, which are mainly seasonal operations and are capable of being contracted out on piece work basis, are mostly given on contract. Labour on contract is employed on a considerable scale for a number of operations, connected especially with the plantation of sugarcane. Contract labour is also much employed in the crushing of sugarcane and the manufacture of *gul*. There were, in the main, two sources of contract labour. The additional casual labour requirements of irrigated farming through the larger part of the year are satisfied by drawing upon labourers in the villages themselves and on labour in the neighbouring dry villages. Thus it was reported from Kohrale and Kakadi [6] that a number of labourers from these two villages were employed in irrigated villages nearly throughout the year.

The specially pressing needs towards the end of the agricultural year are satisfied by migrant labour from more distant parts. Thus when the *gul* season starts i. e. approximately in November bands of workers begin to arrive from the neighbouring districts or talukas. In irrigated group I 1 it was reported that extra labour at the harvesting time was chiefly Konkna labour from Dang, the western part of the Nasik district. In the Kopargaon area such labour is drawn from

Yeola and other contiguous dry parts of the Nasik district, from the neighbouring parts of the Nizam's Dominions, from parts of the Ahmednagar district and sometimes from parts as distant as Khandesh. The dry villages on the border of the irrigated tracts also contribute substantially to this periodic influx of labour into the irrigated tract. The season for the employment of this labour is longer or shorter according to the intensity of farming and area of land under irrigation. The outer limits of the migrant labour season are from November to May. And the season of the greatest employment is from January to March.

The data relating to farm servants give a quantitative indication of the extent of additional regular labour employed. It is not possible to add up in a similar manner the various types of units of casual and contract labour and indicate the increase in employment quantitatively. However, if a payment of approximately Rs. 150 p. a. per adult male unit is taken as the rough standard, the total expenditure on hired labour other than farm servants on irrigated farms yields 2·3 adult male labour units employed per farm for the year, as compared with 0·5 similar unit on the dry farms at the rate of approximately Rs. 120 p. a. per adult male unit on them.

Baluta labour does not seem to profit directly from the advent of irrigation. The main reason for this is that *baluta* sharing in the irrigated areas is confined to produce which was ordinarily grown under dry conditions and does not extend to the more valuable irrigated crops such as sugarcane or lucerne. The *baluta* payment is, therefore, increased only to the extent that irrigated farming of the ordinary dry crops gives better and more secure yields. The artisans among the *balutedars*, of course, profit in their capacity as artisans. They obtain an extra amount of repair and original work due to the greater intensity of farming.

The next sub-division of social income is represented by the value of unpaid family labour. This is an attributed payment not actually made. The income to the family whether in the nature of rent, profits or wages accrues as a whole. The effects of the increase of the family income must, therefore, be

studied as a whole and cannot be separately indicated for family labour wages as such.

In Table No. 11 are shown family labour units. The difference made by irrigation to requirements of family labour on the farm is evidently not marked. The highest absorption of family labour per farm unit among all groups is in group D 3. This is evidently owing to the large acreage of the farms in this group. The average requirements in Group D 1 indicate that garden production also absorbs considerable labour and the somewhat lower figure in I 1 as compared with D 1 might point to increased labour requirements where water has to be lifted from wells rather than received from canals. The highest average absorption in irrigated groups is that in I 3. The intensity of cultivation in the group accounts for this; that the absorption is not higher still or is not higher than in D 3 is due to the great reliance on hired labour in sugarcane cultivation.

It must, however, be noted that the distribution and timing of this employment is somewhat different in irrigated farming from the distribution and timing in dry farming. For example, irrigated group I 3 gives employment to about the same number of family labour units per annum as dry group D 3. But in the dry group the employment of labour is concentrated in a comparatively small period. So that a larger number of members of the family have to work during a shorter period to make up the same total annual measure of labour units. In this particular area i. e. D 3 large farms, large holdings of livestock and large families are the rule; hence the much larger than average employment of family labour units. But it also follows that while a large number of members of the family work on the family farm during the agricultural season they are mostly unemployed during the off-season of agriculture and have usually to migrate to the irrigated villages in search of work during that season. The employment in the irrigated farms, on the other hand, is continuous employment. This is not the place to enter into a discussion as to whether larger units of family labour can be employed in irrigated farming than are actually so employed today. It may, however, be noticed that in the opinion of Prof. Patil there is in some

sugarcane tracts an incidental slackening of effort on the part of the irrigator.[7] This might, if true, also be taken as an index of the rise in the standards of living of the irrigator consequent upon the increased income.

The last division of the total social income is represented by farm investment income. This is arrived at by deducting, from the total farm income, the wages of the operator and his family on the farm calculated at current rates payable for labour. The farm investment income consists of two analytically separable elements: (i) rent in respect of lands owned by the operator, and (ii) profits accruing in respect of the whole farm business. As has been explained, however, it is not necessary for the purpose in hand to try and separate these two. Irrigation makes an enormous difference to farm investment income.

In interpreting the figures of farm investment income it must be remembered that this is a residual calculation; as such its size is liable to fluctuate very violently from year to year. As agricultural costs are held comparatively stable the force of the effects of, say, a change in prices is exhibited in the range of fluctuations of farm investment income. This is brought out clearly by the difference in the farm investment income per farm in all groups and in the relative position of the groups between 1938–39 and 1939–40. The farm investment incomes of the dry groups D 2, D 3 and D 4, for 1938–39 are on a similar level while they are highly divergent in 1939-40. The average farm investment income of farmers in D 4 for 1939–40 is remarkably high and is higher than the corresponding income of farmers not only of I 4 but of also I 1. The difference made to farm investment income by intensive irrigation is, however, clearly exhibited in the figures both for 1938–39 and 1939–40. The average farm investment income for 1939–40 is not much larger than Rs. 100 per farm for all the dry groups as well as for I 4. For the same year it ranges above Rs. 775 for I 3 and above Rs. 1,100 for I 2.

These extraordinarily high incomes made by irrigators, especially in groups I 2 and I 3, must bring about a great diffe-

7. *Principles and Practice of Farm Costing*: Rao Bahadur P. C. Patil, 1933, pp. 23–24.

rence in their standards of living and their outlays. Two considerations would, however, indicate that the difference is not as large as made out by our data. In the first instance the year 1939-40 was one in which the prices of *gul* were highly favourable. Therefore, calculations made at those levels of prices present an unusual picture. The average prices of *gul* in the previous decade ruled at substantially lower levels and, therefore, the average income of these farmers, which would determine their standard of living, would also be substantially less. Secondly, there is another sharer in these investment incomes of whom we have taken no cognisance. All farm businesses studied by us have been treated as debt-free. It was not possible to obtain full information regarding the burden of debt on a farm. Also it is well-nigh impossible to separate the debt for production purposes from the debt for other purposes in the total debts of a farmer. While, therefore, it was necessary for investigational reasons and in order to facilitate comparison to treat all business as debt-free it would be wrong to assume that the whole of the farm investment income as calculated by us is retained by the farmer himself. Almost all farmers, whether in dry or irrigated areas, find it necessary to borrow and the very much larger investment and working capital outlays that are necessary for intensive irrigated farming make the size of these borrowings very large. The risks of failure on account of a drop in *gul* prices are also considerable. The plight of cooperative societies in sugarcane areas in the Deccan during certain recent periods was very bad. Thus from the farm investment income obtained by farmers in both the dry and irrgated areas a varying deduction must be made for payment on account of interest to creditors. These payments would, on an averge, be much larger in the intensively irrigated tract than in others. No generalization could however be made, on account of the possibility of very large individual variations, as to how much larger they actually were.

The change brought about in the degree of self-sufficiency of the farm and the introduction of money economy in its business is even greater than that indicated by the figures of gross return or of farm investment income. A considerable part of the produce of the farm is utilised in farm business. This is

TABLE NO. 12:—*Disposal of Produce of*

	Crop	1939–40						
		Total Irrigated (193 Farms).				Total Dry (198 Farms).		
		Sold	Paid in Kind	Retained at Home	Total	Sold	Paid in Kind	Retained at Home
1	*Gul*	2,41,398·7	1,315·4	9,478·0	2,52,192·1	6,692·3	456·2	367·5
2	Lucerne	4,589·0	234·8	36,338·2	41,162·0	1,535·0	110·0	6,478·0
3	Wheat	9,039·0	4,874·8	13,943·2	27,857·0	8,176·8	3,414·9	8,872·2
4	Bajri Grain	4,608·2	4,607·1	17,079·4	26,294·7	4,526·0	4,954·8	15,302·4
5	Sugarcane	10,119·3	523·7	13,537·5	34,180·5	185·0	37·0	923·0
6	Jowar Grain	3,831·3	4,303·3	12,598·1	20.732·7	3,462·0	3,378·9	8,232·4
7	Jowar Fodder (*Kadba*)	30·0	1,454·7	11,429·5	12,914·2	332·0	1,007·2	6,170·5
8	Onions	7,593·8	683·1	261·0	8,537·9	3,550·4	80·0	195·6
9	Groundnut	5,923·0	930·0	642·5	7,495·5	1,910·0	243·1	379·7
10	Gram	3,715·0	866·0	2,745·7	7,326·7	678·0	143·7	863·9
11	Bajri Fodder	54·0	353·7	6,629·1	7,036·8	121·5	443·0	5,740·9
12	Fodder (*Kadwal*)	...	12·0	4,812·0	4,824·0	...	16·6	297·4
13	*Tag*	...	2·0	4,037·3	4,039·3	...	...	115·0
14	*Methi*	1,689·2	...	336·4	2,025·6	...	...	...
15	Cotton	1,779·5	...	...	1,779·5	3,978·0	650·0	...
16	Fodder (*Khonde*)	...	...	1,734·0	1,734·0	120·0	12·5	945·0
17	Fodder (*Nilwa*)	...	...	1,482·0	1,482·0	...	...	...
18	Safflower	625·1	140·2	585·2	1,351·5	1,021·6	223·8	752·7
19	Linseed	887·7	83·0	170·6	1,141·3	1,148·1	117·2	87·8
20	*Tur*	234·0	30·4	430·2	694·6	106·7	33·4	610·5
21	*Matki*	49·5	12·9	502·3	564·7	365·3	103·8	835·5
22	Chillies	297·5	22·5	240·0	560·0	638·1	10·6	468·4
	Total	2,96,463·8	20,449·6	1,39,013·2	4,55,926·6	38,546·8	15,436·7	57,638·4

Important Crops: Value (Rupees)

Total	1938-39							
	Total Irrigated (142 Farms).				Total Dry (148 Farms).			
	Sold	Paid in Kind	Retained at Home	Total	Sold	Paid in Kind	Retained at Home	Total
7,516·0	1,69,299·2	723·1	832·9	1,70,855·2	3,756·0	336·7	33·3	4,126·0
8,123·0	2,070·0	...	19,442·0	21 512·0	455·0	58·3	1,959·7	2,473·0
20,463·9	9,654·0	2,705·1	8,385·6	20,744·7	6,671·0	2,104·1	3,529·3	12,304·4
24,783·2	2,578·0	2,559·4	9,851·5	14,988·9	4 151·0	3,883·0	11,555·9	19,589·9
1,145·0	15,430·0	...	10,764·5	26,194·5	130·0	16·0	250·0	396·0
15,073·3	2,252·5	2,862·3	8,824·0	13,938·8	1,871·0	1,753·5	5,588·1	9,212·6
7,509·7	40·0	787·1	7,709·0	8,536·1	120·0	475·6	4,480·5	5,076·1
3,826·0	160·0	...	...	160·0	332·5	...	3·8	336·3
2,532·8	4,829·8	397·3	286·0	5,513·1	1,366·5	241·9	200·5	1,808·9
1,685·6	2,537·5	265·3	1,399·5	4,202·3	301·5	63·3	171·7	536·5
6,305·4	102·0	203·9	3,774·5	4,080·4	84·0	350·9	4,221·0	4,655·9
314·0	...	...	3,580·0	3,580·0	...	16·6	58·4	75·0
115·0	...	...	2,315·3	2,315·3	...	...	60·0	60·0
...	1,970·0	16·0	296·0	2,282·0	...	...	...	...
4,628·0	2,904·0	67·5	...	2,971·5	1,785·5	180·0	5·0	1,970·5
1,077·5	...	...	1,440·0	1,440·0	202·5	...	1,090·0	1,292·5
...	108·0	...	768·0	876·0	...	...	...	...
1,998·1	722·5	99·9	426·1	1,248·5	781·2	128·1	485·1	1,394·4
1,353·1	519·8	38·3	93·1	651·2	518·3	68·6	38·5	625·4
750·6	56·0	...	111·6	167·6	263·0	47·3	231·3	541·6
1,304·6	31·9	20·7	346·0	398·6	404·8	104·5	799·0	1,308·3
1,117·1	...	...	...	...	362·4	2·6	209·3	574·3
1,11,621·9	2,15,265·2	10,745·9	80,645·6	3,06,656·7	23,556·2	9,831·0	34,970·4	68,357,·6

TABLE NO. 13:—*Disposal of Produce of*

	Crop	1939-40						
		Total Irrigated (193 Farms)				Total Dry (198		
		Sold	Paid in kind	Retained at Home	Total	Sold	Paid in kind	Retained at Home
1	*Gul*	95·7	0·5	3·8	100	89·0	6·1	4·9
2	Lucerne	11·4	0·5	88·1	100	18·8	1·4	79·8
3	Wheat	32·4	17·6	50·0	100	39·9	16·8	43·3
4	Bajri Grain	17·6	17·5	64·9	100	18·2	20·0	61·8
5	Sugarcane	42·0	1·9	56·1	100	16·2	3·1	80·7
6	Jowar Grain	18·3	20·8	60·9	100	23·0	22·4	54·6
7	Jowar Fodder (*Kadaba*)	0·2	11·2	88·6	100	4·5	13·4	82·1
8	Onions	88·8	8·0	3·2	100	92·3	2·6	5·1
9	Groundnut	78·8	12·4	8·8	100	75·5	9·5	15·0
10	Gram	50·7	11·8	37·5	100	40 2	8·5	51·3
11	Bajri Fodder	0·7	5·0	94·3	100	2·2	7·0	90·8
12	Fodder (*Kadwal*)	...	0·1	99·9	100	...	5·3	94·7
13	*Tag*	...	...	100·0	100	...	...	100·0
14	*Methi*	83·4	...	16·6	100	...	...	...
15	Cotton	100·0	...	...	100	86·0	14·0	...
16	Fodder (*Khonde*)	...	...	100·0	100	11·2	1·0	87·8
17	Fodder (*Nilwa*)	...	...	100·0	100	...	...	...
18	Safflower	46·3	10·3	43·4	100	51·1	11·2	37·7
19	Linseed	77·6	7·3	15·1	100	84·7	8·6	6 7
20	*Tur*	33·8	4·1	62·1	100	14·5	4·4	81·1
21	*Matki*	8·8	2·0	89·2	100	28·0	8·0	64·0
22	Chillies	53·1	4·0	42·9	100	57·2	0·8	42·0
	Total per cent.	64·9	4·7	30·4	100	34·6	13·7	51·7

Important Crops: Percentages.

1938-39								
Farms)	Total Irrigated (142 Farms)				Total Dry (148 Farms)			
Total	Sold	Paid in kind	Retained at Home	Total	Sold	Paid in kind	Retained at Home	Total
100	99·1	0·4	0·5	100	91·0	8·2	0·8	100
100	9·6	...	90·4	100	18·4	2·3	79·3	100
100	46·6	13·0	40·4	100	54·2	17·1	28·7	100
100	17·2	17·1	65·7	100	22·1	19·9	58·0	100
100	58·8	...	41·2	100	32·8	4·0	63·2	100
100	16·2	20·6	63·2	100	20·3	19·1	60·6	100
100	0·4	9·2	90·4	100	2·3	9·4	88·3	100
100	100·0	...	...	100	98·9	...	1·1	100
100	87·4	7·1	5·5	100	75·6	13·3	11·1	100
100	60·2	6·6	33·2	100	56·1	11·8	32·1	100
100	3·2	5·0	91·8	100	2·9	7·6	90·6	100
100	...	...	100·0	100	...	23·5	76·5	100
100	...	...	100·0	100	...	...	100·0	100
...	86·4	0·6	13·0	100	...	...	...	...
100	98·0	2·0	...	100	90·6	9·1	0·3	100
100	...	...	100·0	100	15·7	...	84·3	100
...	12·5	...	87·5	100	...	...	...	...
100	57·9	8·0	34·1	100	56·0	9·2	34·8	100
100	79·7	6·0	14·3	100	82·8	11·0	6·2	100
100	33·4	...	66·6	100	48·7	8·7	42·6	100
100	8·0	5·2	86·8	100	30·9	8·0	61·1	100
100	...	...	...	...	63·2	0·4	36·4	100
100	70·2	3·5	26·3	100	34·5	14·4	51·1	100

proportionately greater on dry farms than on irrigated farms. Apart from this a certain portion of the net produce is used by the farmer for the consumption needs of the family. Where the proportion of the total produce of the farm consumed by the farmer and his family is large the business is called subsistence farming; as commercialisation of agriculture increases, more and more of the income of the farmer accrues to him in the form of money. We collected no data, directly bearing on this question. However, information was collected regarding the manner of disposal of each kind of crop and livestock produce indicating quantities sold during the year and those paid out in kind to labourers, landlords, etc. Produce remaining after deducting the total disposed of in these two ways was either consumed during the year or was still held by the farmer at the end of the year. The production retained on hand at the end of the year was not necessarily consumed subsequently. It might happen that some of it was held over for being sold at a later date. This is very largely the case with produce like *gul* which was held over. The bulk of the unsold quantities of consumption grains etc. would, however, represent broadly actual family consumption. Anyway, it might be assumed that the proportion of the value of production sold to the value of total production in the particular years indicates generally the extent of importance of money transactions. Table No. 12 sets out the relevant data. It shows that the average of the value of all produce sold, to total receipts was more than two-thirds in irrigated groups as a whole and was higher than 70 p. c. in the most intensively developed tracts. On the other hand in dry groups as a whole the similar average was only about a third of the total receipts and in the dry group D 3, it fell as low as 22 p. c. The difference made in average money figures is equally striking. The total annual receipts of the average dry farmer for produce sold were only about Rs. 200 per annum; these receipts were lower than even Rs. 150 p. a. for the average farmer belonging to the group D 3. The corresponding figure for the average of farmers belonging to irrigated groups was about Rs. 1,500 p. a. while for group I 2 they amounted to about Rs. 3,000 p. a. The same table indicates that payments in kind of irrigators are not appreciably greater in value than those of dry farmers.

Consequently they play a much smaller part in irrigation farming than in dry farming.

We shall now turn to the farming expenses Table No. 7 i. e. expenditure on materials, etc. incurred by the two types of farmers. The main outlays in farming consist of fodder, seeds and plants, and manure. But the actual cash expenditure on these is not as large as would appear from their importance in the general economy. This is because, considerable requirements in all these three respects are met by the produce of the farm itself. It would be seen that both in dry and irrigated farming the overwhelming proportion of fodder requirements of the farm business are met from within the business itself. The proportions vary from group to group but broadly the value of the home produce is 7 to 9 times the value of the produce bought. The total outlay on fodder by the irrigators in the sample is larger than that made by the dry farmers. But the proportion of home produce to total is actually larger in the former than in the latter. The seeds and plants requirements are not met by the produce of farm to an equally large extent. Here generally the value of seeds bought is a little less than half of the home produce. In individual cases on account of special circumstances as in irrigated group I 4 there might be large variations. In this respect also the irrigators seem to be more self-sufficient than the dry farmers as a class. With manure the circumstances are radically altered. All the dry groups and the irrigated group I 4 are almost as self-sufficient in respect of manure as in respect of seeds and plants, but irrigated groups I 1, I 2 and I 3 produce only a small fraction of their total requirements of manure on the farm itself. Outside requirements of manure are proportionately large in irrigated group I 1. In irrigated groups I 2 and I 3 they are so large as to make the value of home produce quite negligible in comparison.

Another set of expenses that we have included in the group of outlay expenditure is the expenditure on marketing and processing. The expenditure is counted in as a part of expenditure of the farm business only insofar as it was actually incurred by the farmer. If the practices of different farmers differed the items for which expenditure is

entered in our survey schedules would also differ. Thus if a farmer sold his produce locally without incurring any transformation or packing expenses credit would be given to him for the price actually received and no expenditure for packing or transformation was calculated. On the other hand, if he incurred the expenses of marketing at a distant place they would be counted in. Ordinarily, the practice of farmers does not vary greatly and for the great majority of crops few processing or marketing expenses are actually incurred. A reference to the figures for the dry groups and irrigated group I 4 will make this clear. It is chiefly in the case of *gul* that the processing and marketing expenses are considerable. But as there is almost no market for sugarcane as such every farmer has necessarily to incur transformation and marketing expenses in this case. The expenditure incurred in the making of *gul* is obviously not all of a uniform type. It is not all expenditure incurred in the purchase of materials. It includes all types of charges for investment, charges for material and charges for labour. Marketing charges also include storage charges chiefly in the form of godown rent. As the making of *gul* is treated separately in another section no further comment on this expenditure is made at this stage.

The remaining group of expenditure items in outlays is the miscellaneous group. Its main constituents are miscellaneous materials, kerosene and lubricants, repairs to implements, hire of implements, maintenance of watch dogs and breeding fees. Of these the first mostly consists of expenditure on materials annually required such as ropes, baskets, etc. and the second constitutes expenditure on materials proper. Kerosene is required chiefly in connection with watching the crops and some work at night on the farm such as irrigation; lubricants chiefly for the cane crusher and to a small extent for the cart. The implements are most usually hired from neighbouring farmers, and this is consequently income flowing chiefly to operators in the neighbourhood. Repairs to implements indicate the additional demand made for the services of the local artisans. The maintenance of the watch dog is an item of expenditure very generally incurred. It does not, however, result in a cash outlay as it is met chiefly by drawing on the produce of the farm.

The discussion in this section may now be briefly summed up. No measurable addition is made to land revenue and to the Local Board cess levied on it on account of irrigation The direct effect of the collection of the water rate is the employment of the irrigation staff in the tract and expenditure on maintenance and operation of the system. The further effects of this expenditure are the outlays by this staff in the tract. The further effects of that part of the water rate accruing to Government but not expended in the tract are not traceable. The additional Local Board cess on the water charges increases the income of the Local Board and enables it, among other things, to expand or intensify its activities in the irrigated tract as required by its greater development. Rent, farm investment income and farm labour income constitute shares accruing to the classes of landlords, operators, and financiers of agricultural operations. The vast majority of the receivers of these shares stay in the tract itself. No substantial increase in their numbers seems to have resulted from irrigation. Their incomes have, however, increased considerably and the secondary effects due to outlays made by these classes are observable. The increased employment of hired labour is one of the most considerable indirect effects of irrigation and the outlays in the tract itself from the wages received by these labourers have considerable secondary effects. Labourers from among the irrigated villages themselves presumably spend their whole income within the tract. The effects of the employment of labour from the dry villages nearby might be manifold. It might increase to some extent the general standard of living in those villages. The increased outlays would expand the activity of the region as a whole. Within the region for purposes such as markets for consumable goods the dry villages cannot be easily separated from the irrigated areas. The increased employment might also result in a slight improvement of the standard of agriculture by making additional resources available for the purpose to the agriculturists in the neighbouring dry area. Labourers migrating from more distant parts would spend part of their earnings while employed in the tract itself and take away the remainder as savings. The utilisation of this might result in repayment or avoidance of debt, improvement of the standard of living or improvement in the standard

of agriculture in the centres from which the immigrant labour came. Generally the greater employment afforded by irrigation would stabilise the economic position of a considerable number of families in an area, large or small, round the irrigated tract. There is no increase in the numbers of *balutedars* and no marked additions to their incomes as *balutedars*. There is some addition, however, to the income of artisans as such, due to additional expenditure incurred on construction of buildings and their repair, and the manufacture of implements and their repair.

The increase in the demand for fodder is not very considerable, and does not lead to marked encouragement to additional agricultural enterprise. The fodder supplies are almost entirely obtained from within the region itself. This is also the case with seeds and plants. A reference to Table No. 13 giving the proportion of produce unsold and sold etc. shows that even the requirements of sugarcane plants are met from within the region itself by mutual purchase and sale among the operators. The demand for manure has undoubtedly very considerable effect. Only a small part of these are, however, felt in the tract or its immediate neighbourhood. Ordinary farm-yard manure is not usually in excess supply with any operator, dry or irrigator. Only a small amount of the import of such manure from dry villages into the irrigated villages has been noted. The rest of the demand for manure is met by the supply of organic or artificial manures from outside the tract. The only other considerable indirect effects due to the irrigator's outlays are those in constructional and implement industries. The iron plough and the cane crusher (power driven or bullock driven) and the epuipment required for the manufacture of *gul* create a considerable demand in these directions. The temporary or permanent constructions required to conduct these operations and the materials used in providing sheds for additional livestock and to a small extent for casual labour result in calling forth a considerable supply of the requisite materials. The additional livestock requirements of the irrigator do not seem to call forth special activity in livestock rearing nearby. Table No. 14 shows that the annual purchases of livestock by irrigators are small and that

TABLE NO. 14:—*Number of Bullocks and Buffaloes Sold and Purchased.*

	Bullocks				Buffaloes			
	Purchased		Sold		Purchased		Sold	
	No.	Value	No.	Value	No.	Value	No.	Value
1939–40		Rs.		Rs.		Rs.		Rs.
I 1	18	448	8	184	3	73	...	...
I 2	15	988	...	...	15	796	6	135
I 3	15	678	...	...	11	708	1	25
I 4	14	447	4	102	7	252	1	65
Total	62	2,561	12	286	38	1,829	8	225
D 1	2	40	...	...	...	...	...	...
D 2	11	391	4	122	3	80	...	...
D 3	23	660	...	...	1	45	...	...
D 4	7	150	6	200	6	166	...	...
Total	43	1,241	10	322	10	291	...	...
1938–39								
I 1	...	...	...	...	...	...	...	...
I 2	3	135	...	...	13	775	...	...
I 3	10	457	2	10	6	364	1	30
I 4	25	681	...	...	1	85	...	...
Total	38	1,273	2	10	20	1,224	1	30
D 1	...	...	...	...	...	...	...	...
D 2	2	111	...	...	..	...	...	...
D 3	23	633	...	...	1	45	...	...
D 4	39	1,024	...	...	5	235	...	...
Total	64	1,768	...	...	6	280	...	...

for the larger part they supply their needs from breeding operations on the home farm itself.

Orange Orchards:—It has been explained above that the business of fruit cultivation stands on a different footing from that of the cultivation of annual or biennial crops. It is a long-term enterprise involving an initial outlay which makes inadequate returns in early years but yields later an income over a comparatively long period of years determined largely by the life cycle of the fruit trees. An enquiry into the economics of orange orchards, which is the dominant type of fruit cultivation on the Godavari and Pravara Canal systems, had, therefore, to proceed on lines of its own and the presentation of the results of the enquiry has also to be somewhat different. As a part of this investigational project we conducted an enquiry into orange orchards in the Rahuri Taluka. This taluka has been, for many years past, the main centre of orange cultivation, though recently large acreages are being put under this fruit in Kopargaon also. Even before the advent of the canal, oranges were being grown under well-irrigation in Rahuri Taluka. The enquiry into orange orchards conducted by us covered orchards watered by the canal as well as those watered by wells. This was done in order chiefly to enable us to frame a comparative estimate of costs, yields and incomes under the two types of conditions. The bulk of the data was collected through an intensive study of 25 orchards of each type. The sample orchards under canals were situated chiefly in Rahuri, Devalali and Kolhar. The orchards irrigated by wells included in the study were spread over a larger number of places. These were Rahuri, Wambori, Digras, Sade, Deswandi, Tandulwadi, Baragaon Nandur and Kolhar. For each of the orchards studied details regarding income and expenditure for the two latest years were taken in full. In estimating income special attention was paid to information regarding the yields of plantations of various ages. For each orchard, information was also obtained regarding the costs of planting and rearing up the orchard until it reached the stage of maturity. This information as also the information regarding yields, the average age of trees, etc. was further checked by reference to a large number of orchard owners, orchard contractors, traders, etc. The presentation of

merely the added up data of the orchards specifically studied for a year or two would not give a sufficiently clear idea regarding the economics of orange orchards in general or of the difference between well-irrigated and canal-irrigated orchards. Therefore, instead of presenting the data for all the orchards of various sizes and various stages of maturity together, we have reduced these data to typical standard figures relating to a hypothetical orchard covering an area of 2 acres. This area was chosen because it provided the minimum economic unit for a canal-irrigated as well as a well-irrigated orchard. It has been taken for granted that an orchard with this area will contain an average of 350 trees in both cases. The figures set down below have been arrived at after a careful study of the data collected and information obtained. The figures do not obviously relate to any specific case but are representative of actual average conditions and are, therefore, useful for making the calculations needed in this enquiry. The level of prices at which expenditure on labour, material, etc. has been calculated and at which the income from sale of fruit has been estimated are those relating chiefly to the years 1938-39 and 1939-1940. The data are presented in a series of tables in each of which comparative figures are given for both canal and well irrigated orchards. The first of these tables relates to initial investment. This is comparatively small and differs only in one material par-

TABLE NO. 15:—*Investment required for the minimum economic unit of an Orange Orchrad.*
(Area—2 acres with 350 trees).

	Under Canal	Under Well
	Rs.	Rs.
1. Farm Buildings	50	100*
2. Bullocks 4 @ Rs. 50 per animal	...	200
3. Miscellaneous	20	20
Total	70	320

* (Including Bullock-shed.)

ticular from canal-irrigated orchard to well-irrigated orchard. For a well-irrigated orchard a livestock holding of 4 bullocks is absolutely necessary. A canal-irrigated orchard on the other hand can do without any permanent holding of livestock. Its irrigation has no need of bullock labour and the initial operation of ploughing, harrowing, etc. can easily be got done by hired man and bullock labour. The stabling of the bullocks and the housing of the men in charge increases somewhat the cost of farm buildings on a well-irrigated orchard over that of the canal-irrigated orchard. Similarly the permanent tool equipment of the former has to be somewhat larger and more varied than of the latter. Table No. 16 gives the standard costs incurred in rearing a young orchard during the first six years and the income obtained from crops, chiefly lucerne, during the first four years together with the income of the first instalment of fruit during the year.

It will be observed that the main costs in the case of the canal irrigated orchard are, the costs of plants and of lucerne seed, the cost of manure, almost equally divided between farmyard manure and oilcake and the cost incurred on bullock and human labour in the various cultivating operations. The extent of bullock labour required is very little. Almost all of the human labour can be got performed by contract labour employed as the occasion for it arises. Miscellaneous costs are those in respect of fencing, repair of implements and building and kerosene and lanterns. The main difference made in the case of the well-irrigated orchard is the necessary maintenance of bullocks over all this period and also of human labour to tend the bullocks and to do the continuous operation of irrigating the plants. Under conditions of canal-irrigation the watering of plants is an operation concentrated within a small number of hours during a certain period of days. In a well-irrigated orchard this is a continuous process throughout almost all the days of the year. While in the former case, therefore, casual contract labour can be employed at each time of watering, in the latter it is necessary to maintain permanent farm servants for the purpose. The other important difference made by conditions of well-irrigation is the cost of maintenance of bullocks and the recurring expenditure on the materials for

TABLE NO. 16:—*Cost of rearing an Orange Orchard during first 6 years*

(Area—2 acres with 350 trees).

Items	Under Canal. Rs.	Under Well Rs.
I. Labour for :—		
(i) Preparation for Planting	36	30
(ii) Planting	16	16
(iii) Watering	162	1,360
(iv) Interculture and Manuring	84	104
(v) Weeding	82	71
(vi) Earthing and Manuring	70	70
(vii) Watering and Guarding	262	174
Total	712	1,825
II. Land Revenue with L. F. Cess	17	17
III. Water charges	265	...
IV. Seeds and Plants	113	113
V. Manure	935	276
VI. Feed for 4 Bullocks	...	1,360
VII. Materials for *Mats*	...	205
VIII. Miscellaneous	155	174
IX. Depreciation	37	58
Total	2,234	4,028
Deduct total income from orchard during first 6 years (Table No. 17)	1,940	1,730
Net Cost	294	2,298

mot[8] and the repairs to the *mot* structure. The water charge which is an important item of cost in canal-irrigation does not, of course, find a place in the costs of a well-irrigated orchard. The manuring of canal orchards, as usual under canal-irrigation, is much heavier than those of well-irrigated orchards. There is, therefore, a substantial difference in the expenditure on this item between the two types. It may be noted also that some difference is made to costs of watching, by the fact of the presence of farm servants in well-irrigated orchards. No

TABLE NO. 17:—*Income from an Orange Orchard during first 6 years*

(Area—2 acres with 350 trees)

Season	Items	Under Canal		Under Well	
		Lbs.	Rs.	Lbs.	Rs.
1st	Lucerne at 200 lbs. per rupee	80,000	400	70,000	350
2nd	Lucerne ,,	1,60,000	800	1,40,000	700
3rd	Lucerne ,,	70,000	350	60,000	300
4th	Lucerne seed at 1 lb. per rupee	160	160	150	150
5th	Nil	...	...	...	...
6th	Oranges Rs. 20. per 1100 fruits	12,600 (No. of fruit)	230	9,420 (No. of Fruit)	170
	Farm Yard Manure	...	...	...	60
	Total Income Rs.		1,940		1,730

permanent farm servants are usually employed in canal-irrigated orchards and the costs of watching are, therefore, heavier in them. The income from lucerne is generally a little higher under conditions of canal irrigation because of the heavier

8. *Mot* : Leather bucket used in lifting water from the well.

TABLE NO. 18:—*Cost of maintenance of mature Orange Orchard (7th year onwards)*

(Area—2 acres with 350 trees)

	Items	Under Canal Rs.	Under Well Rs.
I.	Labour for :—		
	(i) Earthing and Manuring	35	35
	(ii) Interculturing	21	28
	(iii) Weeding	22	22
	(iv) Watering	27	240
	(v) Watching and Guarding	178	90
	Total Labour	283	415
II.	Land Revenue with L. F. Cess	3	3
III.	Water charges with L. F. Cess	48	...
IV.	Manure	270	78
V.	Feeding 4 Bullocks	...	240
VI.	Material for *Mots*	...	36
VII.	Repairs	3	12
VIII.	Miscellaneous	35	27
IX.	Depreciation	6	10
	Total Expenditure	648	821
	Total Income	1,700	1,600
	Profit	1,052	779

watering. It will be seen that little investment of capital is required for rearing up an orchard under a canal. Under well irrigation, this investment is, however, substantial. No allowance has been made in either case for any interest charged, simple or cumulative. The calculated costs, especially under conditions of well-irrigation, give a slightly exaggerated estimate because they are divorced from considerations of a combination of the orchard business with other types of farming. A well-irrigated orchard is invariably so combined.

Table No. 18 gives data regarding annual standard costs of the maintenance of a mature orange orchard from the 7th year onward. The main features of costs as well as the main differences between the two types are the same as those noticed in the case of rearing a young orchard. The income figures are calculated from considerable data regarding the yield of plantations of various ages under canal-irrigation and under well-irrigation. It is generally agreed that a higher yield is definitely obtained from trees watered by canals. As a result, the annual income from a mature orchard is substantially higher from a canal orchard than a well orchard. Our enquiries failed to yield any indication of a material difference between the term of life of the two types of orchards. For both, this was usually put at between 35 and 40 years. Attention may, however, be drawn in this connection to an important consideration. It was reported that land under canal-irrigation tended to be spoiled and to be rendered unfit for further cultivation towards the end of the life of the orchard. Some allowance must, therefore, be made for costs that would have to be incurred in bringing it back to its original condition. It was not possible to obtain any definite idea regarding these costs.

The tables presenting the estimates of costs have been so arranged as to indicate the distribution of the farm produce between social income and expenses. The investment income of the farmer cannot in this case be easily calculated as it has to be averaged over the entire series of years. Its broad size is indicated, however, by the difference between the annual income and expenditure of a fully mature orchard. While the well-irrigated orchards created a demand for both permanent and casual labour the demand of the canal-irrigated orchard is

for the latter alone. In the case of the well-irrigated orchard a substantial portion of permanent labour is likely to be supplied, in most cases, by family labour. The main outlays are those in respect of manure in case of a canal orchard and bullock feed and manure in connection with a well orchard. The bullock feed in the latter case is also likely to be ordinarily the produce of farm. Other outlays are those in respect of fencing, kerosene, a small annual demand for plants and the repairs to tools and building.

Sugar Factory Plantations:—In 1939-40 there were in all three sugar factories operating in the area irrigated by the Godavari and Pravara Canals. Of these one, the Godavari Sugar Factory, had just begun to operate and manufactured sugar for the first time in 1939-40. We have obtained from all these three factories relevant information regarding their agricultural and industrial operations for the two years 1938-39 and 1939-40. The information for the agricultural side which is treated in this section has been put for all the three factories together and set out in Table No. 19. It has been set out in a form as closely comparable as possible with the results as presented for the individual farming business. The figures for 1939-40 for one factory could be obtained only as rough approximations. The totals for the three factories for that year have, therefore, been shown in approximate round numbers.

The area operated is for the most part not owned by the companies but is leased from other holders on long leases. Most companies have, in recent years, been increasing the total area of their leased lands. There was, it will be noticed, considerable increase in the area operated between the years, 1938-1939 and 1939-40. This increase was, however, not fully reflected in the area cultivated, because the area newly leased could not all be put under cultivation immediately and had to be kept fallow for most of the year 1939-40. This accounts for the increase in the fallow area in that year. The area of water-logged land appears to be unduly low. This is because one of the three factories had started planting operations very recently and there had not been time enough for the effects of

TABLE NO. 19:—*Data Regarding Sugar Factory Plantations*

(as supplied by the Factory Companies)

Items		1939–40	1938–39
I. Investment :			
(i) Real Estate	Rs.	21,66,991	19,69,383
(ii) Livestock	,,	1,63,000	1,53,040
(iii) Agricultural Machinery and Implements	,,	8,78,000	8,72,380
Total	,,	32,07,991	29,94,803
II. Area operated :			
(i) Cultivated	Acres	10,904	8,765
(ii) Pasture, Fallow and Waste	,,	14,006	10,810
(iii) Under Roads, Buildings, etc.	,,	1,897	1,847
(iv) Water logged	,,	1,000	1,000
Total	Acres	27,807	22,422
III. Distribution of Cultivated area :			
(i) Sugarcane	Acres	10,120	7,953
(ii) Other crops	,,	765	854
Total	,,	10,885	8,807
IV. Crop Receipts :			
(i) Sugarcane crushed	Tons	3,17,000	2,48,602
V. Livestock Receipts	Rs.	9,800	9,100
VI. Expenses :			
(i) Land Revenue (Consolidated)	Rs.	500	453
(ii) Rent	,,	1,85,100	1,69,499
(iii) Water charges	,,	5,40,000	4,39,428
(iv) L. B. Cess on water charges	,,	28 500	20,840
(v) Fodder and Concentrates	,,	61,000	48,400
(vi) Manure :			
(a) Farm-Yard Manure	,,	2,73,500	2,62,060
(b) Chemical Fertilizers	,,	6,14,500	4,20,741
(c) Oilcake	,,	4,02,000	1,74,000
(Total Manure)	,,	(12,90,000)	(8,56,801)
(vii) Labour :			
(a) Supervisory, Mechanical and Clerical	,,	1,27,000	1,19,040
(b) Other	,,	11,62,000	7,96,150
(Total Labour)	,,	(12,89,000)	(9,15,190)
(viii) Sundry Materials	,,	23,000	24,135
(ix) Medical aid etc.	,,	27,000	24,603
Total Expenses	,,	34,44,100	24,99,349

intensive watering to be visible. Another factory claimed that on account of considerable initial expenditure on drainage works it had lost almost no area due to water logging. The water-logged area thus relates only to one factory. We had enquired of the estate managers of all the factories whether any old waste land had been brought under the plough for the first time by irrigation. In each case no such accession to the cultivated area on account of irrigation was reported. The distribution of cultivated area shows that almost all the cultivated area is under sugarcane. Complete details were not available for the distribution of the acreage under crops other than sugarcane. Most of this acreage was, however, under jowar, wheat and pulses. Very little of it was under lucerne and only one factory for one year reported the planting of a small area for green manure. In the main, estate managers do not consider it worth their while to put land under crops other than sugarcane; so that the proportion of fallow on factory plantations is very much greater than that under ordinary farming conditions. The area under sugarcane represents the area on which sugarcane was a standing crop for either a whole or a part of the year; it thus includes the area under sugarcane crushed during the year as well as the area planted newly with sugarcane. The investment in the development of sugarcane plantations is seen to be very considerable. Only a negligible fraction of this is due to the cost of land purchased. The bulk of the investment on real estate is on account of the trolley lines laid down by two companies and the farm buildings, including residential quarters for the estate staff, erected by them. One sugar factory has also a railway siding on which the total investment exceeds Rs. 1 lakh. An elaborate drainage scheme was undertaken and completed by one factory only in the earlier years. The cost of this is put at a little over Rs. 2¼ lakhs. The cost of clearing and levelling land is reported to have been negligible except in the case of one factory. The cost of roads is an important item. Other costs are those of wells, fences and embankments. The investment in agricultural machinery and implements is naturally very considerable in all the factory plantations. Almost all this investment is in agricultural machinery worked by non-animal power.

The investment on implements worked by bullock power amounts only to few thousand rupees. Consequently, the investment of factory plantations on livestock is comparatively small. One factory holds no dairy cattle at all, but the other two together hold about 400 head of cattle (including calves) for the requirements of their staff. Barring a small number of horses the other livestock holding is all of a varying quantity of working bullocks. The total of these in all the three factories together was less than 600.

On the receipts side almost the only item is the value of sugarcane produced. The value of the produce of other crops has not been indicated as detailed figures were not available. Further the bulk of this produce is in the form of fodder which is fed to the cattle on the farm. In the case of the factory plantations we could not obtain the detailed figures of the produce of the farm utilised in the farm business itself; hence details have been given only of outside purchase and of receipts by sales made outside. From this point of view also the receipts from other crops become negligible in value. The receipts from livestock indicate the value of milk sold, mostly to members of staff, from the dairy cattle maintained. For the reasons stated above no account is taken of the value of manure produced on farm.

The expenditure side shows very little charge on account of land revenue, most of the land being rented. The rent charge is on the other hand considerable and works out roughly at the rate of Rs. 7-06 per acre. The water charge and the Local Board cess on it constitute the main contributions made by the plantations to governmental revenues. The expenditure on the purchase of fodder and concentrates is comparatively small because of the restricted use of bullock power in the main agricultural operations. Manure i. e. fertilizers and oilcake, is the most important item on the side of expenses. The larger part of this expenditure is on purchase of oilcake. The complete details regarding the distribution of this expenditure between the two items were available only for 1939-40 and showed that expenditure on oilcake constituted from 70 to 75 p. c. of the total expenditure on manure. Expenditure on labour has been shown under two broad heads, (1) supervisory,

mechanical and clerical, and (2) other. The latter is chiefly composed of skilled and unskilled labour of various sorts used in the agricultural operations. The total labour force, permanent and temporary, employed by all the three factories on the plantation side may be put at about 7,500. The labour charges are naturally very considerable. Table No. 20 giving figures relating to one factory shows how they were distributed between permanent farm labour and casual labour employed on temporary basis during the season.

The supervisory, etc. labour was, of course, engaged on a long term basis. The expenditure incurred on medical aid and other welfare services in connection with labour are to be reckoned also as a supplementary charge incurred in labour employment. The last item shown is that of expenditure on the purchase of sundry materials.

In comparing these figures with those of the business of the individual farmer certain reservations must be borne in mind. In the first instance the factory plantation business is heavily capitalised. The item of interest charge on this capital must figure largely in the accounts. This, however, could not be taken into consideration in our calculations as it formed part of the larger business of the company. The charge on the depreciation of the machinery is also considerable and only a general calculation of it has been shown in our figures. Again some part of the investment shown in the agricultural business is also used in the factory business. This applies especially to the investment in roads, trolleys, etc. We have made no allowance for this, but have also made no allowance for any share of the overhead expenditure of the business to be borne proportionately by the agricultural side. Again expenditure on certain materials which were used both on the factory as well as on the plantation side, such as kerosene, petrol, etc. could not be split up and could not, therefore, be included in the expenditure shown on the plantation side. These defects in the data make it impossible to strike a balance of income and expenditure of the plantation side comparable to that of the individual farm. For our purpose, however, this is not a great handicap; for, this affects our ability to assess only the residual income. The residual income accrues to the business as a

TABLE NO. 20:—*Distribution of Labour in one Factory Plantation*

Type of Work	Labourers		
	Total	Men	Women and children
I. Permanent Labour	No.	No.	No.
(a) For 12 months			
(i) Irrigators, Bullock-drivers, *wadi* workers etc. on daily wages.	800	800	
(ii) Diggers etc on Piece work basis.	1,000	1,000	
(iii) Weeding, Manuring etc. on Piece work basis.	1,200		1,200
Total	3,000	1,800	1,200
(b) For 7 months only. (October to May).			
(i) Cane-cutters	150	150	
(ii) Cartmen	100	100	
Total	250	250	
II. Casual Labour on Piece-work basis at Harvesting season			
(i) Cane-cutters	200	200	
(ii) Bundlers	50	50	
(iii) Carters	250	250	
(iv) Supervisory staff	50	50	
(v) Contractors for Cane-cutting	100	100	
(vi) Stripping cane	600		600
Total	1,250	650	600
Total Permanent+Casual	4,500	2,700	1,800

whole, whether it is earned on the plantation or on the factory side and it ultimately passes into the hands of the owners i. e, shareholders of the company. The effect of this residual income is, therefore, so scattered and is operative in such distant places that no idea of it can be obtained or presented. We are, therefore, more directly concerned with shares of the produce other than that passing to the owners of the company. In this respect our information is fairly complete. It shows certain striking variations from the effects of the operations of the individual farm. The rent charge may safely be taken to accrue to original landowners who might mostly continue to reside in the tract. It would have secondary effects similar to those of the rental incomes of farms. As regards the water charges and the Local Board cess also nothing need be added to what has been previously said in this behalf. The expenditure on fodder and concentrates shows how the great diminution in the maintenance of livestock affects this item. Even the amount of expenditure actually incurred is due chiefly to the non-cultivation of grain or fodder crops by the factories For example, one of the factories which feeds its livestock mainly on the tops of sugarcane plants spends a very small sum annually on the purchase of fodder and concenerates. The expenditure on manure is very large and does not in any essentials differ from the type of expenditure incurred by the individual farmer. In case of labour, however, the direction of expenditure is in some respects entirely new. Almost all the employment of the supervisory, technical and clerical staff is due to farming being conducted on a plantation basis. The expenditure on other labour has effects which do not materially differ from the effects of the employment of annual seasonal and casual labour by the individual farmer. The type of labour employed is also similar to that employed by the individual farmer and hails from the same tract. Its condition of employment and wages, however, differ in some material respects from the conditions of ordinary agricultural labour. On the capital side of expenditure while the demand for livestock by plantations is very low, factory expenditure on the purchase and repair of machinery and implements is considerable. Further the type of machinery and implements for which the operation of the factory plantation creates demand is also very different

from the implements demanded by the average farmer. The maintenance of roads, buildings, trolley lines, etc. also makes for an annual expenditure of a type not incurred by the individual farmer. The special labour charges on this account are included in the wages of the supervisory, etc. staff shown, but the charges on the purchase of materials and the replacement of equipment are not included in our figures. These have the effect of creating a demand for materials required chiefly in the constructional and transport industries.

An important consideration in the case of the sugar plantations is the effect of the original capital outlay. The layout of the land and its pre-existing state of cultivation made it unnecessary for the factories to undertake any considerable initial expenditure for clearing the land or otherwise making it fit for cultivation. In one factory, however, an extensive and costly drainage scheme was undertaken and in all of them considerable outlay was made on the building of roads, trolley lines, sheds, quarters and in one factory on a railway siding. This considerable capital outlay created demand for materials and labour during the time that it was being made. The effects of this demand were, no doubt, confined to the short period of early development. Even so, they cannot be neglected from a general estimate of the total effects of the system of irrigation. Each time large new areas are added to the factories and specially when new factory plantations are created a considerable expenditure on capital account is incurred, and this has large effects for the time being both inside and outside the tract. While we note this fact, we have made no attempts at estimating either their total size or their directions.

Total Direct Effects.

The data given in the three sections above represent the results of our investigations. In one respect, that of the working of sugar factory plantations, the data are exhaustive, i. e., they cover the whole field of enquiry. In the other two respects, i. e., ordinary irrigated farms and orange orchards, they represent results of sample enquiries. It is now necessary to calculate with the help of these the total direct effects, during

a given period, of the operation of the Godavari and Pravara canal systems.

The Godavari and Pravara canal systems irrigate lands in various talukas of the districts of Nasik and Ahmednagar. The Godavari canal system comprises a storage reservoir viz. Lake Beale on the Darna river, a pick-up-weir at Nandurmadhameshwar and two canals, the Godavari right and left bank canals. The Pravara system comprises a storage reservoir called Lake Arthur Hill, a pick-up-weir at Ozar and two canals, the Pravara right and left bank canals. Lake Beale irrigates lands chiefly in the Sinnar taluka of the Nasik district. The pick-up-weir at Nandurmadhameshwar is situated in the Niphad taluka of the same district; no area is, however, irrigated by the Godavari system in the Niphad taluka. The Godavari left bank canal irrigates some lands in the Yeola taluka of the Nasik district and the right bank canal those in the Sinnar taluka of the Nasik district. The bulk of lands irrigated by this system, however, lie in the Kopargaon taluka of Ahmednagar district. The most westward area irrigated by the Pravara canals is in the Sangamner taluka of Ahmednagar district. The irrigated area in this taluka is, however, small and the bulk of the irrigated lands lie in the Rahuri taluka and in the Kopargaon and Nevasa talukas in the same district.

Value of Produce with Irrigation:—In order to arrive at the total direct effect the first set of statistics necessary are the figure of the total area irrigated by the canals and its distribution under the different crops. There are two sources of this information. In the first instance, this information can be obtained directly from the irrigation authorities. It can also be collected from the land revenue records. The irrigation authorities are able to supply figures regarding the total irrigated acreage and also regarding the distribution of the various crops under any particular system of canals. In the land records the information is available by villages or by talukas and is classified according as the land is irrigated by first class or second class canals or wells, etc. An important defect in the statistics of the total area as given by the irrigation authorities is that it includes a large area which

TABLE NO. 21:—*Classification by Crops of Area under Godavari and Pravara Canals (Acres)*

Crops	1939–40	1938–39
Vegetables	114	206
Fruit and other trees	3,061	2,064
Sugarcane	25,359	30,996
Wheat	3,131	1,815
Rice	28	7
Maize	50	149
Jowar	8,655	2,792
Bajri	3,305	2,045
Gram and *Udid*	3,401	2,699
Tur	14	6
Peas	131	23
Groundnut	1,725	2,822
Miscellaneous	60	2
Fodder	2,676	1,374
Lucerne	2,260	1,943
Cotton	1,202	2,867
Tag	1,590	1,136
Tobacco	2	2
Oil seeds	7	4
Chillies, Onions, Garlic, Turmeric and *Methi*	1,341	2,692
Miscellaneous Area*	36,915	12,978
	95,027	68,622

* Area assessed but not irrigated, area insufficiently irrigated and area irrigated under penalty etc.

TABLE NO. 22:—*Area under Fruit Trees (Acres)*

Taluka	1939–40	1938–39	1936–37	1934–35
Kopargaon ...	1,741	1,211	877	715
Rahuri ...	3,167	2,971	2,279	2,108
Sangamner ...	905	887	...	813
Nevasa ...	373	393	347	297
Yeola ...	148	150	203	204
Sinnar ...	208	207	210	156
	6,542	5,819	3,916	3,793

is not sufficiently irrigated or is assessed for water charges but not irrigated or assessed under penalty. In particular years the total of such area can be very large. For example, for the year 1939–40 the total of the area under these three heads amounted to nearly 12,000 acres. The difficulties in using the land records figures are that, on the one hand, the classification as between the various irrigated crops is not sufficiently detailed, and that on the other, in particular talukas where two first class canals may be irrigating lands no means can be found of isolating figures relating to a particular canal. In these circumstances we decided to adopt the Irrigation Department figures excluding, however, the classes of land insufficiently irrigated, etc. It appears from a cross-check of the totals obtainable from the land record figures that these also do not record as irrigated, the areas assessed under penalty or insufficiently irrigated and assessed but not irrigated which are counted in the total of lands irrigated in the published irrigation reports. Table No. 21 shows the total of irrigated acres under particular crops during the years 1938–39 and 1939–40; it represents figures of the acreage irrigated by first class canals for the six talukas in which these canals operate.

The total irrigated area as well as the area under particular crops varies considerably from year to year. Any calculation of total effect must, therefore, hold valid only for particular periods. Instead of working on the particular figures of either 1938–39 or 1939–40 we have taken as the basis of our calculations an average of the figures of these two years reduced to round numbers. The table of final calculations, Table No. 23, shows the average assumed by us under particular crops.

The total effect attributable to the irrigation system can be calculated by estimating the value of the gross produce grown under irrigation and deducting from it the value of the gross produce that would have been yielded by the same lands in the absence of irrigation. Having determined the average figures of the total land irrigated and its distribution under particular crops for a particular period we have next to calculate the total yield of these lands and the value of the yield. In calculating the yield for the various crops we have in the main relied upon the figures of yield indicated by the results of our

survey. In the case of sugarcane this yield has to be calculated in terms of *gul*. For both the years 1938-39 and 1939-40, [9] the average yield of *gul* per acre of crushed sugarcane amounted to 37 *pallas* and this is the yield that we have assumed in our calculations. In the case of sugarcane acreage an allowance has to be made for acreage under the crop in the factory plantations. We have allowed for an average area of 9,000 acres under this head. It has been calculated that sugarcane grown on half the remaining area under sugarcane is crushed every year. The sugarcane crop of different varieties occupies the field for about 15 to 18 months. All types of sugarcane areas are, therefore, entered as irrigated in two consecutive years. When these areas are shrinking or expanding as new plantations increase or decrease the crushed area may be somewhat less or greater than half during particular years. For average calculations, however, it may safely be taken as half of the total area. [10]

The value of the sugarcane raised and crushed by the factories has been put at Rs. 15 per ton. This is a fair figure in view both of the factory expenditure on the raising of sugarcane and the average current price of *gul*.

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9. The reasons for including *gul* production in direct effects as also some objections to doing so are indicated in the section on *gul* manufacture.

10. It may parenthetically be noted that the figures of the total production of *gul* yielded by our calculations amount to a little over 3·5 lakhs of *pallas* and taking *palla* as equivalent to 3 maunds this gives a figure of 10·5 lakhs of maunds. This figure may be compared with the total average of exports by rail of *gul* from the stations in the irrigated tract which reaches an average annual figure of 7·23 lakhs maunds for the period, 1937-38 and 1939-40. In comparing the two sets of figures allowances have to be made on the one hand for *gul* produced on well irrigated lands in the tract which has to be added to our calculations and on the other for *gul* produced in such areas as Sinnar which cannot reach the stations in the irrigated tract. The two may be held to cancel each other. The main difference remaining is that owing to the transport by motor. As shown elsewhere, this takes up from 20 to 30 per cent. of the produce in the Kopargaon–Belapur area and a much larger percentage in the Rahuri area. In the light of these considerations our calculations of the average annual *gul* production of the area seem to be a good approximation.

The area under fruit trees has to be distributed between mature and immature orchards. When the area under fruit trees is stabilised the average area under immature orchards would be about a fifth or a sixth of the total orchard area. However, the area under fruit has been growing rapidly in recent years. A reference to Table No. 22 will show how the area under fruit trees in both the Rahuri and Kopargoan talukas, especially the latter, has grown after 1934–35.

The proportion of immature orchards was thus very high during the period to which our calculations refer. In view of the known data we have put the area under immature orchards at about 40 p. c. of the total orchard area. The calculations of the value of the produce of both immature and mature orchards are based on data presented in the tables regarding the working of these orchards. It will be noticed that we assume the entire area under fruit trees to be under oranges. This is an assumption that is for all practical purposes valid for the tract for the period under consideration.

Lucerne is harvested in periodical cuttings which are mostly fed to farm cattle. The production and its value are, therefore, difficult of evaluation. During the course of the survey elaborate enquiries were made from the growers of lucerne in the surveyed villages and estimates were obtained regarding the total yield during a year and its current market value. The estimates obtained through these were used in the survey schedules and the average figure of per acre income yielded by the survey results has been used in the calulations of the value of the gross produce of lucerne. The land under fodder crops has been treated as land under *Nilva* and the average per acre income of this crop on survey farms has been used for calculating the total income from fodder lands. The yields of wheat, jowar and bajri are those indicated by the working of the average sample farmer and the prices, as in all other cases, are the average wholesale prices that obtained during the period in the tract. It is difficult to make these calculations in regard to groundnut because of its many varieties and their differing yields and prices. The way out of these difficulties was to arrive at an approximation at a rough average of yields and prices of the important varieties.

TABLE NO. 23—*Estimated value of Gross Produce after Canal Irrigation.*

(1 maund = 64 Standard Seers of 80 tolas except in case of Groundnut where it is of 40 seers. 1 palla = 120 standard seers.)

Crop	Area† Acres	Produce per acre.	Total Produce	Rate	Value of Total Produce Rs.
Canal-Irrigated					
1. Individual Farmer Sugarcane	9,500*	37 Pallas	3,51,500 Pallas	@ Rs. 17 per Palla	59,75,500
2. Factory Plantation Sugarcane	9,000	...	2,80,000 Tons	„ Rs. 15 per ton	42,00,000
3. Fruit Trees:					
(i) Mature	1,500			„ Rs. 850 per acre	12,75,000
(ii) Immature	1,000			„ Rs. 160 „ „	1,60,000
4. Lucerne	2,100			„ Rs. 312 „ „	6,55,200
5. Jowar Grain	5,700	8 Maunds	45,600 Mds.	„ Rs. 3 per Md.	1,36,800
„ Fodder				„ Rs. 16 per acre	91,200
6. Wheat	2,500	7½ „	18,750 Mds.	„ Rs. 4·5 per Md.	84,375
7. Fodder	2,000			„ Rs. 80 per acre	1,60,000
8. Groundnut	2,300	20 „	46,000 Mds.	„ Rs. 3 per Md.	1,38,000
9. Bajri Grain	2,700	6 „	16,200 Mds.	„ Rs. 4 per Md.	64,800
10. „ Fodder				„ Rs. 7 per acre	18,900
11. Gram	3,000	5 „	15,000 Mds.	„ Rs. 4 per Md.	60,000
12. Cotton	2,000	3 Pallas	6,000 Pallas	„ Rs. 20 per Palla	1,20,000
13. Onions	1,200			„ Rs. 50 per acre	60,000
14. Miscellaneous	400			„ Rs. 50 per acre	20,000
Total	53,400‡				1,32,19,775

† 10,000 acres have been calculated to be under additional fallow and 16,000 acres as waterlogged reducing the total cultivated area of 80,000 acres to 53,400 acres.

* Crushed area only.

‡ Includes 9,500 acres, the standing sugarcane crop area.

Gram was treated more or less in the same manner as wheat, jowar, etc. For cotton the data yielded by the survey sample was thought to be too small. The yields have, therefore, been based on the results of supplementary enquiries over a larger area in the tract. The value of the produce of *tag* has not been computed because it is used as green manure and cannot be separately treated as income. This is the way in which it has also been treated in the survey results. While the costs of its production are entered, no income is calculated on its account. On the other hand, its value is also not added to the expenditure on manure. With regard to the group of garden crops such as onions, *methi*, chilli, etc. the data available in the survey related chiefly to onions in irrigated group I 1 and to *methi* in the other irrigated groups. A rough average of the per acre income indicated by these results has been used in calculating the total income of this group. The small acreage under other miscellaneous crops has all been lumped together and given an average income of Rs. 50 per acre. The total of the various items calculated in the manner set out above gives a value of gross produce of about Rs. 136 lakhs. This is as careful an estimate of the total gross produce of crops under irrigation as could be made in the circumstances.

Value of Produce without Irrigation: The task of preparing an estimate of the value of the gross production from the same tract in the absence of irrigation is, of course, much more difficult. Lack of data makes it necessary to make in this regard a number of assumptions not fully supported by evidence. However, the comparatively uniform result of values of yields makes the total margin of error arising from possible mistakes not potentially large. In making these calculations an initial estimate has to be made regarding the total acreage under crops. There is no evidence of any substantial acreage having been put under the plough subsequent to canal construction. On the other hand, there are two directions in which considerable areas which were cultivable and cultivated as dry areas are no longer so used. Very large areas have become useless owing to waterlogging since the beginning of intensive irrigation. These areas are separately shown as such in the land records and Table No. 24

TABLE NO. 24:—*Total Cultivated Area, Area under Canal and*

	Kopargaon		Rahuri		Sangamner	
	1939-40	1938-39	1939-40	1938-39	1939-40	1938-39
A Total Area under Crop	2,56,797	2,64,028	1,99,929	2,03,673	2,54,202	2,73,120
Double Cropped	6,857	8,927	4,930	4,530	4,684	9,131
Net Area under Crop	2,49,940	2,55,101	1,94,999	1,99,143	2,49,518	2,63,989
B Under Canal:						
(1) Total Cropped	32,668	53,651	20,067	14,787	2,755	2,528
(2) Double Cropped	4,869	3,932	831	995	482	320
(3) Net Total	27,769	49,719	19,236	13,792	2,273	2,208
C Under Well:						
(1) Total Cropped	6,062	4,013	10,846	8,220	7,878	8,428
(2) Double Cropped	809	718	768	765	1,537	1,311
(3) Net Total	5,253	3,295	10,078	7,455	6,341	7,117
D Cultivable fallow due to:—						
(1) Rotation	4,856	2,078	Not available	14,916	739	...
(2) Waste	...	10	,,	...	...	88
(3) Uncultivated owing to poverty of the cultivator	...	...	,,	...	2,669	...
(4) Under buildings	476	2,544	,,	649	221	...
(5) Untimely rains	...	...	,,	...	10,158	...
(6) Miscellaneous	3,042	2,592	,,	15,382	277	185
(7) Negligence	24,168	19,335	,,	...	32,778	27,276
(8) Disputes	...	...	,,	...	...	5,909
(9) Under trees	...	...	,,	...	...	...
(10) Under wells	134	208	,,	314	101	...
(11) Water-logged	10,331	12,586	,,	6,295	615	...
Total fallow	43,007	39,353	,,	37,556	47,558	33,458

Note:— Cultivable fallow was nil under the following heads: Grassland Under Nalas, Footpaths, Hardland and Saline lands.

under Well and Classification of Cultivable Fallow (In Acres).

Nevasa		Yeola		Sinnar		Total	
1939-40	1938-39	1939-40	1938-39	1939-40	1938-39	1939-40	1938-39
3,01,426	2,98,263	2,18,461	2,16,974	2,32,398	2,54,152	14,63,213	15,10,219
3,731	2,783	11,445	10,152	6,543	8,902	38,190	44,425
2,97,695	2,95,480	2,07,016	2,06,822	2,25,855	2,45,250	14,25,023	14,65,785
3,506	1,998	820	Not available	7,505	6,680	67,291	79,644
223	43	161	,,	1,999	906	8,565	6,196
3,283	1,955	659	,,	5,506	5,774	58,726	73,448
7,979	6,265	4,799	,,	7,329	6,436	44,893	33,362
1,018	708	716	,,	1,275	1,433	6,123	4,935
6,961	5,557	4,083	,,	6,054	5,003	38,770	28,427
...	...	315	40	7,079	6,294	12,989	23,328
...	...	...	...	...	...	...	98
6,401	...	214	323	...	...	9,284	323
...	...	110	108	92	93	899	3,394
...	697	...	...	18,411	10	28,569	707
258	104	188	259	...	...	3,765	18,522
26,200	34,469	1,012	1,167	57	40	84,215	82,287
101	...	...	...	...	...	101	5,909
...	22	...	...	...	...	...	22
...	...	125	129	60	60	420	711
1,279	1,608	...	...	17	18	12,242	20,507
34,239	36,900	1,964	2,026	25,716	6,515	1,52,484	1,55,808

Grazing, Grass, Cactus, etc., Under Roads, Uneven lands, Under mines.

gives details of the progress of waterlogging in the six talukas during the period. All the area now waterlogged must be treated for purposes of the calculation of the dry area income as cultivated.[11] Secondly, the sugar factories let almost all land under their control other than that under sugarcane lie fallow. This means that a large acreage which would under ordinary circumstances have been cultivated was not put under any crops during 1938–40. In the light of the figures of the fallow, etc. areas for the two years given in the tables relating to the working of the sugar factory plantations the area lost to cultivation on this account may be put in the neighbourhood of 10,000 acres. Making an allowance for both these factors we have to make calculations of produce regarding a dry cultivated area of approximately 80,000 acres as against 53,400 under existing conditions.[12]

After the determination of the total acreage, the next question is the hypothetical distribution of this acreage under the different crops. One way of treating this problem would be to take the distribution in the period prior to the construction of canals as indicating the pattern that might have persisted today. This, however, would not be satisfactory, as it would leave out of account important trends that have since been evident, as for example, that towards the increase in the areas under groundnut and cotton. In the table prepared by us the old dominance of wheat which was ever a feature of the economy of this tract has been retained but room has also been made for a hypothetical increase in the acreage in groundnut and cotton. Reference to Table No. 25 will show that the values of per acre yields of the different crops, worked out in the conditions postulated by us, are very similar and no material difference to

11. We follow the Land Revenue Department statistics in these calculations. No salt-affected lands are shown in these statistics for recent years. The *Report of the Irrigation Enquiry Committee* (1938), however, puts them at a high figure. (Statement No. 8) On that basis the allowance would have to be greater than the one actually made by us.

12. Another addition to this acreage that should be made is in respect of land lost to cultivation by being submerged because of the construction of the reservoir. This acreage was, however, not significantly large.

TABLE NO. 25—*Estimated value of Gross Produce under Dry and Well-Irrigated or purely Dry conditions.*

(1 maund = 64 standard seers of 80 tolas except in case of groundnut where it is of 40 seers. 1 palla = 120 standard seers.)

Crop	Area Acres	Produce per acre	Total Produce	Rate	Value of Total Produce Rs.
Dry only					
1. Wheat	25,000	3 Maunds	75,000 Mds.	„ Rs. 4·5 per Md.	3,37,500
2. Groundnut	15,000	8 „	1,20,000 Mds.	„ Rs. 3 per Md.	3,60,000
3. Gram	10,000	3 „	30,000 Mds.	„ Rs. 4 per Md.	1,20,000
4. Jowar Grain	10,000	3½ „	35,000 Mds.	„ Rs. 3 per Md.	1,05,000
„ Fodder				„ Rs. 8 per acre	80,000
5. Bajri Grain	10,000	2½ „	25,000 Mds.	„ Rs. 4 per Md.	1,00,000
„ Fodder				„ Rs. 3·5 per acre	35,000
6. Cotton	10,000	1 Palla	10,000 Pallas	„ Rs. 20 per Palla	2,00,000
Total	80,000				13,37,500
Dry and Well-Irrigated					
(a) *Well-Irrigated*					
1. Sugarcane	4,000	26 Pallas	1,04,000 Pallas	@ Rs. 17 per Palla	17,68,000
2. Fruit Trees					
(a) Mature	1,600			„ Rs. 800 per acre	12,80,000
(b) Immature	400			„ Rs. 150 per acre	60,000
3. Lucerne	2,000			„ Rs. 312 per acre	6,24,000
4. Jowar Grain	2,000	8 Maunds	16,000 Mds.	„ Rs. 3 per Md.	48,000
„ Fodder				„ Rs. 16 per acre	32,009
5. Wheat	3,000	7½ „	2,250 Mds.	„ Rs. 4·5 per Md.	10,125
Total	13,000				38,22,125
(b) *Dry*	67,000				11,20,156
Total (a) & (b)	80,000				49,42,281

the total calculations would be made by even a considerable variation from our hypothetical distribution.

The yields that we have assumed in the calculations are not the average yields of the dry group area in our sample. For obvious reasons the lands not under command of the canals in tracts contiguous to the irrigated area are on an average inferior in quality to lands under the canals Sometimes, the contrast is very great; for example, that between lands of Rahata and Shirdi of which a sample is included in our irrigated group I 3 and the lands of Kohrala and Kakadi, our dry group D 3. In general the degree of the difference in quality is indicated by the difference in the average assessments of the lands of the various villages. In Kopargaon, where the whole taluka forms one group for assessment purposes, with one set of standard rates, the comparison is easily made. Instead of basing ourselves, however, on the dry group area yields and then making these allowances in relation to soil assessment we have relied on the data of yields of the areas under dry crops in the irrigated groups themselves. The calculations that we have to make relate to dry conditions in the area now irrigated. Therefore, it was thought better to rely on data relating to the present dry conditions in this area. It must, however, be conceded that with the more liberal use of manure, etc. for irrigated crops the yields of dry crops might have slightly increased in this area because of the residual effect. There is, on the other hand, the consideration of the possibility of some exhaustion of the soil on account of more intensive cultivation. On a balance of considerations, the yield of dry crops in the irrigated area was thought to be the most satisfactory basis and it has been used for calculations of yields in the hypothetical calculations. The prices used are the same as those assumed in the table relating to the value of produce of irrigated crops. The difference between the values gives a measure of the value of the increased gross produce due to irrigation.

These calculations assume that the entire area which is at present irrigated would have been cultivated as dry area in the absence of canals. This assumption, however, is not completely justified. There has been a tendency in recent decades for an increase in the area under well irrigation in

tracts where no irrigation was available through other means and where suitable sub-soil water supply existed. Even in the tract now under irrigation there existed formerly a certain extent of well irrigation which has declined owing to the availability of the supply of water from canals. We must in our calculations, therefore, allow for some land that would have been irrigated by well water and the value of the gross produce of such lands. It is very difficult to attempt to estimate the area that would have been irrigated by wells under these hypothetical conditions. The sub-soil water supply in Kopargaon and Rahuri talukas was never very plentiful, and well irrigation in these parts was, in the main, treated as a reserve for the years in which the rainfall was scanty.[13] Only a restricted area in both these talukas was, previous to irrigation, under crops requiring water supply for the whole year such as sugarcane, fruit trees, etc. The available statistical material does not afford any basis for a proper estimate of the possibilities of the development of well irrigation in this tract. If the effects of years of deficient rainfall are eliminated, Appendix B–1 of both Mr. Ghosal's and Mr. Garret's reports would indicate that in both the Kopargaon and the Rahuri talukas the stable level of acreage under well irrigation was about 3,000 acres in each taluka at the periods to which these tables refer. However, during the decades that have since passed a very considerable increase in well irrigation has taken place in these talukas in the area outside the command of the canals. A striking feature of this development has been the area under oranges irrigated by wells in the Rahuri taluka.

On a rough guess, therefore, the hypothetical extent of well irrigation that might have existed today in the irrigated tract has been put by us at about 13,000 acres. We indicate in Table No. 25 a possible distribution of this acreage and calculate the value of the gross produce that might have been grown on it. In these calculations we have, for the figures of yields of *gul* and the income per acre from fruit trees, followed the averages afforded by the data for *motasthal* lands included

13. See para 20 of Mr. J. Ghosal's report of the Second Revision Settlement of the Kopargaon Taluka, (1907) and para 8 of Mr. J. H. Garret's report of the Second Revision Settlement of the Rahuri Taluka, (1921)).

in our survey. For lucerne, wheat and jowar the yields of canal irrigation and *motasthal* have been taken to be identical. In calculating the difference between the gross produce of the irrigated lands and the hypothetical dry area with this extent of well irrigation, a deduction will have to be made from the total produce of the dry acreage as calculated above in respect of the acreage, 13,000 acres, now treated as under well irrigation. On making this deduction the increment of value

SUMMARY OF TABLES 23 & 25

	Area Acres	Total value of Produce Rs.
I Canal Irrigated	53,400	1,32,19,775
II All Dry	80,000	13,37,500
III Dry and Well irrigated	(Dry) 67,000 + (Well) 13,000	49,42,281
I Minus II		1,18,82,275
II Minus III		82,77,494

of gross produce brought about by irrigation is indicated to be Rs. 82,77,494. This may be treated as the final measure of the direct effects of the Godavari and the Pravara Canal systems.

It will be noted that the calculation above refers only to income from crop production. It does not take into account income from livestock produce. This is because the direct effect of irrigation has been almost wholly to increase crop production and the larger size of the livestock economy is merely the result of the demand for more cattle which is the result of more intensive cultivation and the possibility of maintaining the increased livestock due to the increased supplies of fodder. To add the income from livestock to the crop income would, therefore, be in the nature of double counting.

The calculations regarding the value of gross produce refer to the specific period 1938–39 and 1939–40. This period differed in many respects from the years preceding it. The general level of the prices of agricultural produce was more favourable

to the cultivator at this time than it had been for, say, the previous 10 years. And as a result of the favourable prices of *gul* and fruit, the areas under both these paying crops had recently increased to a very considerable extent. The calculation made in this report thus puts the effects of irrigation in a quantitatively more favourable light than at almost any other period since the construction of the canal system, except perhaps the period immediately after the war of 1914–18. It is not intended to enquire into the fluctuations of the value of gross produce from period to period chiefly because of the lack of adequate statistical data. It would also serve no purpose to try and attempt an estimate of average or normal effects. During the inter-war decades price levels and price parities changed so often and to such a large extent that the concept of the average or of a normal period was not of much validity. It must be emphasized, in view of these considerations, that the extent and the nature of the effects of irrigation depend a great deal on the distribution of crops in the irrigated area and on the prices obtained for them. It will be indicated later that the extent of the indirect and secondary effects are also greatly dependent on both these factors. The fluctuations in the prices of individual crops and the acreages under them cause large variations in the gross income of the farmers. The variations in their net income caused by these fluctuations are even larger. The costs of cultivation of the irrigator are to a very considerable degree rigid. His residual income, therefore, fluctuates much more violently than his gross receipts. It is necessary to bear this in mind in estimating the effects of irrigation on the standard of living of the irrigator. This standard of living is ordinarily adjusted to long term trends and it is, therefore, not to be judged by the exceptional level of farm investment incomes reflected in our survey data.

Effects on Investment and Employment

We have stated in the introductory analysis that the gross crop production is the joint result of the operation of the irrigation system and the additional investment and additional employment in crop production made possible by it. Among the direct effects of irrigation are, therefore, to be counted these additional investment and employ-

ment opportunities.) It is now necessary, if possible, to frame an estimate of their extent. It will be seen that there are considerable difficulties in the way of framing such an estimate. Only an exhaustive inquiry into the investment made by each irrigator and the employment afforded by him can give a fully reliable measure. This being impossible we have to see whether a workable estimate can be framed with the help of our survey data. The total field of irrigation has been divided by us into 3 sections: (i) the sugar factory plantations, (ii) the orange orchards and (iii) other irrigated farming. The data regarding the investment of sugar factory plantations to date and the employment currently offered by them were more or less completely available to us. It might be possible with regard to orange orchards to make calculations regarding both these items from the standard estimates prepared by us. A review of the data given for orange orchards under well-irrigation will show that the scope for investment and employment afforded by an orchard under canals is distinctly less than that under a well. Additional investment and employment on account of orange orchards under canals could thus be presumed only if it is supposed that the area brought under fruits after construction of canals would have, in their absence, been under dry cultivation. If, however, it is presumed to have been diverted from oranges under wells there would be a shrinkage in both investment and employment as a result of the construction of canals. Because of this consideration we neglect the orchards altogether in these calculations.

The main difficulty is in respect of the other irrigated acreage under the annual and biennial crops. In this respect the data for the farmers in the irrigated groups are the only material on which we have to work. Confining one's attention to the irrigated crops cultivated by these farmers it will be seen that they represent a somewhat varying percentage of the total irrigated acreage under the different crops. The total area under irrigation for the years 1938-39 and 1939-40 included in our sample represents less than 3 per cent. of the total assumed in our calculations. On the other hand, the area included in our sample represents almost 4 per cent. of the total area under such

important crops as sugarcane and lucerne. For the more valuable crops the sample represents an area approximately 4 p. c. of the total irrigated and its deficiency lies chiefly in respect of the less valuable crops. Our sample also contains an element of dry farming and the costs and the incomes of both these are included in our data. The overwhelmingly important items on both the income and the expenditure sides are those relating to the raising and disposal of such crops as sugarcane and lucerne. The exclusion of the element of dry farming would not make any substantial difference to the data of this intensive farming ; however, it might be considered to make up for the deficiency in the sample proportions of the minor cereal and other irrigated crops indicated above. We, therefore, consider that it would not be misleading to treat of the total survey data relating to the irrigated groups I 2, I 3, and I 4 as representing a sample of about 3·5 per cent. of the total irrigated area and to base the estimates of total investment, employment and outlay for the whole area on this assumption. This would mean that we consider the total irrigated area occupied under individual farms, other than orange orchards, as being constituted of 4000 units of average farmers of the type of the average of the 142 farms covered by our survey. This number of 4000 is not to be taken to represent an estimate of the actual number of irrigators' businesses but merely gives a measure for coverting the survey data into estimates for the entire irrigated area.

A beginning in these calculations might be made with an estimate of the investment effects of irrigation. What is necessary to estimate is the additional investment made possible by irrigation. For estimating the difference made to investment by irrigation it is legitimate to use the figures relating to dry groups D 2, D 3, and D 4 included in our study. It has been pointed out that the main difference between the dry area which is represented in our study and the present irrigated area as it might have existed in the absence of irrigation lies in the quality of the soil. But differences in quality of soil do not lead to differences in such investment as in buildings, livestock or implements which are uniform in character over varying qualities of soils. The average of the investment of

the dry farmers in the three dry groups may, therefore, be taken to represent the average investment that would have been made by the farmer in the irrigated area if it had been dry. The present average investment of the farmer in the irrigated area is greater roughly by about Rs. 200 per unit than the corresponding figure for the dry area. On the basis indicated above this would give us a figure of about Rs. 8 lakhs as the additional investment of individual farmers over the entire irrigated area excluding orange orchards and factory plantations.

Among the investment possibilities and capital requirements of irrigation farming the investment in permanent or semi-permanent capital instruments plays a minor role. The main capital requirements in the type of farming practised in this area are those of working capital. An estimate of these requirements is, however, even more difficult than that of the permanent investment. We have almost no information on this point and have, therefore, to proceed by assuming the existence of a relation between annual expenditure and working capital needs. It is common in some countries to assume that the working capital requirements of a farm business are equal to half the total expenditure of the business during the year. In making assumptions of this character under Indian conditions an allowance must be made for consumption in the business itself of produce of farm and for the payments in kind. Both these do not necessitate a holding of working capital. The basis of our calculations in this respect must, therefore, be the total requirements for cash outlay of the farm business during the year. These consist chiefly of the payment of land revenue, the water charge, the rent paid in cash, the cash outlay on materials and labour and the processing and marketing expenses. These amounted on an average to about Rs. 1,300 per unit for the irrigated farms. In order to compute the total requirements of working capital of the irrigated area it is necessary to estimate what proportion of the total cash outlay during the year the farmer must hold as working capital. The sugarcane crop which is the main cash crop has a long period of maturity and the cash income from it is all obtained at the end of the period after the crop has been finally processed and

marketed. It is true that the entire area under sugarcane of each farmer is not planted at the same time; so that, during each crushing season he crushes roughly half of the total area of his standing sugarcane crop. Even so he has to carry the expenses of the new plantations and the non-crushed standing crop through the larger part of the year. It is, as a matter of fact, a common practice with sugarcane farmers to draw upon the wholesaler with whom they store their *gul* for their requirements of working capital in the shape of oil cake, etc. The proceeds of the sale of *gul* in one season thus provide for the cash outlay during the greater part of the succeeding year. It would, therefore, appear that the requirements of working capital of the irrigator producing *gul* would ordinarily amount to more than half of his total cash expenditure requirements during the year. On the other hand, the grower of crops like vegetables could do with less than half year's cash expenditure. The working capital requirements per unit may, on a rough guess, be put at about Rs. 800 and would amount for the whole area to about Rs. 32 lakhs.

We made no inquiries regarding the source from which the requirements of the invested capital and working capital of the farmers in the tract were met. To a large extent the development of intensive irrigation in the tract has been a gradual process. Apart from those who arrived newly with ample capital resources, or those who had previous resources of their own to draw upon, the irrigators started intensive farming, such as that of sugarcane, on a small scale; and it was gradually with widened capital resources as a result of the profits of this farming that they increased this area. Thus the growth of the area of intensive cultivation was gradually brought about from out of the small beginnings of the early years. The process was a cumulative one and gathered momentum with better prices and larger areas under sugarcane. To a substantial extent, therefore, the present capital resources of the farmers of this area may be said to have been built up from the savings of previous years. They thus represent in themselves the lasting effects of irrigation.

The inclusion of land values in investment is another problem that requires consideration. It is undoubted that

values of cultivable land under command of canals have increased very considerably during the last 25 years. The general development of the tract has also led to a large rise in the rents and prices of sites in trade centres. Should all this increment be included in the calculation of the increase of income? In the first instance, the preparation of land for receiving the water supply had cost old holders of land no significant additional amounts. Further, no investment was made by them other than the cultivating expenses necessary to reap advantage of the new water supply facilities. To holders of land before the construction of the canals the increment in land values represented purely unearned increment involving almost no capital expenditure. For them it would be wrong to treat of the land values as representing additional investment. The later purchasers no doubt invested capital to the extent of the increased land values in purchase of land. This also went to the old owners in return of the accidental increase in the values of their rights and did not result in adding in any manner to pre-existing capital resources, invested in land, in the tract. Finally, the increase in land prices or rents is merely the result of the increased capacity of land to yield incomes and the extent of this increase is related to the extent of the increase in incomes. It would, therefore, be double counting to reckon in both the increased values and the increased incomes. The latter is the important primary fact. The former merely results from it. We have, therefore, neglected increased land values in all our calculations.

The direct employment given by irrigation enterprises may be considered as before under the various headings of family labour, permanent hired labour and casual and contract labour. It has been indicated above that average employment afforded to family labour by irrigated farming is not appreciably greater than that afforded by dry farming. Making some allowance for the fact that the farms included in our dry group D 3 were specially extensive and absorbed an unusual number of units of family labour, the increment brought about by irrigation in the employment of family labour may be placed at about 20 to 25 per cent. of that required in dry farming. Thus, while the average dry farm employed approximately 1·2 units of family

labour per annum the irrigated farm would give employment to about 1·5 units. The former estimate refers mainly to conditions of dry farming. If, however, any substantial part of the area is under well irrigation the difference between the units of family labour employed by the two types would be negligible.

Another question which must be considered in this connection is whether the total number of farming units in the tract has increased because of the advent of irrigation. If there has been such an increase it would amount to an additional absorption, to that extent, of family labour units in farming. We have little information in this regard. Statistical data regarding merely the number of irrigators or the number of landholders would not enable us to reach any conclusions on this question. What is necessary to determine is whether the average farming unit in the area has decreased in size because of canal irrigation. The general impressions gathered from statistics or from observation do not point to any such increase. An increase of this type would be possible only under two sets of circumstances: (i) If any considerable migration of new farming elements occurred into the tract and these were accommodated by a partial renting of lands by the old occupants who also continued to be farmers, or (ii) if a more rapid progress of the subdivision of holdings was made possible by irrigation. The time that has elapsed since the construction of canals hardly covers the life of a generation. No great progress in the latter direction was, therefore, possible; it has not also been evident. As to the former possibility there is no doubt that some measure of immigration into the tract has taken place, especially of members of the community called Saswad Mali, well known for their proficiency in irrigated farming. A measure of this immigration is, however, very difficult to obtain. Only a small percentage, less than 10, of the farmers included in our sample were new migrants. This does not necessarily indicate the extent of immigration. However, it is generally observed that the new migrants tend to rent out not parts of but the entire holdings of the old landholders. Thus immigration does not necessarily result in an increase in the total number of farmers. It rather

leads to a small displacement of the older landholders by the immigrant element. Broadly, therefore, it would seem that neither in the employment of units of family labour nor by way of an addition to the total number of farming units has irrigation affected the volume of employment in a substantial measure. As has been pointed out above, the degree of continuity of, and the quality of labour and the remuneration for it, afforded by farming to the operator and his family have no doubt changed very much for the better because of irrigation.

The employment of permanent farm servants has increased substantially on account of irrigation. Table No. 10 showing the number of farm servants employed on the sample farms indicates that the average employment of farm servants on dry farms was about 0·3 per farm. The similar proportion was nearly 1·3 on irrigated farms. Therefore, on an average irrigation led to an increase of the employment of one man-unit per farm as a permanent farm servant. This would mean that on our assumed basis irrigation afforded additional permanent farm employment to about 4,000 persons in the tract. With regard to the employment of casual and contract labour we have no measure of the employment of persons similar to that available for permanent farm servants. All that we can do, in their case, is to estimate the total outlay on wages and convert it on some hypothetical standard rates into day-labour units. The average expenditure on hired labour per unit of the farms studied was Rs. 195·6 and its excess over the average expenditure of dry units was Rs. 132·5. Thus the total expenditure on such hired labour for the whole area may be put at about Rs. 5·3 lakhs. The calculations of employment made above do not include the employment afforded during the course of processing and marketing the produce. The major activity under this head is the manufacture of *gul* and it would be convenient to treat of this activity by itself.

The Manufacture of *Gul*

The classification of the manufacture of *gul* whether as a direct, indirect, or secondary effect of irrigation is an interesting problem by itself. Sugarcane is readily saleable only when converted into the form of *gul*. This

conversion has to be undertaken by the farmer himself. It is, therefore, an activity which forms part of the business of farming and which must necessarily precede the obtaining of the final income from the produce. Also, a small proportion of farmers conduct the business of the conversion of *gul* on their own premises closely integrated with the farming business. This activity may in such cases be considered as arising directly out of the construction of canals. In a majority of cases, however, the conversion of *gul* is not undertaken by the individual farmer. If the agricultural operations are reckoned as ending with the final maturity and cutting of the sugarcane crop and hauling it to the place where it is converted, (as we have treated it in the case of factory plantations) then the manufacture of *gul* becomes a secondary effect following upon the completion of the primary agricultural operation. In some cases, especially that of power crusher factories in the area, the business of *gul* manufacture is divorced almost entirely from agricultural operations. It is then conducted as a paid service performed for the agriculturist by an outside agency. The farmer gets his produce processed in this manner before it finally passes out of his hands. From this point of view the activity of *gul* manufacture might be considered an indirect effect of the agricultural operations.

However we classify it, the manufacture of *gul* is an activity which is of considerable importance in the tract and is vital to its economy. *Gul* is manufactured in the tract by two sets of agencies: (i) factories having a crusher equipment driven by mechanical power and (ii) bullock driven units owned by individual farmers. The *gul* factories of type (i) are usually owned by persons holding a considerable acreage under sugarcane who use their equipment primarily for the conversion of the sugarcane from their farms into *gul;* but they also manufacture *gul* for other farmers in the area. Occasionally a *gul* factory might be owned even by persons having no farming interest of their own. The bullock driven units are invariably owned by sugarcane farmers. Even they, however, do a considerable amount of work for farmers other than the owner of the unit. In the case of *gul* factories the charge

made by the factory for converting the sugarcane crop of an outsider is usally at the rate of so much per unit of work. The entire capital and labour equipment in this case is that of the owner of the *gul* factory. The farmer brings the sugarcane to the factory and takes away the *gul*. With the bullock driven crushers the owner of the equipment does not operate it for others. Here, the crusher and the accessory equipment is hired out for so much per day. The farmer hiring the equipment uses his own bullocks and incurs the additional necessary expenditure on materials, etc. The labourers working the equipment and manufacturing the *gul* are usually a team who work primarily for the owner of the equipment, but their services are ordinarily available on the same terms to others who hire it from time to time.

All the power driven factories had a complement of more than 10 workers and were, therefore, included under the administration of the Factories' Act. Information relating to these factories is available classified by districts. Table No. 26 gives the data relating to *gul* factories for the years 1939 and 1940 for the districts of Nasik and Ahmednagar.

TABLE NO. 26:—*Data relating to Gul Factories*

District	1939			1940		
	No. of factories	No. of workers	Wages paid Rs.	No. of factories	No. of workers	Wages paid Rs.
Nasik ...	6	131	6,850	7 1*	173 13*	12,643
Ahmednagar ...	73 4*	2,043	1,00,213 48*	107 8*	2777 126*	1,60,145

* Indicates number of certain small factories brought under the administration of the Act by a recent (1939) notification. The statistics relating to wages do not take account of wages received by employees of these factories.

It could not be ascertained whether all the factories included in this table served the area of the Godavari and the

Pravara canals. A *gul* factory becomes a possibility only in areas where large acreages are put under sugarcane. It may, therefore, be taken for granted that no *gul* factories could be established outside the compact, intensively cultivated tract under the Godavari and the Pravara canals and that all the factories for which the statistics are given above, operate in the area under consideration. The information regarding the total number of bullock-driven crushers is not available for an equally recent period. Among the agricultural statistics is included a quinquennial census of agricultural dead-stock which gives information relating to the number of cane crushers. The latest available figures of this type before the year 1939–40, are for 1937–38. Table No. 27 gives the figures for the talukas covered by the Godavari and the Pravara system.

TABLE NO. 27 :—*Number of Cane Crushers driven by Bullocks in rural areas (1937–38).*

Taluka	Crushers driven by Bullocks	
	Iron	Wooden
Kopargaon ...	285	...
Rahuri ...	202	...
Sangamner ...	17	2
Nevasa ...	60	4
Yeola ...	35	37
Sinnar ...	133	...
Total ...	732	43

The Sangamner figures have been omitted as that taluka shows no crushers in the rural area. With regard to the total Sinnar figure, which is 133, only about a quarter of it may be taken as relating to the area with which we are concerned.

In this taluka about three quarters of the area under sugarcane is irrigated by wells and only a quarter by first class Government canals. The cane crushers in talukas other than Sinnar also serve areas under well irrigation. As a matter of fact because of the scattered character of the planting of sugarcane under wells, the numbers of units necessary to serve the well irrigated areas is larger than the corresponding number required for an equal area under canals. The *gul* factories might possibly crush some cane grown under well irrigation. However, these factories are all concentrated round Kopargaon and Belapur and there is little cane area under wells near this area. The work performed by the power crushers may, therefore, be taken to relate, all of it, to the canal area.

It is very difficult to say what proportion of the total cane crop is crushed by *gul* factories and bullock driven crushers respectively. We made some enquiries in order to ascertain the volume of business done at the *gul* factories and detailed information was also obtained from four such factories in the neighbourhood of Kopargaon. A full account of these factories is also available in Part II relating to Seasonal Factories of the Report of the General Wage Census conducted by the Labour Office of the Government of Bombay.[14] From the information obtained by us and that contained in the report of the wage census it would appear that the wage charges per *adhan*[15] in the *gul* factories amount on an average to As. 12. The statistics contained in the table relating to these factories inserted above gives information regarding the total amount paid in wages by 72 factories in 1939 and 107 factories in 1940. An *adhan* usually contains one and one quarter *palla* of *gul*. And if the outturn of *gul* per acre is taken at our average figure of 37 *pallas* per acre, the total production of *gul* of these factories would cover the produce of 6,300 acres of sugarcane. This gives somewhat over 63 acres per *gul* factory. At the rate of two days per acre this would give an average working period of 126 days or 21 weeks. This period tallies with the average working period reported to us and also that given in the report of the Wage

14. Pages 63 to 74 (1939).

15. *Adhan* = conversion of a pan full of cane juice.

Census. It may be noted that the assumption that the average factory requires two days to crush one acre of cane is based on information collected by us. This works out at an average of about 55 maunds of *gul* per day per factory. The corresponding figure given by the Wage Census is 77 maunds. This would represent, according to our information, the average not for the entire working period but only for the shorter period during which the factories work at their full. The disbursement in wages made by the factories have already been noted above and the details regarding the composition of workers in the factory may be seen in the report of the Wage Census.

The other important outlay made by the factory is the expenditure on account of materials required chiefly in connection with the generation of power, such as crude oil, lubricating oil, kerosene, grease, etc. According to our information, this averages at about Rs. 6 per day or roughly As. 6 per *adhan* and would thus reach a total of about half of the total wage bill. The investment in equipment etc. of these factories has been put in the report of Wage Census at about Rs. 6,000 per unit. The four units we enquired into reported an average investment of Rs. 7,000. The total investment on this account in the area may thus be put in the neighbourhood of Rs. 7 lakhs. Only a certain portion of this equipment is in durable machinery and a large part of it consists of accessories, utensils and implements which have to be replaced at fairly frequent intervals. These, therefore, give rise to a considerable demand for the products of the iron, hardware and machine industries. The usual charge made for the manufacture of gul by these factories is Rs. 2–8–0 per *adhan*. The wage statistics in the table do not cover a small number of the factories recently brought under the Act. We assume that the acreage covered by this group of factories will roughly equal 200 acres giving a total of 6500 acres for all the *gul* factories worked with power driven machinery.

This leaves us from our average figure of 9,500 acres an acreage of 3,000 as having been crushed by bullock–driven cane crushers. There is no way of determining how many of the total of such crushers were utilised for the canal and the well irrigated area respectively. If we make an assumption that an average of