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SUMMARIES

A FUTURE POLICY WITH RESPECT TO IRRIGATION WATER MANAGEMENT

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Irrigation water being the key input in agricultural production, a large amount of public funds was invested in irrigation projects in different Five Year Plans and the irrigation potential was increased from 22.6 million hectares in 1950-51 to 65.7 million hectares in 1983-84. But the agricultural production could not be increased as per expectation and the gap between irrigation potential created and its actual utilisation widened over time. On the other hand, the outlay needed per hectare for the creation of irrigation potential increased tremendously. Therefore, in the Sixth Five Year Plan, more emphasis was placed on better utilisation of existing irrigation potential than on creating new ones. With this in view, the Command Area Development Authorities were established in the major irrigation projects to undertake various On-Farm Development activities to improve the efficiency of irrigation water. But the performance in this respect has been unsatisfactory.

The main reasons for this seem to be (*i*) ambiguity in various concepts used in policy measures and guidelines, (*ii*) lack of right perception of the purpose behind various policy measures and jobs to be done by implementing agencies, (*iii*) non-acceptance of realities (and showing false performance), (*iv*) lack of information and knowledge required to do the jobs, (*v*) non-identification of proper research needs, and (*vi*) social factors.

The following points are, therefore, suggested to be incorporated into future policy with respect to irrigation water management and its implementation:

Attempt should be made to standardise the ambiguous concepts like 'irrigation potential', 'irrigated area', etc., using the scientific and logical criteria. The persons involved in policy making at the top level should visit the command areas to personally explain the policy measures and the objectives behind them to the command area staff upto the level of field staff to enable them to perceive the things in right prospect. The help of scientists trained in specific aspects may also be sought in this. This will help the policy makers also by making them acquainted with field problems. If the irrigation system is not working satisfactorily at some point, the actual problem and reasons should be brought to light so that a practical solution for the same may be found out, rather than ignoring it and do false reporting to show satisfactory working. Before assigning some job to the field staff it should be ensured that they know the scientific procedure for that job, use that procedure and main-

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tain proper record of the same. The scientists must play an important role in imparting such training and guiding the field staff at field level. The information needed for improving the irrigation water management through systems approach should be identified and listed and a sound network for collecting and maintaining this information should be developed in the command areas. The information which is to be generated through research should be fed to the institutions concerned with research such as I.C.A.R, Central Water Commission and Central Board of Irrigation and Power, etc., so that they may invite and finance research proposals on these aspects. More strict vigil should be kept on illegal and corrupt practices by irrigation officials and farmers. Necessary training should be imparted to them for developing thinking of social interest rather than self-interest. The evaluation of performance of the project should be based on the survey of beneficiaries by an impartial agency and not on the basis of official records.

PROBLEMS OF UNDER-UTILISATION OF CREATED IRRIGATION POTENTIALS—A CASE STUDY OF WEST BENGAL AND BIHAR

S. K. Datta, S. Bhattacharjee, R. C. Mondal and D. K. Bagchi†

The paper analyses the problem of under-utilisation of created irrigation potentials at the farm level on the basis of cross-section data randomly collected from the Sone Command Area of Bihar and a tubewell irrigated area of West Bengal by the Agro-Economic Research Centre, Visva-Bharati. The paper modifies the Prasad-Appu measure of utilisation as area under irrigation-intensive crops as percentage of total irrigated area and calculates it separately for each season. Both irrigation utilisation indices and yield rates of major crops have been analysed in order to bring out the socio-economic and institutional factors which are impeding the optimum utilisation of created irrigation potentials.

Three types of hypotheses have been tested. The semi-feudalism hypothesis mainly associated with the earlier works of Prasad and Appu have been tested by looking at the behaviour of utilisation indices in response to changes in irrigated owned area and irrigated operated area and also by looking at the variations in the utilisation indices across owner-operated and tenant-operated farms. Although this hypothesis is not clearly confirmed, the need for land reforms is still highlighted from the available results. The complementary inputs hypothesis which highlights the importance of complementary modern inputs like field channels, fertilisers and credit has been tested using caste as a proxy for households' access to the market for these resources and also using scatteredness of land holdings as a measure of success of the much needed land consolidation programmes in this con-

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text. Confirmation of this hypothesis calls for institutional reforms which go beyond the scope of simple land reforms. The quality of irrigation hypothesis highlights the importance of the nature of irrigation device, namely, whether the source of supply is a centralised or a relatively decentralised one, and also several other attributes of supply like the geographic location of the beneficiaries, and steadiness, prior assurance and adequacy of supply. Confirmation of the various dimensions of this last hypothesis obviously calls for not only development of an appropriate portfolio of irrigation systems but also a complete overhauling of the management system with respect to centralised sources of irrigation.

POLICIES FOR MANAGEMENT OF SYSTEM TANKS

M. Sivanantham and S. Varadarajan*

Tank irrigation system served nearly 30 per cent of the net irrigated area in Tamil Nadu. The majority of the tanks are centuries old. In pre-colonial times, they were managed by village community largely with social participation of people and little intervention by the government. Involvement of local people ensured proper maintenance and efficiency in the management of tanks with collective responsibility and mutual benefit. Today the rights and duties in the maintenance of tanks continue to remain separated and it is at the cost of efficiency in the use of available water supply. This situation finds a remedy through better management and involvement of the people. A comprehensive plan allowing for participation of farmers in the management of system tanks and a definite technical programme to regulate the supply are suggested policies. Development and effective functioning of a farmers' organisation named 'water *manyam*' is suggested as an effective instrument to implement the plan.

MANAGEMENT OF IRRIGATION WATER THROUGH LINING OF FIELD CHANNELS IN SEMI-ARID ZONE OF HARYANA

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In order to reduce the huge water losses occurring in conveyance and to make rational use of water for avoiding waterlogging, etc., Haryana Government has taken a project on lining of water courses with the help of World Bank and other institutions. The present study is an attempt to make an economic analysis of lining of field channels. Rohtak district was selected which has acute problem of waterlogging and salanity. Further, 12 villages were selected from three tehsils. From each village,

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a sample of 8 farmers was drawn, thus, making a total sample of 96 farmers. The study revealed that the area under crops wheat, sugarcane, berseem and jowar has increased on lined farms and the area under bajra, guar, *desi* cotton, gram, rapeseed and mustard which are mostly rainfed and less intensive crops has decreased. There was a shift of 7.63 percentage points in cropping intensity from unlined to lined farms. It was also found that the requirement of human labour, bullock labour, tractor hours, NPK has increased to 16.38 man-days, 19 hours, 2.5 hours and 10.9 kg. per hectare respectively on the lined farms over the unlined farms. The net returns increased by Rs. 349 per hectare on the lined farms over the unlined farms. The lining cost per hectare was Rs. 258. Benefit-cost ratio was 1.35 : 1. Water efficiency also increased to 162 per cent from unlined to lined farms. It is concluded that lining of field channels is an economical and a viable project resulting in saving of scarce agricultural resource and overall improvement of the economy.

STUDY OF WATER ALLOCATION IN COMMAND AREA OF JAYAKWADI PROJECT (MAHARASHTRA)

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The study of water allocation in Jayakwadi command area in Maharashtra aimed at developing optimum crop plans both at existing and improved levels of technology. Linear programming technique was used to develop optimum plans. The results revealed that the area under *kharif* jowar, cotton and sugarcane increased in optimum plans while *rabi* jowar and wheat area declined. New oilseed crops like sunflower performed well in the command area. The crops like sugarcane, summer groundnut and cotton which require water in large quantity appeared in the plan to the extent of 69 per cent. The study of water utilisation indicated that the available water was fully utilised in August, October, November, December, January, April and May exhibiting scarcity of water at the existing level of technology while at the improved level of technology water was scarce during August, October, February, March, and April. The marginal value productivity (MVP) of *kharif* deep land was Rs. 111.87 per hectare while the MVP of September water was highest at Rs. 21.66 per ha. mm. of water followed by August irrigation (Rs. 21.03), December (Rs. 12.55) and March (Rs. 8.79) at the existing level. At the improved level the MVP of October irrigation was highest (Rs. 38.68) followed by August (Rs. 19.97), April (Rs. 10.62) and February (Rs. 8.53). The study indicates the need to revise the pattern of water distribution policy so as to maximise the efficiency of available water.

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COMPARATIVE ANALYSIS OF DRIP AND FURROW METHODS OF IRRIGATION

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The paper attempts to study the effect of same amount of water on the yield of tomato under drip and furrow methods of irrigation and to work out the economics of these methods of crop production, based on experimental data in a carefully laid out experiment conducted in the research farm of the Water Technology Centre of Indian Agricultural Research Institute, New Delhi during the years 1980-81 and 1981-82.

The total yield obtained for test crop 1 (summer) was 964.9 kg. in drip irrigated plots or 35.739 tonnes per hectare and that obtained from furrow irrigated plots was 790.8 kg. or 23.42 tonnes per hectare. This indicates an increase of yield by 52.5 per cent in drip irrigated plots over the furrow irrigated plots under an identical amount of water supply. In the case of test crop II (winter), the total yield obtained was 397.2 kg. or 14.711 tonnes per hectare in drip irrigated plots and 349.12 kg. or 10.34 tonnes per hectare for furrow irrigated area, representing an increase of 42.3 per cent in drip irrigated plots over the plots irrigated by furrow methods. The yield difference between the plant rows and water application rates in drip as well as in furrow irrigation system shows that there is not much difference in the crop yield within plant rows in each replication of drip irrigation system. However, there has been a gradual reduction in crop yield obtained with the increase in water application rates. The drip irrigation method can be more economical, if the prices of tomato are increased and made remunerative. It also depends on the saving of water and its price. Water saving is much more in the case of drip irrigation as compared to furrow irrigation. Drip irrigation is more economic than furrow irrigation because it does not require land levelling.

TANK IRRIGATION IN CHHATTISGARH REGION: MANAGEMENT AND POLICY ISSUES

Dinesh K. Marothia*

An attempt has been made in this paper to work out the economics of tank irrigation, to analyse the organisation and management aspects of tanks and to suggest policy alternatives for the improvement and future expansion of tank irrigation in Chhattisgarh region. For the purpose of this study, 18 village tanks (micro-minor irrigation tanks)—eight primary and

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ten supplemental—were selected from the three blocks, namely, Arang, Dhamtari and Dharsiwa of Raipur district of Chhattisgarh region. Primary tanks are those which have adequate water supply in most of the years and supplemental tanks are those that have just enough water to irrigate one *kharif* paddy crop. Eighty and 120 farmers were randomly selected from those served by the eight primary and ten supplemental tanks respectively. A sample of 100 farmers under rainfed conditions was also randomly selected from the same area where tanks are located to have a comparative picture of tank irrigation and rainfed farming. Information about village tanks was collected from the office of the soil conservation, Department of Agriculture. Primary data from the selected farmers were collected through personal interview with the help of pre-tested structured schedule. The data relate to the year 1984-85. On primary tank irrigation farms (PTI), the cropping intensity was higher than that under supplemental tank irrigation (STI) and rainfed (RF) farms. This was due to high proportion of reliable supply of water. There was not much difference in the extent of use of improved practices in paddy production between PTI and STI. However, the extent of adoption of improved sowing method was higher on PTI farms. Similarly, the majority of the farmers have extensively used improved practices in wheat and gram on PTI farms. The benefit-cost ratios at the farmer's level indicate that against irrigation fees of Rs. 10 and Rs. 20 per hectare paid for one and two crop seasons respectively, the benefits accruing to PTI and STI are almost 34 and 12 times that of RF. Only irrigation fees was considered as source of panchayat benefits. In comparison to the annual cost in terms of present value and cost of maintenance and repairs, the per hectare returns were almost negligible. Poor maintenance of the tank, lack of field channels and poor water control are the most pressing problems in tank irrigation. The following policy alternatives are suggested for the improvement and future expansion of tank irrigation.

A Micro-Minor tank irrigation body should be established under the regional development authorities (for example, Chhattisgarh Development Authority). Micro-Minor tank irrigation act should be developed and incorporated in the irrigation manuals of the States. Legislative and administrative powers should be formulated and given to the managing body (Panchayat) of tank irrigation. For efficient and equitable distribution of water, an appropriate irrigation system should be developed which may include tank designs, water measuring devices, field channels, scheduling of irrigation and rules and regulations governing the water use. In areas where underground potential is almost negligible, tank irrigation is the most economically and technically feasible solution. A systematic survey of tank location should be taken on top priority. Suitable areas should be identified in the canal command area where excess water from canal can be discharged into the tanks. Fish production, agro-forestry and plantation of fruit trees should be made mandatory to enhance the social and economic benefits of the village people.

POLICIES AND PROBLEMS IN THE USE OF IRRIGATION WATER UNDER MAHARASHTRA WATER UTILISATION PROJECTS

S. D. Suryawanshi†

Lack of water management planning has led to wastage of a large percentage of water resources. Therefore, the new system of *Warabandi* or rotational water supply is being tried in some of the States. This system ensures adequate, timely and dependable supply of water to all farmers. This is the genesis of the new approach of 'Maharashtra Water Utilisation Project (MWUP)'. It is being implemented in five command areas of Maharashtra, of which Mula command area was selected for the study. In all, 250 sample farmers were selected randomly from 21 villages, representing the agro-socio-economic situation of MWUP area. The selected holdings were categorised into small, medium and large size-groups. The data were collected by survey method for the agricultural year 1984-85.

In the command area about five per cent of the area was uncultivable because of waterlogging and waste lands. The cropping pattern showed that a smaller area was sown in *kharif* due to late monsoon and non-availability of pre-sowing irrigation. About 73 per cent of the area at the middle and tail-end of the outlet faced the problems of shortage of water, low flow, interruption by head reach farmers, etc. Of the total irrigated area, 25 per cent was through well + canal which is an encouraging situation for planning the conjunctive use of water. This will enable them to increase the double cropping area and to adjust to the required irrigation intervals. In the case of 55 per cent of the farms, well water was either adequate or just sufficient. Thus, on the majority of the farms the policy of conjunctive use of water can be implemented. In the case of 39 per cent of the farms where water is insufficient or meagre, the possibilities of digging of new wells and deepening of existing wells need to be explored. It was observed that, on an average, 0.86 hectare area per farm needed land levelling work. About 0.07 hectare area per farm was rendered unfit for cultivation due to waterlogging and soil salinity. In all, only 19 per cent of the farmers were aware of the consequences of over-irrigation.

The important problems reported by the sample farmers were irregular and uncertain water supply (18 per cent), lack of advance information of water rotation (9 per cent), inadequate water supply to tail-end farmers (10 per cent), excess area under each outlet (11 per cent), improper field drains and outlets (9 per cent), lack of maintenance of field channels (17 per cent), absence of lining (4 per cent), interruption of head reach farmers in sharing water (12 per cent), non-co-operative attitude of officials (14 per cent) and favouritism to particular group (19 per cent). The important suggestions made for better and efficient use of irrigation water are: It is necessary to convince the farmers about the advantages of conjunctive use

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of water and to ascertain the potentiality of groundwater. The concept of outlet committee and Warabandi do not seem to have percolated at the grass-root level. A better rapport of the irrigation officials can help to solve and minimise the problems of farmers and popularise the system. Very few farmers are aware of the problems of soil deterioration by the use of excess water. Advance notification of water rotation may help the farmers in taking proper decisions at proper time. The proposed policy of covering an area of 25 hectares per outlet, if implemented, will minimise the problem of insufficient water, low flow and interruption of farmers in sharing the water.

IRRIGATION WATER MANAGEMENT IN KERALA— A CASE STUDY

C. J. Joseph*

To throw light on the irrigation water management problems, a case study of Periyar Valley Irrigation Project (PVIP) is undertaken. It is a sample study limited to an enquiry of aspects like operation and maintenance of the irrigation system, method of irrigation, anti-percolation measures and administrative aspects. A major problem in water management in Kerala is that much water runs waste during *viruppu* and *mundakan* seasons while many parts of the State face acute scarcity during *puncha* season. For instance, in PVIP, barrage shutters are lifted and water released down into the river during monsoon season while only 182.4 km. of canals (out of a total of 553.8 km.) serve water during *puncha* season, indicating bad water management. To overcome this, V. K. Vamadevan has suggested the three-tier system of water management in Kerala. The feasibility of this system, or the Tank Group sytem in Japan, or the Kanat system in Iran and of other alternatives is worth consideration.

Consider maintenance; the maintenance of the barrage is properly done. Every year, in the second week of April, shutters are lifted up totally which in effect eliminates aquatic plants, clears of the debris and desilts the dam-bed. Almost all canals are earthern. Cent per cent of the sample canals were found to suffer from silting and 60 per cent infested with weeds and infiltration was permitted in all. Desilting was done manually and not mechanically. Of the four methods of weed elimination, manual, mechanical, chemical and biological, only manual methods were employed. Water guards and the farmers were almost ignorant of the modern devices in desilting and weed elimination. This shows poor extension work in irrigation. On the whole, maintenance was unsatisfactory mainly because of lack of funds and poor organisation of the work. Construction, maintenance and operation of the field channels were the responsibility of the farmers. Only few maintained the canals properly.

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Others were ignorant of the needs for proper maintenance. The proposal of Water Users Association, as in the lines of Far Eastern and Asian countries, was turned down by the vast majority of sample farmers. Even in organising such a water users association, they preferred participatory approach to public sector approach.

Percolation loss in laterite soils in Kerala is as high as 20 cm. per hour as revealed in a recent study. The beneficiary ryots were ignorant of the needs and potentialities of canal lining. This throws light on the poor extension service carried out by the Irrigation Department. The method of irrigation is another factor in water management. Universal flooding method applied to paddy in PVIP is appropriate, but defective in that it was not adjusted to consumptive use. The flooding method applied to other crops is excessive and injurious.

The irrigation structures consist of storage structures, canal structures and farm irrigation structures. Storage structures functioned properly. Canal structures took the form of open canals wasting large areas of scarce land surface. In some other countries, the pipe system is employed. The possibility of its introduction or some other alternatives like pre-fabricated structures, automation facilities, etc., should be examined in Kerala conditions. The farm irrigation structures consisting of diversion, conveyance and distribution structure were not functioning in the sample area.

With regard to administrative aspect, water guards were ineffective in regulating water supply and checking malpractices. The cultivators at the head reach of the canal could be lavish while the tail-enders suffered from scarcity of irrigation water. Absence of effective means of communication and transport, unattractive terms and conditions of employment of water guards, their ignorance of modern practices of irrigation, the inability of the project management to control the malpractices of rich farmers, were all factors which led to the failure of administration.

A systematic, detailed investigation is recommended to examine (*a*) the economic feasibility of alternatives to storage reservoirs and dams, alternatives to water conveyance, canal lining and farm irrigation structures, (*b*) the possibility of eliciting better public participation in operation, maintenance and distribution of irrigation system and (*c*) the possibility of introducing irrigation scheduling service as in countries like the U.S.A.

OPTIMAL RESERVOIR MANAGEMENT AND CROP PLANNING UNDER DETERMINISTIC INFLOWS—A CASE STUDY OF JAI SAMAND DAM (RAJASTHAN)

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This study analyses planning under deterministic inflows for Jai Samand Dam in Alwar district of Rajasthan. Linear programming model was developed

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to indicate the optimal storage of reservoir water, the transfer of water to the producing regions, and the spillage of water from the reservoir, if needed. The existing use of reservoir water was far from optimal. Water was released only for 70 to 100 days during October to December mainly for *rabi* sowings. The results of the study indicate that a change in the existing cropping pattern and reservoir management policy is desirable and consistent with the maximisation of net returns. The optimal cropping patterns suggested by the model favour inclusion of crops of improved varieties in place of local varieties. The dam water should be released for a period of nine months in a year, *i.e.*, from July to March keeping in view the irrigation requirements of the crops. Such a pattern of release of irrigation water combined with optimal cropping pattern will double the farm income.

KANDI WATERSHED AND AREA DEVELOPMENT PROJECT—AN INTEGRATED DEVELOPMENT APPROACH

H. S. Sandhu and Balbir Kumar*

Kandi Watershed and Area Development Project, a multi-disciplinary integrated development project in Punjab estimated to cost Rs. 59.54 crores was taken up for implementation during the year 1980. The integrated multi-disciplinary approach aims to tackle the twin problems of ecological degradation and flood damage through adoption of most appropriate development package comprising reforestation-cum-soil conservation, livestock improvement, horticulture and agricultural development, fisheries, soil and water management on farm lands, irrigation development-cum-flood protection and strengthening of other supporting services, components. The concept underlying integrated development was institutionalised thus ensuring successful implementation under Indian conditions. Economic evaluation of the various alternatives resulted in an awareness amongst the executing agencies to adopt the most economically beneficial alternatives, thus maximising benefits from a unit of investment.

The success of the project was ensured through participation of the local inhabitants and their representation in various committees related to the project planning, implementation and sharing of benefits on completion. The development works generating employment and permanent assets resulting in increased productivity of the forest lands, agricultural lands and pastures acted as a catalyst in convincing the beneficiaries about the usefulness of project objectives. Social problems and prejudices were overcome through sustained efforts made by dedicated staff. Integrated Watershed Development Project has been accepted as a suitable model of growth for economic uplift of backward areas.

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PLANNING OF CANAL IRRIGATION

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After classifying the soils of river basins into four categories, namely, (*a*) heavy alluvial soils along the banks of the rivers, (*b*) the broad belt of medium soils, (*c*) light soils along the slopes of hills made up of murum and (*d*) hard murum and hard rock, the paper deals with statutory planning for the use of irrigation in the Deccan table land region. It is observed that the heavy alluvial soils have a capacity to produce crops on rains. They have a very bad effect of irrigation and manuring. They become saline or waterlogged, resulting in a great national waste. So the irrigation of these soils must be forbidden statutorily. Emergency irrigation can be supplied to this belt in times of crop failure. Dairy farming is the most suitable industry of this belt. The medium soils react very favourably to irrigation and manuring and can bring bumper crops. It can grow all kinds of crops from cane to condiments and offers scope for intensive irrigation through a network of canals. On light soil or murum where the practice of agriculture is most uneconomical, vast lands are sown with crops like bajra and small millets and their yields are scanty, leaving the farmers of this belt very poor and backward. These lands should be treated as forest wastes and forest trees should be grown on them along with goat rearing. Agriculture-based industries should be located in this belt as land cost will be minimum; the foundations of buildings will be shallow; road construction for communication will be easy and cheap; there will be ample land for labour colonies; and these industries will provide employment to the people of this region and improve the economic conditions of the labour. The fourth belt is rocky and it should be used for trenching and soil conservation; thorny bushes and cactuses may be planted and grown during monsoon at suitable places by government agencies.

A MULTIVARIATE ANALYSIS OF ECONOMICS OF DRY AND WET LAND CROP FARMING FOR POLICY IMPLICATIONS

K. A. Varghese and B. L. Sharma*

The paper attempts to study the economic disparities of irrigated and dryland farms in a particular region. The specific objectives were (*i*) to differentiate asset, income and cost pattern of irrigated versus unirrigated crop farming (multivariate approach); (*ii*) to examine the feasibility of crop diversification on net incomes; (*iii*) to assess the extent of inequalities within

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and between crop farming systems; and (*iv*) to suggest policy measures to maintain growth and equity within and between systems. The study relates to Ganganagar district of Rajasthan where three main canal systems, *viz.*, Gang, Bhakra and Indira Gandhi canal add to the prosperity of the area by irrigating together nearly half of the cultivated area of the district. The present study is based on a sub-sample of farmers selected for the Farm Management Study carried out in this district. Two zones, out of the four agro-climatic zones earmarked for the main study, were chosen in such a manner that one represented irrigated condition and the other unirrigated condition, both being contiguous. Thirty farmers of comparable farm sizes were chosen from each of the zones making a sample of 60 farmers, spread in eight villages, four irrigated and four unirrigated. The data selected for the sample farmers pertaining to the crop year 1983-84 were used. The univariate and multivariate statistical techniques were used to estimate and test various economic similarities/dissimilarities of both types of farms.

For the comparable farm size situation of both types of farms, it was found that the cropping intensity, the number of crop enterprises taken up, the asset position, the cost of cultivation, the incomes as well as the pattern of use of yield-increasing inputs differed significantly. The joint distribution of asset, cost and incomes was also found different for both types of farm conditions. The number of crop enterprises was found to have positive association with income generation under unirrigated condition while the irrigated farms showed negative association. The diversification of crop enterprises was found promising for unirrigated farms while specialised crop farming was found advantageous for irrigated farms. The relative income inequality conditions measured through graph/curve revealed that the irrigated farms were more consistent in per hectare farm business (disposable) income. Another important observation that emerged from the study was the positive association of cost and assets in income generation under irrigated condition. For unirrigated farms the assets and costs were negatively associated with disposable income, cautioning that additional short- and long- term investments under unirrigated conditions are not remunerative.

A STRATEGY FOR EFFICIENT MANAGEMENT OF IRRIGATION WATER

V. K. Madalia*

With the development of irrigation resources since the First Plan the problems of water use have developed. A large quantity of water is wasted through seepage and deep percolation in the canals. The farmers mis-use water through faulty practices of irrigation. They have the tendency to over-irrigate the crops. As a result of mis-utilisation of water, the problems of waterlogging and salinisation have developed in many project areas.

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In the case of minor sources of irrigation also, a large quantity of water is wasted due to faulty practices of irrigation. Moreover, these farmers suffer heavy financial losses due to improper selection of irrigation equipment. There is considerable scope for increasing the efficiency of water use in agriculture. For this, an appropriate strategy has been suggested in this paper. The essential components of this strategy are greater emphasis on research and extension activities in water management and the training of those involved in water management, *viz.*, the farmers, the personnel of Irrigation Department and the extension agents. Since the existing extension agencies have not achieved much in regard to the scientific use of water by the farmers, it is proposed to create a separate extension agency at the district, taluka and village levels specially for irrigation water management. Further, since at present there is no training facilities in water management, it is suggested that the existing Trial-cum-Demonstration Farms established in command areas of irrigation projects should be up-graded as Trial-cum-Demonstration-cum-Training Farms. Along with these measures, it has also been suggested to provide supporting services to the farmers. The on-farm development works should be speeded up and the farmers should be supplied farm inputs and credit. In order to achieve maximum efficiciency in the use of water, greater co-ordination between various agencies involved in water management should be achieved. Lastly, for the equitable distribution of water some sort of local control over water is necessary. Therefore, the farmers should be organised co-operatively and should be made responsible for management of water at the village level.

CHAMBAL COMMAND AREA DEVELOPMENT PROGRAMME—"A SOURCE OF PROSPERITY AS WELL AS INEQUITY": A CASE STUDY

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This study was undertaken during 1980-81. In 1984-85 the non-beneficiaries were again surveyed with a view to find out whether there was any change in their farm economy after a gap of four years. The specific questions that are sought to be answered were: whether the Command Area Development programme is growth oriented with equity; to what extent it has widened the gap and what should be done to minimise the gap between beneficiary farms and non-beneficiary farms. For this purpose, an equal number of beneficiaries, *i.e.*., 32, were selected from each of the marginal, small, medium and large category of farms, making a total of 128. In the same manner the non-beneficiaries were also selected from the respective villages of district Morena and Bhind constituents of Chambal division of Madhya Pradesh.

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The findings of the study revealed that the intensity of cropping was 33 per cent higher on beneficiary farms with 33 per cent and 34 per cent higher employment for human labour and bullock labour respectively. The difference in capital investment between beneficiary and non-beneficiary farms was 91.4 per cent. The income and marketable surplus gap was more than 76 per cent and 170 per cent respectively over the non-beneficiary farms of the command area.

Analysing the changes within the non-beneficiaries group before and after the adoption of lift irrigation and credit use, it was noted that human labour and bullock labour use increased by 11 per cent and 12 per cent respectively. The capital investment increased to 39.5 per cent per hectare after the adoption of lift irrigation and credit use. In the same manner the net farm income and marketable surplus increased to 14.2 per cent and 35.4 per cent respectively on non-beneficiary farms after the adoption of lift irrigation and credit use.

The gap in cropping intensity, capital use and human and bullock labour employment had reduced to more than 27 per cent, 14.8 per cent, 36 per cent and 20.16 per cent respectively after the adoption of irrigation and credit use by the non-beneficiaries as compared to the beneficiaries. A reduction in this gap was also noted in net farm income (per farm) and marketable surplus, *i.e.*, 97.8 per cent and 155.4 per cent on non-beneficiary farms over those of beneficiary farms. It is therefore concluded that the inequity between beneficiary and non-beneficiary farms may be reduced through the introduction of lift irrigation in a phased manner with the interaction of suitable credit advancement plans on non-beneficiary farms of Chambal Command Area of Madhya Pradesh.

UNDER-UTILISATION OF IRRIGATION POTENTIAL— A CASE STUDY OF RIVER LIFT IRRIGATION PROJECTS IN WEST BENGAL

Anandamoy Sen†

This paper attempts to study the nature and extent of utilisation of irrigation potential created by river lift irrigation and to identify the causes of under-utilisation both at the project and farm level. There were 105 river lift irrigation projects in Birbhum district of West Bengal in 1985. Due to various reasons most of the schemes remained under-utilised. Our survey could identify 40 households only having land in the officially defined 'Command Area' of the river lift irrigation system in this district. In addition to this, five river lift irrigation projects were surveyed in order to examine the cropping pattern and water management systems in the schemes. Under-utilisation of irrigation potential may be due to two factors: one is due to lack of demand for water from the farmers and the other may be

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due to constraints of supply of water. Most of the farmers did not utilise irrigation water in the *kharif* season in the command area. During *rabi* and *boro* seasons a noticeable amount of land in the command area remained fallow. Caste, education, institutional finance did not play important role always. The supply of water—its extent and regularity—also plays an important role in the utilisation of irrigation potential. Water source is not dependable to meet the total requirements, particularly in times of *rabi* and *boro* crops. Thus, the owners of plots in the command area may be deterred from participation in the system because of uncertainty about timely delivery of water. This uncertainty was aggravated by erratic supply of power, fuels, spare parts, etc. Due to lack of proper supervising personnel the machine operators neglected their work in times of need. Whatever the causes, the operational aspect of the river lift irrigation system demands further technical probe to allay the doubts. The study, however, reveals that the utilisation of land in the river lift irrigation is much more intensive than in the other unirrigated areas. Any plan to expand the present scheme successfully should be preceded by the establishment of an elaborate organisational network for crop planning, risk-coverage, extension service, water management and better social relationship in production.

OPTIMISATION OF LAND AND WATER RESOURCES IN SEMI-ARID TROPICS (SAT) OF HISAR DISTRICT IN HARYANA

O. P. Chhikara and I. J. Singh†

Irrigation is one of the key factors to increase agricultural production and considerably affects on cropping pattern, farm income and employment in the semi-arid tropics (SAT) in Haryana State. It helps in the modernisation of inputs and growth in production. It would be rewarding to study the existing and optimum use of land and water resources as well as its impact on income and employment. To achieve these objectives, linear programming model was used in the study. It is observed that irrigation water is not fully utilised in the study area when capital, labour and irrigation water constraints are relaxed, the available irrigation water is relatively better utilised under the existing level of technology. Significant changes are noticed in the cropping patterns in the optimum plans at both the levels of technologies. Thus, the net farm returns at the improved level of technology are the highest in all the blocks under both the levels of resources supplies. It reflects that there exists the possibility of increasing net returns through optimisation of land and water resources at both the levels of technology in all blocks.

It is evident from the study that employment of human labour on farms has increased in all the optimum plans as compared to the existing plans of different blocks at both the levels of technologies under the restricted as

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well as relaxed resource supplies. It was also noticed that with relaxed resource constraints, farm employment further increases in the optimum plans at the improved level of technology as compared to the existing level of technology. It indicated that adoption of improved technology could be paying only with the augmentation of more restricting resources (capital, labour and irrigation). After relaxing these restrictions, the total cropped area in the optimum plans further increased at both the levels of technologies. These findings have important policy implications for efficient utilisation of farmers' resources and increasing their farm incomes.

A NOTE ON THE PROBLEM OF IRRIGATION TO THE FLAT IMPERMEABLE CLAYEY BLACK SOIL IN MANGALWEDHA TAHSIL UNDER UJJANI RIGHT BANK CANAL

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Rainfall in large parts of the country is low and uncertain in its distribution. Therefore, there is an increased need for providing assured supplies of water through irrigation system. Before sanctioning the irrigation scheme in a particular area the Government should undertake a detailed survey about the nature and contents of the soils which will come under the command area. But mostly this does not happen. Due to lack of prior survey and of proper watering method, within a few years the major portion of the land in the command area will be non-cultivable. With this background, the paper cites an example where the Government has already sanctioned an irrigation scheme in Maharashtra without undertaking a prior survey of the command area. Deep black soils with poor drainage characteristics are found in the Mangalwedha taluka in the command area of Ujjani Right Bank Canal. The PH values of the soils are below 9.0, the critical limit for sodic soils. The soils are clayey. The infiltration rate of least premeable layer in all profiles is less than 0.25 cm. per hour. The soils are rich in free lime which varies from 5 to 12 per cent. It will be seen that free gravitational flow of irrigation from canal water is highly injurious to the deep soils in this problematic area, for which some suggestions are given in the paper. Mangalwedha is a case in point of how a major irrigation project is launched without giving full thought to the impact on a conspicuous portion of the command area.

STRATEGIES FOR IRRIGATION DEVELOPMENT IN HIMACHAL PRADESH

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Agricultural production can be increased either by bringing more areas under cultivation, or by increasing productivity per unit of land or by both.

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The specific objectives of the study are (*a*) to examine the impact of irrigation on cropping pattern, labour utilisation and net return from important crops on different size-groups of farms, and (*b*) to explore the possibilities of increasing the farm income. For the study, three villages in the foothills of Himachal Pradesh were selected on the basis of probability proportional to the net area sown under the important crops. The holdings of each village were divided into three categories according to their size: (*i*) marginal upto one hectare, (*ii*) small farms with 1 to 2 hectares and (*iii*) medium farms with 2 to 6 hectare each. A proportional sample of 12 households was drawn randomly from each village. The required in formation was obtained by the cost accounting method for the year 1981-82. The data were originally collected for the Comprehensive Cost of Cultivation Scheme by the H.P. University.

Linear programming model has been used to assess the objectives of income maximisation. The proportion of net area under irrigation decreased with an increase in the farm size. Human labour utilisation has an inverse relationship with the farm size. If we compare the existing and optimum land use pattern plans, there is a significant change in income maximisation plans. A closer examination of the analysis reveals that increases in income are relatively more on medium farms mainly due to shift in irrigated land. On marginal and small farms net income from reallocation of crops under irrigation also significantly increased.

The analysis reveals that irrigation is an important and crucial component which helps the farmers a great deal by way of increasing the productivity of field crops, besides solving to a larger extent the unemployment problem as well. The direct field observation also reveals that the desired goals could not be achieved by the farmers in so far as (*a*) the farmers are not able to supply the required quantity of water to each crop and (*b*) irrigation water is not available during the required time. The rapid agricultural development of the State is directly proportional to the development of irrigation facility. To promote this, therefore, the government should initiate time-bound action plans and set up new irrigation schemes and modernise the new ones. To begin with, irrigation co-operatives should be set up for each project areas in the State. The government should draw a well-knit and well synthesised irrigation infrastructure and hand it over to these co-operatives. To encourage massive participation of all, liberal subsidies should be offered.