CHAPTER 2

IRRIGATION AND AGRICULTURAL DEVELOPMENT
Agriculture is the primary sector of the economy which provides the basic ingredients necessary for the existence of mankind. It also provides most of the raw materials of which, when transformed into finished products serve as basic necessities of mankind. Early theoretical literature on the role of agriculture in economic development could be traced to the writings of the Physiocrats. The Physiocrats were of the opinion that only agriculture turned out a 'net product' over and above its cost of production, with agricultural surplus serving to maintain the 'sterile' class of manufacturers and traders. In their view, it is only in agriculture, the nature labours along with the man and by her bounty, yields not only what the agricultural labourer or farmer consumes, but also a surplus which nourishes the other classes of society. Thus, according to the Physiocrats it was agriculture which produced an economic surplus over costs of production and thereby plays a most strategic role in the economic development. They also pointed out that the rate of growth of non-agricultural sectors was limited by the growth of the agricultural sector. Hence, the role of agriculture in economic development was recognised by the earlier economists. Thereafter many economists recognised the role of agriculture in economic development. Among them William H. Nicholls pointed out that the role of agriculture in economic development depends heavily upon the stage of economic history in which a particular nation finds itself and especially at the time that economic progress first becomes a major social aspiration.
The relative emphasis which public policy gives to agriculture and the particular form which agricultural policies take, must therefore vary accordingly. Hence, the role of agriculture in economic development may not be uniform in all countries. Moreover economists like W.A. Lewis, Fei and Ranis, assigned crucial role for agriculture in economic development. Indeed, agriculture was recognised as key sector in the development of a country.

**Importance of Agriculture in Indian Economy:**

From the dawn of civilization, India has primarily been an agricultural country. Agriculture in India is the life blood of the nation. Agriculture is the largest sector of economic activity and plays a crucial role in the country's economic development by providing food and raw materials and employment to a large proportion of the population. While agriculture held an important place in Indian economy, its efficiency remained at a low level. Over vast areas in the country agriculture has continued to be traditional in character, resulting in low yields, limited income and consequent low capacity for reinvestment. However, modern agricultural sector has been developing on a limited scale based on new technology. In this sector, in contrast to vast unorganised agricultural sector, notable success has been achieved in yield rates, income generation and investment. This notable success had a considerable impact on the life and economic activity of the people.

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Agricultural production based on modern technology requires all round institutional and infrastructural support. Since the absence or inadequacy of any element is likely to impinge on the realisation of the full yield potential of modern technology, the basic policy should be to offer support by way of package consisting of different inputs. Among the inputs, water occupies an important place in the development of agriculture.

Significance of Irrigation:

Water is an important pre-requisite for agricultural development. An assured water supply spells prosperity, creates employment potential, increases income and enhances capital formation. The need for regulated supplies of water and manure at regular intervals and in requisite doses was long realised for the increase in the productivity of land. In fact, the production of a crop requires soil, water, seed, labour, implements, proper planning and management. The Famine Enquiry Commission of 1945 has rightly observed that among the measures that may be adopted to increase the area under cultivation and the yield per acre, the first place must be given to the works for the supply and conservation of water.

Irrigation has proved beneficial to the agricultural development of a country. In fact, irrigation forms the life line for sustained successful agriculture. It alleviates suffering, preserves life, averts famine and advances the material prosperity of the country. In a country like India, its importance is all the more great. As
pointed out by Sir Charles Trevelyan, "Irrigation is everything in India; water is more valuable than land, because when water is applied to land, it increases its productiveness at least six fold." Moreover, Dr. Knowles observed "The irrigation works have provided security of life, they have increased the yields and the value of the land and the revenue derived from it. They have lessened the cost of famine relief and have helped to civilize the whole region."3

In our country development of irrigation in the past had taken place as a measure of famine relief. In India, in fact, famines gave birth to the idea of irrigation. Now with the population multiplying rapidly, irrigation has assumed greater importance for augmenting agricultural production.

The importance of irrigation may be judged from protective and productive angles. The protective irrigation makes up the moisture deficiency in soils to ensure proper and sustained growth of crops. The productive irrigation enables raising of second and third crops on the lands provided with irrigation which could otherwise not be cultivated efficiently more particularly during the post and pre-monsoon period. While the protective aspect helps in stabilizing agricultural production against droughts, the productive aspect cannot be neglected by an agriculturist. Irrigation has third aspect also. It helps in augmenting and preserving the properties of soils by application of adequate supply of water.

Irrigation and Employment:

In an agrarian economy irrigation may be a good source of employment as well. Irrigation raises both employment and income content of land and thus adds to capital formation. The construction and maintenance of an irrigation project has far-reaching effects on the economic life of the community living within a region. Investment in an irrigation project leads to the creation of new productive activity. The utilization of the opportunities created by an irrigation project needs further investment either to launch new productive activities or to expand old activities in the area affected by the project. This additional investment involves the employment of additional capital and labour resources which in turn will lead to an increase in production.

The continued maintenance of the new investment would depend 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. A number of consequences may follow from the emergence of this new production. First, increased production means additional produce which has to be processed, traded, transported etc., and increased production also means increased incomes in the hands of producers which may be spent in various ways. If the new product is directly consumed, there will be no further effects on economic activities. If on the other hand, it is kept as surplus, it would generate series of economic activities necessitating the employment of further capital
and labour resources. Further, the additional production means accrual of additional incomes to various categories of persons. These persons may utilise this income in a number of ways. The outlays by income recipients 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.

Indian Agricultural Strategies and Irrigation:

From time to time, different strategies have been adopted in India in an effort to revamp Indian agriculture. Among others, they include cooperative Farming, Community Development, Intensive Agricultural District Area Programme, High Yielding Varieties Programme and Integrated Rural Development.

Irrigation has direct bearing on some of the agricultural strategies in India. Concentration of land and land holdings in the hands of a few was obvious in India. Small and scattered holdings were owned by majority of farmers. Notwithstanding scientific and technological progress, such concentration of land in the hands of a few hardly gave a chance of prosperity to a majority of farmers. Against this background was evolved the concept of Joint Cooperative Farming. Small holdings were organised into a joint effort on the basis of joint cooperative farming. The land holdings were pooled together and they were managed as one farm. Each farmer gets a share in the produce in proportion to his contribution of land and labour. The minimum period for joint farming experiments was to be five years. Cooperative Farming societies were formed and they were
eligible for assistance on a priority basis. In the form of assistance, common irrigation systems were also created.

Another attempt to reorganise Indian agriculture was made with the launching of Community Development Programme in 1952. The programme sought to bring about integrated development in rural India through maximum utilisation of resources on an area basis. Block is an important administrative unit of Community Development. Here Block Development Officer worked under the direction of Block Panchayat Samithi. He was responsible for the execution of all developmental schemes. His staff included experts in agriculture, Animal Husbandry and Cooperative Management. The jurisdiction of Block extended upto about 100 villages. Village Panchayat assumes considerable importance from the point of view of rural development under the programme of community development. Village Panchayat is responsible for augmenting agricultural production, establishment of rural industries, provision of medical relief, maternity and child welfare, maintenance of common grazing grounds, village roads, tanks and wells. Thus Community Development Programme did recognise the significance of irrigation in the form of maintenance of tanks and wells by Village Panchayats.

Yet another landmark in Indian agriculture lies in the introduction of High Yielding Varieties of seeds in 1966. Such seeds and fertilizers constitute the core of the new strategy, often referred to as 'Green Revolution'.
The High Yielding Varieties Programme calls for better water management. The traditional irrigation equipment becomes out-moded to serve the new function. More efficient water management calls for changes in the techniques of irrigation from labour intensive to capital intensive. The result is a linkage between High Yielding Varieties Programme and pumpsets via the pressures created for better water management. Since electricity is found to be a cheaper and more efficient source of power than any other mode, pressures are created for energising pumpsets. A higher linkage coefficient is noticed between electricity and High Yielding Programme consumption in agriculture. Understandably High Yielding Varieties Programme and Irrigation go together.

In India the area under High Yielding Varieties of seeds has increased considerably. The total area under improved seeds, in case of food grains was 1.89 million hectares in 1966-67. This increased to 34.5 million hectares in 1976-77, by the time the programme was a decade old. The crop-wise area covered by High Yielding Varieties Programme in the present decade is shown in Table 2.1.

The area under High Yielding Varieties Programme increased from 47.5 million hectares in 1982-83 to 55.2 million hectares in 1985-86. The pace of increase has slowed down since 1983-84 largely because of unfavourable monsoon conditions. Significant increase in area under High Yielding Varieties in 1985-86 occurred in paddy and wheat. However, area covered by jowar and bajra declined in 1984-85.

TABLE 2.1

AREA UNDER HIGH YIELDING VARIETIES
(million hectares)

<table>
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<th></th>
<th></th>
<th></th>
<th></th>
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<td></td>
<td>(49.1)</td>
<td>(52.6)</td>
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<td>2</td>
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<td>19.4</td>
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<td></td>
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<td>(78.6)</td>
<td>(80.9)</td>
<td>(85.3)</td>
</tr>
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<td>5.1</td>
<td>4.9</td>
</tr>
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<td></td>
<td></td>
<td>(26.9)</td>
<td>(32.3)</td>
<td>(32.1)</td>
<td>(31.0)</td>
</tr>
<tr>
<td>4</td>
<td>Bajra</td>
<td>4.7</td>
<td>5.4</td>
<td>5.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(43.0)</td>
<td>(45.6)</td>
<td>(48.6)</td>
<td>(43.0)</td>
</tr>
<tr>
<td>5</td>
<td>Maize</td>
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<td>1.9</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(29.7)</td>
<td>(32.4)</td>
<td>(34.5)</td>
<td>(37.3)</td>
</tr>
</tbody>
</table>

TOTAL 47.5 53.7 54.1 55.2

* Targets.

NOTE: Figures in brackets indicate the percentages of the High Yielding Varieties area to the total area under crop.

as well as in 1985-86, largely due to severe drought in the areas where the two crops are raised under rainfed conditions.

The strength and stability of Indian economy, lies in the development of rural sector. Integrated Rural Development is the accepted strategy for the upliftment of rural poor - small and marginal farmers, landless labourers, tenants, share croppers and petty artisans. Though areas of health, education and cultural values are included in the promotion of Integrated Rural Development, development of agriculture forms the main theme of Integrated Rural Development. In the application of Integrated Rural Development attention is paid to the special characteristics which are rural. The special characteristics include domination of land, land use and land relations, the low level of individual productivity and a large extent of underemployment.

The planning for Integrated Rural Development calls for the establishment of the basic institutions. They are necessary for maximum mobilisation of rural productive resources, securing mass participation and ensuring equitable distribution. A radical change in land distribution together with the supply of other assets and inputs needed for production is a step in the right direction.

Any plan for Integrated Rural Development depends upon the determination of the area selected for rural development. The selected area cannot be so large as to dilute motivation, prevent participation and involve organizational problems that defy solution. At the same time, it cannot be so small as to be non-viable. Given
the area unit for Rural Development, a productive plan has to be
drawn up. The plan apart from aiming at diversification of economic
activity, should draw concrete programmes for promotion of agri-
culture. Significance of irrigation is obvious in promoting agriculture
in the context of Integrated Rural Development. In the creation of
infrastructural facilities in the unit area, minor irrigation, water
supply and drainage, together with soil conservation, contour building,
afforestation would go a long way. Indeed, significance of irrigation
in Integrated Rural Development Programme is not negligible.

In tune with the increasing demand for irrigation, additional
irrigation potential is created from time to time. In 1985-86, irri-
gation potential of 2.2 million hectares was created. Of this, signifi-
cant addition came from minor irrigation projects covering about 1.7
million hectares. By the end of 1985-86 a cumulative potential of
about 69.8 million hectares was created. Particulars of source-wise
irrigation together with created potential and utilisation in the
current decade are shown in Table 2.2.

Clearly all has not been well with the utilization of potential
created. The utilization has not kept pace with the creation. Irriga-
tion commission and successive Five Year Plans have identified the
lack of field channels and programmes to enable the ayacut area
to make full and effective use of water as the principal reason for
lags in utilisation. Adoption of cropping pattern at variance with the
envisaged pattern, contributed in no small measure for under-utili-
sation of the created potential. The gap between creation and
<table>
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<th>Sl. No.</th>
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<th>Minor Schemes</th>
<th>All Schemes</th>
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<td>Utilisation</td>
<td>Potential</td>
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<td>26.60</td>
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<tr>
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<td>1980-81</td>
<td></td>
<td>27.30</td>
<td>22.70</td>
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<td>28.20</td>
<td>23.20</td>
<td>32.80</td>
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<td>4</td>
<td>1982-83</td>
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<td>29.10</td>
<td>24.00</td>
<td>34.20</td>
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<td>5</td>
<td>1983-84</td>
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<td>30.10</td>
<td>24.60</td>
<td>35.60</td>
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<tr>
<td>6</td>
<td>1984-85</td>
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<td>30.01</td>
<td>25.33</td>
<td>37.52</td>
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<tr>
<td>7</td>
<td>1985-86*</td>
<td></td>
<td>30.57</td>
<td>25.84</td>
<td>39.18</td>
</tr>
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<td>8</td>
<td>1986-87**</td>
<td></td>
<td>31.26</td>
<td>26.42</td>
<td>40.91</td>
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<tr>
<td>9</td>
<td>Ultimate potential</td>
<td></td>
<td>58.50</td>
<td>-</td>
<td>55.00</td>
</tr>
</tbody>
</table>

* Anticipated  
** Target

utilization regarding irrigation potential has increased from 6.9 million hectares in 1984-85 to 7.5 million hectares in 1985-86. The problem is more severe in the case of major and medium irrigation schemes. Major and medium irrigation schemes involve storage and utilisation of surface water. Storage and utilisation pose less problems in the case of minor irrigation.

**New Irrigation Strategies**

New irrigation strategies refer to improved water management practices. There is an imperative need to economise on water use. Economy on water use will help increase productivity and bring more areas under irrigation. The gross cultivated area can be increased through the stepping up of cropping intensity. The present cropping intensity is 120 per cent⁵. If this could be raised to 200 per cent to 300 per cent the gross cultivated area can be greatly increased. This could be made possible by increased irrigation brought about by new irrigation strategies.

The investment per hectare in irrigation projects is tremendous. The cost was about Rs. 1,500/- a hectare, in the First Plan Period. The present cost is in the range of Rs. 30,000/- to Rs. 40,000/- per hectare. In the light of these higher costs there is every need to economise on water use by modern methods. This will help register higher levels of agricultural output through increased productivity.

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In addition, economy on water use will also minimise the hazards of water logging which renders large areas saline.

It is believed that the average annual surface flow of water is about 180 mhm. Of this, the harnessable part is only about 70 mhm. A greater part of annual surface flow is not utilised due to terrain conditions, sporadic rains and dearth of suitable sights for dams. Further, the annual recharge of ground water is estimated at 50 mhm, and the amount utilisable is about 35 mhm. Thus, the total utilisable water is of the order of 105 mhm. Not all the utilisable water would be available for irrigation. The water demand for municipal and industrial purposes would cut into this. Hence, employment of advanced methods of irrigation becomes indispensable to bring more area under irrigation and register higher production levels.

A major effect of water saving is called for, to contain the increasing scarcity of water. A reasonable growth rate of 'national income' dependent on irrigated agriculture is possible, through economy on water use. Given the rainfall, water supplies can be increased through certain ways. Among others, they include desalination, salt water utilisation, re-use of water, weather modification and improved water management practices. Efficient water management practices also known as new Irrigation strategies are by far the best to achieve economy on water use. Control and proper method of irrigation in canal and tank command areas, providing drainage and re-use of water

facilities, conjunctive use of surface and ground water, using sprinkler irrigation in canal/tank command areas, introducing drip irrigation in well irrigated areas and Bi-wall irrigation for closely spaced crops like sugar cane, vegetables and cotton are the significant irrigation strategies to achieve economy on water use.

Under major irrigation projects farmers use water indiscriminately unaware of the adverse effects of over-irrigation. Moreover, irrigation and drainage are complementary. Drainage channels are inadequate in most irrigation projects. This causes water logging and makes the land saline or alkaline. Water saving is about 30 to 50 per cent in sprinkler irrigation. Closely spaced crops like millets, groundnut, pulses and wheat are eminently suited for sprinkler irrigation. Studies have revealed that water saving is 50-70 per cent and the yield increase is 10-70 per cent for different crops under drip irrigation. Drip irrigation is suitable for all row-crops, specially for wide spaced crops. Water saving on this count is substantial, judged from the significance of well irrigation which accounts for 35 per cent of irrigated area in India. Bi-wall irrigation is based on advanced technology. Here water is delivered from the main chamber with a distribution chamber through evenly spaced supply orifices provided by Laser beams. It is then slowly released through the emission orifices. This type of irrigation has relevance for all close growing row-crops like sugar cane, cotton, vegetables, grapes, pineapple and onion. This method saves about 50-70 per cent of the water used and increases the yield by about 50-100 per cent. At present small farmers
are granted subsidy for adopting sprinkler, drip and Bi-wall irrigation. Extension of this concession to all farmers will greatly economise on water use.

**Impact of Irrigation on Productivity**

Individual crop yields are considerably higher under irrigated areas than under rainfed conditions. Moreover, irrigated areas grow more of high value crops which cannot be raised at all or do not do as well under rainfed conditions. It is observed that differences in output per gross hectare as well as crop intensity across space are significantly and positively associated with irrigation ratio (i.e. ratio of irrigated to cultivable area)\(^7\). Under irrigation, land is used more intensively. Further irrigated lands grow crops of higher productivity and high value. Again average yields of almost all crops are substantially higher in irrigated areas. Irrigation affects crop yields both directly and indirectly. There is strong complementarity between water and other inputs. The differences in land productivity between irrigated and unirrigated farming can be taken as a measure of the overall impact of irrigation. The productivity impact of irrigation differs between projects and across the regions. Climatic factors and nature of irrigation source also affect productivity. In certain parts of India (Karnataka) the areas irrigated by wells have higher cropping intensity and higher yields than tank fed areas\(^8\).

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Irrigation and Inequality

Uneven distribution of irrigation facilities in India are observable. Access to irrigation is unequal among different regions. It is believed that there exists an inverse relationship between the holding size and the irrigation ratio. Such an inverse relationship appears to be weakening.

An attempt is made to study the extent of regional disparities in respect of irrigation in India. This is shown in Table 2.3. The rise in the coefficient of variation (C.V.) of the ratios of net irrigated area to net sown area from 59 per cent in 1961 to nearly 61 per cent in 1979 indicates worsening of regional imbalances in respect of irrigation.

The impact of irrigation development on different classes of cultivators has been unequal. Indeed, there is no large farmer bias in the case of surface irrigation works. However, such bias is observable in the case of ground water. The outlays required to set up wells, energised pumpsets and tube-wells are beyond the means of small cultivators. Liberal loan assistance provided by the Institutional Financial Agencies is used mostly by the large farmers. Moreover, investments are not remunerative unless a certain minimum area could be irrigated. In principle, small farmers could overcome these problems through cooperative ownership by groups of farmers. However, they seldom do so in practice. These factors together with the rapid increase in the relative importance of ground water as a source of
### TABLE 2.3
PERCENTAGE OF NET IRRIGATED AREA TO NET SOWN AREA

<table>
<thead>
<tr>
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<td>13.0</td>
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<td>14.2</td>
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<td>71.8</td>
<td>91.4</td>
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**SOURCE:**
irrigation, are the basis for the apprehensions that large farmers may have reaped a disproportionate share of the increments to irrigated area.

Irrigation policy has a bearing on water distribution. In any given system, the available supplies could be used to sustain farming at varying levels of intensity, involving different degrees of multiple cropping and cropping patterns. By and large, more intensive use is believed to be associated with higher levels of output per unit of irrigated land. But at the same time the area irrigated by a given supply under intensive pattern tends to be smaller than under an extensive pattern. Hence, intensive irrigation tends to confer benefits in the form of additional output and income on relatively smaller area. By implication, the benefits are confined to fewer farmers compared to the extensive pattern, which makes for wider diffusion of benefits to a large number of farmers. From a social point of view benefits to a large number of farmers is preferable.

High Yielding Variety of seeds constitute the basis of new technology in Indian agriculture. Such a technology presupposes the existence of assured irrigation. Although High Yielding variety of seeds and fertilizers are size neutral, they are not resource neutral. Large farmers have better command over resources. They adopt capital intensive techniques in the exploitation of ground water and reap larger output and income compared to small and marginal farmers. This perpetuates economic inequality.
SUMMARY

Agriculture is the life blood of an economy. This is equally true of Indian economy. In an effort to revamp Indian agriculture different strategies were adopted from time to time. Among others they include cooperative farming, Intensive Agricultural District Programme, Green Revolution based on High Yielding Varieties technology and Integrated Rural Development. Irrigation has direct bearing on agricultural strategies in India. It forms the backbone for sustained and successful agriculture. An assured water supply helps increase farm yield and income and facilitates increased capital formation. Irrigation in India performs protective and productive functions. The protective irrigation makes up the moisture deficiency in soils to ensure healthy growth of crops. The productive irrigation helps to raise the second and third crops. The irrigation is also employment creating in character, in a predominantly agricultural economy.

It is necessary to economise on water use. Economy on water use will help increase productivity and bring more areas under irrigation. This calls for water management practices. New irrigation strategies facilitate improved water management. Control and proper method of irrigation in canal and tank command areas, providing drainage and re-use of water facilitates, conjunctive use of surface and ground water, sprinkler irrigation in canal/tank command areas, drip irrigation in well irrigated areas and Bi-wall irrigation for closely spaced crops are the significant irrigation strategies.