CHAPTER II

CHANGES IN IRRIGATION PATTERNS

Irrigation refers to an artificial way of providing water to plants. Its urgency needs no emphasis for having a stable and successful agriculture in an area like the Bist Doab, where rainfall is not only inadequate but also is seasonally concentrated and unreliable. The history of irrigation in the region is very old. It dates back to the Mughal period (sixteenth century). But during earlier times it was practised on small scale. The methods used to draw water from wells were crude and slow. With the passage of time, the system experienced expansion and refinement. The traditional mot system (leather bucket pulled by men or a pair of bullocks), lever system etc. were replaced by Persian Wheel wells. Wooden wheel and earthern buckets of Persian wells were gradually replaced by more durable iron wheel and buckets. Canal irrigation remained obsolete till the Britishers introduced the same through the extension of Shah Nahr canal in northern part of the region in 1893. Major emphasis, however, remained on well irrigation, particularly till the initiation of planned development era in 1951. At the beginning of First Five Year Plan in 1951, the Bist Doab had 39.6 per cent (209,612 hectares) of its net area sown under irrigation. Almost whole of it was irrigated by wells. The proportion of net irrigated area increased to 45.5 per cent (279,862 hectares) in 1966 and to 63.3 per cent (449,552 hectares) in 1980. It is quite evident that the pace of irrigation was slower during 1951-66 than that during 1966-80. The extension of the Bist Doab canal system (Map 2;3) in 1954 and development of minor irrigation through wells, tube-wells and pumping sets was largely responsible for the increase in net
irrigated area during pre-1966 period. The real breakthrough in this regard, however, came after the introduction of Green Revolution technology in mid-sixties. High yielding varieties of seeds and chemical fertilizers were the chief ingredients of this technology. The use of these inputs pre-required the development of assured irrigation. Therefore, the government decided to encourage the development of irrigation particularly through minor irrigation schemes, as these were less expensive and more dependable. Farmers were offered loans at concessional rates for installing tube-wells and pumping sets. Cement, bricks, steel etc. were also distributed for the purpose, on priority basis. More and more tube-wells were energised by extending power lines to rural areas. Farmers took the advantage of the state policies and participated fully in this task. The realization among them about the urgency of irrigation was particularly high after the drought of 1967 (Singh, 1977). Greater availability of farm machinery, increase in farm productivity and consequent surplus generated in terms of cash on the farms also contributed to the faster expansion of irrigation during post-1966 period. Predominantly plain topography, soft alluvial strata and favourable underground water conditions of the Bist Doab played their own role in this regard. The Persian Wheel wells were replaced by tube-wells and pumping sets, which increased in number from 20 in 1951 to 5,995 and 76,016 respectively in 1966 and 1980. They accounted for 92.7 per cent of the net irrigated area of the Bist Doab in 1980 and thus are the chief modes of irrigation in the region (Map 2.1 and 2.2). Irrigation brought remarkable transformation in the agricultural scene of the Bist Doab. The extension of cultivation to new areas, rationalization of cropping pattern on commercial lines, increase in intensity of cropping
BIST DOAB
Irrigation by Various Modes
1980
(Data by assessment circles)

Source: Unpublished Revenue Records (Lai Kitabs)
BIST DOAB
Distribution of Tube-wells and Pumping Sets: 1980
(Data by assessment circles)

One Dot Represents 100 Tube-wells and Pumping Sets.

Source: Unpublished Revenue Records (Lai Kitabs)
BIST DOAB
NETWORK OF CANALS
1980
Source: Irrigation Department, Punjab
(from 119 to 140 per cent), increase in farm productivity and stabilization of agriculture in the region are largely the functions of the development in irrigation.

**Spatial Pattern of Change in Net Irrigated Area during 1951-80**

As already mentioned, net irrigated area in the Bist Doab increased from 39.6 per cent in 1951 to 63.3 per cent in 1980 (Maps 2.4 to 2.6). This increase of nearly 24 per cent is true for the region as a whole but not for its parts. It varies from a minimum of 0.3 per cent in Rakkar assessment circle of Dasuya tahsil to a maximum of 58.5 per cent in Dona assessment circle of Nakodar tahsil. Few areas of the region suffered decline too though of a small magnitude. (Map 2.7). In order to study the areal variations in changes in net irrigated area, the Bist Doab may be divided into the following four types of areas:

1. **Areas where increase in net irrigation is over 24 per cent;**
2. **Areas where increase in net irrigation varies between 12 and 24 per cent;**
3. **Areas where increase in net irrigation is below 12 per cent; and**
4. **Areas where net irrigated area decreased.**

**1. Areas where increase in net irrigated area is over 24 per cent**

Fifteen out of thirty-five assessment circles of the Bist Doab experienced an increase of more than 24 per cent in net irrigated area.
BIST DOAB
NET IRRIGATED AREA
(Data by Assessment Circles)

1951
As percentage of net area sown

No. of Units

Significant Values

Highest: 90.5%
Lowest: 00.0%
Mean: 39.6%

MAP 2-4

1966
As percentage of net area sown

No. of Units

Significant Values

Highest: 90.5%
Lowest: 00.0%
Mean: 45.5%

MAP 2-5

1980
As percentage of net area sown

No. of Units

Significant Values

Highest: 99.2%
Lowest: 00.0%
Mean: 63.3%

MAP 2-6

Change 1951-80
Change in percentage

No. of Units

Significant Values

Highest: 56.5%
Lowest: 06.2%
Mean: 22.7%

MAP 2-7

Source: Unpublished Revenue Records (Lal K'tabs)
Most of these fall in central upland plain region of the Bist Doab. The increase here varies from 24.5 per cent in Dona circle of Kapurthala tahsil to 58.5 per cent in Dona circle of Nakodar tahsil. A part of this increase is due to the extension of the Bist Doab canal system. But a major share of this increase is ascribed to the extension of tube-well irrigation. Its plain topography, soft alluvial strata, rich reservoir of good quality sub-soil water at favourable depths, sufficient capital with the farmers due to more intensive farming and foreign remittances by the emigrated relatives are largely responsible for such a large increase in net irrigated area in this part of the Bist Doab.

2. Areas where net irrigated area increased between 12 and 24 per cent

The flood plain of the Satluj in Nakodar and that of the Beas in Sultanpur and Kapurthala tahsil form a contiguous belt where increase in net irrigated area ranges between 12 and 24 per cent. A few other isolated patches, such as City Circle of Jalandhar, Dhak circle of Phagwara, Sirowal circle of Hoshiarpur and Maira circle of Dasuya tahsil also fall in this category. The areas associated with the flood plains in Nakodar, Sultanpur and Kapurthala tahsils experienced frequent floods prior to the damming of the two rivers. Water-table in most of their parts was close to the surface. At places it created waterlogging. Due to the same reason, canals were not extended to these areas. Thus, their base of irrigation was low during early 1950s. However, construction of dams across and embankments along the rivers created conditions for faster development of irrigation. Tube-well irrigation
picked up quickly. But due to the delayed start, the increase in irrigation during the study period remained moderate.

On the other hand, the City Circle of Jalandhar and Dhak circle of Phagwara experienced moderate increase in irrigation because they had high proportion of net irrigated area in 1951, over which the scope for further expansion was limited. Maira circle of Dasuya tahsil witnessed medium increase in percentage irrigated area despite considerable increase in absolute hectarage. Fairly large increase in net area sown vis-a-vis net irrigated area kept this circle in the average category. But moderate pace of development of irrigation in Sirowal circle of Hoshiarpur tahsil is due to its deeper sub-soil water and dissected topography. Both these limitations came into the way of faster increase in this regard.

3. Areas where increase in net irrigation is below 12 per cent

The hilly and adjoining choe-infested foothill tract registered low increase in net irrigation. It ranges between 0.3 per cent in Rakkar circle of Dasuya to 11.8 per cent in Rakkar circle of Balachaur tahsil. Beat Manswal circle of Garhshankar tahsil may also be included into this category, where irrigation remained unknown to the farmers throughout the period under review. Physiographic hindrances such as uneven relief, severe dissection by seasonal streams and deep as well as inadequate underground water seriously impeded the development of irrigation in this zone. Besides, small and less productive holdings did not provide enough surplus money for installation of tube-wells.
The Dhak assessment circle of Nawanshahr tahsil also recorded a low increase in irrigation. But it is due to the fact that it had an extremely high base (89.5 per cent) of irrigation in 1951 over which the scope for further expansion was limited.

In brief, low increase in irrigation was a feature of either the areas where physical problems came in the way or of the parts where it was already highly developed.

4. Areas where net irrigation decreased

What is of interest and amaze is the decrease in net irrigated area which took place during 1951-80, in one out of thirty-five assessment circles of the Bist Doab. It is the Bet assessment circle of Dasuya tahsil. The proportion of net irrigated area here declined from 18.8 per cent (3,814 hectares) in 1951 to 14.6 per cent (2,509 hectares) in 1980. This is mainly ascribed to the emergence of waterlogging which was caused by overflooding of the Beas and seepage from Shah Nahr canal system introduced as back as 1893.

In short, the upland plain of the Bist Doab, where sub-soil water conditions are highly favourable, land is flat and fertile, strata are soft and people have more money, recorded highest increase in net irrigated area. On the other hand, hilly and dissected foothill tract registered the lowest increase in this regard. The flood plains, where conditions regarding floods and waterlogging improved recently fall in between the upland plain and the hilly areas in terms of expansion of irrigation.
Spatial Pattern of Net Irrigated Area in 1980:

In 1980, the Bist Doab had 63.3 per cent (449,552 hectares) of its net area sown under irrigation. Though the proportion is fairly high for the region itself, yet it is quite low in comparison to the state average of 81 per cent. This is chiefly because greater proportion of the state's hilly and dissected area falls within the Bist Doab which poses problems for the extension of irrigation. Besides, it did not receive adequate attention in the matter of canal irrigation. However, some parts of the region exhibit high intensity of irrigation while some others lag far behind in this respect. The proportion of net irrigated area varies from as low as 0.9 per cent in Rakkar assessment circle of Dasuya tahsil to as high as 99.2 per cent in Dhak assessment circle of Nawanshahr tahsil. For analysing spatial variations in existing pattern of irrigation, the Bist Doab may be divided into following three types of areas (Map. 2.6):

1. Areas with more than 75 per cent of their net area sown under irrigation;
2. Areas where net irrigated area varies between 50 and 75 per cent;
3. Areas where net irrigated area is below 50 per cent.

1. Areas with more than 75 per cent of their net area sown under irrigation:

Southcentral Bist Doab, comprising almost whole of Jalandhar district and adjoining parts of Kapurthala district, is the most irrigated
part of the region. It covers 16 out of 35 assessment circles of the Bist Doab. Net irrigated area in this tract ranges from 80.7 per cent in Dona assessment circle of Kapurthala tahsil to 99.2 per cent in Dhak assessment circle of Nawanshahr tahsil. It had fairly high irrigation base in 1951 which improved further substantially. Plain topography, soft alluvial strata, rich reservoir of sub-soil water, consolidation of holdings, fairly large capital with the farmers attained through intensive farming and foreign remittances largely account for this situation.

2. Areas where net irrigated area varies between 50 and 75 per cent:

Bet assessment circles of Kapurthala, Sultanpur and Nawanshahr tahsils have moderate intensity of irrigation. Net irrigated area in these units varies between 56.8 and 68.1 per cent. Occasional floods, high water-table and consequent waterlogging in some parts and considerable moisture in the soils keep these areas at a lower level of irrigation than the neighbouring upland plain. Sirowal assessment circles of Garhshankar and Balachaur tahsils falling in foothill plain where sub-surface water is deep, too have moderate intensity of irrigation.

3. Areas where net irrigated area is below 50 per cent:

Hills and the foothill zone forming an elongated belt along eastern boundary of the region is the least irrigated part of the Bist Doab. The proportion of net irrigated area varies between 0.9 and 24.6 per cent in 12 out of 14 assessment circles of this belt. Beat Manswal circle of Garhshankar tahsil is exclusively rainfed. Hilly terrain, dissection by
choes both in the hills and the foothill plain and deep as well as inadequate sub-soil water are detrimental to the development of irrigation in these areas. Loose soils, small and less productive farms and consequent low investment capacity of the farmers too thwart irrigation development. Maira assessment circle of Dasuya tahsil, where depth of water-table is quite favourable and Shah Nahr canal provides irrigation to a considerable area, has higher (40 per cent) proportion of its area under irrigation than other areas falling in this tract.

Irrigation Regions

On the basis of changes in and existing pattern of irrigation, the Bist Doab may be divided into the following three irrigation regions (Map 2.8):

1. The most dynamic and intensively irrigated upland plain;
2. The least dynamic and least irrigated hilly and foothill zone; and
3. Fairly dynamic and moderately irrigated flood plains.

1. Covering 51.5 per cent of the total geographical area, the central upland plain is the most intensively irrigated part of the Bist Doab. Fastest
BIST DOAB
IRRIGATION REGIONS
1980

(1) The Most Dynamic and Intensively
    Irrigated Upland Plain

(2) The Least Dynamic and Least Irrigated
    Hilly and Foothill Zone

(3) Fairly Dynamic and Moderately
    Irrigated Flood Plains.
increase in net irrigation (from 54.8 to 87.2 per cent) in this region during 1951-80 brought this distinction. Out of the total increase, more than four-fifths (83.3 per cent) was brought by the expansion of tube-well irrigation and rest by way of increase in canal irrigation. As stated earlier, this region is characterized by an excellent physical setting for the development of tube-well irrigation. Consolidation of holdings and availability of sufficient capital with the farmers played their own role in this regard. Excessive withdrawal of sub-soil water through tube-wells, however, is fastly depleting its underground water reservoir. Water level is sinking at an unexpected rate. As a result, the cost of pumping out water and installation of tube-wells has increased. Continued depletion of this vital resource is a matter of serious concern which needs immediate attention of the planners. Further extension of canals may prove beneficial. It is likely to release pressure on sub-soil water.

2. In sharp contrast to the region discussed above, the hilly and foothill zone, covering 35.3 per cent of the total area of the Bist Doab, lags far behind in the development of irrigation. During the last thirty years, this tract could register an increase of only 8.7 per cent (from 11.2 to 19.9 per cent) in its net irrigated area. Most of the increase in this region too came through tube-wells which were installed in private as well as in public sector. But extension of irrigation through these modes remained slow because of deep and inadequate sub-soil water and uneven terrain. Canals could not be extended due to physiographic handicaps. Thus, it remained the least irrigated. Foothill zone, however, is better than the hills in terms of increase
in and existing base of irrigation for obvious reasons. Sinking of tube-wells in this zone is an expensive affair. It is beyond the resources of most of the farmers. Therefore, the installation of tube-wells in the public sector may improve the situation to some extent. Extension of a canal along the foot of hills with distributaries running parallel to seasonal streams may also go a long way in developing irrigation in the foothill zone. But it is a costlier proposition. Notwithstanding, the Kandi Watershed and Area Development Project (including the extension of Kandi canal) which has recently been launched by the government with the assistance of World Bank, is a new hope for this tract. Under this project, nearly 6,000 hectares of additional land will be brought under irrigation.

3. The flood plains of the two rivers constitute a different irrigation region which is transitional to previous two in terms of development as well as existing position of irrigation. Net irrigated area here increased from 41.2 to 60.3 per cent during the study period. Tube-wells, pumping sets and wells are the exclusive means of irrigation. Canals were purposely not extended to this region because floods were common and water-table was closer to the surface. It has a rich reservoir of sub-soil water which is continuously replenished through the percolation of water from river beds. Thus, minor irrigation has a wider scope of development in this part.

Conclusion

The Bist Doab recorded substantial increase in its irrigation base during 1951-80. Nearly 240,000 hectares of additional land were brought under irrigation during this period. Out of these, about 187,000 hectares
were due to increase in tube-well irrigation and the remaining 53,000 hectares were brought under irrigation through the extension of new canals. The proportion of net irrigated area in the region increased from nearly 40 per cent in 1951 to more than 60 per cent in 1980. The traditional, less efficient modes of irrigation were replaced by the modern more efficient ones.

Central part of the Bist Doab, associated with the upland plain, where physical, economic and social conditions are favourable, registered the highest increase in net irrigation. As a result, it turned out to be the most irrigated area of the region in 1980. The hilly and foothill tract, where physical forces are detrimental, had low base of irrigation during early fifties, and continued to lag behind in this regard with lower positive change. The flood plains fall in between these two, in terms of increase in and the intensity of irrigation.