

## CHAPTER IX

### IRRIGATION AND AGRICULTURAL INPUTS

Among various inputs applied in raising agricultural produce, the following inputs are important —

- (1) Irrigation
- (2) Manures, fertilisers and pesticides
- (3) Seeds
- (4) Agricultural Implements.

#### (1) Irrigation

##### Origin and History

The history of irrigation in Sikkim could be traced back to the days when the Britishers encouraged Nepalese immigrants into Sikkim during the early part of the 19th century as an easy solution to the problem of labour shortage. The Nepalese immigrants soon after their settlement in the new land cleared the jungle, terraced the hill sides for the cultivation of paddy and began a mode of cultivation that obtains to this day and forms the very basis of Sikkim's economy<sup>(1)</sup>. Paddy without sufficient water does not thrive. It seems irrigation system developed with the beginning of the transplanted paddy cultivation. It may not be wrong to say that paddy is the first crop cultivated with irrigation in the state<sup>(2)</sup>.

### Need for Irrigation

Though Sikkim is endowed with heavy rainfall, it is concentrated for a few months only, from June to August. The other months remain dry due to which most of the cultivated area is monocropped. The period from December to February is the critical period of dry season in the state.

In Sikkim there is practically no scope to bring additional area under cultivation. For increased agricultural production intensive cultivation is the only solution. Intensive cultivation in the absence of required amount of agricultural inputs including irrigation is not feasible (3).

### Irrigation Existing

Although the state is endowed with abundant surface water resources, irrigation here is mainly through small water springs. The river and streams flowing through deep gorges make it difficult for erecting major dams and to have limited utilisation for irrigation. In Sikkim the availability of spring water increases with the onset of monsoon and decreases with the lapse of monsoon.

The water from springs collected into small riverlets is commonly known as "kholisa" and when this "kholisa" becomes sufficiently big is known as "kholisa". The topography of the state is such that most of the "kholisa" and "jhora" have a high head.

Traditionally the farmers have been tapping these kholsa and khola etc. at a higher level and diverting the water in channels for irrigating their paddy fields which are on terraces. Another traditional method of irrigating vegetable fields is to take water from the water springs in aqueducts made of bamboo.

The sole disadvantage of this traditional method of irrigation is that once the streams plunge deep down into ravines, the water cannot be utilised for irrigation, because the pumping back of water is a costly affair. Even the water springs, some of them get dried up during winter when rainfall is either scanty or there will be no rainfall.

During the last two to three years, a few shallow dug wells have been tried in the East, South and West Districts. However since only shallow aquifers are tapped, the dugwells dry up in summer - the time when they are needed most.

Irrigation by means of tube wells, tanks, pump sets, lift irrigation etc. do not exist in the state (4).

In Sikkim inspite of the fact that paddy is cultivated in rainy season, irrigation is provided for paddy. Well defined irrigation channels exist only in paddy fields and all paddy fields are irrigated. Irrigation in vegetables and other crops are done casually and are not specific. Cardamom is normally grown under shaddy trees and the water from "kholsa" and "khola" is allowed to flow from the top of the field to be spread mostly by itself. Well

defined channel for carrying water exists in cardamom fields.

The irrigation in crops, other than paddy, cardamom and vegetables is limited mainly due to the danger of soil erosion. The crops like maize, wheat, barley, millet etc. are grown in soil which is untterraced, partly terraced or unlevelled. Terrace and irrigation can not be done without the risk of soil erosion<sup>(5)</sup>.

### Irrigation Status

The government of Sikkim set up the Department of Irrigation in 1976. Since then the Department has been formulating a number of irrigation schemes within the state. At present a number of minor irrigation channels have been constructed and they have gained popularity among the cultivators. In a hilly state like Sikkim major irrigation schemes could not be successful due to land slides.

The information on districtwise distribution of wholly irrigated holdings and area and their percentage by size group is presented in the following table.

Table 9.1

Districtwise distribution of wholly irrigated holdings and area and their percentage by size group.

Sl. No.	District	Size group (Hec.)	Wholly No	Irrigated holdings area	% No.	% Area
1	2	3	4	5	6	7
1.	East	1. Marginal (upto 1.00)	1714	658	74.46	41.88
		2. Small (1.00-2.00 hec)	316	336	13.73	21.39
		3. Semi-medium (2.00-4.00 hec)	197	372	8.55	23.68
		4. Medium (4.00-10.00 hec)	70	189	3.04	12.03
		5. Large (10 and above)	5	16	0.22	1.02
		Total :			<u>2302</u> 44.27	<u>1571</u> 49.12
2.	West	1. Marginal	1375	488	85.40	60.00
		2. Small	146	150	9.07	18.63
		3. Semi-medium	66	112	4.10	13.92
		4. Medium	22	58	1.37	7.20
		5. Large	1	2	0.06	0.25
		Total :			1610 (30.96)	8.05 (25.16)
3.	South	1. Marginal	894	368	79.05	49.66
		2. Small	153	163	13.53	22.00
		3. Semi-medium	63	113	5.56	15.25
		4. Medium	20	80	1.77	10.80
		5. Large	1	17	0.09	2.29
		Total:			1131 (21.75)	741 (23.16)

1	2	3	4	5	6	7
4.	North	1. Marginal	131	44	83.45	53.66
		2. Small	15	14	9.55	17.07
		3. Semi-medium	7	11	4.46	13.42
		4. Medium	2	1	1.27	1.22
		5. Large	2	12	1.27	14.63
Total:			157	82	100	100
			(3.02)	(2.56)		(6)

From the above table, it is clear that in respect of wholly irrigated holding number, East District has the highest percentage i.e. 44.27% followed by West District, 30.96%, South District 21.75% and North District 3.02% respectively.

In the same, East district again has the highest percentage, 49.12% of irrigated area to the total irrigated area of the state, West District has 25.15%, South District has 23.16% and North 2.56% of irrigated area to the total irrigated area of the state (7).

Districtwise distribution of wholly unirrigated holdings is given in the table 9.2.

From table 9.2, it is observed that 23.62% of the total number of wholly unirrigated holdings are in East District having 18.22% wholly unirrigated area of total wholly unirrigated area of Sikkim, 32.89% holdings of the total number of wholly unirrigated holdings are in West District with an unirrigated area of 34.20%

Table 9.2

Districtwise distribution of wholly unirrigated holding numbers and area with the percentage to the state total.

Sl. No.	Size Class	District Area (Hec)								State No.	Total Area
		East		West		North		South			
		No.	Area	No.	Area	No.	Area	No.	Area		
1.	Marginal	4242 (27.58)	1643 (24.44)	4797 (31.20)	2031 (31.45)	1393 (9.06)	573 (8.87)	4945 (32.16)	2211 (34.24)	15377 (100)	6458 (100)
2.	Small	1764 (21.24)	1953 (20.44)	2712 (32.66)	3061 (32.51)	569 (6.85)	710 (7.54)	3260 (39.25)	3292 (39.21)	8305 (100)	9416 (100)
3.	Semi-medium	1278 (19.81)	2358 (18.03)	2352 (36.45)	4771 (36.48)	444 (6.88)	1104 (8.44)	2378 (36.86)	4846 (37.05)	6452 (100)	13079 (100)
4.	Medium	654 (19.18)	2068 (15.74)	1184 (34.72)	4417 (33.73)	518 (15.19)	2410 (18.40)	1054 (30.91)	4201 (32.08)	3410 (100)	13096 (100)
5.	Large	112 (20.63)	796 (12.55)	167 (30.76)	2268 (35.77)	151 (27.80)	2242 (35.36)	113 (20.31)	1035 (16.32)	543 (100)	6441 (100)
Total:		8050	8818	11212	16548	3075	7039	11750	15985	34087	48390
		23.62	18.22	32.89	34.20	9.02	14.35	54.47	33.03	100	100

of total wholly unirrigated area of Sikkim. 34.47% holding of total number of wholly unirrigated area of 14.55% of total wholly unirrigated area of Sikkim reported in North District (9).

#### Impact of Irrigation on farming activities

With more and more areas coming under irrigation there has been a steady increase in intensity of cropping as well as intensity of irrigated crops. A good example is the cultivation of Sonalika irrigated wheat and potato at Daramdim, Tharpu, Dentam, Hee and other places during rabi season with assured irrigation (10).

#### Irrigation Potential

Sikkim being richly endowed with water resources has a great potential for developing irrigation.

A high level team for Land use Planning of Sikkim appointed by the Government of India, Planning Commission in its report of May 1981 has made the following suggestions on the exploration and exploitation of irrigation systems in Sikkim —

##### 1. Harvesting Perennial Streams

The strategy should be to utilise the natural streams, "khola" and "kholsa" for giving not only supplemental irrigation to the main crops of paddy, but also to meet the irrigation demand of rabi crops thus encouraging cultivation of two to three crops wherever possible.



## 2. Tank Irrigation

It is possible to harvest run-off through construction of small farm tanks. These farm tanks can be used for increasing the intensity of cropping.

## 3. Lift Irrigation

Along river beds if hydroelectric projects are taken up and its power becomes available easily lift irrigation through suitable mechanical means as hydram, or lift pump may be explored.

## 4. Command Area Development

To make irrigation effective, suitable actions for command area development can be taken. In the case of Sikkim, it means developing good bench terracing system on unirrigated lands at present for unirrigated crops. This means intensification of soil and water conservation programme, appropriate cropping systems and production technology side by side with the development of water resources for irrigation<sup>(11)</sup>.

## 2. Manures, Fertilizers and Pesticides

With changes in cropping pattern, farmers in Sikkim have started using fertilizers and pesticides along with organic manure.

Organic manure -

Organic manures are farm yard manures (F.Y.M.) compost, night soil, green manure, town refuse, sewage and sludge and

concentrated organic manures etc. Farm yard manure means decomposed mixture of dung and urine of farm animals along with litter (bedding materials) and left over materials from roughages and fodder fed to cattle, buffaloes, sheep, goats, pigs and horses. Bedding materials consist of weeds, bushes, ferns, farm refuse, jungle leaves etc. The Farm yard manure collected daily from the cattle shed consists mainly of such materials soaked with urine and dung. It is first collected in a pit and when it is fully decomposed and becomes friable it is ready for use<sup>(12)</sup>.

#### Chemical Manures

The type of fertilizers to be used depends on soil condition, its response to crops, its residual effect on soil and economy per unit area for the crop. A soil Testing Laboratory has been set up at Tadong, Gangtok from where nutrient recommendations based on soil tests are communicated to farmers through V.L.W.S. Sikkim soil being highly acidic, fertilisers with acidic residual effect is not recommended for Sikkim Soil<sup>(13)</sup>.

How much organic manures, fertilisers and pesticides are being used in Sikkim districtwise can be presented in the following table.

Table 9.3

## Districtwise consumption of fertilisers in unirrigated areas

Sl. No.	District	No. of holdings growing one or more selected crops	Chemical fertilisers		Organic manure		Pesticides	
			No.	Areas treated with (hec)	No.	Arreas treated with	No.	Areas treated with
1	2	3	4	5	6	7	8	9
1.	East	10521	4048	2250.59	7672	7333.35	756	534.67
2.	West	7756	1446	2051.42	7056	10226.88	28	45.32
3.	South	10222	1988	3305.24	8517	13077.67	70	113.56
4.	North	2099	471	429.06	1442	3874.48	229	293.00
	Sikkim	30598	7953	7636.31	24687	34512.38	1083	2986.55
	Total:							

It is known from the above table that in unirrigated areas organic manures are applied more than chemical fertilisers. The holdings and areas benefitted by the organic manures accounted for 80.68% and 67.10% respectively as compared to the total holdings growing unirrigated crops.

After organic manures, chemical fertilisers occupy the second place of importance. The holdings and areas treated with fertilisers are 26% of the total holdings growing unirrigated crops and 15.40% of the total area.

In East District the response to chemical fertilisers is highly encouraging as is evident from the holdings and area benefitted by chemical fertilisers are 38.5% of the holdings and 24.1% of the area.

Pesticides have been assuming significance only of late. The percentage of holdings of all sizes and areas benefitted by pesticides work out to be 3.54 and 1.92 respectively as compared to the total pesticides.

East district ranks foremost with 69.81% of its total holdings and 54.19% of the total area treated with pesticides in the state (14).

So far as consumption of fertilisers is concerned there is considerable scope of enhancing fertiliser consumption in Sikkim, because the farmers have exhibited interest in using fertilisers. However, non-availability of credit, infrastructure and bottlenecks in transportation have resulted in a sluggish growth in utilisation

of this important input (15).

### Agricultural Implements

In Sikkim, the agricultural implements are simple and of daily use connected with various agricultural operations. They are not important agricultural machineries like tractors, pump-sets, threshers, oil crushers etc. used in other parts of the country.

The estimated number of these agricultural implements are given in the following table.

Table 9.4

Estimated number of agricultural implements

Agricultural implements	No.	District	With highest No.
1	2	3	4
1. Spade including spade for paddy cultivation (कोदालो)	34077	South	15,400
2. Spade (small) * (कुटे)	4563	South	1,547
3. Grinder * (जाँतो)	24911	South	9,361
4. Rice husker * (दिक्की)	7543	East	3,876
5. Ploughs * (हलौ)	15024	South	9,382
6. Scrapers * (फरुता)	4773	South	1,813
7. Bullock driven levellers	5275	South	2,730
8. Sprinklers * (झरिक्ती) (फ्याउरी)	11049	South	5,967
9. Duster * (धूलो पुछने)	6127	South	3,093
10. Axe * (बँचरो)	27891	South	10,481
11. Secateurs * (सिकेट)	1587	East	1,104 <sup>16</sup>

\*Note: These are the local names for various implements.

From the above table, it can be known that South District has the highest numbers of implements. East District has the highest number of rice huskers and secateurs.

### Seeds

Seeds being one of the important inputs due attention is being given by the Agriculture Department in Sikkim in developing and introducing seeds of high yielding varieties (H.Y.V.), besides using the seeds of local varieties. As such crop improvement work has been initiated in a number of principal crops like rice, maize, potato etc. with the objective of developing seeds of high yielding variety. After a series of adaptation trials and yield performance the type that is best for the state will be recommended by the Regional Centres for cultivation.

For paddy cultivation, first Pusa-33 was recommended, then found susceptible to paddy blast and farmers rejected it. Later other varieties such as IET-1444, Giza-14, CR-126 replaced Pusa-33. The local varieties of rice like Addey, Kalchanti etc. are still grown by farmers.

In maize cultivation, new composite maize varieties such as Amber, Jawahar, Kissan, Vikram, N.L.D. etc. have been recommended.

For potato seeds Sikkim has been doing excellent work by multiplying at its Research Centres, breeder plant of Kufri Jyoti obtained from Simla Central Research Institute, as foundation seeds.

The foundation seeds are then multiplied as certified seeds under the supervision of potato experts. In 1980, in Sikkim, at a place called Hilley, Potato Research Centre a new system called clonal selection with Red Pimpernel variety has been started. The clones are then multiplied in the fields of certified potato seed growers and distributed among other potato growers (17).

### Summary

In Sikkim the scope of bringing additional land under cultivation for increasing agricultural produce being limited, the development of irrigation system and application of agricultural inputs like seeds, fertilisers etc. assume great importance.

So far as irrigation is concerned, a number of minor and medium irrigation schemes are being undertaken in different parts of Sikkim since 1976 when a separate Irrigation Department has been set up by the government. The main source of irrigation in Sikkim is spring water collected in small rivulets known locally as "kholisa" and "khola". Farmers tap these "kholisa" and "khola" at a higher level and divert water in channels or aqueducts for irrigating their paddy fields. Irrigation in vegetable fields and cardamom is done casually.

In La-chen and La-chung as in other parts of the state spring water is the main source of irrigation. Irrigation by means of tanks, tube wells, pump sets, lift irrigation do not exist in these two valleys and other districts of the state. However Sikkim

has the possibility of developing tank irrigation, lift irrigation and command area development as pointed out by a high level team for Land Use Planning appointed by the Planning Commission, Govt. of India in 1981.

In respect of wholly irrigated holdings East District has the highest percentage, i.e. 44.27% followed by West District, 30.96%, South District 21.75% and North District 3.02%

Area-wise again, East District has the highest percentage of 49.12% of irrigated area of the state followed by West District, 25.16%, South District 23.16% and North District 2.56%.

So far as manuring is concerned, throughout Sikkim including La-chen and La-chung farmers basically apply farm yard manure from their cattle. It is the decomposed mixture of dung and urine of farm animals with the litter and left over materials from roughages and fodder fed to farm animals.

The application of chemical fertilisers in Sikkim depends on nutrient recommendations based on soil testing by the Soil Testing Laboratory. A number of chemical fertilisers such as Urea, Suphala, Nitrogen, Phosphorus etc. are being applied in irrigated areas throughout Sikkim including La-chen and La-chung. However, in unirrigated areas, organic manures are applied more than chemical fertilisers.

Agricultural implements used in Sikkim are very simple and of daily use connected with various agricultural operations.



Tractors, pump sets, threshers etc. are available in Sikkim. In La-chen and La-chung implements like rice huskers, bullock driven levellers are not used. Ploughing is done with the help of yaks in the two valleys.

Seeds used in Sikkim are both of local varieties and high yielding varieties. Seeds of high yielding varieties in some of the principal crops like rice, maize, potato etc. are being developed by the Regional Centre by a series of adaptation trials and yield performance and finally the best suited for the state will be recommended for cultivation.

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