Indian agriculture is crop oriented (Sen Gupta, 1968) and the Lower Chambal Valley is not an exception. Major portion of the total cropped area in the region under study is devoted to food crops and the commercial crops occupy a little area. The main crops are jowar, groundnut, bajra, maize and pulses in the kharif and wheat, gram, barley and linseed in the rabi. The State Agriculture Departments of the Valley have recommended that cropping pattern in the near future should be oriented so as to include new crops like paddy, sugar-cane, cotton, hybrid maize, jowar and fodder crops. It is hoped that as a result of extensive efforts of the Agriculture Department the new crops shall gradually replace the old crops in the canal irrigated tracts and it is expected that this change will be accentuated to use the canal water properly.

It is interesting to note that since after the introduction of canal irrigation the cropping pattern in the Chambal Commanded Area has gradually been making shift from dry cultivation to irrigation agriculture. On the contrary, within the hilly tract, plateau and ravine lands there has been no change, instead the cropping pattern has deteriorating. The personal inquiry, specially in the
ravine lands, reveals that within last ten years or so the acreage under superior crops like wheat has decreased because of declining soil fertility and deteriorating hydrological condition of soils due to the continuous soil erosion and ravine formation. In these tracts thus, only crops like bajra and barley are grown which can adjust themselves to the poor soil and inadequate drainage.

While discussing the cropping pattern in the lower Chambal Valley it should also be remembered that the environmental conditions in the valley vary from place to place and they greatly influence the cropping pattern and the yield of crops. Particularly, the soil characteristics and relief features determine the intensity of cropping. For example, wheat and jowar are grown in clayey and clayey loam where the irrigation facilities are adequate, natural drainage and fertility status are sufficient to feed the plants well. Bajra and barley which may be grown in inferior soils, are cultivated in the sandy and sandy loams of the badly ravine infested areas of the valley. However, it may be said that the geomorphic and hydrological features as have been studied in Part I limit and determine the degree and intensity of cropping pattern in various parts of the region.

The present chapter deals with cropping seasons, cropping techniques and major crops. A detailed discussion of major crops has been given by the statistical method. Moreover, the conclusions of this method to a great extent
have also been substantiated by the results of personal village to village inquiry.

PRINCIPAL CROPPING SEASONS

Predominantly there are two main cropping seasons in the valley. They are the kharif (unalu) and the rabi (syalu). The cropping seasons follow the seasonal rhythm of temperature and rainfall. The kharif season starts with the onset of monsoon from the end of June and sowings are completed usually by the middle of July. Distribution of rainfall is very important for kharif crops in the valley as the soils are heavy and their working depend on timely rainfall. Land operations are started only after the first shower. Further, in case of continuous rainfall the soils which are heavy in texture and retain more moisture offer some difficulty in tillage operations. Alternate heavy showers and a break is desirable for timely operations. Harvesting of kharif crops starts from the end of October and continues till December.

The rabi season starts from the end of October and sowing is completed by the end of November. Monsoon rainfall is stored in the heavy soils of the valley for the growth of rabi crops. Inadequate rainfall during this period results in failures of rabi crop except in the irrigated tracts. In spite of storage of moisture from rains received during August and September small winter
rainfall is also important for successful rabi crops.

CROPPING TECHNIQUES

There are three principal cropping techniques viz., mixed cropping, crop rotation and double cropping.

1 Mixed cropping

Mixed cropping is the most common practice in the Lower Chambal Valley. In the kharif season a variety of crops are grown as a mixture is more common than rabi. The combination of mixed cropping are as follows: Jowar-Tur and Groundnut; Maize-Urd-Til and Pulses.

In the rabi season wheat and barley is grown mixed which is known as 'baijer'. At places wheat is grown mixed with gram called 'gulchani'. Where the soil is retentive of moisture it is a common practice.

2 Double cropping

Double cropping is a very common practice particularly where the irrigation facilities are available and moisture holding capacity of soils is considerable. After the expansion of the canal irrigation double cropping has become a common practice in the Chambal Commanded Area. The area in this tract has just doubled now.

Double cropping in the hilley and ravine infested regions is not a common practice. It is because of non-
availability of water during rabi season, poor moisture holding capacity of sandy loams and loamy sand, and permeable nature of soils. However, within the last 10 years or so there has been a decline in the double cropped area as evident from village studies.

In the Lower Chambal Valley, jowar, groundnut, maize, moong, bajra, tuar, and til are grown in the kharif season, while crops like wheat, barley, gram, and linseed are grown in the rabi season.

3 Crop rotation

Crop rotation is an important aspect of crop pattern. It varies from one place to another depending upon the nature of soil irrigation facilities and the extent of double cropped area. In the valley the regional pattern of crop rotation is as follows:-

Table A1a

i) Hilly region
   a. Maize-Wheat-Maize-Wheat
   b. Fallow-Wheat-Fallow-Barley or Wheat
   c. Til-Fallow-Til
   d. Fodder-Linseed-Fallow-Linseed
   e. Sugarcane-Sugarcane-Ratoon-Maize and Wheat
   f. Chillies-Fallow-Wheat
   g. Cotton-Fallow-Wheat
ii) The Chambal Commanded region
   a. Jowar-Fallow-Wheat
   b. Jowar-Fallow-Til-Fallow
   c. Fallow-Gram-Fallow-Wheat
   d. Jowar-Fallow-Fallow-Linseed

iii) Ravine lands
   a. Jowar-Fallow-Bajra-Wheat
   b. Fallow-Barley-Bajra-Gram

In the ravine lands there is no systematic crop rotation.

K.S. Sheta (1956) has recommended the systematic crop rotation pattern in order to maintain soil fertility under different water allowance classes in the Chambal Commanded area of Rajasthan.

**Table No. 44**

Suggested rotation for different water allowance classes.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Kharif</th>
<th>Rabi</th>
<th>K</th>
<th>R</th>
<th>K</th>
<th>R</th>
<th>K</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heavy</td>
<td>Irrigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Groundnut Sugar cane Sugar Ratoon Ratoon Fallow Cotton Fallow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Jowar Pulses Paddy, pulses Green wheat Cotton Fallow, pulses and oilseeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Fodder Fodder - - - - - - - -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The personal observation of the author in some villages of the Chambal Commanded Area, Rajasthan reveal that the system of crop-rotation is still traditional. The cultivators in Ballop, Sultanpur, and Digod villages have not yet realized the significance of new system of crop rotation. But it is hoped that with the efforts of development blocks this system will gain popularity in the next two or three years.
Kharif Crops

Main kharif crops are jowar, til, bajra, maize, and pulses which are taken both under irrigated and unirrigated conditions. Groundnut, sunhemp, sugarcane and rice also occupy small area. The percentage of area on each crop to net sown area is given in the appendix table VIII.

Jowar

Jowar as the staple food of the people is not only the main kharif crop but it is also the major crop of the valley. Apart from its use as a food crop its plant forms a very good fodder for cattle.

In the Lower Chambal Valley jowar is mainly associated with the heavy clay to clayey loam soils but it is also grown in sandy loams. It is taken mainly as a rainfed crop. Only 4 to 5% of the total jowar area is taken under irrigation in Kota and Bundi districts.

The distributional map (Fig. 35) of jowar shows that the tahsils of Ladpura (29.85%), Digod (31.96%), Pipalda (38.53%), Indargarh (43.33%), Baran (34.44%), Mangrol (40.00%), Antah (37.97%), Atru (30.78%) and Sangesod (32.66%) of Kota district, Patan (37.29%) of Bundi district and Sawai-Madhopur (44.29%) and Khandar (33.96%) of Sawai-Madhopur district have the largest percentage of net sown area under jowar. In Kota district it is grown in clay to clayey loam soils which are well-watered. In the tahsils of Baria,
Baseri, Jholpur, Rajekhera, and Shind jowar occupies a significant position. In these tahsils only 0 to 9 percent of net sown area is devoted to this crop. However, geographically the south western part of the Valley is significant for jowar cultivation and the percentage of jowar decreases in the north eastern portion.

Within last 10 years the area under jowar has considerably increased in Kota district. It is because this part of the Valley has been taken under intensive jowar cultivation scheme by the State Agricultural Department, Kota, Rajasthan. The table below gives a clear idea.

<table>
<thead>
<tr>
<th>Name of tahsil</th>
<th>Area under jowar crop</th>
<th>1956-67</th>
<th>1966-67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digod</td>
<td>14352.4</td>
<td></td>
<td>19313.2</td>
</tr>
<tr>
<td>Pipalda</td>
<td>10427.6</td>
<td></td>
<td>19615.2</td>
</tr>
<tr>
<td>Ladpura</td>
<td>5208.0</td>
<td></td>
<td>11486.8</td>
</tr>
<tr>
<td>Saran</td>
<td>10708.4</td>
<td></td>
<td>15706.8</td>
</tr>
<tr>
<td>Kishanganj</td>
<td>2800.8</td>
<td></td>
<td>9598.0</td>
</tr>
<tr>
<td>Atru</td>
<td>7715.2</td>
<td></td>
<td>14576.4</td>
</tr>
<tr>
<td>Antah</td>
<td>9676.2</td>
<td></td>
<td>10621.6</td>
</tr>
<tr>
<td>Fatan</td>
<td>14702.8</td>
<td></td>
<td>23891.2</td>
</tr>
</tbody>
</table>

(area in hectares)
Average yield of jowar varies from 4 to 5 maunds per acre. In some villages of the valley where the new variety (Sanker') has been introduced high yield per acre is obtained. On the contrary, in some villages of the Commanded Area as Bigad, Sultanpur, Ballpur and Sangrol yield per acre of jowar has gone down because of the increasing wetness in the soil and resulting salinity.

**Til**

Til is the second main kharif crop in the valley. It is an important oilseed grown under unirrigated condition. Til is mostly grown in areas where soil is loamy or clayey loams with good drainage conditions.

Main tahsils in the region where til is cultivated are Indargarh (11.69%), Kishanganj (9.02%), Ladpura (5.86%) and Baseri (4.91%). In rest of the tahsils it occupies a very small percentage. It is grown mixed with pulses and maize. The yield per acre is 2 to 3 maunds.

**Bajra**

Bajra is another important kharif crop of the Lower Chambal Valley. It is a food crop of poorer class of people. It is also used as a cattle feed. Bajra is grown in inferior quality of soils mostly on yellow brown sandy and sandy loams with adequate drainage. It requires manuring but hardly manured in the area.
Bajra is an important field crop of the ravine lands of the Valley and it occupies an insignificant position in the Chambal Commanded Area. The map (Fig. 36) indicates that the cultivation of bajra is mainly concentrated in the north eastern part where it forms a staple food of ravine villagers. In the tahsils of Sapotra, Bari, Baseri, Bhulpur, Rajakhera, Sajaipur, Sobalgarh, Morena, Trara, Ambah and Shind bajra occupies a significant position. Among these tahsils Sapotra, Bijaipur and Sobalgarh devote highest percentages viz., 49.64%, 47.7%, 45.0% respectively. The whole bajra growing area lies in the ravine eroded alluvial Valley. In this tract rainfall is low which enables the cultivation of nothing else but bajra in the kharif season. Moreover, it is easier to grow for the farmers as it does not require much labour. Besides this, the soils of this part is sandy loam to loamy sand which is favourable for its cultivation.

It is further evident from the map that acreage under bajra decreases abruptly to 0-6% in the tahsils of the Chambal Commanded Area and the hilly tahsils. In these tracts better soils and adequate irrigation facilities replace bajra with other superior food crops as jowar and wheat. In this part only inferior soils are devoted to this crop.

**Groundnut**

Groundnut is another important oilseed grown in the
Lower Chambal Valley as a kharif crop, experiments have revealed that it is a very suitable crop as a soil binder and for checking the erosion.

Groundnut is grown only in the Commanded area of the Valley especially in Kota district. In this region that part of land is devoted to groundnut which is unsuitable for jowar and other kharif crops. Generally, 1 to 2.15% of net sown area is devoted to this crop.

Since it is a soil binding crop so it should be raised on the marginal ravine fields of the Lower Chambal Valley in order to stabilize the soils and to check further erosion.

**Rice**

Rice is a newly introduced crop in the area under investigation. It is grown under irrigated condition. It occupies 1% of net sown area in the Valley. In Kishanganj and Baseri tahsil rice comprises 5.14% and 3.74% of net sown area respectively. The Japanese method of rice cultivation has been introduced very recently after 1961 and it has gained some favour. The State Agriculture Department, Rajasthan, has recommended popularization of the Japanese method of rice cultivation in the Commanded Area.

**Pulses**

Important pulses grown in the Valley are moong, urd, and tur. These pulses are usually grown mixed with either
jowar or sometimes with maize. Amongst pulses, tur
occupies significant position in the ravine infested areas
of Bari, Baseri, Bhulpur, Rajakhera, Sheopur, Sijaipur,
Sabalgarn, Jaora, Amban, Korena and Shind tahsilis. In
these tahsilis about 1 to 5% or the net sown area is devoted
to tur.

RABI CROPS

Wheat, gram, barley, linseed, and coriander are the
main rabi crops which are generally grown under irrigated
and 'barani' (unirrigated) conditions. The percentages
of net sown area of these various crops are given the
Appendix No. VI. The detailed study of the main rabi crops
will point out how these crops are governed by the topographic
conditions, soil texture and structure and the hydrological
conditions.

Wheat

Wheat is the second important food crop and the main
rabi crop of the Lower Chambal Valley. In the area under
study wheat is grown both as a dry crop and as an irrigated
crop. As a dry crop its cultivation is confined almost to
the ravine and hilly sections of the Valley where the soil
is sandy loam to loamy sandy. Rich clayey soil free from
gravels, stones or coarse sand of uniform texture, is best
suited for wheat crop. All wheat growing soils in the Valley
are more clayey than otherwise. In the irrigated tracts due
THE LOWER CHAMBAL VALLEY: RABI CROPS

WHEAT
ACREAGE
1966-67

PERCENTAGE TO
NET SOWN AREA

- 25 - 32
- 20 - 25
- 15 - 20
- 10 - 15
- 5 - 10
- BELOW 5

FIG. 37

GRAM
ACREAGE
1966-67

PERCENTAGE TO
NET SOWN AREA

- 25 - 10
- 20 - 25
- 15 - 20
- 10 - 15
- 5 - 10
- BELOW 5

FIG. 38
to the heavy nature of soils, the problems of water logging has been creeping thereby reducing the yield per acre of wheat.

In the Lower Chambal Valley, wheat is generally grown in almost every tahsil, predominantly in the south western or the canal irrigated tract. The distribution map (Fig. 37) of wheat shows that the percentage of the area under wheat decreases from south west to north east. The descending trend of wheat percentage in the north east may be explained by the occurrence of poor soil, low moisture content and rugged hilly and ravine topography.

The tahsils of Ladpura, Digod, Sundi, Patan and Antah of the Chambal Commanded Area devote more than 24% of net sown area to wheat. Largest portion of first class wheat growing soils clayey and clayey loams with sufficient moisture content, level land, and the use of modern implements like tractor and thrusher have conjoinedly enabled the cultivators to devote larger rabi area under wheat cultivation.

In the ravine land and hilly tract of the Valley the percentage of wheat are low ranging from 10 to 20%. It is because of the poor soil, undulating topography, low moisture content of soil and the inadequate irrigation facilities. Moreover, concentrated efforts of farmers to grow bajra in the Sharif is the other reason for the decrease in the wheat land.

In the recent years a number of improved varieties
of wheat have been introduced by the State Agriculture Department and the Development Blocks. C 581, MP 708, Malvi and C 236 are the main varieties which are most adaptable to the soils and the hydrological conditions of the Valley. The newly introduced varieties have given larger per acre yield. Generally the yield of wheat under unirrigated condition is 4 - 5 maunds per acre while under irrigation and manuring it is 12 - 15 maunds per acre.

It is surprising to note that the acreage under wheat has decreased in all the tahsils within last 10 years. The reduction in the wheat area in Digod, Ladpura, Pipalada, Baron, Kishanganj and Patan tahsils is well-marked. The following table gives a clear idea about the acreage of wheat cultivation.

<table>
<thead>
<tr>
<th>Name of tahsil</th>
<th>Area of wheat(hectares) 1956-57</th>
<th>Area of wheat(hectares) 1966-67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digod</td>
<td>14073.2</td>
<td>11683.6</td>
</tr>
<tr>
<td>Ladpura</td>
<td>23742.8</td>
<td>18877.2</td>
</tr>
<tr>
<td>Pipalada</td>
<td>21626.4</td>
<td>11949.2</td>
</tr>
<tr>
<td>Baron</td>
<td>14185.2</td>
<td>8303.6</td>
</tr>
<tr>
<td>Kishanganj</td>
<td>11282.4</td>
<td>8411.6</td>
</tr>
<tr>
<td>Atru</td>
<td>15206.0</td>
<td>9723.6</td>
</tr>
<tr>
<td>Patan</td>
<td>22636.0</td>
<td>17868.0</td>
</tr>
<tr>
<td>Antah</td>
<td>11211.2</td>
<td>6766.8</td>
</tr>
</tbody>
</table>
The reason of this decline in the area of wheat in these tahsilis is the increasing area under jowar and gram after 1956-57 as indicated above.

After the introduction of canal irrigation in the Lower Chambal Valley the area of irrigated wheat has increased considerably. The 1966-67 statistics reveal that nearly 50 to 60% of the total wheat area of Ladpora, Digod, Aaron, Hangrol, Atru, Sahgod, Kishanganj, Bundi and Ratan tahsilis is irrigated mainly by canals. Prior to 1956-57 only 10% of the total Commanded area was irrigated. The net increase in the irrigated wheat area is five times.

The irrigated wheat area has also shown slight increase in the hilly tracts and ravine lands because of the increasing number of wells and tanks.

Gram

Gram is the second important rabi crop of the Valley next to wheat. It is a pulse which belongs to the natural order legumes.

In the Valley gram is grown almost on every type of soil but the best soil for its cultivation is the heavy clay soil. This soil is found in Kota and Bundi districts of the Valley. The soil has a very high moisture retaining capacity. Moisture retaining capacity of the heavy soil helps germination and the maturity of the crop. Generally, that soil is devoted to gram which is unsuitable for wheat.
The map (Fig. 38) of gram indicates that Sawai-Madhopur, Sapota, Sabalgarh, Dholpur, Rajkhera, Bijaipur and Ambah are the main gram producing areas where 24 to 40% of the net sown area is devoted to gram. The percentage of gram to net sown area decreases from north east to south western part of the area. In the south west only 10 - 20% of the net sown area is reported under gram. Here wheat replaces gram and becomes the important rabi crop.

Gram is generally grown mixed with wheat and barley; when it is grown with wheat it is called 'Gulchani'; with barley it is called 'Baijer'.

**Barley**

Barley is a grain crop which resembles wheat in many respects. Barley or 'jao' is another food crop of poor people. Very little area is devoted to this crop in the Valley.

In the Lower Chambal Valley, barley is grown in those soils which are lighter in texture or less moisture retentive and are not suitable for wheat and gram. This type of soil is found in the north eastern part along the Chambal river. Sawai-Madhopur, Khandar and Khandars are the main tahsils where on 2 to 5.68% of net sown area barley is cultivated. In the Chambal Commanded Area percentage of barley is low below 1%. Here wheat and gram are dominating rabi crops.
Barley is grown both under irrigated and unirrigated conditions. In the tahsil of Bundi, Ladpura, Indergarh, Mangrol, Sapotra, Sawai-Madhopur, Saseri, Dari and Dhulpur nearly 70 to 90% of the total barley growing area is irrigated. Very small proportion of barley growing area is irrigated in the Commanded Area because greater part of canal water is shared by wheat.

CROPPING PATTERN IN RAVINE LANDS

The above statistical analysis of the agricultural landuse of the Lower Chambal Valley hardly explained the characteristic features of cropping pattern in the ravine lands. Personal inquiry and observations in ravine villages indicate that less than 50% of the total village area is under plough. Out of this, very little is occupied by wheat and gram crops which are the crops of fertile soil and well drained region of the south east. In the ravine villages the fertility of soil has decreased by the continuous washing away of the top soil every year. In this tract, therefore, only such crops are grown that may flourish and withstand poor soils and poor hydrological conditions.

The field inquiries in Barhi (Shind tahsil), Sagar Pada (Dhulpur tahsil), Neikpura (Morena tahsil), Kathkar (Bundi tahsil), Pali (Khander tahsil) and Gohata (Patan tahsil) villages reveal that in the ravine infested lands there are three sites where cultivation is being practiced
i.e. bottom of wide ravines, slip off slopes of rivers and the marginal lands. The fertility status of the soil of ravine bottom is very low but the soil on slip off slopes is very fertile which supports wheat and gram crops without manuring and irrigation. The reason is that in these parts of the Valley every year new soil is being deposited by the river during the monsoon period. In these small and scattered pockets farmers of ravine lands usually grow wheat, barley, and cash crops like tobacco (tobacco is grown only in Kathar village-Bundi tahsil).

In the ravine bottoms only rabi crops are harvested. During the rainy season these tracts usually remain under water. So in these lands rabi crops are cultivated under dry conditions.

Bajra, jowar and pulses (arhar, moong and urd) are the main crops of rainy season. Greater proportion of the total kharif area is devoted to bajra. For instance, in Barhi (Bhind tahsil) of the total 648 acres of kharif area 448 acres is reported under bajra in 1966-67. The area under bajra in the ravine lands of Kota and Bundi districts is low. Here jowar is predominant kharif crop.

Wheat, barley and gram are the main rabi crops. Actually wheat occupies an insignificant position. Lack of irrigation, sandy and loamy nature of soils and less moisture retaining capacity of soils have collectively made these parts of the Valley unsuitable for wheat. In
such conditions barley and gram as a mixed crop is grown.
mostly all crops are cultivated under dry conditions.

Literature cited in the text:

