CHAPTER - VIII

CROPPING PATTERN
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Introduction

In spite of the fact that Hooghly is one of the most important industrial districts of West Bengal with numerous factories flanking the Bhagirathi, it still retains as a whole its basic rural character since it engages no less than 50 percent of its total working population in agricultural activities. Preponderance of crop cultivation is the main characteristic of agriculture in the district as in West Bengal and in India as a whole. Of the total reporting area of 775.7 thousand acres some 554.33 thousand acres represent the net area sown i.e. 71.46 per cent of the total area according to the landuse statistics of 1982-83. In the same year gross cropped area amounted 855.338 thousand acres indicating higher intensity of crop cultivation. In order of area covered the most important crops are rice, potato, oil seed, vegetables, jute, wheat and pulses occupying 68.05, 9.33, 5.80, 5.78, 5.07, 3.85, 2.04 per cent of the total cropped area respectively.

Chief crops

Rice is the principal crop of the district. The three varieties of rice, aman, aus, and boro are grown. Other cereals
of less importance include wheat, barley and maize. Pulses like masur, mug, gram, mashkalai, khesari and arhar and oilseeds like mustard, til are also produced in substantial quantities. Jute, potato and sugarcane are the principal cash crops. Among the subsidiary cash crops mention may be made of vegetables, onions etc. Fruits include bananas, mangoes, coconuts etc.

The following table gives the distribution of main crops in the district in 1982-83.

Table 1
Distribution of main crops during 1982-83

<table>
<thead>
<tr>
<th>Crops</th>
<th>Area in 000' acres</th>
<th>Per cent of total cropped area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total rice</td>
<td>581.819</td>
<td>68.05</td>
</tr>
<tr>
<td>a) Aus</td>
<td>41.430</td>
<td>4.84</td>
</tr>
<tr>
<td>b) Aman</td>
<td>444.205</td>
<td>51.96</td>
</tr>
<tr>
<td>c) Boro</td>
<td>96.184</td>
<td>11.25</td>
</tr>
<tr>
<td>Wheat</td>
<td>33.000</td>
<td>3.85</td>
</tr>
<tr>
<td>Pulses</td>
<td>17.459</td>
<td>2.04</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>49.720</td>
<td>5.80</td>
</tr>
<tr>
<td>Jute</td>
<td>43.400</td>
<td>5.07</td>
</tr>
<tr>
<td>Potato</td>
<td>79.850</td>
<td>9.33</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.654</td>
<td>0.08</td>
</tr>
<tr>
<td>Vegetables</td>
<td>49.456</td>
<td>5.78</td>
</tr>
<tr>
<td>TOTAL ...</td>
<td>855.358</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Rice: Rice is the predominant food crop in the district occupying a considerable portion of the total cropped area. This single food crop accounts for 68.02 per cent of its total cropped area giving the first place among the crops grown. In all the blocks it shares more than 40 per cent of gross cropped area. The percentage varies from 41.16 to 80.76 per cent. Panduah, Chinsurah-Mogra, Polba-Dadpur, Jangipara, Arambag and Goghat are the principal rice producing block where this crop accounts for more than 70 per cent of gross cropped area. Tarakeswar and Pursurah are the least important blocks in this respect as rice occupies only 46.73 and 42.16 per cent respectively. In the remaining blocks the percentage varies from 55.27 to 67.16 (Table 32 Appendix and Fig. 46).

Aus: Aus is the least important among the varieties of rice as it occupies only 7.12 per cent of total rice acreage in the district and 4.84 per cent of total cropped area. In 1982-83 it occupied 41.43 thousand acres as compared with 444.205 and 96.184 thousand acres occupied by aman and boro respectively. The important aus producing blocks are Balagarh, Panduah, Dhanikhali, Tarakeswar, Pursurah and Goghat where its percentage varies from 5.08 to 11.57. In Pursurah the percentage is the highest. In the remaining blocks the percentage varies from .49 to 4.66 (Fig. 47).
HOOGHLY
PADDY CROPPED AREA

PER CENT OF TOTAL CROPPED AREA

- > 70
- 61 - 70
- 51 - 60
- < 51

Fig. 46
Aus is grown mainly in Suna land (high land) where water does not generally accumulate during the rains and it produces coarse grain. There are two management practices of growing aus. It is broadcast as well as transplanted. The broadcast aus is grown in soils which get drained very easily, whereas the transplanted one under more restricted drainage. Weeding in the broadcast aus fields and aeration of the fields by cultural operations makes growing of broadcast aus more expensive. But since these lands do not hold water sufficient for transplanting purpose, the method of broadcasting is adopted. It has also the advantage that cultivation of both rabi and kharif can be commenced earlier. Broadcasting aus in line is being experimented upon as a possible measure to make the weeding and cultural operations of aus easier and good results in this respect have been obtained. Yield of aus is considerably higher in the district as compared with the West Bengal average. In 1976-77 the yield for it was 1564 kg/hectare against West Bengal's average of 788 kg.

Aman: It is the principal rice crop accounting 51.96 per cent of total cropped area and 76.34 per cent of total rice area. In terms of area it contributes 4.37 per cent of total aman area within West Bengal. Yield rate is also considerably higher as compared with the West Bengal average. Yield rate of
Fig. 47
aman in the district was 1272 kg/hectare against West Bengal's average of 1106 kg/hectare in 1976-77.

Leading aman producing blocks are Panduah Polba-Dadpur, Jangipara, Arambagh and Goghat where this crop occupies 58.2 to 68.43 per cent of total cropped area (Table 32 Appendix). The percentage of aman is below the district average in Balagarh, Tarakeswar, Singur, Pursurah, and Khanakul where it ranges from 23.46 to 48.13 per cent (Fig. 48). In the remaining blocks the percentage amounts to the district average. Such variation in the dominance of aman cultivation is due to the varied degree of ecological condition required for aman cultivation and other infrastructural facilities. As low lying sali land subject to natural inundation is highly suitable for aman cultivation it is dominant in those blocks where such land has the greater percentage to the total cropped area.

It is sown in May and June, transplanted on the set of rains and harvested on high lands between November and January, and on lower grounds by February. The principal varieties of fine aman rice are Rupsal, Sitasal, Dudhkalma, Kanakchur, Saban, Dadkhani, Ramsal and Gobindabhog. Other types yielding medium quality rice are Mekrasal, Nona, Dudhenona, Jatkalma, Dhubkalma and Sindurmukhi. Harkuti, Latasal and Jhingasal constitute
HOOGHLY
AMAN CROPPED AREA

PER CENT OF TOTAL CROPPED AREA

\[ \begin{array}{c}
\text{\textgreater 60} \\
\text{51 - 60} \\
\text{41 - 50} \\
\text{\textless 31} \\
\end{array} \]

Fig. 48
the coarser varieties. In recent years, the finer stuff is being gradually replaced by coarser varieties. In addition to these indigenous varieties some high yielding varieties like Palman, Pankaj etc. are being increasingly preferred because of their higher productivity.

**Boro:** Next to aman, boro is the most important as it contributes 16.53 per cent of total rice area of the district. It covers 11.25 per cent of total cropped area in the district and 16.53 per cent of total boro area of West Bengal. This district contributes 12.99 per cent of total production of boro rice in the state of West Bengal. Yield of boro is also higher. It is 3250 kg/hectare against the West Bengal's average of 2040 kg/hectare. Khanakul is the leading block producing boro paddy where it covers 26550 acres i.e. 28.37 per cent of gross cropped area of the block. Arambag ranks second in this respect covering 12500 acres for the cultivation of boro. In addition to these blocks boro cultivation is also significant in Balagarh, Panduah, Chinsurah-Mogra, Polba-Dadpur, Jangipara, where boro paddy occupies 10.89 to 21.72 per cent of total cropped area (Fig. 49). Boro cultivation is quite insignificant in the remaining blocks namely Dhaniakhali, Tarakeswar, Haripal, Singur, Chanditala, Pursura etc. where potato is preferred as second
Fig. 49
crop to boro paddy. It is because suna land (High and moderately land) is highly suited for potato cultivation if irrigation is present. Such land is not suited for boro paddy because it would require irrigation more frequently as much of the water irrigated would be drained out through seepage. Whereas the Sali lands are highly suitable for the cultivation of boro paddy as it would create standing water condition for a larger number of days with irrigated water because of their low lying condition.

It was originally the marsh rice transplanted in winter and harvested in spring. It would ordinarily grow along the banks of marshes or in very low lands which remain wet till the advent of summer. Though at present such marshes and depressions are being used for the cultivation of boro paddy a large portion of Sali lands has been brought under boro cultivation utilising irrigated water from different sources. These lands are scientifically ploughed, manured and transplanted. Previously indigenous boro paddy was cultivated having much lower productivity. At present high yielding variety is being widely cultivated. The most important varieties are I.R. 8, Jaya, Padma, Ratna, Masuri, etc.
Jute: Jute is the most important cash crop of the district.

With the partition of the country in 1947, the main jute belt of undivided Bengal went to East Pakistan while the manufacturing industry remained within the Indian Union. This imbalance has since been largely overcome by expanding the cultivation of jute in the West Bengal districts (as also elsewhere in the country) and Hooghly district plays an important role in this bid to self-sufficiency which is instrumental in earning substantial foreign exchange for India. It is the fifth ranking crop in the district.

Jute occupies 5.07 per cent of total cropped area within the district. It contributes 5.78 per cent of total acreage in W. Bengal. But it accounts for 8.49 per cent of total production in West Bengal. Per hectare yield of the crop is also higher. It is 1967 kg/hectare as compared with West Bengal's average of 1418 kg/hectare. In terms of acreage covered by the crop Khanakul ranks first succeeded by Panduah, Goghat, Haripal. Next important blocks are Balagarh, Polba-Dadpur, Dhaniakhali, Singur, Chanditala, Pursurah etc. (Fig. 50).

After the first showers in May Suna land on which jute is usually grown is ploughed and the seeds sown. The fields are then weeded twice or thrice before the onset of the
monsoons. In August and September the stalks are cut, stripped of their leaves, steeped in bundles in some pools or streams and retted there for several days. When the fleshy part of the stem reach a suitable stage of decomposition, they are taken out and beaten so as to extract fibre. The fibre is then cleaned, dried by hanging and are made up into bundles, ready for the market, the dry stalks being used as fuel, for thatching or for fencing betal-leaf plantations. Jute - aman paddy - Jute is a rotation followed in the district wherther possible. Jute -Potato-Oilseed-Jute is also a common rotation. Formerly the district occupied third position in the production of jute next to Murshidabad and 24-Parganas in the State. In 1960-61 this district shared 8.16 per cent of the acreage and 11.15 per cent of the total quantity of jute produced in West Bengal. At present its position in the production of jute has been sufficiently reduced. It occupied 8th position in jute production in 1980-81.

Potato : Among the districts of West Bengal, Hooghly occupies the first place in the production of Potato. In 1982-83 the district accounted for 28.54 per cent of total acreage occupied by potato and it shared 36.4 per cent of total production of potato in West Bengal. Potato accounted for 9.33 per cent of total cropped area in the district in 1982-83. It is the second ranking crop in the district after rice.
The fairly extensive area in which potato is grown in the district lies mainly along the Saraswati, Behula, Kana Damodar and other small rivers, the chief concentration being in Dhaniakhali, Tarakeswar, Haripal, Singur, Pursurah, Arambagh and Khanakul, blocks where potato accounts for 8.2 to 32.90 per cent of total cropped area (Fig. 51). In terms of acreage Khanakul ranks first covering 13,075 acres i.e. 32.9 per cent of total cropped area succeeded by Tarakeswar (10,536 acres i.e. 18.49 per cent of cropped area) Khanakul (9985 acres i.e. 10.67 per cent), Dhaniakhali (9800 acres i.e. 12.10 per cent), Arambagh (7050 acres i.e. 8.20 per cent) Haripal (6500 acres i.e. 11.45 per cent), Panduah (4100 acres i.e. 5.86 per cent) and Singur (400 acres i.e. 10.02 per cent). With increased facilities of perennial irrigation from the D.V.C. canals the entire Damodar riverine area and a portion of the flat lands having higher surface soil take up Jute - Potato or Jute - Potato - Oilseed or Jute - Potato - Onion rotation. Formerly indigenous or desi varieties like Rangoon and Nainital were highly favoured. At present the desi variety has lost its ground because of its very lower yield. Now the most preferred varieties are Chandramukhi (Kufri), Jyoti, Alankar etc.

Potato is usually cultivated on high land having facilities of irrigation, Sandy loam or loam soils are highly
Fig. 51
suitable for its cultivation. To start with, the field is ploughed twice in the month of September - October and is then levelled with a harrow, manures like ammonium sulphate and oilcake being mixed with the soil at the same time. The process of ploughing and barrowing continues until all clods are broken up and the soil becomes powdery. The land is made entirely free of roots, of weeds and other plants. A few linear depressions are then made across the field so as to permit the irrigation water to flow along them. The seeds are obtained by the cultivators from the storages situated at various places in the district. Those of the seeds which are big are cut up into pieces, their being as many pieces as there are eyes on the potato. The eyes are planted in rows in the field. Slight water is applied as soon as it is seen that the seeds are germinating. The field is irrigated once a week, but the water is not directly applied at the plants but along the channels parallel to the rows in which the seeds have been planted. As the plant grows, earth is piled up on the roots to ensure that all the potatoes which sprout from the roots remain underground. The potato plants wither away in the month of January to March. The potatoes are then dug out.
The harvesting of potato extends from November to March and the normal period of greatest supply to the market continues from January to June. The important potato markets in Hooghly district are Sheoraphuli, Champadanga and Tarakeswar.

The higher outrun of potato which is a perishable commodity has led to the setting up of a large number cold storages in the district.

**Oilseeds:** It is the third ranking crop in the district contributing 5.80 per cent of its total cropped area. It shared 6.77 per cent of total oilseed acreage of West Bengal in 1980-81. In terms of production it contributed 5.95 per cent of total production of oilseed in West Bengal in 1979-80.

Various types of oilseed are grown in the district namely rape, mustard and til (sesamum). Excepting til, mustard and rape are cold weather crop grown in small plots in high lands round the villages and on river chars which are periodically fertilized by new silt. Acreage under them is low although oil happens to be the universal cooking medium of Bengalees. Following the recent grave difficulties faced by the West Bengal mill owners in obtaining regular supply of mustard seeds at economic prices from the growers in northern India attempts are being made in the district as also elsewhere to increase the cultivation of mustard seeds. Oilseeds are cultivated as second
or third crop after jute and potato. Mustard is generally grown as second crop in the rabi season after jute. In almost all the blocks mustard occupies more than one per cent of total cropped area. In Arambag Block it occupies the highest per cent of total area (3.2 per cent). Other important blocks producing mustard in substantial quantities are Panduah, Balagarh, DhaniaKhali, Goghat, Chanditala and Chinsurah-Mogra where it occupies 2.03 to 3.08 per cent of their total cropped area. In the remaining blocks the percentage varies from .19 to 1.74 (Fig. 52). Next to mustard important oilseed is til. It is grown in summer. In most cases the important rotation is Jute-Potato-Til-Jute. After the harvest of potato til is grown. As a whole till occupies 3.72 per cent of total cropped area in the district. Til occupies a considerable percentage of total cropped area in those blocks which are leading producers of potato. Tarakeswar block ranks first in the production of til covering 9000 acres i.e. 15.81 per cent of its gross cropped area. Next important block is Pursurah where some 2968 acres are devoted to the cultivation of til. Khanakul, Goghat, DhaniaKhali, Arambagh are of considerable importance.

Vegetables: Hooghly district is noted for its large vegetable gardens thriving on the remunerative market of Greater Calcutta area. As a whole it is the fourth ranking crop in the district
HOOGHLY
OILSEED CROPPED AREA

PER CENT OF TOTAL CROPPED AREA

- > 9
- 7 - 9
- 4 - 6
- 1 - 3

Fig. 52
covering 5.78 per cent of total cropped area. Balagarh is the first ranking block in the production of vegetable. This block contributes 8040 acres i.e. 12 per cent of its cropped area to the cultivation of vegetables. Next important is the Haripal block where vegetables covers 5196 acres i.e. 9.15 per cent of its cropped area. Dhanishkhali, Tarakeswar, Singur, Chanditala and Chinsurah-Mogra areas also are of considerable importance in the production of vegetables where the percentage varies from 5.24 to 11.73 per cent (Fig. 53). It is obvious that production of vegetables is most important in those blocks which are in close proximity to the nearby greater Calcutta urban centres being facilitated by quick and efficient transportation facilities. In addition to this the area also possesses ideal ecological conditions and other infrastructural facilities like irrigated water. Vegetable gardening is less important in those blocks which are not within easy reach of the Greater Calcutta area.

Vegetables are grown both in Kharif and Rabi seasons. Rabi vegetables is comparatively more important than the Kharif one. Vegetables grown in the rabi season includes palam, cauliflowers, cabbages, radish, chillis, peas etc. According to some, cauliflowers and cabbages were first introduced in the district by William Carry, the celebrated missionary and educationist.
HOOGHLY
VEGETABLES CROPPED AREA

PER CENT OF TOTAL CROPPED AREA

- 10 - 12
- 7 - 9
- 4 - 6
- 1 - 3

Fig. 53
During the rabi seasons these vegetables are grown either as a single crop or in mixture with some other standing crop. Among the summer vegetables the most important are brinjal, radish, kachu, cucumber, patal, water melon, chilli, avums locally called ol etc. The brinjal is a favourite plant but the crop is very exhausting to the soil and cannot be grown on the same field for more than two consecutive years. The brinjal seed is first sown in a nursery in January and February and the seedlings transplanted in the month of May and June in rows two or three feet distance from each other in a well ploughed and manured field. The plants soon grow into shrubs some two feet in height and are in bearing from July to October. There is also another variety which is transplanted in the month of December and bearing from April to July. Muktakesi is considered the best variety growing from October to March and grows on the banks of the Damodar. Patal and water melons are grown extensively on the loamy soil of river banks. Cucumbers prosper near homestead lands and pumpkins and gourds are also widely cultivated, the creepers growing on thatched roofs on the ground. Sweet potatoes are grown on sandy soils and edible tubers called man-kachu and gunri-kachu are cultivated mostly in homestead gardens.
Wheat:  Wheat is only the cereal next to rice. Previously cultivation of wheat was quite insignificant. But in view of the greater demand of cereals, wheat has also become important with the gradual increase in the irrigation facility. It occupies 33 thousand acres i.e. 3.85 per cent of total cropped area in the district. Thus it is the sixth ranking crop in the district. Wheat is grown as a second crop on jute land utilising irrigated water. Khanakul and Panduah are the leading blocks in the production of wheat where it accounts for 4.91 and 5 per cent of their cropped area respectively. Balagarh, Dhaniakhali, Haripal, Singur Chanditala, Goghat are also of considerable importance in this respect where the percentage varies from 3.74 to 7.

Pulses:  Pulses are the seventh ranking crop in the district occupying 2.04 per cent of total cropped area. The district contributed 1.60 per cent of total area of pulses in West Bengal in 1980-81. In 1979-80 it contributed 1.67 per cent of total production of pulses in West Bengal. Balagarh block ranks first in the production of pulses as it occupies 4025 acres out of 17,459 acres covered by pulses in the district. Next important block is Arambag contributing 2495 acres for this crop. Singur, Chanditala, Serampore-Uttarpara, Khanakul
and Goghat are also important as in all these blocks it occupied more than one thousand acres.

Pulses are grown both in kharif and rabi seasons as a second crop. Jute-pulse or Aus-pulse are the most common practices. Among the pulses gram is grown on a limited area but masur, mug, khesari and maskalai are the most favoured pulses. Khesari is sown broadcast in October, grows slowly until the winter rice is harvested, then shoots up rapidly and is gathered in February and March. It costs little to cultivate but the yield is not large if the rice crop is good. It is a grain which owing to its cheapness is much used in the form of pulses by the poorer classes while the straw is an excellent fodder for cattle. The other pulses form the main cold weather crops of suna lands. They are sown in October and November after ploughing and are reaped in February and March.

**Sugarcane** : Sugarcane is the least important crop in the district as it occupies only 0.07 per cent of total cropped area. The district contributed only 0.69 per cent of total sugarcane area in West Bengal in 1980-81. It shared also the same percentage of total sugarcane production in 1980-81. In forties, fifties and sixties this crop had some importance as cash crop. But since middle of sixties there has been a
remarkable fall in sugarcane acreage. It is because there is no good demand of sugarcane from the sugar mill. Marketing of sugarcane is the most pressing problem. In addition to this total return of such crop from a land is found to be comparatively lower as single crop occupies the land for the whole year. Therefore, cultivation of a number of crops on a land suitable for sugarcane cultivation is more profitable than that of the sugarcane. Previously sugarcane would be cultivated on a wide scale in order to meet the demand of gur. But at present as the gur making is not being economy little attention is being paid to the cultivation of sugarcane.

**Orchard crops**: Several orchard crops are also significant in the district. These crops in the district accounted for 4.95 per cent of total acreage under orchard crops in the state. The crops altogether account for 1.56 per cent of total geographical area in the district. West Bengal's figure of 1.66 per cent. Among the orchard crops banana, mango, papaya and betelvine are most important.

**Banana**: Banana accounted for 59.54 per cent of total acreage covered by orchard crops in 1981-82 (Table 33 Appendix). High land with no facility of irrigation is found to be used for banana cultivation. The lands which are subject to inundation during the rainy period are unsuitable for the cultivation of the crop. The lands occupied by
the banana can provide greater return than it would be obtained from banana if the lands are provided with irrigation facilities. Because under this condition the farmers will be in a position to grow more than one crop from the same land with the help of irrigation. Of course at present the high yielding variety of banana is being preferred on the land which is provided with irrigation. It is because the high yielding variety essentially requires irrigation and greater return can also be had from this variety than that of the indigenous variety.

Singur block consisting of Singur and Bhadreswar Police Stations is leading producer of banana accounting for 55.43 per cent of total acreage under banana in the district. Polba-Dadpur is the next important block in this respect. Excellent ecological condition suitable for banana cultivation and the vicinity of Bowbazar near Chandernagore Station the most important whole-sale market of banana in the District are conducive factors for the wide extent of banana cultivation in the aforesaid blocks. Bananas are cultivated to meet the demands of Calcutta and up-country markets. The chief indigenous varieties are Kanthali, Champa and Martaman. Among the high yielding varieties the most important are Kabuli, Robasta etc.
Mango: Next to banana, mango is an important orchard crop. It accounts for 22.32 per cent of total acreage under orchard in the district. This district occupies an important place in the production of mango in the state. Next to Malda, Hooghly is the important producer of mango. High land not subject to inundation is suitable for mango cultivation. It does not require irrigation water and much care except during the flowering stage. Polba-Dadpur is the leading block in the production of mango as it accounts for about 37 per cent of total area occupied by mango in the district. Singur is the next important block where mango occupies near about 26 per cent of total mango acreage in the district. Dhanishkhali, Chanditala, Serampore-Uttarpara blocks also occupy important place in the production of mango. Bowbazar is the chief whole-sale market of mango. Singur and Polba-Dadpur blocks are within the close proximity of this market. Various types of mango are grown in the district which have high reputation in the State. Himsagar and Sari are very much important in this respect.

Papaya: Next to mango papaya is the important orchard crop accounting for more than 6 per cent of acreage under orchard. High well drained land with loamy soil is highly suitable for it. Polba-Dadpur ranks first in
the production of papaya accounting 65.87 per cent of total papaya acreage in the district. Singur is the next ranking block accounting 10.54 per cent. Dhaniakhali, and Chanditala blocks are also important in this respect contributing 6.58 and 5.53 per cent respectively.

Betel leaf: Pan or betel leaf is largely grown in the district, especially in the Serampore Sub-Division. The crop requires much care and attention and its cultivation is expensive. It is raised more or less exclusively by the Barui caste, in thatched enclosures made of jute stalks. The cuttings are planted in rows in February and watered daily for first three months. The leaves begin to shoot in June and July and continue to do so for a year. Old stems are cut down in April when the roots spend up fresh stems which begin giving new leaves in June and July. In this ways the fresh leaves may be got for several years. The betel leaves of Begampur, a village few miles west of Serampore were once noted for their fine flavour. Singur block is the leading producer of betel leaf accounting near about 99 per cent of total acreage under betel leaf.

Coconut and others: Cocoanut cultivation in the district deserves special mention. In 1965-66 there were three government nurseries in Hooghly located at Chandernagore,
Jangipara, and Chinsurah, of which the first was the oldest having been started in 1951. There are besides two more nurseries at Chinsurah and Singur under private management. In the state nurseries the seed nuts are imported mainly from Kerala, Madras and Andhra and the seedlings are locally raised and distributed among the growers at reasonable price. Chanditala is the leading producer of cocoanut in the district. Other orchard crops include jack-fruit, pineapple, lichies, jam, gulabjam, jamrul etc.

CROP-COMBINATION REGIONS

The study of crop combination regions constitutes a significant aspect of agricultural geography as it provides a good basis for regional planning. In recent years owing to its importance the problem has engaged the attention of geographers and agricultural landuse planers. Owing to certain variation in physical set up and the infrastructural facilities a variety of crops are grown in an agrarian sector. These crops are grown in combinational associations where a number of crops are cultivated side by side in the same season or in rotation with others in the same field in a year. An isolated geographical study of any of these crops gives a partial picture of the integrated net work of the agricultural landscape of its utilization.
Thus to draw a comprehensive picture of the broad mosaic of cropped land use in the agrarian sector a systematic study of the character and extent of its crop association patterns seems imperative. The delineation of crop regions thus determined would emphasize the regional framework of agricultural activities and specialisation of crops in the area. The patterns of crop combination regions that will emerge from the delineation might also serve the purpose in a balanced regional planning of agriculture. The studies made so far in this field range in approach from topical to regional and vary in extent from small areas of minor political units to the entire country.

**Methodological Consideration**

Several methodological approaches have been taken into consideration by different authors with a view to delineating the crop combination regions. The different methods applied in the delineation of crop combination regions can be summed up under two headings: first, in some cases crop regions are developed by making arbitrary choice of crops e.g. first crop only, first two crops and first three crops; secondly, crop regions developed in terms of variables based on certain
differences which are relative and not absolute. The second method being based on statistical approach is more scientific and popular. In 1954, John C. Weaver in an article entitled "Crop Combination Regions in the Middle West" delineated crop-combination regions using "Minimum standard deviation" method. \(^1\) Coppock also applied this method in delineating agricultural regions of England and Wales. In his studies of delineating crop combination region, Weaver has taken into consideration the percentages of the total harvested area occupied by individual crop in each areal unit and has calculated deviation of real percentages for all the possible crop combinations against the theoretical standard. To determine minimum deviation from theoretical curve the following formula was adopted.

\[
\delta = \sqrt{\frac{\sum d^2}{n}}
\]

Since it is the relative deviation from theoretical curve was desired and not the actual magnitude of deviation Weaver eliminated the square root and especially used variant was as follows:

\[
\delta^2 = \frac{\sum (d^2)}{n}
\]
In this formula \( d \) is the difference between the actual crop percentage in a given areal unit and the appropriate percentage in the theoretical curve and \( n \) is the number of crops in a given combination. In this technique of analysis even minor crops with 1 per cent of the total harvested area are taken into account and thus it produces complicated crop-combination regions. Indeed it appears to be over generalized.

With a view to overcome this defect of over generalisation a new deviation formula was introduced which is referred as "Maximum Positive Deviation Method". Rafiullah introduced this deviation method in his study "A New Approach to Functional Classification of Towns". Hussain applied this technique in his work "Crop-Combination regions of Uttar Pradesh": A study in Methodology and found comparatively more suitable than minimum deviation method in delineating crop-combination region. This formula advocated by Rafiullah is algebraically expressed as follows:

\[
d = \sqrt{\frac{\sum D_p^2 - D_n^2}{n^2}}
\]

Where \( d \) is the deviation, \( D_p \) is the positive difference and \( D_n \) is the negative difference from the medial value of the combinations and \( N \) is the number of crops in the
combination. Since it is relative rank of the deviation which is desired the root sign may be ignored and is expressed.

\[ d^2 = \frac{\sum D_p^2 - \sum D_h^2}{N^2} \]

Dr. Satyesh C. Chakraborty applied another method which is referred as "The coefficient of spatial Association of Crops in delineating crop-combination regions in Eastern India." In this method the author has at first computed the percentage shares of each district in the total land allocated to the different crops in Eastern India separately.

By comparing the distribution of any two crops between the given statistical units the order of spatial association between these is computed. Through such comparison the differences in the percentage share between two crops for each areal unit is determined separately. The sum of the negative deviations over the column will be equal to the sum of the positive deviations. Either of these sums, ignoring signs is divided by hundred. The result will be taken as the coefficient of spatial association which will vary between 0 and 1.

It is obvious that the coefficient can come to only zero when the distribution of the two given crops between the constituent statistical units are identical. This will mean that environmental determinants are also held similarly between
these crops. When on the other hand the index value comes to 1, then such environmental determinants are surely ordered very disparately between these crops. Such a situation i.e. the index becoming equal to 1, can obtain only when one of the two crops are not at all grown in any of the constituent statistical units. Such an extreme case can only mean that the environmental situation that is conducive for one crop is totally hostile for the other crop. It may be mentioned that the coefficient of spatial association varies between 0 and 1 in a linear fashion.

After computing the coefficient of spatial association between all possible pairs of crops a symmetric matrix with them is constructed. Here the cells on the diagonal running from top-left to bottom-right will all have 0 entries because the distribution of any crop over the constituent tracts can only be equipropotional to itself. By running along each row or column we can identify the pair of crops which have the lowest coefficient of spatial association with the respective row or column. The orderliness in the spatial distribution of such two crops can be said to be most concordant to each other compared to the other pairs of crops within the territory under consideration.
K.R. Dikshit delineated crop combination region in his study "Agricultural Regions of Maharastra" applying "spearman's rank correlation". In his study he at first found out ranks of different crops according to the area covered by respective crops in the constituent districts of Maharastra. Then a relative rank matrix was prepared in which ranks were assigned in relation to only seven crops chosen for rank correlation. The spearman's rank correlation coefficient was then calculated for each pair of districts using the following formula.

\[
R_s = 1 - \frac{6d^2}{n^3 - n}
\]

where \( R_s \) = rank correlation coefficient, \( d \) = difference in ranks, \( n \) = total number of observation.

The value of correlation coefficient at 5 per cent level was found out with reference to the graph of significance levels for correlation coefficient using student's "T" test.

The rank correlation values were then grouped according to their importance and are used as linkages between the districts. As high correlation between the crop ranks of two districts would mean a similarity of crop pattern enabling them to be grouped in one region and a low or negative correlation would suggest a contrasting crop pattern the constituent pair of districts having
high rank correlation coefficient have been grouped into different crop regions.

Different crop combination regions of Hooghly District have been identified with the application of arbitrary choice method, weaver's "Minimum Standard Deviation" method, Rafiullah's "Maximum Positive Deviation" method and "Spearman's Rank Correlation" method.

**Arbitrary Choice Method**

By arbitrary method the crops have been ranked according to the total area under individual crop. Rice is the first ranking crop in all the blocks and also of the district as a whole. But the ranks of the other crops vary considerably in different blocks because of the varied ecological conditions suitable for respective crops and socio-economic factors. Thus in most blocks the second ranking crop is potato and in some others vegetable. The blocks occupied by the respective second ranking crops are given in the following table. The blocks in the following table have been arranged in decreasing order of the percentage of the crop in question to the gross cropped area.
Table 2

Second ranking crop

<table>
<thead>
<tr>
<th>Crop</th>
<th>No. of blocks</th>
<th>Name of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>9</td>
<td>Pursurah, Tarakeswar, Dhania-khali, Haripal, Khanakul,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arambagh, Jangipara, Panduah, Polba-Dadpur.</td>
</tr>
<tr>
<td>Vegetables</td>
<td>4</td>
<td>Balagarh, Singur, Chanditala</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chinsurah - Mogra.</td>
</tr>
<tr>
<td>Pulses</td>
<td>1</td>
<td>Serampore - Uttarpura</td>
</tr>
<tr>
<td>Oil Seed</td>
<td>1</td>
<td>Goghat</td>
</tr>
</tbody>
</table>

It is obvious from the above table that potato predominate as a second crop in nine blocks covering a major portion of the district. In all these blocks ecological and socio-economic conditions are quite favourable for the cultivation of potato. Loamy and sandy loam soil and Sona land (Moderately high land or medium terrace) are ideal for the cultivation of Potato. Scope of irrigation from different sources
is also helpful for this crop. Vegetables emerges as a second
crop in four blocks occupying the urban fringe of the district.
Balagarh is first ranking block producing vegetables occupying
more than 30 per cent of its gross cropped area. In all other
blocks namely Singur, Chanditala, Chinsurah Mogra this crop
occupies 5-11 per cent of their gross cropped area. The Sona
land (Moderately high land) is highly favoured for the culti-
vation of the crop with the irrigated water. Loamy soil is also
an additional advantage. In addition to this ideal ecological
condition the blocks are within the immediate vicinity of the
urbanised and industrial tract of West Bengal providing enor-
mous demand for fresh vegetables. These blocks are again provided
with excellent transportation facilities both by roads and rail-
ways. Pulse ranks second only in one block i.e. Serampore -
Uttarpara. Though this block is nearer the urbanised tract
of West Bengal, the ecological condition and other infra-
structural facilities like irrigated water are not conducive for
the cultivation of either vegetables or potato.

Several crops ranks third in different blocks of the
district. Excepting rice all the other crops emerge as third
crop. The distribution pattern of the third ranking crops
and the blocks occupied by it is given in the following
Table have been arranged in decreasing order of the percentage of the crop in question to the gross cropped area.

Table 3

Third ranking crop

<table>
<thead>
<tr>
<th>Crop</th>
<th>No. of blocks</th>
<th>Names of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>2</td>
<td>Haripal, Boghat</td>
</tr>
<tr>
<td>Jute</td>
<td>3</td>
<td>Balagarh, Purusur,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polha-Badur</td>
</tr>
<tr>
<td>Pulse</td>
<td>1</td>
<td>Chinsarh - Megwa</td>
</tr>
<tr>
<td>Potato</td>
<td>1</td>
<td>Singur</td>
</tr>
<tr>
<td>Wheat</td>
<td>3</td>
<td>Chinsarh, Pandua, Serampore-Uttarpada</td>
</tr>
<tr>
<td>Oil seed</td>
<td>5</td>
<td>Tarakandwar, Khansuli,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arambagh, Dhanalgabi,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jangipara</td>
</tr>
</tbody>
</table>

First two crops

On the basis of first two crops four crop regimes may be recognised. The resultant crop association patterns have been plotted in Fig. 54 and are given in the following table.
Fig. 54
<table>
<thead>
<tr>
<th>Crops</th>
<th>Number of blocks</th>
<th>Names of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice/Potato</td>
<td>9</td>
<td>Panduah, Polba-Dadpur, Dhaniakhali, Tarakeswar,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Haripal, Jangipara, Parsurah, Arambagh, Khanakul</td>
</tr>
<tr>
<td>Rice/Vegetables</td>
<td>4</td>
<td>Balagarh, Chinsura-Mogra, Singur, Chanditala.</td>
</tr>
<tr>
<td>Rice/Pulse</td>
<td>1</td>
<td>Serampore - Uttarpura.</td>
</tr>
<tr>
<td>Rice/Oilseed</td>
<td>1</td>
<td>Goghat</td>
</tr>
</tbody>
</table>

It is obvious from the above table that rice/potato combination predominates in major part of the district occupying nine blocks. Next important combination is rice/vegetable occurring in four blocks namely, Balagarh, Chinsurah, Mogra, Singur, Chanditala. Two other combinations viz. rice/pulse and rice/oilseed are insignificant being practised in two blocks.
HOOGHLY
FIRST THREE CROPS

INDEX

RICE-VEGETABLES-JUTE
RICE-POTATO-JUTE
RICE-VEGETABLES-WHEAT
RICE-POTATO-WHEAT
RICE-POTATO-OILSEED
RICE-PULSE-WHEAT
RICE-VEGETABLES-PULSE
RICE-VEGETABLES-Vegetables
RICE-OILSEED-VEGETABLES

Fig. 55
First Three Crops

With the application of this choice the number of crop combination regions becomes as large as mine. These crop combination regions have been plotted in Fig. 55 and are as follows:

Table 5

<table>
<thead>
<tr>
<th>Crops</th>
<th>Number of blocks</th>
<th>Name of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice/Vegetables/Jute</td>
<td>1</td>
<td>Balagarh</td>
</tr>
<tr>
<td>Rice/Potato/Wheat</td>
<td>1</td>
<td>Panduah</td>
</tr>
<tr>
<td>Rice/Vegetable/Pulse</td>
<td>1</td>
<td>Chinsurah - Mogra</td>
</tr>
<tr>
<td>Rice/Potato/Jute</td>
<td>2</td>
<td>Polba-Dadpur, Pursurah</td>
</tr>
<tr>
<td>Rice/Potato/Oilseed</td>
<td>5</td>
<td>Dhaniakhali, Tarakeswar,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Khanakul, Arambagh,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jangipara</td>
</tr>
<tr>
<td>Rice/Potato/Vegetables</td>
<td>2</td>
<td>Haripal, Singur</td>
</tr>
<tr>
<td>Rice/Vegetables/Wheat</td>
<td>1</td>
<td>Chanditala</td>
</tr>
<tr>
<td>Rice/Pulse/Wheat</td>
<td>1</td>
<td>Serampore-Uttarpura</td>
</tr>
<tr>
<td>Rice/Oilseed/Vegetables</td>
<td>1</td>
<td>Goghat</td>
</tr>
</tbody>
</table>
It will be seen from the above table that rice and potato are dominating constituent crops in the first three combinations which cover 10 blocks out of 15. The other crops entering the combinations are jute, vegetables, pulse, oilseed, wheat. Among the above crop combinations rice/potato/oilseed region dominates in the district occupying 5 blocks. In two crop combination it was also noticed that rice/potato combination dominates the agricultural scenery. In all those blocks oilseed is third-ranking crop because after the harvest of potato oil seed particularly til, is grown. Mustard and rapeseed are also cultivated during the rabi season. Next important combinations are rice/potato/jute and rice/potato/vegetables covering 2 blocks each.

Minimum Deviation Method

To delineate the crop combination regions in the district by this method crops occupying more than 0.5 per cent of total cropped area have been taken into consideration. As a result of the application of this method 4 crops combination regions have emerged out in the district. The blocks falling into different blocks are given in the following table and are plotted in Fig. 56. The crop regions are as follows:
HOOGHLY
CROP COMBINATION REGIONS
( BY MINIMUM DEVIATION METHOD )

LEGEND
R- RICE
J- JUTE
P- POTATO
O- OIL SEEDS
Pu- PULSES
V- VEGETABLE
W- WHEAT

Fig. 56
Table 6

Crop Combination regions (Minimum Deviation Method)

<table>
<thead>
<tr>
<th>Crop Combination</th>
<th>Number of blocks</th>
<th>Names of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Crop (Rice)</td>
<td>4</td>
<td>Panduah, Jangipara, Arambagh, Goghat</td>
</tr>
<tr>
<td>2. Crop Combination (Rice/Potato)</td>
<td>1</td>
<td>Parsurah</td>
</tr>
<tr>
<td>5 Crop Combination (Rice/Potato/Oilseed/</td>
<td>1</td>
<td>Tarakeswar</td>
</tr>
<tr>
<td>Vegetables/Jute)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Crop Combination</td>
<td>9</td>
<td>Balagarh, Chinsurah-Mogra, Polba-Dadpur,</td>
</tr>
<tr>
<td>Rice/Potato/Oilseed/Vegetables/Jute/Pulses/Wheat</td>
<td></td>
<td>Dhaniakhali, Haripal, Singur, Chanditala,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serampore-Uttarpara, Khanakul.</td>
</tr>
</tbody>
</table>

Monoculture (Rice) - Monoculture rice region occurs in Panduah, Jangipara, Arambagh, and Goghat blocks. In all these blocks rice is the dominant crop occupying 75 to 80 per cent of the total cropped area. In all these blocks aman paddy occupies a considerable portion of the total cropped area. Share of other two paddy namely Boro and Aus is significantly low.
2 Crop Combination: This combination emerges in only one block, i.e. Pursurah. The chief crops in the combination are rice and potato.

5 Crop Combination: This combination also occurs in one block namely Tarakeswar. The principal crops in the combination are rice, potato, oil seed, vegetable and jute in order of rank.

7 Crop combination: This is the very common combination in the District covering 9 blocks out of 15. Rice is the first ranking crop in those blocks. Vegetables is the second ranking crop in Balagarh, Chinsurah - Mogra, Singur, Chanditala, and Potato in Polba-Dadpur, Dhaniakhali, Haripal, and Khanakul. Whereas jute emerges as third ranking crop in Balagarh and Polba-Dadpur, Vegetables in Haripal, Pulse in Chinsurah-Mogra, wheat in Chanditala, Serampore-Uttarpara, and Oilseed in Dhaniakhali and Khanakul. In most cases jute emerges as fourth ranking crop. Wheat ranks either fifth or sixth. Pulse is the seventh ranking crop.

Maximum Positive Deviation Method:

As a result of the application of this method 3 types of crop combination regions have emerged which are as follows (Fig. 57).
HOOGHLY
CROP COMBINATION REGIONS
( BY MAXIMUM POSITIVE DEVIATION METHOD)

LEGEND
R—RICE
P—POTATO
O—OIL SEEDS
J—JUTS
V—VEGETABLES
A—RP
B—RP

Fig. 57
Table 7
Crop Combination Regions (Maximum Positive Deviation Method)

<table>
<thead>
<tr>
<th>Crop Combination</th>
<th>Number of blocks</th>
<th>Names of the blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Crop (Rice)</td>
<td>6</td>
<td>Panduah, Chinsurah-Mogra, Polba-Dadpur, Jangipara, Arambagh, Goghat.</td>
</tr>
<tr>
<td>2 Crop Combination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice/Vegetables</td>
<td>3</td>
<td>Balagarh, Singur, Chanditala</td>
</tr>
<tr>
<td>Rice/Potato</td>
<td>4</td>
<td>Dhaniakhali, Haripal, Serampore Uttarpura, Khanakul</td>
</tr>
<tr>
<td>3 Crop Combination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice/Potato/Oilseed</td>
<td>1</td>
<td>Tarakeswar</td>
</tr>
<tr>
<td>Rice/Potato/Jute</td>
<td>1</td>
<td>Pursurah</td>
</tr>
</tbody>
</table>

Monoculture (Rice): This combination occurs in all those blocks which emerged as one crop combination in the Weaver's "Minimum Deviation Method". Chinsurah-Mogra and Polba-Dadpur blocks which emerged as 7-crop combination in Weaver's
Method have emerged as 1 crop combination in this method. Rice is the Principal crop in all these blocks.

2- Crop Combination: Balagarh, Singur, Chanditala, Dhaniakhali, Haripal, Serampore-Uttarpara, Khanakul which emerged as 7-crop combination have emerged as 2-crop combination. Rice is the first ranking crop in all cases. But second crop varies considerably. Thus rice/vegetables combination predominates in Balagarh, Singur and Chanditala where vegetables is widely cultivated to provide supply of it to the nearby urbanised tract of the district and of Calcutta. Rice/Potato combination is practised in Dhaniakhali, Haripal, Khanakul and Serampore-Uttarpara blocks where potato is the second ranking crop. These blocks are again the chief potato producing region of the district.

3-Crop Combination: This combination is found to occur in two blocks namely, Tarakeswar and Pursurah. In each of these blocks rice and potato are the first and second ranking crops respectively. But the third ranking crop is quite variable. Oil seed is the third ranking crop in Tarakeswar and Jute in Pursurah.
Spearman's Rank Correlation Co-efficient Method:

In order to find out the crop combination regions applying this method a relative rank matrix of different crops has been prepared in which ranks have been assigned in relation to the crop chosen for rank correlation (Table 34, Appendix). The Spearman's rank correlation coefficient has been calculated for each pair of the blocks. A matrix of correlation co-efficient has been compiled (Table 35 Appendix). The values of correlation co-efficient significant at 5 per cent level has been found out with reference to the graph of significance levels for correlation co-efficient using student's "t" test.

The co-efficient gives an idea about the degree of association of any pair of blocks in respect of their crop combination. Higher the co-efficient value of any pair of the blocks is higher their association. Going through the matrices either along the rows or down the columns the pairs having the highest co-efficient have been identified. At the same time the nature of their linkage has been identified. If both the members of any pair show highest association with each other it may be called a "closed" link, if however, any member of the pair exhibits highest association with any other member outside the pair it is called an "open" link. "Closed" link forms the nucleus of any system or region whereas "open"
HOOGHLY
LINKAGE OF BLOCKS
(BASED ON CORRELATION CO-EFFICIENT)
link helps adding members to the system or region. Nature of
linkage of the blocks has been shown in the Fig. 58. Based on
this linkage 4 crop combination regions have been identified
which have been shown in the Fig. 59.

1. Rice, Potato, Oilseed Region: This region includes
Polba-Dadpur, Dhaniakhali, Pursurah, Tarakeswar, Arambagh,
Goghat and Panduah. Rice is the first ranking crop followed by
potato and oilseed. In each block potato occupies no less than
5 per cent of total cropped area. Highest percentage occurs
in Pursurah. Oil seed also occupies a considerable portion of
the total cropped area.

2. Rice, Vegetable, Jute Region: Balagarh, Singur,
Haripal and Chanditala have emerged as rice-vegetables-jute
region. Rice is the first ranking crop followed by vegetables
and jute. In each block vegetables occupies more than 9 per cent
of the total cropped area. Jute also occupies a significant
place covering 6.19 to 11.04 per cent of total cropped area.

3. Rice, Potato, Oilseed, Jute Region: This combina-
tion occurs in Khanakul and Jangipara. Rice is the first ranking
crop followed by potato oilseed and jute.

4. Rice, Pulse, Wheat Region: Serampore-Uttarpara
and Chinsurah-Mogra blocks have emerged as rice, pulse,
HOOGHLY
CROP COMBINATION REGION
(CORRELATION COEFFICIENT METHOD)

LEGEND
RICE POTATO OILSEED
RICE VEGETABLES JUTE
RICE POTATO OILSEED JUTE
RICE PULSE WHEAT

SCALE
0 5 10 15KMS

Fig. 59
wheat region. Rice is the first ranking crop followed by pulse and wheat. Pulse occupies 5.94 to 14.67 per cent of the total cropped area. Wheat is also important covering 4.07 to 11.29 per cent of gross cropped area.

Remarks

The statistical approaches applied in the delineation of crop regions of the district bring to light the important crops which enter the crop associations. From the above study it has been ascertained that the methods though suffer from laborious calculations have their quality of precision in the demarcation of crop regions. The maximum positive deviation methods however gets ascendancy over Weaver's method as it reduces the number of crops in the combination and thus simplifies the crop association map which can be helpful in the designation of agricultural regions of the area. The application of arbitrary choice method e.g. first crop only, first two crops and first three crops is not judicious as by doing so the rest of the crops are being excluded without any consideration of their percentage weightage.
References


