CHAPTER III

RICE CULTIVATION AND ITS SPATIAL VARIATION WITH SPECIAL REFERENCE TO H.Y.V. RICE

Rice cultivation including HYV like other crops varies from season to season. The methods and techniques of rice cultivation, area of concentration, productivity pattern, area occupied by HYV rice, their spatial distribution etc. are discussed in the following pages.

i) METHODS AND TECHNIQUES:

The methods and techniques of cultivation of different crops vary from each other. Rice, the staple food crop in India is grown in different seasons with varying agricultural practices. Its sowing, growth and harvest can however be seen all through the year. In the Malda district three crops of rice (Aus, Amon and Boro), in an agricultural year are grown. The rice seasons include Aus, Amon and Boro of which Amon and Boro are the most important. Table No.III-I shows the sowing as well as harvesting seasons of Aus, Amon and Boro.

AMON: Amon is also known as winter paddy, Amon is sown in July after the onset of the monsoon. During this season, paddy is grown along with capsularies jute in lowlands. After the first rains in June, the farmers prepare the fields. The fields are ploughed and cleared of weeds. The paddy is sown in nurseries. Seedlings are raised in highly manured nurseries.
TABLE : III-I

Different rice crops with showing and harvesting seasons

<table>
<thead>
<tr>
<th>Name of the Crop</th>
<th>Sowing season</th>
<th>Harvesting season</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aus or Pre-Kharif</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Autumn Rice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Low-land Aus</td>
<td>February/April</td>
<td>July/August</td>
</tr>
<tr>
<td>b) Direct sown</td>
<td>March/June</td>
<td>July/October middle</td>
</tr>
<tr>
<td>c) Transplanted</td>
<td>February/June</td>
<td>July/October middle</td>
</tr>
<tr>
<td></td>
<td>(Seedling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>March/July</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Transplanted)</td>
<td></td>
</tr>
<tr>
<td>2. Amon or Kharif Rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Broad casted low land</td>
<td>April/May</td>
<td>October/November</td>
</tr>
<tr>
<td>b) Direct sown</td>
<td>June/August middle</td>
<td>October/December</td>
</tr>
<tr>
<td>c) Transplanted</td>
<td>May/July middle</td>
<td>November/December</td>
</tr>
<tr>
<td></td>
<td>(Seedling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>July/August</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Transplanted)</td>
<td></td>
</tr>
<tr>
<td>3. Boro Rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Rabi Rice)</td>
<td>November/January</td>
<td>April/May</td>
</tr>
<tr>
<td></td>
<td>(Seedling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>December/February</td>
<td>(Transplantation)</td>
</tr>
</tbody>
</table>

The transplantation is carried out in puddled condition with standing water in the field, during the months of July and August. Before transplantation takes place, the field is ploughed and puddled 4 to 6 times depending on the nature of the soil and the available labour and cattle energy. Transplantation is mostly done by female labour and the entire operation is labour-intensive. After a month and a half from
the date of completion of transplantation, farmers apply available quantity of fertilizer. Amon crop flourished during the rainy season and is harvested in the months of November and December. It is practised almost everywhere. Average production is 1600 kg. per hectare for local varieties and 1870 kg. for HYV varieties.

**A U S**: Aus is cultivated during autumn season. The broadcast varieties are sown in low-land in well prepared fields in February-April only, whereas direct sown variety is sown between March to June. Weeding becomes essential for broadcast Aus paddy. Transplanted Aus is grown in irrigated field. Before transplantation also weeding is essential. During February-June, seeds are sown in well manured nurseries when the seedlings come up, after 4 to 5 weeks these are transplanted in puddled fields from March to July. Aus like Amon is practiced in almost all over the district.

During the field work, the author was confirmed that Aus if transplanted gives higher yields than the broadcast. This fact is also proved by secondary data and information. The average production may be taken as 944 kg. per hectare for local varieties and 1202 kg. per hectare for HYV.

**B O R O**: The paddy grown during rabi season (i.e. during November, December and January) is called Boro. It is cultivated in marshy land in clayish soil generally situated
near the edge of a bil. Boro is usually called a summer crop and hence requires adequate and timely irrigation. For Boro, seeds are raised in nurseries like Aus and Amon in the months of November to December and when the seedlings are nearly a foot high, they are transplanted (as that in Aus and Amon) into a similar but rather larger well puddled plot during December to February. Boro rice is harvested during April and May and unlike Aus and Aman is widely cultivated in Harishchandrapur-I & II, Chanchal-II, Ratua-I & II, Old Malda blocks. The yield is higher than other kind of paddy. But the grain is coarser. The average production is 2370 kg. per hectare for HYV varieties.

It can however, be concluded in the light of the above discussion that Amon and Boro rice crops are the most important and principal crops in the Malda district. Amon and Boro are widely grown in central and northern part of the district and the area under these crops exceeds 60 percent of the gross cropped area in all the blocks, Bamongola and Habibpur are the two blocks located in the eastern part of the district are exception where more than 80 percent of the cropped land are covered by Aus, Amon and Boro paddy crops. However, two striking low rice producing blocks from the southern parts of the districts are Manikchak and Kaliachak-I where substantial amount of land is used for jute, oilseeds, pulses and mulberry production. In southern part of the
district rice occupied relatively less area which never exceeds 50 percent of the gross cropped area.

ii) **IRRIGATION POTENTIALITIES** :

It is worthwhile to discuss in brief the irrigation potentials in the district of Malda as a primary indicator for successful and effective implementation of High yielding rice cultivation programme. The block areas under irrigation is evident from the table given below appear to be highly variable with a range of area in hectares between 12.66 to 47.99 percent Kaliachak-II and Ratua-II respectively during 1990-91 to 1991-92.

**TABLE : III-2**

Degree of Irrigation in Different Blocks

<table>
<thead>
<tr>
<th>Class groups of irrigated areas in percentage</th>
<th>Frequency/Name of the blocks</th>
<th>Cumulative percentage</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 15</td>
<td>2 (Manikchak, Kaliachak-II)</td>
<td>2</td>
<td>Very low</td>
</tr>
<tr>
<td>15 - 20</td>
<td>3 (Kaliachak-III Habibpur &amp; Bamongola)</td>
<td>5</td>
<td>low</td>
</tr>
<tr>
<td>20 - 25</td>
<td>1 (Gazole)</td>
<td>6</td>
<td>low medium</td>
</tr>
<tr>
<td>25 - 30</td>
<td>4 (H.C.Pur-I, Chanchal-II, Kaliachak-I, English Bazar)</td>
<td>10</td>
<td>medium</td>
</tr>
<tr>
<td>30 - 35</td>
<td>2 (Old Malda, Ratua-I)</td>
<td>12</td>
<td>High</td>
</tr>
<tr>
<td>More than 35</td>
<td>3 (H.C.Pur-II, Chanchal-I, Ratua-II)</td>
<td>15</td>
<td>very high</td>
</tr>
</tbody>
</table>
It will be seen from the table that a good amount of area exhibits very low and low percentage of area under irrigation. Out of the 15 blocks only 5 blocks (Manikchak, Kaliachak-II & III, Habibpur and Bamongola) have very low and low percentage of area under Irrigation. These account for only 21.80 percent of the total area irrigated. There is 1 block i.e. Gazole (22.08 percentage) fall in the category of 20 - 25 percent. However, there are 4 blocks which fall within the medium category of 25 to 30 percent accounting for 22.90 percent are under irrigation out of the total irrigated area. The blocks include of Harishchandrapur-I, Chanchal-II, Kaliachak-I and English Bazar. The other two blocks, old Malda and Ratu-I posses high irrigation potential between 30 - 35 percent areas to the gross cropped area. Harishchandrapur-II, Chanchal-I, Ratua-II however, seem to be very highly equiped with irrigation potential having more than 35 percent of their gross cropped area under irrigation (appendix-2). These three have a share to the total of 20.88 percent of irrigated land. It is interesting to note that area under irrigation of the district represents 25.83 percent only against the state average of 36 percent (16 lakh hectares) in 1994.

To sum up, the Malda district though receives sufficient rainfall, has also an appreciable irrigation potential as compared to the rest of the North Bengal districts. The district is not commanded by any major
irrigation project. The irrigation in the district is made through minor and small irrigation projects only.

As such, installation of Shallow Tubewell is technically feasible everywhere except in Barind area. 'Doba' area of Barind tract, however, offers an opportunity for having Shallow Tubewell (S.T.W.) and consequently makes it possible to cultivate Boro. The network of rivers and their 172 km. long course flowing through this district has made it possible to install largest number of river lift irrigation scheme. If this advantage along with rainfed conditions are properly utilised with high management skill then the High yielding varieties programme can have better prospect.

iii) AREA OF CONCENTRATION:

Agricultural landscape of a region is well conceived of when its area dominance of different crops is identified with the help of some standard statistical techniques. The simple delineation of an area into a wheat of cotton region may be useful knowing the areas of wheat or cotton cultivation but it does not identify the degree of their density of cultivation in a given space and time. The study of concentration of crops therefore, bore a great relevance in understanding the agricultural mosaic of a region and finally in the agricultural land use planning at macro and micro level. The main objective of such an attempt is to study and
analyse the cropping patterns of an area on a regional basis with a view to bringing out their area of concentration (Hussain, 1970)\(^2\). Since the introduction of new High yielding varieties of crops can relatively be easier in the region where its traditional culture is dominated, the study of spatial concentration of a particular crop, is of immense help and most vital to the planners, agricultural scientists and administrators for policy formulation in the implementation of new innovations of agricultural programmes. This study has great socio-economic significance for it suggests how effectively the innovation of advanced technology (such as HYV of rice in the present case) can be implemented for its speedy diffusion and acceptance among the farmers. A high concentration index always indicates higher potential of agricultural resources. And it is probable that High yielding varieties of crops can be most favourably and easily grown in the areas of high concentration of these crops.

In the present chapter, an attempt has therefore, been made to analyse first the distribution pattern of the area under rice in Malda District to find out its area of concentrations and the second to have a discussion over the productivity of HYV of rice and spatial distribution of HYV are in the region. In order to have average picture of the area devoted to rice in Malda district, 5 years data (i.e. 1988-89 - 1993-94) have been taken into account with the
intention that the 5 years average would minimise the vagaries of weather on the area of rice cultivation. The density pattern of area under HYV of rice has been shown with 5 years average (1988-89 - 1992-93) (appendix-3).

With a view to showing the density pattern of rice cultivation in Malda, a seasonwise break up of the area under rice has been presented. So far as the HYV is concerned, the total area under the same has been shown as percentage to gross cropped area. The regional dominance of rice has been determined, firstly, by comprising the sown area in proportion and secondly, by relating the crop density in each of the component areal units of the district as a whole (appendix-4). Hence, for the purpose, the location Quotient method has been applied (Plan of work).

The percentage values for the density of area under rice in all the component areal units that show concentration have been put in descending array into five equal parts to distinguish the very high, high, medium, low and very low concentration with the help of index scale. The concentration of rice as the first ranking crop in every unit has been plotted and mapped.

After having identified the areas of less and more concentration of rice, an attempt has been made to enquire as to whether there is any space relationship within the
MALDA

BLOCKWISE AREA UNDER RICE

(1993 - 1994)

INDEX IN PERCENTAGE

- 80 AND ABOVE
- 61-80
- 41-60
- 40 AND BELOW

FIG-4
variables such as concentration indices of rice as a whole and HYV of rice and the extent of area irrigated. A glance at figure No.4 reveals that rice is the dominant and principal food crop in all the component areal units of the area under study irrespective of block and district and it has a substantial percentage share which invariably exceeds more than 35 percent in each units. The percentage of rice is significantly high in some blocks but the region can't be delineated as an area of monoculture. The minimum and maximum area varies between 35.37 to 86.19 percent for the blocks of Manikchak and Habibpur respectively (appendix-5).

Since rice posses a major share of area under cultivation in each areal unit, it ranks second to none of the agricultural field crops in the district of Malda as well as in the West Bengal. However, the percentage share to gross cropped area of the different crops other than rice is significantly high in the Tal and Diara region.

The following Table shows the frequency distribution of the indices of concentration of area under rice.

It will be seen from the Table No.III-3 that the Indices of concentration vary between as low as 0.51 in Manikchak to as high as 1.43 in Habibpur. The reason for such a low concentration of area under rice in Manikchak may be attributed to less areas put under rice, low irrigation
TABLE III-3

Frequency Distribution of Concentration of Rice

<table>
<thead>
<tr>
<th>Class group of the indices of concentration</th>
<th>Degree of concentration</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>.60</td>
<td>very low</td>
<td>4 (Ratua-I, Manikchak, Kaliachak-I &amp; II)</td>
<td>4</td>
</tr>
<tr>
<td>.60 to .80</td>
<td>low</td>
<td>3 (Ratua-II, English Bazar, Kaliachak-III)</td>
<td>7</td>
</tr>
<tr>
<td>.80 to 1.00</td>
<td>medium</td>
<td>2 (Harishchandrapur-II, Chanchal-II)</td>
<td>9</td>
</tr>
<tr>
<td>1.00 to 1.20</td>
<td>high</td>
<td>2 (Harishchandrapur-I, Chanchal-I)</td>
<td>11</td>
</tr>
<tr>
<td>1.20 (\Delta)</td>
<td>very high</td>
<td>4 (Gazole, Bamongola, Habibpur, Old Malda)</td>
<td>15</td>
</tr>
</tbody>
</table>

facilities and high penchant for wheat and pulses cultivation by the farmers. Habibpur having high areal concentration of rice seems to be an exception because the area despite a medium level of irrigation potential has the highest density of rice cultivation as compared to the rest of the blocks in Malda district.

As per the arrangement of the index values in a descending order of magnitude with the different distinguishing parts of the array, 4 blocks are observed within the very high degree of concentration exceeding 1.20. The blocks constitute of Gazole, Bamongola, Habibpur and Old Malda. The reasons attributed to such a high concentration, however are not very
MALDA
CONCENTRATION OF AREA UNDER RICE

FIG-5
positive. Though irrigation facilities mainly by river lift and tanks are relatively better but soil of old alluvium formation, composed of stiff clay containing iron and lime and acidic in nature is not very conducive for any other crop. The main crop grown in this region is winter rice.

High concentration of area under rice is noticed in the blocks of Harishchandrapur-I and Chanchal-I. Both these blocks enjoying better irrigation facilities and soil fertility.

The doash type of soil in these blocks is the most fertile in the district and neutral in reaction. However the other two blocks (Harishchandrapur-II and Chanchal-II) from this region are observed having medium degree of concentration with a range between 0.80 to 1.00 (Fig.5).

As many as 7 community development blocks show low and very low concentration having index values between 0.51 to 0.80. The blocks include English Bazar, Manikchak, Kaliachak-I II & III are located in the southern parts of the district in Diara region. The low concentration of rice cultivation in this region is mainly because of diversified agriculture. Mulberry, Pulses, Wheat, Maize with Aus rice are the main crop combination. The low concentration of rice in two blocks of Ratua-I & II of Tal region seems to be an exception. However better irrigation facilities by Shallow Tubewell (STW) and
River Lift Irrigation (RLI), favourable soil texture and better price have encouraged the farmers in these two blocks to grow rabi pulses, wheat and mustard substantially.

From the discussion it is inferred that out of 15 community development blocks, 8 are coming within medium, high and very high categories indicating moderate agricultural potential.

iv) PRODUCTIVITY PATTERN:

So far as the level of output of rice in Malda is concerned, it has been observed that the output has shown an increasing trend. From about 26,26,000 lakh tonnes in 1970-71, the production has gone up to about 46,42,400 lakh tonnes in 1992-93. Thus there has been a net increase of 20,16,400 tonnes during the past 23 years. The simple annual growth rate, linear growth rate and compound growth rates are 4.3 percent, 2.6 percent and 3.8 percent respectively (Annual plan on Agriculture 1993-94).

The average yield rate of total rice (1993-94) is about 1966 kg. per hectare. The linear growth rate of productivity come out to be only 0.61 percent. Better yield rate depends on favourable agro-climatic and socio-economic factors. Absence of floods and timely rains stand favourable for rice productivity. The average production of rice during 8
years out of 23 years (from 1970-71 upto 1992-93) was 1000 kg. per hectare. During 1986-87 the yield rate dropped below 900 kg. per hectare. Production of rice increased by 60.5 percent against the area which increased by 68.74 percent over the plan periods. Thus the increase in production is mainly due to increase in area, High yielding seeds and better agricultural practice.

In the absence of virtually little or no control over floods and drought and as there is little use of irrigation and poor inputs in agriculture, there is relatively slow growth of agricultural production compared to the state of West Bengal and India.

v) **INTRODUCTION OF H.Y.V.**

During the annual plan 1966-67 to 1968-69) for the first time a few quick maturing High yielding varieties of rice were introduced in the state such as Taichung, Manohar Sali, I.R. 8 main in Burdwan and through district. At the end of the adhoc plan period, strategy adopted for increasing agricultural production was on quick maturing programme, such as extensive use of High yielding variety of seeds.

In the years of 1968-69, 1969-70 HYV rice varieties were first introduced in the Govt. farms of Malda District to examine its performance in the locality by the extension
agency of the Directorate of Agriculture, Department of Agriculture, Govt. of West Bengal. The varieties were Taichung Native-1, Tiachung-65, Tainan-3. The agricultural extension agency observed an unbelievable result which they found true in this locality too. The message was disseminated to the farmers of the locality and HYV were introduced in the farmers' plot the next year to see the fate of these varieties in the farmers' hand. The result was outstanding and thereby expansion from one farmer to another, one area to the other is going on since then.

The introduction of short duration of HYV of rice in Malda which is less photosensitive has created such a situation that three rice crops in a year can be successfully grown in the field, provided proper irrigation facilities are available. The incentive for a change in agriculture sector, such as, taking up HYV programme, bringing institutional changes, undertaking river lift irrigation scheme, came during the period 1970-71 to 1971-72, though the successive agricultural plan periods in the district put more stress in accelerating these plan and programmes. As for instance, a pilot project for lift irrigation with power was undertaken for the first time in Barind area. The district annual agricultural plan 1984-85 and 1985-86 adopted some important measures, to accelerate progress in production and to increase area under High yielding varieties substantially. A special
extension service programme was undertaken to push adoption of improved method of cultivation and package of practices by cultivations, conversion of traditional paddy monoculture system into multiple cropping. Large scale demonstration in compact blocks was organised with HYV to popularise the cultivation of the same. As a result the diffusion of HYV started getting momentum.

HYV new rice seeds first introduced in Diara area, particularly in those areas having assured irrigation facilities with the introduction of HYV the area have increased tremendously and farmers got crazy for growing Boro paddy. Unlike kharif paddy (Aus and Amon) where the percentage coverage of HYV is relatively less almost the entire Boro Crop is grown with HYV. This is because of very high yield potentialities of the Boro Paddy due to long sunshine hours, regulated water, high utilisation and intake of plant nutrients and low intensity of pest and disease and so on.

Of the HYV seeds, Taichung Native-I was found to be the best and still now has very high yield potentialities. But T.N.-I is highly susceptible to various pest and diseases. The other two varieties were also having the problem of pest disease complex. The short and bold nature of the grain and quality did not satisfy the cultivators as well as the consumers. Low expansion of the grains after cooking was not accepted by the consumers and hence the market value of such varieties, which though yielded high, becomes very low.
Thus there was a need for the replacement of such HYV. The variety I.R.-8, the other name being "miraculous paddy" was introduced soon which solved the aforesaid problems of the quality. Jaya and Padma varieties of rice were also released soon after I.R.-8. The expansion now was accelerated, though having high yield potentiality and blessed with improved quality, these varieties were also lacking in resisting pests and diseases in general.

Ratna, Vijaya, TKM-6, Pankaj, Jagannath and Kalinga-I etc. were evolved in the 2nd phase incorporating partial resistance and further improvement in the grain quality.


The varieties which are in practice in cultivation at present are I E T 1444 (Rasi), I.R-36, I E T 4094 (Kshitish), Mashuri, Pankaj, C N 540 (Syresg) etc.

Non-availability of suitable varieties in higher situation and also in lower situation posed a hindrance in the expansion of the area. Moreover, theremo-sensitivity of the varieties was also another constraint in the initial stage. The agricultural scientist could make a breakthrough and release situation specific varieties. Now suitable varieties
for medium, high and lower situations have improved the position greatly. Suitable varieties for very high lands i.e. direct sown condition and very low situation are still in the search. The problem of the effect of temperature has been solved to some extent by evolving cold tolerance varieties.

It may be kept in mind that the traditional Amon varieties are season-bound i.e. whatever may be sowing time, the varieties will come to flower only in late October to 1st week of November. The HYV paddy on the other hand is period bound, i.e. the number of days from sowing of seed to harvesting is fixed. This character of HYV has helped in growing the crop in all the three seasons of paddy i.e. Aus, Amon and Boro and thus helped the expansion of the HYV area and increasing the paddy production per annum.

The incentive for a change in agricultural sector such as, taking up HYV programme, bringing institutional changes undertaking lift irrigation scheme came during the period 1986-87 to 1988-89, though the successful plan periods put more stress in accelerating these plans and programmes. The strategy adopted to bring about accelerated progress in production was to increase the area under High yielding variety substantially and to strengthen the extension services to push adoption of improved method of cultivation and package of practices by cultivators, conversion of traditional paddy monoculture system into multiple cropping.
The achievement at the end of the 1993-94 plan period in the case of HYV programme in the district of Malda was spectacular. Area under HYV rose from 6022 hectares in 1971-72 to 1,60,490 hectares in 1992-93. Thus there has been a net increase of 1,54,468 hectares during last 22 years, which shows simple growth rate of 116 percent per annum and almost all the blocks have increased its HYV during this time.

Though more area was brought under High yielding programme but the overall impact on production was not satisfactory to the desired level. This is mainly because of non-package practice of cultivation without fertilizer and irrigation. These basic facilities for HYV cultivation were also not adequate, such as, irrigation and fertilizer. During the Fifth Five Year Plan period (1974-79) irrigation was given due importance in the district.

During the Sixth Five Year Plan period, in the district along with the state the strategy of agricultural development was based on the programme of High yielding varieties with package practices, thereby getting all possible supports from rapid development of irrigation, efficient supply of inputs through agro-industries corporation and speeding up the proper educational programmes along with research and extension. There are also high level concensus over multiple cropping keeping the intention of increasing the cropping intensity. The major achievement during the Seventh
plan period was extension of HYV rice in the Barind area in the Kharif season with the help of National Water-shed Development programme. And in the year 1991-92 Integrated programme for Rice Development earstwhile known as S.R.P.P. started operating as a pilot project for HYV culture. This programme operating in 12 blocks of the district viz. Harischandrapur-I & II, Chanchal-I & II, Ratua-I & II, Gazole, Bamongola, Habibpur, Old Malda, English Bazar and Kaliachak-III. In this programme the farmers are supplied with seed implements, need-based pesticides in subsidy rate under the scheme arrangement for 20 training programme in each block was also organized. The programme has already shown its impact by increasing its productivity from 1528 kilogram per hectare in 1989-90 to 1690 kilogram per hectare in 1992-93 in case of kharif paddy (in terms of clean rice).

vi) AREA OCCUPIED BY H.Y.V. RICE:

Information available on the area under HYV from 1971-72 to 1992-93 and as total area under HYV rice for the district of Malda shows that only 2.39 percent of the total area under rice have been covered by HYV by the end of 1971-72, this coverage continued till 1975-76.

But in 1983-84, 62,955 hectares of the total rice area was extended for High yielding varieties, which accounts for 25.02 percent. The changes in the extent of HYV area in
Malda district during that period was due to a tremendous urge for some new magic varieties which had some unbelievable productivity performance in early eighties. Moreover, during this period the double cropped area also increased largely owing to the extension of Boro cultivation mainly in Tal and Diara region, which was significantly HYV oriented.

The consumption of fertilizers had been increased in that period substantially. The consumption of nitrogen fertilizers increased from 1710 tonnes, of phosphatic fertilizers 780 tonnes and that of potassic fertilizers from 430 tonnes in 1978-79 to 8550 tonnes of nitrogenous, 3900 tonnes of phosphate and 1930.5 tonnes of potassic fertilizers in 1982-83. Considerable progress has been made in overall irrigation and specially in river lift irrigation in this period. Irrigated area extended from 51,209 hectares in 1978-79 to 57,230 hectares in 1982-83. The Table III-4 reveals that HYV rice appreciably diffused to Harishchandrapur Block-II (47.44 percent), Chanchal-I (36.52 percent) in Tal region and Kaliachak-I (34.49) in Diara regions. During this period almost all the blocks increased their HYV rice area substantially.

It will be seen from Table III-4 that in 1988-89 the diffusion of HYV is much more spectacular and even in all the blocks of Malda district. The coverage area under HYV rice has doubled from 62,955 hectares in 1982-83 to 12,800 hectares in
### TABLE : III-4

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Harischandrapur-I</td>
<td>4.06</td>
<td>12.05</td>
<td>25.21</td>
<td>59.97</td>
<td>67.32</td>
</tr>
<tr>
<td>Harischandrapur-II</td>
<td>5.67</td>
<td>7.83</td>
<td>47.44</td>
<td>62.76</td>
<td>77.71</td>
</tr>
<tr>
<td>Chanchal-I</td>
<td>4.19</td>
<td>6.59</td>
<td>36.52</td>
<td>65.55</td>
<td>66.00</td>
</tr>
<tr>
<td>Chanchal-II</td>
<td>2.21</td>
<td>5.29</td>
<td>26.38</td>
<td>52.64</td>
<td>65.75</td>
</tr>
<tr>
<td>Ratua-I</td>
<td>5.16</td>
<td>6.06</td>
<td>31.71</td>
<td>65.01</td>
<td>81.16</td>
</tr>
<tr>
<td>Ratua-II</td>
<td>3.03</td>
<td>3.83</td>
<td>27.77</td>
<td>59.95</td>
<td>81.66</td>
</tr>
<tr>
<td>Gazole</td>
<td>1.36</td>
<td>2.34</td>
<td>18.71</td>
<td>45.11</td>
<td>55.78</td>
</tr>
<tr>
<td>Bamongola</td>
<td>1.04</td>
<td>2.89</td>
<td>11.85</td>
<td>32.84</td>
<td>46.28</td>
</tr>
<tr>
<td>Habibpur</td>
<td>0.66</td>
<td>3.08</td>
<td>15.04</td>
<td>34.66</td>
<td>48.89</td>
</tr>
<tr>
<td>Old Malda</td>
<td>0.87</td>
<td>9.93</td>
<td>16.97</td>
<td>51.39</td>
<td>70.34</td>
</tr>
<tr>
<td>English Bazar</td>
<td>8.19</td>
<td>15.53</td>
<td>24.52</td>
<td>65.37</td>
<td>70.77</td>
</tr>
<tr>
<td>Manikchak</td>
<td>0.0</td>
<td>0.39</td>
<td>29.29</td>
<td>62.62</td>
<td>63.34</td>
</tr>
<tr>
<td>Kaliachak-I</td>
<td>0.46</td>
<td>6.59</td>
<td>34.49</td>
<td>59.53</td>
<td>85.71</td>
</tr>
<tr>
<td>Kaliachak-II</td>
<td>0.0</td>
<td>2.06</td>
<td>20.93</td>
<td>35.42</td>
<td>53.12</td>
</tr>
<tr>
<td>Kaliachak-III</td>
<td>0.67</td>
<td>0.86</td>
<td>18.94</td>
<td>47.85</td>
<td>65.26</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td><strong>2.39</strong></td>
<td><strong>5.32</strong></td>
<td><strong>25.02</strong></td>
<td><strong>51.11</strong></td>
<td><strong>63.65</strong></td>
</tr>
</tbody>
</table>

1987-88, which comprises 51.11 percent of the total rice area. Fertilizer consumption has gone up significantly. Nitrogenous fertilizer consumption increased by 31 percent (2240.81 tonnes) phosphatic fertilizers by 37 percent (1068.86 tonnes).
MALDA

H.Y.V. RICE AREA, FERTILIZER CONSUMPTION AND IRRIGATED AREA

(1971-1994)

(SEE APPENDIX-6)

FIG-6
and potassic fertilizers by 58 percent (1119.4 tonnes). Another pre-requisite for extension High yielding varieties of rice, i.e. irrigation (as stated earlier) considerably increased in this period to 90,032 hectares. As a result the HYVs have greatly replaced the indigenous varieties in a large scale, all over the blocks including the Barind area, Fig.6.

A simple growth rate of 12.54 percent has been achieved by the Malda farmers in the extension of the HYV rice cropped area from 1988-89 to 1992-93. Coverage area has increased from 1,28,000 hectares to 1,60,490 hectares (appendix-6).

vii) **PERFORMANCE OF H.Y.V. RICE**

According to a report on performance of HYV rice in West Bengal for which trials were conducted by Rice Research Institute Chinsura, Hooghly recommended 42 varieties of HYV rice seeds to suit the different agro-ecological regions and for different seasons (in West Bengal). Rice Adaptive Research Centres at Malda and Chanchal selected 32 varieties from them, which are suitable for different blocks of Malda district. The pre-kharif (Aus) rice which is generally directly seeded after the first shower at the end of February to early April in Malda District, faces one or two drought spells, low minimum temperature at seedling and early vegetative state poses another problem. Under such circumstances, a bunch of short
duration HYV varieties like Rasi, I R-36, Palman 579, Ratna, CNM-25, IET 826 etc. have been recommended. These varieties are doing well in Tal areas i.e. the Central and Northern part of the district. However, the performance is not satisfactory as far as the productivity is concerned. Information obtained through adaptive research centres and block agricultural offices that as many as 15 varieties of High yielding seeds, farmers are using for their different fields, as in the case of upland rice (rice grown on both flat and slopping fields that are not bounded, that were prepared and seeded under dry conditions and that depend on rainfall for moisture) i.e. IET-1444, 2508, 826, M2-7029 etc. For low land Amon rice (rice is usually grown in their prepared wet or dry land but water is always held on the fields by bunds) usual varieties are Ratna, Jaya, I R-20, Pusha-33, Masuri, I R-442, I R-36, and I R -58. Boro, unlike the pre-kharif and kharif paddy,(where the percentage coverage of local varieties and inspite of applying N., P and K fertilizers at the rate of 50 : 25 : 25 and 10 : 50 : 50 per hectare) productivity appears to be low compared with other South Bengal districts performances. As a matter of fact, the HYV varieties of all seasons perform better when there is adequate and controlled water supply in time according to need.

viii) PACKAGE PROGRAMME IN H.Y.V. RICE CULTIVATION :

So as to achieve better and higher output per unit
area in the cultivation of High yielding varieties of rice, the package programme plays the most vital role in both the farmer's field and the farm level management. Package practice of cultivation involves as a systematic and scientific method of cultivation of any agricultural field crop with the application of advanced agricultural inputs such as chemical fertilizers, pesticides, insecticides, adequate irrigation facilities and upto date farm machinaries etc. The impact of various system of cultivation (such as package, non-package and partial package) has been observed very significantly in the farm level as well as in the fields of the farmers in Malda district. The following discussion throws light on the pattern of yield of HYV of rice per hectare of cultivable land in relation to the different package yield have been attained from the assessment survey of the Aus and Amon (HYV) rice programme during 1991-92 undertaken by Directorate of Agriculture, Government of West Bengal for the district of West Dinajpur and Malda of North Bengal. The survey is based on the yield obtained from the individual (sample farms of the Community Development Blocks) where the highest productivity has been obtained from Kaliachak block (2893 kg. per hectare).

Comparing the yield rates of full, partial and non-package programmes, the variation comes out to be very striking in either cases of Aus or HYV rice. Yield obtained from the partial package of early Aus HYV of rice has a range
between 1421 to 2203 kg. per hectare for Habibpur and Manikchak respectively. Generally the partial package programme has been taken into consideration with the rotation of each single agricultural input. Thus the yield obtained from the partial package and full package programmes does not indicate any striking variation. However, the variation between the yield responses due to full and partial package where a single agricultural input operates seems to be significant for both early maturity and regular maturity Aus (HYV) rice in the Malda district.

The Amon HYV of rice production also indicates the similar impacts of different package practices with the same geographical variation in yield rate. But a comparative study between the yield rates of Amon and Aus (HYV) rice shows that the yield obtained during the Amon season is more in kg. per hectare than that of the Aus season.

ix) SPATIAL DISTRIBUTION OF H.Y.V. OF RICE:

The analysis of spatial distribution pattern is of paramount significance for several reasons. First it has been observed that overall district picture (63.65 percent) marks many regional differences in regard to the adoptability of HYV and that for a proper understanding of the situation, spatial study is indispensible. Secondly, it has been recognised that the areal variation in the diffusion of HYV is related to
MALDA
SPATIAL DISTRIBUTION OF H.Y.V. RICE

INDEX IN PERCENTAGE

- 81 AND ABOVE
- 71-80
- 61-70
- 51-60
- 50 AND BELOW

FIG-7
regional differences in physical controls and socio-economic constraints, thus the spatial potentials for the diffusion of the HYV need to be observed and ascertained.

During 1993-94 the High yielding varieties of rice growing area for the district as a whole were 1,60,490 hectares or 63.65 percent of the total rice area. However in the block level analysis it has been found that area under HYV rice ranges between as low as 46.28 percent to as high as 81.66 percent in Bamongola and Ratua-II respectively. Now such a big range of spatial differences in a small regional unit owing to many reasons like distribution of rainfall, irrigation facilities, supply of surface water and deep ground water level, soil fertility etc. A detailed discussion in this regard will be in Chapter-IV. Figure 7 and Table III-5 indicate the spatial variation of HYV rice area of 15 blocks of the district.

Having a look at the distributional Table III-5 it is observed that only two blocks of Barind tracts come under the very low category of HYV rice adaptation. The blocks are Bamongola and Habibpur, poor irrigation facilities, hard older alluvium, soil moisture deficit and deep ground water level impose restriction on these two North-Eastern blocks. Though, rice is almost a mono-crop in this region but due to the above facts stated farmers could not find much interest on HYV of rice cultivation. Only one block comes under the low
<table>
<thead>
<tr>
<th>Class group (percentage of HYV area)</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
<th>Percent- age</th>
<th>CATEGORIES</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50</td>
<td>2</td>
<td>2</td>
<td>13.33</td>
<td>Very low</td>
<td>Bamongola, Habibpur</td>
</tr>
<tr>
<td>51 - 60</td>
<td>1</td>
<td>3</td>
<td>6.66</td>
<td>low</td>
<td>Gazole</td>
</tr>
<tr>
<td>61 - 70</td>
<td>8</td>
<td>11</td>
<td>53.33</td>
<td>moderate</td>
<td>Chanchal-I &amp; II, Harishchandrapur-I, Manikchak, Kaliachak-I, II, III, Old Malda</td>
</tr>
<tr>
<td>71 - 80</td>
<td>2</td>
<td>13</td>
<td>13.33</td>
<td>high</td>
<td>Harishchandrapur-II, English Bazar</td>
</tr>
<tr>
<td>81 and above</td>
<td>2</td>
<td>15</td>
<td>13.33</td>
<td>very high</td>
<td>Ratua-I &amp; II</td>
</tr>
</tbody>
</table>

category cultivation of HYV rice. The block is Gazole of the Barind area which devoted 55.78 percent of its rice area to HYV.

Coming to the moderate group of adapters of HYV rice cultivation, it is observed that as many as 8 blocks of Malda district are falling under this category. The percentage of their HYV area varies between 61 to 70 percent. The blocks are mainly from Tal and Diara regions of the district namely Harishchandrapur-I, Chanchal-I & II, Manikchak, Kaliachak-I, II & III and Old Malda. These are the areas where intensity of irrigation is low but the soil and climatic conditions are
favourable for HYV cultivation.

So far as the high HYV rice cultivated area is concerned, 2 blocks are falling in this group, the blocks being Harishchandrapur-II and English Bazar, having 77.71 and 70.77 percent total rice area under HYV respectively. Diffusion of HYV is high in these two blocks may be due to better lift irrigation facilities, good soil conditions and other socio-economic influence. The farmers of English Bazar have gradually adopted the improved practices of rice cultivation from the early seventies and replaced local varieties of rice substantially. Being district headquarter and very close to the zonal adaptive research centre farmers of this block enjoys greater thrust on HYV coverage.

Switching over the last class group of HYV coverage within which the area of as many as 2 blocks have very high percentage. The blocks are Ratua-I & II, located in the Western part of the district. It is interesting to note that these blocks from Tal region adapted HYV rice cultivation only from late seventies (see appendix-6) but since 1981-82, diffusion of HYV rice is in a very fast rate. In order to ascertain the spatial pattern of HYV rice concentration, a cumulative frequency curve has been prepared (Fig.8).

It is inferred from the above analysis that the distribution of HYV of rice appears to have been biased to the
Tal and Diara areas than the Barind areas. Now to have a broad understanding pattern of diffusion and spatial distribution of HYV of rice among the farmers of the Malda district, it is necessary to discuss the seasonwise HYV of rice among the farmers of the Malda district. It is for, this new variety of rice cultivation has been adopted by the farmers for different reasons and concerns in different parts of the districts. Initially (1972-78) HYV cultivation in Malda was accepted by the farmers in their Bora cultivation, where water was assured either at the low land areas or by irrigation. Substantially, this improved seeds started replacing Kharif varieties (Aus and Amon) in all the blocks of Malda District. Unlike Kharif rice where the percentage coverage of HYV slowly replaced the local and traditional varieties, almost the entire Boro (Rabi crop) cultivation grown with HYV. This is due to the very high yield potentials of the Boro rice, due to long sunshine hours, regulated water, high utilization and intake of plant nutrients and low intensity of pest and diseases and so on. Investment of every rupee on Boro gives at least twice than that of the Aus or Amon rice. The area under Boro was very much limited; with the introduction of HYV the area has increased tremendously in the Tal and Diara areas.

As far as the Kharif HYV rice is concerned it is worth noting to mention that due to non-availability of suitable varieties for short duration Aus crops HYV is facing
some hindrance in expansion of its area. The traditional Aus growing areas of the district fall in the Diara areas comprising English Bazar, Manikchak and Kaliachak blocks is still largely under traditional varieties of rice. But in the case of Amon rice more and more areas are covered with HYV in every year all over the district.

The following Table presents the blockwise Kharif (Aus & Amon) HYV area of the Malda District.

**TABLE : III-6**

**Distribution of Kharif HYV Rice**

<table>
<thead>
<tr>
<th>Class Group (percentage of Kharif HYV area)</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
<th>Percentage Categories</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 and below</td>
<td>4</td>
<td>4</td>
<td>26.66</td>
<td>very low Kaliachak-I &amp; II, Ratua-I &amp; II</td>
</tr>
<tr>
<td>66 - 70</td>
<td>1</td>
<td>5</td>
<td>6.66</td>
<td>low Harishchandrapur-II</td>
</tr>
<tr>
<td>71 - 75</td>
<td>5</td>
<td>10</td>
<td>33.33</td>
<td>moderate Chanchal-I &amp; II, Habibpur, English Bazar, Harishchandrapur-I</td>
</tr>
<tr>
<td>76 - 80</td>
<td>2</td>
<td>12</td>
<td>13.33</td>
<td>high Old Malda, Manikchak</td>
</tr>
<tr>
<td>81 and above</td>
<td>3</td>
<td>15</td>
<td>20.00</td>
<td>very high Bamongola, Gazole, Kaliachak-I</td>
</tr>
</tbody>
</table>

It may be seen from the above Table III-6 that the very low class of group of HYV rice areas devoted to Kharif
MALDA

PERCENTAGE OF H.Y.V. RICE AREA (Kharif)

INDEX

IN PERCENTAGE

- 81 AND ABOVE
- 76-80
- 71-75
- 66-70
- 65 AND BELOW

FIG-9
season it the 4 community development blocks, and its constitutes 26.66 percent of Kharif rice area of the district. The very low class group i.e. less than 65 percent Kharif rice area under HYV comprises Kaliachak-I & II and Ratua-I & II blocks. It is a significant point to note that these are the blocks which adapted HYV rice cultivation much more during Boro season than the Kharif cultivation and as a consequence they have been categorised in the very low class group inspite of very high adaptability of total HYV rice. One block falls within the low group i.e. 66 - 70 percent. Maximum number of blocks i.e. 5 of the 15 blocks constituting 33.33 percent of the entire Kharif rice cultivation areas of the district come within the moderate category. High and very high categories of area under HYV of Kharif rice have been found mainly in Barind area. Very high (81 percent and above) adaptation of Amon HYV rice reveals the fact that the farmers utilizing maximum area for the improved rice varieties in the summer season when monsoon rainfall is assured.

In view of the above analysis, it can be concluded that the distribution of Kharif HYV of rice has substantial variation among the blocks in the district (Fig.9).

The following table gives a comprehensive picture of the distribution of area under Boro HYV rice among the blocks under study.
Table : III-7 and Fig.10 shows that area under Boro HYV rice has substantial percentage share in all the component areal units of Malda District. Nevertheless, high and very high categories of HYV rice during the Boro season concentrated in the Tal and Diarah areas. As many as 2 blocks, namely, Harishchandrapur-II and Ratua-I have 31 to 35 percent of the HYV area under Boro cultivation, which is fairly high. In the Kaliachak-II & III and Ratua-II have over 35 percent land is devoted to Boro HYV rice which is fairly high percentage concentration. These high and very high categories of HYV adaptation in the summer rice indicating better irrigational facilities in this areas. On the otherhand the lack of
MALDA
PERCENTAGE OF H.Y.V. RICE AREA (BORO)

INDEX

IN PERCENTAGE

35 AND ABOVE
31-35
26-30
21-25°
20 AND BELOW

FIG-10
irrigation is probably the most significant factor which restricted H.Y.V. in summer season in the Barind areas.

Other major interesting factors for the comparatively poor success of the HYV rice is the susceptibility of the new rice seeds to pests and diseases. Growing the new varieties increases costs, but yields are not proportionately higher because of damage by pests and diseases.