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11.1. Summary of Findings

The nature, consequence and the basic causes for the crop diversification that have been undergoing since the arrival of Green revolution in West Bengal have been discussed elaborately in the previous chapters. The current chapter is devoted first to briefly outline the observations of the entire foregoing discussion. Thereafter the conclusions and policy implications emanated from the analysis will be highlighted towards the end of the discussion.

The main findings of the works have been sought to be analysed beginning from chapter-4. It provides a rigorous study of the nature of changes in cropping pattern in terms of acreage allocation among the crops. Results obtained after the application of different statistical and econometric methods indicated that the diversification has taken place largely in favour of boro rice cultivated in the summer season, potato and oilseeds as a whole, whose primary component is mustard. The diversification has taken place largely in favour of high value crops or towards the crops with relatively higher remuneration than the others grown in their respective seasons. This is clear from the positive contribution of cropping pattern change on the increasing total agricultural output of the state over time as discussed in chapter-7. It is also observed that over time high yielding varieties of each crop occupied major portion of the land used for the cultivation of each of them.

Area under foodgrains in absolute unit however observed an increasing rate of growth because of increasing rate of growth of area under cereals which more than offset the decreasing rate of decline in area under pulses. Superior cereals have gained in area at the cost of area under inferior cereals (like jowar, bajra, ragi, small millet etc.), wheat and pulses. Among cereals, paddy especially boro rice has experienced significantly increasing rate of growth in area under cultivation.

Among the major rabi crops sharp decline in area under wheat has been observed while that of potato and mustard has increased at the cost of other relatively low remunerative crops.
Inter-district variations in cropping pattern change have been varied and divergent. Significantly larger rate of increase in area and proportion of area under boro rice was noticed in all the south Bengal districts except Purulia and Malda, West Dinajpur, Cooch-Behar in the north. In the early years the rate of growth was much higher in Burdwan, Hooghly and Nadia, the three relatively advanced districts while the case was reversed for other districts. Deceleration in the rate of growth was noticed in those three frontrunner districts whereas acceleration was observed in other districts. Wheat, one of the major rabi crops in earlier years, experienced sharp decline in area under cultivation in central region (Burdwan, Birbhum, Bankura, Howrah and Hooghly) while all the northern districts recorded a positive trend of the same in terms of absolute and proportion of area. Sizeable growth in absolute and proportion of area under potato have been observed in the southern districts like Hooghly, Burdwan, Midnapore and Howrah in descending order and only in Jalpaiguri in the north. Area under oilseeds as a whole especially mustard, has increased but at a decelerating rate in most of the major oilseed producing districts. Absolute area of jute remained more or less same in most of the districts while the other cash crop sugarcane recorded a sharp decline in absolute area in all the districts.

Variability and instability of acreage growth also differs among the crops and across the districts and also between sub-periods. Variability of area under boro rice was much significant in the earlier period than the latter sub-period in the districts where the growth was also rapid but irrigation was uncertain in early years of development. In the districts of draught prone zone like Purulia and Bankura both variability and instability were insignificant since there was very little scope for boro rice cultivation in the earlier periods due to the lack of assured irrigation. The development of irrigation though started later (as is clear from chapter-9) the growth was rather slow but smooth. The districts with high growth in area under non-food crops observed greater instability in all those crops. Growth of wheat in the northern region of the state was associated with greater instability. Instability of growth of area under cereal crops as a whole was significant in the southern districts where the growth was significant but variability of growth of leading cereal, aman rice has been reduced over time in the major growing districts like Burdwan, Midnapore, Nadia, Murshidabad in the south and West Dinajpur, Malda and Jalpaiguri in the north.

Output of different crops also changed broadly in the same way as the area under crops. Production of boro rice, potato and oilseed as a whole particularly mustard
increased vigorously while that of pulses, wheat and other cereals like jowar, bajra, ragi etc. has decreased significantly. Though production of wheat had increased during the earlier years, it has been declining since 1979-80. Inter-district disparity in the production of boro rice and oilseed decreased along with the increase in production while inter-district variability in case of potato followed a decreasing trend with the increase in its production. Reduction in inter-district disparity in case of boro rice and oilseed implies that the laggard districts have advanced faster in these fields than the erstwhile-developed districts. Despite slower rate of growth in area and production, rice remains the first crop in terms of area and output. Production of foodgrains was highly concentrated in the developed districts of southern part. Though absolute production of foodgrains has increased in all the districts, proportional contribution to state’s total production of the formerly backward districts has risen while that of others has fallen. Production of wheat experienced an increasing trend in all the northern districts while it recorded a negative trend in most of the southern districts. In absolute amount production of jute also increased disproportionately in all the districts despite an insignificant change in its acreage.

Like area and production, inter-crop and inter-district variation in yield growth was also varying and divergent. Throughout the entire period 1970-71 to 1994-95 yield of foodgrains has experienced significantly positive rate of growth despite short-term variation in growth rate. Yield of cereals as a whole increased at a rate higher than that of pulses. Among cereals, yield of rice experienced a significantly higher rate of growth than that of wheat. However among different varieties of rice, yield of boro-rice recorded very slow rate of growth. Among non-food crops yield of oilseed experienced highest exponential rate of growth, which was followed by potato and jute.

Inter-district variation in composite productivity indices was observed to increase over the years. Disparity in yield has however decreased in case of boro rice, wheat, pulses, potato and sugarcane whereas it has increased in case of other crops. Burdwan and Hooghly have always been at the top two positions in terms of composite agricultural productivity while Darjeeling, West Dinajpur and Cooch-Behar were always among the bottom five districts in the relative rankings. Nadia has been observed to advance at a relatively faster rate than the other districts in terms of composite productivity.

Component analysis of chapter-7 revealed that intensive cultivation of crops through rising yield has significantly contributed to the total increase in agricultural
production of the state. Irrespective of the contribution of yield growth, impact of changes in cropping pattern on total changes in agricultural production is by no means negligible. The explanation revealed that the choice of combination of crops to be grown in a cyclic order in a crop-year or cropping pattern at any given situation has an important bearing on the total revenue from the agricultural crop activities. From the analysis it is also clear that though in the earlier sub-period area growth was much significant and that was possible through rising net sown area and bringing more and more land under multiple cropping system, later it became increasingly difficult to increase total area under cultivation. The stress therefore shifted on to yield and cropping pattern component. Impact of yield growth and cropping pattern component became more and more significant with the passage of time. Significantly large contribution of yield-cropping pattern interaction component also indicated the increasing allocation of land towards the high yielding or high value crops.

Changes in cropping pattern have been due to several reasons. The regression analysis has given some basic information about the important causes for the rapid growth of area under boro rice, potato and oilseed (particularly mustard) during 1970-71 to 1993-94. Though the impetus for raising acreage of aforesaid crops/crop groups has come from different sources, the basic and ultimate criterion for increasingly allocating land towards those crops is net or gross revenue. In the early stages of Green Revolution it was believed that the small farmers would be less commercial minded and allocate maximum portion of land for the cultivation of food crops whereas the large farmers would be more commercial minded and allocate a large portion of land for the cultivation of cash crops. But in the modern age of commercial movement that concept has gradually faded away. Even the small farmers can easily collect their required commodities from the market in exchange of money earned by selling the commodities produced by them. Over time profit motive is becoming more and more dominant criterion. At any given technical knowledge and available other resources, farmers will choose to grow those crops successively in different seasons that gives maximum possible net benefit. Simultaneously the profits and also the cultivation of those specific crops are guided by the changing technology and available supporting inputs that facilitates easy cultivation of those specific crops. Institutional changes are also found to play some role in alternative situations.

1 Raj, Sen, Rao; op cit.
The main supporting factor that has prompted boro rice to emerge as one important cash crop is the development of irrigation. Chemical fertilizer also has substantial impact on the acreage growth of boro rice. Irrigation is the leading input of boro rice as it is grown during summer time and regular supply of water is essential for paddy cultivation. Chemical fertilizer and yield growth has led to the acceleration of area under potato and oilseed especially mustard. Irrigation development has also boosted up the growth of area under potato and mustard though it is not clear from the regression equation. Actually expansion of ground-water irrigation in West Bengal has important bearing on the growth of cultivation of potato, mustard and boro rice along with canal irrigation. But it is not incorporated into the regression analysis due to the lack of systematic data. But it is clear from the inter-district disparity in acreage growth of those crops in relation to variation in ground-water irrigation as explained in chapter-9. Moreover there is a correlation between the growth of irrigation, consumption of chemical fertilizer and yield of crop, though not perfect. Still farmers are much influenced by the yield of boro rice and dummy variable shows a significantly positive impact of land reforms on acreage growth of oilseed and also on that of boro rice. Simultaneous expansion of area under potato and mustard during winter was possible due to expansion of area under cultivation during that season. Though a substitution of acreage between them was possible both were practised in order to reduce the problem of management and finance as well as to disperse risk involved in the cultivation of crops.

The extended version of regression analysis also reveals that direct price effect lagged one year is much strong in case of acreage allocation decision of the farmers. Moreover it is observed that even if any one of the price and yield has no significant impact on acreage growth, direct effect of expected total proceed per unit of area evaluated at prices lagged one year is much significant. Therefore the revenue from the cultivation of each crop is one of the important criteria which when increase relative to other crops induce the farmers to increasingly allocate their land resources for the cultivation of that crop. The diversification or inter-crop acreage shift has been reinforced due to the advancement of technology in different fields that makes up the conditions necessary for the cultivation of desired crops along with the maintenance of economic feasibility.

The extended versions however exhibit some kind of contradictory results emanated from the cross price and yield effects. The contradictions arise mainly due to
the specific nature of inter-correlation among the explanatory variables. Though impact of changes in price and yield of wheat on area under potato is negative, the effect of variation in that of mustard, on area under potato is completely opposite (though not significant). The main reason is that in the early years of development much of land used to remain uncropped during winter and summer seasons (owing mainly to lack of irrigation). With the expansion of capacity of irrigation a large portion of uncultivable land became available for cultivation during that time. Though initially food crop production was given special emphasis, later when the country became self-sufficient in foodgrain production, rapid commercialisation set in. With the arrival of HYV seeds, development of irrigation and other complex agricultural implements as well as revision of prices both mustard and potato became profitable. In spite of differences in their profitability; on consideration of the problem of management, financial positions, relative cost components and risks involved in the production of various crops farmers were goaded to allocate the increasing area under cultivation between potato and mustard in an optimum proportion. This is the main reason for the growth (at different rates) of area under both potato and mustard.

Relative revenue per unit of area evaluated at prices lagged one year is found to play more important role in the acreage allocation between any two competing crops than the relative prices lagged one year. Coefficient of dummy variable that reflects the impact of land reform measures undertaken by the left-front government of West Bengal after 1978-79 is found to be significantly positive only in case of oilseed as a whole and boro-rice but insignificant in other cases. There is much doubt about the contribution of land reform measures in mobilising land towards the newly emerging commercial crops from other uses. Just by looking at the performances of the beneficiaries of the programme (as has been done in several cases) it is not possible to comment on the impact of the land reforms on changes in cropping pattern unless their role in the process of diversification is compared with that of same category of non-beneficiaries. Moreover, the surplus lands are generally distributed among the landless or marginal farmers. According to Dharm Narain those farmers are less commercial minded than the big farmers.\(^2\) Again if these beneficiaries do not receive adequate financial and technical support it is not possible for them to go for producing those highly commercial crops.

\(^2\) Dharm Narain (1965), op. Cit.
It is also important to note that growth of area under any crop is not only dependent on the profitability of that crop and that of crops which can be grown during the same season but also on the profitability of other crops grown during other seasons. This is because of the close dependence of profitability of different crops that are grown in successive seasons on the same plot. This type of dependence occurred due to overlapping harvesting and sowing seasons of crops that can be cultivated in successive seasons on the same plot of land. From the last section of chapter-8 it is clear that though irrigation, chemical fertiliser availability and its application, development of technology in other fields were the key factors for the expansion of cultivation of boro rice, potato and oilseed in the post-Green Revolution period; it was the gross and net profit from each unit of area throughout the whole crop-year (a year within which maximum three major crops can be grown successively on the same plot) that provided the ultimate ground and guided the farmers of the region to increasingly allocate land for the production of those crops. The combination of crops that can possibly be grown in successive seasons on the same plot over each year yielding highest expected profit, is given the top priority, provided technology and other inputs are available sufficiently to support the cultivation of those crops. As technology and thus cost of cultivation, constellation of price change, relative profitability of different combination changes, choice of crop-combination or crop rotation changes accordingly. In the same way future prospects of crops always invite new technology and innovation takes place to accelerate the growth of desired crops. It is observed from chapter-9 that the districts having experienced rapid expansion and diffusion of modern technical inputs and implements also recorded rapid growth of area under relatively faster growing crops during 1970-71 to 1993-94.

The same result has also been observed from the analysis of data collected from some farm families of the district of Burdwan. It has been found from chapter-10 that the relative profitability of crop-combinations is of vital consideration for the allocation of land resources towards the cultivation of different crops in different seasons of the years.

11.2 Conclusion and Policy Implication

Crop diversification is an essential dynamic feature of agricultural development. It is closely associated with the process of agricultural growth. With the changing agricultural scenario, technological advancement and changes in institutional
conditions, patterns of crops grown changes. Besides that cropping pattern and its movement diverge across the regions on account of differences in the agro-climatic, social, technical and economic factors. Sometimes a new cropping pattern is introduced by the farmers in each region that is best suited to changing technology and available input resources and from which they can earn more. There is always coherence between the changing cropping pattern and variation in technology, availability of resources and market structure. Changes in cropping pattern is important from the point of view of employment of labour force, steady flow of income of the farmers from their limited land holdings as well as environmental sustainability. Proper choice of cropping pattern can solve many problems faced by the people, where there is no scope for raising net area under cultivation.

It is clear from the overall discussion that irrigation was the primary factor that facilitated the growth of acreage of boro rice, potato and mustard that have experienced a rapid growth at the cost of area under other lower value crops. These three crops have emerged as newly commercial crops of the region dominating the importance of former commercial crops like jute, sugarcane etc. Though boro rice is a food crop, it is now-a-day grown mainly for earning profit. Moreover, the districts having easy access to irrigation sources experienced more rapid expansion of cultivation of the aforesaid crops than the districts where irrigation development started later. Again fluctuation of acreage growth was very high in the early years of Green Revolution which got reduced with the passage of time and more rapidly in the districts, which recorded swift expansion of irrigation. The districts having easy access to irrigation sources experienced deceleration of growth after the exhaustion of all easily available irrigation sources with existing technology. However, where the process of irrigation started later the expansion still continued with accelerated pace and reduced variability as well as instability of growth.

It is therefore important to emphasise more on technological development to bring about a new breakthrough, so that the maximum possible and difficult sources of irrigation can be exploited and the development process can be continued. Not only that, special programmes that have already been launched for the development of arid zone should be reframe for assured irrigation throughout all seasons of the year. Then it would be possible to reduce the inter-district disparity in acreage growth of those crops and also agricultural development.
Sometimes cropping pattern change may not be a sequel to mere agricultural development. A new cropping pattern may be introduced to fulfil the desired targets. For instance production of foodgrains (specially, wheat) was given tremendous emphasis at the time of acute food shortage in the country to reduce deficiency in the supply of food. For this HYV seeds were imported and irrigation development projects were started to support the programmes. In order to introduce a new cropping pattern technological changes best suited to the cultivation of desired crops in best possible way are invited. If all the resources are fully utilised and there is no short-term scope for changing technology, choice of crops best suited to the agro-climatic and existing technological conditions gives highest possible remuneration. Sometimes government policies (e.g. government price policy) are framed to encourage the production of some crops and discourage some others.³

In spite of the programmes undertaken by the government for drought prone areas, it was found that many districts are lagging behind in raising area under the desired crops or a new cropping pattern. River water-flows should be utilised more properly and channelised to reduce the quantity of unused land in winter and summer along with the perfect cropping choice. Generation of more and more crop varieties with drought, flood resistant capacities should be encouraged in the governments research and development programmes which can also solve the problems to some extent. Even in the relatively advanced area, where deceleration of growth of area under boro rice, potato etc. (despite much of land remain unused in the off-monsoon season) has set in due to exhaustion of already available irrigation sources, new sources are to be searched or difficult sources will have to be utilised to use optimally the unused land during the off-monsoon season. Hundred percent relief from monsoon dependence is never possible but proper management of available water (river flows and ground water) can in many cases solve the problems.

Besides this, disproportionate growths of agricultural implements are found to be partly responsible for the disproportionate expansion of area under boro rice, potato and mustard. Use of tractor and power tiller has raised the capacity of management and converted the lands hitherto left fallow (or used otherwise), suitable for potato cultivation. In this context the use of agro-implements in the state is still below Punjab. The government should take steps to expand the use of those implements especially in

the districts where the use is at very low level. Finance in this case is also a great problem. Though the small farmers can utilise these technologies from machine market, they can not take full advantage of them due to peculiar nature of market and other problems. It thus requires the development of co-operatives for supplying and maintaining the machines that can be of great help to the small and marginal farmers. Government schemes can be developed to advance loans and the existing schemes should be handled effectively.

Regarding land reforms it can be said that it is not by itself conducive to proper cropping pattern growth. The marginal farmers can not by themselves use the allocated land properly as they in most cases suffer from resource crunch and lack of informations. Even if there is available resources like irrigation, agro-machineries, which can be hired they can not take the full benefit of modern technology. It is also not possible for them to maintain separate establishments for those things. They thus require to be provided with adequate government assistance and technical support to enable them to use lands perfectly, otherwise the objectives of land reform measures will be left partially successful. The panchayets in the rural areas can play an important role in this regard. Panchayets can identify the eligible farmers, who requires proper training and different facilities and also arrange the programmes in appropriate ways. In case of resource management the panchayet can make different arrangements (for better utilisation of groundwater and ponds, timely allocation of government subsidised modern seeds, development of local communication etc.) and make more and more people aware of different programmes and facilities extended by the government and other institutions.

Sometimes farmers are unable to take risk of cultivating some crops, due to greater fluctuation of market price or low storage capacity of non-durable crops etc. In those cases government can take steps towards giving proper information sufficiently in advance and measures for market stabilisation. Development and maintenance of good infrastructure is also another essential criterion for the channelisation of inputs and outputs throughout the whole region which can help farmers making better choice for the use of their land and other resources in best possible ways.