CHAPTER : 3

REVIEW OF LITERATURE

With the introduction of high yielding varieties, principally of foodgrain crops, the Indian agriculture had witnessed a breakthrough in 1966. All the new varieties evolved and introduced in the Indian agricultural sector overtime revealed quite varying degree of success. Farmers' acceptance of different varieties varied widely within as well as across different areas. Initially, the HYV programme had been found as launched with particular reference to major foodgrain crops of rice, wheat, jowar, bajra arid maize. Later on an attempt was made to extend this programme to major non-foodgrain crops such as groundnut, cotton, jute etc. However, in the first decade, the spread of their HYVs was very slow.

To some extent, the regional variations observed presently in foodgrain production are accounted for by the variations in the adoption of HYVs. Since 1966, the States which had a higher spread of HYVs were found to have observed a substantial rise in foodgrain production. These States are Punjab, Haryana, Western Uttar Pradesh and some selected districts of Andhra Pradesh, Maharashtra, Gujarat and Tamil Nadu. Thus, a big take-off in agricultural production definitely took place but remained concentrated only in some parts of the country.

By nature, the HYV programme is input intensive and is best suited to irrigated areas. The cultivation of HYVs requires large
amount of strategic inputs. Hence, the farmers capable of making this investment can successfully adopt them. In practice, therefore, the large farmers who are capable of making heavy investment in fertilisers, pump sets, tubewells and machinery are proportionately higher in number in adopting this programme. Besides, these farmers have an easy access to credit from the cooperatives and commercial banks. On the other hand, due to financial weaknesses, the small farmers are not capable of adequately purchasing the different strategic inputs. They, therefore, do not adopt this programme to a large extent. In India, quite a significant number of farmers possess small holdings. The situation so prevailing has led to increased disparities in the distribution of benefits from HYVs across farmers.

A former U.N. Secretary General, Mr. Thant (1975) expressed the view that the green revolution might prove to be the pandora’s box rather than a corna copia, unless developing countries urgently and successfully implement land reform measures. He further added that there were many observers who contended that, if left to market forces, the green revolution was likely to benefit primarily those farmers who were already engaged in commercial production rather than subsistence farmers; and among commercial farmers, big ones rather than small ones enjoyed the fruits.

So, the whole programme became an interesting area of research and varied aspects were studied in the last two decades and more. The areas studied can be divided into the following different parts:
3.1 Concept of Adoption of Agricultural Technology

A number of researchers have talked about the concept of adoption of technology. The concept has been used by different scholars as under:

Wilkening (1953) defined adoption as "a process composed of learning, deciding and acting over a period of time. The adoption of a specific practice is not the result of a single decision, but a series of actions through decisions."

Copp (1956) viewed adoption as a general behavioural predisposition on the part of the farm operator rather than as a set of independent behaviour. He emphasized mainly the general consideration in the farm operator's economic, social and psychic life situation.

Ramsey et al (1959) indicated that adoption is of two types: (1) Behavioural adoption, and (2) Cognitive adoption. Behavioural adoption is observed in terms of a number of
practices actually put to use. Cognitive adoption involved complex decisions and changes including obtaining knowledge, critically evaluating the practice in terms of individual situations etc.

Singh, S.N. (1969) reported that the average doses of nitrogen, phosphorus and potash applied by the Delhi Territory farmers participating in HYV programme were 58.75 kg., 21.75 kg. and 15.77 kg. per hectare respectively as against the recommendations of 100-125 kg., 45.60 kg. and 30-40 kg., respectively. A number of other studies by Shah, N.R. (1968), Motiramani, D.P. (1978), Parmar, M.T. and Patel, R.M. (1978), Rao Subba et al. (1985), Rao Subba et al. (1986), and Trivedi, H.P. (1990) also indicated that fertilising practices in terms of application of various nutrients followed by farmers in different regions are found as unscientific. They use either more or less than the recommended doses of inputs both in HYV and non-HYV varieties areas.

In short, the concept of adoption incorporates a series of actions and decisions to adopt a specific action. The literature review also includes a general behaviour of a farmer under given economic, social and phychic life situations.

3.2 Extent of Adoption of Agricultural Technology

To measure the extent of adoption of HYVs, researchers have used two methods. In the first method, the extent of adoption of a particular HYVs is estimated by working out a proportion of area under HYV of a particular crop to the total cultivated area
of that crop. In the second method, a proportion of number of farmers cultivating a particular type of HYV to total number of farmers belonging to a particular region is worked out. Easy access of data at an aggregate plane makes it possible to widely use the second method at micro and macro levels. Here, an extent of adoption with regard to five major crops has been analysed which is followed by relevant available studies.

Rao, T.R. (1968) examined economic aspect of HYV programme in West Godavari district. He reported that small farmers used less hybrid seed, fertilisers, farm implements and improved practices compared to medium and larger farmers.

Shukla (1968) found that in Ajarpura village in Kheda district, young farmers were more inclined to adopt HYVP as compared to old farmers. He also found that trend of adoption was positively related to area and caste. More farmers preferred to grow hybrid bajra in the summer season than in the monsoon season. More acreage was brought under hybrid bajra during the summer than in the monsoon each year.

Patel, B.T. (1970) in Gujarat, Mundhwa (1984) in Bhal area of Gujarat, Dhul (1988) in Hissar district of Haryana, and Lawania Ramawtar (1989) in Bharatpur in Rajasthan State found that of the total sample farmers, a majority had cultivated HYV paddy from a commercial point of view. In the study, age, education, knowledge and social participation were found to be positively related to the use of mass media sources.
Vyas, U.I. (1976) selected 180 farmers from progressive and non-progressive villages for his study of Kheda district in Gujarat. In progressive villages, almost all the farmers had adopted the HYV paddy and wheat, whereas in non-progressive villages, 61.67 per cent of the sample farmers adopted HYV of paddy and wheat. There was significant relationship between the size of the holding and area of HYVs paddy and wheat crops in both the progressive and the non-progressive villages.

There are a number of studies which have examined the aspect of the acceptance of recommended practices. These studies can be divided into two parts (i) crop-wise studies, and (ii) practice-wise studies. In this context, Badve, M.K. (1976), in his study pertaining to Satara district of Maharashtra, found that among the sample cultivators, the extent of adoption of the recommended practices of bajra and jowar crops was poor and low. A similar finding was observed in respect of a majority of the farmers cultivating H-4 cotton variety in the study area. Deshpande, H.K. (1980) concluded in his study area of Nanded district of Maharashtra that the respondents fully adopted the maximum number of recommended practices.

Patel, R.J. and Patel, M.K. (1982) found that between 1966-67 and 1980-81 in Gujarat HYVs seeds were successfully introduced in respect of wheat and bajra, whereas in the case of paddy, maize and jowar, only limited success was achieved. The authors also examined the seed demand which is observed to depend to a considerable extent upon the following: (i) the nature of functioning of the relevant government agencies, (ii) the
extension services for demonstration and introduction of new farm inputs including seeds along with related production techniques, (iii) the failure of some seed programmes to attain their targets/attaining for success, the farmers not only have to be convinced of the benefits of the programmes, but they have to be properly encouraged to achieve the best possible results, (iv) the farmers must also be well-informed on matters such as soil proportion, time and depth of planting, scientific use of fertilisers, irrigation and pesticides etc., and (v) the farmers also need market information on prices. Marketing seed agencies (private or co-operative or public) have, therefore, an important role to play in respect of the work of the extension agents and in helping to see that farmers carry out the operations required to adopt HYV seeds and attain expected growth in crop yields. Farmers' training in the context of the seed extension programme need be organised particularly in respect of the programmes, policies and regulations, and technical information and practices related to the use of certified seed and specific production methods. In fact all these determinants have a bearing on the extent of the adoption of HYVs.

Sadhu, A.N. and Mahajan, R.K. (1985) made an attempt to study adoption of HYVs. According to them, the success in the sphere of HYV seeds, and a few commercial crops such as cotton, groundnut, sugarcane etc., besides inter-State differentials in the adoption of HYV seeds are found to be very wide. The States like Punjab, Haryana and Tamil Nadu were quite ahead in adopting HYV seeds, while States like J & K, Assam, Bihar, A.P. and
Rajasthan remained far behind. It is noted that faster growth in the use of HYV seeds was mainly in the wheat growing States. The co-efficient of variation of adoption of HYV seeds among 15 major States was 59 per cent in 1974-75 and 38 per cent in 1978-79. Thus, over a period of time, variations in the adoption of improved seeds declined. The trend of area under HYVs at the State level in a period from 1974-75 to 1978-79 revealed that tremendous increase in percentage of area under HYV seed had been achieved in States such as Kerala, Orissa, West Bengal and Maharashtra. This faster growth was mainly due to the development of HYVs for rice, jowar and bajra.

In a study by Rao, K.P.C. (1987), it is shown that the adoption levels of dry land technologies are found to be quite low. The adoption level in the State of Andhra Pradesh ranged between 30 and 35 per cent for pearl millet and maize, while in the case of sorghum, it was less than 10 per cent during both kharif and rabi seasons. For pulse crops, the adoption rate was close to zero. These adoption rates were only with respect to improved seed and not the whole package of improved practices. Economic constraints were largely responsible for the non-adoption or the partial adoption of HYVs. There were several instances of farmers reverting back to the traditional practices once the subsidies were withdrawn. The adoption is rarely total and consistent.

Sidhu, D.S. (1990) examined the rate of adoption of seed varieties innovated during the 1980s. It was noted in this study
that constant improvement in seed technology is necessary for rapid development of the agricultural sector, and such developments should be successfully practised at the field level. Sidhu's inquiry in this field shows a very poor rate of adoption of seeds innovated during the 1980s in India. To put in his own words, "probably less than 10 per cent of the cropped area in the country is under varieties developed in the last ten years. This indicates dismally low replacement rates".

Purnendu Sekhar Das and Amit Kar (1995) have shown that in West Bengal, during the two periods of 1966-67 to 1977-78 and 1977-78 to 1986-87, the growth rates of rice production and overall foodgrain production were very low. The authors further noted that the performance of the area and productivity, the two sources of growth of production was poor. The authors' contention is that the rate of adoption of HYV technology remained poor in the State of West Bengal. The position so obtained is attributed to inadequate irrigation and poor drainage facilities in the State. Consequently, the technology failed to make any dent on the State's total foodgrain production. Further, the authors pinpoint that the rate at which the irrigation potential is being created is not satisfactory and the future prospects seem to be very poor. After describing the general position, the authors held that the lack of knowledge on the part of the farmers about the distribution of rainfall over the farmers' planning period and, therefore, to the risks associated with the cultivation of HYVs are responsible for the below optimum utilisation of land for the cultivation of HYVs during the kharif season. For the
detailed analysis, in the different action choices, the authors also included high yielding short duration varieties (HYs) and high yielding long duration varieties (HYL). The analysis shows that in the drought prone and the flood prone areas, all the categories of farmers, with some exceptions, can make substantial gains from the recommended actions. On the whole, the conclusion emerges that a proper crop planning can meet the uncertainty and lead to substantial impact of new technology despite the limitations of irrigation and drainage facilities mentioned in the beginning.

To sum up, the extent of adoption is found to be higher among medium and large farmers when compared to small farmers. Farmers of young age groups were found to be more responsive to the adoption of HYVs as compared to those with relatively old age farmers. The extent of adoption of new technology was found to be lower in rainfed areas in comparison with irrigated areas. Technically, it is maintained that constant improvement in seed technology is necessary and such improvements should be successfully practised at the field level. Research work on this front is continuing and improvement is taking place. However, the fact observed is that only 10 per cent of the cropped area in India is under varieties which were developed in the last decade.

3.3 Factors Associated with Adoption of Agricultural Technology

One can view a farmer as an individual who makes choices from among options open to him. The research task, then, is to isolate the factors, both direct and indirect, which determine
the choice actually made. Research studies relating to various factors affecting adoption of HYVs are reviewed here below:

Age:

Wilson and Jaccard (1930) found that there was no apparent relationship between the age of farmers and adoption of recommended farm practices, whereas Hoffer (1942) stated that the age of adopters was negatively associated with the adoption of improved farm practices, when certain other factors were held constant.

Padma Rao (1968), Munchwa (1984), and Dhul (1988) reported that there was positive relationship between youthfulness and early adoption of improved agricultural practices. Similarly, Lakshminarayana (1970) concluded in his study that more adopters belonged to lower age group (to below 45 years).

Tripathy and Mishra (1971) carried out a study in Community Development Block, Seson, Allahabad district, and concluded that age was not associated with adoption. Later on, Opare (1978) also found in Kheda district that the age of respondents did not influence their adoption behaviour.

Suryawanshi (1979) found that age of farmers was associated with their adoption of recommended technology. Deshpande (1980) reported in his study of Macgoan taluka of Nanded district that relationship between age of the adopters and adoption of H-4 cotton variety was not significant.
Examining the above studies in respect to age as a factor of adoption, it can be concluded safely that the age of the farm operator influences the adoption of recommended farm practices quite differently under varying conditions.

**Education:**

Hoffer (1942), Wilkening (1952), Sargle (1962), Gupta (1968), Dimit (1954), Deb and Sharma (1969), and Patel and Madalia (1974), in their respective studies, found that education of farmers as a decision-makers plays a positive role in the adoption of improved practices including that of HYVs.

Ryan and Gross (1950), Singh (1975), Setty (1976), Jetley (1977), Mundhwa (1984), Thakrar (1986), Patel, V.B. (1987), and Lawania (1989) commonly found that education of farmers was significantly related to their adoption behaviour. A study by Deshpande (1980) reported that there was no association between education and adoption. On the whole, it can be concluded that education has a significant bearing on the adoption of improved agricultural practices including that of HYVs.

**Family Size:**

Wilkening (1953), Choubey (1972), Shahi (1974), and Suthar (1989) found that family size is positively related to the adoption of improved farm practices. This means that the extent of adoption increases with the increase in size of family. Mukherjee (1970) observed that there was a correlation between...
size of family and adoption behaviour of farmers. However, he did not examine the nature of its relationship.

Deshpande and Nikhade (1965), Salve (1966), Singh (1974) and Bhatia (1974) found that there was no association between size of family and adoption of improved farm practices. Thus, there is no unanimity among researchers with regard to the exact relationship between the family size and adoption of new technology. On a priority ground also, there is no case for such a relationship.

Caste:

Receptivity for improved agricultural practices amongst the social strata differs widely. This is because attitudes toward any issue, a business or otherwise, vary widely among the different social strata. Desai and Mehta (1964) made an intensive field study of Padra taluka in Gujarat State during 1961-63. According to them, out of a total sample of 42 farmers, who adopted improved implements, 71 per cent were Patidars, 17 per cent were Baraiyas, 6 per cent Brahmins, 4 per cent Rajput and 2 per cent Muslims. Thus, there is a clear evidence of differential adoption among different castes.

Salve (1966) and Mundra and Batham (1967) found caste to be an important factor affecting adoption behaviour of the farmers. They found a relatively higher degree of adoption of innovations on the part of socially advanced castes. Roy et al (1968), Reddy (1976), Mundhwa (1984), Patel, V.B. (1987), Patel, J.M. (1989), and Suthar (1989) concluded that the farmers' caste
status was highly correlated with the extent of progressiveness of the villages in determining the level of the progress of village.

Social Participation:

Participation in varying social activity is another important variable which affects the degree of adoption of new innovation. A person, who is actively participating in society's social activities, is likely to possess an open mind to think and to adopt any new idea or innovation he comes across.

Copp (1956), Narayan (1963), Ernest (1973), De (1977) and Somasundaram (1976) observed that there was a positive association between farmers' social participation and the level of adoption of innovations. This means that those farmers, who are participating in various social activities, are quick in accepting new ideas.

An opposite result is also obtained in this respect. Patel, P.M. (1965), Patel, G.V. (1975) and Mukhopadhyay (1979) found that the sample farmers, a majority adopters of new ideas had low level of social participation and only a few had a high level of social participation.

In a study by Supe and Sulode (1975), there was no significant relationship between participation and adoption.

agricultural practices was significantly correlated with the farmers' social participation.

Thakrar (1986), Jain (1987) and Suthar (1989) reported that social participation was associated with the adoption of recommended technology. On the whole, the available literature on this aspect establishes that with increase in social participation, there will be increase in the adoption of improved practices.

Cultivation Experience:

Kulkarni, R.R. (1979) observed non-significant relationship between farming experience and technological gap, whereas Bhatia et al (1974), Mundhwa (1984), and Bhatol (1987) reported that farming experience was significantly associated with adoption of H-4 cotton variety. Thus positive as well as negative relationship is experienced as between cultivation experience of farmers and adoption of new technology.

Knowledge of Agricultural Technology:

Parsones and Shills, E.A. (1952), Trivedi (1984), Thakrar (1986), Diwan (1987), Suthar (1989), Patel, J.M. (1989), and Lawania (1989) found that the level of knowledge of farmers regarding the improved practices was a significant factor affecting the adoption of improved practices.

Jaiswal (1965) reported a positive, significant correlation between knowledge of farmers about agricultural innovations and their adoption, whereas Reddy (1962) did not observe any
significant relationship between farmers' level of knowledge about recommended practices and adoption by the farmers.

In a study by Sangale (1962), it was observed that more than three-fourth of the total respondents knew the name of the recommended wheat variety, nearly three-fourths had knowledge about sowing time, followed by 50 per cent who knew about seed rate, two-fifths knew about the distance of sowing and below one-third of the respondents knew about seed preservation.

Characteristics of Technology:

As in the other sectors, the technology in the agricultural sector is found to be of varying types and possessing varied characteristics such as simplicity, complexities, cost-effectiveness, etc. These characteristics have a significant bearing on a farmers' decision to accept any new technology. Trivedi (1984) found significant correlation between new technology and their adoption. Choudhry (1970) found that initial cost of the innovation was one of the important factors governing the extent of the adoption of new innovation.

Jaiswal et al (1971) and Rogers (1962) found that the farmers' perception about characteristics of innovations was significantly related to their level of adoption. Thus, characteristics of new technology and farmers' perception about new technology play an important role in the adoption of new technology.
Risk Orientation:

Beals and Sibely (1967) found that individuals vary in willingness to take risk and Sangale (1977) observed that risk orientation was positively related to adoption behaviour of farmers.

Trivedi (1984) made an observation that insofar as the risk preferences of the tribal farmers are concerned, it is found to be of medium level.

Ballabh, Vishwa and Sharma, B.M. (1989) made an attempt to study adoption performance of HYVs of paddy and wheat, productivity gaps, components of productivity gap and farmers' insurance mechanisms to withstand flood risk. They discussed the adoption pattern with respect to HYVs of paddy and wheat in flood-prone and flood-free districts of Uttar Pradesh. The study corroborates the contentions of Binswarnagar and Sillers (1983) that any innovation would be adopted by farmers in favourable environment irrespective of their risk preferences. They also maintained that the regional differences in adoption of innovations should be attributed to farmers' risk aversion.

Economic Motivation:

Nair (1969), Trivedi (1984) and Patel, V.B. (1987) made an observation that economic motivation was positively associated with the adoption behaviour.
Income:

Fliegel (1957), Tewari (1959), Lionberger (1964), Choubey (1972), Mundhwa (1984), Bhatia (1974), Thakrar (1986), Patel, V.B. (1987) and Patel, J.M. (1989) found that family income was significantly related to the adoption of improved farm practices. Hoffer (1942), Shahi (1974), Zia-Ul-Karim and Mahboob (1974) and Mundhwa (1984) observed that the extent of adoption was positively correlated with family income. This means that the adoption of HYV technology increases with the increase in family income. Contrary to this, Chavan (1979) and Deshpande (1980) found that the relationship between annual income of family and adoption of hybrid and HYV was not significant.

Farm Size:

New technology is said to be neutral to farm size. However, available literature on this aspect shows a mixed evidence. This is because many a times, marginal and small farmers, due to their poor resource base, fail to acopt new practices.

Gross et al (1952), Chettopadhyay (1976), Mundhwa (1984), Patel, V.B. (1987) and Patel, J.M. (1989) reported in their study that the size of holding was significantly related to the extent of adoption. Further analysis by Rahudkar (1962), Deshpande (1980), Asduzzaman (1979), Dasgupta, B. (1977), Ahmed (1981), Parthasarthi and Prasad (1978) and Kailas Sharap and Vashist, D.C. (1994) showed that farm size was positively related to adoption of improved practices, whereas Lomte (1977) observed that size of holding had negative relationship with the adoption of vegetable
practices. In contrast, Choubey (1972) and Chavan (1979) found that there is no significant correlation between the size of holding and adoption of HYV wheat technology.

Extension Contact:

The importance of extension services in adoption of new agricultural technology by farmers at all levels is great. After all, the extension worker is the man who tries to understand the motives of his farmers in order to introduce the improved practices in the villages. Motivation is imperative to bring about desirable changes in the behaviour of farmers. National Extension Services (NES) perform the work of rural development programme, which has accepted the principle of aided self-help through education.

Since training the farmers for developed technology is a must, various schemes and projects like Farmers’ Training Centre, National Demonstration Scheme and Krishi Vigyan Kendra, which come under extension services, have been initiated by the Indian Government. In short, extension contact by farmers influences, to a large extent, the adoption level of new technology. Regarding this aspect, the references of a few studies are presented below.

Wilkening (1952) stated that contact with country extension agents was highly associated with the adoption of improved farm practices. A detailed analysis on this aspect by Poul Marsh and Coleman (1955), Amar Singh (1965), Moulik (1965) and De Dipak (1977) sheds light on the fact that in the contact of farmers
with extension agency was positively associated with the adoption of improved farm practices. Singh (1971) found that the big farmers had high level of extension contacts compared to that of small farmers, and that extension contacts were highly correlated with agricultural progressiveness.

Use of Information Sources:

Rogers (1958), Rahudkar (1962), Lakshmana and Satyanarayana (1967), Dudhani and Rao (1969), Singh and Lokhande (1974), Bhilegoankar (1976), Trivedi (1984), Bhatol (1987) and Jain (1987) reported that village level workers and the neighbour cultivators were the most frequently consulted sources. Among these researchers, Rogers (1958) tried to study importance of information sources to influence adoption behaviour of farmers. He found that the personal source such as individual contact with the neighbours proved effective in the adoption process. Sawhney (1967) and Dudhani et al (1965) observed that farmers with larger farm size used personal cosmopolite sources such as telephones, etc. to a greater extent than the farmers with smaller farms.

Source Credibility:

Credibility of source of information or communicator plays an important role in (i) acceptance or rejection, and (ii) the degree of acceptance of any new innovation in any sector. This is more true for the agricultural sector in a developing economy because the literacy level is relatively low in this sector. If the farmers do not trust the communication they receive, the adoption of any new innovation would be very poor. Faith in
adoption may take place till the communicator's trustworthiness is proved.

A communicator is a person or source of information that passes message directly or indirectly through a chain of channels to the receivers. The communicator's credibility is the degree of trustworthiness and authenticity accorded to him by his audience at any given point of time. It may be noted here that this aspect of research has not received much attention.

Reddy (1968), Singh and Shankariah (1969) reported that the written materials like newspapers and bulletins received low credibility. The credibility of various information sources varied significantly between progressive villages. Kalamgam and Menon (1977) accorded high credibility to village level worker, whereas Wakade (1981) accorded high credibility to mass media in the case of progressive villages. Thus, credibility accorded to various information sources varies considerably across even progressive villages. Kalamgam and Menon (1977) found that in the less progressive villages, the most credible sources were neighbours and friends, followed by relatives.

Desai, B.M. (1967) made an attempt to study hybrid maize programme in Gujarat. In the two selected villages of Jambua and Gangarda, the importance of hybrid maize as reflected in the crop pattern of the selected farmers varied. It was comparatively more important in Jambua than in Gangarda. Though comparable data regarding increase in the area under hybrid maize were not available, the extent of substitution of the new variety in place...
of the old ones seems higher and more rapid in Jambua than in Gangarda. Enlightened leadership and better receptivity of the farmers of Jambua seemed to be responsible for this phenomenon. This finding has a wider applicability in this particular area where the people are backward and the leadership is not prone to rapid change.

Parikh and Sharma (1967) emphasised that the acceptance of improved practices generally increases with an increase in the size of the holding. The study found that irrigation was the dominating factor determining both the coverage of area under HYVs and the rates of application of improved practices. The choice of crops grown by the farmers was largely governed by the availability of irrigation facilities which, in turn, determined the acceptance, type and rate of adoption of improved farm inputs, especially so in case of the chemical fertilisers.

Shah, N.R. (1968) made an attempt to study hybrid bajra programme in the Kheda district of Gujarat. The reference year for the study period was summer 1967-68. In all, eight factors were found to determine the adoption rate of HYV bajra. They are: (i) fodder found unpalatable by animals, (ii) lack of assured and adequate irrigation facility, (iii) high irrigation charges, (iv) difficulty of practising mixed cropping, (v) small holdings, (vi) unremunerative price of hybrid bajra, (vii) no adulteration in seeds, and (viii) high price of hybrid seeds. Here, it is pertinent to note that because of less expenditure incurred on growing local bajra, the participants, who had grown the local
variety, were able to derive marginally higher net returns from it than that from hybrid bajra.

Roy Prodipto and others (1968) studied factors determining the adoption of new technology in India. They identified as many as 48 variables which act as the constraints in the choice of new technology. (See Appendix - III.1). Among these variables, the important ones refer to (i) caste, (ii) religion, (iii) taxes and level of living were all very highly related to adoption, and (iv) securality and the extension contact index were found to pay greater net contribution to adoption.

Singh, K.N. and Lokhande, M.R. (1980) made an attempt to study factors affecting the adoption of farm innovations. The research findings on the factors affecting adoption of farm innovations were summarised under the different headings such as : (i) situational, (ii) personal (social and psychological), (iii) innovational, and (v) communication factors. In all 29 such factors have been reported in Indian context. On the basis of these studies, a model for adoption behaviour of farmers had been conceptualised which is presented in Figure 1. (See Appendix - III.2).

Ranade, C.G. (1982) observed that the adoption of HYVs of cereals depended not only on yield, but also on cost of production and the output price.

On the whole, researchers have identified all the important factors associated with the adoption of agricultural technology. With regard to each of the factors studied and its relationship
with adoption of HYVs or new technology, four different variations are obtained. They are: (i) no apparent relationship, (ii) negative relationship, (iii) positive relationship, and (iv) mere existence of relationship between a particular factor and its adoption without any indication of positive or negative relationship. Here, there are contrasting observations across different types of studies as also within a particular factor under study.

3.4 Constraints in Relation to Adoption of HYVs:

Sinha, P.R.R. (1966) found that 63 per cent of the sample farmers did not get sufficient credit, about 16 per cent did not get it in time and about 37 per cent did not receive any credit at all. About 68 farmers complained that they did not receive enough technical guidance during the execution of the farm production plans.

Patel, P.M. (1965) and Mundhwa (1984) studied the Bhal area of Gujarat. They reported that lack of knowledge of agricultural activities, lesser contact with the extension agents, lack of availability of seeds and fertilisers at local markets, small size of the land holding and low incomes were the problems of small farmers.

An evaluation study conducted by the Directorate of Evaluation (1967) indicated that the main problems of cultivators growing HYVs of wheat were lack of adequate irrigation facilities, inadequate supply of fertilisers and lack of finance.
Salve (1966) found that 27.16 per cent of cultivators did not adopt improved variety of seed due to inadequate supply, untimely, or sometimes, no supply of the required seed. Financial difficulties and high cost of seed were also pointed out as the important factors by a large proportion of farmers.

Sinha and Basin (1968) concluded that lack of irrigation facilities, irregular supply of material, and economic factors like higher cost of plant protection measures, green manuring and lack of finance emerged as the most important ones resulting in low adoption of the HYVs.

Kulkarni (1979) studied both the tribal and the non-tribal farmers. The constraints like non-compatibility of technology, inefficient use of inputs and credit services and lack of knowledge about technology were found responsible for increasing the gap between the HYV and the non-HYV areas. Bhilegaoukar (1976) reported untimely supply of inputs inadequate knowledge of technology, lack of irrigation, and inadequate credit facilities as the major constraints inhibiting growth of the HYVs.

Choudhary, H.A. (1978) showed that in Pakistan, the exploitative and non-egalitarian social structure in the villages was mainly responsible for reducing small farmers' risk-taking potential. Adoption of innovation is far more rapid among large farmers.

Trivedi (1984) found that in Petlad of Kheda district, among all the constraints associated with technological gap as
perceived by the tribal farmers, inadequate crop protection, lack of inputs needed, lack of irrigation facilities and lack of needed finance were the major constraints.

Bhatol (1987) found that in the paddy cultivation technology in Anand taluka of Gujarat, the main constraints in adoption of recommended kharif paddy cultivation technology were low price of crop produce, high cost of seeds, high wages of labourers and non-availability of pure seeds.

Thakrar (1986) has showed that in Anand taluka of Kheda district, the main constraints in adoption of recommended summer groundnut cultivation technology were irregular supply of electric power, canal irrigation not available in time, non-availability of pure seeds and labour problems.

Patel, V.B. (1987) found that in Idar taluka of Sabarkantha district, the main constraints in adoption of recommended hybrid cotton cultivation technology, were high cost of insecticides, non-remunerative price of cotton, high cost of fertilisers, crop susceptible to pest and diseases and irregular supply of electricity.

Diwan (1987) studied the north district of Sikkim and reported that the main constraints found in adoption of large cardamom were lack of finance, lack of knowledge and lack of technological guidance. Other major constraints were non-availability of inputs, lack of labour, shortage of land and lack of transportation etc.
Jain (1987) found that in Rohtak district of Haryana State, the main constraints in adoption of recommended sugarcane cultivation technology were high cost of inputs, high irrigation charges, lack of transport facilities, shortage of electric power, non-availability of credit in time, lack of timely irrigation and non-availability of supply orders from the sugar factory.

Dhul (1988) reported that in Hissar district of Haryana State, the main constraints in adoption of the recommended wheat technology were irregular supply of canal water, uncertain weather conditions, short supply of electricity, low price of produce, lack of storage facilities, lack of technological guidance for seed treatment and weedicides and lack of knowledge regarding application of chemical fertilisers.

Patel, J.M. (1986) reported that in Saharkantha of Gujarat, the main constraints in adoption of recommended hybrid castor cultivation technology were high cost of fertilisers, high cost of pesticides, non-remunerative price of castor, irregular supply of electricity and high charges of electricity.

Jyani (1989) studied in Hissar Sub-division of Haryana, the main constraints in adoption of the recommended cotton technology. The constraints were high cost of HYVs of cotton seed, lack of finance for the purchase of inputs, lack of irrigation facilities, high cost of labour, non-availability of market facilities at village level, low price of the final
produce, lack of technical guidance for weed control, application of medicines and the seed treatment.

Suthar (1989) found that in Kheda district of Gujarat, the main constraints in adoption of recommended mustard cultivation technology were high wages of labour, irregular supply of electricity, non-availability of labourers at the time of harvesting, non-availability of canal irrigation in time and of chemical fertilisers.

Dibakar Naik, Bikaram Keshari Pattanaik and Binod Chandra Mohanty (1991) found in Orissa State that the farmers' adoption constraints, particularly in the green revolution belt, will help the scientists to reorient their research programme and priorities research as per the local need.

In short, studies completed so far have highlighted a number of constraints in adoption of the HYVs. Important constraints observed are: irregular and inadequate supply of canal water, finance, electric power, inefficient use of various inputs, lack of knowledge about HYVs. Lack of standard quality of HYVs seeds is a major complaint heard all over the country. The shortage of foundation and breeder seeds is also widely felt in various parts of the country. The other constraints highlighted refer to lack of transport facility, small size of the holdings, market problems etc.
3.5 Impact of HYVs on the Agricultural Sector:

In the literature reviewed above, the emphasis has been on the forces determining the adoption of the HYV programme. Now, in the following discussion, literature emphasising the aspect of impact of HYV is taken up.

A study by Patel, Arun S. (1975) contended that the performance in respect of new technology between 1966-67 and 1972-73 was not satisfactory. It remained highly selective in its spread effects. The degree of its success varied from crop to crop and from region to region. Even vast disparities existed within each region. It was further contended that the failure of HYV was not due to any inherent weakness of the new technology, but due to lack of relevant regional research and weaknesses in the arrangements for the supply of strategic inputs, and especially the irrigation water. He also examined the various factors which governed the success or failure of HYVs of five major cereals grouped into three categories: (i) wheat, (ii) rice, and (iii) millets (bajra, maize and jowar) in the country from 1966-67 to 1972-73. The important points of this study are indicated herebelow:

i) The import of HYV wheat from Mexico, whose environmental conditions are similar to the major wheat growing areas in India.

ii) The well-planned plant breeding research carried out in the country were held as the two most important factors which
contributed to the rapid rise in the adoption level of HYV wheat and its productivity.

iii) Wheat zones were found relatively more developed compared to the rice and millet zones of the country.

iv) The human element has also played its role in the success of wheat in India. The wheat growing areas of Punjab and Haryana have farmers whose risk bearing and innovative capacity is known all over India. This has brought spectacular results to the farmers of these two States.

v) The institutional support and detailed planning and coordination at all levels had created suitable conditions for the rapid spread of the HYV wheat in the country, especially in Punjab and Haryana.

vi) There are two major factors which determined the normal productivity of the rice at farm level: (a) the season (wet and dry) in which it is grown, and (b) availability and control of the water supply. If rice is grown in dry season, it offers better water control and abundant sunlight.

vii) Among the various crops studied, limited success was obtained for bajra and, to some extent, for maize in some States. The success attained was due to the development of new strains of totally indigenous character which proved successful in States like Haryana and, to some extent, Gujarat (for bajra) and also due to better weather conditions. Moreover, the adoption of HYVs
is noticeable mostly in areas with good rainfall which are free from recurrent droughts and having assured irrigation facilities.

The development of new strains has not been successful for all these crops for most of the millet zone areas, more particularly jowar and maize.

viii) To a larger extent, the principal jowar growing areas and, to some extent, bajra and maize growing areas were said to have suffered due to recurrent droughts. The irrigation facilities available to the farmers growing these crops was found to be very low. Being low cash value crops, they involve a high degree of risk and uncertainty in crop farming and, hence, they receive low priority in the use of strategic inputs like chemical fertilisers, irrigation etc. compared to other cereal crops.

Sadhu, A.N. and Mahajan, R.K. (1985) made an attempt to study adoption of HYVs. The success in the sphere of HYV seeds had been limited to wheat, rice crops, and a few other commercial crops. There were inter-State differentials in the adoption of HYV seeds. States like Punjab, Haryana and Tamil Nadu were much ahead in adopting HYV seeds. The faster growth in the use of HYV seeds was mainly in the wheat growing States. The co-efficient of variation of adoption of HYV seeds among 15 States was 59 per cent in 1974-75 and 38 per cent in 1978-79. A decline in co-efficient of variation is a good sign of development indicating a decline in inter-State variations in adoption of improved seeds.
The trend of area under HYVs under various States in 1974-75 and 1978-79 revealed that a tremendous increase in percentage of area under improved seeds had been achieved in the States of Kerala, Orissa, West Bengal and Maharashtra. This faster growth was mainly due to the development of HYVs for rice, jowar and bajra.

Rao Hanumanth, C. H. (1986) critically examined the various aspects relating to the application of science and technology to Indian agriculture. He pinpointed that the existing scientific infrastructure responsible for the development of HYVs was evolved in the context of rising labour cost, and the availability of cheap fertilisers, apart from the scarcity of land. In his other research work (1989) on 'Technological Change in Agriculture Emerging Trends and Perspectives'; it is noted that after the mid-sixties, apart from the introduction of HYVs of wheat and rice, public investment in agriculture was stepped up significantly. The new technology raised the profitability of investment for the farmers.

Parthsarthy, G. (1979) reviewed a number of relevant studies to examine the impact of new technology on agrarian structure. His review indicated a varying impact of new technology on this structure. In Punjab, a profitable technology led to the eviction of tenants, expansion in the size of the owner cultivated holding, growing landlessness and mechanisation and increased productivity without any serious immediate tensions. Similar results were obtained for Gujarat. In West Bengal, the new technology pushed owners towards cost sharing
with the tenants. In Andhra Pradesh, a similar result but of transitional type was obtained. In Orissa, share cropping with small tenants continues with added emphasis on awareness for the purchase of new inputs. He held that a superior technology had been a driving force to induce institutions to adopt themselves to its requirements.

Sharma, J.S. (1982), while reviewing the progress of agricultural production from 1949-50 to 1978-79, tried to examine whether or not the HYVs programme had any influence in accelerating growth rates. For this purpose, he divided the period after the introduction of the new technology into three phases, viz., (i) 1966-67 to 1970-71, (ii) 1971-72 to 1974-75, and (iii) 1975-76 to 1978-79. His observation is that the new strategy for agricultural production contributed to the growth in production and productivity but, because this growth was largely confined to wheat and irrigated areas, its impact was not reflected in the overall growth of food grain production for the country. Of course, he held that without the introduction of HYVs of cereals, growth rates might have been slower. With regard to prospects for the future after reviewing important studies on this aspect, he contended that everything would depend upon the achievements of the targets in respect of irrigation and fertilisers and that, even in irrigated areas, considerable scope existed for increasing yield.

Sharma also examined in detail the impact of new technology on tenancy economically viable holding, number of marginal and
small holdings etc. His contention is that there is no evidence to suggest that the large increases in marginal holdings and agricultural labour households are the direct result of the adoption of new technology. According to him, the new technology had the effect of reducing the size of an economically viable holding. He indicated that wages have risen in the areas of HYVs. This is particularly true for seasonal wage earners. Gains from new technology were available to all types of farmers, including marginal and small farmers who had access to sources of inputs and credit. Consequent to the new technology, inter-regional disparities got accentuated in India, which is mainly due to the fact that the new technology has remained confined largely to irrigated and assured rainfall areas.

Jain Reena (1990) studied the HYVs and correlated response of yields of wheat and rice in Uttar Pradesh. She found that the increase in correlation between actual yields is due to the systematic trend in yield. With the introduction and adoption of the HYVs, most districts experienced simultaneous increase in yields. As a result of this positive trend in yields, the yields across districts tended to move together.

Khuthar, R.K., Chamola, S.D. and Manoch Veena (1991) found that the agricultural production has increased manifold due to the introduction of HYVs along with the use of improved production practices. An attempt has been made to examine the changes in the cropping pattern and use of improved inputs and their impact on soil and water management, dry land agriculture, farming system, ecological imbalance and change in the
composition of livestock of Haryana State. The emphasis on the area, production and productivity showed an increase, especially in the case of rice and wheat due to the evolution of HYVs in period from 1966-67 to 1980-81.

C.H. Hanumanth Rao (1975) observed that for the success of the green revolution and its spread without social tensions, it would be advisable to make a frontal attack on feudal and semi-feudal land relations. Technological changes were widespread in the labour abundant sectors such as backward regions and the small farmers.

C.H. Hanumantha Rao and Ashok Gulati (1994), in their study, referred to the issue of technological changes in a number of different ways. As indicated by S.D. Sawant and C.V. Achuthan (1995) and A.S. Patel (1994), Rao and Gulati (1994) also held that the 1980s has witnessed the spread of new technology to rainfed and other unfavourable areas. They further held that the importance of fertiliser in relation to irrigation as a source of growth has increased considerably in the recent years. The important points noted by them are as under: (i) The initial success of the green revolution in the favourable agro-climatic regions has led to the neglect of unfavourable areas, both with respect to the evolution of technologies suited to such regions and conservation of land and water resources. (ii) Unit cost of production in wheat and rice declined, and the fall was more significant in respect of wheat. It is held that since rice lagged behind wheat in application of HYV technology and since
the growth in rice yields has only recently accelerated in such low cost areas as the eastern region, a significant cost reduction in rice should also be expected. (iii) The rate of return to investment in public research and extension has been quite high, i.e. 60 per cent for public research and more than 50 per cent for extension and this is attributed to the spread of new technology to new regions and crops in the 1980s. (iv) Talking about the future prospects, these researchers have rightly noted that for the proper development and diffusion of new technology, the three basic requisites are: (a) provision of adequate finance for public research, (b) appropriate economic signals for setting right priorities in public or private research, and (c) a favourable institutional frame-work providing for the absorption of new technology. (v) In the context of the emergence of biotechnology, these researchers have accorded high value to private research and extension. (vi) Citing the example of wheat in the case of which, the recommended fertiliser rates have remained unchanged for the past 20 years in spite of expected changes in soil fertility, it is observed that this is due to continuous intensive cultivation and evidence on imbalances in nutrient use. Their study suggests that evaluation of the package from the national or social perspectives of efficiency and sustainability is also inadequate. A hint has also been specifically given in respect of irrigation recommendations which need to be re-evaluated from the point of view of the efficiency of water use in the wheat crop in the face of emerging water scarcities.
In their study on "Agricultural Growth Across Crops and Regions - Emerging Trends and Patterns", S.D. Sawant and C.V. Achuthan (1995) came out with the following conclusions: (i) the aggregate growth rate in agriculture has remained fairly stable and unchanged in the first two decades of the post-green revolution period. (ii) In the early phase of green revolution, wheat, due to its decisive lead in technological progress, enjoyed an overwhelming advantage of area expansion. In the 1980s, the growth of wheat production declined and this was solely due to a fall in area growth rate from 2.60 per cent per annum in the 1970s to 0.28 per cent per annum in the 1980s. (iii) In the 1980s, the other crops commence to benefit increasingly from the technological advances and their wider diffusion. Here, the reference is made to rice and maize which noted considerable improvement in productivity in the 1980s than in the 1970s. (iv) Another important feature relates to greater pace of diffusion of technology to the kharif foodgrains as compared to that of the rabi foodgrains in the 1980s. (v) Wider dispersal of growth across regions is also another noteworthy feature of growth in the 1980s. Of course, this was associated with retardation of growth in some other regions like western region wherein the performance of Gujarat is noted as very poor.

In a similar type of study, A.S. Patel (1994) compared the performance of the Indian agriculture in the 1980s with that of the 1970s. Apart from the growth rates of crops examined by him, he also analysed in detail the performance with respect to various variables such as general trend in investment of
agricultural sector, irrigation, fertilisers, pesticides and HYVs programme. Weather conditions were noted to be similar in both the periods. As per his study, a downward trend in the spread of HYVs in the eighties has been observed. Despite such a nature of the behaviour of the HYVs and some other variables like irrigation, pesticides etc., a better performance in the eighties can be viewed as being due to more effective use of technological inputs in the 1980s as compared to the 1970s.

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Jose, A.V. (1974) indicated that from 1956-57 to 1971-72, the real wages improved significantly not only in Punjab, Haryana and Kerala, but also in Tamil Nadu, Uttar Pradesh and Gujarat. He further held that inter-State disparities in many wage rates tended to increase since 1964-65. It is evident from this that in the period of new technology, wages have increased along with the increase in the inter-State disparities.

Vyas, V.S. (1979), while discussing the agricultural labour market situation in India, held the view that wages have moved in an upward direction in all the areas where the spread of HYVs was substantial.

Joshi, C.K. and Alshi, M.R. (1985) indicated in their study that per hectare female labour use on HYV cotton and jowar farms is more as compared to the local variety farm. In respect of cotton, HYV cotton farms used about 157 per cent more female labour per hectare over that of local variety, while in the case of jowar, the HYVs used 26 per cent more female labour over that of local variety. The adoption of HYV of cotton and jowar increased the requirement of casually hired female labour to a large extent, implying thereby an increase in the employment opportunities for female labour seeking agricultural wage employment.

Joshi, B.H. (1991) examined the level of employment, wage and income of agricultural labourers in the post-green revolution belt as compared to the non-green revolution belt in Saurashtra region of Gujarat. He examined the impact of green revolution
on agricultural labourers of Dhoraji taluka in the Saurashtra region. He observed that in the post-green revolution belt, employment for 283 mandays per annum was available to the agricultural labourers as against 119 mandays of employment in the non-green revolution belt. Moreover, wage rates for men, women and children for different agricultural operations were also higher, and hence, the income of agricultural labourers was higher in the post-green revolution belt than that in the non-green revolution belt. J.S. Chawla and T.S. Chahal (1991) concluded that in the post-green revolution period, employment and wages of the agricultural workers have gone up.

A study by Kaushik Krishan Kanta (1993) reveals that during the period I (1968-69 to 1979-80), most of the growth in oilseeds output was due to the growth in area, whereas during the period II (1980-81 to 1991-92), it was mainly due to the improvement in productivity. The study further reveals that the fluctuations in productivity is the major cause for the fluctuations in the output and, hence, the fluctuations in yield have to be controlled to bring in stability in the output. This would mean concerted research efforts in developing new varieties of oilseeds whose yield potential is stable across different agro-climatic regions. These new varieties of seeds have not only to be high yielding under adverse weather conditions but will also have to be disease and pest-resistant. The prime concern of farm scientists should be to increase the competitiveness and profitability of oilseeds with that of other field crops.
A study by Narayana, D.L. (1966) shows that instead of creating a positive favourable impact, the agricultural extension programme is found to have generated backwash effects, unfavourable reactions towards the programme among backward communities. The negative backwash effect visible in backward communities is attributed to various reasons such as (i) Farmers give up the practice as soon as the incidental benefits provided by the government to encourage the adoption of new practices are withdrawn, (ii) The velocity of repulsion is greater than the velocity of the circulation of success, and (iii) A normally negative attitude of farmers towards new agricultural practices.

N.S. Jodha (1973) noted a relatively poor performance of the important course cereals and pulses. According to him, although serious concern has been expressed about this situation, it was seldom recognised that certain inherent weaknesses make the relatively depressed performance of these crops almost inevitable. This seems to be the case at least with regard to jowar and bajra, as indicated in his research paper. He noted permanent constraints for these crops as under: (a) crops of moisture deficient areas, (b) low value crops, and (c) area and economic class-specific consumers' demand for these crops. He also indicated the search for new directions in his paper. The new approach based on a proper understanding of the basic deficiencies of the two crops, bajra and jowar, as discussed above, should be directed towards the following: (1) Evaluation of a low cost technology to raise and stabilise the production of
jowar and bajra, and (2) Exploration of alternative demand channels in order to widen the market for these crops.

The first two points need specific emphasis. Firstly, the two crops under consideration are important crops of moisture-deficient areas and are likely to remain so in the long run, as is suggested by the tendency towards crop succession, following the gradual upgrading of the land resource base (through irrigation, etc.). Therefore, any technology which can help in making efficient use of the available moisture would help more in stabilising and raising the production of these crops. Evaluation of cheap and efficient dry farming technology is thus one area where efforts may be usefully concentrated.

Secondly, any technology for jowar and bajra, which calls for an intensive use of scarce inputs like fertilisers and water, have a limited chance of being extensively adopted because even when such technology substantially raised the yields of these crops, the cost return ratios of jowar and bajra, owing to their low value character, are unlikely to compete well with the high value crops.

AJOR Ram (1984) observed the reversion from improved wheat to local wheat in hilly areas of Uttar Pradesh. His research findings indicated that 12.5 per cent and 24.6 per cent farmers reverted to the cultivation of traditional wheat in 1982-83 and 1983-84 respectively. The area under improved wheat decreased by 5.8 per cent in 1982-83 and 10.3 per cent in 1983-84.
Madhwati, B. and Subramanyan, G. (1991) examined the trends in area, production and yield of rice at the State and the district levels in Tamil Nadu. The growth rate in area has been negative. The negative trend is visualised in most of the districts and the State as a whole. Regarding the trends in production, the co-efficients corresponding to the growth rates are negative and statistically insignificant, indicating thereby the stagnant production of rice during the period (1970-71 to 1987-88) under study. The trends in yield have been found to be quite reverse to that of area and production. By and large, one can infer that the rise in the yield has compensated the decline in area and consequently the production has remained stagnant during the post-green revolution.

M.K. Chaudhary and D.R. Aneja (1991) found that the Indian agriculture has made a spectacular progress since the introduction and widespread use of HYVs particularly in areas endowed with assured irrigation. Production of foodgrains increased from 72.35 million tonnes in 1965-66 to 173 million tonnes in 1989-90. Wheat and rice are noted as the main contributors to this increase. According to them, the green revolution successes have led to a breakthrough in production of foodgrains in Haryana, but the unscientific use of modern technology has resulted in a number of problems. Over-exploitation of land and water resources during the last two decades has led to the deterioration of soil health, created nutritional imbalance and disturbed the natural hydrology, particularly in intensively irrigated areas. The new development
strategy should, therefore, be aimed at maintaining growth in productivity while reducing its harmful side effects. This can only be achieved through scientific management of land and water resources and better crop planning.

Balishter and Roshan Singh (1991) examined the changes in the farm economy and the use of human labour on account of changing technology in agriculture in Sadarban village of community development block, Bichpuri, in Agra district of Uttar Pradesh on a census basis between 1965-66 and 1985-86. They found that among the rabi crops, there was not only a marked increase in the area under wheat during the green revolution period, but there was also an almost complete substitution of local varieties by HYVs. Comparing the growth of farm income and the share of different categories of farmers, they observed that as a result of the green revolution, the gap in income between the small and large farms increased substantially, leading to accentuation in income inequalities. The use of labour per cultivated hectare and cropped hectare increased considerably during the green revolution period, but it showed a declining trend in the latter part of the green revolution period due to the growing use of labour saving technology in the form of machines. There is a negative relationship between farm size and the use of labour per cultivated as well as cropped hectare.

In brief, due to the adoption of HYVs on a wide scale, substantial impact on agricultural sector has been observed. According to various studies reviewed here, the impact of HYVs can be summarised into various heads such as employment, income,
productivity and agrarian structure. HYVs have significantly raised employment but the increase in income and productivity seemed to have favoured large farmers when compared to small farmers. Besides, HYVs are also held responsible for expansion in the size of cultivated holding and increased mechanization.

GENERAL OBSERVATIONS

General observations emerging from the review of literature are presented below:

1. The HYVs programme has been found as launched with particular reference to major foodgrain crops of rice, wheat, jowar, bajra, and maize and some commercial crops like cotton, jute, and oilseeds. In order to achieve a sustained rate of growth, it is vitally important that the research may be directed toward those crops, which have not been covered so far, so that a break-through in the output of these crops is also achieved.

2. The agricultural revolution initiated by the HYVs programme was found to be more evident in respect of wheat. For bajara, rice, jowar and maize, although the revolutionary effect was observed, it was not as visible as in the case of wheat. Among non-foodgrain crops, the revolution was seen in cotton but it raised a number of problems for its sustenance. While in the case of oilseed crops, particularly in case of groundnut, the revolution is yet to be seen.

3. A substantial rise in foodgrain production had taken place in Punjab, Haryana, Western U.P. and in some selected districts
of Andhra Pradesh, Maharashtra, Gujarat and Tamil Nadu. Only the above-mentioned States and some districts had shown the way to a big take-off in agricultural production. Thus, a substantial part of India is still to experience the impact of HYVs.

4. Another important observation pertains to the fact that co-operative societies and rural banks, which are spread over the rural areas of the country, have provided less than 30 per cent of the total farm credit, and a large chunk of this credit went to big farmers. The small and marginal farmers, who need less expensive credit, had to be satisfied with the most expensive credit from non-institutional agencies. Consequently, the real price of inputs had remained substantially lower for large farmers as compared to that for small farmers, quite obviously to the disadvantage of the latter.

5. The new strategy was found to have created three types of conflicts, namely (i) between large and small farmers, (ii) between owners of land and tenant farmers, and (iii) between employers and employees (Rudradutt and Sundharam, 1978). The nature of conflicts created by the new strategy are presented below:

(a) The large farmers are capable of making heavy investment in the form of fertilisers, pump sets, tubewells and agricultural machinery. They have easy access to credit from the co-operatives. On the other hand, the small farmers are found deprived of the much needed inputs at reasonable prices. (b) In India, quite a significant number of farmers possess small
holdings and, consequently, they hire land on tenancy from the large owners. Since the landlords pay for the strategic agricultural inputs, such farms are experiencing a dualism in the technique of agricultural production. The part of land hired by tenants is provided with modern techniques, whereas the small fragments continue to be dominated by traditional techniques. This has led to the cause of social tension. More so, when the landlords demand exploitative rents on the land hired by them. And (c) The gains of HYVs were found being pocketed by the rich land-owning classes and the new strategy has further tilted the scales of distribution in their favour. It had been maintained that organised peasant resistance alone might help the small peasants, the tenants, the share croppers and the landless labourers, i.e. the agricultural proletariat maintaining their relative share in agricultural income (C.H. Hanumanth Rao, 1975, 1988 and D.T. Lakdawala, 1985).

6. Participation in the modernisation process was observed to be restricted to the regions which had shed the feudal and semi-feudal structures and attitudes and where the inequalities in wealth and status were not conspicuous. Rao (1975) cited the example of Punjab, Haryana and Uttar Pradesh, where the technological change did not result in perceptible social tensions because real wages had risen in these regions. However, in case of Thanjavur (Tamil Nadu), the landlords tried to counter the demand for higher wages by bringing in farm labour from outside. Although, this is a single case it is quite possible
that further research in the area in different parts of the country may provide similar results.

7. The HYVs have an inherent genetic capacity of giving higher yields than traditional varieties. Therefore, the State should extend the programme of provision of HYVs seeds to all the cultivated areas.