CHAPTER - 3
TECHNOLOGICAL CHANGES

It is an established fact that the pace of advancement in a society is to a great extent driven by cumulative technological evolution. Technology is not tools alone but encompasses irreducibly the human skills and ideas necessary to make and use tools for instrumental purposes. In his most celebrated phrase, Clarence Ayres— in his famous book 'Theory of Economic Progress' (1962)— says, "thus what happens to any society is determined jointly by the forward urging of its technology and the backward pressure of its ceremonial system."

Agriculture in Kashmir has always been an exceptionally important aspect of people’s lives, straddling as it does even today, in the highland and lowland zones, extensive forests and wastes.¹ For centuries it has been characterized by subsistence farming, primitive techniques, and low yields. The pressing demand for food had always been the guiding principle of the agriculture [of the valley] and most of the land was devoted to foodgrain production, yet deficits could not be eradicated and, in many areas, starvation and famines were frequent. Development of agriculture in Kashmir has a very chequered history, its successes and failures being determined by a multitude of socio-political and environmental factors. Majid Husain, the famous geographer of Kashmir, rightly remarks that “the agricultural processes of a region are directly controlled by the prevailing physical environmental condition (temperature, precipitation, terrain, soil etc.) and the socio-cultural milieu (land tenancy, size of holding, technology, work force, family requirements, irrigation, power, roads, marketing, aspirations of the growers, etc.).”²

Kashmir had been an abode to a large number of crops, both kharif and Rabi, which made it [Kashmir] more inward looking as by and large all needs were met within the region, however, due to certain climatic constraints only a few crops like rice, maize and wheat were sown on a large scale\(^3\). Rice being the staple food of the inhabitants was the principal crop cultivated in Kashmir\(^4\). It had been cultivated mostly in the flat areas of the valley with alluvial soil and assured irrigation facilities\(^5\). The peasant in Kashmir practised two systems of paddy cultivation. Under the first rice was sown broadcast while under the second rice was first sown in a nursery and then transplanted.\(^6\) Though in comparison to the nursery system, the broadcast system was labour intensive and risky yet because of its best outturns per acre the Kashmiri cultivator preferably practised it.\(^7\) In fact upto the late nineteenth and even early twentieth century all lands were sown using the broadcast method \((\text{wotur})\).\(^8\) There were two main methods for preparing the soil, namely, Tao and Kenlu. Under the Tao system the soil was made absolutely dry to eliminate moisture before sowing the seeds and according to the Kenlu \((\text{wet})\) method the field was allowed to remain wet.\(^9\) In order of priority maize came next to rice and was cultivated, as a poor man’s crop, in the highlands where irrigation was not available.\(^10\) In fact Kharif was the only main cropping season in Kashmir. Though there is no certainty about the history of agricultural output in Kashmir, especially the course of yield rates and productivity, however, it would not be an exaggeration to say that upto the beginning of the 2\(^{\text{nd}}\) half of the 20\(^{\text{th}}\) century, agriculture in Kashmir continued to be practised on traditional lines and the state had been deficient in food crops even in politically and climatically normal years.

\(^3\) For more details see the chapter, \textit{Changes in the Cropping Pattern}.


\(^6\) Ibid. p. 331.

\(^7\) Ibid. pp. 331-32.

\(^8\) Hangloo, \textit{Agricultural Technology in Kashmir}, op. cit., p. 76.

\(^9\) Lawrence, op. cit., p-332

\(^10\) Ibid. p. 19.
Chapter 3  Technological Changes

Under the Dogra rule, which was overall a period of negligence of developmental activities, some measures were undertaken to increase agricultural production. For the development of agriculture, a separate Department of Agriculture was established in 1906 with two experimental farms under the name of Pratap Model Farms, one at Shalimar for Kashmir province and the other at Golasmada for Jammu province. According to the official Dogra sources, “agricultural and horticultural experimental work and the demonstration of improved methods of cultivation of crops and fruit plants were the important features of this department. It also distributed improved varieties of seeds, implements, and gave technical advice to the cultivators.”

The main purpose of experiment farms was the production of better seeds through agricultural research. To educate farmers about the new techniques of production and make them familiar with new seed varieties, Agricultural Department used to organize ‘District Agricultural Shows’ and annual exhibitions and commercial fertilizers and improved implements were also kept in stock for sale to zamindars”. This official version, however, seems to be exaggeration in view of the fact that even in British India the Agricultural Department which was set up in 1905 to systematize agricultural research-agricultural research enjoyed substantial financial support and served the political economy interests- could not perform functions of the type its parallel department in Kashmir claimed to have done. Both output per acre and output per capita appear to be either stagnant or declining.

The agriculture of Kashmir, on the eve of 1947 was entirely traditional in nature, subsistence farming was still in vogue and farmers were quite ignorant about the scientific methods of cultivation. The use of chemical fertilizers was almost non-existent and inferior quality seeds continued to be used on a very

13 The agricultural research in India under the colonial rule was guided by the compulsions of the political economy. More resources were allocated for the research of cotton and Sugar cane, the two main commercial crops, than on rice and wheat. For details see, Carl E. Pray, “The Impact of Agricultural Research in British India”, The Journal of Economic History, Vol. 44, No. 2: The Tasks of Economic History (Jun., 1984), pp. 429-440.
large scale. The technological backwardness of the state’s agriculture had a lot to do with the ‘relations of production’ existing in the valley. This was so because the “technological progress is considerably influenced by the motivation which a particular set of ‘relations of production’ provide for investment”\(^\text{14}\). The incentive for investment in technology, *ceteris paribus*, is greater in a system where the class which appropriates the economic surplus pays the direct producers a fixed quantum than in a system which provides sharing of gross produce in a certain fixed proportion\(^\text{15}\). Therefore, in Kashmir where the mode of appropriation was based on the sharing of the gross produce in fixed proportion, it is not astonishing to see that there was almost no initiative from the peasantry and landlord towards investment in technology. Thus the technological bottlenecks notwithstanding, the agriculture was backward because of the institutional depressants. The peasant happened to cultivate with traditional seeds and outdated techniques and had to bear the heavy burden of taxation. The position of the state’s agriculture can be well understood from the fact that despite the cropping pattern of the state was predominately in favour of food crops, it had to import large quantities of food.


\(^{15}\) Ibid.
The import of food in the pre-1947 days is depicted in the following table:

Table 3.1  
Year-wise Import of Food Grains (Rice, Wheat and Maize) into the state of Jammu and Kashmir

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Food Year</th>
<th>Total Imports of Food Grains [in ‘000 quintals]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1942-43</td>
<td>7.46</td>
</tr>
<tr>
<td>2</td>
<td>1943-44</td>
<td>86.96</td>
</tr>
<tr>
<td>3</td>
<td>1943-44</td>
<td>92.94</td>
</tr>
<tr>
<td>4</td>
<td>1944-45</td>
<td>109.73</td>
</tr>
<tr>
<td>5</td>
<td>1945-46</td>
<td>78.01</td>
</tr>
<tr>
<td>6</td>
<td>1946-47</td>
<td>69.42</td>
</tr>
<tr>
<td>7</td>
<td>1947-48</td>
<td>228.42</td>
</tr>
<tr>
<td>8</td>
<td>1948-49</td>
<td>187.74</td>
</tr>
<tr>
<td>9</td>
<td>1949-50</td>
<td>260.52</td>
</tr>
</tbody>
</table>


The situation underwent a sea-change after 1947, particularly after mid-1960s. Immediately after assuming power the new government started taking initiatives to release the agriculture from the shackles of stagnation. In order to rationalize agricultural production the government adopted certain measures as were likely to assist in the extension of area under cultivation and help in increasing the productivity of the presently cultivated land. The Grow-More-Food campaign programme of 1948 was one among such measures which resulted in an increase of nearly 200,000 mounds (about 7500 quintals) in the annual production of food.\(^\text{16}\) Landlordism was abolished and land was transferred to the tiller. This had an everlasting impact on the agriculture of the

\(^{16}\) For more details on the scheme refer to the Chapter ‘Agrarian Reforms’.
state since it not only relieved the state from its obligations to a parasitic class but also secured the position of the peasant, thereby, motivating him in making efforts towards the development of agriculture (for details see chapter on Agrarian reforms). In spite of all these steps, the agricultural production of the state could not be improved to the extent of taking the state close to self-sufficiency in food items. The state, in 1950s, continued to be deficient in food grains. Not surprisingly, therefore, the government through the First Five Year Plan, proposed to make the state self-sufficient in food grains by improving the agricultural standards. Hence, in order to improve the conditions of the bulk of the agrarian population, the top priority of the government was to increase the production of food through all possible ways. It was for this reason that radical transformation of agriculture, through the adoption of advanced agricultural practices and modern inputs, to widen the range of production possibilities became a necessity. Towards this end the government combined the institutional reforms with the rationalization of technological relations.

Along with institutional changes, the new government took keen interest in initiating technological changes as well. Efforts were made regarding the supply of improved seeds and fertilizers to the farmers. During the last two years of the First Five Year Plan, ten seed plant nurseries were established to produce improved seeds. Steps were taken by the Agricultural Department to produce ‘Double-Hybrid Maize Seed’ and improved varieties of paddy. The number of seed multiplication farms increased to 15 during 1956-59 and about 1 lakh maunds of pure seeds were distributed on premium basis to the farmers. In order to increase the production of food grains the government distributed

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17 It was thought that such changes would secure the position of the peasant, increase private investment in cultivation and would thus help in increasing agricultural production. Therefore, the main thrust was on legislation regarding agricultural property and social relations in the countryside. For more details see the chapter “Agrarian Reforms”

18 Government of Jammu and Kashmir, First Five Year Plan, Department of Planning and Development.

19 Government of Jammu and Kashmir, Second Five Year Plan, Department of Planning and Development
quantities of sulphate of ammonia on subsidised and deferred payments and also as free gifts. The distribution is given as under:

Table 3.2

<table>
<thead>
<tr>
<th>Year</th>
<th>On subsidies &amp; deferred payments</th>
<th>Free gifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954-55</td>
<td>12900</td>
<td>8000</td>
</tr>
<tr>
<td>1955-56</td>
<td>44,000</td>
<td>24,000</td>
</tr>
<tr>
<td>1956-57</td>
<td>29,331</td>
<td>29,000</td>
</tr>
</tbody>
</table>


However, on the technological front the most significant contribution of the state during the first three plan period was the development of irrigation infrastructure, which greatly helped in expanding agriculture to the hitherto uncultivated lands and also acted as an edifice for the new agricultural technology adopted in late 1960's\textsuperscript{20}.

Despite these efforts the state continued to remain deficient in food grains and had to import food from outside. The net import of food grains increased from 56.10 thousand tons in 1961-62 to 95.95 thousand tons in 1964-65\textsuperscript{21}. This food gap seemed to be widening both because of the growth in population as well as due to improvement in the standard of life after 1947. People who earlier lived on wild fruits and other inferior food items had now shifted towards the consumption of the so called superior food grains, like paddy and wheat. Also there was a considerable increase in the daily intake/consumption of food; needless to say that during the Dogra rule the Kashmiri peasant lived a half starved life.

\textsuperscript{20} For the development of Irrigation see Chapter 4.
Chapter 3

Technological Changes

Therefore, a radical new prescription for technological change was adopted. In order to increase productivity in the newly created small farms, the state initiated various policy measures to remove imperfections in the factor and commodity markets in an attempt to raise agricultural production. Moreover, the government had realised that mere development of irrigation infrastructure would not suffice for making the state self-sufficient in food production and, therefore, had from the early 1960s started searching for the potentialities of intensive agriculture and the possibilities of harnessing them. It was widely accepted by the government and the experts that in order to increase agricultural production, the productivity of the land had to be increased. The government of the state was also alarmed by the poor performance of the Indian agriculture during the Second Five Year Plan which led to the shortage of food and a sharp rise in price level, and had made it clear that there was no alternative to technological change in agriculture for achieving self-sufficiency in food grains. The further motivations/pressures for the shift to technological changes came from the fact that even those countries which had carried out more far-reaching land reforms also had to follow the path of making modern technological improvements in agriculture to keep up their growth rates– Japan took the lead in this direction and China followed suit even after successfully experimenting with structural changes and mobilization of a growing labour force for capital formation. The government of the state therefore, keenly observed the changes in Indian agriculture and positively responded to the various developmental programmes extended to the state. The Third Five Year Plan, therefore, emphasised on the consolidation of holdings, setting up of agricultural colleges, improvement of market intelligence and agricultural statistics and also proposed to start an Intensive

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24 Ibid.
Agricultural District Programme,\textsuperscript{25} which was based on the 1960-61 ‘Ford Team’ recommendations.\textsuperscript{26} Nevertheless, the shift towards intensive cultivation became even more necessary in light of the fact that cultivation was already extended to marginal lands and further extension was not possible. The Techno-Economic Survey Report, 1969 concluded; “......in order to sustain itself the farming community has already extended cultivation of food grains to marginal lands so that further extension is not possible.”\textsuperscript{27}

Towards the technological transformation of state agriculture two districts, Anantnag and Jammu, were taken up for the introduction of package programmes (six blocks of Anantnag and three blocks of Jammu) and efforts were made to provide all types of agricultural inputs and other services to them

\textsuperscript{25} The third plan like the proceeding two plans aimed at making the state self-sufficient in food. The proposed investment outlay on agriculture and allied activities during the third plan was Rs 1261 lakh which was 16.8% of the total expenditure (7514.44) and 67% more than the outlay earmarked for it in the second plan. But the actual utilization was less leading to the failure of the plan on agricultural front. However, the Agricultural District Programme could not get off the ground on account of supply and organisational difficulties and the programme of consolidation of holdings could not be successfully implemented since the area of operation was severely limited and because the training of the specialist staff took longer than expected leading to large shortfall in production. For more details see, Government of Jammu and Kashmir, Third Five Year Plan, Planning and Development Department.

\textsuperscript{26} The failure of the Second Five Year Plan in India caused a great concern to the planners and consequently the govt of India invited a team of agricultural experts of Ford Foundation to suggest measures for increasing production and productivity of agricultural sector The team visited India during the January to April 1959 and submitted its report entitled “Indian Food Crisis and steps to meet it” in 1959. This report suggested intensive efforts for increasing agricultural production and productivity in the selected regions of the country with assured water supply, with stress on modern inputs, especially fertilizers, credit, marketing facilities etc The recommendations made by the team were accepted by the govt of India and in 1960-61, the Intensive Agricultural Development programme (IADP) popularly known as Package Programme was taken up on pilot basis and was initiated in five district of the country Viz. Ludhiana, Shahabad (Bihar), West Godavari(AP), Raipur and Aligarh (UP) the districts selected under the IADP programme were required to possess qualities such as assured water supply, minimum hazards (like floods, drainage problem, acute soil conservation problems etc), well developed village institutions and maximum potentialities for increasing agricultural production within a short span of time. Later on some more districts were included in the programme and by the end of 1962; the package programme was extended to almost one district in each state of India. For details see, S.K. Misra & Puri V.K, Indian Economy, 24th ed. (Mumbai: Himalaya Publishing House, 2006), p. 344; N. S. Gupta & Singh Amarjit, Agricultural Development of states in India Vol.1: Jammu and Kashmir (New Delhi: Seema Publications, 1979), p. 236.

through block development agencies. In March 1964, an Intensive Agricultural Area Programme [IAAP] was taken up which aimed at intensive development of a selected area and not the development of one or two particular crops. Thus, it was during the 3rd Five Year Plan that the base of a new approach to agricultural development was laid to increase agricultural production. Subsequently greater emphasis was laid upon the use of modern methods of production and it was realised that the transformation of traditional agriculture was possible only through the strong injection of modern technology and the use scientific techniques on a massive scale. Moreover, by the mid-1960s, the institutional change via land reforms had failed to transform agriculture due to the oligarchy’s manipulation of change to benefit themselves. Therefore, the ‘New Agricultural Strategy’ which aimed at rapid and spectacular increase in the food grain production was adopted in the state in 1968-69. It is important to mention here that the ‘New Agricultural Strategy’, which was the name given to a set of technological innovations– scientifically evolved exotic seed varieties called high yielding varieties– transferred to the under-developed countries from the developed world through the sophisticated mechanism of the institutionalization of research and adopted in India in 1966-67, had so rapidly changed the agriculture of India, Pakistan, Turkey and Philippines, that William S. Gaud of the US Department of Agriculture in 1968 used the phrase ‘Green Revolution’ to refer to such changes. It would not be out of place to mention that IADP and IAAP had paved way for the adoption of the ‘New

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30 Siddhartha Prakash, *Political economy of Kashmir since 1947*, op. cit., P. 2054; The shift from institutional to technological change in agriculture seems to be guided by similar factors. By the late fifties and early sixties the benefits from land reforms that could be carried out in Indian conditions had begun to peak and the possibilities of agricultural growth based on extension of agriculture, that is, bringing more area under cultivation, were also reaching their limit. For more details see, Bipan Chandra, *India since Independence* (New Delhi: Penguin Books, 2008), p. 572.

Agricultural Strategy’ which was based on the new technological innovations both biochemical, forming its backbone, and mechanical innovations.

The ‘New Agricultural Strategy’ made its debut in the same two districts which had earlier been brought under the IADP programme Viz. Anantnag and Jammu. Since the results of the new strategy began to be witnessed in Indian plains within a very short period, therefore, the state government became more enthusiastic to transform the agriculture through the application of the new technological innovations. The 4th Five Year Plan which was launched in 1969-70 after the three plan holidays, therefore, put agriculture among the top priority sectors and out of the total outlay of Rs 158.40 crore fixed for Jammu and Kashmir, the outlay for agricultural production as a whole was Rs 30.15 crore. Faced with a persistent food shortage amid a growing population the 4th plan was designed to ensure adequacy in food grains in the state. It was envisaged that food production would increase at a rate of 6% per annum and from a level of 9.23 lakh tonnes in 1968-69 it would rise to 11 lakh tonnes in 1973-74. Since the scope for extensive cultivation had already been questioned the proposed increase was expected to be brought about by technological change.

The New Agricultural Strategy adopted a three dimensional approach towards the development of agriculture which consisted of the use of high yielding varieties of seeds [HYV], adoption of modern chemical technology and food grain support policy. Typically technological change in agriculture involves improvements in the biological processes by which plants and animals grow and yield output or in the mechanical functions that are necessary for biological processes to carry on more efficiently than in a natural setting. ‘Bio–chemical innovations such as hybrid seeds, pesticides and fertilizers all tend to

32 Bipan Chandra, op. cit., p. 574.
33 Government of Jammu and Kashmir, Fifth Five Year Plan, Planning and Development Department, p. 9.
34 Ibid.
be yield increasing and thus save on land. Mechanical technology can have a yield effect when it permits more timely cultivation, cultivation of heavy soils, or irrigation of dry lands, but it mostly makes agricultural works less burdensome and saves on labour.\textsuperscript{36} However, in Kashmir the ‘new agricultural strategy’ remained almost confined to the use of high yielding varieties of seeds and fertilizers as the topography of the state in general and that of Kashmir in particular was not conducive for large scale mechanisation of agriculture. Also vitally important to mention is that the task of developing appropriate technology for hilly regions like Kashmir was extremely difficult in comparison to plains because, owing to variations of topography, temperature, rainfall, and length of frost periods, there is a substantial diversity in the micro-environment over a relatively short distance.\textsuperscript{37}

Therefore, in order to understand the technological changes, if any, in Kashmir’s agriculture and their impact on the production and productivity of the principal crops, it is important to focus on the different aspects of the new strategy especially its bio-chemical aspect.

**Use of HYV Seeds**

Seed is considered as a basic input to agriculture. It also serves as a catalyst for making other components / inputs of production technology effective. In fact the nature of agriculture is to a great extent determined by the quality of the seeds used for cultivation. Kashmir’s traditional crop varieties have been evolved over several centuries in order to withstand droughts, floods, and the severe cold. Rice was the most extensively cultivated crop of the valley. About ninety varieties of rice were grown in Kashmir the important being

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Chapter 3

Technological Changes

Kunjidanyi, Basmat and Chogul. These varieties continued to be used by the peasant, almost unmodified, till the very end of the Dogra rule. Though the importance of distribution of the quality seeds for agricultural production was recognised in India for the first time in the year 1926, through the establishment of the Royal Agriculture Commission but sincere efforts towards the development of improved seeds in the state were taken only after the end of the Dogra rule - on systematic basis the seed production programme for improved material of seeds including hybrids started as late as 1963 with the establishment of a ‘National Seed Corporation’. In 1949, under the guidance of the Indian Council of Agricultural Research [ICAR] the government of the state launched the ‘Rice Research Scheme’ primarily with the objectives of: a) to evolve suitable high yielding types of improved quality of paddy by: i) pure line selection among the predominately grown varieties of the valley; ii) introduction of foreign varieties both Indian and exotic; iii) Hybridization and b) to evolve suitable strains of paddy which would do well both in the plains and on hills. The scheme succeeded in acclimatizing some Chinese varieties viz. China 1039, China 988, China 1007 and China 972, which not only had more outturn per acre than local varieties – their yields per acre were more than highest yielder local variety, the Begum- but they were also resistant to diseases and more responsive to nitrogen fertilizers. China-1039 was released as the best variety on the ground of its early maturity, suitability for rotation, high yield potential besides being resistant to diseases especially blast Rai. The variety became most popular as, besides other characters its sheath was pigmented which resembled one of the best local varieties, Begum and locally

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38 Some of them are as follows: Larbyol, Mushkabudji, Reban, Yimbirzal, Pothibrar, Sukhdas, Basmat, Braz, Nur, Bathal, Bud Braz, Nihali, Chatazaz, Gurah, Karhana Shesher, Keoziv; Diwan Kripa Ram, Gulzar-i-Kashmir, p. 278.
41 Ibid. pp 5-7.
came to be called as Begum China.\textsuperscript{42} Research on rice continued with more vigour after the establishment of Rice Research Station Khudwani [1954-56]. The main focus of the station was to evolve varieties with high yield, response to heavy fertilization, easy threshing character, resistance to diseases and pests with special reference to ‘blast’ besides other desirable plant characters, suitable for the agro-climatic conditions of the state. Around the same time research was initiated on other agricultural sectors through the establishment of Maize Research Farm [1952-54], Vegetable Research Station Shalimar [1959], and Wheat Research Station R.S. Pora with a sub-station at Shalimar. The Department of Agriculture introduced double hybrid maize named U.S. 13 in Kashmir. The variety did not gain popularity and was replaced by Him-123 and composites C\textsubscript{1} and C\textsubscript{3}.\textsuperscript{43} As regards the wheat varieties released in preference to local varieties in the state upto 1966 were C\textsubscript{59}, NP\textsubscript{4}, IP\textsubscript{20}, NP\textsubscript{770}, NP\textsubscript{809} and NP\textsubscript{818}. The new varieties were superior in yield to the local varieties but did not stand high doses of fertilizers due to the plants tall stature.\textsuperscript{44} By the end of the Third Plan Period though only 1/5\textsuperscript{th} of the area under cereals was covered with improved seeds but paddy and maize registered good progress. In fact the programme remained almost confined to paddy and maize– the china 1039 was quite prevalent in Kashmir in 1960s.\textsuperscript{45} However, it is important to mention that during the first three Five Year Plans, ‘the state government tried to concentrate efforts on agricultural development on the pattern of schemes followed in the rest of the country’.\textsuperscript{46} To tackle the local problems, techniques were borrowed from other parts of India. However, as the physical and climatic conditions of the state of Jammu and Kashmir were vastly different from other states of India, therefore, the borrowed techniques could not provide any long-lasting solution to the local problems.\textsuperscript{47} The state agriculture continued to face

\textsuperscript{42} This information is based on a discussion with aged peasants of District Pulwama and Budgam.
\textsuperscript{43} First Five Year Plan, op. cit.
\textsuperscript{45} Techno-Economic Survey of Jammu and Kashmir, op. cit., p. 34.
\textsuperscript{46} Ibid. p. 35.
\textsuperscript{47} Ibid.
problems with regard to the use suitable varieties of seeds, fertilizer requirements, pest control, and introduction of new crops. The shift from China-1039 to local varieties in late 1960’s was a result of the same problem. China-1039 was shedding and matured two or three weeks later than the local variety, hence it was likely to get damaged if winter would set early.\textsuperscript{48} Moreover, major part of the requirement of the improved seeds was met through imports from outside the state\textsuperscript{49}. It was, therefore, strongly suggested that the state should heavily invest in research to evolve location specific varieties in the state.

The use of high yielding varieties came under more focus after 1966 when the Mexican varieties were put to use in India and the limitations of the extensive cultivation had become clearly visible.\textsuperscript{50} However, as already explained the HYVs adopted in India could not be as such used in the valley owing to certain climatic constraints, therefore, efforts had to be made to modify the varieties and develop suitable strains for the state, which was a research intensive and long drawn process. It is worth to mention that location specific strains were more essential for Kashmir than Jammu as the latter, because of its climatic proximity, could procure Hybrid and High yielding Varieties from other similar regions of the India.\textsuperscript{51} Nevertheless, most of the regions of Jammu cultivated wheat for which the Mexican varieties Lerma Rao and Sanora-64 could comfortably be used. Therefore, for a long period of time Kashmir continued with varieties especially that of rice, which were no match to those under use in the Indian plains especially Punjab.

It was with the development of several high yielding, cold resistant and early maturing strains of rice in late 1970s at the Rice Research Station Khudwani, Anantnag that the production of paddy received impetus. The new

\textsuperscript{48} Ibid.
\textsuperscript{49} Ibid.
\textsuperscript{51} See proceedings of One Day Seminar on Agricultural Renewal in temperate and cold arid regions of Jammu and Kashmir, Directorate of Agriculture Kashmir.
strains called K-78 [Barakat], K-332, K-333, K-39 were immune to pests and low temperature and helped in extending farming to lands ranging between 1500 meters to 2,280 meters which had hitherto not been brought under farming. The Barakat strain had a yield potential of 3.8 to 4 tons per hectare and was resistant to high degree of cold and 'blast' under field conditions. It was suitable for higher elevations of the valley [upto 2000 m.a.s.l], and had a maturation period of about 130 to 140 days. K-39 had a yield potential of 6 to 8 tonnes per hectare, as compared to 4 to 5 tonnes of china-1039, but had a maturation period of about 140-146 days and was more specific for the lower belts of valley. K-332 variety was suitable for cultivation in higher belts of the valley [above 2000 m.a.s.l] and had a potential of 4 to 4.6 tons per hectare besides being highly resistant to blast under filed conditions. It matured in about 130-140 days.

Notwithstanding that a number of research activities were going on in the state since 1950s but on account of lack of proper coordination between the different schemes and absence of higher direction the research base was weak even in 1970s and the achievements were very meagre. The different research programmes and schemes had become highly individualistic and hence static by content, context and facilities. There was hardly any interdisciplinary interaction or coordination. Regarding the development of agricultural research base in the state of Jammu and Kashmir, the Development Review Committee remarked: ‘research work done in the agricultural universities in the country may not be wholly relevant to the state particularly Kashmir valley and Ladakh and some parts of Jammu region which have different agro-climatic characteristics. In this background it is recommended that all the research

53 For details see the production recommendations kharif, 1992, Directorate of Extension Education SKUAST, Shalimar. pp. 3-5.
56 Ibid. p. 15.
activities in agriculture and allied sectors should be brought under the umbrella of an institute of Agriculture research and education which should have its out stations in various agro-climatic zones of the state’. It was towards this end that a team of experts from Indian Council of Agricultural Research visited the state and recommended for the establishment of an agricultural university. Consequently Jammu and Kashmir University of Agricultural Sciences and Technology was established in the year 1982 which was later on renamed as Sheri-Kashmir University of science and technology [SKUAST]. The University used the earlier findings as base material and conducted research on different agricultural issues; however, fresh perspectives were given to generate technologies to address the specific problems peculiar to overall agricultural development of various regions of the state. Nevertheless, the university issued packages of practice for both the Kharif and Rabi crops. The following table provides the list of some of the important crop varieties released by the university since its inception:

Table 3.3

<table>
<thead>
<tr>
<th>Crop</th>
<th>Name of the Variety</th>
<th>Crop</th>
<th>Name of the Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>Rambir Basmati, Jehlum, Chenab</td>
<td>Almond</td>
<td>Mukhdoom, prabat, Waris, Shalimar,</td>
</tr>
<tr>
<td></td>
<td>Kohsar, Shalimar Rice-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>C-8, C-14,C-15,Composite Super-1,</td>
<td>Apple</td>
<td>Shireen, Firdous, Akbar,</td>
</tr>
<tr>
<td></td>
<td>Shalimar KG Maize-1,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>Jittoo, Kailash, Mansaravar, Singchen,</td>
<td>Walnut</td>
<td>Hamdan, Suilaman</td>
</tr>
<tr>
<td></td>
<td>Shalimar Wheat-1,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil Seeds</td>
<td>Ks-101</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Director Research, Shere-i-Kashmir University of Agricultural Sciences and Technology.
It is often argued that the redistribution of land in Kashmir through the radical land reforms of 1950s impeded the use of HYVs, by reducing the size of holdings, and thus retarded the pace of modernization of agriculture. But in light of the fact that the HYVs were neutral to scale –because both the seeds themselves and the resources required to complement them were infinitely divisible across all ranges of output\(^{57}\)- the argument holds little ground. Not only was the use and impact of HYVs not dependent on the size of the landholding but the new seeds were land augmenting as well-they increased yield per unit of land.\(^{58}\) Nevertheless, it is a fact that land reforms made the small peasants more receptive to the new technologies because they made the peasant the direct beneficiary of the positive changes in agriculture. However, it is pertinent to mention that though the high yielding varieties were neutral to scale, they were not neutral to resources. High yields could only be obtained under certain optimum conditions: optimal irrigation; intensive use of fertilizers; pest control using chemical pesticides\(^{59}\).

Towards the diffusion and transference of the HYV to the farming community a number of initiatives were taken by the government which included the extension programmes like National Demonstration Project and Lab to Land Programme.\(^{60}\) Through such measures the peasants were made to believe in the economics of the new varieties and were also motivated to adopt the same. Moreover, the zeal to see the state self sufficient in food grains—which the state believed could be achieved by increasing acreage under HYV-accelerated the efforts of the government to extend the new varieties to the maximum. It is an established fact that all the Five Year Plans upto the 7\(^{th}\) plan

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\(^{58}\) Ibid. p. 216.


had self sufficiency as a priority item. Therefore, in the succeeding Five Year Plans the area, under high yielding varieties and improved seeds of various cereal crops, was proposed to be raised to increase the production of food. However, in order to make the programme a success it was required to keep the quality seeds available in time and, therefore, initiatives were taken to produce the seeds locally to decrease the dependence of the state on imports. In addition to the big seed production farms one at chinore (Jammu), which had an area of 3000 acres, and the other at Padgampora [Kashmir] having an area of 600 acres along with a number of departmental seed multiplication farms, the 5th Plan proposed to continue the programme of multiplication of seeds through registered growers on payment of premium. Through such efforts not only did the state's dependence on import of seeds drastically decreased but seed production turned out to be the potential sector of the state agriculture. During the 8th and 9th Five Year Plans the state of Jammu & Kashmir was exporting seeds to other states.

A perceptible change in HYV area since 1968-69 had taken place and area under HYV paddy, maize and wheat recorded an annual compound growth rate of 6.15%, 19.39% and 11.47% respectively for the reference period 1968-69 to 1983-84. The area under High Yielding Varieties of important food grains in Jammu and Kashmir is shown in the table below:

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61 Government of Jammu and Kashmir, Seventh Five Year Plan, Planning and Development Department, p. 11.
63 Ibid.
Table 3.4
Area under High Yielding Varieties of Important Foodgrains in J&K State

[Area in 000 hectares]

<table>
<thead>
<tr>
<th>Year</th>
<th>Paddy</th>
<th>Maize</th>
<th>Wheat</th>
<th>Total</th>
<th>% Change over previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-69</td>
<td>114.93</td>
<td>2.43</td>
<td>36.02</td>
<td>153.58</td>
<td></td>
</tr>
<tr>
<td>1969-70</td>
<td>121.00</td>
<td>2.84</td>
<td>40.47</td>
<td>164.30</td>
<td>7.12</td>
</tr>
<tr>
<td>1970-71</td>
<td>108.45</td>
<td>12.14</td>
<td>56.66</td>
<td>177.25</td>
<td>7.88</td>
</tr>
<tr>
<td>1971-72</td>
<td>109.26</td>
<td>15.38</td>
<td>59.89</td>
<td>184.53</td>
<td>4.11</td>
</tr>
<tr>
<td>1972-73</td>
<td>139.61</td>
<td>16.19</td>
<td>96.72</td>
<td>252.52</td>
<td>36.84</td>
</tr>
<tr>
<td>1973-74</td>
<td>106.00</td>
<td>16.00</td>
<td>112.00</td>
<td>288.00</td>
<td>14.05</td>
</tr>
<tr>
<td>1974-75</td>
<td>165.00</td>
<td>20.00</td>
<td>124.00</td>
<td>309.00</td>
<td>7.29</td>
</tr>
<tr>
<td>1975-76</td>
<td>180.00</td>
<td>25.00</td>
<td>140.00</td>
<td>345.00</td>
<td>11.65</td>
</tr>
<tr>
<td>1976-77</td>
<td>193.00</td>
<td>29.00</td>
<td>152.00</td>
<td>374.00</td>
<td>8.41</td>
</tr>
<tr>
<td>1977-78</td>
<td>200.00</td>
<td>35.00</td>
<td>165.00</td>
<td>400.00</td>
<td>6.95</td>
</tr>
<tr>
<td>1978-79</td>
<td>250.00</td>
<td>40.00</td>
<td>180.00</td>
<td>425.00</td>
<td>6.25</td>
</tr>
<tr>
<td>1979-80</td>
<td>199.50</td>
<td>25.20</td>
<td>180.00</td>
<td>404.90</td>
<td>-4.73</td>
</tr>
<tr>
<td>1980-81</td>
<td>216.00</td>
<td>59.00</td>
<td>180.00</td>
<td>455.00</td>
<td>12.31</td>
</tr>
<tr>
<td>1981-82</td>
<td>229.00</td>
<td>44.00</td>
<td>178.00</td>
<td>451.00</td>
<td>-0.88</td>
</tr>
<tr>
<td>1982-83</td>
<td>235.00</td>
<td>50.34</td>
<td>188.16</td>
<td>473.72</td>
<td>5.04</td>
</tr>
<tr>
<td>1983-84</td>
<td>243.85</td>
<td>57.25</td>
<td>175.20</td>
<td>475.30</td>
<td>0.33</td>
</tr>
</tbody>
</table>


The table depicts that there was a tremendous increase in the area under HYV between 1968-69 and 1983-84. However, while as the area under HYV paddy increased from 114.93 thousand hectares in 1968-69 to 243.85 thousand hectares in 1983-84, the percentage it constituted of the total area under HYV’s had decreased from 74.93% in the base year to 51.09% in 1983-84. There was an increase in the contribution of wheat and maize to the area under HYV. This trend can be explained on the basis of the fact; that the state of Jammu and Kashmir had dearth of the HYV strains of paddy suitable to the climatic conditions of the valley; that the HYVs used in Punjab could successfully be
used in the Jammu region which was predominately wheat cultivating—needless to say that *Green Revolution* in India in true sense was *wheat revolution*. The marginal increase in the area under HYV in case of maize in comparison to other two major cereals was that maize was mostly cultivated under un-irrigated conditions—though with adequate irrigation it was known to be as responsive to fertilizers as the other two cereals. 65 This was one of the factors which prohibited the state from witnessing the so called green revolution in case of maize. The area under HYVs of principal crops had gone upto 4.50 lakh hectares during 1989-90. 66

**Use of Fertilizers**

The Kashmiri cultivators have been considered fortunate in that they have possessed large varieties of manures. All the dung from animals like sheep, cattle and horses, especially dropped during winter, was collected and preserved for the fields. The dung particularly that of cattle was more efficacious as in Kashmir cattle used to receive oilcakes during the winter. 67 Apart from the yearly farmyard manure and animal dung, fresh earthen clods were also cut from the sides of watercourses which were rich in silt and enriched the soil for years 68. Moreover, the value of night soil was thoroughly understood and green manuring was unconsciously practised in as much as the weeds which grew in the fields were rapidly ploughed in when land was prepared for the spring crops 69. The use of inorganic fertilizers in Kashmir agriculture before 1950s was absolutely meagre. 70

Though the use of fertilizers [inorganic] was introduced in the state during the First Five Year Plan (1951-56), 71 but upto the end of the first three Five Year Plans the use of chemical fertilizers was low, because the cultivators

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65 M. K. Dhar, op. cit., p. 45.  
67 Lawrence, op. cit., p. 331.  
68 Ibid. pp. 67-68.  
69 Lawrence, op. cit., p. 322.  
70 Gupta and Singh, op. cit., P. 214.  
were slow to use them. This was because of the fact that the use of chemical fertilizers by the cultivator besides other things, was subject to the availability of easy credit facilities which, however, were not available to him.\textsuperscript{72} It was only after 1962 that the state government in Jammu and Kashmir in pursuance of the recommendations of the \textit{All India Rural Credit Committee 1961-62} started financing the agricultural operations in the state—short term loans for the purchase of seeds, fertilizers and pesticides etc. and long term loans for the purchase of machinery etc. were started.\textsuperscript{73} The total quantity of fertilizers distributed in the state amounted to 2,108 tons in the first plan, 11,287 tonnes in the second plan and 28,351 tonnes in the Third Plan.\textsuperscript{74}

The use of chemical fertilizers had a promising start after mid-sixties with the introduction of new agricultural strategy also referred to as Seed-Water-Fertilizer technology -most of the new varieties required complementary inputs in the form of artificial fertilizers and assured irrigation in order to attain potential yields.\textsuperscript{75}

\textsuperscript{72} Institutional credit system in the state was almost unknown. For more details see the recommendations of the \textit{All India Rural credit Committee Report}.
\textsuperscript{73} See recommendations of the \textit{All India Rural Credit Committee Report}, Government of India.
\textsuperscript{75} Frank Ellis, op. cit., pp. 226-29.
The distribution of inorganic fertilizers in the state from 1970-71 to 1986-87 is shown as under:

Table 3.5
Distribution of fertilizers

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-71</td>
<td>5.42</td>
<td>3.84</td>
<td>1.27</td>
<td>0.31</td>
</tr>
<tr>
<td>1971-72</td>
<td>5.71</td>
<td>4.50</td>
<td>0.90</td>
<td>0.31</td>
</tr>
<tr>
<td>1972-73</td>
<td>10.66</td>
<td>8.21</td>
<td>1.72</td>
<td>0.73</td>
</tr>
<tr>
<td>1973-74</td>
<td>11.94</td>
<td>8.71</td>
<td>2.31</td>
<td>0.92</td>
</tr>
<tr>
<td>1974-75</td>
<td>7.18</td>
<td>5.81</td>
<td>1.07</td>
<td>0.30</td>
</tr>
<tr>
<td>1975-76</td>
<td>9.42</td>
<td>7.82</td>
<td>1.28</td>
<td>0.32</td>
</tr>
<tr>
<td>1976-77</td>
<td>12.08</td>
<td>9.90</td>
<td>1.80</td>
<td>0.38</td>
</tr>
<tr>
<td>1977-78</td>
<td>15.38</td>
<td>11.64</td>
<td>3.24</td>
<td>0.50</td>
</tr>
<tr>
<td>1978-79</td>
<td>17.17</td>
<td>13.40</td>
<td>3.30</td>
<td>0.47</td>
</tr>
<tr>
<td>1979-80</td>
<td>21.23</td>
<td>16.11</td>
<td>4.32</td>
<td>0.80</td>
</tr>
<tr>
<td>1980-81</td>
<td>21.50</td>
<td>16.41</td>
<td>4.08</td>
<td>1.01</td>
</tr>
<tr>
<td>1981-82</td>
<td>24.00</td>
<td>18.00</td>
<td>5.00</td>
<td>1.00</td>
</tr>
<tr>
<td>1982-83</td>
<td>25.18</td>
<td>18.91</td>
<td>5.27</td>
<td>1.00</td>
</tr>
<tr>
<td>1983-84</td>
<td>25.24</td>
<td>19.63</td>
<td>4.55</td>
<td>1.06</td>
</tr>
<tr>
<td>1984-85</td>
<td>28.67</td>
<td>21.71</td>
<td>5.62</td>
<td>1.34</td>
</tr>
<tr>
<td>1985-86</td>
<td>34.19</td>
<td>25.02</td>
<td>7.42</td>
<td>1.75</td>
</tr>
<tr>
<td>1986-87</td>
<td>30.43</td>
<td>22.67</td>
<td>6.53</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Source: Different Issues of the Digest of Statistics, Directorate of Economic and Planning.

The table given above depicts that there was a tremendous increase in the distribution of chemical fertilizers since 1970-71. A multitude of factors viz. subsidies, tenancy securities, and credit facilities, were responsible for this substantial increase in the distribution of chemical fertilizers. The consumption
of fertilizers in the state, however, remained very low as compared to the other states of India. The average quantity of NPK [Nitrogen-Phosphorus-Potassium] used in the state in the year 1970-71 was 5.67 kg/acre against 13.75 kg/acre in West Godawari (AP), 40 kg/acre in Kerala and 20kgs/acre Mandya.\(^{76}\) Here it is of utmost importance to mention that besides market factors like supply and price, the consumption of chemical fertilizers was also determined by the peasant discourse on agriculture. Most of the cultivators believed that the HYV seeds would render the soil weak in the long run and affect farming. They also believed that the taste of the food had declined as a result of the application of fertilizers\(^{77}\). Nevertheless, ‘a disquieting feature of fertilizer consumption in the state was that the distribution was taken as proxy for actual consumption’. Most of the fertilizers were used for vegetables and orchards and therefore, there had been only a misleading picture of crop wise consumption of fertilizers\(^{78}\).

### Use of Modern Tools and Implements

Besides seeds, fertilizers, and plant protection chemicals -pesticides and weedicides- improved agricultural implements constitute one of the basic tools for cultivation on scientific lines. In fact agricultural mechanization implies the use of various power sources and improved farm tools and equipments, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and timelines of efficiency of utilisation of various crop inputs and reduce the losses at different stages of crop production.


\(^{77}\) This information is based on the researcher’s discussions with the peasant community, across the length and breadth of the valley. During the field survey it was found that the peasants, by and large had the same perception towards the application of new inputs especially fertilizers. It would not be out of place to mention here that in some areas the peasants had resisted the supply of fertilizers. In Shopian, which is presently the commercial agricultural hub of the state, the peasants had to be strongly motivated and at times intimated to use fertilizers (Information is based on the researcher’s interaction with a close relative of Late Aman Ullah Kar, Director Agriculture Kashmir)

In Kashmir the agricultural operations had been labour intensive and were, largely, performed manually. The age-old agricultural implements of Kashmir were few and simple. For tilling light plough preferably made up of the wood of apple or mulberry was used, the use of iron remained confined to the tip of the ploughshare\textsuperscript{79}. Usually a wooden mallet was used to break the clods but at times a log of wood drawn over the furrows by bullocks, with the driver standing on the log was also used to break the clods.\textsuperscript{80} A wooden spade with narrow face and tipped with iron was used to dig out turf clods and for preparing the fields for irrigation\textsuperscript{81}. A small hand hoe was used to extract weeds and loosen the soil especially in case of maize and cotton crops\textsuperscript{82}. Pestle and mortar were used for husking rice and pounding maize. For the making of these implements, there were two special occupation groups, the blacksmiths who provided and fitted iron on the implements and the carpenters who designed the wood being provided to them by the cultivator. These occupational groups used to get a part of the cultivator’s produce either at the time of the harvest or at the threshing time, a practice similar to the Jagmani system of India.

Notwithstanding that the rate and pattern of mechanization is governed substantially by an economy’s land and labour endowments, the non-agricultural demand for labour, and the demand for agricultural products\textsuperscript{83} but in case of Kashmir the topography had been an important limiting factor on the mechanization of the agriculture. However, since the end objective of farm mechanization is to enhance the overall productivity and production with the lowest cost of production, therefore, from the very beginning the policy of the new state government was to promote the use of those improved agricultural implements which could be operated throughout the length and breadth of the state. Consequently, some of the agricultural implements imported into the

\textsuperscript{79} Lawrence, op. cit., p. 324.

\textsuperscript{80} Lawrence, op. cit., pp. 324-325

\textsuperscript{81} Ibid.

\textsuperscript{82} Ibid.

state were exempted from custom duties in 1952. Furthermore, in order to replace the age old agricultural implements by the improved ones, the state conducted a large scale demonstration of improved agricultural implements in different districts of the state. Schemes of training the village artisans were implemented and at least one artisan per panchayat was made to attend workshops organised by the state to get a knowhow of the manufacturing, replacement and repairment of improved agricultural implements.

No doubt large scale mechanization of the state agriculture was not possible on account of the topographical factors but nevertheless, the state also lagged behind in the use of those machines which could have been used comfortably within the state. In 1961 the number of tractors and irrigation pumps used in the state was 132 and 85 respectively whereas the corresponding number for Punjab was 7866 and 8524 respectively. Also while as the density of tractors in Punjab was, 7.407 per 1000 hectare it was only 0.5773 per 1000 hectare in the state of Jammu and Kashmir. Besides topographical constraints a number of other factors were responsible for the poor mechanization of the state agriculture which included low land-labour ratio, low cropping intensity, and the costliness and scale bias of the mechanical innovations which made them accessible to large farmers only. However, from the late 1960s the benefits of mechanical innovations in agriculture were quite visible in the state of Punjab where the bio-chemical innovations— the new seeds had shorter maturation period and made the cultivation of two or three crops possible in a

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84 Heavy custom duties, about 30% on like tillers, storage hoes with or without discs, sub-soilers and potato soilers were imposed in the state.
87 Ibid. pp. 30-32.
88 The state of Jammu and Kashmir had Low Land-Labour Ratio on account of the fact that agriculture was the predominant occupation of the state. Moreover, because of climatic constraints the cropping intensity was also low- the valley was predominately monocropic; Also see also Biswanga, Mechanization of Agriculture: A Historical Perspective; and Terene J. Byres, op. cit.,
year– had tremendously increased the cropping intensity and had made it compulsory for the cultivator to quickly complete harvesting so that the land could be prepared for the next crop.\textsuperscript{89} Besides other machines tractors played a key role in it.

The government of Jammu and Kashmir realised the importance of tractor, as the topography of the good part of the state was conducive for its use in increasing production and started a tractor hiring organization which was later on brought under the preview of the Agro-Industries Development Corporation\textsuperscript{90}. The main aim of the organization was to make the reach of tractor possible to the poorest strata of the agricultural community. The corporation started with only 40 tractors in 1970 and the number of tractors increased to 113 in 1971-72, thereby, enabling the poor farmers to use them, which otherwise was an expensive affair for him.\textsuperscript{91} About 40000 acres of land were tractorised by the corporation during the year 1972-73 whereas it was only

\textsuperscript{89} Terrene J Byres, op. cit., p. 23

\textsuperscript{90} To provide broad-base technological services to the farmers by efficient supply of inputs including agricultural tools, implements and machinery and for extending custom hiring facilities, the government of India, through a centrally sponsored scheme promoted the establishment of 17 State Agro Industries Corporations (SAICs), one each in the major States of the country as joint ventures during 1965-70. The broad objectives in setting up of these corporations were:

- Manufacture and distribution of agricultural machinery improved implements, tools etc.
- To help persons engaged in agricultural and allied pursuits to own the means of modernising their operations and making available necessary custom services for these purposes. Undertaking and assisting in the efficient distribution of inputs for agriculture.
- Promotion and setting up of Industries having a bearing on production, preservation and processing of agricultural products.
- Providing technical guidance to farmers and persons concerned with Agro-Industries, with a view to enabling them efficient management of their enterprises. In line with the above objectives, these corporations were not only allowed to augment their requirement by import of agricultural machinery but also two corporations in the States of Uttar Pradesh and Haryana set up tractor assembly plants and supplying them to all States and Union Territories in the country. The initial role played by these corporations has been primarily responsible for development of the infrastructural facilities in the States at district and subdivision levels. These Corporations also played a major role in supplying imported agricultural machines at reasonable prices and in building up the stock of spare parts and supplying the same to the users at competitive price throughout the respective States.

6000 during the year 1971-72\textsuperscript{92}. Appreciating the efforts of the corporation the Development review committee 1975 remarked: ‘Tractors have become popular with private farmers. The state Agro-Industries development corporation is running a tractor hiring service. These efforts should be supplemented with the introduction of power tillers. The government should take steps to promote the introduction of this convenient and cheap source of farm power by means of a suitable subsidy, arranging supply, providing service facilities both in the private and public sector, and if necessary a custom-hiring service’. Notwithstanding that tractors were widely used in the paddy farms but there is no denying that besides the tilling and levelling of land, tractor in Kashmir performed a number of other activities. It released a considerable drought force and human force from the agricultural practices and by virtue of its superior capacity to plough heavy soils, to work on difficult and uneven terrains, to drain swampy lands etc., it played a key role in bringing previously unutilized lands under cultivation. The negative aspect of this otherwise very progressive mechanical innovation was that the cultivators instead of using the tractors to develop their own land moved out to grab the different categories of land specified under common property resources most of the land brought under cultivation was Grazing land, Shamilat land and other categories of common property resources affecting the rearing of animals thereby, decreasing the production of milk mutton etc.

\textsuperscript{92} Ibid.
The following table shows the number of tractors used for agriculture in the state of Jammu and Kashmir:

### Table 3.6
**Number of Tractors used in Agriculture**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Tractors</th>
<th>Year</th>
<th>Number of Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974-75</td>
<td>710</td>
<td>1990-91</td>
<td>3458</td>
</tr>
<tr>
<td>1978-79</td>
<td>1052</td>
<td>1995-96</td>
<td>5295</td>
</tr>
<tr>
<td>1980-81</td>
<td>1508</td>
<td>1996-97</td>
<td>5765</td>
</tr>
<tr>
<td>1985-86</td>
<td>2330</td>
<td>1997-98</td>
<td>6272</td>
</tr>
</tbody>
</table>

**Source:** Digest of Statistics- Different Issues, Directorate of Economics and Statistics, J&K

Though the table clearly depicts that the number of tractors in absolute number have greatly increased since 1970s but in comparison to other states of India especially Punjab the change was insignificant.º

In order to have true picture of the degree of mechanization of the agriculture of the state it is equally important to know the position of the use of other agricultural implements Viz. ploughs, irrigation pumps etc. the following table depicts the position of agricultural implements used in the state:

### Table 3.7
**Number of Implements used**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ploughs</td>
<td>638942</td>
<td>652592</td>
<td>809773</td>
<td>987311</td>
<td>1075454</td>
<td>760457</td>
</tr>
<tr>
<td>Chaff cutters</td>
<td>19418</td>
<td>28961</td>
<td>NA</td>
<td>65644</td>
<td>83890</td>
<td>103963</td>
</tr>
<tr>
<td>Pruning Scissors</td>
<td>12696</td>
<td>23477</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Orchard ladders</td>
<td>1871</td>
<td>4163</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Diesel and Electric Driven pumps</td>
<td>451</td>
<td>881</td>
<td>NA</td>
<td>2894</td>
<td>3678</td>
<td>7915</td>
</tr>
<tr>
<td>Paddy Thrashers</td>
<td>196</td>
<td>169</td>
<td>104</td>
<td>200</td>
<td>156</td>
<td>664</td>
</tr>
<tr>
<td>Wheat thrashers</td>
<td>129</td>
<td>699</td>
<td>1062</td>
<td>2506</td>
<td>987</td>
<td>1061</td>
</tr>
<tr>
<td>Maize Shellers</td>
<td>32</td>
<td>NA</td>
<td>159</td>
<td>33</td>
<td>35</td>
<td>149</td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>NA</td>
<td>159</td>
<td>33</td>
<td>35</td>
<td>149</td>
</tr>
</tbody>
</table>

**Source:** Live-Stock Censuses, Jammu and Kashmir

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Even in 1962 the number of tractors in operation in Punjab was more than 40000, Terene. J. Byres, op. cit.
The table clearly shows that there was an appreciable increase in the number of capital intensive implements like Diesel and electric driven pumps, and paddy and wheat thrashers since 1970; however, in absolute terms this was too little a change to be called mechanization. The agriculture of the state continued to be dominated by ploughs which suggests that drought animals continued to be used on a large scale in the hilly areas of the state. It also becomes clear that with the adoption of new technology the use of improved machinery had not come into force on a large scale except in apple farms.\(^{94}\) Here it needs to be emphasised that most of the mechanizations are subject to genuine economics of scale: it is technically more efficient to design a large than a small machine,\(^{95}\) therefore, it can safely be argued that the lack of mechanization in the state had been the result of small holding size and large scale fragmentation and economic conditions of the farmers.

It is therefore, not astonishing to see the state agricultural university taking initiative of manufacturing region specific implements. In this connection the university manufactured an iron plough which became popular as Shalimar plough. The adaptability of the improved implements was guided by economy and convenience.

**Impact of Technological Changes**

Notwithstanding that the agrarian structure of the state of Jammu and Kashmir on eve of the introduction of new technologies was far less skewed than in the rest of India - land distribution in Kashmir was much favourable as the land reforms in Kashmir were far more radical than elsewhere in India - but nevertheless, the impact of the new technological changes in the state was not as path-breaking as it was in other states of India especially Punjab. A multitude of factors viz. dearth of location specific HYV seeds, low consumption level of fertilizers, lack of awareness of the cultivator regarding

\(^{94}\) Nisar Ali, op. cit., p. 100.
\(^{95}\) Hans Binswanger, op. cit., p. 36.
the requirements of the new seeds etc were responsible for the slow rate of success of the new technologies. Despite these limitations, however, the new technologies made an impact on the agriculture of the state. Besides other things the cumulative impact of the new technologies -both biochemical and mechanical- on Kashmir agriculture can be analysed on the basis of their impact on production and productivity of food grains\textsuperscript{96}, changes in cropping pattern and effects on rural income distribution.

During the early period of the introduction of new technologies the state had not been able to make any major breakthrough in agriculture. The state continued to import food grains and \( \frac{2}{3} \) rd of the cropped area continued to produce only one crop in a year\textsuperscript{97}. Notwithstanding that the total acreage under the HYV seeds increased from 3.09 lakh acres\textsuperscript{98} in 1968-69 to 7.2 lakh acres during the last year of the 4\textsuperscript{th} Five Year Plan i.e. 1973-74, thereby, bringing about 40% of the total land area under food cereals under the HYV programme, comprising of about 69% paddy, 60% wheat and 6% maize land,\textsuperscript{99} but the production of food remained more or less constant. The production of food during the fourth plan is shown as under:

\begin{table}[h]
\begin{center}
\begin{tabular}{|c|c|c|c|c|c|}
\hline
Year & Rice [Lakh Qtls.] & Wheat & Maize & Other & Total [Lakh Qtls.] \\
\hline
1969-70 & 48.21 & 11.07 & 36.30 & 2.36 & 97.94 \\
1970-71 & 39.69 & 12.38 & 38.00 & 2.67 & 92.74 \\
1971-72 & 37.01 & 16.76 & 36.33 & 2.80 & 92.90 \\
1972-73 & 34.27 & 17.40 & 38.03 & 2.86 & 92.56 \\
1973-74 & 46.01 & 16.09 & 31.58 & 2.86 & 96.54 \\
\hline
\end{tabular}
\end{center}
\caption{Production of Food Grains during the Fourth Plan}
\end{table}

\textbf{Source:} 4\textsuperscript{th} Five Year Plan: A Review, Department of Planning, J&K.

\textsuperscript{96} The new technologies remained almost confined to certain food grains like wheat, rice and maize.


\textsuperscript{98} N. S. Gupta, p. 246.

The above table depicts that the production of paddy and maize decreased during the plan while that of wheat increased. It is interesting to note that while as the production of wheat had increased by about 45% between the years 1969 and 1973, the area under the same crop had increased only by 5%\(^{100}\). Moreover, not only did the production of paddy and maize decrease under the plan but their productivity [yield/acre] also declined. The yield rates of the three principal crops of the state between 1968-69 and 1973-74 are shown as under:

**Table 3.9**

**Average yield rate of Rice, Wheat and Maize**

<table>
<thead>
<tr>
<th>Year</th>
<th>Rice</th>
<th>Maize</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-69</td>
<td>18.86</td>
<td>13.32</td>
<td>6.30</td>
</tr>
<tr>
<td>1969-70</td>
<td>19.98</td>
<td>14.16</td>
<td>6.06</td>
</tr>
<tr>
<td>1970-71</td>
<td>17.85</td>
<td>14.11</td>
<td>6.79</td>
</tr>
<tr>
<td>1971-72</td>
<td>17.39</td>
<td>12.87</td>
<td>9.42</td>
</tr>
<tr>
<td>1973-74</td>
<td>19.40</td>
<td>11.82</td>
<td>8.48</td>
</tr>
</tbody>
</table>

**Source:** Development Review Committee, 1975, pp. 3-4.

Though the yield rate of rice was flatteringly higher than the all India average of 10.7 quintals/hectare and one of the highest amongst the various states of India\(^{101}\), its stagnation, however, questioned the utility of the new technology to the agriculture of the state\(^{102}\).

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\(^{102}\) It was difficult to appreciate a situation where rice and maize production was apparently insensitive to large inputs of fertilizers, high yielding seeds, credit, improved agricultural implements and improved farm practices etc.
The lack of improvement in the productivity and production of the food crops was primarily because of the inability of the cultivator to simultaneously bring all the land that had been brought under the HYV programme under assured irrigation, which happened to be the pre-requisites for the proper functioning of the new varieties. The percentage of area irrigated to the area sown in 1973-74 was only 43.83% which substantiates the above argument. It was for this reason that the development of irrigation infrastructure received fresh attention in the state and large scale projects were taken up.

In the later years the introduction of more location specific HYV seeds, use of fertilizers and provisions of assured irrigation gave some boost to agricultural growth in the state. The gains were reflected in the increases in the yield rates of important food and non-food crops. The average food grain production in 1980s was 31.68% more than average food production in 1970s.103 Nevertheless, the productivity of rice and maize in Kashmir had increased from 22.13 [Qtls/hectare], 7.92, in 1974-75 respectively to 26.88, 12.22 in 1985-86 and to 26.83, 12.40 in 1990-91 respectively.104 The yield of wheat in the state also increased from 10.19Q/h in 1974-75 to 12.14 in 1985-86 and to 12.22 in 199-91.105 Here it is important to mention that the increase in production in irrigated belts was not clearly felt because of the low yield per acre in the rain-fed belts. Although the productivity witnessed steady increase, hence increasing the production, but the increase in production of food grains could not keep pace with the population growth rate and the gulf between food grain requirement and production widened. This resulted in the continued dependence of the

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103 The average food production during 1970s is compared with averages of food production during 1980’s to eliminate the effects of vagaries of weather on production.
104 The trend is based on the data shown in the Digest of Statistics, 2004, Directorate of Economics and Statistics.
105 Notwithstanding this minor no-good improvement in rice, almost all other major crops have faced reversal in production. The average yield of maize was 15.11 Q/Ha during 1964-65 and ironically it stands at 14.13 Q/Ha in 2005-06. The total production of cereals and millets during 1964-65 was 4 lakh quintals and in 2005-06 it has fell to 2 lakh quintals in the state. For pulses the total production was 2.5 lakh quintals and the figure fell to 1.35 quintals in 2005-06. Experts argue that there has been no Green Revolution till date in Kashmir. "The State has always remained food deficit due to lethargic State machinery and uninterested centre," said an agricultural scientist, pleading anonymity.
state on other states for the import of large quantities of food. It is equally important to mention that the conversion of land under cereal crops into non-cereals and the shrinkage of productive areas through rapid urbanization further aggravated the problems thereby, making it virtually impossible for the state to achieve the target levels of food production. Furthermore, the new technology had no programme for the agricultural development of those regions which were rain-fed, 40% of the valley falls in the rain-fed zone. Another shortcoming of the new technology in Kashmir was the inability of the state to adopt paddy-wheat rotation due to un-availability of suitable varieties that could be fit in the rotation.

It is widely accepted that the technological changes in agriculture had led to more skewed income distribution in most of the states of India especially Punjab. The Green Revolution technology, being capital intensive, suited rich farmers much better than small and marginal farmers because the rich farmer alone had adequate resources to afford that technology of production, and that expensive inputs were within the reach of only more affluent farmer; therefore, the latter was better placed to derive its benefits. However, owing to transformation of land relations via land reforms and other institutional changes the income distribution had not been that skewed in the state of Jammu and Kashmir. Although the degrees of acceptability of the new technologies vary from cultivator to cultivator, depending upon the level of exposure, access to other complacent outputs especially fertilizers, and credit facilities but in case of Kashmir, the size/scale neutrality characteristic of the technologies played key role in spreading the technologies to all categories of the farmers- small, marginal and large. Nevertheless, the overall yield-rates as well as productivity per acre were not in any way positively correlated to farm-

106 The production and requirement of food grains in 1950-51 was 206.30 and 307 thousand tons respectively whereas the same was 486.92 and 559.05 thousand tons in 1980-81. Thus there was a deficiency of about 23 thousand tones which had to be met through imports. One Day workshop on Agriculture renewal in temperate and Cold Arid Regions of Jammu and Kashmir, op. cit., p. 15.

107 M. L. Misri, op. cit., P. 245.
The gains of the new agricultural strategy were found to be size neutral. It was observed that the new technology instead of increasing inequality led to the overall decline of the same among the progressive farmers. The inequality in farm income distribution, if any, was in line with the inequality in farm size distribution.

Since the technological changes made agriculture capital intensive, therefore, the cultivator was forced to cultivate remunerative crops. More acreage was brought under crops like Apple, saffron, vegetables and lately under black Zeera. The impact of technological changes on the cropping pattern of the state is discussed in chapter 4. It is important to mention that the new technology helped in creating conducive conditions for double cropping but the traditional rotation of crops in which a soil exhaustive crop used to be followed by a soil enriching crop had also been given up.

Analysis of the material costs i.e., expenditure on seeds, manure and fertilisers, maintenance of bullocks, diesel and electricity, repair and maintenance of implements) has shown that in all the three regions, expenditure on material inputs per acre of cropped area was inversely related to farm-size. This is likely to create an impression that green revolution measures/inputs have truly benefited the small and marginal farmers more than the rich.