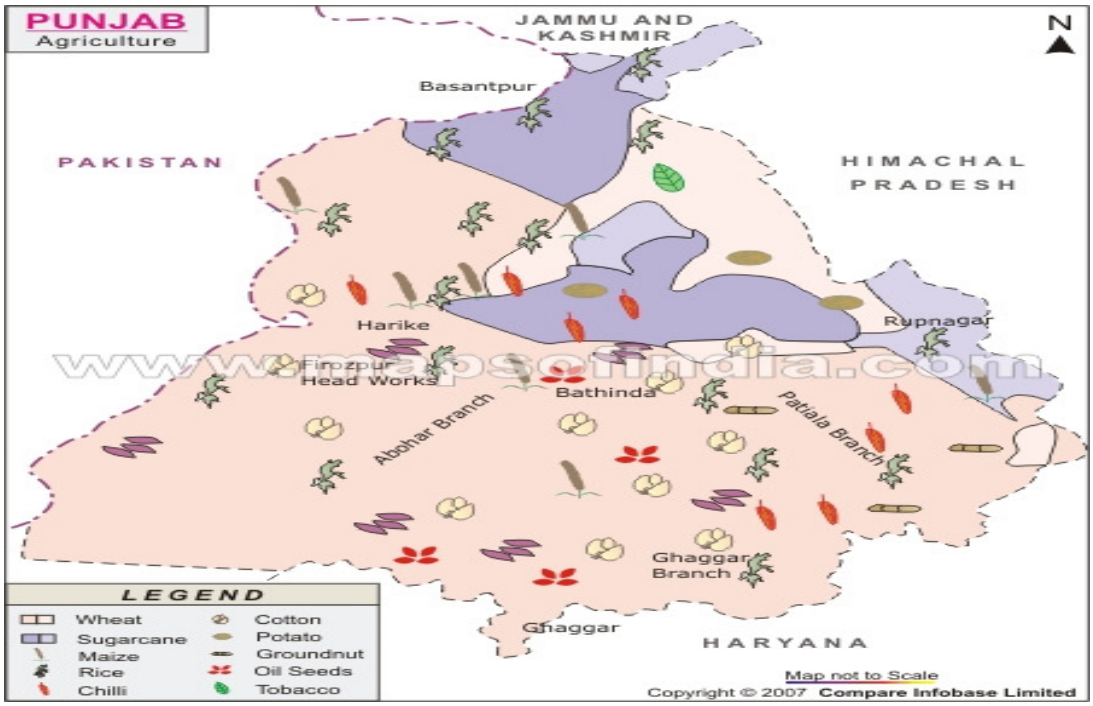
AERC STUDY No. 30

STATE AGRICULTURAL PROFILE – PUNJAB



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PREFACE

The present report has been prepared by Agro Economic Research Centre, Ludhiana to update the information on various performance related indicators of agricultural sector in Punjab, encompassing state population, demography, structure, performance, natural resources management, farm input management, area, production and yield of major crops, status of agricultural research, education and extension, animal husbandry, dairying, fisheries, post harvest management and value addition etc. The Uniqueness of this report is that it contains recent updated trends based on time series data on various socio-economic parameters in the state. This document would serves as a ready - reckener as well as an effective quantitative tool for reaching to logical conclusions in the context of planning and public policy making.

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Authors

Chapter 1

Population Demography and Economy

1.1 Introduction

Punjab holds place of pride among the Indian States for its outstanding achievements in agricultural development. The state has witnessed tremendous increase in the agricultural production during the Green Revolution period, mainly due to healthy mix of institutional and technological factors. Agrarian economy, consolidation of landholdings, reclamation of new agricultural lands, development of irrigation, use of biochemical inputs comprising high yielding variety seeds, chemical fertilizers, insecticides and mechanical inputs were among the important factors which helped Punjab agriculture in making rapid strides. Dominating rural based political power with agricultural background provided favorable environment through thrust on rural and agricultural development. In this context, extension of irrigation network, rural link roads, rural electrification, establishment of focal points and agricultural market centers, efficient delivery system of credit and other agricultural inputs along with effective implementation of agricultural price policy for wheat and paddy played significant role in agriculture and rural development of state. Consequently, the Punjab state comprising only 1.54 per cent of the total geographical area of country now contributes 13-14 per cent towards the total food grain production of the country. State has earned a name of granary of India through contributing 35-40 per cent of rice and 40 to 75 per cent of wheat to the central pool in the past two decades.

Green Revolution sustained till the eighties, after which the agricultural production in the state showed the signs of stagnation. In nineties, the exalting cost of cultivation of major crops further aggravated the situation through squeezing the profitability of agriculture adversely affecting the socio-economic condition of farmers in the state. Thus, the agriculture in state has reached a plateau making it very hard to make further progress under available technologies and natural resource base. Its relative contribution in central pool of food grains both for wheat and paddy has also been declining during last few years, though, still being the largest contributor of wheat and second largest of paddy after Andhra Pradesh to central pool of the country.

The emerging scene of Punjab agriculture is not free from some serious concerns. The state cropping pattern dominated by wheat-rice rotation is causing a serious damage to the state's

natural resource base. Paddy in particular, a water-intensive crop is blamed for water-table depletion in tube-well irrigated areas and water-logging in canal irrigated areas. Increasing incidence of nutrient deficiency in the soils, including micronutrients and insect-pest attacks on the crops are also posing major threats to productivity, food grain production and sustainability of agriculture in the long run. Diversification of cropping pattern towards environment friendly high value crops with emphasis on quality output and promotion of agro-processing industry is the need of hour.

The present study has been an attempt to update the information of the agricultural sector in Punjab state. For this available recent secondary data have been taken from various sources and interpreted.

1.2 Population

Total population of Punjab as per 2011 census is 27,704,236 of which male and female are 14,634,819 and 13,069,417 respectively (Table 1.1). In 2001, total population was 24,358,999 in which males were 12,985,045 while females were 11,373,954. The total population growth in this decade was 13.73 percent while in previous decade it was 20.10 per cent. The population of Punjab forms 2.29 percent of India in 2011. In 2001, the figure was 2.37 per cent. Literacy rate in Punjab has seen upward trend and is 76.68 percent as per 2011 population census. Of that, male literacy stands at 81.48 percent while female literacy is at 71.34 percent. In 2001, literacy rate in Punjab stood at 69.65 percent of which male and female were 75.23 percent and 63.36 percent literate, respectively. With total geographical area of Punjab at 50,362 sq. km the population density of Punjab is 550 per sq km which is higher than national average of 382 per sq km. In 2001, density of Punjab was 484 per sq km, while national average at that time was 324 per sq km. Sex Ratio of Punjab is 893 i.e. for each 1000 male, which is below national average of 940. In 2001, the sex ratio of female was 876 per 1000 males in Punjab. From 2001 to 2011, the share of rural population in the total population of state declined from 66.08 per cent to 62.51 per cent where as that of urban population increased from 33.92 per cent to 37.49 per cent (Table 1.2). During this time period the rural literacy rate increased from 64.7 per cent to 72.45 per cent and that of urban literacy from 79.1 per cent to 83.70 per cent (Population census, 2011).

Table 1.1: Population statistics of Punjab state

(Number)

Population	**2001**	**2011**
Total state population	24358999	27704236
Male population	12985045 (53.31)	14634819 (52.83)
Female population	11373954 (46.69)	13069417 (47.17)
Decennial population growth (%)	20.10	13.73
Percentage to the total population of India	2.37	2.29
Sex ratio	876	893
Population density/sq. km	484	550
Total child population (0-6 age)	3171829	2941570
Male child population	1763801	1593262
Female child population	1408028	1348308
Child sex ratio	798	846
Total literates	14756970	18988611
Male literates	8442293	10626788
Female literates	6314677	8361823
Literacy rate (%)	69.65	76.68
Male literacy rate (%)	75.23	81.48
Female literacy rate (%)	63.36	71.34

Source: Statistical Abstract, Punjab
***Literacy has been calculated after excluding 0-6 age group**
Figures in the parenthesis are percentages to the total population

Table 1.2: Description of rural and urban population in Punjab

(Number)

Population	**2001**		**2011**	
	Rural	**Urban**	**Rural**	**Urban**
Percentage to total population of the state	66.08	33.92	62.51	37.49
Rural/urban population	16096488	8262511	17316800	10387436
Male population	8516596	4468449	9086466	5548353
Female population	7579592	3794062	8230334	4839083
Sex ratio	890	849	906	872
Child population (0-6 age)	2176726	995103	1864484	1077086
Percentage child population	13.52	12.04	10.77	10.37
Child sex ratio	799	796	843	851
Total literates	9008631	5748239	11195395	7793216
Literacy rate of the state (%)	64.7	79.1	72.45	83.70
Male literacy rate (%)	71.0	83.0	77.92	87.28
Female literacy rate (%)	57.5	75.5	66.47	79.62

Source: Statistical Abstract, Punjab

1.3 Work force structure

With the advent of Green Revolution, Punjab has emerged as the most advanced state in agricultural development. Overtime, though agricultural sector experienced a decline in the importance in terms of its share in GSDP and work force, yet it remains the single most important sector of the state economy. As per 2001 census data, total workforce of state was 9127474, out of which 3554928 were dependent on agriculture and allied activities (Table 1.3). Cultivators and agricultural labours directly dependent on agriculture accounted for about 40 per cent of the total workforce of state. Out of the total agricultural work force cultivators and agricultural labours accounted for 58.09 and 41.91 per cent, respectively. Agriculture being the backbone of state economy, other major activities like agro-processing, transportation, trade, storage, etc. are directly or indirectly dependent on it. Thus, performance of agriculture sector

determines the scope and rate of development and employment in other sectors as well as overall state economy.

Table 1.3: Distribution of work force in Punjab

(Number)

Particulars	**1961**	**1971**	**1981**	**1991**	**2001**
Total cultivators	1602666	1665153	1767286	1917210	2099330
Total agri. Labour	334610	786705	1092225	1452828	1498976
Total agri. work force	1937276	2451858	2859511	3370038	3598306
Total work force	3466269	3912592	4927759	6098374	9141760
Share of workers engaged in agri. in total work force	55.89	62.67	58.03	55.26	39.36
Share of agri. labour in total agri. work force	17.27	32.09	38.20	43.11	41.66
Share of cultivators in total agri. work force	82.73	67.91	61.80	56.89	58.34
Share of agri. labour in total work force	9.65	20.11	22.16	23.82	16.40
Share of cultivators in total work force	46.24	42.56	35.86	31.44	22.96

Source: Statistical Abstract, Punjab

1.4 Overview of state economy

Economic activities in state are showing structural changes over a period of time and primary sector is experiencing a decline in terms of share in State Domestic Product (SDP). Sectoral distribution GSDP of Punjab state at current prices and constant prices (2004-05) along with percent distribution is presented through Tables 1.4 to 1.7. Table 1.4 revealed that GSDP of Punjab at constant prices (2004-05) has increased from Rs 123223 crore in 2007-08 to Rs 148069 crore in 2010-11. Overall economy of Punjab state has witnessed a growth rate of 5.85, 6.29 and 6.81 percent during 2008-09, 2009-10 and 2010-11, respectively. At constant prices (2004-05), the contribution of primary sector consisting of agricultural and allied activities towards GSDP has increased from Rs 34107 crore in 2007-08 to Rs 35740 crore in 2010-11. This sector had shown growth of 2.05 and 3.01 percent during 2008-09 and 2010-11, respectively. However, its growth was recorded marginally negative during year 2009-10.

Table 1.4: Gross state domestic product at factor cost by sectors in Punjab at constant (2004-05) prices

(Rs. Crore)

Sector	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Agriculture and livestock	32498.88	33113.53	32924.59	33907.71
Agriculture	21575.44	22155.18	22085.01	22905.55
Livestock	10923.44	10958.35	10839.58	11002.16
Forestry and logging	1298.49	1349.44	1402.55	1451.5
Fishing	282.12	308.89	338.96	350.32
Agriculture & allied	34079.49	34771.86	34666.1	35709.53
Mining and quarrying	27.27	33.32	28.31	30.1
Sub- total (Primary)	**34106.8**	**34805.2 (2.05)**	**34694.41 (-0.32)**	**35739.63 (3.01)**
Manufacturing	24121.68	24882.89	27878.64	30067.03
Registered	12920.46	13676.38	16009.5	17844.19
Un-registered	11201.22	11206.51	11869.14	12222.84
Construction	9550.01	10284.66	10720.47	11329.68
Electricity, Gas & water supply	4039.51	4135.73	4158.86	4324.44
Sub- total (Secondary)	**37711.2**	**39303.3 (4.22)**	**42757.97 (8.79)**	**45721.55 (6.93)**
Total industry	37738.47	39336.6	42786.28	45751.25
Transport, storage & communication	8122.16	8740.52	9389.6	10219.1
Railways	1434.23	1420.85	1428.5	1535.45
Transport & other means	3907.05	4130.02	4441.4	4751.29
Storage	410.35	414.88	419.37	429.41
Communication	2370.53	2774.77	3100.33	3502.95
Trade, Hotel & restaurants	13660.29	1495.69	15552.13	16225.54
Banking & insurance	7265.47	8249.06	9549.93	11421.31
Real estate, ownership of dwelling & business services	6311.49	6626.74	6891.63	7180.87
Public administration	5335.81	6167.65	6769.77	7311.35
Other services	10710.05	11583.64	13023.52	14249.95
Sub- total (Tertiary)	**51405.3**	**56322.3 (9.57)**	**61176.58 (8.62)**	**66608.13 (8.88)**
Gross state domestic product	**123223.2**	**130430.8 (5.85)**	**138628.96 (6.29)**	**148068.9 (6.81)**

Source: Statistical Abstract, Punjab

Figures in parenthesis are percent change over the previous year

Secondary sector mainly consisting of manufacturing, construction and power sectors has increased at rate of 4.22, 8.79 and 6.93 per cent during 2008-09, 2009-10 and 2010-11, respectively. In absolute terms, contribution of this sector in GSDP increased from Rs 37711 crore in 2007-08 to Rs 45722 crore in 2010-11. The contribution of tertiary sector of state comprising trade, transport, banking, insurance and public administration towards GSDP had increased from Rs 51405 crore in 2007-08 to Rs 66608 crore in 2010-11. Per annum increase in this sector was recorded at 9.57, 8.62 and 8.88 percent during 2008-09, 2009-10 and 2010-11, respectively.

The share of agriculture in GSDP at constant prices (2004-05), which was 17.51 percent during 2007-08 declined to 15.47 percent during 2010-11. During the same period, the share of overall primary sector including livestock, forestry, and allied agricultural activities along with agriculture declined from 27.66 percent to 24.12 percent. On the other hand, over this period while the share of secondary sector in GSDP remained almost constant at 31 per cent; that of tertiary sector increased from 41.72 per cent to 44.98 percent. At current prices the Per Capita Income in Punjab state increased from Rs 49380 in 2007-08 to Rs 68998 in 2010-11. At constant prices (2004-05) the Per Capita Income which was Rs 39567 during 2007-08 increased by 13.44 per cent to Rs 44885 in 2010-11 (Table 1.8).

Table 1.5: Percentage distribution of gross state domestic product at factor cost by sectors in Punjab at constant (2004-05) prices

Sector	2007-08	2008-09	2009-10	2010-11
Agriculture and livestock	26.37	25.39	23.75	22.90
Agriculture	17.51	16.99	15.93	15.47
Livestock	8.86	8.40	7.82	7.43
Forestry and logging	1.05	1.03	1.01	0.98
Fishing	0.23	0.24	0.24	0.24
Agriculture & allied	27.66	26.66	25.01	24.12
Mining and quarrying	0.02	0.03	0.02	0.02
Sub- total (Primary)	27.68	26.68	25.03	24.14
Manufacturing	19.58	19.08	20.11	20.31
Registered	10.49	10.49	11.55	12.05
Un-registered	9.09	8.59	8.56	8.25
Construction	7.75	7.89	7.73	7.65
Electricity, Gas & water supply	3.28	3.17	3.00	2.92
Sub- total (Secondary)	**30.60**	**30.13**	**30.84**	**30.88**
Total industry	30.63	30.16	30.86	30.90
Transport, storage & communication	6.59	6.70	6.77	6.90
Railways	1.16	1.09	1.03	1.04
Transport & other means	3.17	3.17	3.20	3.21
Storage	0.33	0.32	0.30	0.29
Communication	1.92	2.13	2.24	2.37
Trade, Hotel & restaurants	11.09	1.15	11.22	10.96
Banking & insurance	5.90	6.32	6.89	7.71
Real estate, ownership of dwelling & business services	5.12	5.08	4.97	4.85
Public administration	4.33	4.73	4.88	4.94
Other services	8.69	8.88	9.39	9.62
Sub- total (Tertiary)	**41.72**	**43.18**	**44.13**	**44.98**
Gross state domestic product	**100.00**	**100.00**	**100.00**	**100.00**

Source: Statistical Abstract, Punjab

Table 1.6: Gross state domestic product at factor cost by sectors in Punjab at current prices

(Rs. Crore)

Sector	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Agriculture and livestock	45625.84	52430.76	57429.55	63572.88
Agriculture	32041.47	37399.67	40658.06	44762.87
Livestock	13616.37	15031.09	16771.49	18810.01
Forestry and logging	1834.7	2731.02	4053.14	5547.12
Fishing	338.54	379.5	484.23	537.06
Agriculture & allied	47831.08	55541.28	61966.92	69657.06
Mining and quarrying	28.65	53.86	30.08	32.95
Sub- total (Primary)	**47859.7**	**55595.1 (16.16)**	**61997.00 (11.52)**	**69690 (12.41)**
Manufacturing	28336.15	29394.12	34383.97	37956.02
Registered	15559.96	16446.96	19702.12	22214.14
Un-registered	12776.19	13447.16	14681.85	15741.88
Construction	11615.61	13239.76	15208.15	16305.78
Electricity, Gas & water supply	3105.34	3562	4087.42	4313.05
Sub- total (Secondary)	**43057.1**	**46695.9 (8.45)**	**53679.54 (14.96)**	**58574.9 (9.12)**
Total industry	43085.8	46749.7	53709.62	58607.8
Transport, storage & communication	8846.25	9848.58	11629.19	13061.25
Railways	1635.81	1638.94	1846.56	1894.89
Transport & other means	4852.83	5513.6	6586.01	7567.79
Storage	422.1	430.27	512.86	534.64
Communication	1635.07	2265.77	2683.76	3063.93
Trade, Hotel & restaurants	18238.24	21315.25	23014.73	24797.01
Banking & insurance	6542.85	7753.36	8950.32	11607.75
Real estate, ownership of dwelling & business services	7968.16	9342.45	10907.23	12862.68
Public administration	6479.46	8146.47	9004.66	10538.33
Other services	13253.53	15342	19209.89	23842.94
Sub- total (Tertiary)	**61328.5**	**71748.1 (16.99)**	**82716.02 (15.29)**	**96710 (16.92)**
Gross state domestic product	**152245.3**	**174039.1 (14.31)**	**198392.56 (13.99)**	**224974.8 (13.40)**

Source: Statistical Abstract, Punjab
Figures in parenthesis are percent change over the previous year

Table 1.7: Percentage distribution of gross state domestic product at factor cost by sectors in Punjab at current Prices

Sector	2007-08	2008-09	2009-10	2010-11
Agriculture and livestock	29.97	30.13	28.95	28.26
Agriculture	21.05	21.49	20.49	19.89
Livestock	8.94	8.64	8.45	8.36
Forestry and logging	1.21	1.57	2.04	2.47
Fishing	0.22	0.22	0.24	0.24
Agriculture & allied	31.42	31.91	31.23	30.96
Mining and quarrying	0.02	0.03	0.02	0.01
Sub- total (Primary)	**31.44**	**31.94**	**31.25**	**30.98**
Manufacturing	18.61	16.89	17.33	16.87
Registered	10.22	9.45	9.93	9.87
Un-registered	8.39	7.73	7.40	7.00
Construction	7.63	7.61	7.67	7.25
Electricity, Gas & water supply	2.04	2.05	2.06	1.92
Sub- total (Secondary)	**28.28**	**26.83**	**27.06**	**26.04**
Total industry	28.30	26.86	27.07	26.05
Transport, storage & communication	5.81	5.66	5.86	5.81
Railways	1.07	0.94	0.93	0.84
Transport & other means	3.19	3.17	3.32	3.36
Storage	0.28	0.25	0.26	0.24
Communication	1.07	1.30	1.35	1.36
Trade, Hotel & restaurants	11.98	12.25	11.60	11.02
Banking & insurance	4.30	4.45	4.51	5.16
Real estate, ownership of dwelling & business services	5.23	5.37	5.50	5.72
Public administration	4.26	4.68	4.54	4.68
Other services	8.71	8.82	9.68	10.60
Sub- total (Tertiary)	**40.28**	**41.23**	**41.69**	**42.99**
Gross state domestic product	**100.00**	**100.00**	**100.00**	**100.00**

Source: Statistical Abstract, Punjab

Table 1.8: Per capita income in Punjab

(Rs/annum)

Year	At current prices	At constant prices (Base 2004-05)
2007-08	49380	39567
2008-09	55315	41003
2009-10 (P)	61894	42752
2010-11 (Q)	68998	44885

Source: Statistical Abstract, Punjab

P: Provisional, Q: Quick estimates

Chapter 2

Structure and Performance of Punjab Agriculture

In the wake of new technology, Punjab agriculture made rapid progress since mid sixties. This progress has been made possible by speedy adoption of improved seeds, irrigation and increased use of non-conventional inputs like fertilizers, machinery and pesticides supported by the natural resource base of state. The progress was spectacular in early phase due to rising agricultural productivity and expansion in gross cropped area. However, of late the progress in agricultural production has slowed down and signs of stagnation are visible. The changes in agrarian structure and agricultural growth performance of state are presented in this chapter.

2.1 Agrarian structure

Distribution of operational holdings, cropping patterns and proportionate share of each sub-sector in primary sector's contribution in Gross State Domestic Product (GSDP) determines the agrarian structure. The agrarian structure of Punjab state revealed by above said factors is discussed in this section as follows:

2.1.1 Operational holdings

The information on distribution of operational holdings in state of Punjab at two points of time viz. 2005-06 and 2010-11 is depicted in Table 2.1. The figure shows that the total operational holdings in state during the last five years period increased by 55 thousands from 10.03 lakh to 10.58 lakh. Point worth noting is the marginalization of holdings with proportionate increase in marginal and small farmers. The proportion of marginal and small holdings which was 13.36 and 18.25 per cent in 2005-06 increased to 15.50 and 18.53 per cent, respectively. On the other hand, the proportion of holdings in all other categories viz. semi-medium, medium and large had been declined during this period. Over this period the average holding size in state also went down from 3.95 ha to 3.78 ha.

Table 2.1: Distribution of operational holdings in Punjab

Size category	2005-06			2010-11(P)		
	Number (000)	Area (000,ha)	Average size of holding	Number (000)	Area (000,ha)	Average size of holding
Marginal (Below 1 ha)	134 (13.36)	83 (2.09)	0.62	164 (15.50)	101 (2.53)	0.62
Small (1-2 ha)	183 (18.25)	258 (6.51)	1.41	196 (18.53)	270 (6.76)	1.38
Semi-medium (2-4 ha)	319 (31.80)	855 (21.57)	2.68	327 (30.91)	862 (21.57)	2.64
Medium (4-10 ha)	296 (29.51)	1701 (42.91)	5.75	301 (28.45)	1728 (43.24)	5.74
Large (10 ha and above)	71 (7.08)	1067 (26.92)	15.03	70 (6.62)	1035 (25.90)	14.79
All holdings	1003 (100.00)	3964 (100.00)	3.95	1058 (100.00)	3996 (100.00)	3.78

Source: Statistical Abstract, Punjab; Figures in parentheses indicate percentage of total

2.1.2 Cropping pattern

The green revolution brought significant changes in the cropping pattern of Punjab. The cropping pattern in Punjab state at selected points over time is given in Table 2.2. The Table show that in 1970-71, about 40.49 per cent of the gross cropped area (GCA) was under wheat which increased to 44.31 per cent in 2007-08 and since then hovered around 44.50 per cent. Rice, which occupied around 6.87 per cent of the gross cropped area in 1970-71, increased to over 33.15 per cent in 2007-08, and then rose further to around 35.85 per cent in 2010-11. The increase in wheat cultivation has been at the cost of gram, rapeseed and mustard, while that of rice has been obtained by shifting the area from maize, groundnut, millets and cotton. The proportionate area under cotton in 1970-71 was 7 per cent of gross cropped area and increased to 9.34 per cent in 1990-91. After mid 1990s the area under cotton has been adversely affected due to inclement weather and pest attack, its share in GCA went down to 5.97 per cent in 2000-01. With introduction of Bt varieties area under cotton started increasing and rose to 7.69 per cent in 2007-08. In 2010-11, it accounted for 6.13 per cent of the GCA in state. Areas under sugarcane and potato have not remained stable. Respective share of pulses and oilseeds in GCA has recorded a sharp decline from 7.29 and 5.20 per cent in 1970-71 to 0.25 and 0.71 per cent in 2010-11. It can be concluded that imbalance in favour of two main cereals viz. rice and wheat in the cropping pattern has further sharpened despite all efforts on diversification of state

agriculture. This happened because of better relative profitability of these crops with minimum production and marketing risk as compared to other crops.

Table 2.2: Shift in cropping pattern in Punjab (1970-71 to 2010-11)

(Percent)

Crop	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11
Rice	6.87	17.49	26.86	32.89	33.15	34.57	35.58	35.85
Wheat	40.49	41.58	43.63	42.92	44.31	44.57	44.72	44.53
Cotton	6.99	9.60	9.34	5.97	7.69	6.66	6.49	6.13
Maize	9.77	5.65	2.51	2.08	1.96	1.91	1.76	1.69
Sugarcane	2.25	1.05	1.35	1.52	1.37	1.02	0.76	0.89
Potato	0.30	0.59	0.31	0.75	1.14	1.04	1.05	0.81
Pulses	7.29	5.04	1.91	0.68	0.34	0.28	0.24	0.25
Total foodgrains	69.18	68.82	75.55	79.05	80.03	81.58	82.52	82.52
Total oilseeds	5.20	3.52	1.32	1.01	0.76	0.76	0.79	0.71

Source: Statistical Abstract, Punjab

2.1.3 Relative share of different agricultural activities in primary sector

Sub-sectoral distribution GSDP from primary sector of state at current prices and constant prices (2004-05) along with percent contribution of each component from year 2007-08 onwards is presented through Tables 2.3 and 2.4. Table 2.3 reveals that during 2007-08, at constant prices, out of total share of primary sector in GSDP at Rs 34107 crore agriculture, livestock, forestry & lodging and fishing accounted for about Rs 21575, Rs 10923, Rs 1298 and Rs 282 crore, respectively. During 2010-11, out of total primary sector's contribution of GSDP at Rs 35739 crore, the respective share of above sub-sectors were at Rs 22906, Rs 11002, Rs 1452 and Rs 350 crore.

The collective per cent share of agriculture and livestock sub-sector in GSDP from primary sector at constant prices (2004-05), which was 95.29 percent during 2007-08 declined marginally to 94.87 percent during 2010-11. During this period while the contribution of agriculture in primary sector increased marginally from 63.26 per cent to 64.09 percent, the contribution of livestock decreased marginally from 32.03 per cent to 30.78 per cent. Over this

period, the respective contribution of forestry and fishing sub-sectors in overall primary sector of state went up marginally from 3.81 to 4.06 per cent and 0.83 to 0.98 per cent. Thus, while the from 2007-08 to 2010-11, the contribution of agriculture and allied activities in GSDP went down by almost 3 per cent, within agriculture sector there were only marginal changes in respective share of different components over this time period.

Table 2.3: Share of different primary sub-sectors in total primary sector (at constant prices), Punjab

(Rs. Crore)

Sector	2007-08	2008-09	2009-10	2010-11
Agriculture and livestock	32498.88 (95.29)	33113.53 (95.14)	32924.59 (94.90)	33907.71 (94.87)
Agriculture	21575.44 (63.26)	22155.18 (63.65)	22085.01 (63.66)	22905.55 (64.09)
Livestock	10923.44 (32.03)	10958.35 31.48	10839.58 31.24	11002.16 30.78
Forestry and logging	1298.49 (3.81)	1349.44 (3.88)	1402.55 (4.04)	1451.5 (4.06)
Fishing	282.12 (0.83)	308.89 (0.89)	338.96 (0.98)	350.32 (0.98)
Agriculture & allied	34079.49 (99.92)	34771.86 (99.90)	34666.1 (99.92)	35709.53 (99.92)
Mining and quarrying	27.27 (0.08)	33.32 (0.10)	28.31 (0.08)	30.1 (0.08)
Total primary	34106.76 (100.00)	34805.18 (100.00)	34694.41 (100.00)	35739.63 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses indicates per cent share in total primary sector

Table 2.4: Share of different primary sub-sectors in total primary sector (at current prices), Punjab

(Rs. Crore)

Sector	2007-08	2008-09	2009-10	2010-11
Agriculture and livestock	45625.84 (95.33)	52430.76 (94.31)	57429.55 (92.63)	63572.88 (91.22)
Agriculture	32041.47 (66.95)	37399.67 (67.27)	40658.06 (65.58)	44762.87 (64.23)
Livestock	13616.37 (28.45)	15031.09 (27.04)	16771.49 (27.05)	18810.01 (26.99)
Forestry and logging	1834.7 (3.83)	2731.02 (4.91)	4053.14 (6.54)	5547.12 (7.96)
Fishing	338.54 (0.71)	379.5 (0.68)	484.23 (0.78)	537.06 (0.77)
Agriculture & allied	47831.08 (99.94)	55541.28 (99.90)	61966.92 (99.95)	69657.06 (99.95)
Mining and quarrying	28.65 (0.06)	53.86 (0.10)	30.08 (0.05)	32.95 (0.05)
Total primary	47859.73 (100.00)	55595.14 (100.00)	61997 (100.00)	69690.01 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses indicates per cent share in total primary sector

2.2 Growth performance of Punjab agriculture

The progress made by agriculture in Punjab state is unparalleled in the history of world agriculture. The state which was deficit in food at the time of independence had made rapid strides in agricultural development. Dominating agrarian structure, consolidation of holdings, development of irrigation infrastructure and hard working peasantry led to the early progress. With adoption of new agricultural technology in mid sixties backed with adequate agricultural policies, the state turned surplus in food grains and became a model of India's successful green revolution strategy. Punjab state with only 1.5 per cent geographical area of the country besides feeding its growing population has been contributing 35-40 per cent of rice and 45-70 per cent wheat to the central pool since last two decades. Selected agricultural growth indicators of state are presented in Table 2.5 and 2.6. Table 2.5 reveals that between 1971-72 and 2010-11 the production of wheat in state has gone up by about three times from 5.62 million tonnes to 16.5 million tonnes. Similarly, production of rice another major crop of state, during this period

Table 2.5: Area, production and yield of different crops and milk production, 1971-72 to 2010-11, Punjab

Area: 000, ha.
Production: 000, metric tonnes
Yield: Kg/ha

Crop		1971-72	1981-82	1991-92	2001-02	2009-10	2010-11
Rice	Area	450	1269	2069	2487	2802	2826
	Production	920	3750	6739	8816	11236	10819
	Yield	2044	2955	3257	3545	4010	3828
Wheat	Area	2336	2914	3237	3420	3522	3510
	Production	5618	8544	12309	15499	15169	16472
	Yield	2405	2932	3803	4532	4307	4693
Maize	Area	548	340	176	165	139	133
	Production	857	625	345	449	475	491
	Yield	1564	1838	1962	2722	3414	3693
Cotton	Area	475	686	719	606	511	483
	Production	1030	1275	2505	1305	2006	1822
	Yield	369	316	592	366	667	641
Sugar cane	Area	103	104	109	142	60	70
	Production	403	601	693	925	370	417
	Yield	3913	5779	6358	6514	6167	5952
Potato	Area	17	33	31	57	74	64
	Production	222	635	617	1147	1918	1609
	Yield	13430	19419	19981	20054	25919	25141
Pulses	Area	384	325	90	49	18	20
	Production	302	161	75	30	16	17
	Yield	786	495	833	612	842	850
Total food Grains	Area	3915	4999	5638	6152	6498	6504
	Production	7925	13156	19632	23878	26947	27846
	Yield	2024	2632	3482	3881	4146	4281
Total oilseed	Area	319	225	141	83	62	56
	Production	272	173	127	84	84	73
	Yield	853	769	901	1012	1355	1304
Milk (Lakh tonnes)	Production	21.04	34.94	53.82	79.30	93.89	94.12

Source: Statistical Abstract, Punjab

Note: Production of sugarcane is in terms of gur
Cotton production is cleaned cotton and is in terms of thousand bales of 170 kgs each, Yield (lint kg/ha) Oilseeds does not include figure relating to non-edible oil seed e.g. Castor seeds

increased by about twelve times from 0.92 million tonnes to 10.8 million tonnes. Total food grain production over this period increased by more than three and half times. Yields of wheat, paddy and total food grains nearly doubled over this period of time. Besides, production of cotton, potato and milk during this period has been gone up by 1.76, 7.24 and 4.47 times, respectively. On the other hand, the production of pulses and oilseeds went down drastically over this period and that of sugarcane with some variations remained almost same. The reason of decline of production of these crops was the drastic decline of area under these crops due to encroachment by paddy and wheat. However, except pulses yields of these crops increased significantly during this time period (Table 2.6).

Table 2.6: Decade wise Compound Annual Growth Rates (CAGR) of major crops and milk production in Punjab

(Percent/annum)

Crop	1971-72 to1980-81			1981-82 to1990-91			1991-92 to 2000-01			2001-02 to 2010-11			1971-72 to 2010-11		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Rice	12.98***	17.70***	4.17***	4.85***	5.61***	0.73ns	2.72***	2.84***	0.12ns	1.24***	2.56***	1.29***	4.46***	5.94***	1.42***
Wheat	2.55***	5.02***	2.41***	0.97***	3.70***	2.71***	0.41*	2.54***	2.11***	0.40***	1.00**	0.60ns	1.02***	2.96***	1.93***
Maize	-4.60***	-4.03***	0.62ns	-5.72***	-7.08***	-1.41ns	-1.79**	1.57ns	3.42*	-1.73**	3.29*	4.81***	-3.87***	-1.70***	2.23***
Cotton	3.43***	1.62**	-1.74***	1.17ns	9.81**	8.53***	-3.58*	-11.17***	-7.87**	0.13ns	6.22*	6.08**	-0.22ns	1.37**	1.59***
Sugar-cane	-3.35*	-0.65ns	2.80**	0.95ns	0.78ns	-0.17ns	2.29ns	2.14ns	-0.15ns	-8.21***	-8.24***	-0.04ns	-0.14ns	0.32ns	0.46***
Potato	11.75***	17.59***	5.11***	-2.77ns	-2.24ns	0.49ns	14.14***	13.93***	-0.01ns	2.22ns	4.91**	2.65ns	3.16***	3.96***	0.75***
Pulses	-1.64ns	-3.73ns	-2.13ns	-7.16***	-4.40ns	2.97ns	-5.67***	-7.97***	-2.44**	-9.84***	-7.40***	2.48**	-8.07***	-7.94***	0.12ns
Total food-grains	2.69***	6.04***	3.57***	1.23***	3.88***	2.61***	1.11***	2.57***	1.44***	0.49***	1.52***	1.03***	1.25***	3.40***	2.11***
Total oilseeds	-5.78***	-6.38***	-0.64ns	-6.27**	-4.57ns	1.81ns	-6.02*	-6.56ns	-0.57ns	-5.86***	-2.42*	3.66***	-4.23***	-2.94***	1.33***
Milk	-	3.96***	-	-	4.51***	-	-	4.66***	-	-	2.33***	-	-	4.27***	-

Source: Statistical Abstract, Punjab, A: Area, P: Production and Y: Yield

*****, ** and * Significant at one, five and ten percent level of probability, respectively**

2.3 Drivers of agricultural growth

Punjab state had made remarkable progress in agriculture through taking a big leap forward in terms of irrigation facilities, use of chemical fertilizer, pesticide, high yielding varieties, mechanization etc. Backed with effective agricultural policies, the farmers of state tended their crops according to the advice of experts through well established agricultural extension network and achieved the record productivity levels. Major drivers of state agricultural growth are provided in Table 2.7. The irrigated area, which was merely 71 per cent to the net area sown in 1970-71, has reached to a level of about 98 percent by the year 2010-11. The number of tube wells has gone up from 1.92 lakh in 1970-71 to 13.82 lakh in 2010-11. The proportion of area under HYVs to gross cropped area has increased tremendously. Hundred per cent of the area of wheat and rice is under HYVs and that of maize is nearly 98 per cent. The adoption of HYVs in Punjab raised the consumption of chemical fertilizers and plant protection materials tremendously in the state. The per hectare consumption of chemical fertilizers (NPK) which was merely 37.50 kg in 1970-71 has achieved the levels of 246 kg in 2011-12. Total consumption of chemical fertilizers (nutrient) in state which was only 213 thousand tons in 1970-71 had been gone up to 1936 thousand tons in 2011-12. Consumption of insecticides and pesticides (Technical Grade) had been increased from 3200 MT in 1980-81 to 6150 MT in 2011-12. The rapid adoption of the green revolution technology in Punjab has led to the sharp increase in farm mechanization. The number of tractors in state was only 5281 in 1970-71, which increased to more than 5 lakh in 2010-11. The Punjab state is one of the leading states for number of tractors tillers in terms of density per 1000 hectare of net sown area. Development of irrigation infrastructure along with large scale mechanization of state agriculture helped in increasing the gross copped area from 5678 thousand ha in 1970-71 to 7872 thousand ha in 2010-11. Consequently, over this period the intensity of cropping jumped from 140 per cent to 190 per cent. Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state.

Thus, rapid dissemination and adoption of new technologies and modern inputs viz. HYVs, fertilizers and pesticides, irrigation, agricultural credit, development of necessary

infrastructure and setting up of institutional mechanisms for the supply of agricultural inputs and procurement of agricultural produce created an enabling environment for enhancing agricultural production in state.

2.4 Marketing and warehouse facilities

Besides advancement in farm technology agricultural development also depends upon the improvement in market infrastructure through ensuring better returns to farmers. Under Agricultural Produce Markets Act, 1961 the market charges in Punjab have been regularized and transactions are conducted by open auction in the regulated markets. Under this act at market level there is a market committee represented by farmers, traders, labourers and officials of agriculture and cooperative departments. The weights and measurement act provides for standardization of weights and measures used in the markets.

Punjab Mandi Board the coordinating body for market committees played the lead role in developing the village approach roads and market yards on priority to facilitate the efficient marketing of farm produce and agricultural input delivery system in state. Indicators of marketing infrastructure presented in Table 2.8 revealed that the number of regulated market in Punjab has increased from 88 in 1970-71 to 146 in the year 2010-11. Likewise, the number of sub-yards attached with these regulated market has increased from 154 to 294 during the same period. Over this period, the geographical area and average number of villages served per regulated market in Punjab decreased from 573 to 345 sq. km and from 139 to 84, respectively.

With large scale state procurement of food grains which takes time to be dispatched to the deficit states; state owned storage capacity remained a major issue. In the recent years many steps has been taken in this regard and total state owned storage capacity increased from 176.39 lakh tons in 2007-2008 to 226.33 lakh tones in 2010-11 (Table 2.9).

The Punjab Mandi Board provided all weather metalled roads to all the villages so that the farmers could sell their output throughout the year. It is very encouraging that hundred per cent villages of Punjab are linked with the all weather metalled roads which helped in efficient marketing of farm output in state.

Table 2.7: Growth drivers in Punjab agriculture

Indicators/Period	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11	2011-12
No. of tractors (Number)	5281	118845	289064	434032	485781	492220	498517	504310	-
Number of tractors per 000' ha	1.30	28.34	69.53	102.13	116.02	118.01	119.89	121.29	
No. of tube wells (Lakh)	1.92	6.00	8.00	10.73	12.46	12.76	13.76	13.82	-
Number of tube wells per 000' ha	47.37	143.06	189.66	252.47	297.59	305.92	330.93	332.37	
Cropping intensity (%)	140.09	161.37	177.86	186.07	187.88	187.96	189.69	190	-
Consumption of chemical fertilizers (000' nutrient tone)	213	762	1220	1313	1698	1768	1866	1911	1936
Consumption of chemical fertilizers (kg/ha)	37.50	112.50	162.60	168.33	213	223	226	243	246
Consumption of insecticides/pesticides (technical grade M.T)	-	3200	6500	6970	5900	5760	5745	5600	6150
Gross cropped area (000'ha)	5678	6763	7502	7941	7870	7912	7876	7872	-
% of net irrigated area to net area sown	71	81	93	93	97.2	97.4	97.9	97.9	-
Area under HYVs in 000'ha (figures in parentheses are per cent of total area under crop)									
Rice	130 (33.33)	1095 (92.56)	1906 (94.59)	2506 (95.94)	2610 (100.00)	2735 100.00	2802 100.00	2826 100.00	-
Maize	49 (8.83)	127 (41.78)	160 (85.11)	154 (93.33)	145 (94.16)	143 94.70	133 95.68	129 96.99	-
Bajra	126 (60.87)	34 (49.28)	11 (91.67)	5 (31.25)	4 (80.00)	5 (100.00)	3 (100.00)	3 (100.00)	-
Wheat	1589 (69.12)	2757 (98.04)	3271 (99.94)	3408 (100.00)	3488 (100.00)	3526 (100.00)	3522 (100.00)	3510 (100.00)	-
No. of Regulated markets	-	120	143	144	145	145	146	146	-
Minimum support price (Rs./qtl)									
Paddy	51	105	205	540	675	880	980	1030	1110
Wheat	76	117	215	580	1000	1080	1100	1170	1285
Cotton	-	304	620	1625	1800	2500	2500-3000	2500-3000	3300
Procurement of major food crops (figures in parentheses are per cent of total production)									
Paddy	637 (62.03)	4432 (89.09)	7882 (78.73)	11057 (81.10)	12802 (81.80)	13234 (80.61)	14237 (84.90)	13136 (81.35)	-
Wheat	2375 (46.16)	4270 (55.62)	7109 (58.47)	7698 (49.50)	7911 (50.34)	10584 (67.27)	10994 (72.48)	10278 (62.40)	-

Source: Statistical Abstract, Punjab

Table 2.8: Market and warehouse infrastructure in Punjab

Particulars	1970-71	1985-86	2000-01	2007-08	2008-09	2009-10	2010-11
No. of regulated markets	88	130	144	145	145	146	146
No. of sub yards attached	154	516	519	294	294	294	294
Average no. of villages served per regulated market	139	94	86	85	85	84	84
Average area served per regulated market (Sq. Km)	573	387	350	347	347	345	345
No. of focal points	NA	362	597	597	596	596	596
Marketed surplus of foodgrains and non foodgrains handled (Lakh tonnes)	NA	132.40	270.56	311.44	325.93	332.05	326.96
Per cent of villages linked with metalled roads	NA	97.59	99.24	99.90	100	100	100
State owned storage capacity (Lakh tonnes)	NA	117.63	251.59	176.39	203.50	251.40	226.33
Storage capacity as % to procurement of Paddy and Wheat	NA	88.11	121.22	56.23	85.44	83.05	99.66

Source: Statistical Abstract, Punjab

Note: NA – Not available.

Table 2.9: Agency-wise state owned storage capacity in Punjab

(Lakh tonnes)

Agency/Year	2007-08	2008-09	2009-10	2010-11
FCI	63.57 (36.04)	63.18 (31.05)	76.30 (30.35)	83.22 (36.77)
Food supply department	6.90 (3.91)	11.79 (5.79)	18.70 (7.44)	18.38 (8.12)
Markfed	19.14 (10.85)	30.15 (14.82)	41.52 (16.52)	44.34 (19.59)
State warehousing corporation	51.45 (29.17)	52.74 (25.92)	19.54 (7.77)	16.57 (7.32)
Central warehousing corporation	7.00 (3.97)	7.09 (3.48)	2.28 (0.91)	1.29 (0.57)
Punjab state civil supply corporation	18.48 (10.48)	23.02 (11.31)	31.59 (12.57)	32.37 (14.30)
Marketing board	0.54 (0.31)	0.33 (0.16)	0.12 (0.05)	0.24 (0.11)
Punjab agro industries corporation	9.31 (5.28)	15.20 (7.47)	19.50 (7.76)	29.92 (13.22)
Total state owned storage capacity	176.39 (100.00)	203.50 (100.00)	251.40 (100.00)	226.33 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentages to total
Storage capacity includes hired and open storage capacity.
Information relates to 31st March

2.5 Emerging demand-supply mechanics

To meet the increasing demand of food grains, country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. The government of India wanted to maintain the tempo of production of food grains production, thus it provides production incentive oriented procurement prices to the farmers. As a result of the assured market at remunerative prices coupled with market infrastructure and available production technology, the Punjab farmers has pushed up the paddy and wheat production remarkably. Thus, Punjab farmers has responded to the country's demand for wheat and paddy and now near about 80 per cent of the gross cropped area in state is under these two crops. Table 2.10 indicates that market arrivals for paddy and wheat in state during year 2010-11 were at 131.36 and 102.78 lakh tones, respectively. Due to decentralization of procurement, although the share of state in central pool of food grains has been declining since last few years; still Punjab is the largest contributor.

During 2010-11, state contributed about 25 per cent of rice and 45 per cent of wheat towards central pool (Table 2.11). Looking at agency-wise procurement, it can be seen from Table 2.12 that since 2007-08 the role of government agencies in procurement has been increased in a major way which pushed the private traders out of paddy and wheat trade in state. During 2010-11, 98.41 and 99.41 per cent of total market arrivals of paddy and wheat, respectively were procured by the government agencies. As the government is the major player in rice and wheat trade in state, private traders are reluctant to enter the market for same. For cotton, the third most important crop of state, demand mainly comes from private mills and traders. However in some years significant quantities were purchased by state owned Cotton Corporation of India also (Table 2.13).

Under contract farming scheme, some companies had entered the Punjab market to buy the farm output. For this, these companies make the contract with farmers to purchase the specific quantity of specific quality produce at some pre decided price. Basmati, maize, hyola and malting barley are the main crops grown under this scheme (Table 2.14).

Table 2.10: Market arrivals of major crops in Punjab

(000, tonnes)

Year	Paddy	Wheat
2007-08	12802	7911
2008-09	13234	10584
2009-10	14237	10994
2010-11	13136	10278

Source: Statistical Abstract, Punjab

Table 2.11: Contribution of Punjab towards the central pool of food grains

(Lakh tonnes)

Year	Rice	Wheat
2007-08	79.8 (27.8)	67.8 (60.9)
2008-09	85.5 (25.1)	99.4 (43.8)
2009-10	92.8 (28.9)	107.3 (42.2)
2010-11	86.3 (25.3)	102.1 (45.4)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentage contribution in central pool

Table 2.12: Procurement of paddy and wheat by different agencies in Punjab

(000, tonnes)

Agency	2007-08	2008-09	2009-10	2010-11
Paddy				
State government	2674 (20.89)	3627 (27.41)	4155 (29.18)	4073 (31.01)
FCI	132 (1.03)	205 (1.55)	671 (4.71)	517 (3.94)
Markfed	2426 (18.95)	2775 (20.97)	2864 (20.12)	2707 (20.61)
PUNSUP	2611 (20.40)	2714 (20.51)	3171 (22.27)	3021 (23.00)
PSWC	1356 (10.59)	1502 (11.350	1687 (1.85)	1488 (11.33)
Traders	2470 (19.29)	1133 (8.56)	371 (2.61)	209 (1.59)
Punjab Agro Industries Corporation (PAIC)	1133 (8.85)	127 (89.66)	1318 (9.26)	1121 (8.53)
Total	12802 (100.00)	13234 (100.00)	14237 (100.00)	13136 (100.00)
Wheat				
State government	1279 (16.17)	1847 (17.45)	1682 (15.30)	1707 (16.61)
FCI	726 (9.18)	1074 (10.15)	1716 (15.61)	1654 (16.09)
Markfed	1886 (23.84)	2481 (23.44)	2557 (23.26)	2382 (23.18)
PUNSUP	1781 (22.51)	2369 (22.38)	2392 (21.76)	2301 (22.39)
PSWC	771 (9.75)	1279 (12.08)	1403 (12.76)	1122 (10.92)
Traders	704 (8.90)	334 (3.16)	22 (0.20)	61 (0.59)
Punjab Agro Industries Corporation (PAIC)	764 (9.66)	1200 (11.34)	1222 (11.12)	1051 (10.23)
Total	7911 (100.00)	10584 (100.00)	10994 (100.00)	10278 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentage to the total

Table 2.13: Purchase of cotton by cotton cooperation of India

(000' bales of 170 kg each)

Year	MSP	Commercial	Total
2007-08	0	78.98	78.98
2008-09	1043.81	1.60	1045.42
2009-10	86.60	9.73	96.33
2010-11 (As on 3/5/2011)	0	100.78	100.78

Source: Agricultural Statistics at a Glance

Table 2.14: Area under different crops under contract farming scheme in Punjab

(Hectares)

Year	Hyola	Malting Barley	Basmati Pure	Maize	Green Pea	Potato Seed	Total
2007-08	13273	3020	33614	45405	-	-	95312
2008-09	14216	2488	33606	32827	448	-	66887
2009-10	7254	3277	31966	33028	449	1625	77599
2010-11	-	3051	28322	-	254	1671	33899

Source: Statistical Abstract, Punjab

Chapter 3

Natural Resources Management

Due to ever increasing demands from increasing population of country, the main emphasis in Punjab state remained on increasing the food production with little attention on managing its natural resource base. There has been continuous increase in the net sown area in the state and currently the proportion of net sown area to total geographical area is the highest in the country. Punjab state has recorded remarkable growth in agriculture sector as more than 97 per cent of the cultivated area is under assured irrigation which is the major reason for higher productivity and input use in agriculture. The intensive agriculture, particularly monoculture of wheat and paddy is now imposing intense pressure on the available natural resources which requires new vision and holistic approach for their management. Now there is need to promote the optimum management of soil and water resources so as to conserve these and improve the productivity. The government policies, availability of resources, appropriate agro-technologies, social and economic factors influence the way in which vital resources are used and managed. Present scenario on use of land and management of soil and water is discussed in this chapter.

3.1 Land use

The Punjab state lies between the 29°33'-32°3'N latitude and 73°53'- 76°55'E longitude and is bounded on the, west by Pakistan, on the north by Jammu and Kashmir, on the north -east by Himachal Pradesh and on the south by Haryana and Rajasthan. The land use classification of state for years 2007-08 to 2010-11 is presented in Table 3.1. The total geographical area of the state is 50.36 lakh ha. During 2010-11, the net sown area was at 41.58 lakh ha which indicated that about 83 per cent of the area in state is already under cultivation. This is the highest in country and the state is virtually comparable to a farmstead where most of the area is under the cultivation leaving little land for other activities. Further, there is virtually no land left for bringing under cultivation and due to recent spurt in urbanization the net sown area declined from 41.87 lakh ha in 2007-08 to 41.58 lakh ha in 2010-11. However, during this period the increase in cropping intensity from 187.9 per cent to 190 per cent led to increase in gross cropped area in state from 78.70 lakh ha to 78.82 lakh ha. The forest wealth of state is very poor with only 5.84 per cent of the total area under the forest cover. The area under permanent barren

and unculturable land has been almost found to be stable at 0.47 per cent of the state area for last many years. The state has been virtually reached the saturation point in the matter of addition to the physical area horizontally; the vertical expansion of area has become increasingly limited due to already achieved higher levels of cropping intensity and some topographical and irrigational constraints in some pockets of the state. Therefore, sustainability in the growth of production per unit of land area has to come through raising the input use efficiency or upward shift in the use of technology.

Table 3.1: Land use pattern in Punjab

(000 hectares)

Area/Period	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Geographical area	5036	5036	5036	5036
Forests	287	296	295	294
Barren and un-culturable land	24	23	25	24
Land put to non-agricultural use	483	494	503	508
Culturable waste	3	2	2	4
Permanent pastures &other grazing land	3	4	4	4
Land under misc. &groves not included in net area sown	4	4	5	4
Current fallow	41	38	37	33
Fallow land other than current fallow	1	1	4	4
Net area sown	4187	4171	4158	4158
Net area sown as percentage to total area	83	83	83	83
Area sown more than once	3683	3741	3718	3724
Gross cropped area	7870	7912	7876	7882

Source: Statistical Abstract, Punjab

3.2 Soil management

Most of the soils of Punjab are alluvial and deep, varying from sandy to silty clay. The soils of Punjab, having developed on alluvium are at initial to medium stage of profile development. They are generally very deep porous sandy loam in texture, and show weak to moderately developed soil structures with good soil-air-water relationship. The soils have great potential for agricultural production in view of their high reserves of weather able minerals. With present state of intensive agriculture surface crusts, sub-soil compaction, soil erosion, development of hard pan, development of fine textured sodic soils, water logging, free percolation in coarse soils and poor permeability in fine textured soils, salinity/sodicity and pollution from agro-chemicals, sewerage and industrial effluent, depletion of organic matter, multi-nutrient deficiencies, nutrient imbalance, decline in quality and quantity of soil biomass, low-biological oxidation and slow rate of decomposition of crop residues are the major problems being faced by the Punjab soils**.**

In some parts of state due to fluctuating ground water table, use of poor quality irrigation water, improper soil and water management practices and lower topographic positions resulted into accumulation of salts in upper soils turning these saline and sodic. The sodic soil can be brought under cultivation by application of gypsum and following rice-wheat cropping system. In 2010-11, about 31000 ha of land were reclaimed in state through application of 20 thousand tons of gypsum. Total land reclaimed through gypsum application in state so far stand at 5.91 lakh ha (Table 3.2).

Table 3.2: Land reclaimed through gypsum application, Punjab

Year	Gypsum distributed (000' tonnes)	Subsidy Utilized (Rs in Lakh)	Area reclaimed (000 ha)	
			Yearly	Cumulative
2007-08	62	297	12	572.34
2008-09	-	-	-	-
2009-10	15	184	3.10	575.34
2010-11	20	268.4	4	591.34

Source: Agriculture at a Glance, Department of Agriculture, Punjab, Chandigarh

Water erosion is the major problem in Kandi area located in the shivalik foot-hills. The south-western parts of the state face the problem of wind erosion in months of May and June. During the last decades considerable efforts have been made to reduce the wind eroded areas by following land-development (leveling and or clearing of sand dunes) and crop management practices and by bringing more areas under irrigated agriculture. The problem of water logging is particularly acute in south-western districts (Ferozepur, Fazilika, Muktsar and Faridkot) of the state occupying lower topographic positions. Introduction of salt resistant crops and good drainage system may overcome this problem to some extent.

As per expert views, the high nutritional requirement of paddy and wheat has exhausted the Punjab soils of vital nutrients. Thus, higher and higher doses of major nutrients, especially nitrogen, have to be applied for sustaining adequate production levels. Low fertility status obviously implies that the amount of plant nutrient that the soil itself is capable of making available to the growing crop is far less than that needed for getting high yields. The most of state soils test low to medium in available nitrogen and available phosphorus. The soils in general are medium to high in available potassium. Micronutrient deficiencies in large areas have also been noticed adversely affecting crop yield. The soils contain sufficient calcium and magnesium. However, their deficiencies can be observed in local pockets supporting sodic soils. Recently sulphur deficiency has been recorded in some soils, especially in coarse-textured soils, receiving high-analysis fertilizers. In recent years, widespread deficiency of one or more micro-nutrients has been observed, resulting in significant decrease in crop yield especially of high-yielding varieties. Deficiency of zinc is of widespread occurrence, particularly in the central and south-western districts. Deficiencies of iron and manganese have been observed in coarse-textured soils recently brought under rice-wheat cropping system.

Thus, it is more important to preserve existing cultivated areas in state from degradation due to water logging, soil salinity and sodicity, besides soil erosion due to intensive cropping and its attended manifestations. Repeated paddy cultivation in the long run will make the soils fine textured, impervious and unfit for cultivation. Corrective measures through intensive R & D have to be undertaken to conserve soil resources. Speedy soil-testing facilities, followed by appropriate advice about fertilizers use, can effectively help save the soils from exhaustion.

3.3 Cropping Intensity

Cropping intensity is a measure of the extent of multiple cropping. In Punjab state there has been progressive increase in intensity of cropping over the years and now intensive copping i.e. getting two crops from the same field is a common feature. The statistics on cropping intensity of state for recent years is presented in Table 3.3. The data shows that cropping intensity in state increased marginally from 188 per cent in 2007-08 to 190 per cent in 2010-11. This, already higher level of cropping intensity indicates that in Punjab state the vertical expansion of area in future has become increasingly limited.

Table 3.3: Cropping Intensity in Punjab State

Year	Percent
2007-08	187.96
2008-09	189.69
2009-10	189.00
2010-11	190.00

Source: Statistical Abstract, Punjab

3.4 Land ceiling limit

In state the ceiling on land is as per the Punjab Land Reforms Act, 1972. Subject to the provisions of section 5 of this act, no person shall own or hold as landowner or mortgagee with the possession or tenant or partly in one capacity and partly in another in excess of the permissible area. Limits of the permissible area are described in Table 3.4.

Table 3.4: Permissible land ceiling limit under Punjab land reforms act, 1972

S No	Particulars	Permissible area (ha)
1	Land under assured irrigation and capable of yielding at least two crops in a year (in this Act referred to as the first quality land)	7
2	Land under assured irrigation for only one crop in a year	11
3	Barani land	20.5
4	Land of other classes including banjar land, and area is to be determined accordingly to the prescribed scale with reference to the intensity of irrigation, productivity and soil classification of such classes having regard to the respective valuation and the permissible area of the classes of land mentioned at (1), (2) and (3) Provided that: a) Where land consists of two or more classes, the permissible area shall be determined on the basis of relative valuation of sub class of land, subject to the condition that it does not exceed 21.8 hectares b) Where the number of member of a family exceeds five, the permissible area shall be increased by one-fifth of the permissible area for each member in excess of five, subject to the condition that additional land shall be allowed for not more than three such members.	< 21.8

Source: Agricultural Statistics at a Glance

3.5 Water management

In Punjab about 98 per cent of the net sown area is irrigated. The state has excellent surface and groundwater irrigation infrastructure. Surface irrigation distribution network comprises of 1, 45,000 kilometers of canals including branch canals and minor distributaries, and one lakh kilometers of field channels or water courses. The canal irrigation system irrigated 1116 thousand hectare in 2010-11 accounting for the 27.40 per cent of the net irrigated area in state (Table 3.5). While canal irrigation has been declining over the years, tube well irrigation,

particularly in the central and northern region of Punjab has been on the increase and during 2010-11, there were about 13.82 tube wells providing irrigation to about 2954 thousand hectares of land accounting for nearly 73 per cent of the net irrigated area in state.

Table 3.5: Source-wise net area irrigated in Punjab

(000, ha)

Year	Govt. canals	Private canals	Tube well & wells	Other sources	Total	% of net irrigated area to net area sown
2007-08	1142	-	2922	4	4068	97.2
2008-09	1110	3	2950	1	4064	97.4
2009-10	1111	3	2955	2	4071	97.9
2010-11	1113	3	2954	-	4070	97.9

Source: Statistical Abstract, Punjab

Table 3.6: Pre and post monsoon ground water level in Punjab

Period	**Season**	**Level**	**Meters**
June 2007	Pre monsoon	Minimum	5.22
		Max	25.06
October 2007	Post monsoon	Minimum	5.13
		Max	25.24
June 2008	Pre monsoon	Minimum	5.92
		Max	23.53
October 2008	Post monsoon	Minimum	6.93
		Max	22.92
June 2009	Pre monsoon	Minimum	5.52
		Max	22.59
October 2009	Post monsoon	Minimum	5.41
		Max	22.28
June 2010	Pre monsoon	Minimum	6.23
		Max	23.57
October 2010	Post monsoon	Minimum	5.53
		Max	23.01
June 2011	Pre monsoon	Minimum	5.78
		Max	21.93
October 2011	Post monsoon	Minimum	5.24
		Max	22.06

Source: Statistical Abstract, Punjab

According to estimates the total annual demand for irrigation water in the state is 4.76 million hectare meters (mhm) against a total annual supply of 3.48 mhm from both canal and ground-water resources. This excessive demand leaves an annual net deficit of 1.28 mhm (Jain, A K) which is met from over-exploitation of groundwater reserves through tube wells. In many areas, excessive exploitation has pushed the groundwater table below the critical depth of 10 meters. Deep tube wells are being used even in the southern region, where the underground water is brackish. Existing cropping pattern, cheap credit and free supply of electricity are the main factors behind steep increase in the use of tube wells for irrigation in the state. The data on per monsoon and post monsoon water table in state for recent years is presented in Table 3.6.

Extensive use of groundwater through tube wells have led to lowering of the ground-water table in most parts of state. The water table in the central districts of Punjab has been going down whereas in south western parts it is going up resulting into the problem of water logging. Most of the centrifugal pumps have been replaced by the submersible pumps leading to additional expenditure along with tremendous increase in energy consumption.

Table 3.7: Distribution of blocks in different categories on basis of underground water resources in Punjab

Category	2000	2005	2010
Over-exploited (Dark)	73 (52.90)	103 (75.18)	110 (79.71)
Critical	11 (7.97)	5 (3.65)	3 (2.17)
Semi critical	16 (11.59)	4 (2.92)	2 (1.45)
Safe	38 (27.54)	25 (18.25)	23 (16.67)

Source: Jain A K, Department of Soil & Water Engineering, PAU, Ludhiana

The distribution of blocks in different categories on the basis of underground water resources in past decade is given in Table 3.7. During 2010, out of 138 blocks of state 110 blocks are over exploited where exploitation is more than 100 per cent of annual net recharge of water, 2 blocks are in critical category (exploitation above 85 per cent) and 3 blocks falls in semi critical-category (exploitation of 65-85 percent). Thus there were only 23 blocks which were considered safe. In other words ground water in 80 per cent of the total geographical area of state

has been over exploited, with another 4 per cent in critical or semi-critical category. Part of about 16 per cent geographical area which is considered to be safe for ground water development falls in kandi area where as rest of it falls in south-western parts of state where ground water is brackish and unfit for irrigation use.

Various steps have taken to work out methods for optimum water-use efficiency for different crops in different regions. Implementation of Punjab preservation of sub-soil water act, 2009 is a major breakthrough in managing dwindling ground water resources of state. Promotion of adoption of tensiometers, laser leveling of fields, ridge planting and emphasis on growing water saving crops are some of the other steps taken in this regard. Time has come to use rainwater harvesting technologies for conserving water and for recharging the underground water, both in rural and urban areas.

3.6 Weather and climate

The land use pattern and crop production depends on the climate to a much greater extent than any other factor of production. The effects of weather on agriculture are far reaching, affecting the crop plants right from germination till maturity. The effects of weather continue to affect the agricultural output in the markets and during storage. Important factors that make environment are the temperature, moisture/rainfall, solar radiation and wind. Plants do best under certain inter-related conditions of these factors and there are also extremes beyond which significant losses to vegetation occurs. The climate of Punjab is mainly influenced be the Himalayas in the North and the 'thar' desert of Rajasthan in the south and south west.

Table: 3.8 Annual average rainfalls in Punjab

Year	Rainfall (Millimeters)
2007	438
2008	529.2
2009	384.9
2010	472.1

Source: Statistical Abstract, Punjab

The mean annual rainfall varies from less than 300 mm to about 1400 mm. A major portion of the rainfall (70%) is received during monsoon season (July to September). The information on annual average rainfall from year 2007-08 onwards is presented in Table 3.8.

Table 3.9: Important characteristics of agro-eco sub-regions of Punjab

characteristics	Agro-eco-sub regions				
	Sub-mountain (Siwalik hills)	**North-eastern undulating subrigion**	**Piedmont and alluvial plain**	**Central alluvial plain**	**South-western alluvial plain**
Major criteria for subdivision	Topography	Topography and climate	Length of growing period and landform	Length of growing period and climate	Length of growing period
Percent area of Punjab covered by sub regions	2.37	8.38	29.36	38.17	21.72
Districts (partly /whole) covered by sub regions	Gurdaspur, Hoshiarpur, Nawan Shahar, Rupnagar	Gurdaspur, Hoshiarpur, Nawan Shahar, Rupnagar, S.A.S nagar	Gurdaspur, Amritsar, Taran taran, Kapurthala, Hoshiarpur, Jalandhar, Nawan Shahar, Rupnagar, Mohali, Ludhiana, Fatehgarh sahib, Patiala	Amritsar, Taran taran, Kapurthala, Jalandhar, Moga, Faridkot, Ferozepur, Ludhiana, Sangrur, Barnala, Patiala	Ferozepur, Mukatsar, Faridkot, Bathinda, Mansa
Topography	Siwalik hills	Foothills and Undulating piedmont plain	Piedmont plain and alluvial plain	Old alluvial plain	Alluvial plain
Length of growing period*- days	150-170	150-170	120-150	90-120	60-90
Rainfall-mm	950-1300	850-1200	700-1000	550-800	300-550
Soil moisture regime	Udic-Ustic	Udic-Ustic	Ustic	Ustic	Aridic
***Temperature (^{o}C)**					
-Maximum	25-34	25-36	24-35	25-35	26-37
-Minimum	8-22	8-22	10-23	10-24	10-24
-Mean	16-28	17-29	17-29	18-30	18-31
Temperature regime	Hyperthermic	Hyperthermic	Hyperthermic	Hyperthermic	Hyperthermic
Potential evapo-transpiration	800-1000	1000-1300	1500-1800	1700-1800	1800-1900
Major soil orders	Entisols	Entisols, Inceptisols	Inceptisols, Alfisols	Inceptisols, Entisols	Aridisols, Entisols

Source: Department of Soils, Punjab Agricultural University, Ludhiana

***Normal/ long term average**

In Punjab state the Mean Annual Temperature (MAT) varies from 23.3°C (Pathankot) to 25.8° C (Abohar). The mean monthly minimum temperature (January) is as low as 4.7°C and the mean monthly maximum temperature in June is as high as 42° C. Information on agro-eco sub regions of state along with important environmental/climatic characteristics is provided in Table 3.9.

Chapter 4

Farm Input Management

The remarkable progress of Punjab agriculture is credited to the use of inputs like fertilizers, improved seeds, irrigation, plant protection chemicals; machinery, credit and technology back up. In state the use of fertilizer (nutrients) increased from 37 kg/ha in 1970-71 to 243 kg/ha in 2010-11. During this period net irrigated area as proportion to net cultivated area increased from 71 per cent to about 98 per cent. Almost hundred per cent area under major crops is covered by the high yielding verities. The farm credit market in Punjab is very extensive and about 90 per cent farmers use credit to finance the farm production operations (Shergill, 2011). Punjab is the leading state in ensuring the timely availability and efficient delivery system of these vital inputs required for agriculture. This chapter deals with the recent trends in use/requirement of important farm inputs and their prices in Punjab.

4.1 Seeds

Good quality seed of high yielding varieties has played the most important role in increasing agricultural production in Punjab. Foundation seed of HYVs is supplied by the Agricultural Universities for its further multiplication. Various Seed Corporations, Punjab Agricultural University and State Department of Agriculture distribute the certified seeds to farmers. Without realizing the yield losses, many farmers are tempted to keep their own seeds particularly of cereals in which the seed rate is quite high and the crops are self pollinating. Government had made efforts to increase the agricultural production through total replacement of seed of the self pollinated crops every three years and hybrids every year. Extension campaigns, subsidies and ensuring timely supply of seeds are some of steps taken in this regard. Due to sincere efforts of concerned state departments and PAU, the state farmers did not faced the shortage of seed of principal crops of state in recent years. Seed requirement of important crops in Punjab and seed prices for recent years is provided in Table 4.1 and Table 4.2, respectively.

Table 4.1: Use of seed for major crops in Punjab

(Tonnes)

Crop	Seed requirement/ hectare (Kg)	Total seed requirement*			
		2007-08	2008-09	2009-10	2010-11
Wheat	100	348700	352600	352200	351000
Gram	40	80	120	120	120
Sarson	3.8	112.7	108.9	116.4	120.2
Summer - mash	37.5	150.0	112.5	112.5	112.5
Sunflower	5	100	100	110	75
Paddy	20	52180	54700	56040	56520
Maize	20	3080	3020	2780	2660
Sugarcane	87.5	9450	7087.5	5250	6125
Cotton	1.5	906.3	789.4	765.5	723.5

*** Calculated by multiplying per hectare requirement of seed with area under respective crops**

Table 4.2: Seed prices of important crops in Punjab

Crop	Price of seed (Rs/kg)				
	2008	2009	2010	2011	2012
Wheat	16.25	17.50	17.50	20	-
Gram	50	50	50	50	-
Sarson	46.67	46.67	66.67	66.67	-
Summer mash	60	60	60	100	-
Sunflower	200	200	200	200	-
Paddy	18.75	18.75	18.75	25	25
Maize	50	50	70	70	150
Sugarcane	1.75	1.75	1.80	2.50	2.75
Cotton	2000	2000	2000	2000	2000

Source: Department of Economics & Sociology, Punjab Agricultural University, Ludhiana

4.2 Fertilizers and manures

Intensive agriculture, with high use of synthetic fertilizers was introduced in India in the 1960s as part of the Green Revolution. The quick adoption of synthetic fertilizers and fertilizer responsive varieties along with irrigation did help in a remarkable increase in agricultural

production of Punjab state. Statistics on fertilizer consumption in state is presented in Table 4.3. Total consumption of Nitrogen (N), Phosphorus (P) and Potash (K) nutrients in state during 2007-08 was 13.17 lakh tons which increased by about 7 per cent to 19.36 lakh tons in 2011-12. During 2011-12, use of N, P and K was 14.09, 4.55 and 0.72 lakh tons, respectively. Per cropped ha use of fertilizers during 2011-12 was 246 kg which is the highest in country. Nitrogen fertilizers are most important for the growth of plants and hence are used in highest proportions which are leading to nutrient imbalances. In spite of the fact that Punjab is one of the most agriculturally progressive states, the ratio of N, P, and K in Punjab is one of the most lop sided ones in the country with the maximum emphasis on nitrogen and very little attention has been given to balanced nutrient application. For instance, while the recommended ratio between N, P and K is 4:2:1, the actual ratio in Punjab during 2011-12 was 19.5: 6.3: 1.

Table 4.3: Consumption Fertilizers in Punjab

(000, nutrient tonnes)

Year	Nitrogenous (N)	Phosphatic (P)	Potassic (K)	Total (NPK)	Consumption per hectare (kg)
2007-08	1317	341	37	1695	213
2008-09	1332	379	55	1766	223
2009-10	1348	383	56	1787	226
2010-11	1403	435	73	1911	243
2011-12 (P)	1409	455	72	1936	246

Source: Agriculture at a Glance, Department of Agriculture, Government of Punjab, Chandigarh

Table 4.4: Fertilizer prices in Punjab

Name of Fertilizer	Year				
	2007-08	2008-09	2009-10	2010-11	2011-12
Superphosphate (Granulated)	370	370	360	-	-
DAP (Rs/qt)	935	935	995	996	1820
Urea 46% (Rs/qt)	478	478	530	530	540
Muriate of Potash(Rs/qt)	445	445	520	520	1200
Zinc sulphate (Rs/qt)	2500	2500	2500	2800	4000
FYM (Rs/tone)	100	100	100	100	120

Source: Department of Economics & Sociology, Punjab Agricultural University, Ludhiana

It can be seen from the Table 4.4 that before 2012, prices remained almost unchanged for many years. However after partial decontrol, prices of phosphate fertilizers particularly Di-ammonia phosphate almost got doubled i.e. from Rs 996/q in 2010-11 to Rs 1820/q in 2011-12. During the same year, the price of zinc sulphate and muriate of potash also gone up from Rs 2800 to Rs 4000/q and from Rs 520 to Rs 1200/q, respectively.

4.3 Pesticides/weedicides

In yield exploitation and stability in state agricultural production, the use of insecticides and weedicides has played a crucial role. The pest problem accentuated with the introduction of high yielding varieties of crops, intensive use of inputs and development of new cropping patterns. Crops like cotton, sugarcane, paddy, oilseeds and vegetables have shown greater reliance on pesticides. Problem of weeds also increased with increase in cropping intensity and fertilizer use particularly in irrigated areas like Punjab. Punjab farmers had used weedicides effectively in weed management of field crops particularly in crops like wheat, paddy, potato, etc. This resulted into tremendous increase in demand of pesticides and weedicides over time. Consumption of insecticides/pesticides for recent years is given in Table 4.5.

Table 4.5: Consumption of insecticides/pesticides in Punjab

Year	Consumption in technical grade (M.T)
2007-08	5900
2008-09	5760
2009-10	5745
2010-11	5600
2011-12 (P)	6150

Source: Agriculture at a Glance, Department of Agriculture, Government of Punjab, Chandigarh

Prices of important insecticides/weedicides are presented in Table 4.6. As revealed by figures, the total consumption of plant protection agro-chemicals including insecticides, weedicides, fungicides and rodenticides in Punjab was at 5900 MT (technical grade) in 2007-08 which declined to 5600 MT in 2010-11. The decline may be attributed to the large scale adoption of Bt cotton and availability of new chemicals requiring application in relatively small doses. However, the estimated consumption of these during 2011-12 is likely to be at 6150 MT. Certain harmful effects of extensive use of these chemicals being observed includes chemical residue in

agricultural output, development of strains of resistance, undesirable side effects on non target flora and fauna and resurgence of certain insect and weed species along with appearance of secondary pests/weeds. Regular monitoring and surveillance of these problems in state is the need of hour.

Table 4.6: Prices of important insecticides/weedicides /fungicides in Punjab

(Rs)

Name of Chemical/Year	Year				
	2008	**2009**	**2010**	**2011**	**2012**
Weedicide					
Arelon (per 500 gm)	160	150	160	170	210
Leader (per 13 gm)	325	340	320	325	400
Topik (per 160 gm)	-	-	350	350	400
2,4 D (per 500 gm)	100	300	200	220	220
Atrazine (per 500 gm)	140	150	150	150	150
Butachlor (per Litre)	160	200	180	180	180
Insecticide					
Chlorpyriphos (per Litre)	180e	250	220	220	250
Malathion 50EC (per Litre)	180	180	250	240	240
Rogor 30EC (per Litre)	230.	240	350	290	300
Cofidor (per Litre)	1800	1500	1600	1800	1800
Thiodan 35 EC (per Litre)	260	250	250	260	260
Dithane M-45 (per 500 gm)	115	200	170	180	250
Indofil M-45 (per 500 gm)	130	145	170	180	250
Stomp (per Litre)	430	390	450	450	450
Fungicide					
Blitox (per kg)	200	200	250	280	360
Streptocycline (per 6 gm)	35	32	30	35	40
Emisan-6 (per 100 gm)	40	50	60	55	65

Source: Department of Economics & Sociology, Punjab Agricultural University, Ludhiana

4.4 Farm machinery and equipments

Mechanization has contributed significantly in increasing the agricultural production of state. It helps in achieving the timeliness of various farm operations like seedbed preparation, sowing, spraying, harvesting and threshing and makes efficient use of resources. Further, it offsets the challenges of labour shortages and drudgery involved in farm work. Farm mechanization, no doubt, has been beneficial for the intensive use of land and has helped considerably in overcoming the risk of unfavorable effects of weather on maturing crops. In Punjab with crop intensification, agriculture has become highly machinery dependent.

Table 4.7: Agricultural machinery and implements in Punjab

(Number)

Machinery	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Tractor	420000	425200	425200	434000
Disc Harrow	220000	224000	224300	210000
Seed-cum fertilizer drill	178000	183000	183400	166489
Knapsac spray pump	655000	665000	655000	600000
Vertical conveyer reaper	5518	5522	-	-
Tractor operated combine	6570	6670	6270	6056
Self propelled combine	7600	8400	8400	8130
Thresher	910400	822000	802000	740000
Straw reaper	21848	32666	32900	33678
Maize sheller/thresher	1890	1893	1850	1832
Potato planter	5160	5330	5250	5228
Tubewell electrical/diesel run	1246000	1276200	1375517	1381606
Sugarcane cutter planter	340	290	290	-
Strip till drill	215	195	-	-
Zero till drill	9083	10141	10300	10465
Rotavator	3309	6419	6720	8691
Aeroblast sprayer	70	70	70	-

Source: Agriculture at a Glance, Department of Agriculture, Punjab, Chandigarh

The data on different types of farm machinery being utilized in Punjab agriculture is presented in Table 4.7. As being indicated by marginal increase in number of various machines (except tube wells) during the recent years, the mechanization of state agricultural has now almost reached a saturation point. As per estimates of Punjab State Farmers Commission, the state has double the number of tractors it requires. The average use of tractors per annum in the state is barely 450 hours, which is much below the minimum 1,000 hours of productive use in agriculture. This over capitalization in farm mechanization and it's under utilization leads to higher cost of production and lower net income to farmers, making it economically unviable. The indicative price of selected machinery like tractor, electric motor and diesel engine is provided in Table 4.8.

Table 4.8: Prices of selected agricultural machinery in Punjab

(Rs/ unit)

Machinery	2007-08	2008-09	2009-10	2010-11
Tractor (35 HP)	370000	375000	450000	480000
Electrical motor	23000	23000	23500	28500
Diesel engine	23000	23000	23000	23500

Source: Department of Economics & Sociology, Punjab Agricultural University, Ludhiana

Prices are approximate only

4.5 Irrigation

Agriculture in Punjab has a heavy requirement of water for irrigation and there is an excellent network of irrigation facilities both surface and ground is serving this purpose. About 98 per cent of net sown area in state is irrigated (Table 4.9). Punjab has an excellent irrigation distribution network of canals, branch canals and minor distributaries and field channels or water courses. Overtime, canal irrigation has been declining whereas tube well irrigation has been on an increase and about 73 per cent of the total irrigated area is being irrigated by underground water pumped out by about 13.80 lakh tube wells. This is mainly due to availability of cheap credit and free supply of electricity in the state. Rice and wheat, being the major crops of the state, account for the 81.33 per cent of the gross cropped irrigated area in state (Table 4.11).

The cultivation of high water demanding crops particularly paddy is an important factor contributing towards decline of underground water levels in Punjab. Annual availability of

surface and ground water in state is 3.48 million hectare meters (mhm). However, the annual demand for state agriculture is 4.76 mhm (Table 4.10). The annual deficit to the tune of 1.28 mhm every year is met through the overexploitation of underground water by tube wells leading to serious problem of deteriorating underground water resources.

Table 4.9: Gross cropped and irrigated area in Punjab

(000, ha)

Year	Gross cropped area	Irrigated area	% of gross irrigated area to gross cropped area
2007-08	7870	7689.3	97.7
2008-09	7912	7723.6	97.6
2009-10	7876	7714.2	97.9
2010-11	7882	7723.8	98.0

Source: Statistical Abstract, Punjab

Table 4.10: Status of water resources on Punjab

Annual canal water available at H/w	1.79 M ha-m
Annual canal water available at outlets	1.45 M ha-m
Annual canal water available	2.03 M ha-m
Total annual available water resources	3.48 M ha-m
Annual water demand	4.76 M ha-m
Annual water deficit	1.28 M ha-m

Source: Jain A K, Department of Soil & Water Engineering, PAU, Ludhiana

Table 4.11: Crop wise gross irrigated area in Punjab

(000, ha)

Crop/Year	2007-08	2008-09	2009-10	2010-11
Rice	2592.4 (33.71)	2721.8 (35.24)	2783.5 (36.08)	2814.2 (36.44)
Jowar	-	0.1 (0.00)	0.1 (0.00)	(a)
Bajra	4.4 (0.06)	4.9 (0.06)	3.4 (0.04)	2.5 (0.03)
Wheat	3437.1 (44.70)	3474.8 (44.99)	3474 (45.03)	3466.9 (44.89)
Barley	15.3 (0.20)	16.0 (0.21)	13.7 (0.18)	11.7 (0.15)
Maize	99.3 (1.29)	98.0 (1.27)	99.9 (1.30)	94.1 (1.22)
Gram	1.7 (0.02)	2.2 (0.03)	2.3 (0.03)	2.2 (0.03)
Other pulses	21.8 (0.28)	16.1 (0.21)	16.3 (0.21)	14.7 (0.19)
Sugarcane	104.4 (1.36)	75.2 (0.97)	58.3 (0.76)	67.6 (0.88)
Other food crops (including condiments & spices	208.5 (2.71)	178.1 (2.31)	165.8 (2.15)	174.3 (2.26)
Cotton	604.8 (7.87)	527.3 (6.83)	508.8 (6.60)	482.8 (6.25)
Other non-food crops	599.6 (7.80)	609.1 (7.89)	588.1 (7.62)	592.8 (7.67)
Total	7689.3 (100.00)	7723.6 (100.00)	7714.2 (100.00)	7723.8 (100.00)

Source: Statistical Abstract, Punjab
Figures in parentheses are percentages to total
(a): less than 500 hectares

Since last many years, the supply of electricity to tube wells as well as canal water to the state farmers is being supplied to agriculture sector of free of cost.

4.6 Labour and agricultural Wages

Punjab State is predominantly an agricultural state with two-third of its population directly or indirectly dependent on agriculture. With introduction of new agricultural technology in sixties, crop rotations experienced significant changes along with the increase in cropping intensity, which resulted in increased aggregate labour employment in agriculture. However, due to fast pace of agriculture mechanization during eighties, the complementary relationship between the agricultural development, mechanization and demand for labour weakened. During nineties, the Punjab

agriculture reached a stage where increased mechanization particularly for harvesting of wheat and paddy and use of labour substituting inputs like weedicides and herbicides along with decrease in area under labour intensive crops, started competing with labour force and resulted in substantial labour displacement. The recent stagnation in productivity of major crops along with imperceptible movement of labour out of agriculture sector raised concern about its potential to increase the income and labour productivity. There is clear evidence that overtime the capacity of agriculture sector to absorb labour has been declining significantly. The employment elasticity with respect to aggregate output come down from 0.54 during 1970's to 0.36 during 1980's and presently even less than 0.20 (Sidhu, 2002). In addition, the experience of the last decade brings out that, the growth in agricultural sector has been generating more casualization of employment. There is increase in casualization of labour as overtime the proportions of family labour and permanent hired labour is declining (Deshapande *et al,* 2007).

The slow growth of agriculture employment in recent years could be largely attributed to imbalanced growth of mechanization that substitutes the machine labour for human and animal labour. The level of mechanization is already higher in Punjab, where man days employed in production of crops are low as compared to other parts of the country and negative growth in agricultural employment was experienced against a positive growth rate of real agricultural output in the nineties (Haque and Sharma, 2004). In a labour surplus economy like ours, the primary concern still centers on human labour employment. As the siphoning off mechanism of agricultural labour to other sectors has remained rather ineffective in Punjab state, the solution to problems of rural unemployment and under employment depends upon the potential of crop production sector in absorbing the labour.

The per hectare labour use in cultivation of wheat, paddy and cotton collectively accounting for more than 85 per cent of the gross cropped area in Punjab state is presented in Table 4.12. During 2008-09, per hectare labour use in cultivation of wheat, paddy and cotton was 184.87, 417.19 and 717.78 man hours, respectively. Wages are equally important in indicating the importance of a particular sector along with socio-economic status of the people employed. The data with respect to the wage rates of major agricultural operations in Punjab is presented in Table 4.13. It was observed from the figures that wage rates for various agricultural operations in state have been almost doubled in the period from 2007 to 2011. This clearly points towards shortage of labour for agricultural sector is experiencing in past few years.

Table 4.12: Labour use (per ha) for major crops in Punjab

(Hours/ ha)

Crop/Year	2007-08	2008-09	2009-10
Rice	402.54	417.19	NA
Wheat	188.01	184.87	177.94
Cotton	803.30	717.78	NA

Source: Estimates of cost of cultivation scheme, NA: Not Available

Table: 4.13 Wages paid to agricultural and skilled labour in Punjab

(Rs/ man day)

Crop/Year	2007	2008	2009	2010	2011**
Agricultural labour: for					
Ploughing	106.24	128.22	143.92	151.82	205.50
Sowing	106.96	130.88	141.18	145.80	204.50
Weeding	105.21	123.10	129.75	149.47	197.25
Harvesting	114.08	127.62	186.00	189.61	203.00
Picking cotton*	107.80	-	-	141.88	190.00
Other agricultural operations	106.48	137.41	144.25	144.43	215.00
Skilled labour:					
Black smith	195.86	218.44	224.65	226.88	270.00
Car penter	198.32	216.69	227.37	230.54	267.00

Source: Statistical Abstract, Punjab

***For female labour, ** Information is prepared July 2011 to Nov. 2011**

4.7 Credit

Credit is an important input which has played significant role in development of Punjab agriculture. The formal credit institutions such as Cooperative Credit Institutions, Regional Rural Banks and Commercial Banks are supposed to meet the agricultural credit requirement in the state. Besides institutional credit, informal sources particularly the commission agents/arthytias provide a significant amount of credit to the farmers. About 2095 rural/semi-urban branches of all Commercial Banks and 4755 retail outlets of Cooperative Credit Set-up are operating in the farm credit market. Out of total retail outlets of Cooperative Credit set-up 3990 are Primary Agricultural Cooperative Societies, Primary Agricultural Cooperative Banks and 676 rural/semi-urban branches of Central Cooperative Banks (Shergill, 2011). The extent formal credit to agriculture in state is provided in Table 4.14. During 2011-12, against the target of Rs 41832

crore under agriculture and allied sector, banks have disbursed Rs 40753 crore, thus achieving 97 per cent of the target.

Table 4.14: Institutional agricultural credits in Punjab

(Amount Rs in Crore)

Year	Targets	Achievements	% Achieved
2010-11	30471	30106	99
2011-12	41832	40753	97

Source: Agenda papers, 120th meeting of State Level Bankers' Committee (Punjab)

With aim at increasing the efficiency of formal credit delivery system, the Central Government launched the scheme of Kisan Credit Cards (KCC) in 1998-99. This scheme offers more flexibility in withdrawing money as per farmers' requirements with fixed borrowing limit. The number of KCCs, amount sectioned and distributed in this scheme is provided in Table 4.15. Since inception of scheme, commercial and Cooperative Banks have sectioned 2671195 KCCs amounting to Rs 37742.63 crore in the state. Out of this, disbursement to the farmers has been made to the tune of Rs 36340 crore. On cumulative basis, there are 1726229 outstanding KCCs accounting to Rs 25741.43 crore as at 31st March, 2012.

Table 4.15: Number of kisan credit cards and amount sanctioned, distributed under KCC scheme

(Rs Crore)

Period	Sanctioned		Disbursed		Outstanding	
	No. of KCC	Amount	No. of KCC	Amount	No. of KCC	Amount
Commercial banks						
2006-07	127378	1922.72	126600	1991.76	125885	1968.40
2007-08	132795	2740.04	132217	2705.51	130283	2610.29
2008-09	165774	3717.19	165218	3601.61	164644	3536.68
2009-10	148942	3660.91	147827	3572.18	147453	3562.37
2010-11	208279	5286.39	196436	5162.14	168840	2477.68
2011-12	238586	8347.89	237801	8138.17	235003	7930.88
Since inception up to march-12	1730566	30569.40	1646621	29216.86	822388	20269.69
Cooperative banks						
2006-07	33937	205.78	33937	205.78	33937	205.78
2007-08	35494	601.51	35494	601.51	35494	601.51
2008-09	18570	157.57	18111	139.62	18111	139.61
2009-10	16216	749.47	16216	749.47	16216	749.47
2010-11	22417	332.44	22415	282.78	14241	175.27
2011-12	8095	149.25	8077	148.87	8075	148.02
Since inception up to march-12	940596	7161.06	940576	7111.02	903841	5471.74
Total since inception	2671195	37742.63	2587228	36340	1726229	25741.43

Source: Agenda papers, 120th meeting of State Level Bankers' Committee (Punjab)

Set up of Cooperative Credit Institutions plays vital role in providing the credit to agricultural sector in state. The structure of cooperative credit in state is provided in Tables 4.16 to 4.19.

Table 4.16: Loan advanced and outstanding of Cooperative Credit Institutions (as on 31st March)

(Rs. Lakh)

Institution	Loan advanced		Loan outstanding	
	2007-08	2008-09	2007-08	2008-09
Primary agricultural cooperative credit societies	613011.49	647572.08	411485.26	457138.36
Primary cooperative agricultural land development banks (PADB)	45887.64	78769.76	205928.91	224321.54
Central cooperative banks	992818.54	1646566.56	716604.28	743320.31
State agricultural development banks (SADB)	25345.94	32292.53	198269.8	198711.45
State cooperative banks	568101.81	848680.73	413836.79	472936.28

Source: Statistical Abstract, Punjab

Figures in parentheses are percentages to total

Table 4.17: Long term and short term credit provided by Primary Agricultural Credit Societies and Primary Cooperative Agricultural Land Development Banks

(Rs. Lakh)

Year	Outstanding loan			
	Long term	Medium term	Short term	Total
2007-08	205928.91 (33.35)	24698.42 (4.00)	386786.84 (62.65)	617414.17 (100.00)
2008-09	224321.54 (32.92)	36017.51 (5.29)	421121.05 (61.80)	681460.10 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentages to total

Table 4.18: Purpose-wise loan advanced by primary cooperative agricultural land development banks (PADB)

(Rs. Lakh)

Purpose	**2007-08**	**2008-09**
Debt redemption	984.04 (2.14)	-
Purchase of land	1465.38 (3.19)	920.02 (1.03)
Purchase of tractor	5890.61 (12.84)	5324.78 (5.98)
Installation of tube wells	4910.28 (10.70)	5215.42 (5.85)
Other land improvements	32637.33 (71.12)	77630.95 (87.14)
Total	45887.64 (100.00)	89091.17 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentages to total

Table 4.19: Tractors and tube wells financed by state land development banks

(Number)

Description	**2007-08**	**2008-09**
Tractors		
(i) During the year	98	176
(ii) Up to year	77632	77808
Tube wells		
(i) During the year	1074	606
(ii) Up to year	335586	336192

Source: Statistical Abstract, Punjab

Chapter 5

Major Crops: Area, Production and Yield

Punjab agriculture has shown sign of stagnation in the nineties. The changes in the area, production and productivity of major crops in the Punjab state over a period from 1992-93 to 2010-11 are presented in Table 5.1. These changes were also observed plan-wise for the plan periods viz. 8th plan (1992-93 to 1996-97); 9th plan (1997-98 to 2001-02); 10th plan (2002-03 to 2006-07) and initial four years of 11th plan (2007-08 to 2010-11). The plan wise Compound Annual Growth Rates (CAGR) of major crops with respect area, production and yield were also worked out.

The area, production and yield of rice over the study period (1992-93 to 2010-11) went up tremendously by 35.23, 59.92 and 18.25 per cent, respectively. This tremendous increase in rice production happened despite the Punjab was not traditional rice growing state. Plan-wise the area expansion under rice was largest during 9th plan (9.03 %) and lowest during 10th plan (3.60 %). Production and yield increase was observed to be highest in 9th plan by 14.17 and 10.20 per cent, respectively. While lowest increase in rice production (4.38 %) was observed in 8th plan, its yield went down by 0.22 per cent during the period of 11th plan. Wheat also showed the same trend but the increase was at lesser pace than for the rice as its area, production and yield during the study period went up by 7.28, 22.34 and 14.03 per cent, respectively. Plan-wise largest (3.64%) area increase under wheat was observed during 9th plan, where as it went down by 1.64 per cent during 8th plan. While the highest increase in wheat production (21.90%) and productivity (17.62%) was observed during 9th plan, these went down in period of 11th plan by 3.48 and 4.44 per cent, respectively. The reason being the Increase in area and productivity of both of these crops are the main movers for this increase in production of these crops in the state. Except potato, all other crops showed either decrease in area during this period.

The area under cotton, the third most important crop of state went down drastically during the 9th plan, reason being the uncontrollable pest problems in late nineties. However, with introduction of Bt cotton its yield and production picked up remarkably during the 10th plan. Despite the area under maize crop went down by 26.84 per cent over the study period, due to tremendous increase (48.63%) in its productivity, its production in state increased by 8.94 per cent. It clearly reveals that the paddy and wheat crop rotation became predominant at the cost of

maize, other cereals, oilseed and pulses in the state. A cursory glance on the table revealed that during the study period, the productivity of these crops went up significantly with the exception of sugarcane.

Compound Annual Growth Rates (CAGR) for major crops of state in 8^{th} to 11^{th} five year plans and for overall study period are presented in Table 5.2. The figures revealed that rice area, production and productivity over the period of about two decades increased significantly at the CAGR of 1.56, 2.79 and 1.20 per cent, respectively. Thus, over the study period the increase in area under rice contributed relatively more towards production increase as compared to the contribution of yield increase during this period. Plan-wise while the significant increase in area and yield was observed during 11^{th} plan and 10^{th} plan, respectively, production of rice increased significantly during 9^{th} and 10^{th} plan periods. The production of wheat during the study period increased at CAGR of 1.16 per cent while area under it and yield increased at CAGR of 0.47 and 0.69 per cent, respectively. Thus major contributor towards wheat production over this period was the increase in yield. Plan-wise major increase in wheat area, production and yield was observed during 9^{th} plan. With the exception of potato CAGR of area of all other major crops in state viz. cotton, maize, pulses, oilseeds and sugarcane during this period were found to be negative.

Table 5.1: Area, production and yield (plan-wise) of major crops, Punjab

Crops		8Th Plan			9Th Plan			10Th Plan			11Th Plan*			Overall		
		1992-93	1996-97	Change over 1992.93	1997-98	2001-02	Change over 1997-98	2002-03	2006-07	Change over 2002-03	2007-08	2010-11	Change over 2007-08	1992-93	2010-11	Change Over 1992-93
Rice	**A**	2072	2159	87 (4.20)	2281	2487	206 (9.03)	2530	2621	91 (3.60)	2609	2802	193 (7.40)	2072	2802	730 (35.23)
	P	7026	7334	308 (4.38)	7904	8816	912 (11.54)	8880	10138	1258 (14.17)	10486	11236	750 (7.15)	7026	11236	4210 (59.92)
	Y	3391	3397	6 (0.18)	3465	3545	80 (2.31)	3510	3868	358 (10.20)	4019	4010	-9 (-0.22)	3391	4010	619 (18.25)
Wheat	**A**	3283	3229	-54 -1.64	3300	3420	120 (3.64)	3375	3467	92 (2.73)	3487	3522	35 (1.00)	3283	3522	239 (7.28)
	P	12399	13672	1273 (10.27)	12715	15499	2784 (21.90)	14175	14596	421 (2.97)	15716	15169	-547 (-3.48)	12399	15169	2770 (22.34)
	Y	3777	4234	457 (12.10)	3853	4532	679 (17.62)	4200	4210	10 (0.24)	4507	4307	-200 (-4.44)	3777	4307	530 (14.03)
Maize	**A**	190	166	-24 (-12.63)	165	165	0 (0.00)	153	154	1 (0.65)	154	139	-15 (-9.74)	190	139	-51 (-26.84)
	P	436	352	-84 (-19.27)	345	449	104 (30.14)	312	481	169 (54.17)	525	475	-50 (-9.52)	436	475	39 (8.94)
	Y	2297	2118	-179 (-7.79)	2091	2722	631 (30.18)	2040	3123	1083 (53.09)	3408	3414	6 (0.18)	2297	3414	1117 (48.63)
Gram	**A**	26	16	-10 (-38.46)	13	7	-6 (-46.15)	7	4	-3 (-42.86)	2	3	1 (50.00)	26	3	-23 (-88.46)
	P	17	15	-2 (-11.76)	11	6	-5 (-45.45)	7	4	-3 (-42.86)	2.1	3.4	1.3 (61.90)	17	3.4	-13.6 (-80.00)
	Y	672	915	243 (36.16)	824	873	49 (5.95)	953	1010	57 5.98	1046	1129	83 (7.93)	672	1129	457 (68.01)
Rapeseed & Mustard	**A**	73	92	19 (26.03)	72	51	-21 (-29.17)	65	41	-24 (-36.92)	30	30	0 (0.00)	73	30	-43 (-58.90)
	Y	947	1256	309 (32.63)	872	1191	319 (36.58)	912	1119	207 (22.70)	1182	1284	102 (8.63)	947	1284	337 (35.59)
Sugarcane	**A**	112	173	61 (54.46)	126	142	16 (12.70)	153	99	-54 (-35.29)	108	60	-48 (-44.44)	112	60	-52 (-46.43)
	P	688	1022	334 948.55)	715	925	210 (29.37)	902	602	-300 (-33.26)	657	370	-287 (-43.68)	688	370	-318 (-46.22)
	Y	6141	5905	-236 (-3.84)	5678	6512	834 (14.69)	5894	6083	189 (3.21)	6086	6172	86 (1.41)	6141	6172	31 (0.50)
Total cereals	**A**	5597	5593	-4 (-0.07)	5791	6103	312 (5.390	6243	6268	25 (0.40)	6271	6480	209 (3.33)	5597	6480	883 (15.78)
	P	19982	21471	1489	21083	23848	2765	24459	25286	827	26789	26931	142	19982	26931	6949

				(7.45)			(13.11)			(3.38)			(0.53)			(34.78)
	Y	3570	3839	269 (7.54)	3641	3908	267 (7.33)	3918	4034	116 (2.96)	4272	4156	-116 (-2.72)	3570	4156	586 (16.41)
Coarse cereals	**A**	242	212	-30 (-12.40)	208	184	-24 (-11.54)	338	180	-158 (-46.75)	175	156	-19 (-10.86)	242	156	-86 (-35.54)
	P	557	481	-76 (-13.64)	486	143	-343 (-70.58)	1634	552	-1082 (-66.22)	587	526	-61 (-10.39)	557	526	-31 (-5.57)
	Y	2302	2269	-33 (-1.43)	2337	777	-1560 (-66.75)	4834	3067	-1767 (-36.55)	3354	3372	18 (0.54)	2302	3372	1070 (46.48)
Pulses	**A**	99	91	-8 (-8.08)	84	49	-35 (-41.67)	44	29	-15 (-34.09)	27	19	-8 (-29.63)	99	19	-80 (-80.81)
	P	74	75	1 (1.35)	56	30	-26 (-46.43)	35	24	-11 (-31.43)	20	16	-4 (-20.00)	74	16	-58 (-78.38)
	Y	747	824	77 (10.31)	667	612	-55 (-8.25)	795	828	33 (4.15)	741	842	101 (13.63)	747	842	95 (12.72)
Total foodgrains	**A**	5696	5684	-12 (-0.21)	5875	6152	277 (4.71)	6288	6297	9 (0.14)	6298	6499	201 (3.19)	5696	6499	803 (14.10)
	P	20056	21546	1490 (7.43)	21139	23878	2739 (12.96)	24727	25310	583 (2.36)	26809	26947	138 (0.51)	20056	26947	6891 (34.36)
	Y	3521	3791	270 (7.67)	3598	3881	283 (7.87)	3932	4019	87 (2.21)	4257	4146	-111 (-2.61)	3521	4146	625 (17.75)
Total oilseeds	**A**	194	208	14 (7.22)	150	83	-67 (-44.67)	98	70	-28 (-28.57)	60	62	2 (3.33)	194	62	-132 (-68.04)
	P	236	277	41 (17.37)	156	84	-72 (-46.15)	85	78	-7 (-8.24)	78	84	6 (7.69)	236	84	-152 (-64.41)
	Y	1216	1332	116 (9.54)	1040	1012	-28 (-2.69)	867	1114	247 (28.49)	1300	1355	55 (4.23)	1216	1355	139 (11.43)
Cotton#	**A**	702	741	39 (5.56)	724	606	-118 (-16.30)	450	607	157 (34.89)	605	511	-94 (-15.54)	702	511	-191 (-27.21)
	P	2353	1920	-433 (-18.40)	937	1305	368 (39.27)	1085	2678	1593 (146.82)	2359	2006	-353 (-14.96)	2353	2006	-347 (-14.75)
	Y	570	440	-130 (-22.81)	220	366	146 (66.36)	410	750	340 (82.93)	663	641	-22 (-3.32)	570	641	71 (12.46)
Potato	**A**	28	48	20 (71.43)	55	57	2 (3.64)	68	76	8 (11.76)	90	83	-7 (-7.78)	28	83	55 (196.43)
	P	498	838	340 (68.27)	827	1147	320 (38.69)	1395	1353	-42 (-3.01)	1714	2116	402 (23.45)	498	2116	1618 (324.90)
	Y	17518	17463	-55 (-0.31)	15122	20054	4932 (32.61)	20515	17803	-2712 (-13.22)	19044	25494	6450 (33.87)	17518	25494	7976 (45.53)

*** Constitutes initial four year of plan. Figures in parentheses indicate percentage change.**

A : Area (000 ha), P: Production (000 metric tonnes) and Y: Yield (Kg/ha)

 # Production of cotton in 000 bales (cleaned lint)

Table 5.2: Plan-wise compound annual growth rates of major crops in Punjab

Crop		8th Plan	9th Plan	10th Plan	11th Plan*	Overall (1992-93 to 2010-11)
Rice	A	0.85ns	2.11ns	0.84ns	2.67***	1.56***
	P	-0.25ns	3.68**	3.26*	1.16ns	2.79***
	Y	-1.09ns	1.53ns	2.40*	-1.48ns	1.20***
Wheat	A	-0.68ns	0.93***	0.60ns	0.19ns	0.47***
	P	1.29ns	4.81*	0.58ns	1.05ns	1.16***
	Y	1.98ns	3.84	-0.02ns	0.73ns	0.69***
Maize	A	-3.89**	0.69ns	-0.27ns	-5.09***	-1.47***
	P	-5.70ns	8.29**	7.63ns	2.76*	2.18
	Y	-1.95ns	7.55**	7.92ns	2.47*	3.71***
Gram	A	-9.25**	-15.83*	-14.14***	12.93*	-12.48***
	P	-1.32ns	-13.37*	-12.56**	16.22*	-10.82***
	Y	7.31ns	3.10ns	0.77ns	3.02*	1.86***
Sugarcane	A	15.47ns	4.08ns	-11.77*	-14.79*	-2.08*
	P	15.40ns	7.81ns	-10.58ns	-14.76*	-2.87**
	Y	-0.001ns	3.57***	1.36ns	0.01ns	-0.23ns
Cotton	A	3.66ns	-5.13ns	8.41**	-6.82***	-1.56**
	P	-1.65ns	14.61ns	25.69***	-8.65***	2.29ns
	Y	-5.13ns	20.79*	15.94**	-1.97ns	3.91**
Potato	**A**	19.07*	-2.02ns	3.00**	-9.61**	6.07***
	P	19.15*	4.25ns	-2.29ns	-1.39ns	7.45***
	Y	0.57ns	6.26*	-5.14ns	8.90*	1.32**
Total cereals	A	-0.31ns	1.24ns	0.05ns	1.08**	0.82***
	P	0.61ns	3.55ns	0.48ns	1.00*	1.78***
	Y	0.93ns	2.16ns	0.43ns	-0.07ns	0.95***
Total Pulses	A	-1.88***	-13.00***	-9.97**	-9.94*	-9.86***
	P	0.53ns	-13.37***	-9.15*	-6.38*	-9.50***
	Y	2.45ns	-0.44ns	0.94ns	3.93ns	0.41ns
Total foodgrains	**A**	-0.28ns	1.18ns	-0.01ns	1.04**	0.73***
	P	0.61ns	3.50ns	0.28ns	1.00ns	1.76***
	Y	0.89ns	2.29*	0.29ns	-0.04ns	1.01***
Total oilseeds	**A**	6.15ns	-16.12***	-7.18**	-1.73ns	-7.12***
	P	8.22ns	-16.55***	-3.35ns	-0.58ns	-6.89**
	Y	1.97ns	-0.52ns	4.13ns	1.17ns	0.25ns

*** Constitutes initial four year of plan**

*****, ** and * Significant at one, five and ten percent level of probability, respectively**

Chapter 6

Agricultural Research, Education and Extension

Agricultural research is a vital input for planned growth and sustainable development of agriculture in the country. With Indian Council of Agricultural Research (ICAR) being an apex scientific organization at national level, at state level Punjab has an excellent infrastructure for agricultural research and education at Punjab Agricultural University. It played a crucial role in promoting and accelerating the use of science and technology programmes relating to agricultural research and education. It also provides assistance and support in demonstrating the use of new technologies in agriculture. Punjab Agricultural University did a commendable job in adapting/developing wheat and rice varieties to suit the regional conditions leading to manifold increase in productivity. It has also made notable contributions in increasing livestock and poultry production. In 2006 the College of Veterinary Science of PAU, Ludhiana was upgraded to become Guru Angad Dev Veterinary and Animal Science University (GADVASU) which is now looking after the research, teaching and extension regarding livestock and veterinary sciences.

Table 6.1: List of crop varieties/hybrids released by Punjab Agricultural University

S. No.	Name of crop	Number of varieties
1	Wheat	56
2	Barley	11
3	Rice	33
4	Maize	31
5	Cotton	37
6	Pulses	54
7	Soybean	8
8	Oilseeds	53
9	Pearl millet	14
10	Fodder	39
11	Sugarcane	21
12	Vegetables	158
13	Fruits	132
14	Flowers	30
15	Mushrooms	9
16	Forest crops	11
17	New crops	3
18	Green manuring crops	3
	Total	703

Source: Directorate of Research, Punjab Agricultural University, Ludhiana

In PAU, research is a major arena and it is engaged in carrying out research in Agriculture, Agricultural Engineering, Basic Sciences and Home Science. Since its inception, PAU has evolved a strong crop improvement programme and released 703 crop varieties and hybrids. Number of varieties/hybrids released at national level is 115. Among these several have gained national and international acceptability. List of crop varieties/hybrids released by PAU is given in Table 6.1. PAU introduced cultivation of many new crops and developed/recommended resource conservation/crop production technologies like;

- technology for reclamation of problem soils (saline and water logged)
- zero tillage/minimum tillage
- bed planting/ridge planting
- leaf colour charts
- integrated nutrient management
- soil testing based fertilizer application
- net-house cultivation of vegetables
- direct seeding of paddy
- laser leveling of fields
- tensiometer (for optimum irrigation)
- crop residue management technologies

PAU also worked out crop disease/fungus management and integrated pest management/insect resistance management technologies. Besides, it has strong farm machinery development and testing programme. Italian honeybee was introduced in Punjab and technologies in honey production, extraction and processing were developed.

The State Department of Agriculture as well as extension services of PAU and GADVASU play lead role in dissemination of research findings and recommendations among the farming community of Punjab, who quickly respond through adoption of the same. The State Department of Agriculture has district level training centres which are instrumental in imparting training to the farmers and farm-women in day to day agricultural technological developments with regard to crop production and allied activities. District level camps are organized both in Kharif and Rabi season by department where experts/scientists educate the field staff as well as

progressive farmers about the latest scientific crop production/management technologies. Field staff of the department has been organizing farmers training camps at block and village level. Extension wings of the PAU and GADVASU are the vital links between scientists and different state departments, other development agencies and farmers. Directorate of Agricultural Extension, PAU provides agricultural extension services through farm advisory services, Krishi Vigyan Kendra's (KVKs) and farm communication wing. Besides expert TV talks, PAU demonstrates latest technologies to farmers at Kisan Melas at University Campus as well as at various Regional Research Stations which attracts large number of farmers. List of major agricultural extension activities of PAU is given in Table 6.1.

Table 6.2: Major agricultural extension activities by Punjab Agricultural University

Activity	No. of activities performed				
	2007-08	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Kisan melas	10	10	10	11	11
Workshops	4	5	5	7	5
Adaptive research trainings	105	58	745	1053	433
Demonstrations	2900	5100	1859	771	2935
Field level days	1200	-	2052	3388	853
Campaigns	-	-	-	-	656
Field days	272	275	36	134	285
Exhibitions	427	425	200	420	941
Training courses	1227	670	1582	2264	1885
Training camps	362	700	580	677	656
Technical guidance	12691	10538	79211	109975	63421

Source: Directorate of Extension, Punjab Agricultural University, Ludhiana

Since inception PAU is operating an elaborative programme of undergraduate and post graduate studies in agricultural and allied fields. During 2011-12, there were about 2950 students studying in various agricultural and allied disciplines. Besides four year programme in B Sc agriculture, with aim to induct more students from the rural areas a six year programme of B Sc agriculture

was started in 2008-09. Certificate courses for farmers to train in application of recent agricultural technologies are being also run in the University. With a view to meet the emerging challenges in agricultural economy these programmes are regularly being updated. Besides, in recent years a number of private colleges and universities in state have also started graduate programmes in agriculture.

Chapter 7

Animal Husbandry, Dairying and Fisheries

In Punjab, animal husbandry is closely interwoven with agriculture and plays an important role in rural economy. But it received relatively less attention in comparison to crop production till recently. After achieving self sufficiency in food grain production, government initiated various steps to usher the white revolution in the country. Livestock is one of the important components of the primary sector of the economy; contributing about 8.36 per cent of the Gross State Domestic Product (GSDP) and about 27 percent share in agriculture and allied activities in 2010-11.

Most of the farm families in Punjab maintain milk animals to produce milk major part of which is consumed at home. The per capita availability of milk in Punjab is 944 grams per day, which is quite higher than the national average of 263 grams. The yield of milch animals, though higher than national average, is not in consonance with the levels attained in developed countries. The dairy sector in the state is facing problems due to less productivity of animals, higher cost of production and marketing of the produce. About 5.98 lakh hectare area in the state is under fodder cultivation, which comes out to be about 7 per cent of gross cropped area of the state. The fodder crops occupied about 2.91 lakh hectare area in the rabi season, about 2.82 lakh hectare during kharif season and about 0.15 lakh hectare area cultivated during summer season. However, daily fodder availability in the state comes to be 10-12 kg per animal, which is quite lower as compared to the optimum requirement of 40 to 50 kg per animal. Hence, the milch animals are under nourished and it affects their productivity level (Grover and Kumar, 2011).

The data on livestock population in Punjab is presented in Table 7.1. The figures revealed that people of state are losing interest in livestock enterprise as livestock population in Punjab has been decreasing continuously since 1997. It declined tremendously by about 25 per cent per about 98.57 lakh in 1997 to only 73.65 lakh during 2007. The number has decreased for all the livestock animals. Due to consumers' preference towards buffalo milk reason being its high fat content, Punjab is dominated by buffalo population. While at national level cattle outnumber the buffaloes, in Punjab buffaloes outnumber the cattle. Share of buffaloes in total livestock population of state was found out to be about 68 per cent during 2007. The buffalo population showed decline in number from 61.70 lakh in 1997 to 50.37 lakh in 2007. Similarly, cattle

population has declined from about 26.39 lakh to 17.61 lakh during this period and its share in total livestock population also declined from about 27 per cent to 24 per cent. The population of sheep reduced from 4.36 lakh in 1997 to 2.11 lakh in 2007. Over this period the goat population also reduced from 4.14 lakh to 2.86 lakh. The respective share of sheep and goat in total livestock population over this period went down from 4.42 and 4.20 per cent during 1997 to 2.86 and 3.89 per cent.

Table 7.1: Number of livestock, Punjab, 1997 - 2007

(000 head)

Particulars	**1997**	**2003**	**2007**	**Change (%) 1997 to 2007**
Cattle	2639 (26.77)	2038 (23.68)	1760.92 (23.91)	-33.27
Buffaloes	6170.7 (62.60)	5994.57 (69.64)	5035.63 (68.37)	-18.39
Horses and ponies	34.2 (0.35)	29.3 (0.34)	29.81 (0.40)	-12.84
Donkeys	17.4 (0.18)	9.2 (0.11)	4.83 (0.07)	-72.24
Mules	22.5 (0.23)	5.3 (0.06)	9.67 (0.13)	-57.02
Sheep	436 (4.42)	220.1 (2.56)	210.6 (2.86)	-51.70
Goat	414.1 (4.20)	278.2 (3.23)	286.39 (3.89)	-30.84
Camels	29.7 (0.30)	3.40 (0.04)	2.21 (0.03)	-92.56
Pigs	93.7 (0.95)	29.00 (0.34)	24.99 (0.34)	-73.33
Total livestock	**9857.3 (100.00)**	**8607.5 (100.00)**	**7365.27 (100.00)**	**-25.28**

Source: Statistical Abstract, Punjab

Note: Figures in parentheses show the per cent to total in each column.

The data on production of important livestock products in state is given in Table 7.2. During 2009-10, the milk production in the state was observed to be about 94 lakh tones. Although the per capita availability of milk in the Punjab state is the highest in the state, still the dairy sector in the state is facing problems due to less productivity of animals, higher cost of production and marketing of the produce. Production of eggs the second most important

livestock product in state which was at 37.91 billion in 2007-08 went down to 32.83 billion during 2009-10. Meat production during this period went up from 109 thousand tones to 147 thousand tones.

Table 7.2: Production of important livestock products in Punjab

Item	2007-08	2008-09	2009-10
Milk (000, tonnes)	9282	9387	9389
Eggs (Lakh No.)	37914	36790	32828
Meat (000, tonnes)	109	108	147
Wool (000, kg)	435	451	485

Source: Agricultural Statistics at a Glance
Meat production is from recognized sector unless specific otherwise

After the green and white revolution, Punjab is now on the threshold of a blue revolution as the state has a great potential of diversification of agriculture in favour of fish farming. The farmers are already engaged in the intensive fish culture in ponds and tanks on modern scientific lines through composite fish culture of fast growing resources. Fisheries resources of Punjab comprise 868 kilometers of rivers, 11,200 kilometers of canals, 5084 hectares of small water reservoirs and lakes. In addition to this, there are 7135 village ponds covering an area of 4378 hectares, which can be made suitable for fish culture after minor renovation. Another 5228 village ponds covering an area of 2668 hectares, which requires major renovation work, can also be made fit for fish culture (Grover and Sanjay, 2011). The relevant statistics regarding fish culture and production in the state is presented in Table 7.3.

Table 7.3: Fisheries statistics in Punjab

Year	Area where fish stocked (hectare)	No. of fingerlings (000')	Fish seed and nurseries production (Lakh)	Fish production (000 tonnes)
2007-08	9941	142281	465.62	78.73
2008-09	10058	139486	527.94	104.77
2009-10	10247	153179	341.29	122.86
2010-11	10857	164474	532.17	NA

Source: Statistical Abstract, Punjab and Agricultural Statistics at a Glance

The area where fish is stocked has been increased from 9941 ha in 2007-08 to 10857 ha in 2010-11. During this period production of fish seed and nurseries improved from 465.62 lakh to 532.17 lakh. Fish production in state increased remarkably from 78.73 thousand tonnes in 2007-08 to 122.86 thousand tonnes in 2009-10.

Table 7.4: Average no. of livestock units, area and units served per veterinary institution and per veterinarian in Punjab

Year	Unit No*	Livestock units per		Area served per sq. km.	
		Institution	Veterinarian	Institution	Veterinarian
2007-08	7052908	2473	5159	17.66	36.84
2008-09	7052908	2473	5159	17.66	36.84
2009-10	7052908	2473	5159	17.66	36.84
2010-11	7052908	2473	5159	17.66	36.84

Source: Statistical Abstract, Punjab
Estimated on the growth rate of 1977 and 1990, 1990-1997 and 2003 livestock census by using modified geometric method
Note: Total livestock has been converted into livestock units-One livestock unit=one cattle=one buffalo=one horse/pony=one donkey=one camel=10 goats=10 sheep= 5pigs= 100 poultry

Table 7.5: Livestock and artificial insemination development centers and frozen semen straw produced in Punjab

(Number)

Livestock	2007-08	2008-09	2009-10	2010-11
Bull kept in A.I. centers/ semen banks				
Cow bulls	63	64	61	63
Buff bulls	59	53	56	60
Holstien Friesian	487311	609839	918739	985902
Breed-wise frozen semen straw produced in semen banks				
Sahiwal	71745	67270	65966	75142
Crossbred	410107	364169	569857	554517
Jeracy	153694	183211	213243	154032
Buffalo	803281	1001982	1278691	1655417

Source: Statistical Abstract, Punjab

Growth in any sector or sub sector is not possible without back up of adequate infrastructure and related services. However, in Punjab the number of livestock units as well as

area served per institution and veterinarian has not been improved since 2007-08 (Table 7.4). Information on breed-wise frozen semen straw produced in semen banks also reveals that except for buffalo there is no significant improvement for other breeds (Table 7.5).

Chapter 8

Post harvest Management and Value Addition

Developing countries have long promoted post harvest management and value added processing of agricultural output as a path of industrialization. With increase in per capita income and urbanization leading to increase in demand for high quality processed and packaged foods the process of value adding to agricultural production and fostering of farm non-farm linkages starts gathering momentum which in turn generates higher income and employment for the farm families, besides making agriculture a more effective contributor to industrial growth (Sarkar, 1997). Agro based industry refers to the subset of manufacturing that processes raw materials obtained from agriculture and its allied sectors such as animal husbandry, forestry and logging and intermediate products derived from other industries such as semi processed hides and skins for manufacturing leather and leather products and edible oils for manufacturing hydrogenated oil. The value adding processes ranges from simple preservation like drying, grading and storage of output to production of high value products such as manufacturing of textiles, paper, rubber etc., through modern capital intensive methods (Chadha and Sahu, 2003).

Punjab, despite being the leading producer of food grains is way behind in value addition industry to agricultural output. The state government has taken many steps to diversify the Punjab agriculture toward the production of high value crops. However, the high value crops like fruits and vegetables are highly perishable in nature and the farmers have to decide immediately at the time of harvest to dispose of the produce. Due to lack of adequate facilities for post harvest handling of high value crops like grading and packing houses, cold storages etc. diversification initiates in state met with limited success. The processing plants established in the area procure the produce from a few contract farmers only and the majority has to depend upon the markets where the prices are highly volatile in nature whenever there is glut in the market and a slight delay in disposal may lead to serious post harvest losses to the produce. Both quantitative and qualitative losses of extremely variable magnitude occur at all stages in the post harvest system from harvesting, through handling, storage, processing and marketing to final delivery to the consumer. The principal causes of these losses are physiological deterioration due to high temperature, low atmospheric humidity and damage due to physical injury, diseases and pests.

Post harvest losses range between 15-35 per cent for different types of agricultural

produce. It is obvious that any reduction in post harvest losses will contribute to the net availability of food in the economy, which is of immeasurable worth and will help to increase the producer's returns and consumer's price (Grover and Kumar, 2011).

With the scale of production the most prominent food grain processing activity in state is the milling of paddy. Rice milling is a primary processing activity under which the paddy grain is converted into polished rice. Rice forms the basic primary processed product obtained from paddy along with various secondary and tertiary products like husk and bran oil. Till nineties, the major portion of the paddy was milled through hullers usually with low milling capacity and no control on the polishing of rice, bran and a higher breakage of rice occurs. To overcome all these, rice mills have been established and became more popular as substitute for a huller mill. Over time number of improved/modern rice mills in the state increased remarkably to 3778 in the year 2011-12 (Table 8.1).

Table 8.1: Number of rice mills in Punjab

Year	Modernized rice mills
2009-10	3161
2010-11	3505
2011-12	3778

Source: Department of Food and Civil Supplies, Punjab, Chandigarh.

District-wise number of modern rice mills in state and installed capacity is presented in Table 8.2. Sangrur and Patiala district of the state are leading districts in terms of the number of modern rice mills in the state and occupying about 18 and 17 per cent of the total number of mills in the state in the year 2009-10. Ludhiana, Barnala and Bathinda are the other important districts in terms of the number of modern rice mills in the state and occupying about 10, 9 and 7 per cent of the total number of mills in the state, respectively. Presently, the milling capacity of paddy processing by the modern rice mills in the state was 7308MT. Sangrur district of the state has the highest milling capacity of paddy accounting for about 16 per cent of the total capacity in the state in the year 2009-10. Ludhiana, Patiala and Moga are the other important districts in terms of milling capacity of paddy processing by the modern rice mills in the state which was about 14, 11 and 8 per cent, respectively.

Table 8.2: District wise number of modern rice mills, 2009-10, Punjab

District	Number	%age	Capacity (tonnes)	%age
Gurdaspur	77	2.40	206.90	2.8
Amritsar	33	1.00	61.00	0.8
Tarntaran	33	1.00	83.00	1.1
Kapurthala	74	2.30	263.00	3.5
Jalandhar	63	2.00	376.00	5.0
SBS Nagar	37	1.20	133.50	1.8
Hoshiarpur	40	1.30	101.25	1.4
Ropar	32	1.00	112.00	1.5
SAS Nagar	21	0.70	44.50	0.6
Ludhiana	306	9.70	1025.69	13.7
Ferozepur	140	4.40	391.00	5.2
Faridkot	100	3.20	411.00	5.5
Muktsar	136	4.30	217.00	2.9
Moga	166	5.30	628.50	8.4
Bathinda	231	7.30	411.00	5.5
Mansa	192	6.10	274.50	3.7
Sangrur	563	17.80	1161.25	15.5
Barnala	268	8.50	546.00	7.3
Patiala	526	16.60	801.25	10.7
Fatehgarh	123	3.90	232.00	3.1
Punjab\	3161	100.00	7308.84	100.0

Source: Department of Food and Civil Supplies, Punjab, Chandigarh

Table 8.3: Cane crushed and sugar produced by sugar mills in Punjab

(000, tonnes)

Year	Daily Crushing capacity	Cane crushed (Supply)	% of capacity utilization
2007-08	9377.40	5760.5	61.42
2008-09	9377.40	2603.5	27.76
2009-10	9377.40	2112.0	22.52
2010-11	10502.40	3433.2	32.69

Source: Statistical Abstract, Punjab

Note: Number of working days of sugar mills assumed to be 150 in a year

Sugar is also one of the largest agro industries in state with daily crushing capacity of 105.02 lakh tones during 2010-11 (Table 8.3). However, due to declined interest of farmers in sugarcane cultivation and hence decline in cane supply, per cent capacity utilization is decreasing day by day. The per cent capacity utilization in state sugar industry has been gone down from about 60 per cent in 2007-08 to only about 33 per cent in 2010-11.

Cotton is the first largest agro based manufacturing industry in India with value addition of at least 100 per cent in successive stages of processing. Cotton after spinning to yarn is woven to fabrics, processed and converted to made ups or readymade garments. The value addition by converting cotton to readymade garments is impressive through export of cotton products (Chengappa, 2004). The number of spinning mills, composite mills, spindles, roster and looms installed in textile industry of Punjab is given in 8.4. Production of yarn, cloth in Cotton Textile Mills and production of traditional Khadi in Punjab is given in Table 8.5.

Table 8.4: Cotton textile mills, spindles and looms in Punjab

(Number)

Particulars	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12 (April-Nov.)**
Spinning mills	109	119	119	127	127
Composite mills	4	4	4	6	8
Spindles installed (000)	1950	2199	2353	3116	3113
Roters installed	54412	61024	61024	72996	75016
Looms installed	1241	1090	1090	1269	1359

Source: Statistical Abstract, Punjab
The data includes small scale industries

Table 8.5: Production of yarn, cloth in cotton textile mills and production of traditional khadi in Punjab

Year	**Total yarn (000 kg.)***	**Total cloth/ M.sq.mtr**	**Production of traditional khadi (000' metre)****
2007-08	489617	206.51	913
2008-09	545482	220.30	740
2009-10	-	-	627

Source: Statistical Abstract, Punjab
Total cloth includes cloth production by mill sector and exclusive wearing units
Includes production of yarn by SSI units
Includes khadi sewa sangh Jalandhar also

The state is one of the major milk producing states in India and per capita milk availability in Punjab is highest in country. During 2010-11, there were 73 milk plants in state of which 11 were in cooperative sector (Milk fed), 3 in joint sector and 59 in private sector (Table 8.6). Out of total milk processing capacity of 8125 thousand liters per day about 21 per cent falls with the Milkfed, about 6 per cent in joint sector and the rest (72.63%) with the private sector. The figures revealed that since 2007-08 the relative role of private sector in milk processing has been increasing consistently.

Table 8.6: Numbers of milk plants and milk processing capacity in Punjab

Particulars	Number of milk plant	Capacity (000 liter/day)
2007-08		
Milkfed	11 (18.03)	1525 (26.93)
Joint sector	4 (6.56)	700 (12.36)
Private sector	46 (75.41)	3437.88 (60.71)
Total	61 (100.00)	5662.88 (100.00)
2008-09		
Milkfed	11 (15.71)	1525 (31.17)
Joint sector	3 (4.29)	400 (8.18)
Private sector	56 (80.00)	2967.86 (60.66)
Total	70 (100.00)	4892.86 (100.00)
2009-10		
Milkfed	11 (14.86)	1525 (24.47)
Joint sector	3 (4.05)	500 (8.02)
Private sector	60 (81.08)	4206 (67.50)
Total	74 (100.00)	6231 (100.00)
2010-11		
Milkfed	11 (15.07)	1725 (21.23)
Joint sector	3 (4.11)	500 (6.15)
Private sector	59 (80.82)	5900 (72.62)
Total	73 (100.00)	8125 (100.00)

Source: Statistical Abstract, Punjab
Figures in the parentheses are percentage to the total

Processing of fruits and vegetables is very limited in Punjab. Specific processed products that are produced from horticulture sector in state include tomato paste, potato chips, juices, jams, chutney, pickles, murabbas, frozen vegetables, etc. Due to climatic conditions the fruits and vegetables production in state is characterized by short harvesting seasons and high productivity. Hence the viability of processing plants handling only one type of fruits/vegetables

becomes limited and ultimately becomes uneconomical. Punjab Agro Juices Limited (PAJL) was established in 2006 with aim to add value to horticultural crops and provide opportunity to farmers for selling their produce at competitive basis. Two major plants (Hoshiarpur and Abohar) which can handle processing of various fruits and vegetables, commissioned by PAJL had started commercial production during 2008. These processing plants can handle pulp as well as store all the concentrates and single strength juices at the facility. In addition both of the plants are equipped with facilities of normal cold storage and deep freezer. Other notable high tech agro/food industries involved in value addition to agricultural production in state are Glaxo Smithkleim at Nabha (Patiala), Nestle at Moga, Nijjar Agro Foods at Jandiala and Pepsico agro Foods at Zahoora (Hoshiarpur).

Overall despite being the leading agrarian state of country, Punjab is way behind in food processing/value addition industry. The agro industry in state is limited to grain processing like rice milling, flour mills, oil mills and cotton ginning.

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