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1 Overview of Jammu and Kashmir State

The Himalayan hill and mountain areas lying within India fall into two distinct geographical regions with wide variation in climate, land use and culture. These are (i) North West Himalayan region comprising of the states of Jammu and Kashmir, Himachal Pradesh and Uttaranchal. (ii) North East Himalayan region comprising of states of Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Nagaland, Tripura and Sikkim and Siliguri-Darjeeling districts of West Bengal. North West Himalayan region covers more than one eighth of the total land of the country and is located between 20° and 30° N latitude with elevations in the range of 300 to 8400 m masl. Some of the areas at higher altitudes are sparsely populated. The Jammu and Kashmir State lies in the extreme north of the Himalaya and constitutes about 67.5 per cent of the North West Himalayan region.

The State of Jammu and Kashmir located in the north Western corner of India, extends between 32°-17' and of 37°-5' North parallels of latitude and 73°-26' and 80°-30' east of meridians of longitudes and 81° East of Greenwich. The State is located almost in the middle of three climatic regimes of Asia. In its south border lies the weak monsoon zone of Punjab. On the north-east the State is bordered by the vast arid plateau of Tibet while the North-west border areas face the eastern limits of Mediterranean climatic region. This geographical position, coupled with the varied physiography, provides the State a wide climatic variation. The State has been divided into four broad macro-climatic zones (i) sub-tropical (ii) valley temperate (iii) intermediate (iv) cold-arid. The State has mostly a mountainous area and occupies a central position in the continent of Asia. Out of 3.5 million ha of mountainous area of India, nearly two third i.e. 2.3 million ha are found exclusively in Jammu and Kashmir State. The State is bounded on the north by Chinese and Russian territories, on the east by Tibet, on the south by Punjab (India) and on the West by Pakistan (Fig.1). It has high mountainous terrains with many snow covered peaks ranging in altitude from 554 to 7077m masl in North and North-west, which are succeeded towards the South by lower range of hills.

Total geographical area of the State is 2,22,236 km² out of which 78,114 km² (35.15%) area lies under the occupation of Pakistan, and 42,735 km² (19.23%) under the occupation of China (including the area handed over by Pakistan to China). Therefore, the State is left with an area of 101,387 km² (45.62%). Ladakh is the largest hilly arid zone which occupies 58321 km² (42.00%).

The population of Jammu & Kashmir State according to 2011 census was 1,25,41,302 constituting about 1 per cent of the total population in India. Out of this nearly 53 per cent were males and 47 per cent were females. The population density in 2011 was 123 persons per square km against 99 persons in 2001. In Jammu and Kashmir State, according to 2011 census about 75.19 per cent population lives in villages and rest in urban areas. The literacy rate of Jammu and Kashmir State is about 67.16 per cent against 65.38 per cent of literacy rate at national level (Census of J&K, 2011). The State of Jammu and Kashmir is predominantly an agriculture State. In J&K state cultivators and those engaged in primary occupation constitute about 64.8 per cent of the total work force. Nearly 3.1 per cent are

agricultural labourers and 4 per cent involved in other primary activities like livestock, forestry, plantation, mining, quarrying and other allied activities. About 21.0 per cent work force is dependent on construction works and 7.7 per cent involved in trade and commerce, transport, communication, storage activities etc. Other services provide employment to 11.6 per cent of the total work force (Table 1)

The state on the basis of physiography may be divided into three main regions (i) outer Himalayas which comprise of Jammu province (ii) lesser Himalayas which comprises of Kashmir Valley and (iii) inner Himalayas which comprises of Ladakh province and four major corresponding agro-climatic zones detailed below:

i) Jammu region

Jammu region comprises of two major agro-climatic zones viz. low altitude subtropical zone and mid to high intermediate zone.

Low altitude subtropical zone (JK-1)

The zone is characterized by monsoon, concentration of precipitation, hot spell of summer, relatively dry but pronounced winter and preponderance of alluvial soils. It comprises of whole Jammu district and lower parts of Kathua, Udhampur, Poonch and Rajouri districts. Maximum rainfall is received during July-September. The mean height above sea level ranges from less than 300 m to nearly 1350 m. Hottest months of the zone are May, June and July and coldest December, January and February. Its sub-zone is outer hills with preponderance of brown hill soil, with slightly higher elevation than the subtropical zone.

Mid to high altitude intermediate zone (JK-2)

This zone is subtropical – temperate transition and comprises of the mid and high altitude areas of the Panjal trap. The zone is characterized by monsoon, concentration of precipitation, relatively wetter, cold winters and higher mean annual rainfall than subtropical zone. The soils are mainly spodic. It encompasses all the areas above outer hills, including the districts of Doda, Poonch, parts of Rajouri, Udhampur and Kathua. The zone varies in elevation from 800 to 1500 m masl in mid altitude and upto 4000 m masl in higher altitude. River Chenab and its tributaries constitute the major drainage base. However, upper parts of Kathua district drain into Ravi. Its sub-zone marks the limit between valley temperate and cold arid zone. The intermediate zone marks almost the last line of South Western monsoon in summer and similarly the last line of North Western disturbance in winter. In summer, the zone, therefore, receives more rainfall than subtropical and valley temperate zone.

ii) Kashmir region (Mid to high altitude temperate zone) (JK-3)

Kashmir region or temperate zone essentially covers the valley of Kashmir comprising of the districts Anantnag, Pulwama, Srinagar, Budgam, Baramulla and Kupwara. This zone experiences wet and often severe winters with frost, snow and rain and relatively dry and warm summer. Snowfall, an important form of precipitation, helps to maintain adequate moisture supply during summer when rainfall is scanty. The valley temperate zone encompasses the areas of varied relief. The plain valleys have an altitude of 1560 m masl, which rises to 1950 m in low altitude Karewas in mid belts, 2400 – 3000 m in the upper belts and to 4200 m in snow bound areas. The soils of Kashmir valley are alluvial

Table 1 Area and Population of J&K State.

Particulars	Region			State
	Jammu	Kashmir	Ladakh	
Area (sq. km)	26293	15948	59146	101387
Percentage area	25.93	15.73	58.33	
Population (2011 census)	5378538	6888475	274289	12,541,302
Density of population (per sq. km)	204	431	4.6	123
Literacy rates (%)				
- Males	81.11	72.8	84.79	76.7
- Females	61.72	52	59.19	56.43
- Av.literacy	71.98	62.9	74.2	67.16
Rural population as %age to total population	77	68.39	77.32	75.19
Percentage to total population of				
- SC	17.06	0.098	0.18	7.38
- ST	-	-	-	11.91
Total Working force ('2011)				
- Rural	1403035	1336827	94713	2834573
- Urban	338540	471532	19057	829129
Main Workers as %age to total population.	23.20	19.01	31.3	25.77

Source: Digest of Statistics, Directorate of Economics & Statistics, J&K Govt., Year 2011-12.

The region has two districts namely Leh and Kargil. The terrain is mostly mountainous and denuded. With exception of some pockets, most of the area is devoid of vegetation. The cold arid zone experiences severe cold and dry winter and moderately hot and dry summer. The zone receives about 80-90 mm rainfalls in Leh to about 300 mm in Kargil. The zone is characterized by formidable aridity with very cold thermal index. Soils of this zone are mountain meadow soils with appreciable spread of Skeletal and Tarai soils. Usually soils are derived from weathered debris of rocks, with high permeability and low water holding capacity. This is the zone of highest average elevation. The elevation range from more than 2400 m with peaks ranging from 7200 to 8400 m (Table 2)

Climate of Jammu and Kashmir

The long term climatological parameters of J&K are presented in Table 3. Compared to other parts of the country which are witnessing externalities of climate change, long term annual rainfall in the state showed positive growth momentum with annual growth rate of 1.39 percent during last 28 years. Overall, annual maximum and minimum temperature for the State almost exhibited a uniform trend during last 40 years.

Table 2 Major characteristics of agro-climatic zones of J&K

S. No.	Particulars	Jammu		Kashmir	Ladakh
		JK-1 (sub-tropical)	JK-2 (Intermediate)	JK-3 (Temperate)	JK-4 (Cold arid)
1.	Geographical distribution	Jammu district, lower parts of Udhampur, Rajouri, Kathua, Poonch districts	District Doda, all outer hills of Jammu Division and parts of Poonch, Rajouri,	All six districts of Kashmir valley viz., Anantnag, Pulwama, Srikangar, Budgam,	Two districts of Ladakh (Leh, Kargil)
2.	Principal crops/fruits	Paddy, maize, wheat, oats	Maize, wheat, barley, Paddy, oats, oilseeds	Paddy, maize, oilseeds, temperate fruits almond, saffron	Barley, wheat, alfalfa, apricot
3.	Major livestock	Cross and local cow, buffalo, sheep and goat	Local cow, buffalo, crossbred cow	Crossbred and local cow, sheep and goat	Local and crossbred cow, yak, pashmina
4.	Average land holdings (ha)	0.99	0.93	0.53	1.08
5.	Net irrigated area (%)	36	10	62	100
6.	Major rivers	Ravi, Tawi	Chenab	Jhelum	Indus, Shyok
7.	Altitude (m masl range)	300-1350	800-1500	2400-3000	3500-8400
8.	Average annual rainfall	1069	1649	789	83
9.	Temperature (°C)				
	Minimum	32.1	31.4	24.5	17.4
	Maximum	13.6	11.5	1.2	-7.0
10.	Thermal	Mild	Mild	Cold	Very cold
11.	Hydric index	Humid	Humid	Humid	Arid

Land utilisation pattern

As per land utilization statistics for the year 2010-2011, the total reported area of the state is 2416 thousand hectares of which 74 per cent, 23 per cent and nearly 3 per cent is in Jammu, Kashmir and Ladakh regions respectively.

Table 3 Climatological parameters of Jammu and Kashmir

Annual Rainfall (mm)		Annual Temperature (C°)		
Year	Rainfall	Year	Maximum	Minimum
1980	669	1970	25.66	12.55
1985	640	1975	24.44	12.05
1990	882	1980	24.63	12.69
1995	1152	1985	26.35	12.73
2000	714	1990	24.85	13.06
2005	1166	1995	24.51	12.75
2008	1032	2000	25.53	13.5
2009	1125	2005	24.55	12.59
CGR	1.39	2008	25.08	12.91
SE	0.36	2010	25.62	13.33

Out of the total reported areas, net sown area is 732 thousand hectares which constituted 30 per cent for state and 22.15 per cent, 57.67 per cent and 30.89 per cent in Jammu, Kashmir and Ladakh regions respectively. Area sown more than once constituted nearly 17 per cent, 15 per cent and 2 per cent for Jammu, Kashmir and Ladakh and more than 16 per cent for the state and thus revealing cropping intensity of 178 per cent, 126 per cent, 106 per cent for Jammu, Kashmir and Ladakh regions, respectively and 154 per cent for the state as a whole. Jammu region has shown over-riding performance with cropping intensity of 178 per cent

Box 1 Geographical area and forest cover

The revenue records which form base of land use pattern in the State do not take into account the area maintained by the forest department or the total geographical area, which constitutes the entire land mass within the territories of the State. The revenue department figures refer to the inhabited areas only. In addition to this state has forest cover of 20230 sq. Kms (2023 thousand hectares) accounting for 19.95 per cent of total geographical area of 101,387 sq. Kms on this side of line of control. With the exception of cold desert Ladakh the Jammu and Kashmir regions of the state has forest cover of more than 46 per cent of the total geographical area which is twofold higher than the national average of 24 per cent (Economic Survey, 2010-2011)

ahead of Kashmir region and state average. The other purpose to which land is put to use in the state included area under forests (27.22%), area not available for cultivation (23.83%), cultivable but barren land (6.20%), permanent pastures and other grazing lands (5.31%) and fallow land (3.65%) etc. To find the trends in different land-use classes in J&K, percentage changes in each class were estimated (Table 4). The percentage changes have revealed a marginal decline (0.083%) in the total reported area which necessitates proper land-use surveys through remote sensing. The area under forest according to village papers has decreased from 671 thousand hectares (1966-67) to 658 hectares in 2010-11. This decline could be attributed to deforestation and a wide gap between rates of afforestation and deforestation.

The set trends are culminating into shortage of fuel, fodder and timber in the state. The area put on on-agricultural uses has shown a substantial increase from 276 thousand hectares in 1966-67 to 339 thousand hectares in 1977-78, but a slight favourable decline has been observed there after in its reaching to 292 thousand hectares in 2010-11 (*Digest of Statistics, various issues*). The increasing demand of nearly 6 percent land per annum during the period 1966-67 to 2010-11 for infrastructural development and urbanization has resulted in the increase of area under non-agricultural uses. This trend may have serious implications in the long-run. The area under permanent pastures and other grazing lands has declined by 4.8 percent over the years which is a cause of concern for livestock based productive system (Table 4).

Productive land utilization

The net area sown and irrigated area in a year were taken as the productive land-use in this study. It has been observed that the area available for cultivation had increased from 675 thousand hectares to 732 thousand hectares during 1966-67 to 2010-11. The net area sown as per cent of total reported area in the state has also shown an increase, from about 28

Table 4 Productive Utilization of Land in Jammu & Kashmir (area in '000ha)

Year	Total Reported area (TRA)	Net area sown (NAS)	Net sown area as percent of TRA	Per capita NAS	Irrigated area	Irrigated area as percent of NAS
1966-67	2418	675	27.91	0.165	280	41.48
1974-75	2415	688	24.49	0.137	295	42.88
1980-81	2414	715	29.62	0.122	304	42.52
1985-86	2415	732	30.31	0.109	309	42.30
1990-95	2416	731	30.26	0.096	298	40.78
1995-96	2416	734	30.38	0.084	307	41.77
2000-01	2416	748	30.96	0.075	311	41.56
2005-06	2416	734	30.38	0.070	317	43.18

2010-10	2416	732	30.29	0.070	321	43.85
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Source: Digest of Statistics (various issues), Government of J&K, Srinagar

per cent to 31 percent during this period. However, per capita availability of net area sown has significantly declined over the years, indicating a huge pressure of increasing population on land and other resources of the state. The net irrigated area had increased from 280 thousand hectares to 321 thousand hectares, and the irrigated area as percent of net area sown has increased marginally from 41.48 to 43.85 per cent over this period (Table 4)

The district-wise distribution of cultivated area in the state has been presented in Table 5. The reported area has been found to be highest in the district of Udhampur, followed by Doda and Jammu districts. Net area sown as a per cent of total reported area has been found highest in the district Kupwara (68.5%), followed by Anantnag (63.9%) and Baramulla (59%). However in Ladakh region even a blade of grass cannot be grown without irrigation. Although irrigation is a critical input in improving cropping pattern, but the agro-climatic constraints were found to hamper multiple cropping in the temperate and cold-arid regions of the state.

Table 5 District-wise productive land utilization in J&K: 2010-11 (Area in '000ha)

District	Total reported area (TRA)	Net area sown (NAS)	Net sown area as percent of TRA	Average size of holding (ha)	Irrigated area (IA)	IA as percent of (NAS)	Cropping intensity (%)
Anantnag	119.79	76.64	63.98	0.40	51.7	67.46	143.12
Pulwama	97.60	51.61	52.88	0.53	34.5	66.85	159.27
Srinagar	51.00	19.00	37.25	0.35	14.9	78.42	136.35
Budgam	77.89	41.23	52.93	0.56	28.7	69.61	122.48
Baramulla	143.75	84.87	59.04	0.50	40.7	47.96	107.20
Kupwara	66.59	45.65	68.55	0.46	23.1	50.60	100.00
Leh	45.16	9.82	21.74	0.72	9.80	99.7	103.88
Kargil	19.49	9.87	50.64	0.63	9.86	99.8	108.83
Jammu	320.11	112.90	35.27	0.85	63.7	56.42	212.37
Udhampur	431.01	70.33	16.32	1.17	6.48	9.21	170.08
Doda	411.01	64.95	15.80	0.94	7.02	10.81	130.49
Kathua	264.73	63.78	24.09	1.06	21.2	33.24	196.00
Rajouri	253.34	53.24	21.02	1.11	4.93	9.26	184.36
Poonch	114.38	27.68	24.20	0.88	3.74	13.51	168.10
J&K	2415.80	731.63	30.29	0.66	320.6	43.82	155.78

Source: Digest of Statistics, Government of J&K, Srinagar (2010-11)

Cropping pattern

In the state of Jammu and Kashmir, major proportion of total cropped area was allocated towards cereals. Area under different field crops during last 5 years revealed that rice based production system is practiced in Kashmir province while as it was wheat and

maize based in Jammu province. During last five years, a significant expansion in area under different crops was observed in Kashmir, however, in Jammu the area under different crops decelerated except pulses (Table 6). Productivity of food grains witnessed an improvement of 24 per cent during last quinquennial and turned more pronounced for Kashmir province. Overall, Kashmir province experienced a significant growth in yield of rice and wheat (Table 7& 8).

The state produces only 1627.50 thousand tonnes of food grains for feeding the population. The gap between demand and supply in Jammu and Kashmir State is increasing at a faster rate than the increase in the production level. Wheat turned most important crop of the Jammu region followed by maize and rice. The productivity of wheat in the area is low when compared with the productivity of same varieties in adjacently plains of Punjab and a national average of (2.7 q/ha). The low productivity of wheat in the Jammu region besides other factors may be attributed to the rain fed cultivation in the area. Maize is most important cereal of the state and mostly grown as a rain fed crop. The better hydro-thermal regime especially in some areas at the maturity phase of crop yields better productivity. Significant

Box 2 Shifts towards horticulture based production system

Fruit crops have witnessed most significant increase in area contributing to the shifts at a very high pace with bright prospects towards horticulture sector. Important reason being handsome return to the farmers. Horticulture, in the state has developed as an industry and more and more land is apportioned to this sector each year. While the cereal based production system provides household nutritional security in the state. It is ability of horticulture based system to generate sufficient income to provide livelihood security even to smallholder. The Department of Horticulture and Agriculture revealed variegated statistics under the area occupied by fruits and vegetables. While for 2008-09, the former revealed 87 thousand hectares the later 305.62 thousand hectares under fruit cultivation and thus depicted huge variation of 250 per cent.

changes were observed in the nature and direction of cropping pattern. The share of rice in area showed a decrease of 4% from 1981-82 to 2010-11, however during the period a marginal increase was witnessed in maize. Compared to maize, substantial increase was witnessed in the share of wheat acreage from 21.24 per cent in 1981-82 to 24.65 per cent in 2010-11. However, cereals as a group, showed continuous decline as its share got reduced from 80.14 per cent to 78.59 per cent during the same period. The decline is attributed to an absolute fall in area under rice, bajra, ragi and other cereals. Overall, there is a continuous increase in the food grain import. Significant shift in cropping pattern of Jammu and Kashmir has taken place towards horticulture based production system during the past few decades (Table 9).

Table 6. Area under principal crops during the recent years (000ha)

Division		Rice	Maize	Wheat	Pulses	Total food grain	OC&M
Kashmir	2007-08	140	92	5.24	9.93	247	10.20
	2008-09	141	90	5.04	10.93	247	4.70

	2009-10	144	89	4.94	10.07	248	4.51
	2010-11	160	100	8.25	24.50	293	NA
	2011-12	158	100	8.25	24.50	291	NA
	2012-13	158	100	8.25	24.50	291	NA
	% change	12.9	8.6	57.4	146.60	17.6	-55.8
Jammu	2007-08	123	210	273.06	20.22	627	30.24
	2008-09	117	226	273.69	19.07	636	30.86
	2009-10	117	212	283.99	20.23	632	35.56
	2010-11	112	218	284.00	18.39	633	NA
	2011-12	115	206	236.56	30.02	588	NA
	2012-13	111	200	248.00	32.74	592	NA
	% change	-10.0	-4.9	-9.20	61.90	-5.60	17.6
state	2007-08	263	302	278.30	30.15	874	40.44
	2008-09	258	316	278.72	30.00	882	35.56
	2009-10	260	301	288.93	30.30	880	40.07
	2010-11	272	318	292.25	42.89	925	NA
	2011-12	273	306	244.81	54.52	878	NA
	2012-13	269	300	256.25	57.24	882	NA
	% change	2.20	-0.8	-7.90	89.80	1.00	-0.9

Table 7. Production of major crops during the recent years (000qt)

Division		Rice	Maize	Wheat	Pulses	Total food grain	OC&M
Kashmir	2007-08	3468	964	46	57	4535	71
	2008-09	3448	1001	46	64	4559	66
	2009-10	3383	1022	84	59	4548	67
	2010-11	5280	1800	148	220	7448	NA
	2011-12	5410	2000	148	223	7781	NA
	2012-13	5500	1200	148	152	7000	NA
	% change	58.6	24.5	221.7	166.7	54.4	-5.6
Jammu	2007-08	2152	3781	4913	96	10942	159
	2008-09	2189	5330	4789	75	12383	161
	2009-10	1628	3848	2815	113	8404	166
	2010-11	2867	4098	2853	106	9924	NA
	2011-12	3201	4098	4500	367	12167	NA
	2012-13	2200	4500	5200	480	12380	NA
	% change	2.2	19.0	5.8	400.0	13.1	4.4
state	2007-08	5620	4745	4959	153	15477	230
	2008-09	5637	6331	4835	139	16942	227
	2009-10	5011	4870	2899	172	12952	233
	2010-11	8147	5898	3001	326	17371.5	NA
	2011-12	8611	6098	4648	590	19947.6	NA
	2012-13	7700	5700	5348	632	19380	NA

	% change	37.0	20.1	7.8	313.1	25.2	1.3
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Table8. Productivity of major crops during the recent years (qt/ha)

Division		Rice	Maize	Wheat	Pulses	Total food grain	OC&M
Kashmir	2007-08	24.8	10.5	8.8	5.7	18.3	7.0
	2008-09	24.5	11.1	9.1	5.9	18.5	14.0
	2009-10	23.5	11.5	17.0	5.9	18.4	14.9
	2010-11	33.0	18.0	17.9	9.0	25.4	NA
	2011-12	34.2	20.0	17.9	9.1	26.8	NA
	2012-13	34.8	12.0	17.9	6.2	24.1	NA
	% change	40.5	14.6	104.5	8.1	31.2	113.3
Jammu	2007-08	17.5	18.0	18.0	4.7	17.5	5.3
	2008-09	18.7	23.6	17.5	3.9	19.5	5.2
	2009-10	14.0	18.1	9.9	5.6	13.3	4.7
	2010-11	25.6	18.8	10.0	5.8	15.7	NA
	2011-12	27.9	19.9	19.0	12.2	20.7	NA
	2012-13	19.8	22.5	21.0	14.7	20.9	NA
	% change	13.6	25.2	16.5	208.8	19.9	-11.2
state	2007-08	21.3	15.7	17.8	5.1	17.7	5.7
	2008-09	21.9	20.0	17.3	4.6	19.2	6.4
	2009-10	19.3	16.2	10.0	5.7	14.7	5.8
	2010-11	29.9	18.5	10.3	7.6	18.8	NA
	2011-12	31.6	19.9	19.0	10.8	22.7	NA
	2012-13	28.6	19.0	20.9	11.0	22.0	NA
	% change	34.1	21.1	17.1	117.6	24.0	2.2

Table 9. Cropping pattern of food and non-food Crops in Jammu and Kashmir
(Percent of Gross Cropped Area)

Crops /Years	1981-82	2001-05	2010-11
1. Rice	26.77	22.85	22.75
2. Jowar	0.015	0.171	0.212
3. Bajra	1.82	1.325	1.485
4. Maize	27.45	29.51	27.63
5. Ragi	0.87	0.742	0.515
6. Wheat	21.24	23.09	24.65
7. Barley	0.95	0.994	1.150
8. Other Cereals	0.89	0.422	0.382

Total Cereals (1-8)	80.14	79.10	78.59
9. Gram	0.093	0.022	0.019
10. Tur/Arhar	0.0003	0.0004	0.001
11. Other Pulses	4.58	2.590	2.599
Total Pulses (9-11)	4.68	2.61	2.62
Total Food grains (1-11)	84.82	81.73	81.20
12. Sugarcane	0.070	0.014	0.005
13. Condiments	0.161	0.228	0.232
14. Fruits-Vegetables	5.30	6.891	7.665
15. Other Food Crops	0.070	0.076	0.017
Sugarcane Condiments- Fruits-Vegetables(12-15)	5.60	7.21	7.91
Other Non-food Crops	9.5	10.3	10.9
All Major Crops/GCA	100	100	100

Source: Computed on the basis of data obtained from office of the Financial Commissioner Revenue, Government of Jammu and Kashmir.

Food Demand Supply Scenario

Government's promise to increase ration to consumers notwithstanding, Kashmir is facing a monthly shortfall of 9589 MT in food-grains coming under PDS. The reason for the shortfall is due to the allocation of foodgrains from central pool to state as per the Census 2011. There is a shortfall of 9589 MT of food-grains comprising rice, wheat and sugar coming through PDS. The population of Kashmir valley including Leh and Kargil was 57.12 lakh in 2001, which as per the 2011 Census has swelled to 71.99 lakhs. The monthly demand for rice is 39,123 MT, however Kashmir receives only 32,527 MTs depicting shortfall of 6,596 MT. Further, the shortfall of wheat per month is recorded as 2993 MT. The current demand is 6522 MT as per census 2011 while the Valley receives only 3529 MT. Similarly, the shortfall in sugar in Kashmir is pegged at 1228 MT. The sugar supplied to Kashmir as per previous census is mere 3811 MT against the actual demand of 5039 MT. The Economic survey 2013-14 reveals that Jammu and Kashmir is mostly depended on the import of foodgrains from other states and the magnitude of dependence is increasing day by day. The importance of sustained foodgrain imports is essential with a view to augmenting supplies, maintaining food security and buffer stocks and ensuring price stability in land locked different valleys of state. The Economic Survey report reveals that the volume of import as well as the off-take of foodgrains is constantly increasing in the State. During 2011-12, import and off-take of food grains stood at 908.22 and 856.27 thousand metric tonnes,

respectively which depicts that by every passing year, import is swelling by 15 to 20 per cent. On the other hand, there is diversification of foodgrain area to non-food and cash crops besides rapid urbanization. According to Agriculture Department (2011), more than two lakh kanals of agriculture land have been converted for commercial and other purposes in Kashmir region alone situation is no better in Jammu region.

Irrigation in Jammu and Kashmir

Irrigation plays an important role in the agriculture sector of J&K economy. The State does not receive rain throughout the year. In Jammu region, climatic conditions favour cultivation of crops throughout the year but due to insufficient water for irrigation is a major impediment. The focus of attention now remains on extending irrigation to various parts of the state owing to the fact that self-sufficiency and food security are directly linked to it. Kashmir valley, receives rainfall mostly in winter when temperature is too low for plant growth. When the temperature starts rising in May and onwards, the rainfall decreases and except someshowers of rainfall in July-August, most of the growing season remains dry. Since ages, the farm economy has been dependant on a single crop and the cultivator cannot take chances with it. The farmer always requires sufficient water supply for his field, therefore, he depends mostly upon canals for irrigation. Many snow fed streams, running down the slopes of the mountains, makes it very easy for the Government to construct small canals or pools, despite this only 60 per cent of the land in the valley is irrigated.

Table 10 Source-wise irrigated area of J&K State (000, ha)

Year	Canals	Tanks	Wells	Other Source	Total
1980	285(93.7)	2(0.65)	4(1.3)	13(4.2)	304 (100)
1990	278(93.6)	1.58(0.53)	1.3(0.43)	16.2(5.4)	297 (100)
2000	284(91.3)	2.7(0.86)	1.5(0.48)	22.4(7.2)	311 (100)
2010	288(89.7)	6.2(1.9)	11.6(3.6)	14.6(4.5)	321 (100)

Source: Statistical Abstract of Jammu and Kashmir, Govt. of Jammu and Kashmir, 2010

Note: Figures in the parentheses are percentage to total

Input use pattern

Fertilizer is one of the crucial inputs in the Agriculture. The distribution of Chemical Fertilizers in J&K state is reflected in the Table 11. Overall, an excess use of fertilizers in the plain areas is resulting in the low humus content of the soil, thereby affecting the physio-chemical and biological properties of the soil. In hills, excessive slope washes away top soil reducing humus content of top soil, thereby reducing the water holding capacity of the soil. The major portion of the fertilizer consumption of the state is in horticulture based production system.

Table 11. Distribution of chemical fertilizer in J&K State (000, Mt)

Year	N	P	K	Total
1990-91	16.4	4.08	1.01	21.5
1995-96	30.1	11.2	2.3	43.6
2000-01	29.3	16.6	0.5	46.5
2005-06	63.6	27.0	3.1	93.9
2008-09	140.7	68.9	27.0	237

Source: Statistical Abstract of Jammu and Kashmir, Govt. of Jammu and Kashmir, 2010

2 Horticulture Sector of Jammu and Kashmir

During the first few five year plans, priority was assigned to achieve self sufficiency in food-grains production. Over the years, horticulture emerged as an important and growing sub sector of agriculture, offering a wide range of choices to the farmers for crop diversification. It also provides ample opportunities for sustaining large number of agro industries which generate substantial employment opportunities. With agriculture and allied sectors finding alternate ways of increasing productivity of crops, horticulture as a sub-sector, is a revelation, showing remarkable signs of progress in the state. Horticulture sector has emerged as an important sector for diversification of agriculture and has established its credibility in improving farm income through increased productivity, generating employment and in enhancing exports besides providing household nutritional security. The focussed attention on investment in horticulture during the last two decades has been rewarding in terms of increased production and productivity of horticultural crops with manifold export potential.

Jammu & Kashmir State is well known for its horticultural produce both in India and abroad. The state offers good scope for cultivation of horticultural crops, covering a variety of temperate fruits like apple, pear, peach, plum, apricot, almond, cherry and sub tropical fruits like mango, guava, citrus litchi, phalsa and Berete. Besides, medicinal and aromatic plants, floriculture, mushroom, plantation crops and vegetables are cultivated in the state. Apart from this, well known spices like saffron and black Zeera are also cultivated in some pockets of the state. Horticulture is gaining momentum in the state as its contribution to GSDP remains around 7-8 percent over the past few years. As a result, there is a perceptible change in the concept of horticulture development in the state. There are around 6 lakh families comprising of about 30 lakh people which are directly or indirectly associated with horticulture. Horticulture development is one of the thrust areas in the state and a number of programmes have been implemented in the past, resulting in the generation of higher incomes in the rural areas, thereby improving the quality of life in villages. An income of 4100 crore has been generated from fruit production during 2011-12 which includes an amount of 495 crore from dry fruits. The growth of horticulture sector can be attributed to various initiatives taken by the GoI and State Govt; towards market interventions viz. establishment of fruit mandies, provision for support price, technological support, awareness options, publicity inputs, research extension etc.

The Jammu and Kashmir state, situated in the extreme northern part of the country with a total geographical area of 2,416 thousand hectares is divided into three regions, viz., Jammu, Kashmir and Ladakh representing varied agro-climatic zones, thus producing diversified fruits of various kinds as depicted in Table 12. Entire Kashmir valley and few pockets of Jammu region representing temperate zone mostly cultivate temperate fruits,

whereas, major part of Jammu region and two blocks of Kashmir valley representing sub-temperate zone are suitable for production of stone fruits besides almond, pears, pecan nut and kiwi. Sub-tropical zone consists of Jammu region producing mango, citrus, guava, litchi, bear amla etc. Entire Ladakh region represents arid temperate zone producing apricots and seabuck thorn.

Table 12 Agro-climatic zones of the state and the fruits grown

Zone	Areas	Suitable Fruit kinds
Temperate Zone	Entire Kashmir Valley, Parts of Poonch, Rajouri, Doda, Kathua and Udhampur Districts of Jammu Division	Apple, Pears, Cherry, Walnut, Almond, Chestnut, Strawberry, Stone fruits and Grapes etc.
Sub-Temperate (Mid Zone)	Parts of Kathua District, Parts of Poonch District (Surankote), parts of Rajouri District (Rajouri and Kalakote), parts of Udhampur District parts of Reasi, some portion of Doda District, Ramban and Kishtwar), besides minor locations in Uri Tehsil of Baramulla District and Karnah Tehsil of Kupwara district.	Stone fruits (like Peach, Plum, Apricot) Almond, Pears, Pecan Nut, Olive and Kiwi.
Sub – Tropical Zone	Jammu District , parts of Kathua district, parts of Rajouri district, parts of Udhampur district and lower areas of Reasi) , parts of Doda District (Ramban)	Mango, Citrus, Guava, Litchi, Bear, Amla and Grapes.
Arid Temperate Zone	Districts of Leh and Kargil	Grapes (Resin type), Prunes and drying varieties of Apricots. Seabuck thorn besides cultivation of Apple, Walnut, Currants in certain areas of the region.

Food processing industry offers tremendous opportunity for commercial exploitation of horticulture of the State but commercial processing is around 1% only due to lack of post harvesting and processing facilities as well as unscientific packaging. Therefore, opportunities are open for exploiting the potential under processing, with individual, joint venture and Government efforts.

Area under fruits in J&K State has increased from 3.25 lakh hectares in 2010-11 to 3.42 lakh hectares in 2011-12, showing an increase of 5.23%. The production has increased from 17.13 lakh MTs in 2009-10 to 21.61 lakh MTs in 2011-12, recording an increase of 26.15%. The area coverage for 2012-13 is estimated at 3.77 lakh Ha ending Oct., 2012.

Species wise area under horticulture

Looking to the specie-wise details of area figures under fruit for the year 2011-12, it is observed that largest area of 45.14% (154720 hectares) is occupied by apple out of total area of 342791 hectares under fruit. Walnut is the next major fruit occupying 24.39% in the overall area under fruit.

Production

In Jammu and Kashmir State especially in Kashmir Division, horticulture plays a significant role in contributing to the economy of the state. As per estimates, over 6 lac families are actively involved in horticulture sector. This sector is one of the most important employment generating sectors in the state. Year after year, there is a significant increase in area and production under horticulture crops. The continuous increase in production and

Table 13 Variety wise area under fruits(area in 000 hectares)

Year	Apple	Pear	Apricot	Cherry	Other fresh	Walnut	Almond	Other dry	Total fruits
2004-05	107.93	10.54	4.93	2.55	41.62	74.89	15.43	0.42	258.31
2005-06	111.88	11.00	5.16	2.59	43.60	77.22	15.55	0.41	267.41
2006-07	119.04	11.25	5.43	2.75	46.24	81.39	16.37	0.62	283.09
2007-08	127.80	12.10	4.78	3.14	48.32	82.05	16.40	0.55	295.14
2008-09	133.10	12.35	4.92	3.30	49.65	84.56	17.18	0.56	305.62
2009-10	138.19	12.55	5.00	3.41	50.57	87.28	17.54	0.60	315.14
2010-11	141.71	12.53	5.85	3.46	53.50	89.78	17.65	0.58	325.06
2011-12	154.72	13.21	6.05	3.48	54.11	83.61	16.41	11.19	342.78
2012-13	173.63	20.81	9.20	3.75	55.93	81.72	31.63	0.86	377.53

Source: Agriculture Production Department, J&K

productivity can be attributed to modal factors like commitment of the farmers/orchardists towards this sector, continuous efforts of the Department of Horticulture and Research Organisations and above all the conducive agro-climatic conditions of the State. If we look at the data of area and production for the last ten years, it would be observed that there has been a continuous increase in trend both in production as well as in area. A comparison of the area & production can be made with the help of Table 13 and 14

Table 14 Area/production data under fruit crops (J&K)

Year Area	(Hectares)	Production (M. Tonnes)
2001-02	221512	1097208
2002-03	231727	1146586
2003-04	242546	1273813
2004-05	258311	1331861
2005-06	268284	1412992
2006-07	283085	1504101
2007-08	295141	1636203
2008-09	305645	1690059
2009-10	315205	1712409
2010-11	325133	2220493
2011-12	342795	2161034
2012-13 (October 2012)	377531	1883500

Source: Agriculture Production Department, J&K

The overall production of fruit has been recorded to be 21.61 lakh metric tonnes for the year 2011-12, recording a slight decrease of 0.60 lakh metric tonnes over the production of previous year figures which was 22.21 lakh metric tonnes. In the production figures, share of fresh and dry fruit were 89.42% and 10.58% with 19.32 lakh metric tonnes and 2.29 lakh metric tonnes respectively. Apple ranks first with a share of 81.30% followed by walnut with share of 9.67%.

Area and production of fruits - a disaggregate analysis

On vivid outlook of the area and production figures of fruits at district level, apple the major fruit crop of the state, is more concentrated in the districts of Kashmir region with a meagre share also coming out from the temperate areas of Jammu region. Among the Districts of Kashmir region, Baramulla stands front runner both in terms of area as well as production of the apple followed by Kupwara and Shopian districts. Pear, the next major fresh fruit crop is grown almost throughout whole state except Jammu and Samba districts, however, the major share of the production base comes from the temperate Kashmir region where some good cultivars of the crop are grown with longer shelf life. Apricot crop is grown almost in entire temperate areas of the state covering all the regions, however, the major share of the fruit (almost 40%) comes from Kargil district alone of the Ladakh region. The other temperate fruits like peach, plum, and cherry are grown more in Kashmir region. On the other hand, mango, guava, ber and aonla are exclusively grown in sub-tropical areas of Jammu region.

Table No 15: Production of fruit during 2004-05 to 2012-13 (Oct., 2012, estimated)
(Prod. in 000 Mts)

Year	Fresh Fruits				Dry Fruits				Total Fruits
	Apple	Pear	Others	Total	Walnut	Almond	Others	Total	
2004-05	1093.33	40.25	84.02	1217.60	100.60	13.47	0.19	114.26	1331.86
2005-06	1151.34	42.36	86.73	1280.43	108.27	14.33	0.20	122.80	1403.23
2006-07	1222.18	43.09	108.41	1373.68	114.93	15.18	0.22	130.33	1504.01
2007-08	1311.85	45.86	120.31	1478.02	146.78	11.26	0.24	158.28	1636.30
2008-09	1332.81	47.38	150.74	1530.93	147.64	12.17	0.25	160.06	1690.99
2009-10	1373.00	47.98	113.73	1534.71	165.02	12.52	0.19	177.73	1712.44
2010-11	1852.41	62.50	130.64	2045.55	163.74	12.50	0.19	176.43	2221.98
2011-12	1747.22	58.21	127.00	1932.43	224.59	3.74	0.28	228.61	2161.04
2012-13	1500.25	48.31	61.41	1610.00	227.00	3.29	43.21	273.50	1883.50

Source: Directorate of Horticulture (P&M), J&K

Among the dry fruits, walnut is the major crop, grown mostly in Kashmir region with a lesser area from temperate areas of Jammu region. Kupwara is the major walnut producing districts of the state followed by Kulgam, Budgam and Pulwama districts. From Jammu region, Poonch district is the major contributor to walnut production followed by Doda district. Almond is the other important dry fruit crop whose area as well as production is showing a secular decline due to cutting of trees and switching over to other fruit crops mainly because of disease problem.

3 Initiatives taken during recent years

University has taken many initiatives, through building partnership and linkages that lead to effective ways of undertaking research through incorporation of social, economic and policy dimensions. SKUAST-Kashmir has made some strenuous efforts to develop products and processes to super-head agricultural transformation in the state which are listed below.

A. Restructuring of Research Strategy

University focussed its efforts to develop an institutional framework for bringing about reforms in the research set-up and widen the scope and strategies that not only addressed the concerns of production but also included poverty reduction of rural people and environmental sustainability. The research challenges facing the hilly and mountainous region of the state revisited to reorient the University's approach through innovative initiatives. Recognizing the perspectives for mountain agriculture where inaccessibility, fragility, marginality, diversity, niche, comparative advantage and adaptive mechanisms of farmers are recognised as focal conditions, reforms in research programme was planned to accelerate technology absorption and convert research outputs into developmental outcomes.

Future research challenges for the University included natural resource degradation (soil, water, biodiversity etc.), climate change impacts and declining profitability of agriculture and income generation capability. This called for improvement in production system research besides organic agriculture potentials, together with mechanization, processing technologies and value additions. Attempts were made to focus research programmes generating impacts on farming communities in Kashmir and Ladakh region. To make relevant contribution and be demand driven, paradigm shift of research is now based on the following centres;

Box: Reorganization of Research Set-up

Name of Institute/Centre			
1.	Centre for Kashmir & Ladakh Agriculture Watch, Shalimar	14.	Ambri Apple Research Centre, Balpora, Shopian
2.	Centre for Climate Change & Mountain Agriculture, Shalimar	15.	Saffron Research Station, Pampore
3.	Organic Farming Research Institute, Wadura, Sopore	16.	Mountain Agriculture Research & Extension Station, Gurez
4.	Centre for Medicinal & Aromatic Plants, Shalimar	17.	Temperate Sericulture research Institute, Mirgund
5.	Centre for Mountain Horticulture, Shalimar	18.	Mountain Livestock Research Institute, Manasbal
6.	Mountain Crop Research Station, Larnoo, Anantnag	19.	Centre for Pastureland and Fodder Research, Manasbal
7.	Mountain Crop Research Station, Sagam, Anantnag	20.	Mountain Research Centre for Sheep and Goat, Shuhama

8.	Centre for Research in Dairy Husbandry, Manasbal	21.	Research Centre for Residue & Quality Analysis, Shalimar
9.	Centre for Research on Poultry, Shuhama	22.	Research & Training Centre for Pollinators, Pollinizers & Pollination Management, Shalimar
10.	Centre for Mountain Wildlife Sciences, Shuhama	23.	Highland Pastoral Systems Research & Extension Station, Nyoma, Changthang, Ladakh
11.	Urban Technology Park, Habbak	24.	Mountain Agriculture Research & Extension Station, Kargil
12.	Dryland (Karewa) Agriculture Research Station, Budgam	25.	High Mountain Arid Agriculture Research Institute, leh
13.	Mountain Research Centre for Field Crops, Khudwani	26.	Kargil Apricot Research Centre, Kargil

B. Agriculture and allied Sciences

Participatory varietal selection and community based seed production: Initiatives were also taken for making farmers the seed producers and suppliers of various varieties of seeds. In this regard, Participatory Plant Breeding, a novel approach for up-scaling availability of location specific varieties/cultivars was followed, involving plant breeders and the farmers in partnership mode. The activity is being strengthened further both for identifying location specific varieties and strengthening the local seed system. A group of farmers is now engaged in producing quality seed under the scientific supervision.

Conservation and utilization of local biodiversity: In order to harness the comparative advantage and mountain *Kashmiriyat* in agriculture, research focus on indigenous crops and varieties were achieved with local aromatic rice cultivars, *Mushkbudji* and *Kamad*, involving Sagam farmers of Anantnag district. Efforts were also started in 2011 with maize seed farmers of Lolab valley to augment the requirement of quality seed in maize. The blue print has been developed for upscaling these programmes in partnership with line departments and farmers.

Micro propagation of potato: Availability of quality planting material through tissue culture techniques was strengthened further. Whereas, technique has helped produce 50,000 microtubers in potato that were made available to State Department of Agriculture. In the case of saffron, micro-propagation protocol has been standardized to achieve high corm multiplication rate. The technique has good potentialities for adoption under public-private partnership.

Development of crop specific pest inventories: Crop-wise inventories of insect pests associated with major cropping systems like cereals, fruits, pulses, vegetables, ornamental plants and agro-forestry were revised. In addition, 63 spider species belonging to 15 families under 43 genera were identified from different agro-ecosystems of Kashmir.

C. Fruit Sciences

Production of quality planting material: Fruit nurseries expansion efforts resulted in production of one lakh saplings of different fruit crops particularly apple and walnut. University is now geared-up to increase the planting material production to 5 lakh plants by 2015. Models of High Density planting in apple for better productivity and quality have also been created. The adoption of high density orchards under valley conditions is expected to improve the apple production of farmers. During the same period, 15,000 saplings of three high yielding but difficult to root varieties of mulberry viz., Goshorami, KNG and Ichinose were raised through poly house technology and supplied to various agencies.

Development of mother orchards: The mother orchards of quality bud wood have been established in apple (2 ha), cherry (1 ha), walnut (1.5 ha), almond (1 ha) and pear (0.75 ha) at different locations of the University to increase availability of adequate bud wood for production of quality planting material and distribution to the farming community.

Protocol for virus indexing of fruits: Protocol for virus indexing of fruit plants was standardized and a central facility created for marking virus free planting material and bud wood plants of apple and other fruits. Based on our investigations, four apple viruses viz. Apple Mosaic Virus (ApMV), Apple Chlorotic Leaf Spot Virus (ACLSV), Apple Stem Grooving Virus (ASGV) and Apple Stem Pitting Virus (ASPV) were detected in different samples. Molecular Pathology Lab has been set up as a centralized facility in the University. The facility also helped in identifying diversity of the fungus causing apple scab. It will help develop management strategies, through studies on host plant resistance. Four pathogenic races were identified for the first time through comprehensive molecular analysis, first of this kind in India.

Conservation and utilization of apricot and ambri: For conservation and utilization of apricot in Ladakh region, Kargil Apricot Research Station centre has been established at Kargil. Similarly for revival of Ambri, Apple Research Station has been established at Balpora, Shopian.

D. Organic Agriculture

Development of bio-control agents for wilt of solanaceous crops: For development of newly invented bio-pesticides, five bio-control agents viz., BA-18, BCA-20, BCA-16, BCA-31 and K-2 were identified for management of wilt/root rot of solanaceous crops. These bio-pesticides are being evaluated in the farmers field for wider adoption by farmers.

Commercial production of liquid biofertilisers and organic inputs: Efforts were initiated for strengthening the organic input production programme for eventual use in transition towards organic farming. Bio-fertilisers facility (1000 litre capacity/day) has been commissioned and 3000 bottles of microbial based liquid biofertilizers produced. Facilities for vermin-compost production and effective microbial consortia (EMs) production have been established to meet the expected requirement of the state in future. Efforts are underway for skill development and trainings in management of production systems organically.

E. New Research Initiatives

Rural appraisal for livelihood systems: Scientific groups made extensive surveys in disadvantaged areas in the region particularly Changthang, Zaskar and Gurez under the leadership of Vice Chancellor. Based on the livelihood analysis of the population in the region, relevant technology interventions should now be possible with establishment of Highland Pastoral Systems Research and Extension Station, Nyoma, Changthang, Ladakh and Highland Agriculture Research and Extension station at Padum in Zaskar valley in Kargil district.

Seed and Planting Material Production Drive: Although University is mandated to produce Breeders Seed as per the requirement of indenting agencies, the seed production efforts were up-scaled and different approaches adopted to increase the out-reach of quality seed and planting material. Seed processing and packaging plants are now available at different constituent units and nurseries improved through laser levelling, irrigation, drainage etc. to expand production of quality planting material of fruit crops. During this year 110 q of Breeder Seed (rice, maize, pulses, oilseed and fodder crops) was supplied to indenting agencies. 3400 q of foundation and University brand of certified/Truthfully Labelled Seed (Shalimar Beej) was also supplied to State Agriculture Department and the farmers. Seed production programme was also undertaken in partnership with farmers and buy back approach adopted to increase the availability. Specific crop varieties recommended for the region were put in the production chain that included varieties recommended for release (rice, maize, wheat, moong, pea and masoor) by the State Seed Sub-committee for release of crop varieties in its meeting held at Jammu on February 21, 2012.

Rashtriya Kisan Vikas Yojna (RKVY): University first time initiated the programmes funded under RKVY with budget allocation of Rs. 70 lacs. The various programmes have been undertaken to strengthen the local seed system in crops like rice, maize, pulses and fodder (oats). Resource mapping using GPS and GIS has been utilized to map various land resources in different districts of Kashmir valley along with ground truthing at grass root level. The activity shall help the state in devising a comprehensive agriculture and fodder policy for the state. Initiatives have been taken for transition towards organic agriculture and University has first time devised a joint collaborative programme with Lakes and Waterways Development Authority (LAWDA) for year round decomposition of Dal weed which has been transformed into important organic compost. Similarly Organic Horticulture Research and Development Centre has been prioritized to extract maximum productivity per unit in horticulture sector. Models for High Density Orcharding in apple, pear and cherry have been established at different constituent units of SKUAST-Kashmir to help farmers and development departments to acquire canopy management skills under high density.

Tribal Sub-Plan (TSP): The tribal population in J&K are geographically isolated, inhabited exclusive remote and inhospitable areas and livelihood based on primitive agriculture leading to low level of food availability and affordability. University under TSP started a mission for introduction and adoption of modern technologies which will help eliminating continued backwardness and provide precise and process based management in agriculture to achieve the goal of food and nutritional security to some extent in order to overcome problems of hunger, malnutrition and poor health amongst tribes. The first phase of TSP was launched by

the University in Changthang sub-division of district Leh, Zaskar sub-division of district Kargil and Gurez tehsil of district Bandipore.