Agriculture Profile of Uttrakhand

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Introduction:

Uttarakhand, the 27th State of the Union of India was carved out of the 13 north Western districts of Uttar Pradesh on 9th November 2000. The state comprising of the central Himalaya, is spread over 53, 483 square kms. and inhabits 84.8 lakh population (Census, 2001). The state is known for its scenic beauty and is also known as "Devbhoomi" due to its shrines, temples & places of worship and meditation. Uttarakhand is included in the National Agro-climatic zone No.-9 and 14. The plain region of the state known as Tarai-Bhabar region comprises of Udham Singh Nagar, Haridwar and parts of Dehradun and Nainital districts. The hilly region of the state consists of Uttarakashi, Tehri, Pauri, Chamoli, Rudraprayag, Almora, Bageshwar, Champawat, Pithoragarh and parts of Dehradun and Nainital districts.

The entire state is rugged mountainous terrain except Udham Singh Nagar, Haridwar, Doon Valley, Garhwal and Nainital districts. Administratively, it comprises of the divisions of Kumaon and Garhwal, which are further composed of thirteen districts. Kumaon division comprises of districts of Almora, Nainital, Pithoragarh, Champawat, Bageshwar and Udham Singh Nagar while the Garhwal division consists of districts of Uttarakashi, Chamoli, Tehri, Pauri, Dehradun, Haridwar and Rudraprayag. The state has 95 development blocks and 48 tehsils. The Kumaon division covers an area of 21035 sq. kms. and inhabits 35.64 lakh people whereas the Garhwal division has an area of 32450 sq.kms. and a population of 49.16 lakh persons. Thus, Uttarakhand accounts for 1.61 per cent of the total geographical area and 0.82 per cent of the total population of the country (Table 1).

MAP OF UTTARAKHAND

1. Population, Literacy and Workers

The total population of Uttarakhand was 84.8 lakh persons in 2001. The sex ratio was 962 which was above the all India level. The density of population defined as number of persons per square kilometer was only 159 persons. The sparse population is mainly due to large area under mountains (Table-1).

The literacy rate in Uttarakhand has been above the all India level with 72.08% of population being educated. Among males, 84.01% and females 60.26% were literate during 2001. Women are considered to be the backbone of the economy of Uttarakhand. Therefore, it is essential to provide substantial educational facilities and motivation to women in this region.

In Uttarakhand, 36.9 per cent of population was workers. Among males, this proportion was 46.4 per cent while it was 27.1 per cent among females. Surprisingly, work participation rate of population in the state is lower than the all India level. It could be attributed to relatively low work participation of male population which is 46.4 per cent against 51.9 per cent for all India. Historically, male workers have been migrating to plains in search of employment opportunities and this feature has reduced the work participation rate of males in Uttarakhand. On the other hand, work participation rate of females in Uttarakhand is above the national level. It could be due to the significant contribution of women in various economic activities, primarily in agricultural based activities.

Table-1
Area, Population and Work Participation Rate in Uttarakhand and India (2001)

Item	Uttarakhand	India
I. Area	**2001**	**2001**
Total Area (000' Sq. km.)	53 (1.61)	3287 (100.00)
II Population		
Total Population (000')	8489 (0.82)	1028737 (100.00)
Sex Ratio (No)	962	933
Rural Population (000)	6310	742618
% of rural Population to Total Population	74.33	72.22
Population Density per Sq. km.	159	325
Literacy Rate (%)	72.08	65.00
III. Workers		.
Work Participation Rate (%)		
Male	46.4	51.9
Female	27.1	25.7
All	36.9	39.3
% of main Workers to Total Workers	74.16	77.80
% of Marginal Workers to Total Workers	25.84	22.20

Source: Statistical Abstract of India, 2004 and Agricultural Statistics at a Glance, 2008.

The occupational distribution of workers is the most important determinant of social, cultural, economic as well as environmental development of a region. It is responsible for social progress, creation of wealth, development of science and technology. Economic development of a region depends on proportion of working force engaged in primary, secondary and tertiary sectors. Agriculture is the main source of employment in Uttarakhand and around 58 per cent of workers earned their livelihood from this sector in 2001. Like all India, proportion of workers was the highest in agriculture followed by other workers and then household industry workers (Table-2).

The larger part of the state is characterized by a difficult terrain, undulating topography, remote and inaccessible villages, sparse population, tiny land holdings, agriculture based economy and weak infrastructure. Though, region is rich in beauty and natural resources, improper use of these resources and rapidly growing population has thwarted its development and consequently region is technically backward and economically poor. The pressure of increasing population has also resulted in stress on the limited natural resources of the state. This is because of topographical, infrastructural and environmental constraints that do not allow proper utilization of resources available in the inner parts of this fragile region. Thus, an imaginative, ecologically and environmentally balanced dynamic approach is needed to handle the dilemma of development in the state of Uttarakhand.

The economic development of any area is best reflected in infrastructural facilities. A good infrastructure can be achieved by investment in basic amenities like roads, power, water and communication. The infrastructural development of Uttarakhand has been one of the important components of development planning but so far, it has been poor. A serious effort is needed to enhance these facilities to promote economic development.

Table-2

Occupational Classification of Main Workers in Uttarakhand and India (2001)

Category	Uttarakhand		India	
I. Cultivators (‘000)	No.	(%)	No.	(%)
Male	686	34.19	86328	31.33
Female	873	77.46	41300	32.51
All	1559	49.76	127628	31.71
II. Agricultural Laborers (‘000)				
Male	191	9.52	57354	20.83
Female	68	6.03	50093	39.43
All	259	8.27	107448	26.69
III. Household Industry Workers (‘000)				
Male	43	2.14	8312	3.02
Female	27	2.40	8084	6.36
All	70	2.23	16396	4.07
IV. Other Workers (‘000)				
Male (000’s)	1086	54.13	123469	44.82
Female	158	14.02	27571	21.70
All	1245	39.74	151040	37.52
% of Agricultural Workers to Total Workers		58.02		58.40
% of Cultivators to Total Agricultural Workers		85.75		54.29
% of Agricultural Laborers to Total Agricultural Workers		14.25		45.71
% of Female Agricultural Workers to Total Agricultural Workers		51.76		38.88

Agriculture workers = Cultivators + Agricultural Laborers

Source: Agricultural Statistics at a Glance, 2008

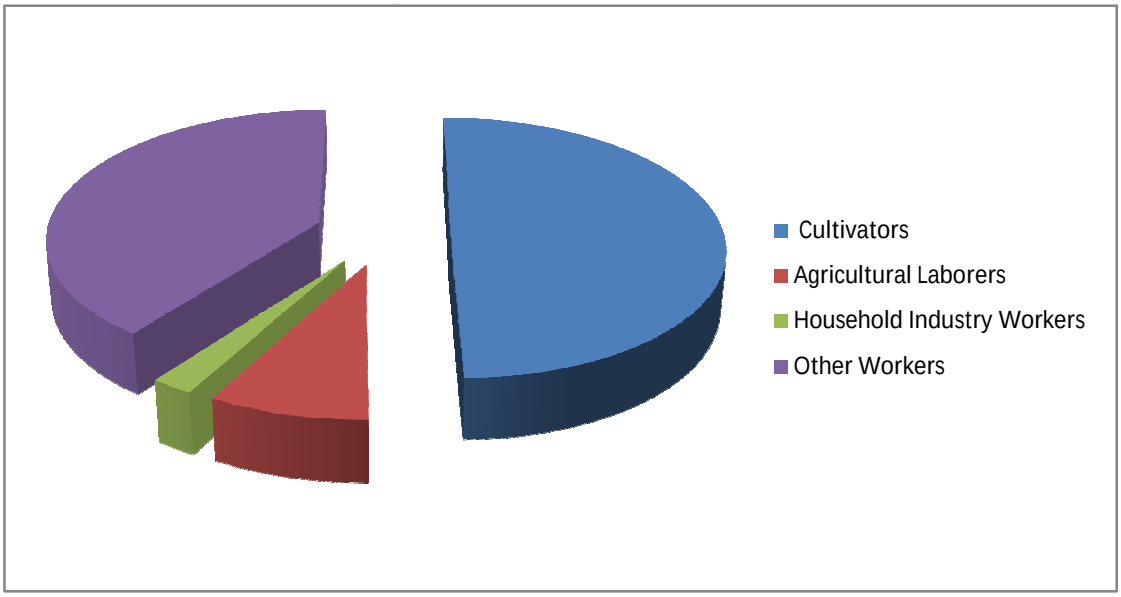

Fig.1: Occupational Classification of Main Workers in Uttarakhand

2. State Income

The Gross State Domestic Product (GSDP) of Uttarakhand has recorded rapid growth between 1999-00 and 2009-10. The GSDP of the state at factor cost at current prices has risen at a higher rate of 13.85 per cent per annum during this period. The per capita income has also risen at the rate of 12.01 per cent per annum (Table 3). It has been contributed by primary, secondary and tertiary sectors.

Table-3

GSDP of Uttarakhand

Year	At Current Prices (Rs.)	Per capita income (Rs.)
1999-00	1118719	13516
2004-05	2079433	23069
2009-10	4094697	42031
Growth Rate (1999-00 & 2009-10)	13.85	12.01

Source: Statistical Diary of Uttarakhand, 2010

The sectoral analysis reveals that primary sector which comprises of agriculture, livestock, forestry, fishing and mining sectors contributed 31.49 per cent to the state GSDP during 1999- 2000. Its share declined to 17.80 per cent in 2009-10. The secondary sector, which covers manufacturing, construction, electricity, gas and water supply sectors had a share of 18.21 per cent in 1999- 2000 which increased to 34.50 per cent during 2009-10. The tertiary sector, which comprises of trade, transport, banking, public administration and other services contributed a share of 50.30 per cent during 1999- 2000. Its proportion has declined by almost 2 percentage points between 1999-2000 and 2009-10 (Table 4). The structural composition of state economy has witnessed significant change during the recent years. But, agricultural sector still continues to occupy a significant position in the state economy with its continuously declining share. The importance of agricultural sector is also responsible for good deal of instability in the rate of growth of the economy due to fluctuations in agricultural output.

In a nutshell, composition of GSDP of Uttarakhand reveals that share of primary sector is continuously declining whereas share of secondary is continuously rising with a marginal decline in the share of tertiary sectors. It implies that state economy is shifting from agriculture to manufacturing with service sector still being the dominant one, which is a sign of structural change in the economy of the state.

Table-4
Share of Important Sectors in GSDP of Uttarakhand
(%)

Year	Primary	Secondary	Tertiary
1999-00	31.49	18.21	50.30
2004-05	24.89	27.02	48.09
2009-10	17.80	34.50	47.70

Source: Ibid

Share of Important Sectors in GSDP of Uttarakhand

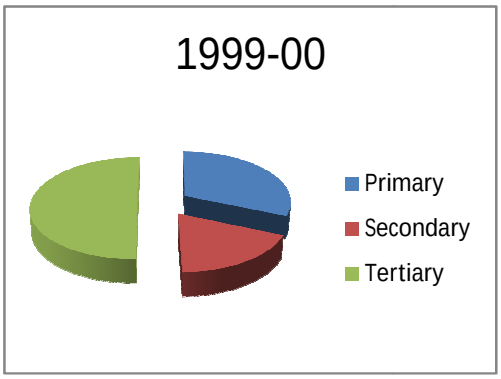

Fig. 2

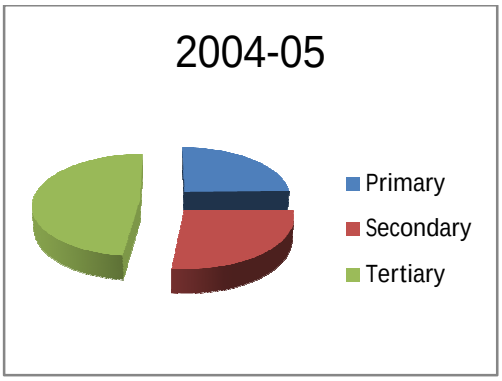

Fig. 3

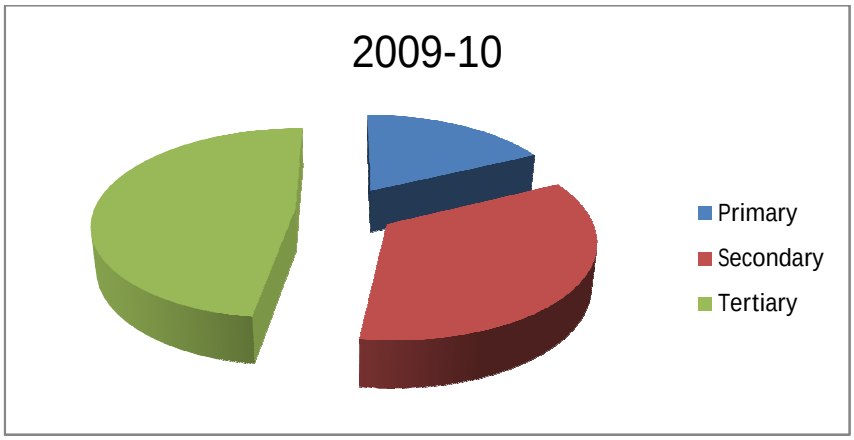

Fig. 4

Most of area in Uttarakhand has hilly terrain and extensive forest cover which limit arable farming and industrialization. As a recently formed state, information on these aspects is scant. Table-5 presents share of Gross State Domestic Product in different sectors for the year 2006-07.

Table-5

Sector wise Contribution to GSDP at Current Prices: 2006-07

S. No.	**Sector/Industry**	**Percentage**
A.	**Primary Sector**	
1	Agriculture (including animal husbandry)	17.40
2	Forestry & Logging	1.31
3	Fisheries	0.06
	Agriculture & Allied	18.77
4	Mining & Quarrying	1.45
	Total	**20.22**
B.	**Secondary Sector**	
1	Manufacturing	12.77
	a. Registered.	9.15
	b. Unregistered	3.62
2	Construction	14.76
3	Electricity Gas & Water supply	3.45
	Total	**30.98**
C.	**Tertiary Sector**	
1.	Transport, Storage and Communication	9.14
1.1	Railway	1.48
1.2	Transport by other means	5.08
1.3	Storage	0.05
1.4	Communication	2.54
2	Trade, Hotels and Restaurants	16.33
3	Banking & Insurance	3.53
4	Real Estate, Ownership Dwellings	4.80
5	Public Administration	5.18
6	Other Services	9.82
	Total	**48.80**
	Grand Total (A+B+C)	**100.00**

Source: Ibid

The analysis of GSDP reveals that the largest contribution came from the tertiary sector (48.80 per cent). Further, services such as hotels and restaurants contributed as high as 16.33 per cent in this sector. The manufacturing sector along with construction, electricity and water supply is the next in terms of contribution (30.98 per cent). The primary sector including crop husbandry and allied activities accounted for 20.22 per cent of the GSDP. The contribution from crops and animal husbandry was 17.40 per cent during the reference year.

3. Agricultural Development in Uttarakhand

Agricultural advancement is the most important challenge in Uttarakhand due to natural constraints. This is urgent since agriculture sector employs more than 55 per cent of workers and provides livelihood security to the major proportion of population in the rural areas.

At the outset, we will discuss land use pattern, which is manifestation of combined effect of various physio-climatic conditions in the region. Table-6 indicates that forests occupy dominant proportion of land and cover around 61 percent of the reported area in the state. As per the information of Directorate of Agriculture, around 30 per cent of forest area is in the category of degraded forests. There are plans to promote cultivation of Jatropha and bamboo on significant proportion of area under degraded forests. This will help to remove rural poverty in these areas. In addition, 6.81 and 1.25 percent of reported area was under cultivable wasteland and fallow land other than current fallows, respectively in 2008-09. These lands can be brought under cultivation through proper planning and execution. These areas can also be utilized for plantation of fruits, medicinal and aromatic plants. Current fallows comprised less than 1 per cent of the reported area.

The net sown area formed only 13.68 per cent of the geographical area. Out of this area, 64.94 per cent was sown more than once during 2008-09. It is found low in comparison to agriculturally developed regions like Punjab and

Haryana. The progress on this front in the state is low and an increase at around 6 per cent was noticed in crop intensity in the year 2009-10. The percentage of net irrigated area to net sown area in Uttarakhand was around 45 per cent and it has increased by almost 3 per cent during the referred years. Further share of gross irrigated area in gross cropped area also has risen marginally by around 1 per cent during the past decade. In a nutshell, land use pattern does not show any perceptible change in Uttarakhand between 2000-01 and 2009-10.

Table –6
Land Use Pattern in Uttarakhand (2001-09)

('000 ha)

Year	Total Reported Area	Forest	Not Available for Cultivation	Permanent Pastures and other Grazing Land	Land under Misc. Tree, Crops and Grooves	Cultivable Waste Land	Fallow Land Other than Current Fallows	Current Fallows	Net Area Sown	Area Sown More than once
2000-01	5672	3465 (61.09)	462 (8.14)	229 (4.04)	254 (4.48)	385 (6.78)	69 (1.21)	38 (0.67)	770 (13.58)	456
2004-05	5670	3465 (61.11)	464 (8.18)	229 (4.04)	249 (4.39)	386 (6.81)	68 (1.20)	42 (0.74)	767 (13.53)	468
2008-09	5672	3486 (61.46)	465 (8.20)	229 (4.04)	252 (4.44)	386 (6.81)	71 (1.25)	41 (0.72)	776 (13.68)	504

**GIA: Gross Irrigated Area*
Figures in brackets show percentage
Source: Directorate of Agriculture, Uttarakhand.

3.1. Soil and Irrigation

Soil health is a major concern for the state – both in the hilly areas as well as in the plains. The soil of hilly areas is mostly shallow and coarse textured. Regular landslides and runoff along with deforestation have led to massive soil erosion. Use of organic manure (mixed with oak and chir pine leaves) has also increased the acidity of the soil. The status of micro nutrients (N, P, Ca, Mg, S, Zn and Cu) is also very poor. Sometimes, high dose of active iron and aluminum makes phosphate fixation a problem. In the plains, heavy uses of chemicals have led to decreasing humus content in soil.

Without improvement in soil health, crop productivity enhancement under the rain fed farming system in the hilly region of the state is a difficult task. Soil and water conservation together should be considered a major thrust area under the state plan. Following a watershed approach, various soil and water conservation measures including construction of water harvesting structures, activities for prevention of soil erosion, forestation, terracing and land development should be taken up in the state without losing time.

With the realization of soil and water conservation, a substantial amount has been proposed for hilly districts such as Tehri (Rs. 5571 lakh), Nainital (Rs. 4335 lakh), Almora (Rs. 4228 lakh), Pithoragarh (Rs. 2408 lakh), Dehradun (Rs. 2500 lakh) and Champawat (Rs. 1200 lakh).

The agricultural land in Uttarakhand has limitations in terms of availability of irrigation. The geographical features of the state limit the development of irrigation facilities especially in the hilly districts of the state. The proportion of net irrigated area to net area sown in the state was around 48 per cent. This implies that even half of the cultivated land is not irrigated. But, there are district variations in availability of irrigation facilities. In the hilly districts of the state, proportion of irrigated area to sown area was found around 11 per cent while it was observed around 90 per cent in plain districts. The major sources of irrigation are tube wells (58%) and canals (28%).

3.2. Size of Operational Holdings

Since, a large part of Uttarakhand is hilly, average size of operational holdings is less than one hectare (Table 7). Around 71 per cent of holdings are marginal and area operated by this category of farmers is merely 0.35 hectare. Further, 18% of operational holdings are small operating less than 2 hectares of area. The size of these holdings is extremely tiny and therefore, scale of economies cannot be availed which makes crop husbandry unviable proposition. Generally, these farmers opt for subsistence farming due to their poor economic status and do not use expensive inputs. Urgent policy initiatives are needed for the development of smallholdings. The options like dairying, poultry and horticultural high value crops including medicinal and aromatic plants should be encouraged to increase per unit productivity of the available small pieces of land for cultivation.

Table-7

Details of Operational Holdings in Uttarakhand

S.No	Size (Ha)	Number		Area	
		Total Holdings	%	Area (Ha)	%
(1)	(2)	(3)	(4)	(5)	(6)
1	Less than 1.0	628267	70.5	242511	28.7
2	1.0-2.0	158402	17.8	220726	26.2
3	2.0-4.0	78414	8.8	212384	25.2
4	4.0-10.0	24163	2.7	132200	15.7
5	10.0 and above	1421	0.2	35629	4.2
	Total	890667	100	843450	100

Source: Statistical Diary of Uttarakhand, 2009-10

3.3. Growth in Area, Production and Yield of Important Crops

We begin with analyzing crop pattern. It indicates percentage of gross cropped area devoted to different crops in a region during an agricultural year. The agro-climate variations in Uttarakhand are large and hence state is bestowed with a variety of crops. The diverse agro-climatic conditions of the state provide a unique advantage as well as a competitive edge over other states in production of off season vegetables and fruits, which fetch high value in the market. The identification of suitable crops for each zone is the great challenge before the state.

Wheat (30.91%) followed by rice (25.51%) and ragi (12.32%) are the principal crops of the state (Table-8). In addition, sugarcane and small millets are also grown on sizeable percentage of gross cropped area. The fact remains that crop pattern in Uttarakhand is dominated by food grains, which occupied 82.24% of GCA in 2000-01. The share of food grains dropped to 77.20% in 2009-10. The proportion of area under wheat remained almost the same while rice has indicated a decline of almost 4%. It appeared that traditional crops like maize, ragi, barley and small millets lost in terms of share while soybean, rape and mustard gained.

Information presented in Table-8 suggests that around 23% of GCA is being devoted to other crops like vegetables, fruits, etc. The crop rotation and agronomic practices differ from zone to zone due to climatic variations in the zones. In the tropical zone (plains), food grains and sugarcane dominate the crop pattern while in the sub-tropical zone, two crops namely, paddy and wheat are harvested. Paddy is sown in the month of March and harvested in September and wheat is sown in the October and harvested in May.

Table-8
Percentage of GCA under Important Crops in Uttarakhand

(% of GCA)

Year	Rice	Wheat	Maize	Ragi	Barley	Sugarcane	Soyabean	Rapeseed & Mustard	Small Millets	Total food grains
2000-01	25.51	30.91	2.98	12.32	2.13	9.99	0.38	1.05	6.03	82.24
2004-05	24.22	31.89	2.41	13.54	1.93	8.70	1.43	1.38	5.80	81.90
2009-10	21.62	30.95	2.37	10.74	2.03	9.56	0.67	1.26	5.37	77.20

Source: Directorate of Agriculture, Uttarakhand

After harvesting wheat, mandua, pulses or other crops are sometimes sown as pure crops or mixed crops. The land unsuitable for these crops is often devoted to fruit crops such as peach, pear and khumani.

Uttarakhand is known for its horticultural crops, which include off-season vegetables, floriculture crops, medicinal and aromatic plants. In temperate zone of the state, only kharif crop is taken due to very cold climate. Thus, agriculture in Uttarakhand is characterized by subsistence farming. The policy should focus on improving food, nutrition and livelihood security. Given the climatic conditions, mixed farming seems a practical approach that should include dairying, horticulture, agro forestry and organic farming.

Table-9
Growth in Acreage under Important Crops in Uttarakhand (2001-10)

('000 tonnes)

Year	Rice	Wheat	Maize	Sugarcane	Soyabean	Rapeseed & Mustard	Total Oilseeds	Total Pulses	Total food grains
2000-01	312.7	379.0	36.5	122.5	4.7	12.9	25.0	48.7	1008.3
2004-05	299.1	393.8	29.8	107.4	17.7	17.0	37.0	42.0	1011.5
2009-10	294.2	394.6	27.9	96.1	11.2	14.9	29.8	56.89	944.9
Growth Rate 2000-01 to 2009-10	-0.61	0.39	-2.74	-2.44	9.06	1.50	1.75	1.58	-0.61

Source: Directorate of Agriculture, Uttarakhand

An examination of growth in acreage under important crops between 2000-01 and 2009-10 indicates that rice has lost area at the rate of 0.61 per cent per annum. It is due to water stress in hilly areas during the kharif season. In the better monsoon years, the situation becomes different. In plains, area under sugarcane fluctuates in response to price policy. Millets are basically grown as substitute alternate crops in times of water stress and therefore, do not receive adequate attention from the Government as well as from the farmers. Wheat has gained acreage at the rate of 0.39 per cent per year between 2000-01 and 2009-10. Although, area has declined under maize as well as sugarcane, maize appeared to be the biggest looser by indicating a decline at the rate of 2.74 per cent per year. Soyabean and rape & mustard gained area at the rate of 9.06 and 1.50 per cent per year, respectively during the reference period (Table-9).

After analyzing acreage under important crops, we would focus on the status of production of important crops. Table-10 gives information on absolute production and its growth over the period (2000-01 and 2009-10). Since, area cultivated under rice has declined and yield did not increase significantly, production has also declined marginally at the rate of 0.09 per cent per annum. The declining rate was most substantial in the case of maize (7.87%). On the other hand, production of wheat has increased at the rate of 1.67 per cent per year during the same period. The other crop with declining production includes sugarcane. It is heartening that yield of pulses in Uttarakhand was found 743 kg/ha against 640 kg/ha. in India during 2009-10 and therefore, production of pulses in Uttarakhand has increased at the rate of 3.05 per cent per annum between 2000-01 and 2009-10. The crop of soyabean has indicated outstanding growth (19.36% per year) during the reference period because it can be grown successfully under water stress too.

Table-10
Growth in Production of Important Crops in Uttarakhand (2001-10)

('000 tonnes)

Year	Rice	Wheat	Maize	Sugarcane	Soyabean	Rapeseed & Mustard	Total Oilseeds	Total
2000-01	621.5	714.6	59.6	7349.2	3.0	9.6	15.40	31
2004-05	550.1	793.8	44.3	6441.4	22.9	11.5	35.00	28
2009-10	613.3	845.4	26.5	5061.7	17.6	1.21	32.18	42
Growth Rate 2000-01 to 2009-10	-0.09	1.67	-7.87	-3.77	19.36	2.34	7.65	3.

Source : Directorate of Agriculture, Uttarakhand

Table-11
Productivity of Important Crops in Uttarakhand (2001-10)

(Kg/ha)

Year	Rice	Wheat	Maize	Sugarcane	Soyabean	Rapeseed & Mustard	Total Oilseeds	T
2000-01	1988	1885	1633	59994	638	744	604	
2004-05	1839	2016	1488	60000	1294	674	946	
2009-10	2085	2122	1361	52687	1305	817	1081	
Growth Rate 2000-01 to 2009-10	0.49	1.23	-1.84	-1.37	7.44	0.96	5.99	

Source: Directorate of Agriculture, Uttarakhand

Yield is the most important factor influencing production but in Uttarakhand, yield of important crops is low. The productivity per hectare of rice, wheat, maize, sugarcane, soyabean, and total food grains is below the national average. Table-11 indicates that productivity of the major crop that is rice in the state has increased marginally at the rate of 0.49 per cent per annum between 2000-2001 and 2009-10. The two crops with declining productivity have been maize and sugarcane. The yield of soyabean has risen at the higher rate (7.44% per annum) during this period. In addition, total oilseeds, pulses, wheat (1.23%), have also shown increase in the yield rates between 2000-01 and 2009-10. To conclude, productivity of a few crops has increased significantly but in most cases, results are not found satisfactory. It is disappointing to note that productivity of main staple crop that is rice in Uttarakhand has increased at a marginal rate. Under these circumstances, policy needs to take an urgent action so that yield of rice can be enhanced. This is possible by adoption of high yielding variety seeds on the larger scale. The adoption of recommended farm practices is pre-condition to maximize the benefits.

4. Need for Diversification

The variations in altitude and climate offer natural advantage for crop diversification. As such, alternative strategies for agriculture related enterprises viz., horticulture, forestry, floriculture, medicinal plants needs to be strengthened. Besides, less remunerative crops can be replaced with more profitable crops on a rotational basis. Utilization of fallow lands may also provide additional gains.

Considering the structure of hill agriculture and the constraints it faces, the strategies should be formulated based on ground realities. The variations n altitude and climate may be utilized for gains through diversification. The traditional and scientific resources/know-how should be blended and disseminated to improve the agricultural economy of hills. It is essential to integrate the available natural resource, tap the untapped potential of crops/varieties and technical know-how in an eco-friendly manner to enhance agricultural productivity for food and nutritional security as well.

Introduction of vegetable crops in the crop sequence is capable of enhancing profitability by 2-3 times. Therefore, serious attempts should be made in this direction.

4.1. Horticulture

Horticulture is one of the critical sectors in the economy of Uttarakhand. It provides much needed opportunity for diversification and increased employment in the state where scope of high rate of growth in conventional agriculture is rather limited due to peculiar topography and majority of scattered and marginal holdings.

Horticulture development can become an effective tool for accelerating development in the hilly areas as well as boosting the income of farmers beyond the subsistence level that they manage from traditional agriculture crops. Area under horticulture crops can be increased by utilization of cultivable wastelands and the farms belonging to absentee landowners.

Among the fruits, mango (21.75 per cent of total area under horticultural crops), apple (18.40 per cent) and citrus (15.28%) occupied top 3 positions in the state during 2010-11. Citrus (malta, lime, mandrarin, and galgal) attained third position but has significant share in production as is evident from the data given in Table-12. However, it is to be noted that while the state's share in the total area under fruits and vegetables in the country was 3.55 per cent and 1.07 per cent respectively, share in production was only 1.35 per cent and 0.90 per cent. This indicates low productivity of these crops. There is hardly any database available on minor fruits like aonla, chyura (butter fruit), wild apricot (chulu), timla fig and kafal. In particular kafal has commercial value even through it is an uncultivated plant.

Table-12 also presents scenario of area, production and yield of vegetable crops grown in Uttarakhand during the year 2010-11. Evidently, potato, peas and tomato are the most important vegetable crops. However, share of potato in total production of vegetables is much higher due to yield advantage.

Table-12

Area, Production and Yield of Horticultural Crops in Uttarakhand during 2010-11

Area: '000 ha
Production: '000 mt
Yield: mt/ha

I. Fruits

S. No.	Fruits	Area	%(Share)	Production	%(Share)	Yield
1.	Mango	39	21.75	135.3	18.82	3.47
2.	Apple	33	18.40	135.9	18.90	4.12
3.	Citrus	27.4	15.28	134.5	18.71	4.91
4.	Walnut	19.5	10.88	21.7	3.02	1.11
5.	Pear	14.9	8.31	108.6	15.11	7.29
6.	Litchi	9.3	5.19	18.7	2.60	2.01
7.	Peach	8.8	4.91	48.5	6.75	5.51
8.	Guava	1.5	0.84	8.9	1.24	5.93
9.	Anola	0.4	0.22	0.7	0.10	1.75
10.	Others	25.5	14.22	106.1	14.75	4.16
	Total Fruits	**179.3**	**100.00**	**718.9**	**100.00**	**4.01**

II. Vegetables:

S. No.	Vegetables	Area	% (Share)	Production	% (Share)	Yield
1.	Potato	24.3	28.32	424.3	41.16	17.46
2.	Peas	11.2	13.05	86.9	8.43	7.76
3.	Tomato	8.8	10.26	97.1	9.42	11.03
4.	Cabbage	5.6	6.53	70.5	6.84	12.59
5.	Beans	5.2	6.06	38.1	3.70	7.33
6.	Onion	3.8	4.43	38	3.69	10.00
7.	Okra	3.3	3.85	27.1	2.63	8.21
8.	Cauliflower	2.6	3.03	34	3.30	13.08
9.	Capsicum	2.3	2.68	12.7	1.23	5.52
10.	Raddish	4.6	5.36	56.9	5.52	12.37
11.	Others	14.1	16.43	145.3	14.08	10.30
	Total Vegetables	**85.8**	**100.00**	**1030.9**	**100.00**	**12.02**

Source: Ministry of Agriculture, Government of India, New Delhi.

4.2. Livestock

The state of Uttarakhand is endowed with a mix variety of livestock: cattle, buffalo, goat, sheep, pig, horse, pony, mule and poultry. The main feature of the animal husbandry in Uttarakhand is huge livestock population with low productivity. The livestock holding per household is small and mix of different species. The tribal population particularly Gujjars have the large number of buffalo and sheep. According to the Livestock Census, 1997, the population of cattle, buffalo, goats, sheep and poultry in Uttarakhand was 2.03 million, 1.09 million, 1.09 million, 0.31 million and 0.97 million respectively.

The animals such as cow and buffalo in the state belong to the nondescript breed and are very small in size as compared to the cattle in plains. Productivity of these animals in mountain districts is low as compared to the productivity of these animals in the plain districts of the state. Keeping in view these constraints, formulation and implementation of pragmatic policy to realize the potential of livestock population is an urgent need.

4.3. Bee Keeping

Bee Keeping has been a traditional practice in the hills for a long time, but it has not been exploited commercially to its potential. The species of honeybee reared in the state are Apis mellifera in the plains and Apis cerana indica in the hills. Both the species perform well in the bhabhar areas. The major feed plants are apple, litchi, peach, plum, mustard, etc. The months of July and August are the major dearth months of foraging. The Khadi and Village Industries Commission (KVIC) is the nodal agency to promote beekeeping.

The beekeeping as a tool for better pollination is a dimension which can enhance productivity manifold. A vision to produce at least 1000 million tonne per district per annum will generate enormous amount of job opportunities and income apart from increasing productivity of crops. A long term programme for beekeeping should be launched as a primary and supplementary activity which will create

necessity for emergence of other ancillary units i.e. bee boxes, wax processing and packing material

4.4. Sericulture

Uttarakhand has excellent opportunity both for mulberry and tasar silk production as the state is rich in natural vegetation of oak and pine in the Central Himalayas. The agro-climatic conditions are suitable for mulberry silk production in terai and foothills. There is a good potential for rearing tropical tasar in Champawat and Pithoragarh districts.

There are 72 mulberry farms in the state covering an area of more than 500 acres which also operate as Chawki Rearing Centers. There are 1-4 sericulture societies, 9 research stations/units of Central Silk Board including 2 Technology Dissemination Centers and 1 Silk Seed Production Centre and Regional Sericulture Research Station in the state.

The production of mulberry silk cocoons is around 110 million tonne by nearly 4,000 families. The oak tasar cocoon production was around 31 lakh and raw silk production was 13 million tonne during 2009-10. There are 4 cocoon markets with an installed cocoon storage capacity of 130 million tonne and 7 reeling units (70 basins) in the private sector in the state. A growth centre of 5 units with 30 basins is also set up at Dehradun to encourage reeling activity. Nearly 80 percent of cocoon production is concentrated in Dehradun district.

4.5. Fisheries

Fishery resources of Uttarakhand comprise of fast flowing rivers and their tributaries, high and low altitude natural lakes, ponds and doggies. Out of total stream length of approximately 2686 km, 725 km. is suitable for food and game fishes like minor carps, trout, asaila and mahseer. Available area of natural lakes in Uttarakhand is above 297 ha. The area under ponds in plain region of state is about 1000 ha. Apart from this, Udham Singh Nagar is also blessed with seven man made medium sized reservoirs encompassing an area of about 20075 ha. Tehri Dam is the largest mountain

reservoir in Asia with a total area of 46 square kms and offers huge potential for development of fisheries as well as sports fishery.

These water bodies are excellent source of fish production. The upland region of Uttarakhand provides conducive ecology for culture and capture of cold water fish where as plain areas of Udham Singh Nagar, Haridwar and Dehradun districts are suitable for culture operations of Indian major carps (catla, rohu and mrigal) as well as exotic carps (silver carp, grass carp and common carp). Mahseer and Asaila are indigenous important fish of cold water. Mahseer happens to be the most important game fish in the state and is rapidly being accepted as exotic food fish. Besides, two other exotic varieties of fish of commercial importance viz. Trout and Mirror Carp, can also be propagated, reared and developed in hilly region of Uttrakhand. Trout (Brown and Rainbow) can be bred and reared and finally stocked in streams where water temperature remains comparatively low and climate is cold.

5. Inputs, Credit and Processing

Adequate and timely availability of inputs is essential for agricultural growth. A dynamic and growing, agricultural sector requires seed, fertilizer, plant protection chemicals, bio pesticides, agricultural machinery and credit at reasonable rates to the farmers. Input management has become an important component of modern agriculture. Balanced use of high quality inputs at the appropriate time brings in the much-desired results in terms of both production and productivity. The detrimental effects of imprudent use of chemicals is an area of concern and ways and means have to be found to ensure sustainable agricultural growth by promotion of balanced use of chemicals with an emphasis on organic farming.

5.1. Input Use

The utilization of fertilizer, pesticides, tractors and tube wells plays an important role in boosting the agricultural development of a region. Uttarakhand is lagging behind in the use of these inputs. The consumption of fertilizer was extremely low. However, use of pesticides was found better in cultivation. The nitrogenous

fertilizers were preferred over phosphatic and potassic fertilizers. The state of Uttarakhand is moving towards agricultural mechanization gradually. But, use of implements per hectare of GCA was found extremely low (Table-13). It was reported that Uttarakhand is ahead of many states in the production as well as distribution of high yielding variety seeds but information on percentage of cultivated area of the wheat and paddy under high yielding variety seeds is not available.

Potential of organic farming in Uttarakhand is excellent. In view of rising demand for organic products, state should exploit this opportunity. Lack of physical infrastructure in hills makes distribution of inputs extremely difficult. Massive investment is needed to address this shortcoming. The government should give priority to this aspect in order to boost growth of agriculture in the state.

Table-13

Status of Manure & Fertilizer Consumption &Agricultural Mechanization in Uttarakhand

Item	**2005-06**	**Use per ha. of GCA (in tonne)**
N (‘000 t)	90.45	0.073
P (‘000 t)	24.56	0.021
K (‘000 t)	10.72	0.009
Micro Nutrients (‘000 t)	0.74	0.001
Manures (‘000 t)	15.51	0.013
Bio-Fertilizers (‘000 t)	0.021	0
Area under Green Manuring (ha)	2550	2.06
Bio-pesticides (MT)	9.97	0.001
Pesticides (MT)	492	0.398
Agricultural Mechanization		
Tractor/Power Tillers (No.)	144	0.12
Power Operated (No.)	330	0.267
Zero till drill (No.)	60	0.049
Sprinkler sets (No.)	43	0.0348
Water Lifting Pumps (No.)	50	0.04

Source: Directorate of Agriculture, Uttarakhand

5.2. Seed

The seed is undoubtedly the basic and the most vital single input that plays a key-role in boosting agricultural productivity. The role of seed sector is not only to ensure the timely supply of adequate quantity of quality seeds to farmers but also to achieve varietal diversity to suit various agro-climatic zones. Availability of viable and vigorous seeds of genetic purity at planting time is very important for achieving target of agriculture production because they act as a catalyst for realizing the potential of other inputs, such as fertilizers, pesticides herbicides, irrigation and crop management. The balance use of inputs, along with quality seeds or the certified seeds can increase production of various crops in the state.

However, despite seed being such an important input in production, Seed Replacement Rate (SRR) of Uttarakhand is abysmally low. Ideally, seed should be replaced every year for hybrids and every three to four years for non-hybrids. However, in practice seed is replaced less often especially in case of open pollinated crops. As a consequence, seed replacement rates are lower than recommended for different crop varieties. Poor quality, higher price and failure to provide timely availability are other important issues, which have adversely affected adoption rate of new seed varieties by the farmers in Uttarakhand.

The state also seeks to lay thrust on promoting agro-processing industry in order to ensure value addition, minimize post-harvest losses and at the same time ensure better market prices to the farmers. The development of agro-processing infrastructure would also generate additional employment in the state thereby, helping in enhancing the income of farmers and also contributing towards arresting the trend of migration from the state.

5.3. Cold Chain

Development of cold chain infrastructure is an utmost requirement of the time as significant proportion of fruit and vegetable production is wasted due to the post harvest losses. These losses take place during post harvest operations. Moreover,

consumption of large marketable surplus available with farmers is outside the state and it further adds to the losses due to lack of proper infrastructure in form of cool chains, pack houses, mechanized grading and packing machinery, efficient transportation/connectivity, markets, etc.

These losses can be minimized by investing in cold chain facilities which will also help in maintaining quality and freshness of the fruits particularly for exports. In hilly areas of the state, extent of post harvest losses are higher in areas where farmers are unable to get remunerative price of the produce. The shared cold chains can be set up on public private partnership (PPP) model which will benefit all the stake holders in the value chain i.e. farmers, private sector, public sector and government.

5.4. Processing

The state plan seeks to establish agro-processing facilities close to the points of production in rural areas, which will promote off-farm employment. Agricultural Cooperatives and Gram Panchayats can play a leading role in this effort. As a part of post harvest management strategy, additional logistic infrastructure will also be required to be created. Some initiatives taken by the state government like gravity ropeways to provide road head access to the farm produce need to be taken to be taken at a larger scale. Private investment must also be encouraged in post harvest technology and infrastructure to bridge the gap in agricultural marketing. Uttarakhand produces large varieties of cereals, fruits, vegetables and spices. A sizable quantities of this produce are wasted because of lack of storage, processing and packaging facilities. In order to develop and strengthen this sector, backward and forward linkages can be established by involving private sector and coordination with all concerned departments and agencies of the State and Central Government.

- Establishment of Small & Medium Size Agro Parks, which provide common infrastructure facilities for storage, processing and marketing of surplus fruits and vegetables.
- Establishment of fruit & vegetable based wineries.

5.5. Credit and Insurance

The state seeks to focus on developing access to credit and insurance for farmers. Considering the small landholdings and low income of farmers it is imperative to ensure that farmers get easy access to credit at reasonable rates which would enable cash starved farmers to exploit investment opportunities, reduce their vulnerability to shocks and this will help in promoting economic growth.

Similarly, subsidized crop insurance – particularly in the context of highly volatile climatic conditions – should be an important source of reducing economic shocks to small farmers due to crop losses caused by scant or excessive rainfall, hails, landslides and other natural calamities.

State interventions along with entry of appropriate insurance and financial institutions are required to support the markets. Micro credit institutions are required to cater to the credit needs of traders and farmers. Including setting up community owned and managed infrastructure and equipment.

6. Conclusions

A large part of geographical area in Uttarakhand is hilly terrain having primarily rain-fed subsistence agriculture. Its undulating topography, varied climate, scant cultivated land, overwhelming percentage of small and marginal holdings, difficult working conditions, high input costs and low returns on food grain crops, sparse settlement, soil erosion, land degradation and inadequate infrastructure like transport facilities in remote areas are serious constraints in development of agriculture. Given these circumstances, major challenge is to promote livelihoods to retain work force through local employment and income generation to enhance quality of life of the people living in rural areas of the state. This is possible through holistic development of agriculture.

Quality seeds, suited to hill agriculture have to be developed for accessibility and affordability of small and marginal farmers. As soil and topography are not suitable for mono-cropping, mixed agricultural practices need be adopted. This

diversified agriculture could be a healthy mix of animal husbandry including cattle rearing, poultry, fishing, beekeeping, etc. There is an urgent need to improve productivity of crops and livestock, etc. There is good potential for aromatic and medicinal plants in Uttarakhand, which remains untapped due to lack of serious efforts. It is also important to introduce organic farming practices to enrich soil and increase soil depth for sustained development of agriculture in the long run in Uttarakhand.