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Status of agriculture and horticulture farming in the hill state of India- Uttarakhand

Monika Chhimwal, Raj Kumar Pandey and RK Srivastava

Abstract

India is also known as an agricultural country and its allied activities act as main source of livelihood for approximately 55% of workers and provide security to rural India (Census 2011). Only in Uttarakhand as in whole majority of farmers belong to the small and marginal category and produce near about half of the total grains. Over 55 percent of cultivated area of Uttarakhand is rainfed with frequent moisture stress to crops. If we talk about the fertility of the soil quality of Uttarakhand then it is low to medium. As an idealized model of farming practice mixed farming has proved particularly attractive in hilly area while in the plains in a given season, mostly monocropping is practiced. Uttarakhand state falls under 9th and 14th agroclimatic zones as given by the agro-climatic regional planning by Planning Commission. In this study we have gathered recent data related to horticulture and agriculture, operational land, land holding pattern, irrigation networks on the basis of survey in districts of Uttarakhand.

Keywords: Livelihood, rainfed, land holding pattern, irrigation networks, monocropping

Introduction

Out of the total 5348300 hectares area of Uttarakhand, (86.15%) of the area is under forests and wastelands, (13.85%) and a small portion of total land (13.85%) is available for agricultural practicing. The soil of Tarai region is very fertile and rich in nutrients. On the other hand, the hill region is prone to constant soil erosion due to steep slopes which again makes it less fertile. Basically two kinds of agricultural methods are followed by the state farmers i.e. rain fed and irrigated. Horticultural practicing is also one of the prominent economic activity in rural areas of this state. It has a potential to generate employment as well as also restore the fragile ecosystem. During the 9th and 10th plan periods horticulture has transformed agrarian economy towards hike¹. Three fourth population of Uttarakhand depends on agriculture for their livelihood dominates with small and marginal land holding, however they are facing several challenges regarding small land holding and fragmented land as well as limited irrigation facilities^[2]. Altitude wise the state is divided into 4 zones (zone A, B, C, and D). The physiographic details of Uttarakhand's various zones are given in Table 1^[3].

Table 1: Distribution of state in various physiographic zones

Zone	Altitude (m)	Average Rainfall (mm/yr)	Soil	Farming situations	Districts under zone
Zone A (Valleys)	Up to 1000	1400	Alluvial	Tarai irrigated	All other districts except Chamoli and Uttarkashi
		1400	Alluvial	Bhabar irrigated	
		2000-2400	Alluvial sandy	Lower hills irrigated	
		2000-2400	Residual sandy loam	Rainfed lower hills	
Zone B (Mid hills)	1000-1500	1200-1300	Sandy loam	Mid hills south aspects	Almora, Bageshwar, Champawat, Dehradun, Nainital, Tehri Garhwal
Zone C (High hills)	1500-2400	1200-2500	Red to dark	High hills	Almora, Bageshwar, Chamoli, Pithoragarh
Zone D (Alpine zone)	>2400	~1300	Red to dark black clay	Very high hills	Chamoli, Pithoragarh, Uttarkashi

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Materials and Methods

The study is conducted throughout all the districts of Uttarakhand. The secondary data are collected from different state directorate offices at Dehradun and official websites of related departments. We have tried to compile data in the following headings 1. Operational land holding and coverage area, 2. Land holding patterns, 3. Irrigation network, 4. Major crops and their yield, 5. Organic agriculture, horticulture and floriculture, 6. Agriculture/horticulture inputs of fertilizers, pesticides and seeds.

Results and Discussion

As per the statistics say the production of food grain is quite varies in different areas of the state. Food grain productivity of the districts Udham Singh Nagar, Haridwar, average size of most operational holdings in Uttarakhand is less than 1 ha. According to latest data, total number of operational holdings in all groups is about 912650, in an area of 815682 ha. Around 74% of holdings are marginal and average area operated by this category of farmers is only 0.35 ha. Further, 17% of operational holdings are small operating less than 2 ha of area. Policy initiatives are needed for the development of small holdings since size of these holdings is tiny and therefore, scale of economies cannot be availed which makes crop husbandry a nonviable proposition. The options like dairying, poultry and cultivation of high value horticultural crops including medicinal and aromatic plants should be encouraged to increase per unit income and productivity from the available small pieces of land for cultivation.

Operational land holding and coverage area

In another estimate, over 27% of the area under cultivation consists of plots of size less than 1 ha. Another 26% of land holdings are between sizes 1 and 4 ha, and account for 51% of the total cultivated area. 22% of the cultivated land consists of plots over 4 ha, and these account for 3% of the land holdings. According to agriculture census of Uttarakhand (2011), institutional, scheduled caste (SC), scheduled tribe (ST) and others constitute 0.23%, 13.73%, 3.25% and 82.79% of the total holdings (Table 2), which envisage that other groups are representing dominated in operational land holdings in Uttarakhand.

Table 2: Social group-wise operational land holdings and area coverage

Item	No.	%	Area	%
Institutional	2002	0.23	12698	1.56
SC	125351	13.73	67533	8.28
ST	29673	3.25	47860	5.87
Others	755624	82.79	687590	84.29
All Social Groups	912650	100	815682	100

Uttarakhand accounts for 1.62% of the total geographical area of the country and 0.83% of the total population. Uttarakhand basically has divided into two region that is kumaon and Garhwal region. So if we talk about Kumaon region this state covers an area of 21,034 km² with a total population of 42.28 lakh, whereas the Garhwal region has an area of 32,449 km² with a population of 58.56 lakh (Census 2011). Therefore, from 2001–2011 the decadal growth rate of Uttarakhand is 19.17% with population density of the state 189 people /km². This state is mostly covered by forest, around 61% of the total area of state is covered by forest. Out of total, more than 85% area is hilly, mostly uncultivated. The total area of the land not under cultivation is 7.8%. This land includes the barren land or uncultivable land. Total Uttarakhand land use patterns and its statistics is given in below table 3 [4].

Table 3: Agriculture land area (mha) by type of use in Uttarakhand

Agriculture land area by type use	Million ha
Total agricultural land	1.55
Total cropped area	1.099
Net irrigated area	0.345
Net sown area	0.701
Follow land	0.286
Other uncultivated land	0.898
Cultivated	0.45
Forest	3.8
Total geographical	5.348

The major crops are grown in Uttarakhand are rice, wheat, finger-millet and maize. Soybean, groundnut, coarse cereals, pulses, sugarcane and oil seeds are the other most widely grown crops. Out of total area of the state 49.5% comes under agricultural crops, and percent coverage of irrigated area under principal crops and total crop are reported in Fig 1 [5] and Table 4 [5].

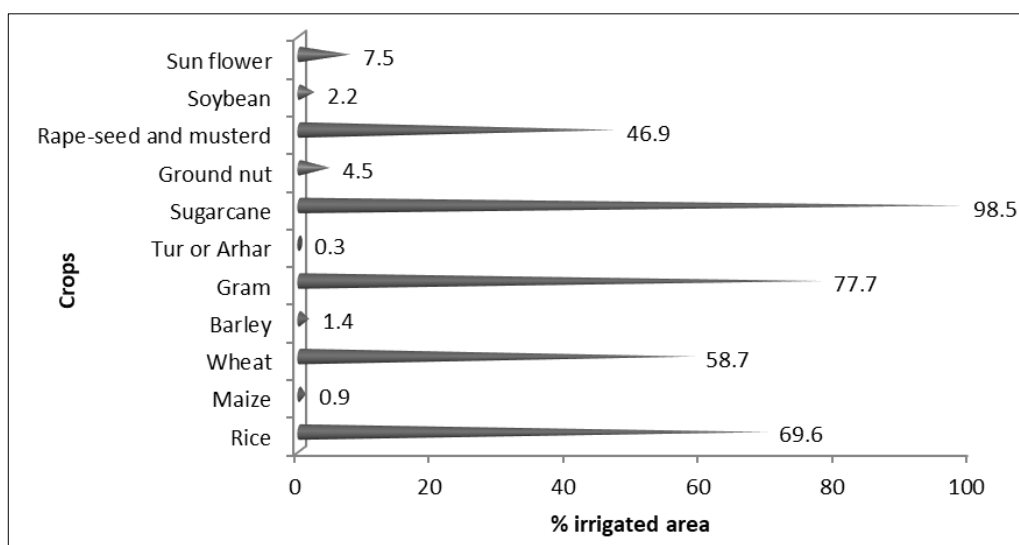


Fig 1: Percentage of irrigated area under principle crop

Table 4: Percent coverage of irrigated area under total crop

Crops	Irrigated area%
Total cereals	46.7
Total pulses	9.2
Total food grain	44.4
Total oil seed	25.5

Land holding patterns

In India, small and marginal land holdings predominates operational land holdings. According to 2011 Census, 67% of holdings classified as marginal (less than 1 ha) and 18% classified as small (1-2 ha) and 0.7% land holdings are classified as large holdings. Similarly average size of most operational holdings in Uttarakhand is less than 1 ha Table 5. According to latest data, total number of operational holdings in all groups is about 912650, in an area of 815682 ha. Around 74% of holdings are marginal and average area operated by this category of farmers is only 0.35 ha. Further, 17% of operational holdings are small operating less than 2 ha of area (Table 5) [6]. Policy initiatives are needed for the development of small holdings since size of these holdings is tiny and therefore, scale of economies cannot be availed which makes crop husbandry a nonviable preposition. The options like dairying, poultry and cultivation of high value horticultural crops including medicinal and aromatic plants should be encouraged to increase per unit income and productivity from the available small pieces of land for cultivation.

Table 5: Percentage to land holding in Uttarakhand

Size	% Area	% of No.
Less than 1.0	36.23	73.65
1.0-2.0	27.6	17.24
2.0-4.0	21.5	7.1
4.0-10.0	11.55	1.9
10.0 & above	3.11	0.12

Irrigation network

More than 70% of population involved in agriculture for livelihood in Uttarakhand. More than half of the cultivated land in the state is rainfed. Irrigated land is largely available in the plains, with over 87% land being irrigated as against about 10% in the hills. The net irrigated area of the state stands at 3.36 lakh ha. The net irrigated area, as a percentage of the net sown area in the state, is 47%. Hence, even half of

the cultivated land is not irrigated. But, there are variations across the districts in availability of irrigation facilities. The major sources of irrigation are tube wells (about 55%) and canals (about 28%).

Canals lift irrigation and rainwater harvesting methods are used in hilly regions of the state. Moreover, only surface water harvesting is the main source for irrigation, as ground water harvesting is very tough in hilly areas. The total number of Minor Irrigation system is 80053 and the total length of Canals [medium and minor] is 8328 km. The total state-owned surface flow and lift systems are 5776 in number; the total non-state surface and lift flow systems are 20458 in number; the total dug, shallow, and deep tube wells amount to 53819. Net irrigated area, gross irrigated area, and area under various irrigation techniques are depicted in Fig 2. Area irrigated by major and medium schemes is about 6.97% of the total actual irrigated area. Actual area irrigated by minor Irrigation is about 93.02%. Other techniques used for irrigation include hauj, gool, hydrum etc. The irrigation infrastructure of Uttarakhand state is briefed in Table 6 [7].

Table 6: Irrigation infrastructure in Uttarakhand

1	Length of canals	12421 km.
2	Length of lift canals	281 km.
3	Tube wells (State)	1478 nos.
4	Pump sets (boring/Free boring)	55456 nos.
5	Hauj	36761 nos.
6	Gool	29785 km.
7	Hydrum	1471 nos.
8	Culturable Command Area (CCA) under State canal	3.338 lakh ha.

Major crops and their yield

Uttarakhand is traditionally an agrarian state. Cereals, pulses, oilseeds are the major groups of food crops of the state. About 1.7% of nation’s food grains and coarse cereals are produced in Uttarakhand. Sugarcane, wheat and rice are the key agricultural products of the state. Apart from these, finger millet and maize are other major crops followed by some important pulses and oilseeds. On an average 63% of land under cereals and 77.5% land under pulses are rain-fed. Wheat is the main crop and accounts for about 50% of total food grain production in the state, still Uttarakhand is deficit in production of food grains and depends on imports from other states. The Fig 2 gives details about all major crops that are produced in Uttarakhand.

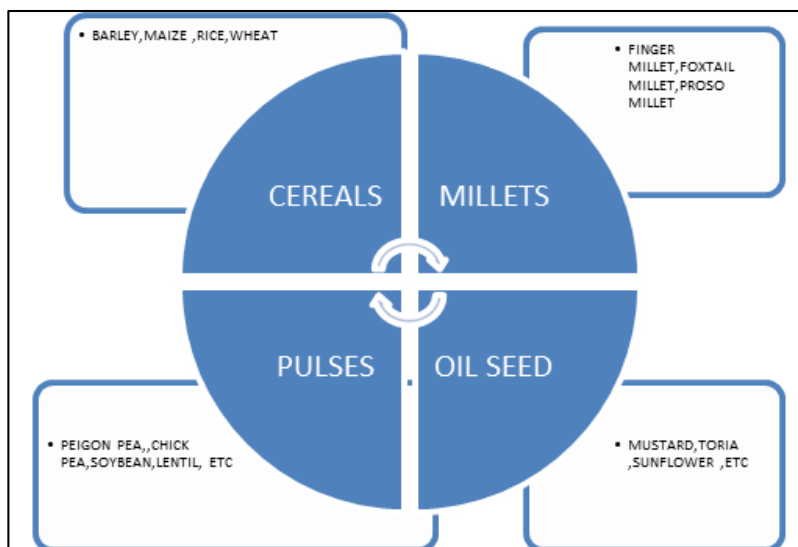


Fig 2: Crops produced in Uttarakhand

Rice, wheat, maize, small millets, ragi, barley are common food grains (cereals) of Uttarakhand. Gram, urad, tur/ arhar etc. are important pulses. Groundnut, sesamum, rapeseed and mustard, linseed, sunflower, etc. are important oil seeds of Uttarakhand. Apart from these it is also common to the farmers cultivate some traditional crops such as mandua

(finger millet), gahat (horse gram), urd (black gram), riains (adzuki bean) and sonta (cow pea). Other traditional crops that are very important for Uttarakhand but not very common are chaulai (amaranth), ogal and haper (black wheat), and cheena (hog-millet). The agricultural productivity of Uttarakhand under major agricultural crops is given in Table 7 [8].

Table 7: Area, yield and production of principal crops of Uttarakhand

Crop	Area under crop ('000ha)		Average yield (kg/ha)		Production '000 Tonnes	
	2015-16	16-17	15-16	16-17	15-16	16-17
A) Food grain (Cereals)						
Rice	250.29	245.65	2341	2332	585.9	575.9
Maize	23.20	21.85	1696	1703	39.37	37.21
Small millets	59	63.28	1210.9	-	74.4	
Wheat	342.65	341	2307	2583	790.37	882
Ragi	107.42	107.17	1402	1489	150.51	159.6
Barley	18.36	21.66	983	1219	18.06	26.4
B) Food Grain (Pulses)						
Gram	0.646	0.668	836	795	0.54	0.531
Urad	14.83	14.569	632	812	9.37	11.83
Tur	4.32	2.99	769	890	3.34	2.668
Other pulses	41.16	42.563	884.84	-	36.42	
Total pulses	60.96	60.79	814.19	-	49.67	51.34
C) Oil seeds						
Ground-nut	1.055	0.729	1426	1299	1.504	0.947
Sesamum	1.766	2.087	271	288	0.478	0.602
Rapeseed & mustard	12.275	13.129	946	856	11.61	11.23
Soyabean	13.539	11.585	1332	1153	18.03	13.35
D) Other					('000 MT)	
Sugar cane	96.85	92.95	60769	59216	5885	5504.56
Potato	24.7	26.03	13840	-	360	360
Chillies	2.55	2.75	3470.5	-	8.85	8.85
Ginger	4.87	4.47	9673.5	-	47.11	47.11
Turmeric	1.407	1.48	8990.7	-	12.65	12.65

Horticulture sector is now contributing significantly in the economy of Uttarakhand. It provides a huge employment to the people as agriculture sector is very limited in hilly areas. The topography of state is very complex but is good for horticulture crop production. Moreover, Uttarakhand is known for its horticulture crops, which especially include off season vegetables, flowers and medicinal and aromatic plants. Among fruits mango, apple and citrus, occupy top production positions in the state. Malta, lime, mandarin, and galgal are important citrus fruits. Insufficient data is available for the production of traditional hilly fruits of Uttarakhand such as

aonla, butter fruit (Chyura), kafal and timila as these fruits are mostly naturally produced and used locally rather than commercially.

About 2.26 lakh ha area of Uttarakhand is under production of fruits from which a production about 678500 MT was achieved in year 2016, with the productivity of 4 Mt/ha. Around 91232 ha area is under vegetable production (potato included), about 11645 ha area is under spices production and 1390 ha area is used for floriculture. The detailed description of area under principal horticulture crops is given in Table 8⁹.

Table 8: Area under fruit and vegetable cultivation in Uttarakhand

Fruits		Vegetables	
Name of fruit	Area (ha)	Name of vegetable	Area (ha)
Apple	25201	Pea	12576
Pear	62061	Radish	4901
Peach	7939	French bean	5753
Plum	8898	Cabbage	6144
Apricot	7992	Cauliflower	3050
Walnut	17373	Onion	4117
Citrus	21275	Capsicum	2401
Mango	36422	Okra	3431
Litchi	10393	Tomato	8626
Aonla	1291	Brinjal	2455
Guava	3432	Potato	26038
Other fruits	24031	Other (vegetables)	11740

Organic agriculture, horticulture and floriculture

Uttarakhand is the first and only province in India, which elaborated organic farming policy. The state has immense potential in the field of organic crop production. The key objectives of diversifying towards organic farming are to improve crop productivity, soil health and the price of the

output, and thus the income of the farmers. Since extensive use of chemical fertilizers ultimately leads to soil deterioration, therefore, yield levels can be effectively raised in a stable and sustainable manner only by adopting organic farming methods. The demand for organic food emerged during the 1970s when environmental and human health

hazards were realized due to the use of agrochemicals in agriculture. In Uttarakhand hills, organic farming is prominent, but mostly unorganised, therefore the result and productivity is much lower than what is required. Majority of the traditional settled upland agriculture is organic by default. Earlier this was because of problems of inaccessibility of agrochemicals, lack of knowledge, poor crop response to chemical fertilizers in the good rainfed condition etc. and due to fairly satisfactory crop yields using organic manure. Therefore, for development of organic farming, government of India released many schemes such as National Project on Organic Farming, National Horticulture Mission, Paramparagat Krishi Vikas Yojana, Jaivik Mulya Shrankhala Vikas Mission Project, for conversion of status to organic state. As most agriculture is rain fed, therefore, organic materials also help to bind the moisture to the soil, therefore, enhance the productivity. About 25,000 farmers are engaged in organic farming on 60,000 ha land. Government has also planned to declare few districts as fully organic districts of the state. Therefore, Government has taken initiative to draw traditional farmers into organic farming by setting up Uttarakhand Organic Commodity Board.

Agriculture/horticulture inputs of fertilizers, pesticides and seeds

Plant requires nutrient for its growth. These nutrients can be classified into macronutrient such as nitrogen, phosphorous and potassium, secondary macronutrients such as calcium (Ca), magnesium (Mg), and sulphur (S) and micronutrients such as copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), boron (B). Moreover silicon (Si), cobalt (Co), and vanadium (V) and some other rare minerals are also important for plant development. Naturally, these elements are derived from soil but nowadays due to over crop production, and due to some natural constraints such as, presence of insoluble forms of iron, phosphorus, zinc, etc., crop yield get reduced. Therefore, external application of fertilizers is necessary. However, use of fertilizers in our country or in Uttarakhand is hardly scientific and done without knowing soil requirement based on scientific soil test. Further, there is indiscriminate use of urea due to subsidy by government. Over reliance on urea and improper nutrient management has led to multinutrient deficiency in soils. The inadequate and imbalanced nutrient use coupled with negligence of organic manures has caused multi-nutrients deficiency in many areas with time. Fertilizer consumption in the state from the year 2011 to 2016 is given in Table 9^[10].

Table 9: Fertilizer consumption in Uttarakhand

Fertilizer consumption (NPK) in '000 tons					
Year	2011-12	2012-13	2013-14	2014-15	2015-16
NPK	166	152	163	170	201
Per ha use of chemical fertilizer (Kg/ha)					
NPK	147.02	135.69	164.13	159.95	169.18

Integrated nutrient management (INM) encompasses conjunctive use of chemical fertilizers including secondary and micronutrients, organic manures, composts/ vermin-composts, bio-fertilizers and green manures on a large scale. Adequate and timely inputs to agriculture are prerequisite for the good and healthy production. Seeds, fertilizers, chemicals that are used to prevent plant infection, other pesticides, biofertilizers, bio-pesticides, and agriculture machinery should be used by farmers on time. Input management has now become a very important part of modern agriculture.

Quality should be high for good and healthy agriculture production. Thus utilization of fertilizers, pesticides etc., plays an important role to boost agriculture. Unfortunately, Uttarakhand is lagging behind in proper input use. This may be because most part of the state is under hills and therefore, floods, earthquakes and other natural disasters are prominent. This affects agriculture and also the dispersion or extension of knowledge about the government schemes is another challenging factor in Uttarakhand.

Fertilizer consumption is very low in Uttarakhand and only the agricultural areas of plains are supposed to be using normal amount of fertilizers in agricultural practices. In Uttarakhand, nitrogenous fertilizer is preferred over others. Although organic farming using organic manure is prominent in state but it is unorganised and therefore has many problems. Moreover, because of lack of physical infrastructure, input distribution in hilly area is difficult, but excellent organic farming is famous in those areas.

Conclusions

After the whole survey, we concluded in nutshell that in operational land holding other section is dominated with 82.79% of population in operational land holdings in Uttarakhand. Near about 73.65% comes under marginal holdings. Canals lift irrigation and rainwater harvesting methods are prominently used in hilly regions of the state. Moreover, only surface water is available as a source for irrigation, and ground water harvesting is very tough in hilly areas. Rice, wheat, maize, small millets, ragi, barley are common food grains (cereals) and are the main agricultural crops cultivated in Uttarakhand in which wheat contributes in maximum production in cereals, urd in pulses and soyabean in oil seeds similarly in case of horticultural crops mango and potato occupy first position in amount of production. Use of improper fertilizer is increasing year by year in agricultural farming. Although Government of this state is focusing towards organic farming and in sustainable development

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