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### RESEARCH ARTICLE

#### HORTICULTURE DEVELOPMENT SCENARIO IN KUMAON REGION, UTTARAKHAND

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#### Abstract

Horticulture is a branch of agriculture that deals with cultivating fruits, vegetables, flowers, etc. The horticulture sector plays an important role in the economic development of local people by improving their income and generating employment. The present study aims to analyze the development and growth in the area, production and productivity of the major fruit crops of the study area for the period of 10 years (2011-12 to 2020-21). For this purpose, the secondary data has been collected from the Directorate of Horticulture, Government of Uttarakhand. This collected data has been analyzed and interpreted in Microsoft Excel and thematic maps are also prepared using QGIS software to visualize the production and area of major fruit crops. The study reveals that the total area under major fruit crops in 2011 was 52783 (H) and 44493 (H) in 2021. Similarly, the total production of major fruit crops in 2011 was recorded to be 298344 (MT), with 289119 (MT) in 2021. The growth rate in 2011-2021 was 15.7(H) and the production growth rate was -3.09(MT). Similarly, the total productivity of major horticulture fruit crops in 2011 was 56.5(H/MT) which increased to 64.9(H/MT) in 2021. Thus, the study demonstrates that the total area under major fruit crop production is decreased but productivity remains higher. This is the main reason for the improvement of the socio-economic condition of the cultivators and other related people.

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#### Introduction:-

Horticulture is an agricultural branch that focuses on the art and science of growing fruits, vegetables, flowers, and other cultivable crops. The horticulture sector plays a unique role in the Kumaon region's economy by improving rural people's income, productivity, land and generating employment. Horticulture in hilly regions is of great importance, not only for economic development but also for environmental restoration. Horticulture has been produced for centuries in the entire Himalayan mountain chain, from the Jammu and Kashmir Himalaya to the Assam Himalaya. As a result, the region has a wide range of fruits.<sup>1</sup> The Horticulture sector has emerged as a potential sector in the economy. India is the world's seventh-largest country with a total geographical area of 32,87,240 square kilometers around 55-60 percent of the total population depends on agriculture and allied activities. Therefore, Horticulture crops constitute a significant portion of total agricultural production in the country. After China, India is the world's second-largest producer of vegetables and fruits and is popularly known as the Fruits and Vegetable Basket (Gandhi & Nambordiri, 2002)<sup>2</sup>. India's total horticulture production in 2021-22 was 341.63 MT, an increase of about 7.03 MT (i.e. 2.10%) over 2019-20, during the ninth and tenth plan period investment in

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horticulture transformed the agrarian economy in many states of India. Similarly, three-fourths population of Uttarakhand depends on agriculture for their livelihood. Horticulture farming is one of the most important economic activities in Uttarakhand as well as the Kumaon region. Kumaon climate supports different agro-climatic zones which help to grow various horticulture crops (Sati, 2004)<sup>4</sup> and a diversity of cultivars in high-quality/crop races. However, productivity in 2020-21 was 35.8 MT/ha in fruits, 90.0 m/ha in vegetables, 67.2 MT/ha in spices, and 27.7 MT/ha in flowers in total Uttarakhand state. Similarly, the horticulture productivity in the Kumaon region according to 2020-21 data was fruits 53.9m t/ha, vegetables 104.3 MT/ha. Spices are 70.6 MT/ha and flowers are 38.4 MT/ha in the area. The major food crops in Kumaon region is mango (25.47 percent of total production with an area under 23.53 horticultural crops), citrus (16.90 percent), and pear (15.47 percent) are in the top 3 positions during 2020-21. The main purpose of this research work is to promote the horticulture sector and production along with horticulture development and productivity.

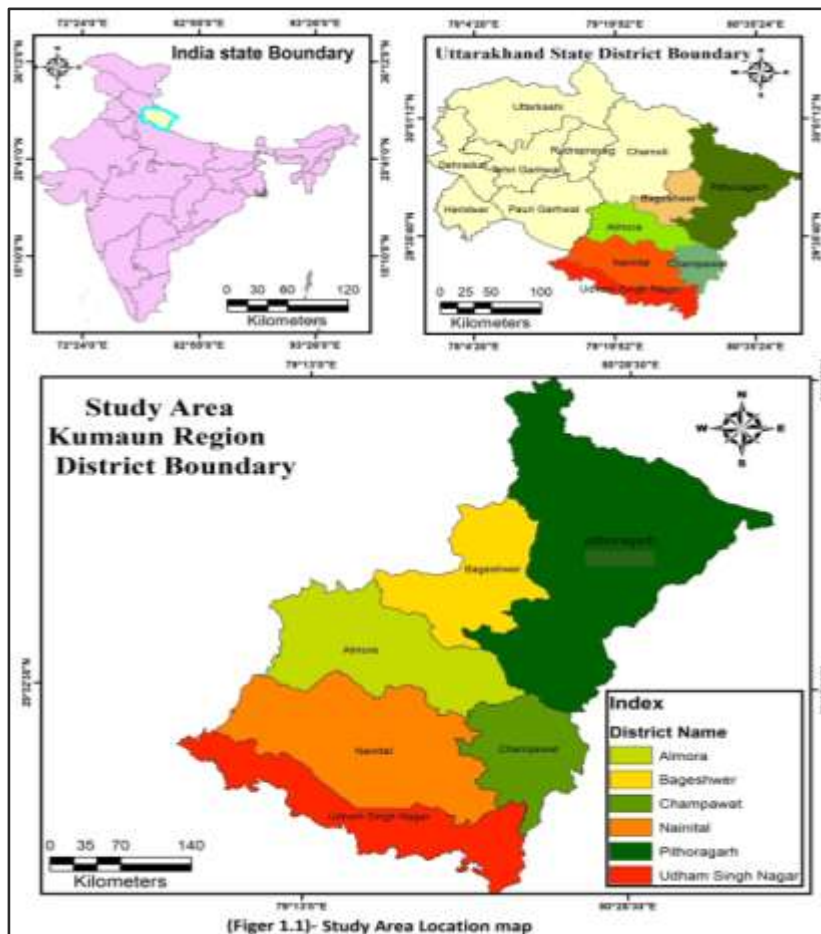
### Objectives of the study:-

The present study has been undertaken with the following objectives:

1. The present study aims to analyze the development and growth in the area, production and productivity of the major fruit crops of the study area for the period of 10 years (2011-12 to 2020-21).
2. To visualize the production and area of major fruit crops on thematic maps.

### Methodology:-

The data for the study has been collected from a secondary source, specifically the government official records. This data has been collected from the Directorate of Horticulture, Government of Uttarakhand. This collected data has analyzed and interpreted in Microsoft Excel and thematic maps have also prepared using QGIS software to visualize the production and area of major fruit crops.



### Study Area-

The Kumaon region is one of the Uttarakhand two administrative divisions. Geographically, it extends from 28°43' 45" to 30°20' 12" North latitude and 78°44' 30" to 80° 12' 45" East longitude. (Figur 1.1) It is bounded in the North by Tibet, in the East by Nepal, in the West by the Garhwal Mandal of Uttarakhand and the district of Bijnor of Uttar Pradesh, and in the south by the districts of Pilibhit, Bareilly, Moradabad, and Rampur. The Kumaon region covers the entire length of Uttarakhand, from south to north, and includes all five latitudinal geophysical zones of Uttarakhand including Tarai and Bhabar. The total cover area of kumaon is 21,035 km<sup>2</sup> and a forest area of 8122 km<sup>2</sup>. The total population of the Kumaon region is 4230570 people. The study region comprises of 6 districts (Almora, Bageshwar, Champawat, Nainital, Pithoragarh, and Udham Singh Nagar) 38 tehsils, 41 communities Development blocks, and 6999 inhabited villages.

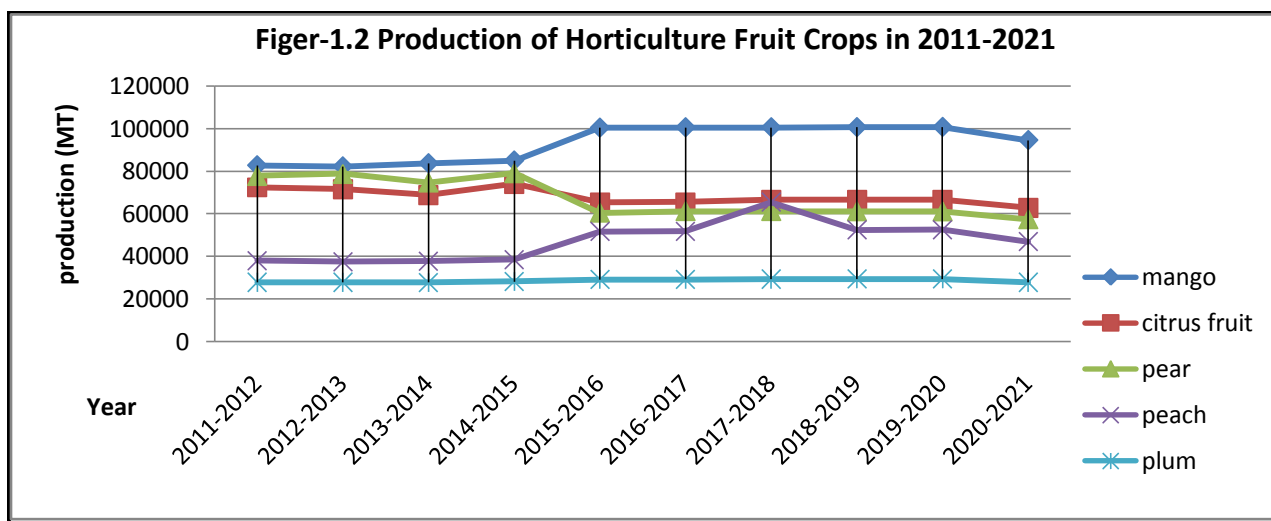
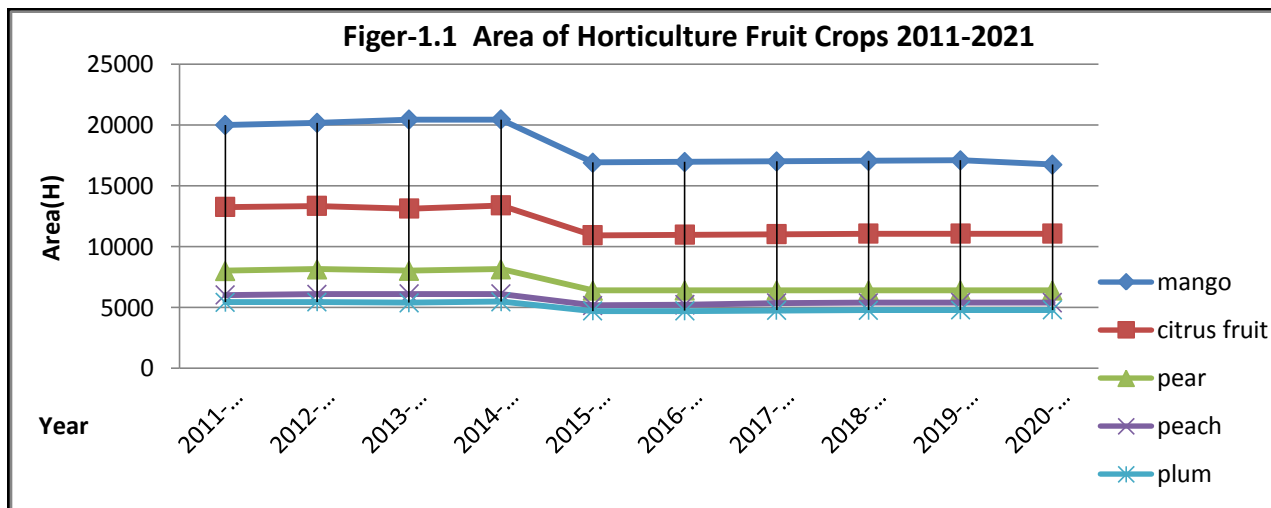
## Result and Discussion:-

### Status of Horticulture in kumaon region-

The total horticulture fruit area in the Kumaon region is 71250 ha (39.34%) and 384162 MT (59.20%), with the major five fruit crops producing 289119 MT (75.25%) and 44496 H (62.45%) in 2020-2021. (Table 1) Major fruit productivity is 64.9 MT/ha, or 53.9 percent of the total fruits grown in the Kumaon region. Over the last ten years, there has been an improvement in the production of major fruits. Thus, it can be seen that there is an increase in the production of horticultural fruits, as well as the growth of the major fruit production and area in the Kumaon region, as shown in table 1 for the years 2011 through 2021. The area dedicated to vegetables is 24.41 ha, while the area dedicated to fruits is 59.11 ha, accounting for 40.91% and 24.41% of the total area dedicated to fruits and vegetables, respectively. Fruits and vegetables account for only 47% of the Kumaon region's total geographical area. Table 1 and 2 shows the area, production, and productivity of the five major fruits from 2011 to 2021. According to 2011 data, mango was ranked first (23.02%) in terms of area shared, followed by citrus fruits (15.29%). Pear is ranked third (9.22), peach is ranked fourth (6.94), and plum is ranked fifth (5.25%) with a 6.26 percent area. The production share ranges from 20% to 30%. Mangoes have the highest percentage, while plums have the lowest (up to 6.70%). Citrus fruit (17.51%) and pears (18.81%) produce nearly equally. And peach was ranked fourth (9.17%). Similarly, mango accounted for 23.53 percent of the total area under fruits in 2021, followed by citrus (15.55 percent), pears (8.93 percent), peach (7.51 percent), and plum (6.75 percent). Mango production was the highest in 2021, at 25.47%, followed by citrus fruits (16.90%), pear (15.47%), peach (12.62%), and plum recorded (7.48%).

Year	Area(H) and Production (MT) of Horticulture Fruit Crops in 2011-2021									
	Mango		citrus fruits		pear		Peach		plum	
	Area	Product ion	Area	Producti on	Area	Producti on	Area	Product ion	Area	Producti on
2011-2012	20007 (23.02)	82642 (20.00)	13284 (15.29)	72373 (17.51)	8017 (9.22)	77745 (18.81)	6032 (6.94)	37890 (9.17)	5443 (6.26)	27694 (6.70)
2012-2013	20181 (23.03)	82136 (19.85)	13376 (15.26)	71457 (17.27)	8153 (9.30)	78682 (19.02)	6090 (6.95)	37413 (9.04)	5457 (6.22)	27741 (6.70)
2013-2014	20451 (23.53)	83610 (20.19)	13116 (15.09)	68655 (16.58)	8037 (9.25)	74671 (18.03)	6106 (7.02)	37762 (9.12)	5390 (6.20)	27664 (6.68)
2014-2015	20460 (23.19)	84896 (20.06)	13401 (15.19)	74047 (17.50)	8160 (9.25)	79032 (18.68)	6112 (6.92)	38407 (9.07)	5491 (6.22)	28072 (6.63)
2015-2016	16924 (24.18)	100294 (24.44)	10939 (15.63)	65264 (15.90)	6411 (9.16)	60482 (14.74)	5181 (7.40)	51550 (12.56)	4725 (6.75)	29105 (7.09)
2016-2017	16979 (23.99)	100478 (24.32)	10991 (15.53)	65343 (15.82)	6425 (9.07)	61211 (14.82)	5236 (7.39)	51653 (12.50)	4738 (6.69)	29149 (7.05)
2017-2018	17025 (23.88)	100476 (24.17)	11041 (15.48)	66449 (15.98)	6430 (9.02)	61219 (14.73)	5371 (7.53)	65371 (15.73)	4781 (6.70)	29209 (7.02)
2018-2019	17075 (23.82)	100534 (24.20)	11065 (15.43)	66476 (16.00)	6428 (8.96)	61126 (14.71)	5389 (7.51)	52389 (12.61)	4789 (6.68)	29282 (7.05)
2019-2020	17117 (23.78)	100634 (24.18)	11089 (15.40)	66484 (15.97)	6430 (8.93)	61080 (14.67)	5407 (7.51)	52417 (12.59)	4803 (6.67)	29292 (7.03)
2020-2021	16765 (23.53)	94466 (25.47)	11080 (15.55)	62686 (16.90)	6418 (9.0)	57389 (15.47)	5417 (7.60)	46818 (12.62)	4813 (6.75)	27760 (7.48)

Source-Directorate of Horticulture, Government of Uttarakhand



The productivity of pear in 2011 was (96.9MT/ha) highest and the lowest productivity was of mango (41.3MT/ha). Citrus fruits share 54.4MT/ha productivity .It is followed by peach 62.8MT/ha and plum was noted 50.8 MT/ha. Thus pear share the highest productivity 89.4MT/ha which is followed by peach at 86.4 MT/ha, citrus fruits at 69.4mt/ha, plum at 57.6 MT/ha, and mango56.3MT/ha lowest recorded in 2021.

**Table 2:-**

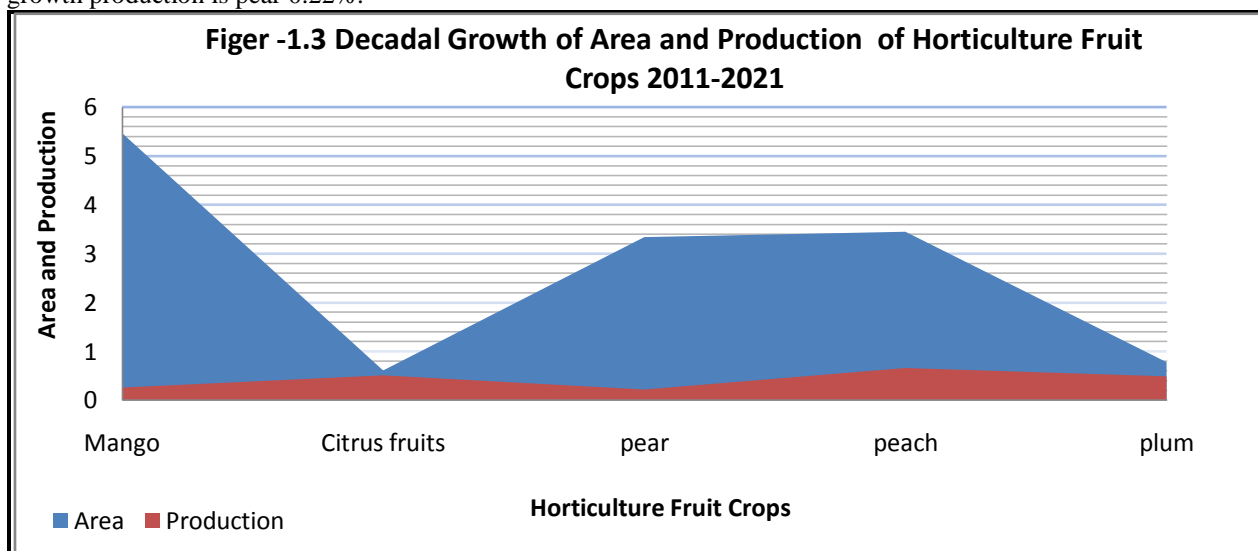
Year	Productivity (H/MT)of horticulture Fruits crop 2011-2021				
	mango	citrus fruits	pear	peach	plum
2011-2012	41.3	54.4	96.9	62.8	50.8
2012-2013	40.6	53.4	96.5	61.4	50.8
2013-2014	40.8	52.3	92.9	61.8	51.3
2014-2015	41.4	55.2	96.8	62.8	51.1
2015-2016	59.2	59.6	94.3	99.4	61.5
2016-2017	59.1	59.4	95.2	98.6	61.4
2017-2018	59	60.1	95.2	99.8	61
2018-2019	58.8	60	95	97.2	61.1
2019-2020	58.7	59.9	94.9	96.9	60.9
2020-2021	56.3	69.4	89.4	86.4	57.6

Source-Directorate of Horticulture, Government of Uttarakhand

**Decadal growth of Area and Production of Horticulture Fruit Crops 2011-2021-****Table 3:-**

Horticulture Fruit crops	Decadal Growth 2011-2021	
	Area	Production
<b>Mango</b>	5.47	0.26
<b>Citrus fruits</b>	0.61	0.51
<b>pear</b>	3.34	0.22
<b>peach</b>	3.45	0.66
<b>plum</b>	0.78	0.49
<b>Total</b>	<b>15.7</b>	<b>-3.09</b>

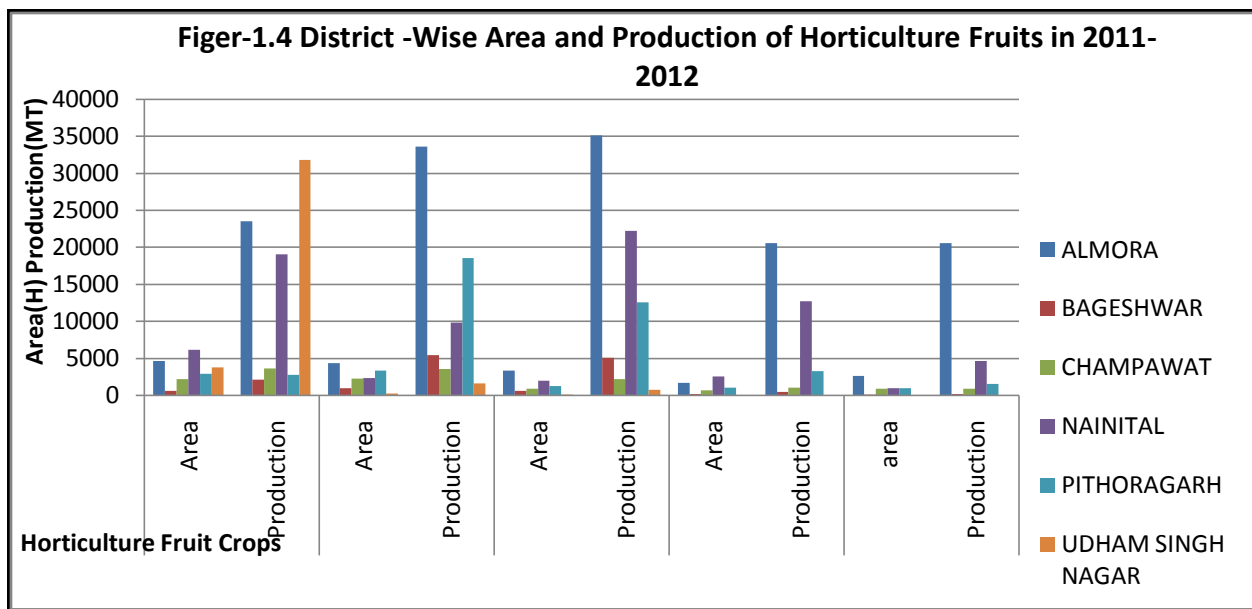
The total area and production growth rates of the Kumaon region's major fruit crops in 2011 - 2021 are 0.39 and 15.7%, respectively, both are negative, with the area growth rate being greater than the production growth rate. The percentage of the growth rate of the major fruits analyzed, In which 5.47% mango is the highest followed by peach at 3.45%, pear 3.34%, plum 0.78%, and the lowest area growth is citrus at 0.61%.and in terms of production at the highest growth rate fruit is peach 0.66%, followed by citrus fruits 0.51%, plum 0.49%,mango 0.26%, and the lowest growth production is pear 0.22%.



**Source:** Directorate of Horticulture, Government of Uttarakhand

The result in growth rates in the area, and production of major fruits crops is presented in table (3) in 2011-2021, i.e. 0.39% and 15.7% both are negative.

**District-wise Area -Production of major horticulture fruit crops 2011-2012-** The District-wise area and production of major horticulture fruit crops in 2021 respectively, mango total production 82642 with 20007 areas, in which the highest production district of kumaon region is Udham Singh Nagar 38.46% with 18.58% area and second rank district are Almora 28.42% with 23.09% area followed by Nainital 22.98% with 30.46% area, Bageshwar and Champawat lowest production of mango. Citrus fruits production in the year 72373(MT) with the area of 13284 (ha) area. The highest citrus fruits production district are Almora 46.36% with a 32.61% area, the second highest district is Pithoragarh 25.56 % with 25.11% area, and share Nainital 13.55% production with a 17.32% area, and Udham Singh Nagar lowest production district within kumaon region. Pear highest share production is in Almora 45.12 % with 41.38% area followed by Nainital with 28.55% production with 23.84 % area, and Pithoragarh 16.11%, Bageshwar with 6.5 % Champawat with 2.76% productions with 15.52%, 7.48%, 10.73% area in kumaon. Peach highest production district is Almora 54.12% with 27.12% area followed by Nainital 33.51 % with 42.37% areas, Pithoragarh share 8.47% production with 16.46% areas and district Bageshwar, Udham Singh Nagar lowest production share of kumaon peach production. Plum highest production district is Almora with production of 74.14% share with 47.41% area and second rank Nainital 16.57% with 17.72% area and Pithoragarh 5.48%, 3.15 % Champawat, Bageshwar 0.61% lowest production with area 16.82%, 16.03%, 1.98% area in kumaon region.



Source: Directorate of Horticulture, Government of Uttarakhand

Table 4:-

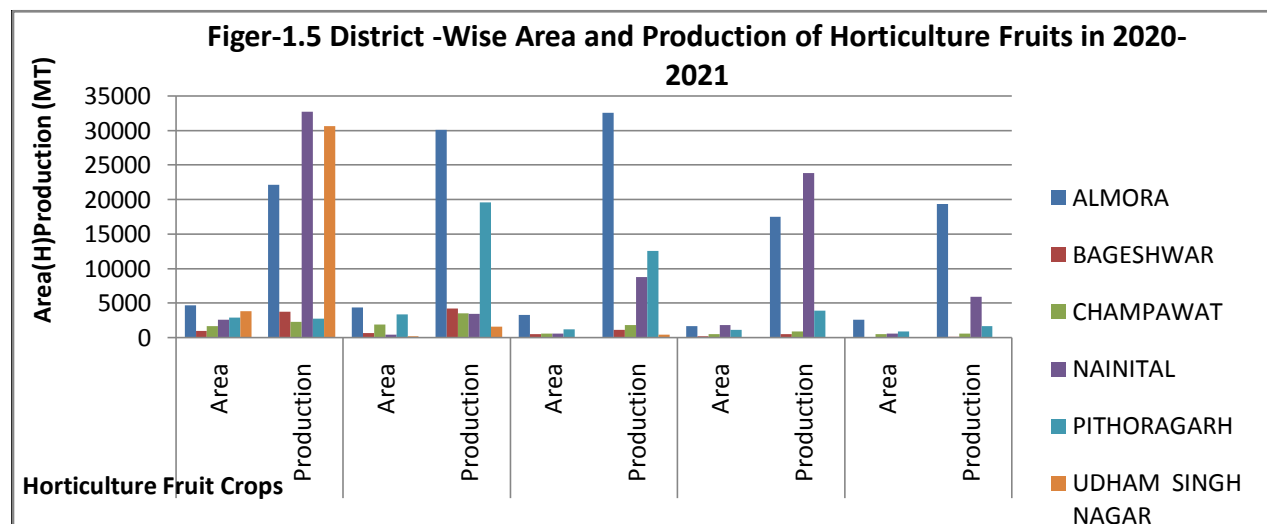
District -Wise Area(H) and Production(MT) of Horticulture Fruits in 2011-2012										
District	Mang o		Citrus fruit		Pear		Peac h		Plu m	
	Area	Producti on	Area	Producti on	Are a	Producti on	Area	Producti on	area	Producti on
Almora	4621	23490	4332	33554	3318	35083	1636	20508	2581	20538
	23.09	28.42	32.61	46.36	41.38	45.12	27.12	54.12	47.41	74.14
Bageshwar	565	2065	905	5410	600	5077	172	460	108	171
	2.82	2.49	6.81	7.47	7.48	6.53	2.85	1.21	1.98	0.61
Champawat	2143	3571	2215	3544	861	2151	675	1012	873	875
	10.71	4.32	16.67	4.89	10.73	2.76	11.19	-2.67	16.03	3.15
Nainital	6095	18995	2302	9807	1912	22200	2556	12700	965	4590
	30.46	22.98	17.32	13.55	23.84	28.55	42.37	33.51	17.72	16.57
Pithoragarh	2865	2735	3336	18500	1245	12530	993	3210	916	1520
	14.31	3.3	25.11	25.56	15.52	16.11	16.46	8.47	16.82	5.48
Udham Singh Nagar	3718	31786	194	1558	81	704	0	0	0	0
	18.58	38.46	1.46	2.15	1.01	0.9				
2011	20007	82642	13284	72373	8017	77745	6032	37890	5443	27694

**District-wise Area -Production of major horticulture fruit crops 2020- 2021-**

The District-wise area and production of major horticulture fruit crops in 2021 respectively, total production of mango 94466 with 16765 areas, in which the highest production district of kumaon region is Nainital 34.67% with 15.78% area and second ranked is Udham Singh Nagar 32.4% production with 22.85% areas, followed by Almora 23.50% with 27.88% area and Bageshwar district are lowest production and area. The total production of citrus fruits



in the kumaon region is 62686 (MT) with 11080 (ha) area. The highest citrus fruits production district area is Almora 48.02% with 39.45% area, the second highest district is Pithoragarh 31.33% with 30.77% area, Nainital shares 5.56% production with 4.50% area, and Udham Singh Nagar is the lowest production district within kumaon region. The total production of pear in the kumaon region is 57389 with 6418 areas, the highest share production district is Almora 56.82% with 51.85% area followed by Pithoragarh 21.91% with 19.58% area, Nainital 15.28% with 9.56% area and Bageshwar 2.04% Champawat 3.18%, Udham Singh Nagar 0.73% with share 8.24%, 9.92%, 0.82% areas in kumaon region. The total production of peach in kumaon region is 46818 with 5417 area the highest production district is Nainital 50.91% with 33.87% area, followed by Almora 37.49% with 30.88% area share, Pithoragarh 8.40% production with 20.95% area and district Bageshwar, Udham Singh Nagar lowest production share of kumaon peach production. Plum production of total kumaon region is 27760 with 4813 area. Highest production district in plum Almora 69.78% share with 54.39% area and second rank Nainital 21.43% with 12.50% area and Pithoragarh 5.98% Champawat 2.24% Bageshwar 0.55% lowest production share with 19.80%, 11.17%, 2.09% area in kumaon region.



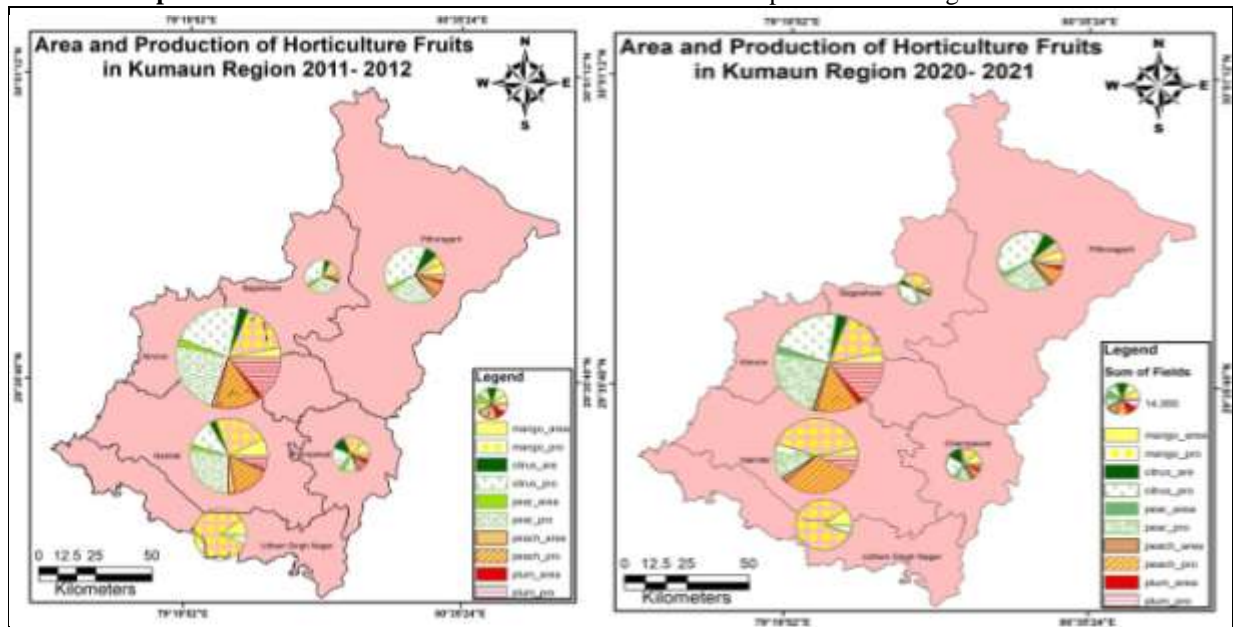
Source: Directorate of Horticulture, Government of Uttarakhand

Table 5:-

District -Wise Area(H) and Production(MT) of Horticulture Fruits in 2020-2021										
District	Mango		Citrus fruit		Pear		Peach		Plum	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Almora	4675	22206	4372	30104	3328	32614	1673	17556	2618	19373
	27.88	23.5	39.45	48.02	51.85	56.82	30.88	37.49	54.39	69.78
Bageshwar	1011.82	3757.11	666.89	4264.52	529	1172	253.56	548.05	101.14	153.47
	6.03	3.97	6.01	6.8	8.24	2.04	4.67	1.7	2.09	0.55
Champawat	1699	2309	1903	3575	637	1830	520	945	538	623
	10.13	2.44	17.17	5.7	9.92	3.18	9.59	2.01	11.17	2.24
Nainital	2646.4	32757	499	3490	614.74	8770.7	1835.35	23836	602.44	5949
	15.78	34.67	4.5	5.56	9.56	15.28	33.87	50.91	12.5	21.43
Pithoragarh	2902.5	2789.2	3410	19643	1257	12578	1135.4	3933.2	953.6	1662.2
	17.3	2.95	30.77	31.33	19.58	21.91	20.95	8.4	19.8	5.98
Udham	3831	30648	230	1610	53	424	0	0	0	0

<b>Singh nagar</b>	22.85	32.4	2.07	2.56	0.82	0.73				
<b>2021</b>	16765	94466	11080	62686	6418	57389	5417	46818	4813	27760

**Map1.2&1.3:- Area and Production of Horticulture Fruit crops in Kumaun region 2011- 2021**



**District –wise levels of productivity of major horticulture fruit crops in 2011-2021-**

The kumaun region's major fruit crops mango, citrus fruits, pear, peach, and plum productivity are divided into four levels –very high (75>) MT/ha, high (50-75) MT/ha, medium (25-50) MT/ha, low to very low (25-0) MT/ha, when we placed districts under each level according to their productivity table. In which terms, of productivity in 2011-2021 the level mango, under a very high productivity level in Nainital and Udham Singh Nagar, followed by districts Almora and Bageshwar with medium productivity in years, and Champawat, Pithoragarh with low level of productivity district in 2011-2021. Respectively, a citrus fruit in 2011-2021 shows very high productivity level in Udham Singh Nagar and Almora .Similarly, Pithoragarh and Bageshwar shows high level productivity and, Champawat in low level of productivity in both years. Meanwhile, five districts – Almora,Pithoragarh,UdhamSingh Nagar,Nainital,and Bageshwar shows very high level of productivity of pear in 2011-2021. A low level of productivity is recorded in Champawat, and Bageshwar districts.

**(Table-6)**

<b>Mango</b>		<b>2011</b>	<b>2021</b>
<b>Indicator</b>	<b>Levels</b>	<b>Districts</b>	
< 0	Very low	Nil	Nil
0-25	Low	Champawat	Champawat, Pithoragarh
25-50	Medium	Nainital, Bageshwar	Bageshwar , Almora
50-75	High	Almora	Nil
75>	Very high	Udham Singh Nagar,Pithoragarh	Udham Singh Nagar Nainital,
<b>Citrus fruit</b>			
<b>Indicator</b>	<b>Levels</b>	<b>Districts</b>	
< 0	Very low	Nil	Nil
0-25	Low	Champawat	Champawat
25-50	Medium	Nainital	Nil
50-75	High	Pithoragarh, Bageshwar	Bageshwar, Pithoragarh, Almora, Udham Singh Naga Nainital ,
75>	Very high	Almora, Udham Singh Nagar	Nil
<b>Pear</b>			
<b>Indicator</b>	<b>Levels</b>	<b>Districts</b>	



< 0	Very low	Nil	Nil
0-25	Low	Champawat	Bageshwar,
25-50	Medium	Nil	Champawat
50-75	High	Nil	Nil
75>	Very high	Bageshwar, Almora ,Pithoragarh, Udham Singh Nagar ,Nainital	Almora ,Pithoragarh, Udham Singh Nagar ,Nainital
<b>Peach</b>			
<b>Indicator</b>	<b>Levels</b>		<b>Districts</b>
< 0	Very low	Udham Singh Nagar	Udham Singh Nagar
0-25	Low	Champawat	Bageshwar, Champawat
25-50	Medium	Bageshwar,Pithoragarh,Nainital,	Pithoragarh,
50-75	High	Nil	Nil
75>	Very high	Almora	Nainital, Almora
<b>Plum</b>			
<b>Indicator</b>	<b>Levels</b>		<b>Districts</b>
< 0	Very low	Udham Singh Nagar	Udham Singh Nagar
0-25	Low	Champawat,pithoragarh, Bageshwar	Bageshwar, Champawat,pithoragarh
25-50	Medium	Nainital	Nil
50-75	High	Nil	Nil
75>	Very high	Almora	Nainital, Almora

Source-Directorate of Horticulture, Government of Uttarakhand,

Peach productivity level was very high in district Almora in both years. Similarly, Nainital showed very high productivity in 2021. Some districts' productivity- was medium in Bageshwar, Pithoragarh, Nainital and very low in Udham Singh Nagar in 2011. Similarly, low productivity was observed in Bageshwar, Champawat district of kumaon region in 2021. Plum shows very high-productivity in district Almora and Nainital followed by low-productivity districts are Champawat, Bageshwar, Pithoragarh. Similarly, Udham Singh Nagar district are very-low productive region. We analyzed very high productivity district areas, in which (plain region districts Udham Singh Nagar, and Nainital) grow in the mango subtropical climatic zone citrus fruits production (Almora, Pithoragarh) suitable in the valley and mid-latitudes, (Almora, Nainital, Pithoragarh) hill districts pear, peach, and plum which are suitable for grow in the temperate zone.

### Conclusion:-

The present study is concerned with the horticulture development scenario in the kumaon region of Uttarakhand from 2011-2021. The total horticulture fruit area in the Kumaon region is 71250(H) (39.34%) with 384162(MT) (59.20%), out of which the production of the major five fruits crops is (289119) (MT) (75.25%) and (44496) (H) (62.45%) respectively in 2020-2021. The result in growth rates in the area, production of major fruits crops in 2011-2021, was 0.39% and 15.7% both are negative in which the area growth rate is more than the production rate. Kumaon region has grown a number of horticulture crops. We listed the major five fruit crops (mango, citrus fruit, pear, peach, and plum) from 2011-2021 during the period and analyzed and observed the crops in which the lowest area has the highest productivity According to 2011, pear, peach, and citrus fruits have the lowest area (15.73% average) each has comparatively the highest productivity which is about 34.35 MT/ha average Similarly in 2021 three highest fruit crops have the lowest area (16.08 average) comparatively highest productivity which is (39.25 MT/ha average). The highest increase was noticed in the productivity with 77.9 MT/ha of major fruits while its 59.11% area is the lowest in area and 40.91% production during the last decade. The finding shows the result of horticulture development has a very high potential for agro climatic and is favorable for growing regions. The landscape also supports its cultivation with high production and productivity, but horticulture development is not happening due to the lack of interest in horticulture production. If horticulture is promoted in the Kumaon region, it will improve the region's socio-economic conditions, cultivators' living conditions, and other related conditions.

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