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Analysis of Temporal Change in Cropping Pattern and its Reasons in Bulandshahr District of Uttar Pradesh

Vikas Kumar, Subhash Chand, Rajni Jain, Dilip Kumar, Mahendra Singh, K.R. Chaudhary and M.S. Chauhan
ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi
Email : vikas.kumar1@icar.gov.in

Abstract

Present study in on secondary data base of Bulandshahr district of Western Uttar Pradesh. Important crops of the district are wheat, rice, sugarcane, maize, onion, pearl millet, rapeseed and mustard, potatoes, fruits and vegetables and fodder crops. Due to biotic and abiotic reasons, it was observed that that there is an increase in area under Rice, Sugarcane, Fruits and vegetable and Potato during 1990 to 2017.We have worked out the compound decadal growth rate of area for these crops which was positive i.e., for rice (112%), fruits and vegetable (10%), sugarcane (3%) and potatoes (3%) for the period from 1990 to 2017. The important reasons were for increase in area were assured irrigation, subsidised power and inputs, pest and disease control, high yielding and resistant varieties and assured procurement by government and private agencies. In 1990s, when irrigation facility was short and crops were mainly cultivated in rainfedcondition.The pulses, oilseeds,barley, sesamum, pearl millet, rapeseed and mustard and sorghum had higher area in 1990s. However, over the years by 2017, the area under pearl millet (8%), sorghum (100%), rapeseed and mustard (45%), oilseeds (48%) and barley (75%) and sesamum (97%) had reduced. These crops could not compete well due to less improved and resistant varieties, lesser demand, less procurement in market by government and private agencies. The analysis clearly indicates that farmers are moving towards high value market oriented agriculture crops that resulted in change in cropping pattern.

Key words : *Temporal change, decadal change, cropping pattern, important factors, Bulandshahr, area, productivity.*

Introduction

Adoption of cropping pattern in any region is an outcome of varied factors, which play important role as physical, social and economic factors. Some of these are changeable like prices, government policies, technology etc. These factors have a combined impact on the decision making process of the farmer. Those which are not subject to much change as soil conditions, climate etc., have varied from region to region. The cropping pattern and the level of crop production of a region is influenced by capital, marketing, labour, transport, economic condition of the farmer, institutional facilities etc. (1). Due to expansion of urbanization, introduction of advanced technology in agriculture and low returns from traditional farming system, farmers were compelled to switch over to professions other than agriculture. Farmers those, who were still engaged in agriculture, had to change their tradition farming system to modern system for their existence (2). Besides water conditions, it is also proposed that there is a relationship between irrigation freedom (degree of water control by farmers) and crop grown (3). The farmers generally expect that they will get a certain quantity of produce from the crops they grow. Thus the associated risk in crop production is also an important factor in determining the cropping pattern. An ideal crops plan should not only fulfil requirement of the local people or food for the farmers and their families, but also to meet fodder requirement of the farm animals. The choice of crops, their variety and the area under different crops obviously depend upon a number of factors, such as soil conditions, temperature and rainfall, economic factors such as price structure of different crops, availability of labour, capital marketing, transport facility, nearness of the market etc. are the factors which determines the choices of the crop grown.

Uttar Pradesh is the largest state of the India in terms of population and second largest in area in the country. The reporting area of the state is 24.2 million ha, out of which cultivated area is 16.68 million ha. The gross cropped area is 25.5 million ha. The cropping intensity in the state is 153 percent. Farming community is dominated by small and marginal farmers. Average size of holding is only 0.83 ha per farmer. However, the average size of holding of marginal farmers is only 0.40 hectare (4,5).

Bulandshahr is one of the important agriculturally dominated districts of Uttar Pradesh. It is located in Meerut region of Utter Pradesh and falls between Ganga and Yamuna rivers. This is situated between 28.4 0 south and 28.0 0 north latitude and between 77.0 0 and 78.0 0 longitude. The District is about 84 km in length and 62 km is breadth. The district is 237.44 meters above sea level.). Annual rainfall was recorded very low in 2019 as 369 mm

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and average rainfall is 750-800 mm annually. The river Ganga separates it from Jyoti Ba Phule Nagar and Badaun districts in east. The district is bounded by Aligarh in south, GautamBudh Nagar in west and Ghaziabad in the north.Important socio-economic parameters of the district Bulandshahr, Uttar Pradesh are given in table-1.

Bulandshahr district has 7 tehsils, 15 blocks, and covers an area of 4338.5 Sq. Kms. with a population 34,99,171. (6). Important crops of the district are Wheat, Rice, Sugarcane, Maize, onion, Pearl millet, Rapeseed and Mustard, Potatoes, Fruits and Vegetables and Fodder crops. Gross cropped area of district in 2017-18 was 537 thousand hectares and net cropped area was 299 thousand hectares and the cropping intensity was 180 and in 2015-16 was 169.1%.In 2015-16, Percentage of Net irrigated area in Bulandshahr is 100% while this is in Bundelkhand region is 49.72% and in Uttar Pradesh, it is 79.69% of total irrigated area. In the net irrigated area. Of this net Irrigated area, 88.62% is irrigated by private tubewell, share of canal is 6.78%. (7,8). Of the total land holdings, 75 % holdings belong to marginal farmers (0-1 ha), 15.77% small farmers (1-2 ha), 7.14% medium farmers (2-4 ha) and 2.08 % land holdings belongs to more than 4 hectares area in 2010-11 (7,8) (Table-1).

Table-1 : Important socio-economic parameters of the district.

Description	2011	2001
Population (Lakhs)	34.99	29.13 Lakhs
Actual Population	3,499,171	2,913,122
Male	1,845,260	1,550,326
Female	1,653,911	1,362,796
Population Growth	20.12%	18.17%
Area Sq. Km	4,512	4,512
Density/km^2	776	656
Proportion to Uttar Pradesh Population	1.75%	1.75%
Sex Ratio (Per 1000)	896	879
Child Sex Ratio (0-6 Age)	854	867
Average Literacy %	68.88	59.39
Male Literacy %	80.93	74.31
Female Literacy %	55.57	42.48

Source : District Census Handbook, Bulandshahr, UP, 2011.

Research Methodology

The data on Area, Production and Productivity were collected from secondary sources as (9), (6), (8), (5), other reports of UP government and Government of India.The area, production and yield data were collected for different decades as 1990, 2000, 2010 and 2017 There were 7 years in last decade as currently available data for 2017 only. For some crops, the data were used for nearby years, if the data were not available for concerned years for reaching to conclusion. For percentage change in area,the initial year was 1990 and final year was 2017. The compound decadal growth rate was calculated to find the change in 3 decades (1990-2000, 2000-2010 and 2010-2017) for explanation of results in simple way. As Compound annual growth rate figure could be very low.

Formula for compound decadal growth rate was taken as

Compound decadal growth rate = (Year 2017/Year 1990)$^{1/3}$ -1

Results and Discussion

The data for area (Thousand hectares) under different crops in the district are presented in Table-2. The important crops in the district were Wheat, Rice, fodder crops, Sugarcane, Maize, Fruits and vegetables, Onion, Pearl millet, Rapeseed and Mustard in Oilseeds, Potatoes and Pegionpea etc. In 2017, the highest area (in thousand hectares) was used for production of wheat (215.96) followed by rice (102), fodder (69.05 in 2016), sugarcane (62.79), maize (44.28), fruits and vegetables (36.62 in 2016), onion (18.32) etc.There were few crops, the area of which had increased in the given period and other crops area had reduced.

Increase in area : The area under some crops had increased from 1990 to 2017. The area under rice was 10.77 thousand hectares in 1990 and increased to 102.1 thousand hectares in 2017. The area was increased by 848% in the given period and the compound decadal growth rate was 112%. In rice case, the factors other than productivity has contributed more for increase in area that were higher demand, high market prices, assured procurement by government and private agencies and subsidised inputs etc. As Compound decadal growth rate for area was 112% and for yield was very low that was 20% only for given period (Table-2, 3 and 4 and fig.-1 and 2).

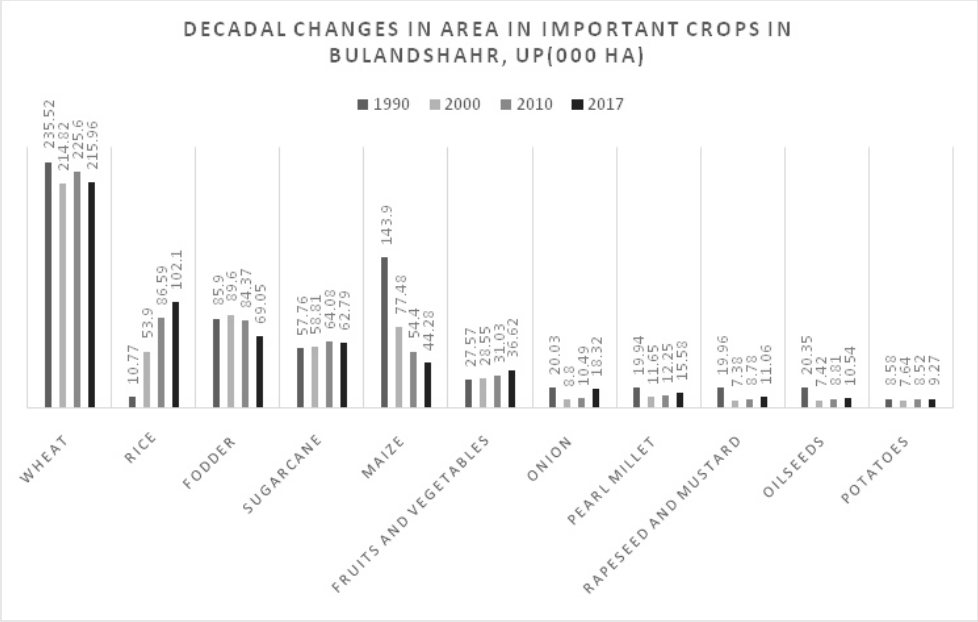
The area under sugarcane had increased by 9%. Important factors for this were improved and disease resistant varieties, higher yield, assured procurement and higher profitability. The area under fruits and vegetables had also increased by 33% from 27.57 thousand hectares to 36.62 hectares in 2016 thousand hectares and Compound decadal growth ratewas found as 10%. The area under potato had also increased during the given period by 8% from 8.58 thousand hectares to 9.27 thousand hectares. The important reasons for increase in area under Fruits and vegetables and potatoeswere increase in cost effective irrigation facility, high yielding and disease resistance varieties, subsidies on water and power and input prices, assured output prices and increase in demand and open markets in fruits and vegetables and potatoes and quick return. Farmers have shifted from traditional to market oriented cropping pattern (10,11).

Table-2 : Area of important crops and compound decadal growth rate. (Area in 000 ha)

S. No.	Crops	1990	2000	2010	2017	Change in area %	Compound Decadal growth rate %
1.	Wheat	235.52	214.82	225.6	215.96	-8%	-3%
2.	Rice	10.77	53.9	86.59	102.1	848%	112%
3.	Fodder	85.9#	89.60	84.37	69.05$	-20%	-7%
4.	Sugarcane	57.76	58.81	64.08	62.79	9%	3%
5.	Maize	143.9	77.48	54.4	44.28	-69%	-32%
6.	Fruits and vegetables	27.57	28.55	31.03	36.62*	33%	10%
7.	Onion	20.03	8.8	10.49	18.32	-9%	-3%
8.	Pearl millet	19.94	11.65	12.25	15.58	-22%	-8%
9.	Rapeseed and mustard	19.96	7.38	8.78	11.06	-45%	-18%
10.	Oilseeds	20.35	7.42	8.81	10.54@	-48%	-20%
11.	Potatoes	8.58	7.64	8.52	9.27	8%	3%
12.	Pigeonpea	10.3	12.19	11.65	6.6	-36%	-14%
13.	Minor pulses	17.15	5.31	5.44	6.32	-63%	-28%
14.	Barley	25.17	13.03	7.52	6.3	-75%	-37%
15.	Cotton	1.68	0.24	0.17	0.13	-92%	-57%
16.	Chickpea	7.57	0.47	0.02	0.02	-100%	-86%
17.	Kharif sorghum	2.89	0.41	0.1	0.01	-100%	-85%
18.	Sesamum	0.36	0.01	0	0.01	-97%	-70%

Note : #Fodder area data is 85.9 for year 1989, $- Fodder area data is 69.05for year 2016.,*Fruits and vegetable area data is 36.62 for year 2016, @ Oilseed area data is 10.54 for year 2013.

Fig.-1 : Graph presenting the decadal changes in area of important crops.



Fodder area data is 85.9 for year 1989, $- Fodder area data is 69.05for year 2016., *Fruits and vegetable area data is 36.62 for year 2016, @ Oilseed area data is 10.54 for year 2013.

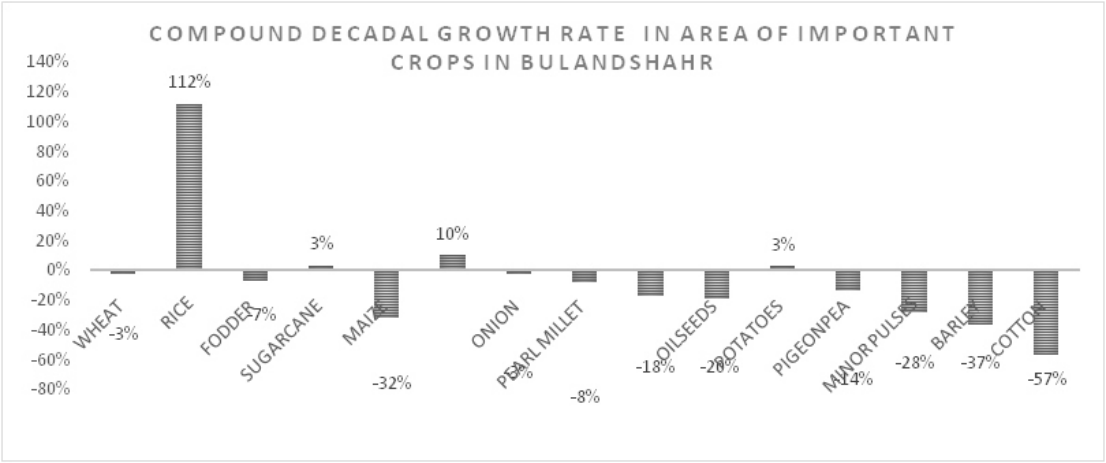
Source : District wise data, ICRISAT, 2020.

Reduction in Area : The area under other crops in the district had reduced and presented in Table-2. There was small reduction in wheat area from 1990 to 2017. In 1990, the area under wheat was 235.52 thousand hectares and in 2017, it reduced to 215.96 hectares, that was 8 percent reduction and Compound decadal growth rate was -3%.

The area under wheat was maintained as it was traditional crop and has demand for home and market both. Its production practices were known to farmers and there is assured government procurement and private markets. In relation to rice, its profitability was found less.

The higher productivity of varieties had contributed more in maintaining the area under wheat. As the Compound decadal growth rate for area was -3% and for

Fig.-2 : Compound decadal growth rate in area for important crops from 1990 to 2017 in Bulandshahr, UP.



Fodder area data is 85.9 for year 1989, $- Fodder area data is 69.05for year 2016., *Fruits and vegetable area data is 36.62 for year 2016, @ Oilseed area data is 10.54 for year 2013.

Source : District wise data, ICRISAT, 2020

Table-3 : Area, production, productivity and compound decadal growth rate (1990-2017) in Bulandshahr.

Year	Rice			Wheat			Kharif sorghum		
	Area (000ha)	Production (000 tones)	Yield (kg/ha)	Area (000ha)	Production (000 tones)	Yield (kg/ha)	Area (000ha)	Production (000 tones)	Yield (kg/ha)
1990	10.77	18.52	1720.07	235.52	718.63	3051.25	2.89	2.1	725.87
2000	53.9	109.34	2028.37	214.82	801.7	3731.92	0.41	0.34	822.59
2010	86.59	196.54	2269.81	225.6	891.36	3950.99	0.1	0.08	782.78
2017	102.1	304.58	2983.12	215.96	968.16	4482.97	0.01	0.01	925.6
Compound decadal growth rate 1990-2017)	112%	154%	20%	-3%	10%	14%	-85%	-83%	8%

Source : District wise data, ICRISAT, 2020.

Table-4 : Area production productivity and compound decadal growth rate (1990-2017) in Bulandshahr.

Year	Maize			Barley			Pearl millet			Sugarcane		
	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)
1990	143.9	300.42	2087.69	25.17	77.11	3062.82	19.94	23.58	1182.82	57.76	334.84	5797.55
2000	77.48	169.34	2185.53	13.03	42.01	3223.92	11.65	18.42	1581.74	58.81	332.64	5656.35
2010	54.4	112.98	2076.89	7.52	25.52	3392.12	12.25	23.87	1948.6	64.08	364.56	5689.29
2017	44.28	110.47	2494.89	6.3	24.93	3959.96	15.58	29.91	1919.28	62.79	527.83	8406.44
Compound decadal growth rate 1990-2017)	-32%	-28%	6%	-37%	-31%	9%	-8%	8%	18%	3%	16%	13%

Source : District wise data, ICRISAT, 2020.

Table-5 : Area production productivity and compound decadal growth rate (1990-2017).

Year	Chickpea			Pigion pea			Minor pulses			Rapeseed and Mustard		
	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)	Area (000 ha)	Production (000 tones)	Yield (kg/ha)
1990	7.57	10.36	1367.54	10.3	10.06	976.82	17.15	13.94	812.63	19.96	20.03	1003.25
2000	0.47	0.4	845.59	12.19	9.39	770.35	5.31	3.06	576.68	7.38	8.8	1193.64
2010	0.02	0.02	900.9	11.65	7.7	660.44	5.44	3.89	715.67	8.78	10.49	1194.72
2017	0.02	0.02	1042.66	6.6	5.85	886.01	6.32	5.92	937.24	11.06	18.32	1657.39
Compound decadal growth rate 1990-2017)	-86%	-88%	-9%	-14%	-17%	-3%	-28%	-25%	5%	-18%	-3%	18%

Source : District wise data, ICRISAT, 2020.

yield is +14% in the given period (Table-3 and 4 and fig.-1 and 2).

The area under fodder crops had reduced from 85.9 thousand hectares from 1998 to 69.05 thousand hectares in 2016. The area under fodder crops was reduced by 20 % from in given period and the Compound decadal growth rate was -20%.

Among the individual crops, the area maize had been reduced drastically. It was visible that due to low selling price of maize in relation to other crops and production variation, the area under maize had been reduced from 143.9 thousand hectares in 1990 to 44.28 thousand hectares in 2017. The reduction in Maize area is 69% and Compound decadal growth ratewas found as -32%.

The area under onion and pearl millet had also reduced in the given period by 9 percent and 22 percent. The area under oilseeds, pulses, barley, chickpea had reduced in the given period as these crops were adopted due to their low water requirement. Farmers prefer to grow those crops which gave them better yield and so the farmers did not prefer to grow pulses and oilseeds because of their low yield. This again showed that farmers tried to maximize their income from their land (10). With the increase in irrigation area, these crops were found less profitable in relation to other crops. At the same time higher cost of other inputs as fertilisers, seed and irrigation water in the area, the expected margin from these crops had reduced (12,13).

Conclusions

There are number of factors responsible for change in cropping pattern in the district. There was an increase in area under rice, rugarcane, fruits and vegetable and potato. The compound decadal growth rate for areawas found to be positive and high for rice (112%), fruits and vegetable (10%), sugarcane (3%) and potatoes(3%) for the period from 1990 to 2017. The important reasons were for increase in area were assured irrigation, subsidised inputs, pest and disease control method, high yielding and resistant varieties and assured procurement by government and private agencies. The pulses, oilseeds, Barley, sesamum, pearl millet, rapeseed and mustard and sorghum had higher area during 1990s due to deficit irrigation facilties and lack of other inputs. But over the years in 2017, the area under pearl millet (8%), sorghum (100%), rapeseed and mustard (45%), oilseeds (48%) and barley (75%) and sesamum(97%) had reduced.The maize area (69%) was also reduced in the given period as found less profitable in relation to other irrigated crops. Thus, the important factors for increase in area for the crops is high yielding and resistant, easily available varieties, cost effective inputs, sufficient demand, assured procurement by different agencies and simple package of practices as in case of traditional crops which are well known to farmers. Beside other factors, the high and assured purchase are found as important factors. Thus, by increase in processing industries and assured procurement of produce in market by creation of different purchase agencies as government agencies, cooperatives, Farmers producers' companies, private firms for domestic supply and export etc, the area under different crops can be increased and that led to diversification in agriculture also and ultimately give less risk, wider market and higher profit.

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