A COMPARISON OF THE CROPPING PATTERNS OF PUNE AND NASHIK DISTRICTS

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ABSTRACT

This paper is an attempt to analyse the impact of cropping pattern on the value of agricultural income generated in Pune and Nashik districts. For this study, thirteen important crops (including cereals, pulses, oilseeds, and cash crops) have been selected viz., rice, wheat, jowar, bajra, maize, tur, moong, udid, gram, groundnut, soybean, sugarcane, and cotton. The area under these crops in Pune and Nashik during the period between 2009-10 and 2013-14 has been studied in order to understand their cropping patterns. With respect to the cropping pattern of Nashik it was observed that the cropping pattern has diversified in the production of cereals, pulses, and oilseeds while in Pune the cropping pattern has diversified in favour of pulses and oilseeds to some extent and to a greater extent in sugarcane. The area and production of fruits and vegetables in Nashik is also higher than in Pune. For a more holistic analysis, the rainfall in both districts during the study period was analysed and it was found that Pune had better rainfall than Nashik in the study period. As far as productivity of crops was concerned, it was found that the productivity of crops, mainly kharif crops, in Nashik was higher than in Pune. It was also observed that during the period of the study, the agricultural income of Nashik district increased four times as compared to the doubling of Pune's agricultural income during the same period. This paper proposes that the cropping pattern of Nashik has a great influence on the agricultural income of the district.

Keywords: *Agricultural income, cropping pattern, food crops, cash crops, Gross Cropped Area*

INTRODUCTION

Pune is the third largest district in terms of Real Gross District Value Added (at current and 2011-12 prices) as well as Per Capita Gross District Value Added at Current Prices. While Mumbai and Thane occupy the top slots with a District GVA of Rs.3,62,185 lakh crores and Rs.2,66,168 lakh crores respectively (at constant prices), Pune comes a close third with a District GVA of Rs.2,09,808 lakh crores (Economic Survey of Maharashtra, 2019-20). However, the value of income generated in Pune by the agricultural sector far outstrips that of Mumbai and Thane. While Mumbai generated agricultural income of Rs.3,19,451 lakhs, and Thane generated agricultural income of Rs.86,991 lakhs for the year 2013-14 (at current prices), the corresponding figure for Pune was Rs.8,82,700 lakhs. (District Socio Economic Review). After studying the value of agricultural income generated by all the 31 districts in Maharashtra, it was found that Pune has the highest agricultural income in entire Maharashtra except for Nashik which is an outlier with agricultural income double that of Pune at Rs.15,26,322 lakhs in 2013-14. The contribution of district GVA to Maharashtra GVA is higher for Pune at 11.4% as compared to a mere 4.84% for Nashik. Further analysis showed that Pune and Nashik are very similar in terms of geographical area at 15,62,000 ha and 15,53,000 ha respectively. However, the Gross Cropped Area (GCA) in Pune is higher at 10,81,000 ha (2017-18) while the corresponding figure for Nashik is 7,45,000 ha (2016-17). The Total Irrigated Area in Nashik is also very less at around 2,00,000 ha (2016-17) as compared to Pune at 5,80,000 ha (2018-19). A broad overview of the cropping pattern for the two districts also revealed that while Pune had more than 1 lakh hectares under sugarcane which is considered a high value cash crop, Nashik had only half that area (42,500 ha) under cotton. Thus, despite having more irrigation facility, more area under a high value cash crop, and more GCA, the low level of agricultural income in Pune district was a puzzle. This paper is an attempt to analyse the impact of cropping pattern on value of agricultural income generated in Pune and Nashik districts.

LITERATURE REVIEW

Bhadwal et al (2014) have shown that the adoption of appropriate policies has guided the shift in the cropping pattern of Jalna towards crops like cotton, oilseeds and pulses which are suitable for growing in its dry lands.

Chand and Paruppurathu (2012) have identified various causes for the renaissance of the agricultural sector in India between 2005 and 2012 chiefly among them being hiking of both

public and private investment as well as improving the terms of trade favorably for the agricultural sector. Another favourable factor for increasing farm production according to them was remunerative prices of farm products though the sustainability of such a trend was found questionable by them.

Dantwala (1986) has argued that the cropping patterns followed in different states in India showed that they are not suitable with regard to their comparative advantage in yields because the farmers' decisions were based on the revenue obtained from growing different crops instead of on their yield potential.

The **ICRISAT report** (2015) found that higher income levels were found to be a primary cause for shifting the cropping pattern from cotton to soybean in Akola villages. Availability of seed subsidy, supplementary irrigation in rabi season, and lower labor requirements for soybean/chickpea/wheat coupled with extremely volatile cotton prices were also relevant factors causing the change.

Jha et al (2009) have studied crop diversification in Indian agriculture and concluded that the shifts in cropping pattern in specific regions/states was caused by the favourable institutional framework and remunerative prices obtained by the farmers.

Kannan (2011) in discussing the cropping pattern of Maharashtra (1960-61 and 2004-05), has highlighted that the increase in area, production and productivity of maize and soybean was due to increasing demand from poultry industry, availability of new seeds and inputs, and higher remunerative prices obtained by farmers for these crops while the area, production and productivity of sugarcane has stagnated or declined due to erosion of soil fertility and certain pests and diseases.

Kannan and Sundaram (2011) proved conclusively in their report that technology and institutional support for rice, wheat and plantation crops were instrumental in influencing the cropping pattern across states.

Najan (2015) found that the cropping pattern of Ahmednagar district showed modification since 1973-74 from food grain crops to non-food grain crops due to the change in the attitude of farmers.

Saha (2013) concluded that in India, dietary habits and increasing demand for food due to increasing population led to crop specialization in food grains while geographical conditions led to crop specialization in places where topography was primarily important. He has also shown that the more economically developed states of the southern, western, and south-western

parts of India also exhibited greater crop diversification favouring commercial and horticultural crops and oilseeds.

Vishandass and Lukka (2013) undertook a study to discover the true levels of profitability of specifically those crops for which MSP was recommended as also the relationship between costs and productivity, the hypothesis being that with rising productivity, real costs go down and the probability is that it will lead to greater competitiveness and higher returns to farmers thus influencing the cropping pattern.

RESEARCH METHODOLOGY

This study is descriptive and comparative analysis of cropping pattern and agricultural income between Pune and Nashik districts has been done using simple percentages.

Objective: To study the impact of cropping pattern on agricultural income generated in Pune and Nashik districts.

Data Collection and Analysis

For this study, **thirteen important crops** (including cereals, pulses, oilseeds, and cash crops) have been selected viz., rice, wheat, jowar, bajra, maize, tur, moong, udid, gram, groundnut, soybean, sugarcane, and cotton. These crops have been selected since they are the principal crops cultivated in these two districts as per the statistics published by the Department of Agriculture, Maharashtra. As such, the data pertaining to the area under these crops in Pune and Nashik districts was compiled from the website of the Department of Agriculture, Maharashtra. Further, the data pertaining to the value of agricultural income in Pune and Nashik districts, the data pertaining to the area and production of fruits and vegetables, productivity of the thirteen selected crops, as well as the rainfall during the study period have all been compiled from the District Socio Economic Reviews. The **scope of study** spans **five years from 2009-10 to 2013-14**. This period has been selected since it was found that the agricultural income of Nashik has increased four times during this period as compared to a doubling of agricultural income in Pune district for the same period. The data for agricultural income after 2013-14 was not published in the subsequent District Socio Economic Reviews till 2019-20. From 2020-21, the data became available but the nomenclature of agricultural income was changed. As such the data published in the latest District Socio Economic Reviews

differs from that published in 2014-15. Further, since this period (between 2009-10 and 2013-14) was the timeframe in which Nashik's agricultural income has skyrocketed, the data from 2014-15 District Socio Economic Review was taken for analysis.

A comparative analysis of the area under the selected crops and agricultural income has been done (using percentage changes) to ascertain the impact of cropping pattern on agricultural income.

RESULTS AND DISCUSSION

It can be seen from Table 1 that in Nashik district, area under rice has increased by 50% during the study period from 48,100 ha to 72,600 ha while area under wheat fell steeply in 2012-13 to 32,400 ha from 73,000 ha in 2009-10 and then recovered to around 65,900 ha in 2013-14. Area under jowar fluctuated during the study period and ended up 50% higher at 15,100 ha in 2013-14 as compared to 10,100 ha at the beginning of the study period. There has been a gradual decline in area under bajra by around 10% from 171,900 ha to 1,49,600 ha. Area under maize increased to an all-time high of 1,76,000 ha in 2011-12 before stabilizing at around 1,45,000 ha (around the same level at the beginning of the study period). Among the pulses, area under tur increased marginally from 9400 ha to 10100 ha and area under gram also increased marginally from 39,300 ha to 40,000 ha; area under udid increased by 32% from 12,700 ha to 16,800 ha, while area under moong increased by 43% from 8,000 ha to 11,500 ha during the study period. Among oilseeds, area under groundnut increased by 67% from 24,800 ha to 41,500 ha while area under soybean has remained around 50,000 ha consistently throughout the study period. Among cash crops, area under sugarcane decreased around 30% from 31,100 ha to 21,000 ha while area under cotton remained steady at around 45,000 ha.

Table 1: Area Under Selected Crops in Nashik District (in hectares)

CROPS	2009-10	2010-11	2011-12	2012-13	2013-14
RICE	48100	59100	62900	67900	72600
WHEAT	73000	75300	52400	32400	65900
JOWAR	10100	15300	12900	9800	15100
BAJRA	171900	171200	165900	154800	149600
MAIZE	144300	169400	176000	169100	146200
TUR	9400	10100	10900	9500	10100
UDID	12700	14000	14900	16000	16800

MOONG	8000	8600	8800	11500	11500
GRAM	39300	40600	37900	25600	40000
GROUNDNUT	24800	34700	28800	30200	41500
SOYABEAN	55100	56900	58600	56000	52400
SUGARCANE	31100	25700	24600	24600	21000
COTTON	46400	50500	47000	45700	46000

Source: District Socio Economic Reviews

Regarding the cropping pattern of Pune, it can be seen from Table 2 that area under rice increased by 30% from 62,600 ha to 82,100 ha between 2009-10 and 2013-14 while area under wheat has remained stable at around 60,000 ha during the study period. Area under jowar declined significantly by 42% from 4,36,400 ha to 2,54,800 ha while area under bajra fell steeply in 2012-13 to 36,000 ha before rising to around 50,000 ha at the end of the study period from around 45,000 ha in the beginning of the study period. Area under maize doubled from 16,700 ha to 31,900 ha during the study period.

Among the pulses, area under tur doubled from 2100 ha to 4200 ha during the study period while area under udid increased by 25% from 1900 ha to 2400 ha. Area under moong increased by 70% from 2,700 ha to 4,600 ha while area under gram stabilized at around 50,000 ha at the end of the study period after witnessing a steep decline to 35,400 ha in 2012-13 from 54,100 ha in the beginning of the study period.

Among oilseeds, area under groundnut expanded by around 18% from 39,000 ha to 46,100 ha while area under soybean more than doubled from 3300 ha to 6900 ha during the study period. While there is no cotton cultivation undertaken in Pune, area under sugarcane increased by 50% from 95,600 ha to 1,43,900 ha during the study period primarily due to increase in the Fair and Remunerative Prices (FRP) provided by the government.

Table 2: Area Under Selected Crops in Pune District (in hectares)

CROPS	2009-10	2010-11	2011-12	2012-13	2013-14
RICE	62600	60900	62000	77600	82100
WHEAT	59600	60000	55300	53000	64300
JOWAR	436400	457200	179100	181100	254800
BAJRA	46000	48600	50700	36000	49800
MAIZE	16700	27000	27200	25200	31900

TUR	2100	2900	2900	3400	4200
UDID	1900	2100	2100	2400	2400
MOONG	2700	6800	6400	4600	4600
GRAM	54100	58100	35400	37800	50600
GROUNDNUT	39000	41600	46100	44600	46100
SOYABEAN	3300	2900	3900	4200	6900
SUGARCANE	95600	111500	129900	137700	143900
COTTON	0	0	0	0	0

Source: District Socio Economic Reviews

In order to ascertain the differences in the percentage share under different crops in the two districts, the total area under principal crops was calculated from the district wise statistics pertaining to area, production and yield (APY) of principal crops provided on the website of the Department of Agriculture, Maharashtra. This was done since the data pertaining to the Gross Cropped Area for the study period was not available in the District Socio Economic Reviews. Table 3 shows the area under the various crop categories, namely cereals, pulses, oilseeds, cotton, and sugarcane. It can be seen that the total area under cultivation of principal crops is more or less same in the two districts at around 7,50,000 hectares. Further, area under cereals and pulses is also similar in the range of 5,00,000 hectares and 80,000 hectares respectively. In oilseeds, it can be seen that Nashik has almost twice the area, over 1,00,000 hectares, while Pune has just over 60,000 hectares under oilseeds. Finally, the area under sugarcane in Pune is almost 1,50,000 hectares while Nashik barely has 200 hectares under this important cash crop. Further, Nashik has only about 50,000 hectares under cotton while there is no cotton cultivation in Pune district.

Table 3: Area Under Principal Crops in Pune and Nashik Districts (in hectares)

PRINCIPAL CROPS	NASHIK	PUNE
TOTAL CEREALS	496700	495300
TOTAL PULSES	86700	76600
TOTAL OILSEEDS	108800	67400

COTTON	46000	0
SUGARCANE	21000	143900
TOTAL	759200	783200

Source: Website of Department of Agriculture, Maharashtra

For a more detailed analysis, the percentage share of the thirteen selected crops in the Total Area under Principal crops was calculated for both Pune and Nashik districts in the year 2013-14. It can be seen from Table 4 that among cereals, the proportion of rice and wheat in total area under principal crops is almost the same in both the districts at around 10% and 8% respectively. However, more than 30% of the area in Pune is under jowar (rabi crop) while hardly 2% in Nashik is under this crop. Further, area under bajra in Pune is just around 6% while it is almost 20% in Nashik where it is grown as a kharif crop. More importantly, nearly 20% area in Nashik is under maize while hardly 4% in Pune is under this very important crop under cereals. Among pulses, more than 13% of the area in Nashik is under tur while udid and moong are cultivated under hardly 1%-2% of the area. Area under gram is similar in both Nashik and Pune at around 5%-6%. However, tur which is a very important crop among pulses occupies less than 1% of the area in Pune. Among oilseeds, both groundnut and soybean occupy around 6% of the area in Nashik. However, while groundnut also occupies around 6% of the area in Pune, soybean which is a very important crop among oilseeds is cultivated in less than 1% of the area in Pune. Among cash crops, sugarcane (grown under fully irrigated conditions) and cotton (grown under rainfed conditions) are grown in around 3% and 6% of the area in Nashik while nearly 18% of the area in Pune is under sugarcane cultivation (grown under fully irrigated conditions). There is no cotton cultivation in Pune.

Table 4: Percentage Share of Selected Crops in Total Area Under Principal Crops* In Nashik and Pune Districts (2013-14)

CROPS	NASHIK		PUNE	
	AREA (HA)	% SHARE IN TOTAL AREA UNDER PRINCIPAL CROPS	AREA (HA)	% SHARE IN TOTAL AREA UNDER PRINCIPAL CROPS
RICE	72600	9.56	82100	10.48
WHEAT	65900	8.68	64300	8.21

JOWAR	15100	1.99	254800	32.53
BAJRA	149600	19.70	49800	6.36
MAIZE	146200	19.26	31900	4.07
TUR	101000	13.30	4200	0.54
UDID	16800	2.21	2400	0.31
MOONG	11500	1.51	4600	0.59
GRAM	40000	5.27	50600	6.46
GROUNDNUT	41500	5.47	46100	5.89
SOYABEAN	52400	6.90	6900	0.88
SUGARCANE	21000	2.77	143900	18.37
COTTON	46000	6.06	0	0

*Total area under Principal Crops in Nashik district and Pune district for 2013-14 is 7,59,200 ha and 7,83,200 ha respectively as calculated in Table 3

Source: Table 1, Table 2, and own analysis

PRODUCTIVITY OF CROPS

For a more comprehensive analysis, a comparison of the productivity of the selected crops in Pune and Nashik Districts for the period between 2009-10 and 2013-14 has been done. In the case of rice, it is seen that the productivity of rice in Pune district has been consistently rising except in 2012-13 and has always been greater than that of Nashik throughout the five years. While the **productivity of rice has increased by 128% in Pune, it has increased by 228% in Nashik.** The productivity of wheat has been fluctuating in Pune with a rise in 2010-11, followed by a fall in 2011-12 and a steep decline in 2012-13 followed by a sharp rise in 2013-14 whereas in Nashik, the productivity of wheat fell steeply in 2012-13 and recovered somewhat in 2013-14. The **productivity of wheat increased by 31% in Pune district for the study period while it increased by only 5% in Nashik.** For **kharif jowar**, the productivity been consistently declining in **Pune** except for a mild recovery in 2011-12; overall it **declined by 20%**. On the other hand, in **Nashik**, though the kharif jowar's productivity was much lower than that in Pune to begin with, by the end of the study period it was more than double that of Pune with the productivity **increasing by a whopping 184%.** In the case of **rabi jowar,** the **productivity in Pune** declined consistently with a steep decline in 2012-13, and then recovered

in 2013-14 so that **overall productivity declined by around 15%** between 2009-10 and 2013-14. In **Nashik** the rabi jowar saw fluctuating productivity at around 700 kg/ha with a moderate rise in 2012-13 and then a steep fall in 2013-14; **overall productivity declined by 14% in Nashik** district for rabi jowar during this period. In the case of Bajra, the productivity in Pune saw a rise in 2010-11 followed by a fall in 2011-12 and a steep decline in 2012-13 and then finally saw a sharp recovery in 2013-14; overall, the **productivity of bajra in Pune district increased by a modest 13%.** In **Nashik district, the productivity of bajra** followed similar trends, however, overall productivity **increased by 48%** during this period. In the case of maize, the productivity of maize in 2013-14 has been taken as an average of the figures for the three seasons; in Pune, it works out to 2495kg/ha, whereas in Nashik it works out to 2868kg/ha. In Pune, the productivity of maize increased in 2010-11 and 2011-12, but has subsequently declined; **overall productivity of maize in Pune district declined by 2%** during this period. In Nashik, the productivity of maize hit an all time high of over 3200 kg/ha in 2010-11 but thereafter it has consistently declined; **overall productivity of maize in Nashik district increased moderately by 13%** during this period.

Table 5: Productivity of selected crops in Pune and Nashik Districts between 2009-10 and 2013-14

PRODUCTIVITY IN KG/HA										
	2009-10		2010-11		2011-12		2012-13		2013-14	
CROPS	PUNE	NASHIK	PUNE	NASHIK	PUNE	NASHIK	PUNE	NASHIK	PUNE	NASHIK
RICE (Kharif+summer)	818	392	1181	407	1380	1237	1368	1190	1867	1286
WHEAT(rabi)	1540	1615	1932	1908	1909	1958	1770	1641	2021	1698
JOWAR(Kharif/rabi)	1054/738	697/744	949/737	1167/707	1004/582	1331/711	856/491	1888/813	846/631	1980/654
BAJRA(Kharif)	736	754	885	1263	803	1025	465	807	836	1119
MAIZE(Kharif+rabi+summer)	2532	2266	2786	3236	3202	3170	2623	2944	2800/3000/1685	3861/3393/1352
TUR	622	420	612	618	527	758	171	635	576	703
UDID	847	510	948	769	1007	970	632	981	912	1040
MOONG	619	532	1017	919	511	801	300	819	765	1010
GRAM	787	701	949	767	932	712	713	687	815	656
GROUNDNUT(Kharif/summer)	883/1985	715/1429	1286/1889	850/1068	1057/1643	1026/1080	881/1461	871/1163	819/1800	1035/1431
SOYABEAN	1414	1187	1983	1422	2109	1391	1935	1559	3881	1578
SUGARCANE	95	73	99	77	101	76	101	76	115	85
COTTON	0	254	0	339	0	349	0	286	0	373

Source: District Socio-Economic Reviews, various years

With regard to pulses, in **Pune, the productivity of tur dal** declined in 2010-11 and 2011-12;

fell steeply in 2012-13 and then recovered in 2013-14 to a certain extent; **overall productivity declined by 8%.** In **Nashik**, the productivity of tur increased consistently in 2010-11 and 2011-12, fell in 2012-13 and then recovered in 2013-14; **overall productivity of tur increased 67%.** In the case of udid, in **Pune**, the productivity increased throughout except in 2012-13; overall **productivity of udid increased by 7%.** The **productivity of udid in Nashik** increased throughout the period and by 2013-14 it had **increased by 103%.** Both moong and gram saw increase in productivity in 2010-11 in Pune; their productivity fell in 2011-12 and in 2012-13 and then recovered in 2013-14. **Overall productivity of moong increased by 23% while the productivity of gram increased by 3% in Pune** during the period. In **Nashik**, the productivity of **moong** increased consistently except in 2011-12; overall **productivity increased by 89%** while in the case of **gram**, the productivity was fluctuating; overall **productivity fell by 7%.** The **kharif groundnut** saw a **fall in productivity in Pune by 8%** and the **summer groundnut** also saw a **fall in productivity by 10%**. In **Nashik, the kharif groundnut** saw an **increase in productivity by 44%** while the **summer groundnut** saw some fluctuations in productivity it regained the **same level in 2013-14 as it was in 2009-10**. Finally, in the case of **soyabean**, in **Pune, the productivity increased by 174%** while in **Nashik the productivity increased by 32%.** While there is no cotton cultivation in Pune, the productivity of cotton in Nashik increased by 46%. The productivity of sugarcane increased in Pune by 21% while it increased in Nashik by 16%

The above data has been summarized in the following table. Table 6 shows the percentage change in the productivity of the selected crops in Pune and Nashik during the study period.

Table 6: Percentage change in productivity of selected crops in Pune and Nashik districts between 2009-10 and 2013-14

CROPS	PUNE	NASHIK
	% CHANGE IN PRODUCTIVITY	% CHANGE IN PRODUCTIVITY
RICE	+128%	+228%
WHEAT	+31%	+5%
KHARIF JOWAR	-20%	+184%
RABI JOWAR	-15%	-14%
BAJRA	+13%	+48%
MAIZE	+2%	+13%

TUR	-8%	+67%
UDID	+7%	+103%
MOONG	+23%	+89%
GRAM	+3%	-7%
KHARIF GROUNDNUT	-8%	+44%
SUMMER GROUNDNUT	-10%	0%
SOYABEAN	+174%	+32%
SUGARCANE	+21%	+16%
COTTON	-	+46%

Source: Author's analysis

From the above table it can be seen that in Pune, the productivity of rice and soyabean has seen very high rates of growth during the study period; wheat, moong and sugarcane showed moderate rates of growth; bajra, udid, and gram showed low rates of growth; while jowar, tur, and groundnut showed negative productivity. In the case of Nashik, rice, kharif jowar, udid, tur, and moong showed very high growth rates of productivity; bajra, kharif groundnut, soyabean and cotton showed moderate increase in productivity; wheat, maize and sugarcane showed low growth rates of productivity while rabi jowar and gram showed negative productivity.

Overall, it can be seen that the productivity of crops in Nashik district is higher than in Pune. However, it should be noted that the productivity of the kharif crops in Nashik district is showing high and moderate rates of growth while the rabi crops or those requiring irrigation are showing low/negative growth rates in productivity. It is difficult to draw any conclusions regarding the productivity of kharif/rabi crops in Pune as it is a mixed bag of results. As such, it is not possible to say with certainty that lack of irrigation is causing low productivity of crops in Pune district.

RAINFALL DATA

In order to further reinforce the above conclusions, the rainfall data for the two districts during this period was compiled as shown in Table 7.

Table 7: Average rainfall in mm and in percentage in Pune and Nashik districts between 2009-10 and 2013-14

Year	Pune		Nashik	
	Average Rainfall in mm	Average Percentage	Average Rainfall in mm	Average Percentage
2009-10	978.9	108.43	762	70.8
2010-11	1046.2	114.4	1107	103
2011-12	956.5	105.95	915.9	81.38
2012-13	677	81.56	787.73	86
2013-14	1091.2	27.8	1135.19	23.94

Source: District Socio Economic Reviews, various years

As can be seen from Table 7, Pune district received more than 100 percent rainfall in the first three years of the study period which was also greater than that received by Nashik. In 2012-13, though there was a shortfall in rainfall in both districts, the different between them was not substantial (81% in Pune and 86% in Nashik); while there was visibly a drought like situation in 2013-14 with both districts getting hardly 25% rainfall (27% in Pune and 23% in Nashik). Overall, the rainfall situation in Pune has thus been more favourable in Pune than in Nashik during the study period.

DATA ON FRUITS AND VEGETABLES

Table 8: Area and Production under Fruits in Pune and Nashik between 2009 and 2016. Units: Area in 000 ha; Production in 000 tonnes

NASHIK		
YEAR	Total Fruits Area	Total Fruits Production
2009	0.00	0.00
2010	95.89	1660.84
2011	97.43	443.87
2012	5.44	0.00
2013	99.32	2854.46
2014	104.72	1904.10
2015	109.33	2022.71
2016	104.54	1929.23

PUNE		
YEAR	Total Fruits Area	Total Fruits Production
2009	12.30	199.04
2010	13.67	224.60
2011	11.74	169.12
2012	37.83	584.44
2013	33.13	381.85
2014	35.21	371.31
2015	36.55	392.54
2016	36.58	438.58

Source: District Socio Economic Reviews, various years

Area under Fruits and Production of Fruits increased in Nashik by around 10% and 16% respectively, while in Pune it increased by 200% and 120% respectively between 2009 and 2016. However, it can be seen from Table 8 that the Area under Fruits and Production of Fruits is substantially higher in Nashik as compared to Pune. Area under Fruits in Nashik is nearly three times more than in Pune in 2016 (after the 200% increase) and Production of Fruits is more than four times more than in Pune (again in 2016, after the 120% increase).

Table 9: Area and Production under Vegetables in Pune and Nashik between 2009 and 2016.
Units: Area in 000 ha; Production in 000 tonnes

NASHIK			PUNE		
YEAR	Total Vegetables Area	Total Vegetables Production	YEAR	Total Vegetables Area	Total Vegetables Production
2009	0.00	0.00	2009	37.86	608.68
2010	147.14	2653.59	2010	48.32	1217.55
2011	143.56	2622.09	2011	47.84	1299.99
2012	18.36	0.00	2012	25.31	316.12
2013	145.23	2987.13	2013	81.49	1389.85
2014	162.78	2814.56	2014	105.97	1604.61
2015	166.51	2881.43	2015	112.05	1727.03
2016	163.19	3519.33	2016	134.93	2697.56

Source: District Socio Economic Reviews, various years

In the case of vegetables too, in Nashik, the Area has increased by 10% and Production has increased by 32% between 2009 and 2016 whereas in Pune, the area under vegetables has increased by 262% and Production of vegetables has increased by 343%. Yet both the area under vegetables and production of vegetables in Nashik is 20% more than in Pune.

Table 10: District Agricultural Income in Pune and Nashik (In Lakhs)

YEAR	NASHIK		PUNE	
	GROSS (Rs.)	NET (Rs.)	GROSS (Rs.)	NET (Rs.)
2009-10	466710	433839	528097	490903
2010-11	797355*	753025*	609047	575908
2011-12	826344	778785	750646	707444

2012-13	1364945	1276933	811242	766417
2013-14	1631523	1526322	943592	882749

Source: District Socio Economic Review 2015
*Source: District Socio Economic Review Nashik 2014

It can be seen from Table 5 that between 2009-10 and 2013-14, the Gross and Net Agricultural Income in Nashik district increased four times from Rs. 4,66,710 lakhs to Rs. 16,31,523 lakhs and Rs. 4,33,839 lakhs to Rs. 15,26,322 lakhs respectively. During the same period, Pune district's agricultural income has seen only half that increase, that is, Gross and Net agricultural income doubled from Rs. 5,28,097 lakhs to Rs. 9,43,592 lakhs and Rs. 4,90,903 lakhs to Rs. 8,82,749 lakhs respectively.

IMPLICATIONS AND CONCLUSIONS

Thus, with respect to cropping pattern of Nashik it can be concluded that the cropping pattern has diversified in the production of cereals, pulses, and oilseeds while in Pune the cropping pattern has diversified in favour of pulses and oilseeds to some extent and to a greater extent in sugarcane. In absolute terms, with reference to cereals it can be seen that there is more area under jowar in Pune while there is more area under bajra in Nashik. More importantly, **Nashik has three times the area under maize as compared to Pune**. Among pulses, **Nashik has more than twice the area under tur, nearly eight times the area under udid and nearly three times the area under moong as compared to Pune**. Among oilseeds, **while both districts have around the same area under groundnut, Nashik has nearly eight times the area under soybean as compared to Pune**. Significantly, the **area under cash crops like sugarcane and cotton in Nashik is around half the total area under sugarcane cultivation in Pune**. The importance of horticultural crops has been increasing lately in both the districts. **Nashik has three times more area under fruits and 20% more area under vegetables than Pune**. The **productivity of kharif crops is also much higher in Nashik than in Pune**.

Another important difference in the cropping pattern of Nashik and Pune districts is that agriculture is predominantly rainfed in Nashik and all the important crops (rice, bajra, kharif maize, tur, moong, udid, kharif groundnut, soybean, and cotton) are cultivated as kharif crops, only wheat and gram are cultivated as rabi crops and cultivation of summer crops is insignificant. Thus, irrigation (both protective and productive) is used prudently over all crop

categories. On the other hand, the cropping pattern in Pune district is dominated by rabi crops (including wheat, jowar, rabi maize, and gram). The kharif crops include rice predominantly and bajra and groundnut to some extent. The cultivation of kharif pulses (tur, moong and udid) and soyabean is not very significant. On the other hand, there is cultivation of summer maize and summer groundnut to some extent in Pune district which would require both protective and productive irrigation. Of course, sugarcane cultivation in Pune district (which occupies almost 20% of the area under cultivation of principal crops) is grown under 100% irrigated conditions which is obviously extremely inefficient and diverts essential irrigation from other crop categories. It can hence be concluded that the cropping pattern of Nashik has a great influence on the agricultural income of the district.

Further study

Correlation analysis of the Farm Harvest Prices of the principal crops with the area under their cultivation will strengthen the evidence in improving agricultural income through appropriate cropping pattern. Also, a comparative study of area, production, and agricultural income in the last ten years using the newly compiled data can be done for further corroboration of these results.

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