

Trends in Agriculture of Yavatmal Maharashtra (India): District Level Analysis

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ABSTRACT

Present paper studies the changes in the cropping pattern of crops in Yavatmal district as case study for the period 1991-2010. We divide the period into two distinct periods: 1991-2000 and 2001-2010. The trends in the production of Cereal Crops, Pulses and Cash Crops are observed using mean comparison T test and Dummy variable regression model. These statistical and simple econometric exercises support the noticeable change occurred in the cropping pattern in the Yavatmal district during the economic reforms period. The results can be concluded as the production of wheat increased marginally but production of Jawar crops has drastically declined from 2206.3 mean value to 990.4, and its place has been taken over by Soybean and Sunflower crops during the study period. The production of Bajara declined. The over all production trends in the cereal is a cause of concern for the government in particular and public in general. The mean value of cereal is declined from 2515.6 to 1266.7, which is significant change at 1% level of significance. If this trend remains continue in the coming years, it would be alarming bell for of us.

Key words: Cropping pattern, Agriculture, Maharashtra, Cereals, Pulses, Economic reform period

The Maharashtra state has more heterogeneity in crop production and cropping pattern arising from its varied agro-climatic conditions. Cropping pattern in the state varies from region to region. Few changes have been taken place in cropping pattern in certain regions and these changes are continuing as new crops are being introduced with and traditional hence old crops are on the decline. Remunerative price for crop, high yield, and low rain fed or low water intakes varieties are always preferred by farmers keeping in mind better income to them is the main motivating factors for changing cropping pattern in Maharashtra. Publicity drive and exposure to information flows are also divert mindset of farmers to give up traditional crops.

Maharashtra state has eight revenue administrative divisions: Nashik, Pune, Kolhapur, Aurangabad,

Latur, Amravati and Nagpur. Yavatmal comes under Amravati division. Akola, Buldhana, Amravati and Washim districts are under this division located between the Northern latitude of 20° 23' 50.51" and East longitude 78° 07' 42.42". Altitude remains 451m. It consists of 16 Talukas. It is a major cotton producing district of Maharashtra. The district boundary touches five districts of Maharashtra namely Nanded, Parbhani, Washi, Wardha and Chandrapur. Andhra Pradesh remains the neighbouring state of Yavatmal.

According to Agro climatic zone, Yavatmal falls in the category of western plateau and hills region zone XI. It can be sub divided into four sub agro climatic zones namely the deccan plateau, the hot semi-arid region, western Maharashtra Plateau and hot moist semi arid eco sub-region. The average rain fall across

the agro climatic zones and in the Yavatmal district ranges 775.2 mm. from south west monsoon (June-September). This zone receives 69.6 mm rainfall from North-East monsoon (October-December) 29.4 mm in winter and 12.2 mm in summer. Annual normal rain fall was 886.4 mm. Normal rainy days from south west monsoon records 39.9%. Rainy season generally starts on June 11 till October 7.

Yavatmal spread over the area of 13, 52,000 ha. However, cultivable area is near about 8, 84 000 ha. Yavatmal has three types of soil namely; shallow black soil (52.2 per cent), deep black soil (34.7 percent) and medium deep black (13 per cent). 15000 hectares area sowed more than once in a year hence gross cropped area increases to 8,99000 ha. Latur division constantly under the rain fed area zone .Yavatmal has 839.3 thousand ha. rain fed area. The share Canals is 21.6 per cent and open wells 78.4 percent in the total irrigation.

Dev (1996) concluded that the large part of Marathwada comes under the rain shadow. Thus agriculture is characterised by the low rainfall and low irrigation. Dastane (2002) observed that Maharashtra lags behind in the productivity of all crops as compared to the national averages, which itself is away behind the averages of some of the other progressive countries of Europe and Asia. Gadgil (2006) found that there is an asymmetry in the response to monsoon variability. Therefore indirect impact of drought on the purchasing power of the majority of the population in this region remains very significant in the modern era as well.

Ray (2009) concluded that credit plays vital role in effecting a significant change in cropping pattern in favour of more remunerative crops. Further, in order to have commercialisation of agriculture, there is a need to design an appropriate crops wise credit policy to ensure food security in India. Fazlur Rahman (2009) discussed the adoption of innovation into cultivating practice can ensure sustainable agricultural productivity. Crop productivity depends on the availability of water, proper use and better management. Vasanta K. (2013) suggested necessity for the nation to speed up efforts to evolve climate-crop varieties, cropping patterns and management policies. As the temperature raises the rice production falls. Complete crop failure is

possible if severe drought takes place during the odd seasons.

MATERIALS AND METHOD

This study is undertaken to understand the trends in the cropping pattern of Yavatmal district. For that, time series data of major crops were collected from the office of Directorate of Agriculture, Pune, Maharashtra and office of the Commissioner of Land Record for the period 1991-92 to 2010-11. To observe the trends in major crops and cropping patterns, data period has been divided in to two periods namely 1991-2000 and 2001-2010. After calculating mean and standard deviation of each crops, independent sample mean comparison test is used to see where there is any significant difference in the mean of the two periods if any. The reason being of using classical independent sample T test is that, it allows to make decision of mean (Average) of crop is not same in the two periods. That may shed light on the trends in crops either increased or decreased.

Besides mean comparison test, we also used dummy variable regression on the same data and for the same period. In this exercise, we used dummy variable which is also knows an as dichotomous variable in the linear regression, dummy variable is used to see the structural change or trend change in the given data set. The result appeared from Dummy variable regression model shows that production of major crops has been gone under change in the two periods. The beta coefficient values shows whether production has increased or decreased over the earlier period and also depicts that whether that change is significant or not? The changes in the cropping pattern have been studied for the year 1991-2011. Yavatmal is under central Vidarbha Zone (MH-8). A brief discussion of land use pattern, cropping pattern, cropping intensity, production and productivity of major crops, annual rainfall, and major contingency for Yavatmal district is presented in this section.

Land use Pattern

The pattern of land use of the district was quite similar after the liberalisation period in India. Cultivable area is 8,84000 ha. Forest area is 2,43000 ha Land under non-agriculture use is 25,000 ha. Permanent pastures cover 35,000 ha. Cultivable waste land covers 22,000

ha. Land under miscellaneous tree .crops and groves are 29,000 ha. Barren and uncultivable land is 39.4 and current fallows, other fallows are 33,000 ha and 25,000 ha respectively.

Cropping Pattern

Cotton is the most important crop under the rain fed area of this (MH-8) zone occupying 4,05,000 ha. It is largely grown during Kharif season. Soybean cultivated on 2,87,000 ha. land. While pigeon pea cultivated on 1,06,000 ha. land. Sorghum, green pea, black gram also grown in this rain fed area as 70,000 ha., 12,000 ha., and 10,000 ha .respectively. Although some crops like gram, wheat and safflower were grown in rabbi season. The main crop remains wheat in Yavatmal district during post rainy season. The most prominent cropping pattern followed by the farmers of Yavatmal was Cotton and Tur. The analysis does not provide strong evidence in favour of changing cropping pattern.

Cropping Intensity and Rainfall

The changes in cropping intensity reflect the sensitivity of agricultural activities to agro- biological and socio-economic condition from time to time. Cropping intensity index is a ratio of gross sown area to the net sown area. It measures the extent of land utilisation by taking into account the area planted more than once. In 2008-09 the cropping intensity actually calculated as 101.6 per cent. Yavatmal located at western plateau and hills regions (XI). Highest rainfall measured in Kelapur, Ghatnanji and Ralegaon 1117 cm., normally rain begins from June 11-17 and fall until October 01-07.

Weather related contingencies

Due to rain fed area, Yavatmal district has to cope up with different situations. It may be early season or season may be delayed by two weeks. Some times farmers have to face situation of draught. Farmers have to sow the Bt. Cotton crop in scanty moisture contained deep to medium deep black soil. Other crops that also prefer are Tur , Soybean , Pigeon pea, Sorghum (Jowar), as per recommendation and guidance given by Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola. Major cropping pattern of Yavatmal district comprises: Soybean, Green

gram and Black gram. Farmers do cultivate cotton in shallow black soil, however the productivity is low. Some times rain may be delayed by two weeks, four weeks or six to eight week also. Different contingency measures suggested by Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola are followed by farmers.

RESULTS AND DISCUSSION

Trends in Production of Major Crops (Mean Comparison Test)

Cotton is the crop key in Yavatmal district. Yavatmal comes under rain fed area. Agriculture in this district is to the large extent depends on monsoon. Therefore cotton, Soyabin, Pigeon Pea, Sorgham, Green Gram Black Gram crops are grown in Kharip (Rainy) season. Besides these crops, Wheat and Chick Pea are cultivated during the Rabbi (winter) season. The Following Table 1 shows Mean Comparisons Test for Trends in Major Crops in Yavatmal district for the period 1991-2010.

It can be seen from the Table 1 that production of Rice has been declined from mean value 40.4 to 12.1 in the period 2001-2010 and that change is significant. However, the production of Wheat has increased during the same period as shown by mean value 212.8 to 347.7 is also significant change supported by T test at 8% level of significance. One of the striking changes is that the production of Jawar crop has drastically declined from 2206.3 mean values to 990.4 and its place has been taken over by Soybean and Sunflower crops in the recent past.

This is probably good price and market for the both the crops, further, good supportive price has attracted farmers for growing Maize in the period under study. This argument has been supported by the mean values of maize production, which has increased from 2.6 to 7.6. This change is also supported by T test. The over all production trends in the cereal is a cause of concern for the government in particular and public in general. The mean value of cereal is declined from 2515.6 to 1266.7, which is significant change at 1% level of significance. If this trend remains continue in the coming years it would be alarming bell for of us.

In the category of pluses the production of Gram has significantly increased but the production of

Table 1: Mean Comparisons Test for Trends in Major Crops in Yavatmal

Variable	1991-2000		2001-2010		t Test	Prob.
	Mean	Std. Dev.	Mean	Std. Dev.		
Rice	40.4	9.191784	12.1	14.90302	5.11*	0.0001
Wheat	212.8	74.82097	347.7	282.204	-1.46***	0.0806
Jawar	2206.3	608.6672	990.4	427.526	5.16*	0.0001
Bajra	49	19.79338	14.9	10.35428	4.82*	0.0001
Maize	2.6	1.429841	7.6	7.136759	-2.17**	0.0200
Total cereal	2515.6	632.7698	1266.7	470.2619	5.00*	0.0001
Gram	80.6	25.49161	301.4	270.1811	-2.57*	0.0096
Tur	1031.3	282.0371	1033.9	279.584	-0.02	0.9837
Mung	259	67.82985	102.3	63.63621	5.32*	0.0000
Udid	111.4	41.56441	64.1	38.40558	2.64*	0.0165
Total pluses	1482.8	392.7263	979.8	630.5207	2.14*	0.0462
Sugarcane	4735.3	1550.238	4344.5	2907.285	0.37	0.712
Cotton	3015.9	992.263	5064.4	2492.529	-2.41*	0.0266
Sunflower	20.8	10.5704	0.9	0.7378648	5.93*	0.0000
Soybean	574.6	485.5371	1808.6	935.161	-3.70*	0.0016

Note: sign * Significant at 1%, ** significant at 5% and *** significant at 10% level.

Tur has not increased at all during the span of 10 years. The production of Mung and Urdid crop are significantly declined during the study period. The aggregate production of Pluses has also declined from mean value 1482.8 to 979.8. This change is also matter of worry for the government and also public. The price level of pluses has been increasing because of shortfall in the production.

Major Cash crops comprises Sugarcane, Cotton, Sunflower and Soybean. Among these crops production of Cotton and Soybean has been significantly increased during second period 2001-2010. However the production of sugarcane has been suffered but not significantly. Another noticeable change is that the production of Sunflower crop has been declined by mean value 20.9 to 0.9. In the cash crops, the production of Cotton and Soybean were scaled up due to the use of BT Cotton seeds and better support prices declared by the government.

It can be concluded from the Table 1 that the production of cereals and pulsed went down significantly. It is matter of concern for the government because of shortages escalated the inflation of foods and it may work as constraint in complying food security right of many poor people. It may perpetuate

the poverty percentage witnessed due to food inflation in Yavatmal district and Maharashtra.

Trends in Production of Major Crops of Yavatmal District: Using Dummy Variable Regression Model

Besides, independent sample mean comparison T test, we also used dummy variable regression to see the change occurred in the production of major categories of the crops widely grown in the Yavatmal district. The following four regressions have been run on the same data for the period 1991-2010.

$$Total\ cereal_i = \alpha + \beta_2 D_{2i} + \mu_i \quad \dots(1)$$

Where Total cereal is dependant variable and α is constant term and is coefficient value of dummy variable shown by D. μ is error term. Dummy variable takes value 0 and 1 for the period 1991-2000 and 2001-2010 respectively.

$$Total\ pluses_i = \alpha + \beta_2 D_{2i} + \mu_i \quad \dots(2)$$

$$Cotton_i = \alpha + \beta_2 D_{2i} + \mu_i \quad \dots(3)$$

Table 2: Trends in Production of Major crops District Yavatmal: Using Dummy Variable Regression Model

Dep. vari.	Ind. vari.	Coef.	Std. Err.	T stats.	P>t	Number of Obs	20
Total Cereal	dummy	-0.72787	0.161462	-4.51	0.000	F (1, 18)	20.32
Production	cons.	7.797824	0.114171	68.3	0.000	Prob > F	0.0003
						R-squared	0.5303
						Adj R-squared	0.5042
						DW stat(2,20)	1.164277
Total Pluses	dummy	-0.23759	0.132449	-1.79	0.090	Number of obs	20
Production	cons.	7.266405	0.093656	77.59	0.00	F(1,18)	4.80
						Prob > F	0.0897
						R-squared	0.1517
						Adj R-squared	0.1045
						DW stat(2,20)	0.953215
Total Cotton	dummy	0.469808	0.181249	2.59	0.018	Number of obs	20
Production	cons.	7.96063	0.128162	62.11	0.000	F(1, 18)	6.72
						Prob > F	0.0184
						R-squared	0.2718
						Adj R-squared	0.2314
						DW stat(2,20)	1.229129
Total Soybean	dummy	1.364844	0.324424	4.21	0.001	Number of obs	20
Production	cons.	6.016379	0.229403	26.23	0.000	F(1, 18)	17.7
						Prob > F	0.0005
						R-squared	0.4958
						Adj R-squared	0.4678
						DW stat(2,20)	0.751978

$$Soybean = \alpha + \beta_2 D_{2i} + \mu_i \quad \dots(4)$$

Above four regressions are tried on the data set under the study. The regression results are reported in the Table 2. The results appeared from the regression supports the finding appeared from independent sample mean T test.

It can be seen from the regression result of 1 that the production of cereals fallen during the period 2001-2010 and same results are supported by minus sign of T test. R² value of regression is 53% but the sign of coefficient value and T test are making sense hence low R² has least impotence in the present regression model. Subsequent regression number 2 also shows that negative trend in the total production of pluses in the second period of study and coefficient value is significant at 9 percent.

The result of regression number 3 reveals that the production of cotton has increased significantly is supported by coefficient value (2.59) at 1 % level of

significance. Last regression number 4 also shown positive trend in the production of the soybean (4.21) in the period 2001-2010, results thereof are significant at 1% level of significance. The results appeared from the dummy variables regression models are correct to our expectation. The declining trends in the production of cereal and pluses are the cause of concern keeping in mind the food security and poverty reduction. Durbin Watson test of autocorrelation is used to check the autocorrelation problem in the data. The results of DW test in the above four regressions are more than 0.511 *Cointegrating regression Durbin Watson (CRDW) rule*. Hence the results appeared from the above four regressions are valid.

CONCLUSION

Present paper studies the changes in the cropping pattern of crops in Yavatmal district as case study for the period 1991-2010. For this task, we divided the period into two distinct periods: 1991-2000 and 2001-

2010. The trends in the production of Cereal Crops, Pulses and Cash Crops are observed using mean comparison T test and Dummy variable regression model. These statistical and simple econometric exercises support the noticeable change occurred in the cropping pattern in the Yavatmal district during the economic reforms period. The results can be concluded as the production of wheat increased marginally but production of Jawar crops has drastically declined from 2206.3 mean value to 990.4 and its place has been taken over by Soybean and Sunflower crops in the recent past. The production of Bajara declined during the same period.

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From the study, we propose policy makers (i) to give push to production of cereals and pulses output by offering motivational package (ii) to consolidate economic condition of the farmers, promote production of non-cereal crops too. The option of encouraging the non-cereal crops appears to be more possible option open to the policy makers. A justification for such argument is found in the changing cropping pattern that went in favour of non-cereal crops. To overcome poverty of the farmers in Yavatmal district and in entire Maharashtra, provide better marketing conditions, offer minimum support prices, and do timely procurement of the crops.

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