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Production Performance of Paddy in Maharashtra

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ABSTRACT: *Paddy is the main staple food of large majority of Indians. Paddy is extensively grown throughout the country. Area wise India is the highest in the world but production wise it is second. It produces approximately 100 million tonnes of paddy production annually. The data obtained from secondary sources were analyzed to obtain estimates of acreage response of* kharif *paddy. The analysis of acreage response of* kharif *paddy to price and non-price variables had been attempted for the period of 28 years i.e. from 1985 to 2013. For this analysis, linear multiple regression based on Nerlovian partial adjustment model was used. The results obtained from the estimated acreage response model in respect of* kharif *paddy have been discussed separately for individual regions as well as Maharashtra as a whole.*

The main factors influencing acreage under kharif *paddy during any current period in the state were lagged price, lagged productivity and lagged area of respective crops. The acreage of paddy mainly influenced by lagged area* kharif *paddy has positive and significantly attributed to be the deciding factors for the acreages under respective cereal crops in Maharashtra.*

The acreage response analysis has shown that the price exerted a significant positive influence on variation in the area under kharif *paddy. This suggests that the price incentive is important determinant in paddy acreages. Hence, a positive price policy in tune with rising trend be continued, so as to maintain the increase the area under paddy crop in future too.*

INTRODUCTION

Paddy is an important food crop of large majority of Indians and stands first in area and second in production. Among major rice growing countries in the world, paddy is extensively grown throughout the country and India has the largest area under rice (43.97 million ha) with a total production of 100 million tonnes during 2011-12. But, the productivity is very low at (2.23 tonnes per ha) compared to other major rice producing countries *viz;* Japan (6.52 t/ha), China (6.24 t/ha) and Indonesia (4.25 t/ha.). In India, maximum area under paddy is in West Bengal (54.60 lakh ha) followed by Uttar Pradesh (59.50 lakh ha), Orissa (440.20 lakh ha), Andhra Pradesh (40.00 lakh ha) and Maharashtra (115.40 lakh ha). Production-wise, Uttar Pradesh stands first (135.30 lakh tonnes), West Bengal (124.20 lakh tonnes) followed by Andra Pradesh (93.10 lakh tonnes) and Maharashtra (35.00 lakh tonnes). In respect of yield, Punjab stands first (3741 kg/ha) followed by Tamil Nadu (3423 kg/ha), Haryana (3044 kg/ha) and Maharashtra (1821 kg/ha) (India Stat.Com., 2011-12).

Maharashtra is one of the major rice growing states in India. It is grown in 15.40 million ha with an annual production of 35.00 million tonnes and productivity 1821 kg/ha during the year 2011-12. Maharashtra ranks 12th in production and 13th in productivity among major rice growing states of the country. Paddy is the most important and extensively grown food crop in the Rice is primarily a high energy calorie food. The major part of rice consists of carbohydrate in the form of starch, protein, minerals and enzymes.

With this view, the present study was undertaken to analyze production performance of paddy in Maharashtra. The specific objective was to estimated regionwise acreage response analysis for paddy in Maharashtra.

METHODOLOGY

The data obtained from secondary sources were analyzed to obtain estimates the acreage response of the paddy for state as a whole was analyzed for entire periods by using linear multiple regression based on Nerlovian partial adjustment model. The following functions and models were employed for the analysis of the data of paddy. The present study was undertaken to analyze the past performance, present

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scenario and future prospects for paddy production in Maharashtra. The investigation was based on the district wise time-series data on area, production, productivity of paddy and other competing crops and farm harvest prices and rainfall. The analysis of acreage response of *kharif* paddy to price and non-price variables had been attempted for the period of 28 years i.e. from 1985 to 2013.

ANALYSIS OF DATA

Acreage response analysis

Supply response models are based on generally accepted notion that current decisions are influenced by experience related to past decisions or past behaviour. The precise econometric specification of this influence, subsequently spelled out in detail, is based on different variants of the theory of distributed lags. One commonly used model in supply response analysis based on time-series data is the Adaptive Expectations (or Distributed Lags) Model developed by Marc Nerlove (1958).

(a) Form of Nerlove Adjustment Lag Model: Nerlove developed two distributed lag models. The choice between different lag models depends upon whether postulated lags are formulations of technological, institutional setting or expectational behaviour of the sector concerned. In the distributed lag model; based on price expectations, he assumed that past experience influence formation of expected price which in turn influences the acreage allocation decision. In adjustment lag model, acreage adjustment is supposed to be based on institutional and technological constraints. Simultaneous consideration of both the types of lags present serious problems for econometric estimation.

The adjustment lag model in its simplest form can be explained as below

$$A_t^* = b_0 + b_1 P_{t-1} + U_t \quad (1)$$

Where, long-run equilibrium acreage for a crop A_t is a function of its price during preceding year and

$$A_t - A_{t-1} = \beta (A_t^* - A_{t-1}): 0 < \beta \quad (2)$$

Where, β is the coefficient of adjustment which means that in each period actual acreages were adjusted in proportion to the difference between the equilibrium acreage desired in the long-run and observed acreage under the crop concerned in the previous years.

Equation (2) may be written as,

$$A_t - A_{t-1} - \beta A_{t-1} = \beta A_t^* \text{ or}$$

$$A_t - (1-\beta) A_{t-1} = \beta At^* \quad (3)$$

Multiplying equation (1) by β we get

$$\beta A_t^* = \beta b_0 + \beta b_1 P_{t-1} + \beta U_t \quad (4)$$

Substituting values of βA_t from equation (3) in equation (4) we get,

$$A_t - (1-\beta) A_{t-1} = \beta b_0 + \beta b_1 P_{t-1} + \beta U_t$$

$$\text{or } A_t = \beta b_0 + \beta b_1 P_{t-1} + (1-\beta) A_{t-1} + \beta U_t \text{ or} \quad (5)$$

By using appropriate notations, the above equation is written as,

$$A_t = a_0 + a_1 P_{t-1} + a_2 A_{t-1} + V_t \quad (6)$$

Where,

$a_0 = \beta b_0$
$a_1 = \beta b_1$
$a_2 = (1-\beta)$
$V_t = \beta U_t$

However, in real world situation, the acreage allocation of the crop is being influenced by a large number of variables. Therefore, efforts were made to develop different types of theoretical models for empirical tests envisaging lagged prices, area under competing crops, lagged yields and rainfall during pre-sowing period for paddy crop.

The competing crops were defined to be those crops which directly or indirectly affect the area allocation of selected crop or the crops for which farmers had a choice to use land in place of selected crop (Table 3.3).

(b) Estimation of Nerlovian Adjustment Model: The following modified version of Nerlovian adjustment model was used in its simplest form for the purpose of this study.

$$At = a + b_1 P_{t-1} + b_2 A_{t-1} + b_3 Y_{t-1} + b_4 R_t + b_5 Ac_{lt} + b_6 Ac_{2t} + b_7 Ac_{3t} + b_8 Pc_{1t-1} + b_9 Pc_{2t-1} + b_{10} Pc_{3t-1} + b_{11} Yc_{lt-1} + b_{12} Yc_{2t-1} + b_{13} Yc_{3t-1} + u_t$$

Where,

- At - Acreage of paddy crop in '00' hectares during the current year
- P_{t-1} - Price (Rs./qtl.) of paddy crop during the preceding year
- A_{t-1} - Acreage of paddy crop in hectares during the preceding year
- Y_{t-1} - Productivity (Kg/ha) of paddy crop during the preceding year
- R_t - Rainfall during pre-sowing period (mm)
- Ac_{lt} - Area under first competing crop during the current year
- Ac_{2t} - Area under second competing crop during the current year

Ac_{3t} - Area under third competing crop during the current year

Pc_{lt-1} - Price of first competing crop during the preceding year

Pc_{2t-1} - Price of second competing crop during the preceding year

Pc_{3t-1} - Price of third competing crop during the preceding year

Yc_{lt-1} - Productivity of first competing crop during the preceding year

Yc_{2t-1} - Productivity of second competing crop during the preceding year

Yc_{3t-1} - Productivity of third competing crop during the preceding year

ut - Error term

a - Intercept term

bi'_s - Regression co-efficient

The rule applied to visualize the magnitude of multicollinearity was the correlation coefficient between a pair of independent variables. The multicollinearity was considered 'high' if it is greater than 0.80 (Heady, E.O. and Dillon, 1961). The data were also tested for presence of autocorrelation in the model by using Durbin-Watson statistic. The level of significance of overall regression was tested by applying 'f' test.

The short-run and long-run price elasticities of acreage for paddy were estimated from the estimated equations. The coefficient of adjustment i.e. 'β' was obtained by substracting coefficient of lagged acreage from unity. In the linear function, long run price elasticity of acreage was obtained by multiplying the estimate of the slope of long-run supply function by the ratio of price to acreage at a particular point. Usually, this point is taken to be the average price and average acreage for the period of analysis. Short-run price elasticity of acreage was obtained by multiplying long-run price elasticity by 'â', the coefficient of adjustment. The levels of significance of short-run and long-run elasticities thus calculated for paddy were tested.

Based on the formulation, both short-run and long-run elasticities can be calculated. The short-run elasticity was worked out by using the conventional model,

$$E(S.R.)=b_1(\overline{P}_{t-1}/\overline{A}_t) \text{ and}$$

Long run elasticity by

$$E(L.R.)=(b_1/1-b_2)(\overline{P}_{t-1}/\overline{A}_t)$$

Since the coefficient of adjustment $\beta = (1-b_2)$ is never greater than unity, it follows that, short-run elasticity can never be greater than long-run elasticity.

(c) Specification of retained variables in the final regression: To examine the influence of different factors on acreage allocation decision of paddy crop amongst those were selected previously, only the following variables were retained.

(i) Current acreage (A_t): The dependent variable included in the analysis was the acreage under selected crop in '00' hectares during current year. The area consists of all types of strains, irrigated as well as unirrigated and also grown during agricultural year.

(ii) Lagged acreage (A_{t-1}): The area under the crop in the current year was mainly affected by the area of selected crop in '00' hectares during preceding year when the conditions are not abnormally changed. This variable was included in the model as proxy for traditional cropping pattern is also expected to affect the decision of the area allocation.

(iii) Lagged price of selected crop (P_{t-1}): The previous year's price of the selected crop was also expected to influence farmer's acreage allocation decision. The lagged price per quintal in rupees from 1985-86 to 2012–13 was, therefore, tried separately as an independent variable in the analysis.

(iv) Lagged per hectare productivity (Y_{t-1}): The per hectare productivity of selected crop was measured in kilograms. The variable was included in the model since the acreage allocation during the current year is also likely to be affected by the productivity of the crop during the preceding year.

(v) Pre-sowing rainfall (R_t): The amount of rainfall received during the pre-sowing months for the crop in 'mm' was tried as a separate variable because the decision of area allocation depends on the rainfall which results into potential irrigation during the season.

(vi) Acreage under competing crops (A_{ct}): The area under competing crops in '00' hectares were also considered as independent variables in different models developed for the selected crop. Because, there is inverse relationship between area under competing crops and selected paddy crop.

(vii) Lagged prices (Pc_{t-1}): The harvest price of competing crops of the preceding year was also expected to influence farmer's acreage allocation decision. Therefore, it was considered as independent variable.

(viii) Lagged productivity (Yc_{t-1}): The lagged productivity of competing crops was considered

another independent variable in the estimation of acreage response model.

Table 1
Regionwise of competing crops

Sr. No.	Regions	Kharif Paddy			
		1	2	3	4
1.	Konkan	Groundnut	Ragi	Udid	-
2.	Western Maharashtra	Groundnut	Soybean	Pearlmillet	-
3.	Marathwada	Groundnut	Cotton	Pigeonpea	Soybean
4.	Vidarbha	Groundnut	Soybean	Sugarcane	Cotton
	Maharashtra	Groundnut	Sugarcane	Soybean	Cotton

RESULTS AND DISCUSSIONS

Acreage response of *kharif* paddy

There had been wide fluctuations in both acreages and production of *kharif* paddy in different regions of Maharashtra state. There are various factors responsible for influencing the acreages under *kharif* paddy. The variation in the acreages of *kharif* paddy can be attributed to a large number of factors *viz;* social, economical, political, technological and natural as well. Therefore, it became imperative to empirically find out the influence of the individual factors on crop acreages, so that appropriate policy measures could be suggested to overcome the problem of wide fluctuation in acreages under *kharif* paddy in different regions of the state.

Recognizing the need of such analysis, an attempt has made to analyze the acreage response of *kharif* paddy in different regions of Maharashtra with the help of multivariate analysis of time series data. This type of analysis enables us to study empirically the factors influencing acreage under *kharif* paddy. The analysis of acreage response of *kharif* paddy to price and non-price variables had been attempted for the period of 28 years i.e. from 1985 to 2013. For this analysis, the modified version of Nerlovian lag model was used. The results obtained from the estimated acreage response model in respect of *kharif* paddy have been discussed separately for individual regions as well as Maharashtra as a whole.

The current acreage of *kharif* paddy as a dependent variable was regressed on the factors which hypothesized to influence, the area under *kharif* paddy in each region. In all the variables were identified which were supposed to influence the area under *kharif* paddy. Finally, using the usual criteria of consistency in signs and statistical significance of regression coefficients, the variables with wrong signs and non- significant levels were dropped and the equations were re-run to estimate the acreage response models. The stepdown linear regression analysis was employed for each region and the results obtained from the estimated acreage response models in respect of *kharif* paddy are discussed below.

Acreage response function for *kharif* paddy in Konkan

The results of estimated acreage response function of *kharif paddy* for the period from 1985 to 2013 are presented in Table 2.

The explanatory variables included in this model were lagged price of *kharif* paddy (P_{t-1}), lagged productivity of *kharif* paddy (Y_{t-1}), lagged area under *kharif* paddy (A_{t-1}), pre-sowing rainfall (PSR), current area under *kharif* groundnut first competing crop-(A_{c1t}), lagged price of *kharif* groundnut (P_{c1t-1}), lagged price of udid (P_{c3t-1}), lagged productivity of *kharif* groundnut (Y_{c1t}-$_1$) and lagged productivity of ragi (Y_{c2t-1}).

The value of R^2 obtained for this function was 0.85. The coefficient of multiple determinations (R^2) was found to be significant. The regression coefficients for lagged price for *kharif* paddy and pre-sowing rainfall were found positive and significant at 5 per cent level of significance, while that of lagged price of *kharif* groundnut and lagged price of udid was negative at 5 per cent level of significance. This indicated that, the farmer's acreage allocation for *kharif* paddy was influenced by pre-sowing rainfall, lagged price of *kharif* paddy, lagged price of *kharif* groundnut and lagged price of udid. If the pre-sowing rainfall increase 1 mm the acreage under paddy will increases 0.09 hectares. If the lagged price of *kharif* groundnut and udid increased by one rupee, the area under paddy will be significantly decline by 0.11 and 0.28 hectares.However, the lagged productivity of *kharif* paddy(Y_{t}-$_1$) and lagged area under *kharif* paddy (A_{t}-$_1$) were not significant but having positive impact on acreage under paddy.This indicated that, the farmer's acreage allocation for *kharif* paddy was influenced by lagged price of paddy, pre-sowing rainfall, lagged price of *kharif* groundnut and lagged price of udid.

Acreage response function for *kharif* paddy in Western Maharashtra

The information on structural parameters, their standard error, R^2 and 'F' value of the estimated acreage response function for *kharif* paddy for the period under study of Western Maharashtra region is given in Table 3.

Table 2
Results of estimated acreage response function for *kharif* paddy in Konkan

Sr. No.	*Factors*	*Regression coefficient*
1	Intercept	3584.02
2	Lagged price of *kharif* paddy -P_{t-1}	0.0460** (0.0198)
3	Lagged productivity of *kharif* paddy-Y_{t-1}	0.0032 (0.0157)
4	Lagged area under *kharif* paddy-A_{t-1}	0.0738 (0.2119)
5	Pre-sowing rainfall-PSR	0.0917** (0.0358)
6	Current area under first competing crop i.e. - kh.groundnut-Ac_{1t}	-0.4637 (0.5246)
7	Lagged price of *kharif* groundnut-Pc_{1t-1}	-0.1162** (0.0564)
8	Lagged price of udid-Pc_{3t-1}	-0.2805** (0.1033)
9	Lagged productivity of kh. groundnut-Yc_{1t-1}	-0.0317 (0.0803)
10	Lagged productivity of ragi- Yc_{2t-1}	-0.0431 (0.1697)
11	R^2	0.85
12	F-value	6.60***

(Figures in parentheses are standard errors of respective regression coefficients)
*, ** and *** indicates significance level at 10, 5 and 1per cent level, respectively

Table 3
Results of estimated acreage response function for *kharif* paddy in Western Maharashtra

Sr. No.	*Factors*	*Regression coefficient*
1	Intercept (a)	1934.44
2	Lagged price of *kharif* paddy-P_{t-1}	2.3777** (1.0529)
3	Lagged productivity of *kharif* paddy-Y_{t-1}	0.0076 (0.0193)
4	Lagged area under *kharif*paddy-A_{t-1}	0.2406 (0.2746)
5	Pre-sowing rainfall-PSR	0.1905*** (0.0687)
6	Lagged price of soybean-Pc_2t_{-1}	-0.2008* (0.1051)
7	Lagged price of *kharif*pearmillet-Pc_{3t-1}	-1.3042** (0.5164)
8	Lagged productivity of soybean-Yc_{2t-1}	-0.0603 (0.0517)
9	Lagged productivity of *kharif* pearmillet-Yc_{3t-1}	-0.4501** (0.1741)
10	R^2	0.78
11	F-value	3.86**

(Figures in parentheses are standard errors of respective regression coefficients)
*, ** and *** indicates significance level at 10, 5 and 1per cent level, respectively

The coefficient of multiple determination (R^2) was 0.78 and it was significant at 5 per cent level. The lagged price of *kharif* paddy and pre-sowing rainfall had positive and significant impact on current acreages. If the lagged price of *kharif* paddy, increased byone rupee, the area under paddy will be significantly increased by 2.37 hectares and if the pre-sowing rainfall increase by 1mm, the area under *kharif* paddy significantly increased by 0.19 hectares.The lagged price of soybean and lagged price of *kharif* pearlmillet had negative and significant impact on current acreages of *kharif* paddy.If lagged price of soybean and *kharif* pearlmillet increased by one rupee, the area under paddy will be significantly declined by 0.20 and 1.30 hectare, respectively**.** The lagged productivity of *kharif* pearlmillet had negatively significant impact on the acreage allocation of *kharif* paddy. The lagged productivity of soybean had negative but non-significant impact on acreage allocation of *kharif* paddy. This indicated that the importance of the above variables in area allocation to *kharif* paddy in Western Maharashtra region.

Acreage response function for *kharif* paddy in Marathwada

Table 4 depicts the information on structural parameters, their standard errors, R^2 and 'F' value of the estimated acreage response function for *kharif* paddy in Marathwada region for the period under study.

A high 'F' ratio of the regression indicated that, the estimated acreage response function for *kharif* paddy was highly significant. The twelve variables included in the function jointly explained 94 per cent of the total variation in the current acreage for *kharif* paddy. The lagged price of *kharif* paddy and pre-sowing rainfall had positive and significant impact on current acreage of *kharif* paddy. If the lagged price of *kharif* groundnut and soybean increased by one rupee, the area under *kharif* paddy will be significantly declined by 0.14 and 0.069 hectares. However, the lagged productivity of competing crop *viz;* cotton, pigeonpea and soybean were negative but not significant indicating there is negative impact on current acreage of paddy. The current area under groundnut and soybean had negative but non-significant impact on current acreages under paddy. If the current area under cotton increaseby one hectare, then the area under paddy will be significantly declined by 0.04 hectares. As expected the regression coefficient for area under cotton turned out to be significant with proper sign.

Table 4
Results of estimated acreage response function for *kharif* paddy in Marathwada

Sr. No.	*Factors*	*Regression coefficient*
1	Intercept (a)	1078.16
2	Lagged price of *kharif* paddy-P_{t-1}	0.0927***
		(0.0324)
3	Lagged productivity of *kharif* paddy-Y_{t-1}	-0.450
		(0.3664)
4	Lagged area under *kharif* paddy-A_{t-1}	0.1495
		(0.3512)
5	Pre-sowing rainfall-PSR	0.1878**
		(0.0.834)
6	Current area under first competing crop -i.e. *kharif* groundnut-Ac_{1t}	-0.2607
		(0.4181)
7	Current area under second competing crop - i.e. cotton-Ac_{2t}	-0.0472**
		(0.0206)
8	Current area under four competing crop - i.e. soybean-Ac_{4t}	-0.0333
		(0.0275)
9	Lagged price of *kharif* groundnut-Pc_{1t-1}	-0.1426**
		(0.0713)
10	Lagged price of soybean-Pc_{4t-2}	-0.0697*
		(0.0403)
11	Lagged productivity of cotton-Yc_{2t-1}	-0.0599
		(0.1932)
12	Lagged productivity of pigeonpea-Yc_{3t-1}	-0.1470
		(0.2105)
13	Lagged productivity of soybean-Yc_{4t-2}	-0.0784
		(0.0729)
14	R^2	0.94
15	F-value	22.28***

(Figures in parentheses are standard errors of respective regression coefficients)
*, ** and *** indicates significance level at 10, 5 and 1per cent level, respectively

Table 5
Results of estimated acreage response function for *kharif* paddy in Vidarbha

Sr. No.	*Factors*	*Regression coefficient*
1	Intercept (a)	5608.9
2	Lagged price of *kharif* paddy-P_{t-1}	4.0948**
		(1.9848)
3	Lagged productivity of *kharif* paddy-Y_{t-1}	0.0003
		(0.0997)
4	Lagged area under *kharif* paddy-A_{t-1}	0.0523
		(0.2514)
5	Pre-sowing rainfall-PSR	2.4770**
		(1.1340)
6	Current area under four. competing crop i.e-cotton-Ac_{4t}	-0.2320
		(0.1669)
7	Lagged price of soybean-Pc_{2t-1}	-0.4210
		(0.4231)
8	Lagged price of cotton-Pc_{4t-2}	-0.0353
		(0.3617)
9	Lagged productivity of sugarcane-Yc_{3t-1}	-1.4949*
		(0.8509)
10	R^2	0.80
11	F-value	4.12***

(Figures in parentheses are standard errors of respective regression coefficients)
*, ** and *** indicates significance level at 10, 5 and 1per cent level, respectively

Acreage response function for *kharif* paddy in Vidarbha

The results obtained for estimated acreage response function of *kharif* paddy in Vidarbha region are presented in Table 5.

The high significance of R^2 value indicated that the form acreage response function had given a good fit. The eight variables jointly explained about 80 per cent variation in *kharif* paddy acreage. The lagged price of *kharif* paddy and pre-sowing rainfall had positive and significant influence which indicated that these variables have played major role in area allocation decisions of *kharif* paddy growers in Vidarbha region. If the lagged price of *kharif* paddy increased one rupee, the area under paddy will be significantly increased by 4.09 hectares and if the pre-sowing rainfall increase by 1 mm the acreage under *kharif* paddy will be significantly increase by 2.47 hectares. The coefficients of lagged productivity of *kharif* paddy and lagged area under *kharif* paddy were positive and have non-significant impact on current acreage. The current area under cotton, lagged price of soybean and cotton had negative but non-significantimpact on current acreage under *kharif* paddy. The coefficient of laggedproductivity of sugarcane was negative and had significant impact on current acreage under *kharif* paddy. If the productivity of sugarcane increased by one quintal, the area under paddy will be significantly declined by 1.49 hectares. This might be due to the reason that if there is less pre-sowing rainfall farmers shifted to other crops like groundnut, soybean, sugarcane and cotton, etc.

Acreage response function for *kharif* paddy in Maharashtra

For studying the *kharif* paddy growers response to price and non price variable in Maharashtra state as a whole during 1985-2013, the function was estimated in the frame of linear multiple regression with a set of eight independent variables. The results obtained for this production function are presented in Table 6.

The coefficient of multiple determinations for the function of entire period showed that 78 per cent dependence of *kharif* paddy acreage on explanatory variables under consideration. The explanatory variables included in this function jointly explained 0.78 variation in the acreage of *kharif* paddy. If the lagged price of *kharif* paddy, increased by one rupee,

Table 6
Results of estimated acreage response function for *kharif* paddy in Maharashtra

Sr. No.	*Factors*	*Regression coefficient*
1	Intercept	150281.69
2	Lagged price of *kharif* paddy-P_{t-1}	3.8357**
		(1.8085)
3	Lagged productivity of *kharif* paddy-Y_{t-1}	0.1052**
		(0.0427)
4	Lagged area under *kharif* paddy-A_{t-1}	0.0627
		(0.4206)
5	Pre-sowing rainfall-PSR	1.3519**
		(0.5145)
6	Lagged price of *kharif* groundnut-Pc_{1t-1}	-0.3172
		(1.2428)
7	Lagged price of soybean-Pc_{2t-1}	-0.1285
		(1.0247)
8	Lagged price of suagarcane-Pc_{3t-1}	-1.1845*
		(0.6776)
9	Lagged price of cotton-Pc_{4t-2}	-0.1230**
		(0.0566)
10	Lagged productivity of *kharif* groundnut-Yc_{1t-1}	-0.4443***
		(0.1289)
11	Lagged productivity of soybean-Yc_{2t-1}	-0.4693
		(0.6348)
12	Lagged productivity of sugarcane -Yc_{3t-1}	-0.4604
		(0.5969)
13	Lagged productivity of cotton-Yc_{4t-2}	-2.7805
		(3.9156)
14	R^2	0.78
15	F-value	4.63***

(Figures in parentheses are standard errors of respective regression coefficients)
*, ** and *** indicates significance level at 10, 5 and 1per cent level, respectively

the area under paddy will be significantly increase by 3.83 hectares and if the pre-sowing rainfall increased by 1mm, the area under *kharif* paddy will be significantly increase by 1.35 hectares. The lagged price of *kharif* paddy and pre-sowing rainfall had played important role in the acreage allocation decisions as the regression coefficient was found to be positive and significant at 5 per cent level of significance. The regression coefficients for lagged price of *kharif* groundnut and soybean were found negative and have significant impact on current acreage under paddy. The lagged price of sugarcane was negative and had significant impact on current acreage under *kharif* paddy. If the prices of sugarcane increase by one rupee, the area under paddy will be significantly declineby 1.18 hectares.However, the lagged productivity of competing crop *viz;* soybean, sugarcane and cotton were negative but not significant indicating there is negative impact on current acreages. Most of the variables included in this model have desired signs but they did not influence significantly the current acreages.

This indicated that, the farmers in the state had given due weightage to the lagged price of *kharif* paddy while making area allocation decision for positive impact of *kharif* paddy during current year. The positive impact of pre-sowing rainfall on the variation in acreages of *kharif* paddy indicated that for variables rainfall had positive impact on the allocation of area under *kharif* paddy. The positive and significant co-efficient of lagged productivity of *kharif* paddy, lagged price and productivity of *viz; kharif* paddy, groundnut soybean, cotton and sugarcane were observed.

The acreage allocation decision of *kharif* paddy growers in Maharashtra were influenced by lagged price and productivity of *kharif* paddy, pre-sowing rainfall, lagged price of competing crops *viz;* cotton and sugarcane and lagged productivity of *kharif* groundnut.

Thus, the hypotheses tested variations in acreages under paddy are governed mainly by lagged prices, lagged acreage and yield of paddy, seasonal conditions at the time of sowing and the competing crops has been proved. These findings confirmed the results reported by Balaji and Sathyanarayana (1990), Shrivastava *et al*. (1999), Joshi (2008) and Nikam (2012).

CONCLUSIONS

1. The acreage response analysis revealed that lagged price and yield of productivity of paddy, pre-sowing rainfall, lagged price of cotton and sugarcane and lagged productivity of *kharif* groundnut were major deciding factors for acreages under paddy in Maharashtra. The negative but non-significant influence on area under paddy was noticed in case of lagged price of *kharif* groundnut and soybean and also lagged productivity of soybean, sugarcane and cotton. However, the competing crops for paddy were different in every region of the State. The most important factor influencing acreage under *kharif* paddy in every region of the State was lagged price of paddy.
2. The main factors influencing acreages under *kharif* paddy during the study period in Maharashtra were lagged price and productivity of *kharif* paddy, pre-sowing period rainfall, lagged price of cotton and sugarcane and lagged productivity of *kharif* groundnut. The lagged price of *kharif* paddy and pre-sowing period rainfall had positive and significant influence on acreages under paddy in all four regions of the State. The

competing crops for area allocation decisions of *kharif* paddy were groundnut and udid in Konkan, bajra and soybean in Western Maharashtra, cotton, soybean and groundnut in Marathwada and cotton in Vidarbha region.

HYPOTHESES

Variations in acreages under paddy are governed mainly by lagged prices, lagged acreage and yield of paddy, seasonal conditions at the time of sowing and the competing crops.

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