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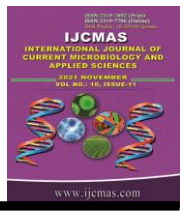

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Stochastic Analysis of Ragi (*Eleusine coracana*) Production in Karnataka

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A B S T R A C T

The purpose of present study was to describe the growth rate study for some time series production factors of ragi and also making of diagnostic study for detecting some influential time series production factors governing total ragi production in Karnataka and also in India during the period 1993 -2017. The secondary data was collected for analysis from Directorate of economics and statistics and http://indiastat.com. The maximum compound growth rate of MSP of ragi was observed in India as well as in Karnataka. Whereas negative CGRs were recorded for ragi production in India as well as Karnataka. The productivity and area of ragi had positive and significant correlation with ragi production in India, whereas ragi production of India had negative and significant correlation with value of output and minimum support price. These factors were found important for total ragi production of India.

Introduction

Ragi or finger millet (*Eleusine coracana* L.) is grown as a cereal in Asia and Africa. It is an important staple food & fodder crop in many parts of Eastern and Southern Africa, as well as in South Asia. Ragi is the staple diet in many villages across South India. It is also used as a major substitute for rice among the diabetic patients and also the diet conscious people. In India, ragi is mainly grown in Karnataka, Tamil Nadu, Uttarakhand and Maharashtra. More than 80 per cent of the crop is grown as *Kharif* crop. In 2017-18 India produced 19.8 lakh tonnes of ragi from an area of 11.9 lakh hectares with an average productivity of 1,661 kg per hectare. Karnataka tops the Indian ragi production with a contribution of 59.52% followed by Tamil Nadu (18.27%), Uttarakhand (7.76%) and Maharashtra (7.16%). Tamil Nadu is having the highest productivity of 2715 kg per hectare, followed by Karnataka (1955 kg per hectare) which is higher than the country's average productivity of 1641 kg per hectare. In Karnataka, ragi is mainly grown in Bengaluru Urban, Bengaluru Rural, Ramanagara, Kolar, Mysore, Mandya, Hassan,

Tumkur and Chikkmagaluru districts. In Karnataka, finger millet is grown in an area of 6.80 lakh ha, with an annual production of 12.72 lakh tonnes and productivity of 1,955 kg per hectare.

Materials and Methods

The information was recorded from the Directorate of Economics and Statistics& indiastat.com for 25 consecutive years (1993 to 2017). From Ragi statistics, five factors were screened which were found to have substantial effect on the total Ragi production (viz., area, production, productivity, value of output, minimum support price pertain to the all-agricultural sector).

In order to study the growth rate, the well-known growth model was filled with respect to each factor. The model

$X_{it} = \alpha \beta^{t} \varepsilon_{it}$

i = 1,2,…….5;

t = 1,2,……25

Where, X_{it} = response of the i-th factor in the t-th year, A and β =unknown parameter of the model to be estimated, t =time element which takes the value 1, 2, 3,…….n. ε_{it} = multiplicative error, ε_{it}`s ~ IID N(0, σ^2)

The above growth model was liberalized by using logarithmic transformation and the unknown parameters were estimated by the ordinary least squares (OLS) method.

From the fitted model compound growth rate percent was computed as: CGR= (Antilog b-1)*100, where, b is estimated value of β.

Simple correlation coefficients among the five factors were computed to study the strengths of their interrelationship in respect of the Karnataka, To diagnose the important factors (appearing in the total production scenario) which have their direct and indirect influences on the total ragi production, the technique of path coefficient analysis has been employed.

Correlation coefficients measure the absolute value of correlation between variables in a given body of data. Correlation does not say anything about the cause and effect relationship. Sewell Wright (1921) developed and applied the method of path analysis for the purpose of interpretation of a system of correlation coefficients in terms of paths of causation.

The theory underlying path analysis is that a variable Y is represented and completely determined by a number of intermediate factors X_1, X_2, X_3, …, X_5 and R, all of which except the residual R is represented as inter-correlated

The correlation between Y(=X_2) and the known variables (X_1, X_3,…,X_5) may be written as a series of simultaneous linear equations equal in number to the unknown path coefficients

$$r_{YX_1} = P_{01} + r_{X_1X_2}P_{02} + r_{X_1X_3}P_{03} + r_{X_1X_4}P_{04} + r_{X_1X_5}P_{05} \text{.....1}$$

$$r_{YX_3} = r_{X_1X_3}P_{01} + r_{X_3X_2}P_{02} + P_{03} + r_{X_3X_4}P_{04} + r_{X_3X_5}P_{05} \text{.....2}$$

$$r_{YX_4} = r_{X_1X_4}P_{01} + r_{X_4X_2}P_{02} + r_{X_3X_4}P_{03} + P_{04} + r_{X_4X_5}P_{05} \text{.....3}$$

$$r_{YX_5} = r_{X_1X_5}P_{01} + r_{X_5X_2}P_{02} + r_{X_5X_3}P_{03} + r_{X_5X_4}P_{04} + P_{05} \text{.....4}$$

Where, r_{YX1}, r_{YX3}, r_{YX4}, and r_{YX5} are the simple correlation coefficient between each of the causal factors and the effect Y.

Results and Discussion

The results emanated from the data considered under the purview of this investigation are

presented as follows: Table 1 reveals the growth dynamics of the ragi production factors for India and Karnataka during the period 1993 to 2017. From the table, it is seen that the maximum compound growth rate of MSP of ragi was observed in India as well as in Karnataka. Whereas negative CGRs were recorded for ragi production in India as well as Karnataka. In case of India as a whole, the significant increase has been occurred in productivity (0.1%), value of output (5.4%), Minimum support price (8.2%) and the decline in growth rate had occurred in area i.e. -2.2% and production i.e. -2.3%. Though the compound growth rates for Karnataka state record significant increase (per year) with respect to the factors value of output (5.66%) and Minimum Support Price (8.2) yet surprisingly, the negative growth rates for the factor ragi productivity (-0.32), production (-2.29) and area (-2.1) has occurred. More efforts should be geared to bring these areas at par with national level. The growth rate scenarios for most of the factors with respect to India are quite satisfactory as, in these areas, positive significant growth rates loudly substantiate the theme of national advancement.

The table 2 indicated that Karnataka contributed 56.07% in area, 57.56% in production. The ragi productivity in Karnataka was107.32% higher than the nation's productivity and the value of output was higher than the India. Average values of factors corresponding to Karnataka and India as a whole were not comparable as percentage figures related to Karnataka in comparison to those of all India show significant contribution on the part of this state to the national scene for most of the factors which can be observed from this table. Moreover, the values of the coefficients of variation revealed the existence of greater inconsistency (fluctuation) in the data. From the table, it was noted that the maximum coefficient of variation was observed in value of output in India (67.57%) as well as in Karnataka (226.6%). The minimum coefficient of variation was observed productivity in India (12.48%) and area in Karnataka (17.92%). Hence, concluded that the most stable factors were productivity and area in India and Karnataka, respectively.

The correlation coefficients for the different pairs of variables were assessed. In this table the interrelationship among the total ragi production X_2 (Y dependent) variable and other production factors independent variables (ragi area, yield, value of output and minimum support price) are represented in table 3 for Karnataka. The results indicated that the production of ragi was positively and significantly correlated with ragi area (0.461), yield (0.824) and the value of output (0.066).

Whereas, negatively correlated with minimum support price (-0.135). From the table it was also noticed that productivity and area has the significant relationship with the ragi production. These components exhibited interrelationship with each other. This shows that the importance of these components as production attributing factors. The correlation coefficients between X_2(Y) and other factors (area, productivity, value of output and minimum support price) are presented in table 4 for India.

Table.1 Fitted the growth models and Compound growth rates of factors of ragi during 1993 to 2017

Factors	Fitted growth models		CGR (%)	
	India	Karnataka	India	Karnataka
X1	$X1=2001.8 \times 0.97^t$	$X1=1055.4 \times 0.98^t$	-2.2	-2.1
X2=Y	$X2=2573 \times 0.98^t$	$X2=1148.4 \times 0.99^t$	-2.3	-2.29
X3	$X3=1286.9 \times 1.008^t$	$X3=1310 \times 1.10^t$	0.1	-0.32
X4	$X4=42262 \times 1.079^t$	$X4=29568 \times 1.0^t$	5.4	5.66
X5	$X5=204.53 \times 1.0^t$	$X5= 204.53 \times 1.0^t$	8.2	8.2

Table.2 Averages, coefficient of variations with respect to Ragi factors and their percentage contributions to India from Karnataka during 1993 to 2017

Factors	INDIA		KARNATAKA		Percentage contribution of Karnataka to India
	Mean	C.V.(%)	Mean	C.V. (%)	
X1	1484.08	18.38	832.16	17.92	56.07
$Y=X_2$	2118.4	18.47	1219.36	36.17	57.56
X_3	1436.96	12.48	1542.2	23.38	107.32
X_4	138588.56	67.57	170830.2	226.60	123.26
X_5	735	65.78	735	65.78	100

Table.3 Correlation of ragi production factors on the total ragi production in Karnataka

	X1	Y=X2	X3	X4	X5
X1	1				
Y=X2	0.461*	1			
X3	0.192	0.824**	1		
X4	-0.195	0.066	0.216	1	
X5	-0.736**	-0.135	0.255	0.408*	1

** Correlation is significant at 1% level;
* Correlation is significant at 5% level.

Table.4 Correlation of ragi production factors on the total ragi production in India

Factors	X1	Y=X2	X3	X4	X5
X1	1				
Y=X2	0.803**	1			
X3	-0.257	0.364*	1		
X4	-0.793**	-0.440*	0.560**	1	
X5	-0.873**	-0.610**	0.392*	0.951**	1

** Correlation is significant at 1% level;
*Correlation is significant at 5% level.

Table.5 Path coefficient between selected factors and ragi production in Karnataka

Parameters	X_1	X_3	X_4	X_5
X_1	**0.196**	0.038	0.144	0.0907
X_3	0.0012	**-0.0064**	0.0026	0.0004
X_4	-0.376	0.208	**0.511**	0.069
X_5	-0.370	-0.053	0.108	**0.802**

Table.6 Path coefficient between selected factors and ragi production in India

Parameters	X_1	X_3	X_4	X_5
X_1	**0.948**	-0.288	-0.745	-0.829
X_3	-0.211	**0.694**	0.428	0.315
X_4	0.154	-0.121	**-0.196**	-0.186
X_5	-0.101	0.052	0.109	**0.115**

Table.7 Direct and indirect influence of ragi factors on the total ragi production in India

Factors	Direct influences	Rank of direct influence	Total indirect influence	Rank of indirect influence
Ragi area	0.948	1	-1.862	3
Ragi productivity	0.694	2	0.532	1
Value of output	-0.196	4	-0.153	4
Minimum support price	0.115	3	0.06	2

The results indicated that the productivity and area of ragi had positive and significant correlation with ragi production in India, whereas ragi production of India had negative and significant correlation with value of output and minimum support price. These factors were found important for total ragi production of India. Path analysis results aimed to diagnose the direct and indirect effect of important factors on the total ragi production which are summarized in table 5 to table 6 with respect to Karnataka and India as a whole respectively. The diagonal elements represent direct effects and the off-diagonal

elements represent indirect effects (Table 5). This indicates that minimum support price had a high positive effect of 0.802 followed by value of output (0.511). Table 6 represents the path coefficient analysis between selected factors and ragi production in India..

This indicates that the area had high positive effect on ragi production (0.948) followed by productivity (0.694). It is found that the corresponding descending order with respect to the factors is ragi productivity via. Minimum support price via. Value of output.

Table 7 portrays corresponding scenario prevailing with respect of Karnataka. In fact, it reveals that minimum support price was the most direct influential factor for ragi production with rank 1 followed by value of output with rank 2nd followed by area, productivity. The total indirect effect of ragi area had 1st rank followed by productivity (2nd rank) and minimum support price (rank 3).

All the factors had positive direct effects on ragi production in India except value of output (Table 8). The ragi area was on first position followed by ragi productivity. The highest total indirect effect of ragi productivity was observed in India.

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