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TECHNOLOGICAL DEVELOPMENT OF CASTOR IN TELANGANA

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ABSTRACT

Telangana is the 29th state of India, formed on the 2nd of June 2014. The state has an area of 1, 12,077 Sq. Km. and has a population of 3, 50, 03,674, with Hyderabad as its capital. The state was formed as a result of the split of Andhra Pradesh state. The state is land locked by (new) Andhra Pradesh to the south and east, Maharashtra and Karnataka to the west, and Odisha and Chhattisgarh to the north. The Economy of Telangana is mainly supported by agriculture. Agricultural growth throughout global history has been the pro-genitor of broad based economic growth and development as linkages between farm and non-farm economies generated widely based employment, income and growth. India is the fourth largest producer of oilseeds in terms of output and second in terms of area under oilseeds. Two important rivers of India, the Godavari and Krishna, flow through the state, providing irrigation. Farmers in Telangana mainly depend on rain-fed water sources for irrigation. Rice is the major food crop. Other important local crops are cotton, sugar cane, mango and tobacco. There are many multi-state irrigation projects in development, including Godavari River Basin Irrigation Projects. Castor is the important oilseed crop in Telangana. It is sown in July-August and harvested from January to March. The crop is concentrated mainly in Mahaboobnagar and Nalgonda districts. In this paper an attempt has been made to study the technological development in Castor production. The exponential function was used to determine the trends in area, production and yield of Castor crops. The Cobb-Douglas Function was adopted to study the technological changes in Castor production.

KEYWORDS:

Agriculture, Technological Development, Castor seeds, Castor oil

INTRODUCTION

Castor oil is a vegetable oil obtained from the castor bean. It naturally biodegrades quickly and comes from a renewable energy resource. Technically it is called as Ricinus Communis. The common name 'castor oil' likely comes from its use as a replacement for castoreum, a perfume base made from the dried perinea glands of the beaver. Castor seeds have been found in Egyptian tombs dating back to 4000 B.C. Herodotus and other Greek travelers have noted the use of castor seed oil for lighting body an ointments.

The castor oil plant can vary greatly in its growth habit and appearance. It is a fast growing, suckering perennial shrub. Which can reach the size of small tree, but it is not hardy. It can reach a height of 2 – 3 m in a year. The glossy leaves are 15 – 45 cm long, palmate, with 5 – 12 deep lobes and toothed margins. Their color varies from dark green, sometimes with a reddish finger, to dark reddish purple or bronze. The stems and the spherical, spiny seedpods also vary in pigmentation. The pods are showier than the flowers.

Castor seed is the source of castor oil, which has a wide variety of uses. The seeds contain between 40 percent and 60 percent oil that is rich in triglycerides, mainly ricinolein. They also contain ricin, a poison, which is also present in lower concentrations throughout the plant. Castor oil maintains its fluidity at both extremely high and low temperatures. Global castor seed production is around one million fens per year. Leading producing areas are India, China and Brazil. The use of castor seed oil in India has been documents since 2000 B.C for use in lamps and in local medicine as a laxative. Purgative and cathartic in unani ,Ayurvedic and other ethno medical systems.

Castor oil and its derivatives have applications in the manufacturing at soaps, lubricants, hydraulic and brake fluids, paints, dyes. Coatings, inks, cold resistant plastics, waxes and polishes, nylon, pharmaceuticals and perfumes. In internal combustion engines, castor oil is renowned for its ability to lubricate under extreme conditions and temperatures, such as in air – cooled engines. The lubricants company Castrol

takes its name from castor oil. However, castor oil tends to form gums in a short time, and its use is therefore restricted to engines that are regularly rebuilt, such as motorcycle race engines.

In the food industry, castor oil is used in food additives, flavoring candy, i.e., chocolate, as a mold inhibitor, and in packaging, Polyoxyethylated castor is also used in the foodstuff industries.

Medicinal castor oil was used for skin problems, burn, sunburns, skin disorders, skin cuts, abrasions etc. As study found that castor oil decreased pain more than ultrasound gel or Vaseline during extracorporeal shock wave application. The oil is also used as a rub or pack for various ailments, including abdominal complaints, headaches, muscle pains, inflammatory conditions, skin eruptions, lesions, and sinusitis. Cold pressed castor oil has been used or time – tested for centuries throughout the world for its anti-microbial and anti-bacterial properties long before any government agency was created to regulate medicines.

Castor oil has over 1000-patented industrial applications and is used in automobile, aviation, cosmetics, electrical, electronics, manufacturing, pharmaceutical, plastics, and telecommunications. The following is a brief list of castor oil uses in the above industries: adhesives brake fluids, Caulks, dyes, electrical liquid, dielectrics, inks, lacquers, leather treatments, lubricating greases, machining oils, paints, pigments, rubbers textiles, washing powders and waxes.Castor oil is non – drying oil, thus, it remains liquid for a long time. As a result, it's naturally a good lubricant, and was a fuel for lamps before alternating current electricity was invented. In India, it is used as the best lamp, giving an excellent white light, vying in brilliancy with electricity, far superior to petroleum, rape seed, and all other oils, whether vegetable animal or mineral. Pure cold pressed castor oil is really tasteless and odorless. When additives are added to pure cold pressed castor oil, the oil becomes adulterated and the taste and smell can change according to the additives. Also, pure cold pressed castor is potent and can be an eye irritant similar to pepper spray. So avoid contact with eyes.

Castor is the important oilseed crop in Telangana.It is sown in July-August and harvested from January to March. The crop is concentrated mainly in Mahaboobnagar and Nalgonda districts. In the Telangana, castor is sown as a pure crop.Mixtures are rare. Here it is mostly raised as a pure crop but mixtures of castor with Jowar, Bajra, groundnut and Ragi, are also to be found.

REVIEW

Badals and Singh's [1] study on 'technological changes in Maize Production' reveals that the technological change was attributed for 30 per cent of total yield increase by HYV's technology in Maize production. Mimmat Singh[2] examined the nature structure and growth of agricultural sector in Punjab. Khatri[3] and other's study on groundnut yield, reveals that the crop yield could be satisfactory predicted by the end of September with forecast crror of 2.48 per cent. Krishna Mohan[4] analyzed the impact of new technology on agrarian structure and agriculture production. Partha Saradhy [5], Singh's study [6] reveals that there is the main factor for the total growth of production of oilseeds crops. Subba Ramaraju [7] and other's study indicates that the return to scale under irrigated area was found to be significant.

METHODOLOGY

The study of technological changes in the production of oilseeds crop, Castor becomes imperative for proper planning of agricultural development. It is proposed to examine the performance of oilseed crop, Castor, in Telangana. The performance of Castor crop may be studied through growth in Castor area, production and yield. It is also examined, the variability in production of Castor and the effect of technological changes on Castor output. Therefore, the main objectives of the study are:

1. To determine the trends in area, production and yield of Castor crop in Telanagana.
2. To study the variability in the production and technological changes in Castor production.

The study was conducted for the period of forty years (1965-66 to 2004 – 2005). The study period was divided into two sub periods.

1. Pre-green revolution and green revolution period (1965-85)
2. Post-green revolution and TMO's period (1985 – 2005)
3. Over all period (1965 – 2005).

To fulfill the first objective, compound growth rate was estimated by fitting the exponential function for the three periods. The adopted exponential function is:

$$Y = ABt \qquad (1)$$

Where Y = Area/ production/yield, A = Constant, B = Coefficient of time, t = time (Years), r = Compound growth rate

The percentage of compound growth rate r = (B-1) .100

The coefficient of variation was used to know the instability in Castor production.

$$CV = \frac{\text{standerd deviation}}{\text{Mean}} X100$$

To examine the technological changes for Castor crop, the following exponential production function has been adopted.

$$Y = \alpha X^{\beta} e^{\lambda t} \mu \qquad (2)$$

Where Y = Production, X = Area, t = Time period

α, β, λ have their usual meanings and μ is the disturbance term, distributed normally and independently. Equation (2) is a non-linear equation. It is not possible to estimate as it is; we have to convert this function into linear form by adopting logarithms.

$$\log Y = \log \alpha + \beta \log X + \lambda t \qquad (3)$$

To study the technological change in agricultural production before and after the green revolution, two functions were estimated separately.

$$\left.\begin{aligned} \log Y_1 &= \log \alpha_1 + \beta_1 \log X + \lambda_1 t \\ \log Y_2 &= \log \alpha_2 + \beta_2 \log X + \lambda_2 t \end{aligned}\right\} \quad (4)$$

To study the change in production due to the change in period, the following equation was fitted.

$$Y = \alpha X^{\beta} e^{\lambda t} e^{\delta D} \mu \qquad (5)$$

After taking logarithms, the above exponential function is

$$\log Y = \log \alpha + \beta \log X + \lambda t + \delta D \qquad (6)$$

Where 'D' is the dummy variable, which takes values 'zero' and 'one' respectively, representing the two periods. The dummy variable 'D' takes 'zero' during the period

'I' and 'one' during the period II. Here 'zero' is meant for the effect of no new technology, while 'one' is meant for the effect of new technology.

The t-test was used for testing the significance of estimated co-efficient.

$$t = \frac{\hat{B}}{SEofB}; \text{ (SE = Standard Error)} \quad (7)$$

The collective effect of all explanatory variables on explained variable is denoted by R^2. It is called as the multiple correlation coefficients.

$$R^2 = 1 - \sum e_i^2 / \sum y_i^2 \quad (8)$$

For the significance of R^2, F-test statistic was been adopted.

$$F = \frac{R^2/(K-1)}{(1-R^2)(N-K)} \quad (9)$$

Where N=No. of observations, K= No. of variables

Data

The data relating to area, production and productivity of Castor crop in Telangana was obtained from various issues of Seasons and Crop Reports of Andhra Pradesh issued by The Director, Bureau of Economics and Statistics, Hyderabad.

ANALYSIS

The study of growth and instability in agriculture is an important concept in estimating the future production, yield and area. With the help of these estimates it is possible to take policy decisions to meet the future demands of the country. The increasing population creates demand to oilseed commodities. To meet the forth-coming demand for oil and oilseeds, it is necessary to study the growth and performance of Castor crop. Equation (1), was fed with the data and the results are given in the following table for the three periods in Telangana and analyzed accordingly

GROWTH AND INSTABILITY IN CASTOR CROP-1.1

	Period	Intercept	Regression Coefficient	SE	CGR	CV
Area	I	7.16E+09	0.1934	1.7611	-80.6591	31.33
	II	785.2473	0.7688	1.3166	-23.1244	15.32
	III	1.33E+11	0.1560	1.7016	-84.0021	26.35
Production	I	700.7355	0.6622	1.6063	-33.7793	35.20
	II	18.9612	1.0422*	1.0822	4.2299	35.51
	III	1.1616	1.2705*	1.3139	27.0508	39.35
Yield	I	0.4916	1.7322*	1.7316	73.2203	28.73
	II	19.5050	1.0809*	1.0939	8.0910	31.22
	III	0.3128	2.0873*	1.3221	108.7341	37.38

Observing the compound growth rates in castor area in Telangana, a negative growth rates were observed. These are –80.66, -23.12 and –84.00 during the periods I, II and III respectively. It reveals that, every year the castor area is decreasing. The effect of green revolution and TMO may not affect positively the increase in castor area in Telangana. It is inferred that, the technological effect on castor area is absent because of lack of technology, the castor growers in the region are not motivated in allocating the area to the crop.

The fitted regression coefficient of castor area in Telangana is less than one during the three periods each. It reveals a decreasing tendency in area under castor crop. So, the average annual growth over the previous period is decreasing. This decrease is an insignificant .The coefficient of time is 0.19 during the period I, nearly 0.77 percent during the period II and 0.16 during the period III. This is insignificance .Beacause of low demand for the castor production is the main reasons to decrease in area under the castor crop.

The estimated coefficient of variation in Telangana is 31.23 percent, 15.32 percent and 26.35 percent in periods I, II and III respectively. It reveals that, the instability in castor area was low in almost three periods. The highest variation is noticed during pre-green revolution and green revolution period and less variation is noticed during the post-green revolution and TMO's period. With respect to the coefficient of variation the stability in castor area is appreciable.

In the case of castor production, the compound growth rate is negative during the period I. This is –33.78 in pre-green revolution and green-revolution period, because of lack of new technology. Later periods, i.e., post-green revolution and TMO's period and over all period, a positive growth rates were noticed. It is 4.23 percent in period II and 27.05 percent in period III. It is inferred that, this positive compound growths in castor production may be possible though the new technology and TMO's operations.

The calculated regression coefficients of castor production are less than one (0.6622) during pre-green revolution and green revolution period. It reveals that a decreasing tendency in production under castor crop. This decrease is not significant decrease. During the post-green revolution and TMO's period, a significant increase (0.66) in castor production was recorded. In over all period, a significant increase in castor production was recorded. It is 1.27. Finally, it is concluded that the new technology and TMO's operations were affect the castor production during the last two periods.

Observing the coefficient of variation, 35.20 percent, 35.51 percent and 39.35 percent of instability was recorded in period I, II and III respectively. Highest percentage was recorded in period III, The less percentage of variation was noticed in period I. During the period II, the variation in castor production is 35.51 percent. Observing the compound growth rate under castor yield in Talangana, a positive growth rates were established during the three periods. These are 73.22 percent, 8.09 percent and 108.73 percent in periods I, II and III respectively. The highest growth rate was noticed in period III, i.e., over all period. Implementation of new agricultural technology, use of high yielding varieties of seeds, fertilizers and pesticides, favorable weather conditions and government attitudes may leads to positive growth rates in all the three periods under castor yield.

The average annual increase over the previous period is maximum (2.09) in period III. This increase is a

significant increase. Similarly, during the first and second periods, a significant increase was observed (1.73 and k1.08). This significant annual increase may be due to high yielding varieties and use of pesticides and fertilizers and favorable weather conditions etc. From the above analysis, it is inferred that the new agricultural technology is influencing the castor yield. The highest instability in yield under castor crop was recorded during third period (37.38). Over 31 percent of variation in castor yield was recorded during the period II. The instability in castor yield is 28.73 percent in pre-green revolution and green revolution period.

To study the technology effect on Castor crop, equation (given in methodology) was developed and it was estimated with the help of collected data. The estimated coefficients of the variables, area and time in Telangana were given in table 1.2.

THE ESTIMATED REGRESSION COEFFICIENTS OF CASTOR IN TELANGANA-1.2

Parameter	Estimation	SE	t	R^2	F
no=20					
α	0.6689	4.0036	2.5525*	0.2977	3.6038*
β	0.8026	0.3145	0.2608		
λ	0.0039	0.0148			
no=20					
α	-17.3179	8.4219		0.4085	5.8695*
β	2.2599	0.6746	3.3502*		
λ	0.0260	0.0190	1.3685		
no=40					
α	-5.1696	3.9655		0.3399	9.5275*
β	1.2569	0.3142	4.0003*		
λ	0.0189	0.0063	3.0164*		

* : Significant at 5% Probability level

From the above table 1.2, it is observed that the value of the coefficient of area (β) is (0.8026) positive. It is observed that, there is a positive relationship between castor area and production during the pre-green revolution and green revolution period. For every one hectare increase in castor area will raise the castor production by 0.80 tones. From t-test statistic, it is noticed that the increase in castor production is a significant increase. The coefficient value of λ is (0.0039) positive. It is noticed that the variable time is influencing castor production positively, in Telangana. It reveals that every year, the castor production may be increased by 0.4 percent. This increase is not significant. From the table, the multiple correlations co-efficient is 0.2977. It is noticed that the collective effect of all endogenous variables on exogenous variable, production of castor, is nearly 30 percent. Almost 30 percent of variation in castor production was observed by both the independent variables. The collective effect of all independent variables on castor production is significant. The intercept term is (0.6689) positive.

During the post-green revolution and TMO period, the estimated coefficient of area under castor is (2.2599) positive and it is significant at 5 percent probability level. It means there exists a positive relationship between castor area and its production. For every one hectare increase in castor area will increase the castor production by 2.26 tones. The coefficient of time is (0.0260) positive, but it is not significant. i.e., every year the castor production is increased by 2.6 percent. But this increase is not significant. This may be happening due to lack of technology. The multiple correlation coefficients R^2 is 0.4085. Nearly 41 percent of variation in castor production was observed. It expresses that the collective effect of all independent variables on dependent variable, castor production, during the period II is 41 percent. From F-test statistic, this collective effect is found to be significant. The intercept value is (-17.3179) negative.

Observing the estimates of the variables during the period III, in Telangana, it is found that the coefficient of area, i.e., β value is (1.2569) positive. It means, a positive relationship was established with castor production during the period III, i.e., for every one hectare increase in castor area will increase the castor production by 1.26 tones. It is observed that the increase in castor production is a significant increase. The value of time variable (λ) is (0.0189) positive. It reveals that every year the castor production may be increased by 2.0 percent. This increase is significant. The collective effect of independent variables, castor area and time period, is shown by the value of R^2. The value of R^2 is 0.3399. It shows almost 34 percent of variation is castor production during the period III. This collective effect is a significant effect on production. The intercept value is (-5.1696) negative.

Comparing the estimates of the variables in both the periods, it is noticed that the area under the crop (β) is an influencing factor on Castor production in Telangana. Hence, the area responds Castor production. The variable time established a positive and significant relationship with output in both periods. During the overall period, two variables show positive and significant effect on Castro production. This may leads that there exists some technological effect on output

In regression analysis it frequently happens that the dependent variable is influenced, not only by variables which can be readily Quantified on some well – defined scale, but also by variables which are essentially Qualitative in nature. Since such Qualitative variables usually indicate the presence or absence of a "Quality" or an attribute. Such variables or attributes is by constructing artificial variables which take on values of 1 or 0, 0 indicating the absence of an attribute and 1 indicating the presence of that attribute. Variables, which assume such 0 and 1 values, are called dummy variable. Alternative names are indicator variable, binary variable, categorical variables, Qualitative variable and dichotomous variable. Here, to determine the net effect of technology on castor production, a dummy variable 'D' was introduced in the Cobb – Douglas model, during the two periods, i.e., Pre – green revolution and green revolution period and Post – green

revolution and TMO's period. The dummy variable takes "zero" during the period 'One' and 'one' during the period two. It the value of 'δ' value is low positive expresses that, the technological effect on output is absent. If the value of 'δ' is negative/low value, the technological influence may be negative on castor's output. It 'δ' value is very low; it is a negligible effect of technology. If the 'δ' value is negative and significant, the impact of new technology was not observed on crop production.

The equation (6) was fed with the data relating to Castor crop for Telangan. The coefficients from the estimated equations were given in table 5.5.

THE ESTIMATED COEFFICIENTS OF CASTOR-1.3

	no=40					
Telangana	α	-4.9883	4.0873		0.3410	6.2091
	β	1.2440	0.3228	3.8534*		
	λ	0.0163	0.0125	1.2959		
	δ	0.0670	0.2788	0.2402		

The coefficient of time, i.e., the value of λ in Telangana is (0.0163) positive. It means, every year, castor output is increased by 0.0163 tones. But this increase is not significant, observed by t-test statistic. The value of land or area i.e., the value of 'β' is 1.2440. It is positive and significant at 5 percent probability level, which is proved by t-test statistic. i.e., for every one hectare increase in castor area will increase the castor output by 1.24 tones. This increase is a significant increase. The intercept value is –4.9883. It is negative. The coefficient of multiple correlation coefficients (R^2) is 0.3410. The combined effect of all independent variables on the dependent variable, castor output is 34 percent. It means 34 percent of variation in castor production was observed by the selected independent variables in the model. This combined effect is a significant effect proved by F-test statistic. The coefficient of dummy variable is positive and it is an insignificant i.e., the castor output is insignificantly influenced by the new agricultural technology. Finally, it is inferred that, its area only affects the castor production. Hence, the effect of new technology on castor output is almost negligible in Telangana.

Observing the table the Castor output is insignificantly influencing by the technology in Telangana. Hence, it is inferred that, the aggregate effect of selected independent variables on output is significant in Castor. The area's effect also significant.

CONCLUSION

In Telangana, the average annual increase of castor area, over the previous year is less than one in all the three periods of study. Lack of technology, farmer's illiteracy and adverse weather conditions may noticed negative and insignificant compound growth rate during the three periods. In case of castor production, during the period I, a negative and insignificant growth rate was observed. But due to implementation of new agricultural technology and TMO operations may record positive and significant growth rate in castor production during the period II and period III. In case of yield, during the all three periods the average annual increase of castor yield is more than one and compound growth rate is also positive and significant. Finally, it may be concluded that, the castor production and yield influenced by the new agricultural technology in Telangana. The instability in castor area is more in period I than period II. Owing to implementation of new agricultural technology, the stability in castor area is increased in period II. But in case of production and yield, the new technology is adversely affecting the castor's crop. So, the production instability and yield instability was increased during the IInd period in Telangana To study the technological changes in Castor crop, the Cobb-Douglas production function has been adopted for the two periods separately. The estimated coefficients were tested by t-test statistic and the collective effect of explanatory variables was tested by F-test statistic.

The effect of castor area on castor's production is positive and significant. i.e., its area positively influences the castor production. The coefficient of time is also positively influence the castor production. But this effect is not significant effect. The same trend was observed during the period II. During the period III, the area and time variables both are effect the castor production positively and this effect is significant effect. So, the proper utilization of new technology may affect the castor production significantly. Observing the multiple correlation coefficients (R^2), the aggregate effect is significant during all the three periods. The values are 29.77 percent, 40.85 percent and 33.99 percent during the three periods respectively. Therefore, it is inferred that, the explanatory variables are significantly influencing the castor production in all the three periods.

To determine the net effect of technology on oilseeds production, a dummy variable was introduced in the chapter. The dummy variables take the values 'zero' and 'One' respectively for the periods I and II. The equation (6) was fed with the data and the results were analyzed accordingly. The effect of castor area on castor's production is positive and significant. i.e., its area positively influences the castor production. The coefficient of time is also positively influence the castor production. But this effect is not significant effect. The same trend was observed during the period II. During the period III, the area and time variables both are effect the castor production positively and this effect is significant effect. So, the proper utilization of new technology may affect the castor production significantly. Observing the multiple correlation coefficients (R^2), the aggregate effect is significant during all the three periods. The values are 29.77 percent, 40.85 percent and 33.99 percent during the three periods respectively. Therefore, it is inferred that, the explanatory variables are significantly influencing the castor production in all the three periods. Hence, it is observed that, the technology is a major determinant of castor in Telangana.

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