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Economic efficiency of chickpea farms in Andhra Pradesh and Telangana

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ABSTRACT

The technical (TE), economic (EE) and allocative (AE) efficiencies of chickpea farms in Andhra Pradesh and Telangana states using production and cost frontier model were estimated. The technical and economic efficiencies of chickpea farms and their determining factors were also estimated. It was found that on an average farmers were able to obtain only 27.43 per cent of the potential output from a given combination of production inputs. The AE and EE of farms were 89.12 and 24.98 per cent respectively. Larger landholding farms were technically and economically more efficient compared to other farming groups. Formal education and farm experience had a significant relationship with TE and EE and extension services had positive and significant relationship with AE. Availability of the new technology and age of the farmers showed no significant relationship with TE, EE and AE of the chickpea farms in the study area.

Keywords: Chickpea; farm efficiencies; rainfed area; output

INTRODUCTION

In India chickpea holds the major share in total area and production of pulses. In recent past much emphasis has been given on the development and adoption of niche-specific new technologies (improved short duration seed varieties with drought and disease resistance, pesticides, farm machinery etc) in chickpea crop for increasing the production and productivity to meet the rising domestic and export demand (Suhasini et al 2009). The adoption of improved technologies was more than 90 per cent particularly in undivided Andhra Pradesh (Kumara Charyulu et al 2014).

At this higher level of adoption of improved technologies and rapid crop intensification there is a need to understand the farm efficiencies. The long-term and economic sustainability of any improved technology depends to a great extent on the higher farm efficiencies. The effective exploitation of the technology is measured by estimating the individual farm efficiencies as they are the performance indicators which assist in understanding the level of technical and economic efficiencies of the chickpea farms. The main objectives of the study were to estimate the parametric stochastic frontier production and cost function, technical, allocative and economic efficiencies and determinants of efficiencies of chickpea farms.

For the selected study rain-fed regions in Telangana and Andhra Pradesh states were purposively selected based on significant growth rate in area, production and yield under chickpea during the last three decades. Two districts namely Mahabubnagar and Kurnool were selected in Telangana and Andhra Pradesh respectively for the study. By using multistage stratified proportionate random sampling technique two Mandals and four villages from each district were selected based on highest acreage under chickpea crop for last three consecutive years. In Kurnool district Uyyalawada and Koilakuntla and in Mahabubnagar district Alampur and Manopad Mandals were selected. In Uyyalawada Mandal, Injeadu and Uyyalawada; in Koilakuntla Mandal, Bheemini Padu and Gulladurthy; in Manopad Mandal, Pullur and Undavalli and in Alampur Mandal, Alampur and Kyatoor villages were selected. Based on the landholding size and cultivation of chickpea, a proportionate sample was drawn from the marginal, small, medium and large farm sizes. From each village 40 chickpea growing households were selected making a total of 320. Primary data were collected from the respondents on various aspects like production per acre, physical inputs pattern used and the cost and price of the outputs and inputs of the chickpea farms during 2015-16.

METHODOLOGY

Estimating the farm efficiencies of chickpea farms

The efficiency of the individual farm is more important along with technology adoption for increasing production and productivity of the agricultural crop (Hayami and Ruttan 1985). In the present study stochastic frontier production function was adopted to estimate the efficiency of the selected chickpea cultivating farms. This production function indicates the average level of output that can be produced from a given level of inputs (Schmidt 1986) and also assist in understanding the efficiencies of the farms. The stochastic frontier production model incorporates a composed error structure with a two-sided symmetry and a one-sided component. The one-sided component reflects inefficiency while the two-sided error captures the random effects outside the control of the production unit including measurement errors and other statistical noise typical of empirical relationships.

Suppose a farm has a production plan (Y^0, X^0) where y^0 is the set of outputs and X^0 represents the set of inputs; given a production function f(x) the farm is technically efficient if $y^0= f(X^0)$ and technically inefficient if $y^0 < f(X^0)$. Therefore the TE can be measured by the ratio output/input and its values vary between 0 and 1. In other words it is the ratio between actual and potential output of a production unit. If a farm is inefficient its actual output is less than the potential output. Its limits are as follows:

$$0 \leq Y^0/f \leq 1$$

Here the frontier production function defines the maximum feasible or potential output that can be produced by a production unit such as a farm given the level of inputs and technology. The actual production function can be written as:

$$Qi= f(Xi; \beta)exp(-ui) \text{ and } 0 < ui < \alpha; i= 1,2.....n \qquad (1)$$

where Qi= Actual output for the i^{th} sample (production) unit, X_i= Vector of inputs, β= Vector of parameters that describes the transformation process, f(X)= Frontier production function, ui= One-sided (non-negative) residual term

Using equation (1) above this measure can be written as:

$$TE= Qi/f (Xi; \beta)= exp (ui) \qquad (2)$$

If the production unit produces the potential output (full TE) ui is zero and it is less than zero when the production is below the frontier (less than full TE). A random noise variable Vi (independently and identically distributed normal with mean 0 and variance σv^2 can be included in the equation (1) to capture the effect of other omitted variables that can influence the output as:

$$Qi= f(Xi; \beta)= exp (vi-ui) \qquad (3)$$

This new function is known as the individual specific stochastic production frontier function. In order to estimate equation (3), the Battese et al (1989) model with exponential distribution is considered.

$$\sigma^2=\sigma v^2 + \sigma u^2 \text{ and } \gamma= \sigma u^2/\sigma^2$$

A significant σ (and γ) would indicate significant variations in the output levels. A zero value of γ would indicate that the deviations from the frontier were entirely due to the random variable and a value of one would indicate that all deviations were purely due to differences in TE across farms.

The selected production frontier model for the present study is written as below:

$$Y_i= F(X_i; \beta) \exp^E$$

$$Y_i= F(X_i; \beta) \exp(v_i - u_i)$$

$$Ln Y_i= \beta_0 + \beta_1 Ln X_{1i} + \beta_2 Ln X_{2i} + \beta_3 Ln X_{3i} + \beta_4 Ln X_{4i} + V_i - U_i$$

where Y_i= Quantity of the output per acre (q) of i^{th} farm, X_{1i}= Seed (kg) of i^{th} farm, X_{2i}= Fertilizer (kg) of i^{th} farm, X_{3i}= Human labour (man days) of i^{th} farm, X_{4i}= Machinery labour working hours of i^{th} farm, β= Vector of unknown parameters to be estimated, V_i (stochastic error term)= Random variable assumed to be independent and identically distributed as N (0, σv^2), U_i= Non-negative estimate of farm technical inefficiency

Estimation of the cost frontier function (economic efficiency)

The cost frontier approach adopted to measure the economic efficiency of the farm shows how far the farms are from full cost minimization (ie cost efficiency). In other words it explains the ability of the farm to produce observed output at minimum cost and at given input prices. As sometime a producer may be technically efficient but yet cost inefficient because he/she fails to choose the correct combination. For assessing the economic efficiency, stochastic frontier cost function was used for analysing the quantity and prices of inputs and outputs of the crop for the crop year 2015-16. The selected frontier cost function is specified as follows:

$$\text{Ln}\, C_i = \beta_0 + \beta_1 \text{ Ln } Y_i + \beta_2 \text{ Ln } X_{1i} + \beta_3 \text{ Ln } X_{2i} + \beta_4 \text{ Ln } X_{3i} + \beta_5 \text{ Ln } X_{4i} + V_i + U_i$$

where C_i= Total production cost (paid out cost) (Rs), Y_i= Output value/q of i[th] farm (Rs), X_{1i}= Cost of seed of i[th] farm (Rs), X_{2i}= Cost of fertilizer of i[th] farm (Rs), X_{3i}= Human labour wage of i[th] farm (Rs), X_{4i}= Machinery labour wage of i[th] farm (Rs), β_0= Constant; β_1 - β_5= Parameters of the cost function, Ln= Natural logarithm

The error term is composed of two elements that is:

$$ei = Vi + Ui$$

where V_i= Random error due to statistical noise eg weather, disease etc which are outside the control of the farmers, Ui= Randomness (technical inefficiency) due to farmers' socio-economic characteristics such as age, formal schooling, farm size and farming experience

In the stochastic frontier cost function, the inefficiency effect is added rather than subtracted. This is because the cost function represents minimum cost whereas the production function represents maximum output. Thus the error components have a positive sign because inefficiency increases with the cost of production (Coelli et al 2005).

Estimation of technical, allocative and economic efficiencies of farms

Farm efficiencies are considered one of the important dimensions because the output is produced by combining the scarce input resources. The success of any farm depends on the ability of the farmer to combine these scarce resources and available technology in the right proportion at the right time. Farrell (1957) was the first to propose the overall efficiency of the farm and a method to decompose the overall efficiency of a production unit into its technical, allocative and economic efficiencies.

Technical efficiency: Technical efficiency of farm *i* can be calculated with an output orientation method as the ratio of actual (observed) output relative to the potential (maximum feasible) output by using the available technology derived which is defined as follows:

$$\text{TEi} = \frac{Yi}{\bar{y}i} = \frac{Yi}{F(Xi;\ \beta)\exp\,(vi)} = \frac{E(\frac{Yi}{ui},\ xi)}{E(\frac{Yi}{ui} = 0,\ xi)} = \text{E[exp}\frac{-\text{Ui}}{\text{ei}})$$

where Yi= Observed output, $\bar{Y}i$ = Corresponding frontier output

This efficiency measure takes value between 0 and 1 with smaller ratios reflecting the greater inefficiency of the farms. Here TE measures the percentage of actual output relative to the potential output that is produced from the same set of inputs by fully efficient farms (ui= 0) with a value of one which indicates actual output equals frontier output (Ben-Belhassen and Womack 2000).

Economic efficiency: It is the ability of a farmer to produce the maximum level of output possible at a minimum cost outlay under a given technology. This economic efficiency is the product of technical and allocative efficiencies (Anyaegbunam et al 2009). The farm specific economic efficiency (EE) is defined as the ratio of minimum observed total production cost (Ci) to actual total production cost C which is defined as follows:

$$\text{EEi} = \frac{Ci}{\bar{C}} = \frac{E(\frac{ci}{ui}, yi\ ,\ xi)}{E(\frac{ci}{ui} = 0,\ yi,\ xi)} = \text{E[exp}\ (-\frac{\text{Ui}}{\text{ei}})$$

Here EE takes values between 0 and 1.

Allocative efficiency: It measures the degree of success in obtaining the best combination of inputs in producing a specified level of output having regard to the relative prices of the inputs (Adeoti 2006). Allocative efficiency is thus obtained from technical and economic efficiencies estimated as AE= EE/TE. By using this methodology the levels of TE, AE and

Table 1. Simple statistics of the selected variables in the production function

Component/acre	Observation	Mean	SD	CV	Minimum	Maximum
Output (q)	320	3.30	2.30	69.76	0.00	9.20
Seed (kg)	320	44.92	8.36	18.62	25.00	100.00
Fertilizer (kg)	320	119.94	33.08	27.58	75.00	239.22
Human labour (man days)	320	17.18	3.37	19.60	9.13	31.58
Machine labour (working hours)	320	9.34	2.66	28.42	5.00	17.00

EE of the chickpea farms at village level and farm holding-wise are calculated. Finally regression analysis was performed to find the determinants of TE, AE and EE for chickpea farms in the study area.

RESULTS and DISCUSSION

Calculation of the simple descriptive statistics of average output per acre and inputs usage pattern in chickpea crop

The average output from chickpea farms was 3.30 q/acre with marginal deviation of 2.30 and 69.76 per cent of variance (Table 1). The high variation in output was due to extreme cases of zero output in Mahabubnagar district farms and record level yields of 9.20 q/acre in Kurnool. Coming to the inputs use pattern 20-30 per cent variation was noticed in the selected sample. Much deviation was noticed in fertilizer use from 75.00 to 239.22 kg/acre. On an average 9.34 working hours of machinery, 17.18 man days, 119.94 kg of fertilizer and 44.92 kg of seeds were used per acre in chickpea cultivation in the study area. A significant difference was noticed in case of average number of human labour working hours and machine labour use which ranged between 9.13 to 31.58 man days and 5.00 to 17.00 working hours respectively per farm. This variation could be due to the reason that intensity of human and machinery labour use was different based on the landholding size.

Among the inputs, seed and fertilizer cost per unit did not show much deviation among the farms whereas the human and machinery labour wages showed a notable deviation due to labour shortage problem and higher demand for the machinery during the crop season (Table 2). The average human wages per man day varied from Rs 210.27 to 533.74 and machinery labour wages per hour between Rs 226.47 to 538.46 in the sample farms. All the selected variable costs and total cost showed a lower variation at 10-15 per cent. The average total cost of cultivation was around Rs 14,707.10 per acre. At lower side it was at Rs 9,700.00 and on the higher side it was at Rs 20,280.00 per acre with Rs 1,799.74 deviation and 12.24 per cent variance.

Estimation of frontier stochastic production and cost function

The empirical results of the stochastic production function are presented in Table 3. The model was estimated using both the OLS and maximum likelihood methods for the cross-sectional data of the chickpea cultivating farms for the crop season 2015-16. The selected independent variables fertilizer use, human labour and machine labour were statistically significant at 5 per cent level of significance except the seed variable.

The variables human labour and machine labour had a positive relationship with output suggesting that an increase in these variables would result in an increase in output level. The variables human labour (X_3) and machine labour (X_4) coefficients in the production function indicated that one unit change in

Table 2. Estimation of simple statistics for input variables cost and total cost in chickpea cultivation (Rs)

Component/acre	Number of observations	Mean	SD	CV	Minimum	Maximum
Total cost	320	14,707.10	1,799.74	12.24	9,700.00	20,280.00
Seed cost/kg	320	39.39	5.94	15.07	36.00	50.00
Fertilizer cost/kg	320	25.10	0.49	1.95	25.00	33.33
Human labour wage/man day	320	400.23	51.48	12.86	210.27	533.74
Machinery labour/h	320	343.73	48.29	14.05	226.47	538.46

these variables showed 11.75 and 7.59 per cent increase in output level respectively. However the variable fertilizer (X_2) coefficient was negative ie -3.86 implying the law of diminishing returns in production that an increase in fertilizer application increased the output level up to some point but had negative effect beyond that. This implies that chickpea crop output declined by 3.86 per cent for every one kg increase in fertilizer as it is a leguminous crop and demand for fertilizers was less.

From OLS estimation it is clear that the selected variables in the production function were able to address the variance in the chickpea output by 47.78 per cent. The left over variance in the output was explained by the other variables which were not taken in the model. In the production function, gamma was estimated as 0.9977 which implied that 99.77 per cent of the (total variation) difference between actual and potential output was primarily due to the technical inefficiency of the farms. The parameter lambda was

Table 3. Maximum likelihood estimates of the parameters of stochastic frontier production function

Variable	OLS production function		Frontier production function (normal/half normal)	
	Coefficient	P>|t|	Coefficient	P>|z|
Constant	-29.87039 (5.246309)	0.000	-5.736711 (3.21571)	0.074
Seed (X_1)	-0.5610185 (1.031272)	0.587	-0.1860077 (0.5108658)	0.716
Fertilizer (X_2)	-3.861766 (0.7649811)	0.000*	-0.7799696 (0.287791)	0.007*
Human labour (X_3)	11.75787 (0.9497691)	0.000*	2.880122 (0.8064561)	0.000*
Machine labour (X_4)	7.599617 (0.6100568)	0.000*	2.009363 (0.6170918)	0.001*
σ_u	-	-	4.687589 (0.1925836)	-
σ_v	-	-	0.2202013 (0.057338)	-
Gamma	-	-	0.997798	-
Lambda	-	-	21.28775 (0.2063823)	-
Log likelihood	-	-	-735.7472	-
R^2	0.4778	-	-	-
Number of observations	320	-	320	-
Prob >chi^2	-	-	0.0025	-

Figures in parentheses indicate standard error, *Significant at 5 per cent level of significance

Table 4. Maximum likelihood estimates of the parameters of stochastic frontier cost function

Variable	OLS production function		Frontier production function (normal/half normal)	
	Coefficient	Significance	Coefficient	Significance
Constant	4.094 (1.21)	0.001	5.740 (0.809)	0.000*
Out put	0.017 (0.001)	0.000*	0189 (0.001)	0.000*
Seed cost/kg	0.0142 (0.042)	0.735	0.0515 (0.039)	0.193
Fertilizer cost/kg	1.070 (0.342)	0.002*	0.3737 (0.225)	0.098**
Human labour wage/man day	0.103 (0.047)	0.03*	0.1712 (0.044)	0.000*
Machinery labour wage/h	0.236 (0.047)	0.000*	0.226 (0.050)	0.000*
σ_u	-	-	0.054 (0.008)	-
σ_v	-	-	0.1471 (0.013)	-
Gamma	-	-	0.877	-
Lambda	-	-	2.680 (0.019)	-
Log likelihood	-	-	279.860	-
R^2	0.3285	-	87.89	-
Number of observations	320	-	320	-
Prob >chi^2	-	-	0.00	-

Source: Primary survey 2015

Figures in parentheses indicate standard error, **Significant at 1 per cent level of significance, *Significant at 5 per cent level of significance greater than one. Such a result according to Tadesse and Krishnamoorthy (1997) indicated a good fit for the model.

For estimating the parameters in stochastic frontier cost function, both OLS and maximum likelihood methods were used. The estimated coefficients of the frontier cost function are presented in Table 4. The constant term which was 5.74 was significant at 1 per cent level of risk. This was because the expenses on fixed factors of production such as land, farm machinery, tools etc continued to be incurred whether production took place or not.

The coefficients of all the factors included in the function were positive implying that an increase in the use of any of the factors increased the total cost of production. The coefficients of the seed cost (0.05), fertilizer cost (0.37), human labour cost (0.17) and machine labour cost (0.22) were positive and each was significant at 5 per cent significance level. This implies that one unit increase in these selected individual input costs by keeping other variables at constant resulted in 5, 37, 17 and 22 per cent rise respectively in cost of production of chickpea in the selected sample. The gamma coefficient 0.8778 was also significant at 1 per cent. Here the implication of the value of gamma was that 87.78 per cent of the total variation in production cost was due to the economic inefficiency of the selected farms.

Estimation of individual farm efficiencies

In Table 5 village-wise technical, allocative and economic efficiencies of the chickpea farms are presented. The mean TE for selected sample farms was around 27.43 per cent which implied that on an average farmers were able to obtain only 27.43 per cent potential output from a given combination of production inputs. The AE and EE for the total sample were around 89.12 and 24.98 per cent respectively. On comparing the efficiencies among the Kurnool and Mahabubnagar sample farms a significant difference was noticed in technical and economical efficiencies. Technical efficiency was higher at 41.3 per cent in Kurnool district and only 13.56 per cent in Mahabubnagar district. Economic efficiency was 38.17 per cent in Kurnool and only 11.8 per cent in Mahabubnagar district. There was a marginal difference in allocative efficiency which was 91.27 per cent in Kurnool and 86.97 per cent in Mahabubnagar district.

Village level also followed the same pattern. Lower technical efficiency particularly in Mahabubnagar was due to the poor implementation of the package of practices and sustainable measures, failure in providing protected irrigation and the excess use of the fertilizers. The lowest variation in allocative efficiency may be due to uniformity in the input prices across the selected study area. The average technically efficient farmer required 42.24 per cent cost saving to attain the status of the most efficient farmer ie (1-0.2743/0.4749) 100 while the lowest performing farmers would need 76.41 per cent ie (1-0.112/0.4748) 100 cost saving to become the most efficient farmer. In the villages of Kurnool district the cost of production was in the range of Rs 3,399.58 to 4,772.20 per quintal where as in Mahabubnagar it was much higher at Rs 10,602.15 to 15,124.50 per quintal due to lower yield levels and crop failure in some cases.

The data given in Table 6 show the farm efficiencies of the chickpea farms according to the landholding size in the study area. Large farm holdings were technically and economically more efficient by 34.73 and 30.84 per cent respectively than the other farming groups. Highest AE was noticed in marginal farms (90.1%) which indicated the efficient use of the inputs in the production process. Small and medium farmers had more or less similar technical, allocative and economic efficiencies. On comparing the cost of production data of the chickpea crop across the landholding size, the landholding size showed an inverse relationship with the cost of production of chickpea ie as the landholding increased the cost of production gradually declined.

It is inferred that despite the use of the same technology (short duration improved variety) by the different categories of farmers, higher yield levels were obtained by the larger farmers followed by small and medium farmers. Lower yield levels were obtained by the marginal farmers. This shows that the poor resource allocation such as maintenance of the crop and lack of protected irrigation resulted in lower yield levels in case of marginal and small farmers. In total 88.44 per cent of the chickpea farms were below 60 per cent of technical efficiency and only 0.93 per cent were 90-100 per cent efficient technically. Majority (99.06%) of the farms had allocative efficiency above 70 per cent. In case of economic efficiency around 91.87 per cent of the chickpea farms were below 60 per cent.

Table 5. Technical, allocative and economic (mean) efficiencies in chickpea crop in the selected villages

Village	Technical efficiency	Allocative efficiency	Economic efficiency	Cost of production/q (Rs)
Injeadu	0.34	0.89	0.31	4,771.48
Uyyalawada	0.47	0.92	0.44	3,399.58
Bheemini Padu	0.41	0.91	0.38	4,047.17
Gulladurthy	0.41	0.92	0.38	4,772.20
Pullur	0.11	0.89	0.10	15,124.50
Undavalli	0.12	0.86	0.10	13,984.95
Alampur	0.20	0.87	0.17	10,602.15
Kyatoor	0.10	0.84	0.08	14,544.87
Kurnool	0.41	0.91	0.38	4,247.61
Mahabubnagar	0.13	0.86	0.11	13,564.12
All	0.27	0.89	0.24	8.905.86

Source: Primary survey 2015-16

Table 6. Estimation of technical, allocative and economic efficiencies in chickpea crop across different categories of the farmers

Landholding size	Technical efficiency	Allocative efficiency	Economic efficiency	Cost of production/q (Rs)
Marginal	0.24	0.90	0.22	10,258.92
Small	0.28	0.88	0.26	8,996.10
Medium	0.26	0.88	0.23	7,635.51
Large	0.34	0.87	0.30	5,319.48
Total	0.27	0.89	0.24	8,905.86

Table 7. Determinants of technical efficiency, allocative efficiency and economic efficiencies

Variable	Technical efficiency	Allocative efficiency	Economic efficiency
Constant	-7.805 (1.083)**	2.591 (0 .223)***	-7.911 (1.07)***
Age of the farmer	0.008 (0.016)	-0.003 (0.003)	0.007 0.0166)
Formal education (in yrs)	0.055 (0.035)*	-0.002 (0.007)	0.054 (0.035)*
Experience in chickpea cultivation (years)	0.0318 (0.021)*	-0.004 (0.004)	0.031 (0.021)*
Extension services (Y/N)	0.273 (0.365)	0.106 (0.072)*	0.280 (0.363)
Availability of short duration variety (new technology) (Y/N)	-0.232 (0.464)	-0.068 (0.095)	-0.260 (0.461)
Dummy variables			
Uyyalawada	4.703 (0.739)***	-0.324 (0.152)***	4.665 (0.735)***
Bheemini Padu	5.941 (0.740)***	0.103 (0.152)	5.928427 (0.735)***
Gulladurthy	6.064 (0.736)***	0.234 (0.151)	6.071017 (0.731)***
Pullur	5.699 (0.745)***	-0.160 (0.153)	5.655 (0.741)***
Undavalli	2.161 (0.725)***	-0.384 (0.149)***	2.106 (0.721)***
Alampur	6.436 (0.733)***	0.163 (0.151)	6.422 (0.728)***
Kyatoor	1.35 (0.732)***	-0.452 (0.151)***	1.294 (0.727)

***Significant at 1 per cent level of significance, **Significant at 5 per cent level of significance,
*Significant at 15 per cent level of significance, Figures parentheses indicate the standard error

Determinants of technical, allocative and economic efficiencies

Apart from the traditional inputs (capital and labour) other factors may determine the technical, allocative and economic efficiency of the farms to some extent (Kalirajan 1991). In the present study to find out the determinants of the differences in efficiency of the selected farm variables such as age of the farmer, experience in chickpea cultivation, formal education in years, access to extension services and availability of the short duration variety (new technology) were selected. Table 7 presents the details of determinants of technical, allocative and economic efficiencies of chickpea farms in selected study area.

It was found that age of the farmers was positive but not significant for technical, allocative and economic efficiencies. The results are similar with those of Onyeweaku et al (2004) who showed that age was a positive but not significant factor in technical efficiency. Formal education of the farmers and experience in chickpea cultivation were positively and significantly related to technical and economic efficiencies at 5 per cent risk level. The finding is contrary to the observations of Rahman and Umar (2009) and Onyenweaku and Effiong (2005). The education of the farmers showed no significant relationship with allocative efficiency in production as also reported by Onu et al (2000). Extension services were positively and significantly related to allocative efficiency whereas there was no significant relationship of extension services with technical and economic efficiencies. Availability of the short duration cultivars (new technology) showed no significant relationship with technical, allocative and economic efficiencies. Thus formal education and chickpea cultivating experience had a significant relationship with technical and economic efficiency and extension services had positive and significant relationship with allocative efficiency. The availability of the new technology and age of the farmers had no significant relationship with technical, allocative and economic efficiencies of chickpea farms.

CONCLUSION

It was found that chickpea cultivating farms attained lower technical and economic efficiencies whereas allocative efficiency of the farms was at satisfactory level. Significant variation in technical and economic efficiencies were noticed across the different landholdings and between selected districts. The differences in input quantity used, failure to provide protective irrigation, deficiency of organic matter and micronutrients and poor maintenance of the crop resulted in poor farm efficiencies. The low variation in allocative efficiency may be due to uniformity in the input prices across the study area.

Landholding size showed a direct relation with the economic efficiency of farms and was inversely related to allocative efficiency. Formal education and chickpea cultivating experience had a significant relationship with technical and economic efficiencies and extension services had positive and significant relationship with allocative efficiency. Availability of the new technology and age of the farmers showed no significant relationship with farm efficiencies.

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