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Factors affecting yield gap in groundnut production in Mahabubnagar district of Telangana

A Jyothirmai, GP Sunandini and K Suhasini

Abstract
Mahabubnagar district had major area under groundnut cultivation in Telangana state with 60 percent of the groundnut production in the state. For the study, a sample of 40 farmers each from marginal, small and large categories were selected. Total 120 groundnut farmers were taken as the sample for the study. Cobb- Douglass production function was used to analyze the various factors effecting yield gap in groundnut. The results implied that for the average farmers, 1 percent decrease in the seed gap (Sg), phosphorus gap (Pg), potassium gap (Kg) and plant protection chemicals gap (PPCg) keeping the other variables constant would decrease the Yield Gap by 0.15, 0.54, 0.29 and 0.34 percent, respectively. 1 percent increase in farm size, education and experience in groundnut farming keeping the other variables constant would decrease the Yield Gap by 0.04, 0.04 and 0.001 percent, respectively. It was also found that 1 percent decrease in nitrogen gap and hired human labour gap would increase the Yield Gap by 0.20 and 0.01 percent, respectively.

Keywords: Yield gap, production function, contributory factors, variables of production

Introduction
There is a need for identifying the gaps and constraints which restrict the productivity in farmer fields. By identifying and removing these gaps, the productivity from the existing land can be increased by adopting new technologies.

The maximum area under groundnut cultivation is concentrated in Mahabubnagar district of Telangana state therefore; Mahabubnagar district was selected purposively for the study. Four villages viz. Uppununthala, Penmilla, Kalwakole and Vennacherla from two mandals viz., Peddakothapally and Uppununthala mandals from Mahabubnagar district were selected purposively on the basis of maximum area under groundnut cultivation as per secondary data obtained from Directorate of Economics and Statistics, Hyderabad. From the selected villages, the list of groundnut cultivators was obtained from the mandal agricultural office of the selected mandals.

For the study, a sample of 30 from each village i.e. marginal (10), small (10) and large (10) farmers were selected. Total 120 farmers were selected from four villages. The top 10 percent of the farmers (12) with highest yields were categorized into progressive farmers, and remaining farmers (108) were considered as average farmers.

The data were collected by personal interview by using a pre-tested schedules for groundnut cultivators. Kadiri-6 (K-6) is the popular variety grown in Mahabubnagar district and the same variety was taken for the study.

Methodology
In order to know the factors contributing identified yield gaps in groundnut the Regression analysis was attempted. In this study OLS estimates of Cobb-Douglas production function had been obtained to ascertain the contribution of each variable to the yield gaps. The variables included in the model were farm size (ha), seed gap (kg/ha), phosphorus gap (kg/ha), potassium gap (kg/ha), plant protection chemicals cost gap (Rs/ha), hired human labour gap (man days), education (literate/illiterate) and experience in groundnut farming (number of years) of the farmers in groundnut cultivation.

Functional analysis
Ordinary least square estimate of Cobb-Douglas production function was used to examine the contribution of each identified factor to the yield gap.

$Y_g = a_0 F_g^{b1} S_g^{b2} N_g^{b3} P_g^{b4} K_g^{b5} PPC_g^{b6} HHL_g^{b7} E_{g8} EXP_g^{b9} u$

Where,
Log Yg = Yield gap (kg/ha)
a_0 = Intercept
Log X_1 = Farm size (kg/ha)
Log X_2 = Seed gap (kg/ha)
Log X_3 = Nitrogen gap (kg/ha)
Log X_4 = Phosphorous gap (kg/ha)
Log X_5= Potassium gap (kg/ha)
Log X_6= Plant protection chemicals gap (Rs/ha)
Log X_7 = Labour gap (man days/ ha)
X_8 = Education (literate/illiterate)
Log X_9 = Experience in groundnut farming (no. of years)
b1, b2, b3, b4, b5, b6, b7, b8 and b9 = Partial elasticity coefficients
u = Error term

Results and Discussion

Table 1: Difference in key factors between average farmers and progressive farmers

Particulars	Average Farmers	Progressive farmers	Difference	% increase
Seed (kg/ha)	86.26	99.16	12.90	14.95
Nitrogen (kg/ha)	52.91	60.31	7.40	13.98
Phosphorous (kg/ha)	71.00	80.62	9.62	13.54
Potassium (kg/ha)	48.00	52.25	4.25	8.85
Hired human labour (Man days)	45.50	43.21	-2.29	-0.05
Plant protection chemicals (Rs/ha)	2217.40	2906.25	688.85	31.06

In functional analysis of yield gap the gaps like seed gap, phosphorus gap, potassium gap, plant protection chemicals gap, hired human labour gap indicate the difference between the input use of progressive farmers and sample farmers. The estimated value of the regression coefficients along with the standard errors for the yield gap of groundnut had been presented in table 2.

From the table 2, it could be noted that in case of marginal farmers the regression coefficients for the seed gap, phosphorus gap, potassium gap and plant protection chemicals gap were positive and significant at 1 percent, 5 percent, 1 percent and 10 percent level of significance, respectively. The results implied that 1 percent decrease in the seed gap and phosphorus gap, potassium gap and plant protection chemicals gap keeping the other variables constant, would decrease the Yield gap by 0.37, 0.18, 0.24 and 0.19 percent, respectively. The Regression coefficient for education was negative and showing 1 percent level of significance, indicated that 1 percent increase in education level would decrease the Yield gap by 0.06 percent.

Table 2: Contributory factors for the yield gap in groundnut

Particulars	Marginal farmers	Small farmers	Large farmers	Pooled farmers
Regression coefficients				
Farm size	-0.0176 (0.0354)	-0.0281 (0.0503)	-0.0400 (0.0496)	-0.02927** (0.1124)
Seed gap (Sg)	0.3704*** (0.2016)	0.3267*** (0.0473)	0.2044** (0.0399)	0.153568*** (0.037837)
Nitrogen gap (Ng)	-0.02063 (0.12312)	-0.0784* (0.4338)	-0.0168 (0.0352)	-0.20656*** (0.23681)
Phosphorous gap (Pg)	0.1896** (0.0431)	0.2019*** (0.0010)	0.4064*** (0.0385)	0.5423* (0.0007)
Potassium gap (Kg)	0.2439*** (0.1439)	0.3575** (0.0286)	0.7342*** (0.1557)	0.2967*** (0.0473)
Plant protection chemicals gap (PPCg)	0.1931* (0.1868)	0.2250 (0.0319)	-0.0531 (0.0434)	0.3423* (0.0007)
Hired human labour gap (HHLg)	-0.0178 (0.0354)	-0.0518 (0.1665)	0.0424 (0.1272)	-0.0134* (0.0424)
Education	-0.0614*** (0.0507)	-0.0421 (0.0434)	-0.0423* (0.0422)	-0.1018 (0.0107)
Experience in Groundnut farming	-0.0175 (0.0351)	-0.0404 (0.0425)	-0.0018*** (0.0007)	- 0.0206* (0.1231)
Intercept	10.09	6.59	8.90	18.90
R^2	0.73	0.75	0.78	0.82

Regression coefficients for farm size and experience in groundnut farming were also negative, indicated that 1 percent increase in farm size and experience in groundnut farming would decrease the Yield gap by 0.02 percent. Regression coefficients for the hired human labour gap and nitrogen gap were turned negative and showed that 1 percent decrease in hired human labour gap and nitrogen gap would increase the Yield gap by 0.01 and 0.02 percent, respectively. It was also found that coefficient of multiple determination i.e., R^2 was 0.73 which indicates that 73 percent variation in the yield gap for marginal farmers were accounted by the explanatory variables included in the functional analysis.

From the table 2, it was found that in case of small farmers, the regression coefficients for the seed gap, phosphorus gap and potassium gap were positive and significant at 1 percent, 5 percent, 1 percent level of significance, respectively. The results implied that 1 percent decrease in seed gap, phosphorus gap and potassium gap keeping the other

variables constant, would decrease the Yield gap by 0.32, 0.20 and 0.35 percent, respectively. The regression coefficient for the plant protection chemicals gap was also positive and indicated that 1 percent decrease in plant protection chemicals gap keeping the other variables constant, would decrease the Yield gap by 0.22 percent. The regression coefficients for farm size, education and experience in groundnut farming were turned negative and showed that 1 percent increase in these variables would decrease the Yield Gap by 0.02, 0.04 and 0.04 percent, respectively. The regression coefficients for nitrogen gap hired human labour gap were turned negative and nitrogen gap is significant at 10 percent level of significance, indicated that 1 percent decrease in nitrogen gap and hired human labour gap would increase the Yield gap by 0.07 and 0.05 percent, respectively. It also found that coefficient of multiple determination i.e., R^2 was 0.75 which indicates that 75 percent variation in the yield gap for small farmers were accounted by the explanatory variables included in the functional analysis.

From the table 2, it was found that in case of large farmers the regression coefficient for the seed gap, phosphorus gap and potassium gap were positive and significant at 5 percent, 1 percent and 1 percent, respectively. The results implied that 1 percent decrease in seed gap, phosphorus gap and potassium gap keeping the other variables constant, would decrease the Yield gap by 0.20, 0.40 and 0.73 percent, respectively. Regression coefficient for the hired human labour gap was also positive and showed that 1 percent decrease in hired human labour gap would decrease the Yield gap by 0.04 percent. The regression coefficients for farm size, education and experience in groundnut farming were turned negative and experience in groundnut farming was significant at 1 percent level of significance and showed that 1 percent increase in these variables would decrease the Yield Gap by 0.04, 0.04 and 0.001 percent, respectively. The regression coefficients for nitrogen gap and plant protection chemicals gap were turned negative and implied that 1 percent decrease in these gaps would increase the Yield Gap by 0.01 and 0.05 percent, respectively. It also found that coefficient of multiple determination i.e., R^2 was 0.78 which indicates that 78 percent variation in the yield gap for large farmers were accounted by the explanatory variables included in the functional analysis.

From the table 2, it was found that in case of pooled farmers the regression coefficient for the seed gap, phosphorus gap, potassium gap, plant protection chemicals gaps were positive and significant at 1 percent, 10 percent, 1 percent and 10 percent level of significance. The results revealed that 1 percent decrease in these variables would decrease the Yield Gap by 0.15, 0.54, 0.29 and 0.34 percent, respectively (Taphee and Jongur 2014) [6]. The regression coefficients for farm size, education and experience in groundnut farming were turned negative and experience in groundnut farming was significant at 10 percent level of significance and showed that 1 percent increase in these variables would decrease the Yield Gap by 0.04, 0.04 and 0.001 percent, respectively. The regression coefficients for the nitrogen gap hired human labour gap were turned negative at 1 percent and 10 percent level of significance, respectively, indicated that 1 percent increase in the nitrogen gap and hired human labour gap would decrease the Yield Gap by 0.20 and 0.01 percent, respectively. It also found that coefficient of multiple determination i.e., R^2 was 0.82 which indicates that 82 percent variation in the yield gap for average farmers were accounted by the explanatory variables included in the functional analysis.

Conclusion

The regression analysis for identifying factors influencing Yield Gap revealed that decrease in seed gap, phosphorus gap, potassium gap, plant protection chemicals gap and increase in farm size, education and experience in groundnut farming would decrease the Yield Gap. It was also found that increase in nitrogen gap and hired human labour gap would decrease the Yield Gap. To reduce the Yield gap excessive application of nitrogen should be avoided by the average farmers and recommended dosages of seed, phosphorus, and potassium should be applied. As they were unaware about the impact of fertilizers they were neglecting P and K as they cost high and going for more nitrogen as it costs low. Increase in hired labour gap would reduce the yield gap and it also reduces the cost of cultivation hence it can be replaced by other measures such as herbicides for weeding, labor-saving machinery i.e. threshers for stripping, seed drills for sowing etc. Increase in education and experience would also decrease the Yield Gap, hence training programmes and extension support is required to bridge these gaps.

From the above results it can be concluded that farmers were using less amounts of seed, phosphorus, potassium, and plant protection chemicals and using excessive amount of nitrogen than the recommended dosage. Education and experience levels were also low for the average farmers compared to progressive farmers. Elimination of these gaps may result in higher yields for the average farmers.

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