Agric. Sci. Digest., 39(1) 2019: 8-14
Print ISSN:0253-150X / Online ISSN:0976-0547

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

# Price and non-price decision making factors of groundnut production in Karnataka: evidence from vector error correction model#

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Received: 09-10-2018 Accepted: 13-02-2019 DOI: 10.18805/ag.D-4835

## ABSTRACT

The study was conducted in Karnataka state with an objective to assess the decision making factors in land allocation sustainability of groundnut production. The results of the coefficients of area response of groundnut indicated that the total rainfall had exerted significant positive influence on current year's area of groundnut in Mysore division and Karnataka. The coefficients of production response of groundnut indicated that the lagged production had exerted significant negative influence on current year's production of groundnut in Bangalore, Gulbarga and Karnataka. The result showed that long run relationship existsed between dependent and independent variable in some divisions. The results indicated that the price inelasticity of supply in both short run as well as long run all the division except some. The study concluded that non-price determinants were more significant for decision making and complementary to price for land allocation in sustainable production of groundnut in the state.

**Key words:** Co-integration approach, Decision making, Karnataka, Land allocation, VECM.

**JEL Codes**: C32, Q10, Q18, R15

## INTRODUCTION

The groundnut (*Arachis hypogaea*) is a legume crop grown mainly for its edible seeds. It is rich in essential nutrients, vitamins and dietary minerals. Hence, it constitutes an important part of our daily diet. The growth in domestic production of edible oils has not been able to keep pace with the growth in consumption and the gap between production and consumption is being met through imports (GOI, 2014). The sustainable production of groundnut depends on decision of the farmers how they allocate the land for crop than compared to competing crops. The rational farmers usually allocate the land under crops based on price and non price factors.

Even though India is the largest producer of oilseeds in the world, it is unable to meet the domestic demands of vegetable oils. Indian government was spending millions of rupees on programmes and policies of oilseeds *viz*., NODP (1985), TMV (1986), OPDP (1991) under TMO, ISOPOM (2004), NMOOP (2014) to fill the demand and supply of oilseeds gap and also to foster the growth of oilseed sectors in our country. Yet its performance was not impressive, still depends on imports of oilseeds. So, the study of decision making factors of farmers in land allocation for oilseed crops is needed to be essential in country as whole and individual states. Karnataka is the sixth largest state in area and production of oilseeds in India, whereas second largest in area, production and yield of oilseeds in South India. The total area under oilseeds in the state was 13.71 lakhs hectare with production is around 11.21 lakh tonnes and yield 833 kg per hectar**e** (GOK, 2016).

Hence, based on above background, the present study was undertaken in Karnataka state with the overall objective of assessing the oilseed farmer's decision making factors *viz*., price and non price factors in land allocation for sustainable groundnut production in Karnataka. The results of this study would help in suggesting suitable policy options and regional level planning to increase oilseed productivity and bridge the demand-supply gap in the state as well as in the country.

Many researchers studied the factors responsible for land allocation to crops by adopting different methodologies. Marc Nerlove (1958) developed two distributed lag models and attempted to estimate the elasticity of supply of corn, cotton and wheat in U.S.A. Nadda (1987) used double-log form of the Nerlovian Lagged Adjustment Model to estimate the supply elasticity**.** Nerlove (1979) used

#This paper has been extracted from Ph.D thesis of entitled "Growth, Instability and Supply Response of Groundnut and Sunflower oilseed crops in Karnataka: An Econometric Analysis" submitted by the first author to PJTSAU, Rajendranagar, Hyderabad in 2018

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partial adjustment model. However, the framework fails to accommodate full dynamics of supply, thereby underes timating elasticity of supply or biasing it downwards (Nickel, 1995; Thiele, 2000). The most time series data are trended over time and regression between trended series that are non stationary may produce a spurious or nonsense regression with significant results and high R squire value (Granger and Newbold, 1974; Braulke, 1982). The recent work recast the supply response model in error correction farm, with the partial adjustment model nesting within it and with a strong theoretical basis (Hallam and Zanoli, 1993). VECM was applied to estimate the decision making factors of groundnut farmers in land allocation (Hallam and Zanoli, 1993).

## MATERIALS AND METHODS

The study was conducted during the period from 1975-76 to 2015-16 so as to capture the decision making factors in Karnataka state. The Karnataka state has 30 districts which are divided into four administrative division's *viz.*, Bangalore, Mysore, Belgaum and Gulbarga. Therefore, these four divisions of the state were chosen for the present study. Since the policy implication, if any from the study would help in regional planning. Among all the oilseed crops grown in the state, the groundnut accounted around 42.07 percent of the Karnataka's total oilseed area and contributed around 71 per cent of Karnataka's total oilseed production during 2012-13 (GOK, 2013). Hence, groundnut was chosen for the present study. The data related to decision factors was obtained from various secondary sources like DES, Bangalore, DAC, District Statistical Office, Indiastat.com, etc.

**Analysis tools Used: Vector Error Correction Model (VECM) model:** The alternative approach to study the supply response of crops was the use of co-integration analysis and VECM (Haq and Arshad, 2010; McKay, 1999; Thiele, 2000; Wani *et al*., 2015). Hence, VECM were applied to estimate the supply response elasticity for groundnut crop in Karnataka state. Here, assumed that current land allocation for groundnut is the function of expected price and non price decision factors. The number of lags to be incorporated in the model before estimating the ECM was determined by AIC or BIC. The decision making factors were estimated by using three response functions of VECM. The model (1), (2) and (3) represents the area, production and yield response models respectively as follows

**Area response function:**

$$\Delta InA_t^{Gnut} = \alpha_o + \sum_{j=1}^{k} \beta \Delta InA_{t-1}^{Gnut} + \sum \gamma \Delta InP_{t-1}^{Gnut} + \sum \delta \Delta InP_{t-1}^{cc} + \sum \phi \Delta InTRF_t + \sum \upsilon \Delta InPR_t + \varphi_1 InA_{t-1}^{Gnut} + \varphi_2 InP_{t-1}^{Gnut} + \varphi_3 InP_{t-1}^{oo} + \varphi_4 InTRF_t + \varphi_5 InPR_t + \varepsilon_t \quad (1)$$

**Production response function:**

$$\Delta InQ_t^{Gnut} = \alpha_o + \sum_{j=1}^{k} \beta \Delta InQ_{t-1}^{Gnut} + \sum \gamma \Delta InP_{t-1}^{Gnut} + \sum \phi \Delta InTRF_t + \sum \omega \Delta InI_t^{Gnut} + \varphi_1 InQ_{t-1}^{Gnut} + \varphi_2 InP_{t-1}^{Gnut} + \varphi_3 InTRF_t + \varphi_4 InI_t^{Gnut} \quad (2)$$

**Yield response function**

$$\Delta InY_t^{Gnut} = \alpha_o + \sum_{j=1}^{k} \beta \Delta InY_{t-1}^{Gnut} + \sum \gamma \Delta InP_{t-1}^{Gnut} + \sum \delta \Delta InP_{t-1}^{cc} + \sum \phi \Delta InTRF_t + \sum \omega \Delta InI_t^{Gnut} + \sum \upsilon \Delta InPR_t + \varphi_1 InA_{t-1}^{Gnut} + \varphi_2 InP_{t-1}^{Gnut} + \varphi_3 InP_{t-1}^{cc} + \varphi_4 InTRF_t + \varphi_5 InI_t^{Gnut} + \varphi_6 InPR_t + \varepsilon_t \quad (3)$$

Where,

$A_t^{Gnut}$ =Current year area (000'hectare),

$Q_t^{Gnut}$ =Current year production (000'tonnes),

$Y_t^{Gnut}$ =Current year yield (Kg/ha),

$P_{t-1}^{Gnut}$ =Lagged FHP of crop (Rs/Qtl),

$P_{t-1}^{cc}$ =Lagged FHP of competing crop (Rs/Qtl),

$PR_t^{Gnut}$ =Current year price risk of groundnut

$TRF_t$ =Current year average annual total rainfall in mm

$I_t^{Gnut}$ =Current year irrigated area under groundnut (000'hectares)

$A_{t-1}^{Gnut}$ =Lagged area of groundnut (000'hectares),

$Q_{t-1}^{Gnut}$ =Lagged production of groundnut (000'tonnes,

$Y_{t-1}^{Gnut}$ =Lagged yield of groundnut (Kg/ha),

The parameters *viz.*, $\alpha, \beta, \gamma, \delta, \phi, \omega$, and $\theta$ indicates the short run relationship; $\varphi_i$ indicates the long run relationship and $\varepsilon_t$ indicates the error term of the regression. The most important decision making factors included in the model were explained as follows;

**a) Price expectation ($P_{t-1}$):** The price which farmers take into account for making decision process is called the expected prices. Generally previous year price is regarded as bases for adjustment in the current year. The lagged by one year farm harvest price of groundnut taken in account which helps in decision making of area allocation.

**b) Price of the competing crops ($P^C_{t-1}$):** The price of the competing crop was selected on the basis of resources requirement, suitability of the soil and agro ecological requirements of the crops (Janaiah, 1989).

**c) Price risk ($PR_t$):** The square deviations of expected values from the actual values were taken as an observation on risk (Ipe and Prabhakarn, 1988; Janaiah, 1989). The expected values are derived from observed values through a three year moving average model.

**d) Irrigated area ($I_t$):** The availability of irrigation is one of the determinants affecting the quantity of production and per unit area production.

**e) Total Rainfall ($TRF_t$):** The average annual rainfall is a crucial factor determining the area under the crops as well as production and yield of these crops.

**f) Preceding Years Area under the Crop ($A_{t-1}$):** Traditionally, previous year's area is expected to play an important role in allocating the area under particular crop.

**g) Preceding Years Production of the Crop ($Q_{t-1}$):** Generally, the farmers will take previous year's production as an indicator for investment decisions for producing a particular crop.

**h) Preceding Years Yield of the Crop ($Y_{t-1}$):** The resource allocating decision for a particular crop is governed by the yield of that crop in the previous year. So, these all above mentioned variables are included in the model.

**Test for Unit roots: Augmented Dicky-Fuller (ADF) Test:** The study uses ADF test to examine variables for the presence of a unit root an indication of non stationary (Dicky and Fuller, 1979). Since, ADF can handle both first order as well as higher order autoregressive processes, by handling the first difference in lags in the test in such a way that the error term is distributed as white noise (Haq and Arshad, 2010; Maiadua, 2017).

$$\Delta Y_t = \alpha_1 + \rho Y_{t-1} + \sum_{t-1}^{j} \gamma \Delta Y_{t-1} + \mu \text{.....}$$

Where, Y is the series to be tested, where it denotes all variable which are mentioned in the choice of variables part; $\rho$ is the test coefficient and j is the lag length chosen for ADF such that $\mu_t$ is empirical white noise. If the coefficient "$\rho$" is not statistically different from zero, then the series has a unit root and therefore is non-stationary. Here the significance of p is tested against the null hypothesis that based on t-statistics on obtained from the OLS estimates. The stationary of the dependent and independent variable was tested by rejecting null hypothesis. If the t-statistics values are more than critical values at 5 percent level of significance, then reject the null hypothesis. The null hypothesis of the unit root was accepted at the level and rejected at the first difference ($I_1$). All the variables become stationary after first difference using the both constant and constant and trend (Maiadua, 2017).

**Diagnostic Checks of the VECM:** The diagnostic checks of the VECM were analysed to find the validity of the model. The goodness of fit of the model was measured by the coefficient of the determination ($R^2$). The $R^2$ is quite high in almost all the equation and F-statistics is significant in nature. The serial correlation was estimated by using Breusch-Godfrey serial correlation LM test, which showed that the model is free from the serial correlation. The heteroscadasticity was checked by Breusch Pagan Godfrey test, if the p value is more than 5% means presence of homoscadasticity. The jarque-Bera statistics were used to check the normality of the residuals distribution. The p value of the Jerque-Bera test is more than 5% means that residuals are normally distributed. The Walds statistics was used to check the short run causality between dependent and independent variables. The null hypothesis were accepted if p value of the Wald test is more than 5 percent indicates that there no short run causality from independent to dependent variables.

## RESULTS AND DISCUSSION

**Johansen's co-integration tests:** The Johansen's co-integration (Table 1) approach was used to check the number of co-integration equations present in the model. The presence of number of co-integration equations was decided based on the either maximum Eigen value or Trace statistics. The both test indicates the number of co-integration equation presents in the time series. If co-integration equation found in the time series, when null hypothesis rejected, thus we can conclude that there is a unique long run equilibrium relationship in between dependent and independent decision making variables. It showed that more than two co-integration equations in area, production and yield response were noticed in all the divisions of the state. Hence, VECM was applied to estimate the decision making variables (Haq and Arshad, 2010, Maiadua, 2017).

**Supply response results of groundnut**

**Area response function:** The area response function of groundnut was presented in Table 2. The error correction term (ETC) shows the speed of adjustment towards long run equilibrium but it must be significant and the sign must be negative. The ETC of the Gulbarga, Mysore and Karnataka were found to be significant and negative. It means that the independent variables such as farm harvest price, competing crop farm harvest price, lagged area, total rainfall, price risk and yield risk have influence on land allocation in the long run for sustainable production of groundnut in Gulbarga, Mysore and Karnataka state as a whole. The study showed that the coefficients of total rainfall had exerted significant positive influence in Mysore Division (0.83) and Karnataka (0.43) state as whole, whereas the price risk and yield risk have significantly negative influence on current year's area of groundnut. It indicated that for every one percent increase in water availability through rainfall is likely to increase the area under groundnut by 0.83 percent in Mysore Division and 0.43 percent in Karnataka state as whole. The results are similar to Kanwar and Sadoulet (2008) who reported that yield of oilseeds strongly responds to water availability.

**Production response function:** The production (Table 3) response of groundnut showed that, the ECT of Bangalore and Mysore divisions were found to be significant and negative, whereas the ECT of Belgaum, Gulbarga and Karnataka state were positive and non significant in nature.

It means there is long run causality running from independent variables to dependent variable in Bangalore and Mysore divisions. The lagged production coefficient had exerted significant negative influence on current year's production of groundnut in Bangalore (-0.37), Gulbarga (-0.92) and Karnataka (-0.56) state as a whole, but the coefficients of own lagged price (1.55) and total rainfall (2.22) had exerted significant positive influence in Mysore and Bangalore division. It indicated that for every 10 percent increase in own lagged price of groundnut is likely to increase the production of groundnut by 15.50 percent in Mysore division, whereas for every 10 percent increase in water availability through rainfall is likely to increase the area under groundnut by 22.20 percent in Bangalore division. The results are similar to Kanwar and Sadoulet (2008).

**Yield response function:** The yield (Table 4) response function indicated that, the ECT of the all the divisions were found to be non significant and positive in nature. It means that in there is no long run causality from independent variables in all the divisions. The study showed lagged farm harvest price (1.36) of the groundnut had exerted significant positive influence on current year's yield of groundnut in Belgaum Division, whereas in same division the price risk had exerted significant negative influence on current years yield of crop.

**Short run and long run elasticity's of groundnut:** The result indicated (Table 5) that highest short run and long run elasticity were found in Mysore division for total rainfall in area response. It indicates the total rainfall were decision making variable for allocation of land under groundnut crop

**Table 1:** Johansen Co integration results of area, production and yield response functions.

| Functions | #No. of CE(s) | Eigen value | Trace Statistic | CV at 5% | Prob.** | Max-Eigen Statistic | CV at 5% | Prob.** |
|---|---|---|---|---|---|---|---|---|
| | | | | **BELGAUM** | | | | |
| Area | r=0* | 0.683313 | 109.4436 | 95.75366 | 0.0041 | 42.54413 | 40.07757 | 0.0258 |
| | r=1* | 0.450392 | 66.89951 | 69.81889 | 0.0836 | 22.14634 | 33.87687 | 0.5963 |
| | r=2* | 0.385181 | 44.75317 | 47.85613 | 0.0950 | 17.99784 | 27.58434 | 0.4953 |
| Production | r=0* | 0.660532 | 50.65625 | 47.85613 | 0.0266 | 27.00940 | 27.58434 | 0.0591 |
| | r=0* | 0.906315 | 115.2698 | 69.81889 | 0.0000 | 59.19550 | 33.87687 | 0.0000 |
| | r=1* | 0.636548 | 56.07433 | 47.85613 | 0.0070 | 25.30271 | 27.58434 | 0.0953 |
| Yield | r=2* | 0.509956 | 30.77162 | 29.79707 | 0.0385 | 17.83152 | 21.13162 | 0.1363 |
| | r=4* | 0.188860 | 5.232878 | 3.841466 | 0.0222 | 5.232878 | 3.841466 | 0.0222 |
| | | | | **BANGALORE** | | | | |
| Area | r=0* | 0.649667 | 106.9102 | 95.75366 | 0.0069 | 38.80820 | 40.07757 | 0.0690 |
| | r=1* | 0.554789 | 68.10202 | 69.81889 | 0.0680 | 29.94066 | 33.87687 | 0.1375 |
| Production | r=0* | 0.680455 | 48.24371 | 47.85613 | 0.0459 | 28.52142 | 27.58434 | 0.0378 |
| | r=3* | 0.104036 | 2.746388 | 3.841466 | 0.0975 | 2.746388 | 3.841466 | 0.0975 |
| Yield | r=0* | 0.782500 | 89.02372 | 69.81889 | 0.0007 | 38.13887 | 33.87687 | 0.0146 |
| | r=1* | 0.624666 | 50.88485 | 47.85613 | 0.0253 | 24.49847 | 27.58434 | 0.1183 |
| | | | | **GULBARGA** | | | | |
| Area | r=0* | 0.698731 | 108.9945 | 95.75366 | 0.0045 | 44.39076 | 40.07757 | 0.0154 |
| | r=5* | 0.083393 | 3.221828 | 3.841466 | 0.0727 | 3.221828 | 3.841466 | 0.0727 |
| Production | r=0* | 0.699771 | 47.89340 | 47.85613 | 0.0496 | 30.08022 | 27.58434 | 0.0234 |
| | r=0* | 0.738886 | 67.06170 | 69.81889 | 0.0813 | 33.56996 | 33.87687 | 0.0543 |
| Yield | r=1* | 0.469602 | 33.49174 | 47.85613 | 0.5297 | 15.85319 | 27.58434 | 0.0482 |
| | | | | **MYSORE** | | | | |
| Area | r=0* | 0.714446 | 123.4459 | 95.75366 | 0.0002 | 46.37305 | 40.07757 | 0.0086 |
| | r=1* | 0.576553 | 77.07283 | 69.81889 | 0.0117 | 31.79509 | 33.87687 | 0.0868 |
| Production | r=0* | 0.613198 | 54.43989 | 47.85613 | 0.0106 | 23.74607 | 27.58434 | 0.1438 |
| | r=1* | 0.468146 | 30.69382 | 29.79707 | 0.0393 | 15.78467 | 21.13162 | 0.2377 |
| Yield | r=0* | 0.896097 | 112.1077 | 69.81889 | 0.0000 | 56.60753 | 33.87687 | 0.0000 |
| | r=1* | 0.680667 | 55.50015 | 47.85613 | 0.0081 | 28.53806 | 27.58434 | 0.0377 |
| | | | | **KARNATAKA** | | | | |
| Area | r=0* | 0.721920 | 114.8473 | 95.75366 | 0.0013 | 47.35429 | 40.07757 | 0.0064 |
| | r=1* | 0.563908 | 67.49304 | 69.81889 | 0.0756 | 30.70636 | 33.87687 | 0.1142 |
| Production | r=0* | 0.538825 | 38.04263 | 47.85613 | 0.3002 | 19.34942 | 27.58434 | 0.3880 |
| | r=0* | 0.762380 | 69.84503 | 69.81889 | 0.0498 | 35.92709 | 33.87687 | 0.0281 |
| Yield | r=1* | 0.475526 | 33.91794 | 47.85613 | 0.5063 | 16.13398 | 27.58434 | 0.0484 |

Max-eigenvalue and Trace test indicates number cointegrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values
#only included significant number of co integrated equations (CE's)

**Table 2:** Groundnut Area Short Run Error Correction Dynamics.

| Particulars | Belgaum | | Bangalore | | Gulbarga | | Mysore | | Karnataka | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| ECT | 0.1160 | 0.2338 | 0.0122 | 0.0165 | -0.1761*** | 0.0863 | -1.5885** | 0.6360 | -0.1279** | 0.0498 |
| D(lnA(-1)) | -0.3760 | 0.3176 | -0.3530 | 0.2220 | -0.2004 | 0.2192 | 0.4820 | 0.5915 | -0.4474** | 0.1849 |
| D(lnA(-2)) | 0.4669 | 0.4670 | -0.0654 | 0.2054 | -0.1540 | 0.2143 | 0.0328 | 0.4452 | -0.0826 | 0.1943 |
| D(lnFHP(-1)) | 0.0799 | 0.2827 | 0.0074 | 0.3707 | 0.3776** | 0.1701 | -0.2292 | 0.5692 | 0.1509 | 0.1437 |
| D(lnFHP(-2)) | -0.1526 | 0.2776 | 0.0949 | 0.3322 | 0.1387 | 0.1537 | 0.0903 | 0.4071 | 0.1311 | 0.1176 |
| D(lnCFHP(-1)) | -0.5429 | 0.3656 | -0.3122 | 0.2541 | 0.0212 | 0.1282 | 0.3381 | 0.5376 | 0.0306 | 0.1290 |
| D(lnCFHP(-2)) | 0.3735 | 0.3171 | 0.0270 | 0.3230 | 0.0550 | 0.1247 | 0.3877 | 0.4773 | -0.0106 | 0.1235 |
| D(lnTRF(-1)) | -0.3736 | 0.4488 | -0.1989 | 0.2377 | -0.0273 | 0.0942 | 0.8350** | 0.3980 | 0.4331** | 0.1871 |
| D(lnTRF(-2)) | -0.1125 | 0.4392 | -0.3115 | 0.3004 | -0.0295 | 0.0941 | 0.0709 | 0.4440 | 0.4145** | 0.1825 |
| D(lnPR(-1)) | -0.1994*** | 0.1029 | -0.0666 | 0.0955 | 0.0370 | 0.0328 | 0.5293** | 0.2399 | 0.1563** | 0.0512 |
| D(lnPR(-2)) | 0.0599 | 0.0911 | 0.0563 | 0.0808 | 0.0177 | 0.0287 | 0.0753 | 0.1725 | 0.0321 | 0.0417 |
| D(lnYR(-1)) | -0.0834 | 0.1052 | 0.0209 | 0.0902 | -0.0249 | 0.0359 | -0.1536*** | 0.0806 | -0.1201** | 0.0568 |
| D(lnYR(-2)) | -0.0544 | 0.1037 | -0.0601 | 0.0595 | 0.0181 | 0.0331 | -0.0882 | 0.0784 | -0.1571** | 0.0543 |
| Constant | -0.0310 | 0.0872 | 0.0298 | 0.0533 | -0.0584 | 0.0301 | -0.1437*** | 0.0778 | -0.0526*** | 0.0256 |
| R-squared | 0.4951 | | 0.3750 | | 0.4126 | | 0.7217 | | 0.5374 | |
| Durbin-Watson stat | 2.0070 | | 1.5805 | | 2.1049 | | 1.8477 | | 2.1153 | |

*Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level,

**Table 3:** Groundnut Production Short Run Error Correction Dynamics.

| Particulars | Belgaum | | Bangalore | | Gulbarga | | Mysore | | Karnataka | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| CointEq1 | -0.3629 | 0.3562 | -1.5005** | 0.5128 | 0.2233 | 0.1906 | -1.0472** | 0.3147 | -0.0842 | 0.1285 |
| D(lnP(-1)) | -0.4085 | 0.3345 | -0.2902 | 0.3409 | -0.9224** | 0.3653 | 0.3474 | 0.3588 | -0.5603** | 0.2530 |
| D(lnP(-2)) | -0.3027 | 0.2831 | -0.3746** | 0.1597 | -0.3060 | 0.3973 | 0.2675 | 0.3217 | -0.2246 | 0.2106 |
| D(lnFHP(-1)) | 0.6009 | 0.5155 | -0.6954 | 1.1884 | -0.3121 | 0.5169 | 1.5563*** | 0.8640 | 0.5654 | 0.5527 |
| D(lnFHP(-2)) | 0.8183 | 0.4845 | 0.9039 | 0.8086 | 0.2092 | 0.5407 | 0.6873 | 0.8673 | 0.0644 | 0.7923 |
| D(lnTRF(-1)) | -0.9779 | 0.7408 | 2.2258** | 0.9769 | -0.0472 | 0.2879 | -0.0197 | 0.4359 | 0.5610 | 0.5842 |
| D(lnTRF(-2)) | -0.0281 | 0.5524 | 0.8938 | 0.6995 | -0.3093 | 0.2708 | 0.2158 | 0.4201 | 0.4919 | 0.5530 |
| D(lnIA(-1)) | 0.4124 | 0.4217 | -0.3031 | 0.2759 | -0.1192 | 0.3994 | -0.5132** | 0.2381 | 0.1277 | 0.1860 |
| D(lnIA(-2)) | 0.3678 | 0.3331 | 0.4264** | 0.2136 | 0.2995 | 0.3215 | -0.5219** | 0.2392 | -0.0151 | 0.1523 |
| Constant | -0.1048 | 0.0811 | -0.1295 | 0.1090 | -0.0405 | 0.0640 | -0.3948** | 0.1304 | -0.0969 | 0.0907 |
| R-squared | 0.6410 | | 0.9072 | | 0.6259 | | 0.6482 | | 0.5888 | |
| Durbin-Watson stat | 1.8264 | | 2.1604 | | 2.0948 | | 2.3055 | | 2.2646 | |

*Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level,

**Table 4:** Groundnut Yield Short Run Error Correction Dynamics.

| Particulars | Belgaum | | Bangalore | | Gulbarga | | Mysore | | Karnataka | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| CointEq1 | -0.2360 | 0.1570 | -0.8245 | 0.5203 | 0.0613 | 0.2298 | -0.6880 | 0.5327 | 0.0466 | 0.0389 |
| D(lnY(-1)) | -0.2699 | 0.2953 | -0.2592 | 0.4048 | -0.3785 | 0.4015 | -0.0172 | 0.4139 | -0.4385 | 0.2527 |
| D(lnY(-2)) | 0.0106 | 0.3167 | -0.2682 | 0.2126 | -0.2590 | 0.3799 | -0.1891 | 0.2792 | 0.0018 | 0.2139 |
| D(lnFHP(-1)) | 1.3667** | 0.3845 | 0.4357 | 0.8359 | -0.0418 | 0.4615 | 5.1671 | 3.9988 | 0.7088 | 0.4183 |
| D(lnFHP(-2)) | 0.7415** | 0.3185 | 0.6087 | 0.9297 | 0.0729 | 0.4247 | 3.6478 | 2.5766 | 0.3435 | 0.5133 |
| D(lnPR(-1)) | 0.1309*** | 0.0623 | 0.0111 | 0.1513 | -0.0173 | 0.0569 | 0.6005 | 0.5125 | 0.2139** | 0.0975 |
| D(lnPR(-2)) | -0.1287** | 0.0512 | 0.0543 | 0.1130 | -0.0025 | 0.0610 | -0.1860 | 0.2403 | -0.1749 | 0.1003 |
| D(lnTRF(-1)) | -0.1424 | 0.2118 | 0.7727 | 0.8707 | -0.2628 | 0.2972 | 0.1078 | 0.4547 | 0.7729 | 0.4434 |
| D(lnTRF(-2)) | -0.0755 | 0.2424 | 0.3897 | 0.6349 | -0.3089 | 0.2257 | -0.1442 | 0.3922 | 0.3325 | 0.3368 |
| D(lnIA(-1)) | -0.2338 | 0.1404 | -0.2615 | 0.2404 | -0.4202 | 0.2981 | -0.1461 | 0.1428 | -0.0578 | 0.1023 |
| D(lnIA(-2)) | 0.0533 | 0.1176 | 0.0350 | 0.1822 | 0.1550 | 0.2907 | -0.1693 | 0.1506 | -0.2239** | 0.0997 |
| Constant | -0.1317** | 0.0565 | -0.1158 | 0.0833 | 0.0142 | 0.0520 | -0.7706 | 0.5179 | -0.0657 | 0.0524 |
| R-squared | 0.6908 | | 0.7993 | | 0.5469 | | 0.5344 | | 0.7866 | |
| Durbin-Watson stat | 2.1842 | | 2.2835 | | 1.8747 | | 1.8460 | | 2.3623 | |

*Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level,

**Table 5:** Price and Non-price Determinant's short run and lung run elasticity's of Groundnut.

| Divisions | | FHP (-1) | FHP (-2) | TRF (-1) | TRF (-2) | PR (-1) | PR (-2) | YR (-1) | YR (-2) | IA (-1) | IA (-2) | ECT | Constant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Short Run Price and Non-price Elasticity's** | | | | | | | | | | | | | |
| Belgaum | A | | | | | -0.2 | | | | | | | |
| | P | | | | | | | | | | | | |
| | Y | 1.37 | 0.74 | | | 0.13 | -0.13 | | | | | | -0.13 |
| Bangalore | A | | | | | | | | | | | | |
| | P | | | 2.23 | | | | | | | 0.43 | -1.5 | |
| | Y | | | | | | | | | | | | |
| Gulbarga | A | 0.38 | | | | | | | | | | -0.18 | |
| | P | | | | | | | | | | | | |
| | Y | | | | | | | | | | | | |
| Mysore | A | | | 0.84 | | 0.53 | | -0.15 | | | | -1.59 | -0.14 |
| | P | 1.56 | | | | | | | | -0.51 | -0.52 | -1.05 | -0.39 |
| | Y | | | | | | | | | | | | |
| Karnataka | A | | | 0.43 | 0.41 | 0.16 | | -0.12 | -0.16 | | | -0.13 | -0.05 |
| | P | | | | | | | | | | | | |
| | Y | | | | | 0.21 | | | | | -0.22 | | |
| **Long Run Price and Non-price Elasticity's** | | | | | | | | | | | | | |
| Belgaum | A | | | | | 0.18 | | | | | | | |
| | P | | | | | | | | | | | | |
| | Y | 1.64 | 0.73 | | | 0.4 | -0.14 | | | | | | |
| Bangalore | A | | | | | | | | | | | | |
| | P | | | 2.52 | | | | | | | 0.8 | -1.21 | |
| | Y | | | | | | | | | | | | |
| Gulbarga | A | 0.58 | | | | | | | | | | 0.02 | |
| | P | | | | | | | | | | | | |
| | Y | | | | | | | | | | | | |
| Mysore | A | | | 0.35 | | 0.05 | | -0.32 | | | | -2.07 | -0.63 |
| | P | 1.21 | | | | | | | | -0.86 | -0.79 | -1.39 | -0.74 |
| | Y | | | | | | | | | | | | |
| Karnataka | A | | | 0.88 | 0.5 | 0.6 | | 0.33 | -0.07 | | | 0.32 | |
| | P | | | | | | | | | | | | |
| | Y | | | | | 0.65 | | | | | -0.23 | | |

Note: A-Area, P-Production and Y-Yield

in Mysore division. The VECM analysis concluded that the groundnut farmers' behaviour showed price inelasticity of supply in both short run as well as long run except Mysore divisions. It indicates that non-price factors are more important and complementary to price for decision making of area allocation under groundnut crop.

## CONCLUSION AND POLICY SUGGESTIONS

The study concluded that the farmers' behaviour was price inelasticity of supply in all the divisions except in some divisions for both short run as well as long run. The rainfall or irrigation and lagged dependent variables are most significant decision making factors of land allocation in Karnataka. The highest short run and long run elasticity found for total rainfall in some divisions. It showed that non-price factors are more important and complementary to price for decision making of area allocation under the crop. Hence, the public and private resource organizations or SAUs have to give more importance to non-price factors like low cost agricultural inputs *viz*., providing irrigation facility through moisture conservation measures, construction of protective irrigation structures like farm pond, providing credit and yield increasing technology like HYV in adequate quantities at affordable price through cooperatives or groundnut producer organizations for increasing the groundnut productivity and for improving the standard of livings of groundnut farmers and in turn which help for the growth and development of oilseed sector in the state.

## ACKNOWLEDGEMENT

I express my special thanks to UGC, New Delhi for their financial support through UGC-MANF FELLOWSHIP during the course of study.

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