# NAVIGATING CHALLENGES: GROUNDNUT CROPPING SYSTEMS REALITIES IN TUMKUR DISTRICT, KARNATAKA, India

**ABSTRACT:**India is the fourth largest oilseed producer in the world, contributing 20.80 % of the total global cultivation area and accounting for 10 per cent of the global production. Inspite of this India is one of the largest importers of vegetable oil in order to meet the growing needs of the population by bridging the demand and supply gap. This scenario is due to climatic factor and decrease in area under groundnut cultivation as well as in productivity. Adoption of cutting-edge crop production technologies in our nation led to a significant improvement in the output of oilseeds. Groundnut (*Arachis hypogaea L.*) is called as 'King' of oilseeds a key oil seed crop in India, and it plays a significant part in bridging the country's vegetable oil deficit. The present study was conducted during 2023 in Tumkur district of Karnataka to know the constraints faced by the farmers practicing groundnut based cropping systems and suggestions given to overcome the problems.Sixty farmer of each CS-□ (Groundnut alone) and CS-□(Groundnut + Redgram) were selected respectively thus, the total sample size was 120. An ex post facto research design was adopted. Data was collected using a pre-tested personnel interview method**.**The study revealed the major production, marketing, technical and financial constraints by the faced by the groundnut growers like high wage rate, price fluctuation, low price for the produce, exploitation by the middleman and non-availability of quality inputs at reasonable rate. The majority of these farmers advocate for a reasonable minimum support price for groundnut and seeds and fertilizers availability at affordable rates in time.

**Key words:**Groundnut based cropping systems,production constraints, marketing constraints, financial, technical constraints, suggestions

## INTRODUCTION

India is an agrarian country where more than 58 % of the popultionsecures livelihood from agriculture. India is the second largest producer of oil seeds and the major oilseeds grown in the country include peanut, soybean, sunflower, sesame, niger, mustard, and safflower, although unfortunately the country is also the largest importer of edible oils. Over 72 % of the oilseed area was grown by small farmers under rainfed conditions,resultingin low productionand due to post

UNDER PEER REVIEW

Green Revolution impacts such as soil degradation, climate change, imbalance nutrients, declineof agricultural land holding and loss of soil fertility, which resulted in low production and productivity. These can be minimized by not only adopting appropriate technologies and suitable cropping systems considering regional agro- climatic situations and resource. The introduction of modern crop production technologies in our country led to a significant improvement in the output of oilseeds (*Arachishypogaea*), 'the unpredictable legume', also known as groundnut, earthnut, peanut, monkeynut can bridge the gap between demand and supply in the domestic consumer market. With this background in order to achieve self-reliance, constraints faced by the groundnut growers should be identified and addressed with proper government policies and adoption of improved production technologies by the farmers.

## METHODOLOGY

The study was conducted in Tumkur district of Karnataka in 2023. Out of ten taluks, Sira and Pavagada were specifically selected for the study as these taluks have a larger area under groundnut cultivation compared to other taluks. From each taluk, three potential groundnut cultivating villages were selected. Further, from each village, 5 farmers practicing the cropping system were selected for the study: CS-□ (Groundnut alone) and CS-□(Groundnut + Redgram) were selected respectively, making the sample size 30 each under category from each taluk. Thus, the total sample size from these villages is 120.An expost facto research design was adopted. Data was collected using a pre-tested personnel interview method.Someofthecommonconstraintswerelistedandthefarmerswereaskedtoindicatetheconstraintsfacedbythemon a three continuum i.e. greater extent, lesser extent and not at all. Ascoreof'one'was assignedforresponse not at all, two for lesser extent and three for greater extent. Some of the common suggestions were listed and the respondents were asked closed end questions. The responses obtained were scored on two-point continuum scale with score of 1 and 0 for yes and no respectively.

## RESULTS AND DISCUSSION

### A. Constraints faced by the farmers practicing groundnut based cropping system

### 1.1 Constraints as expressed by the farmers practicing cropping systems-I ( Groundnut alone)

### 1.1 Production constraints

UNDER PEER REVIEW

Table 1shows that the majority of the CS-I respondents opined thathigh wages (70.00%),uneven distribution of rainfall (68.33%), scarcity of own resources(53.33%), shortageof family labour (51.67%) and incidence of pest and disease (43.33 %) were faced as constraints by them to a greater extent. Problems like high labor costs due unavailability of labour duringpeak sowing and harvesting seasons impose a considerable financial burden, leading to increased overall production costs. Moreover, irregular rainfall patterns lead tomoisture stress during cultivation, which negatively affect crop growth and ultimately reduces yields.Further, lack of awareness about the recommended cropping sequence (43.33%) is the problem faced to a lesser extent and nearly half of the respondents (48.33%) expressed the difficulties in mechanization due to intercropping willnot pose any problem for maximization of production, productivity as well as profit of groundnut growers.

**Table 1: Constraints as expressed by the farmers practicing cropping systems-I (Groundnut alone)**

**$n_1$=60**

| Sl. No. | Constraints | Greater Extent | | Lesser Extent | | Not at all | |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % |
| **A** | **Production constraints** | | | | | | |
| 1 | High wages | 42 | 70.00 | 18 | 30.00 | 00 | 0.00 |
| 2 | Scarcity of own fund | 32 | 53.33 | 28 | 46.67 | 00 | 0.00 |
| 3 | Lack of awareness about recommended cropping sequences | 20 | 33.33 | 26 | 43.33 | 14 | 23.34 |
| 4 | Intercropping-come in the way of mechanization | 08 | 13.33 | 23 | 38.34 | 29 | 48.33 |
| 5 | Scarcity of family labour | 31 | 51.67 | 25 | 41.67 | 04 | 6.66 |
| 6 | Uneven distribution of rainfall | 41 | 68.33 | 14 | 23.33 | 05 | 8.34 |
| 7 | Disease and pest incidence | 26 | 43.33 | 26 | 43.33 | 08 | 13.34 |
| **B** | **Marketing constraints** | | | | | | |
| 1 | Lack of storage facility | 22 | 36.67 | 30 | 50.00 | 08 | 13.33 |

UNDER PEER REVIEW

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | Lack of timely market information | 28 | 46.67 | 32 | 53.33 | 00 | 0.00 |
| 3 | Lack of transportation | 22 | 36.67 | 36 | 60.00 | 02 | 3.33 |
| 4 | Price fluctuation | 46 | 76.67 | 14 | 23.33 | 00 | 0.00 |
| 5 | Low price for the produce | 38 | 63.33 | 22 | 36.67 | 00 | 0.00 |
| 6 | Exploitation by middlemen in the market | 44 | 73.33 | 16 | 26.67 | 00 | 0.00 |
| **C** | **Technical constraints** | | | | | | |
| 1 | Non-availability of quality inputs like seeds, pesticides and insecticides at right time | 36 | 60.00 | 24 | 40.00 | 00 | 0.00 |
| 2 | Lack of technical guidance about production techniques | 24 | 40.00 | 36 | 60.00 | 00 | 0.00 |
| 3 | Lack of relevant literature in local language | 17 | 28.33 | 28 | 46.67 | 15 | 25.00 |
| **D** | **Financial constraints** | | | | | | |
| 1 | Lack of credit availability | 26 | 43.33 | 27 | 45.00 | 07 | 11.67 |
| 2 | High cost of production | 37 | 61.67 | 23 | 38.33 | 00 | 0.00 |
| 3 | Lack of incentives and subsidies | 40 | 66.67 | 18 | 30.00 | 02 | 3.33 |

UNDER PEER REVIEW

**1.2 Marketing constraints**

Farmers practicing CS-I had voiced their problems regarding the marketing of groundnut which hamperthem to a greater extent. Price fluctuations emerged as the most pressing issue, with a substantial proportion (76.67 %) of respondents indicatingthat the impact it has on the farmers' income and financial planning, making it a critical issue in the marketing process. Nearly three-fourth (73.33%) of respondents mentioned exploitation by middlemen as a major challenge. Middlemen often wield considerable influence in agricultural markets and their practices can sometimes result in unfair pricesfor farmers, exacerbating their difficulties. Further, 63.33% of farmers reportedthat receiving low prices for their produce posed a considerable obstacle in the marketing of groundnut. While three-fifth (60.00%) cited a lack of transportation, followed by

difficulty in timely availability of market information (53.33%), which is crucial for making informed decisions, and half of them (50.00%) citeda lack of storage facilities. These challenges they faced were to a lesser extent.

### 1.3 Technical constraints

Table 1 shows that three-fifth (60.00%) of the CS-I practicing farmers reportedthat unavailability of quality inputs at the right time and at reasonable cost was a major technical constraint faced by them toa greater extent. Lack of technical guidance about production technologies (60.00%) and relevant literature availability in the local language (46.67%) hindered the CS-I respondents to a lesserextent in groundnut cultivation.

### 1.4 Financial constraints

Farmers practicing CS-I expressed that the lack of incentives and subsides from the government (66.67%) and high cost of production (61.67%) were affecting them more in groundnut production. They also stated that the lack of credit availability (45.00%) results inthem facing fewer issues in groundnut production activities. The probable reason may be raising input costs and wage rates that raise production costs, government neglect of oilseed farming, and labor-intensive and time-consuming loan application processes.

## 2 Constraints as expressed by the farmers practicing cropping systems-II (Groundnut + Redgram)

### 2.1 Production constraints

Table 2 revealed that the majority of the CS-II reportedthat they were more affected by various constraints such as high wages (70.00%), shortage of family labor (65.00%), scarcity of own funds (56.67%) and unequal rainfall distribution (48.33%) in groundnut production. More than half of the respondents (53.33%) faced difficulties in mechanization owing to inter cropping sequences followed by lack of information about the appropriate cropping sequence (45.00%) and the incidence of pest and diseases (43.33%), which to a lesser extent groundnut cultivation contributed to producer productivity and profit maximization.Notably, the issue of high labor costs imposing a financial burden on farmers and driving up the overall expenses associated with production and limited availability of personal funds constrains their ability to make crucial

UNDER PEER REVIEW

investments essential inputs for successful farming. Further, scarcity of family labor and the prevalence of pests and diseases have also emerged as prominent concerns, presenting formidable challenges to their agricultural pursuits.While a smaller segment expressed that they did not perceive mechanization challenges associated with intercropping (53.33%) and lack of awareness regarding recommended cropping sequences (45.00%) as a major issue.

**2.2 Marketing constraints**

Farmers practicing CS-II stated that difficulties such as price fluctuation (70.00%), poor price for the commodity (65.00%) and exploitation by middlemen (61.67%) were affecting groundnut marketing to a higher extent. The most prominent issue, identified by them was instability of prices in the market and respondents noted that receiving poor prices for their commodities wasa significant hindrance. Low pricing can lead to reduced profitability for farmers, affecting their economic sustainability.Other restrictions, such as a lack of storage space (58.33%) and transportation facility (41.67%) were cited as far less of a barrier to groundnut marketing by CS-II respondents.

**2.3 Technical constraints**

Exactly half (50.00%) of them encountered major obstacles such as a shortage of quality inputs at the correct time and at a reasonable cost, which had a major impact on their production activities. This challenge blows the effect on their production activities, as it affects the quality and quantity of inputs they can access. This in turn influences the overall success of their groundnut cultivation. Further, difficulties stemming from a lack of technical guidance regarding production technologies was notable but appears to have a relatively smallerimpact compared to the problem of input availability and affordability.Further, lack of technical guidance about production technologies (61.67%) and relevant literature availability in local language (45.00%) were hinder the CS-II respondents to a lesser extent in groundnut cultivation.

**2.4 Financial constraints**

Farmers practicing CS-II encountered that lack of incentives and subsides from government (60.00%) is affects groundnut production to a greater degree. Nearly half (48.33%) of the CS-II respondents opined that hindering their production process followed by lack of credit

UNDER PEER REVIEW

availability (46.67%) to a lesser extent.The reason may be due to the rising input costs and wage rates that raise production costs, diminished government support for the production of oilseeds, and labor-intensive and time-consuming loan application processes.

**Table 2: Constraints as expressed by the farmers practicing cropping systems-II**

**$n_2$=60**

| Sl. No. | Constraints | Greater Extent | | Lesser Extent | | Not at all | |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % |
| **A** | **Production constraints** | | | | | | |
| 1 | Wages are high | 42 | 70.00 | 18 | 30.00 | 00 | 0.00 |
| 2 | Scarcity of own fund | 34 | 56.67 | 21 | 35.00 | 05 | 8.33 |
| 3 | Lack of awareness about recommended cropping sequences | 25 | 41.67 | 27 | 45.00 | 08 | 13.33 |
| 4 | Intercropping-come in the way of mechanization | 11 | 18.33 | 32 | 53.33 | 17 | 28.34 |
| 5 | Scarcity of family labour | 39 | 65.00 | 18 | 30.00 | 03 | 5.00 |
| 6 | Uneven distribution of rainfall | 29 | 48.33 | 28 | 46.67 | 03 | 5.00 |
| 7 | Disease and pest incidence | 19 | 31.67 | 26 | 43.33 | 15 | 25.00 |
| **B** | **Marketing constraints** | | | | | | |
| 1 | Lack of storage facility | 09 | 15.00 | 21 | 35.00 | 30 | 50.00 |
| 2 | Lack of timely market information | 24 | 40.00 | 35 | 58.33 | 01 | 1.67 |
| 3 | Lack of transportation | 02 | 3.33 | 25 | 41.67 | 33 | 55.00 |
| 4 | Price fluctuation | 42 | 70.00 | 14 | 23.33 | 04 | 6.67 |
| 5 | Low price for the produce | 39 | 65.00 | 21 | 35.00 | 00 | 0.00 |
| 6 | Exploitation of middlemen in the market | 37 | 61.67 | 21 | 35.00 | 02 | 3.33 |

UNDER PEER REVIEW

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **C** | **Technical constraints** | | | | | | |
| 1 | Non-availability of quality inputs like seeds, pesticides and insecticides at right time | 30 | 50.00 | 25 | 41.67 | 05 | 8.33 |
| 2 | Lack of technical guidance about production techniques | 12 | 20.00 | 37 | 61.67 | 11 | 18.33 |
| 3 | Lack of relevant literature in local language | 12 | 20.00 | 27 | 45.00 | 21 | 35.00 |
| **D** | **Financial constraints** | | | | | | |
| 1 | Lack of credit availability | 11 | 18.33 | 28 | 46.67 | 21 | 35.00 |
| 2 | High cost of production | 24 | 40.00 | 29 | 48.33 | 07 | 11.67 |
| 3 | Lack of incentives and subsidies | 36 | 60.00 | 23 | 38.33 | 01 | 01.67 |

**Table 3 : Comparative analysis of constraints faced by the farmers practicing groundnut based cropping systems (n=120)**

| Sl. No. | Constraints | CS-I $n_1$=60 | | | CS-II $n_2$=60 | | |
|---|---|---|---|---|---|---|---|
| | | Total score | Mean score | Rank | Total score | Mean score | Rank |
| **A** | **Production Constraints** | | | | | | |
| 1 | Wages are high | 162 | 2.70 | I | 162 | 2.70 | I |
| 2 | Scarcity of own fund | 152 | 2.53 | □ | 149 | 2.48 | □ |
| 3 | Lack of awareness about recommended cropping sequences | 126 | 2.10 | □ | 137 | 2.28 | □ |
| 4 | Intercropping-come in the way of mechanization | 99 | 1.65 | □ | 114 | 1.90 | □ |
| 5 | Scarcity of family labour | 147 | 2.45 | □ | 156 | 2.60 | II |
| 6 | Uneven distribution of rainfall | 155 | 2.58 | II | 146 | 2.43 | □ |
| 7 | Disease and pest incidence | 114 | 1.90 | □ | 124 | 2.07 | □ |
| **B** | **Marketing constraints** | | | | | | |
| 1 | Lack of storage facility | 134 | 2.23 | □ | 99 | 1.65 | □ |

UNDER PEER REVIEW

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | Lack of timely market information | 148 | 2.47 | □ | 143 | 2.38 | □ |
| 3 | Lack of transportation | 140 | 2.33 | V | 89 | 1.48 | V |
| 4 | Price fluctuation | 166 | 2.77 | I | 158 | 2.63 | II |
| 5 | Low price for the produce | 158 | 2.63 | □ | 159 | 2.65 | I |
| 6 | Exploitation by middlemen in the market | 164 | 2.73 | II | 99 | 1.65 | □ |
| **C** | **Technical constraints** | | | | | | |
| 1 | Non-availability of quality inputs like seeds, pesticides and insecticides at right time | 156 | 2.60 | I | 145 | 2.42 | I |
| 2 | Lack of technical guidance about production techniques | 144 | 2.40 | II | 121 | 2.02 | II |
| 3 | Lack of relevant literature in local language | 122 | 2.03 | □ | 111 | 1.85 | □ |
| **D** | **Financial constraints** | | | | | | |
| 1 | Lack of credit availability | 139 | 2.31 | □ | 110 | 1.83 | □ |
| 2 | High cost of production | 157 | 2.61 | II | 151 | 2.52 | II |
| 3 | Lack of incentives and subsidies | 158 | 2.63 | I | 155 | 2.58 | I |

**B. Suggestions as expressed by the farmers practicing groundnut based cropping systems**

It can be clearly noted that, majority (96.66%) of the growers practicing CS-I expressed the need for the reasonable minimum support price for groundnut. Other suggestions given by the growers were providing seeds and fertilizers at affordable prices (90.00%) and promoting soil and moisture conservation technologies (80.00%). Further, respondents highlighted the importance of training in the latest improved agricultural techniques (71.66%) followed by awareness about importance of potash and gypsum application (68.33%), teaching skills related to seed treatment, insecticide usage, and trichoderma application (65.00%) while, 56.66% emphasized the importance of creating awareness about bio fertilizers and 51.66% advocated for raising awareness about the significance of ammonium sulphate.

The findings from Table 4 offer valuable insights into the perspectives of CS-II growers. Majority (95.00%) of the growers, voiced a strong preference for the implementation of a minimum support price for their groundnut crop and 86.66% of respondents advocatedfor training

UNDER PEER REVIEW

in the latest advanced farming techniques. Other suggestions given by respondents include promotion of soil moisture conservation technologies (85.00%), importance of imparting essential skills related to seed treatment, insecticide usage, and the application of trichoderma (81.66%). Beyond these key recommendations, other valuable suggestions include providing seeds and fertilizers at reasonable prices (78.33%), the need for greater awareness regarding the benefits of potash and gypsum application (65.00%), and importance of promoting bio fertilizers (63.33%). Lastly, 56.66% of growers advocated for increased awareness about the significance of ammonium sulphate in farming practices.

Efforts from relevant authorities are essential in establishing anappropriate minimum support price (MSP) for groundnut to counter market price fluctuations, demand uncertainties, increased cultivation costs, and seasonal market gluts. Small and marginal farmers, constrained by limited resources, often face market exploitation due to their limited bargaining power. Farmers are more willing to spend in higher-quality seeds, fertilizers, irrigation, and other agricultural inputs when they are guaranteed a minimum price for their harvests this can lead to increased production and yields. Soil and moisture conservation activities like dead furrow method, growing cover crops should be promoted by the line departments in order to reduce the risk posed by the uneven rainfall due to climatic change. Nutrients management by application of micro-nutrients which helps in improving oil content and pod development encouraged by creating awareness through extension strategies.

UNDER PEER REVIEW

**Table 4: Suggestions as expressed by the farmers practicing groundnut based cropping systems (n=120)**

| Sl. No. | Suggestions | CS-I $n_1$=60 | | CS-II $n_2$=60 | |
|---|---|---|---|---|---|
| | | No. | % | No. | % |
| 1 | Providing minimum support price | 58 | 96.66 | 57 | 95.00 |
| 2 | Skill teaching about seed treatment with insecticide and Trichoderma | 39 | 65.00 | 49 | 81.66 |
| 3 | Promote soil and moisture conservation technologies | 48 | 80.00 | 51 | 85.00 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | Training on latest improved technologies | 43 | 71.66 | 52 | 86.66 |
| 5 | Provide seeds and fertilizer at reasonable cost and at a right time | 54 | 90.00 | 47 | 78.33 |
| 6 | Create awareness about importance of potash and gypsum | 41 | 68.33 | 39 | 65.00 |
| 7 | Create awareness about importance of ammonium sulphate | 31 | 51.66 | 34 | 56.66 |

**Conclusion:**

Constraint analysis revealed that high wage rate, price fluctuation, low price for the produce, exploitation by the middleman and non-availability of quality inputs at reasonable rate are hindering the productivity of groundnut and indirectly influencing the farmers to not choose groundnut cultivation and opt for other commercial crops. These can be addressed by proper government intervention. Promotion of oilseed cultivation can be achieved by increasing the training and awareness progrmmmes on production technologies, soil and water conservation technologies and foremost thing is in time availability of quality inputs at reasonable price. The government needs to bring awareness among farmers about regional specific inter cropping of oilseed with pulses through proper coordination with line departments and grass root level workers.

**FUTURE SCOPE**

The study focuses on only one district of Karnataka. Similar studies can be carried out in other agro climatic zones of the state and country in order to reach a more concrete conclusion.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

UNDER PEER REVIEW

2.

3.

**REFERENCE**

UNDER PEER REVIEW

Annonymou. (2017). National Mission on Oilseed and Oil Palm. nmoop.gov.in.

Chavda. M. G. (2007). Knowledge and adoption of post harvest technology of groundnut crop in south Saurashtra agro climatic zone of Gujarat state. Ph.D. (Agri.) Thesis. Junagadh Agricultural University, Junagadh.

Gorfad, P. S. (2012). Farmers' perception and adoption of groundnut production technology. Ph.D. (Agri.) Thesis (Unpublished). Junagadh Agricultural University, Junagadh.

Gorfad. P. S. (2012). Farmers' perception and adoption of groundnut production technology. Ph.D. (Agri.) Thesis. Junagadh Agricultural University, Junagadh.

Jalu. S.N., Bariya. M.K. and Jadav. N.B.(2022). Constraints experienced by farmers in adoption of recommended groundnut crop production technology. Journal of Krishi Vigyan10(2):50-3.

Khare. A., Wakle. P. K., Shambharkar. Y. B and Patil, J. (2013).Correlates of Adoption and Constraints faced by the Gram Farmers in Adoption of Improved Cultivation Practices, Indian Journal of Research. 2(10): 8-10.

Khare. A.; Wakle, P. K.; Shambharkar, Y. B. and Patil, J. (2013). Correlates of Adoption and Constraints faced by the Gram Farmers in Adoption of Improved Cultivation Practices, *Indian Journal of Research,* 2(10): 8-10.

Khodifad. P. B. (2010). Sustainability of groundnut based cropping system of south Saurashtra agro-climaticzone of Gujarat state, Ph.D. Thesis (Unpublished). Junagadh Agricultural Univeristy, Junagadh.

Manjunath patil. (2023). A Study on knowledge and adoption of recommended production technologies of groundnut growers in Bagalkote district of Karnataka. *M.Sc. Thesis* (Unpub.), Univ. Agri. Sci., Bangalore.

Markana.J.G., Kalsariya. B. N and Bharad. N. D. (2015). Constraints Faced by Farmers in Adoption of Scientific *Kharif* Groundnut Production Technologies. *Gujarath. J. Ext. Edu.*26 (1).

Patil. B. N., Bhonde, R. And Khandikar, d. N. (2009). Trends in Area, Production and Productivity of Groundnut in Maharashtra. Financing Agriculture - A *National J. Agric. & Rural Development*:35-39.

Priya.N. K., Padmodaya. B., Srinivasulu. D.V., Shilpakala. V.(2021). Production constraints in groundnut crop in kadapa district of andhra pradesh. Journal of Krishi Vigyan.10(1):218-22.

Raviya. P.B., Fulmaliya. A.M., Mavani. D.B. and Kalsariya. B.N.(2016).Constraints faced by farmers in adoption of recommended groundnut production technologies. Int J Agric Sci. 8(26):1557-9.

Sardhara. A.D., JadaV. N.B., and Zala.(2020).Constraints in adoption of recommended plant protection Practices in groundnut and cotton crops.*Gujarath. J. Ext. Edu.*31(2).

Shwetha. N. V.(2016). Performance and perception about different farming systems adopted by farmers of Chickaballapura district of Karnataka. *M.Sc. Thesis* (Unpub.), Univ. Agric. Sci., Bangalore.

UNDER PEER REVIEW