International Journal of Chemical Studies

**P-ISSN: 2349–8528**
**E-ISSN: 2321–4902**
www.chemijournal.com
IJCS 2021; 9(1): 3289-3293

Received: 23-11-2020
Accepted: 30-12-2020

**AV Satpute**
PG Student, Department of Agronomy Section, R.C.S.M. College of Agriculture, Kolhapur, Maharashtra, India

**Dr. JB Patil**
Assistant Professor, Department of Agronomy Section, R.C.S.M. College of Agriculture, Kolhapur, Maharashtra, India

**NS Ghule**
PG Student, Department of Agronomy Section, R.C.S.M. College of Agriculture, Kolhapur, Maharashtra, India

**MJ Patil**
College Librarian, R.C.S.M. College of Agriculture, Kolhapur, Maharashtra, India

**Corresponding Author:**
**Dr. JB Patil**
Assistant Professor, Department of Agronomy Section, R.C.S.M. College of Agriculture, Kolhapur, Maharashtra, India

# Effect of inorganic and bio-fertilizers on yield attributes, yield and economic of summer groundnut *Arachis hypogaea* L.

**AV Satpute, Dr. JB Patil, NS Ghule and MJ Patil**

**DOI:** https://doi.org/10.22271/chemi.2021.v9.i1at.11743

**Abstract**
A field experiment entitled, "Effect of inorganic and bio-fertilizers on yield attributes, yield and economic of summer groundnut (*Arachis hypogaea* L.)" was conducted at PG Research Farm, Agronomy Section, R.C.S.M. College of Agriculture, Kolhapur during summer, 2019. The experiment was laid out in factorial randomized block design (FRBD) with three replications and nine treatment combinations of three inorganic fertilizer levels *viz.*, $F_1$-75% RDF (18.75:37.5:0 kg $ha^{-1}$), $F_2$-100% RDF (25:50:0 kg $ha^{-1}$), $F_3$-125% RDF (31.25:62.5:0 kg $ha^{-1}$) and three bio-fertilizers levels *viz.*, $B_1$- Control, $B_2$- *Rhizobium* spp. + PSB (Lignite based), $B_3$- *Rhizobium* spp. + PSB (Liquid based). The application of 100% of RDF $ha^{-1}$ was at par with 125% of RDF $ha^{-1}$ significantly over 75% RDF $ha^{-1}$ in respect of recording higher value of yield attributes and yield *viz*., number of pods $plant^{-1}$, weight of pods $plant^{-1}$ (g), dry pod yield (q $ha^{-1}$), dry haulm yield (q $ha^{-1}$), biological yield (q $ha^{-1}$), shelling (%), weight of 100 kernels (g), sound mature kernel (%) and harvest index (%). The dual seed inoculation of *Rhizobium* spp. + PSB (Lignite based) as well as *Rhizobium* spp. + PSB (Liquid based) in respect of recording higher value of yield attributes and yield *viz*., number of pods $plant^{-1}$, weight of pods $plant^{-1}$ (g), pod yield (q $ha^{-1}$), dry haulm yield (q $ha^{-1}$), biological yield (q $ha^{-1}$), shelling (%), weight of 100 kernels (g), sound mature kernel (%) and harvest index (%). The gross monetary returns and net monetary returns were higher due to application of 125% of RDF $ha^{-1}$ which was at par with 100% of RDF $ha^{-1}$ and dual seed inoculation of *Rhizobium* spp. + PSB (Lignite based) significantly higher over control and at par with dual seed inoculation of *Rhizobium* spp. + PSB (Liquid based).

**Keywords:** Inorganic, bio-fertilizers, attributes, economic, summer, *Arachis hypogaea* L.

## Introduction
The groundnut is valuable food and oilseed crop and commonly called as the king of vegetable oilseed crops or poor man's nut. The groundnut crop is worlds the 13$^{th}$ most important food crop and 4$^{th}$ most important oilseed crop and 3$^{rd}$ most important source of vegetable protein. During 2018-2019 groundnut was sown in around 27.84 million hectares and production was 46.75 million metric tonnes in world. The groundnut crop gives three times higher yield than that of *kharif* season because productivity in summer season due to availability of adequate sunshine, warm temperature and availability of timely irrigation during the different growth stages of crop and restricted incidence of pest and diseases. Groundnut is an exhaustive crop and removes large amount of macro and micro-nutrients from soil which cannot be met by single nutrient source. The supply of nutrients through, biofertilizer, organic and inorganic sources has been found to be the best option for increasing productivity and maintaining sustainability, and hence there is ample scope of increasing productivity through combined use of various nutrient sources (Patil *et al*., 2017) [12]. Judicial use of fertilizer is necessary for increasing agricultural production and reduced environmental pollution because continuous use of chemical fertilizers has deleterious effects on soil which in turn cause decline in productivity. Use of balanced fertilizer is required for maximum yields and maintenance of soil fertility. A balanced fertilizer means not only the use of major and secondary nutrients, but also other essential micronutrients and use of biofertilizers in correct proportions. The phosphobacteria solubilize the fixed phosphorus and makes it available to plants while Rhizobium encourages the nodulation, thereby enhancing the nitrogen.

Hence, the biofertilizer hold the key to the solution current problem of fertilizer expensiveness and can be a part of integrated nutrient management.

India is one of the major producers as well as consumer of groundnut in the world with (69.70 lakh tonnes) after China (166.24 lakh tonnes). During 2018-2019 groundnut was sown in around 40.13 lakh hectares which was 3.25 per cent lower than the corresponding period of last year (41.48 lakh hectares). During 2019-2020 in India, oilseeds production higher by 8 per cent in expectation on normal weather condition. The groundnut production in India was 54.41 lakh tonnes in 2018-19 which is lower by 17.74 per cent than the production of 66.15 million tonnes in 2017-2018, due to less crop coverage and deficient rainfall at initial stage of the crop. The average productivity of groundnut in India is just about 1000 kg per hectare as against world's average yield of 1340 kg per hectare. The crop gives three times higher yield than that of *kharif* season. It is observed that oil content in kernels is found to be higher by 2.28 to 4.5 per cent than *kharif* ones. Keeping this in view, a agronomic experiment was conducted to study the effect of inorganic and biofertilizers on yield of summer groundnut in sub-montane zone of Maharashtra.

## Materials and Methods

The experiment was laid out in factorial randomized block design (FRBD) with three replications and nine treatment combinations of three inorganic fertilizer levels *viz.*, $F_1$- 75% RDF (18.75:37.5:0 kg ha$^{-1}$), $F_2$- 100% RDF (25:50:0 kg ha$^{-1}$), $F_3$- 125% RDF (31.25:62.5:0 kg ha$^{-1}$) and three bio-fertilizers levels *viz.*, $B_1$- Control, $B_2$- *Rhizobium* spp. + PSB (Lignite based), $B_3$- *Rhizobium* spp. + PSB (Liquid based). The gross and net plot size were 5.4 m x 4.8 m and 4.8 m x 3.6 m, respectively. The soil of the experimental plot was sandy loam in texture, low in available nitrogen (231.24 kg ha$^{-1}$), moderately high in available phosphorus (24.25 kg ha$^{-1}$) and moderately high in available potassium (243.16 kg ha$^{-1}$). The soil was slightly alkaline in reaction (pH 8.23).

The crop, groundnut with variety JL-1085 (Phule Dhani) was sown on 15$^{th}$ of February, 2019 by dibbling method with different inorganic and biofertilizer levels. The crop was fertilized as per treatments by using urea and single super phosphate was given by placement method. In general, the summer season was good for crop growth and development. The experimental data was statistically analyzed by using a standard method of "analysis of variance" as reported by Panse and Sukhatme (1967) [13].

## Result and Discussion

### Effect on yield attributing characters

### A. Effect of inorganic fertilizers

The yield contributing characters like yield number of pods plant$^{-1}$ (45.18), weight of pods plant$^{-1}$ (44.00 g), shelling (68.41%), weight of 100 kernels (44.38 g) and sound mature kernel (78.54%) were also maximum with the 125% RDF and which was at par with 100% RDF and significantly superior over 75% RDF. The higher number of dry pod was obtained due to better growth as well as higher uptake of nutrients might have produced and converted more photosynthetic into numerous metabolites needed for such yield attribute. The higher number of pods per plant of groundnut could be attributed to favourable changes in physical and chemical characteristics of the soil which might have enabled better pod formation. However, Bhalerao *et al.*, (1993) [2], Ganamurthy and Balasubrimanian (1992) [6] and Chavan *et al.*, (2013).

### B. Effect of Bio-fertilizers

The yield contributing characters like yield number of pods plant$^{-1}$ (44.82), weight of pods plant$^{-1}$ (43.79 g), shelling (67.38%), weight of 100 kernels (44.07 g) and sound mature kernel (77.21%) were also maximum with the *Rhizobium* spp. + PSB (Lignite based) and which was at par with *Rhizobium* spp. + PSB (Liquid based) and significantly superior over control. Thus, the optimum growth of the plant due to favourable nutritional environment and higher uptake of nutrients might have favoured significant increase in number of pegs per plant and thus a greater number of pods per plant. However, Panwar and Singh (2003) [14], Mehta and Rao (1996), and Zalate and Padmani (2009).

**Table 1:** Yield attributing characters of groundnut at harvest as influenced by different treatments at harvest

| Treatments | At harvest | | | | |
|---|---|---|---|---|---|
| | Number of pods plant$^{-1}$ | Weight of pods plant$^{-1}$ (g) | Weight of 100 kernels (g) | SMK (%) | Shelling (%) |
| **Inorganic Fertilizer Levels** | | | | | |
| $F_1$- 75% of RDF | 40.00 | 39.11 | 39.90 | 68.75 | 61.01 |
| $F_2$- 100% of RDF | 44.90 | 43.72 | 43.54 | 77.46 | 67.97 |
| $F_3$- 125% of RDF | 45.18 | 44.00 | 44.38 | 78.54 | 68.41 |
| S. Em± | 0.26 | 0.31 | 0.29 | 0.48 | 0.38 |
| C. D. at 5% | 0.80 | 0.93 | 0.88 | 1.46 | 1.14 |
| **Biofertilizer Levels** | | | | | |
| $B_1$ – Control | 41.10 | 40.04 | 40.47 | 71.53 | 62.89 |
| $B_2$ - *Rhizobium spp.*+ PSB (Lignite based) | 44.82 | 43.79 | 44.07 | 77.21 | 67.38 |
| $B_3$ - *Rhizobium spp.*+ PSB (Liquid based) | 44.16 | 42.99 | 43.28 | 76.01 | 67.13 |
| S. Em± | 0.26 | 0.31 | 0.29 | 0.48 | 0.38 |
| C. D. at 5% | 0.80 | 0.93 | 0.88 | 1.46 | 1.14 |
| **Interactions (F× B)** | | | | | |
| S. E m± | 0.80 | 0.93 | 0.89 | 1.46 | 1.14 |
| C. D. at 5% | NS | NS | NS | NS | NS |
| General mean | 43.36 | 42.27 | 42.61 | 74.92 | 65.80 |

### C. Effect of Interaction

The interaction effects between the inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of yield attributing character of groundnut.

### Effect on yield of groundnut

### Dry pod and Halum yield (q ha$^{-1}$)

**A. Effect of Inorganic Fertilizers Levels:** The different fertilizer levels had a significant impact on the dry pod yield

of groundnut. Among the inorganic fertilizers, the application of 125% RDF recorded significantly the highest dry pod yield (24.95 q ha$^{-1}$) and dry halum yield (35.48 q ha$^{-1}$) of groundnut over 75% RDF. However, it was at par with application of 100% RDF the dry pod yield (24.60 q ha$^{-1}$) and dry halum yield (34.60 q ha$^{-1}$). This may be due to efficient and greater partitioning of metabolites and adequate translocation and accumulation of photosynthesis to developing reproductive structure under adequate fertilization that might have resultated in increase in important growth and yield contributing characters *viz.*, plant spread, number of branches, dry matter accumulation, number of pods and kernels and their weight and thousand kernel weight were significantly increased which resulted in increased dry pod yield with higher level of fertilizer. Further, the fertilizer application provided better conductive condition for higher uptake of nutrients. There results are in conformity with the above finding of Bhalerao *et al.,* (1993) [2], Ganamurthy and Balsubramanian (1992) [6] and Chavan *et al.,* (2013).

**B. Effect of Biofertilizer Levels**

The different biofertilizer treatments significantly differed in respect of the pod yield. The highest pod yield of groundnut were obtained due to dual inoculation of *Rhizobium* spp. + PSB (Lignite based) the dry pod yield (24.42 q ha$^{-1}$) and dry haulm yield (34.32 q ha$^{-1}$) of groundnut recorded significantly superior over the control. However, it was on par with dual seed inoculation with *Rhizobium* spp. + PSB (Liquid based) the dry pod yield (23.98 q ha$^{-1}$) and dry halum yield (33.86 q ha$^{-1}$). The important growth and yield contributing characters *viz.*, plant spread, number of branches, dry matter accumulation, number of pods and kernels and their weight and thousand kernel weight were significantly increased with the application of P-solubilizer treatments with *Rhizobium* inoculation due to additional nitrogen and phosphorous uptake, resulting in increased dry pod yield. Increase in root nodules due to P-solubilizer and nitrifying bacteria also helped in increasing better root development and dry pod yield by fixing more nitrogen and consequently increasing its absorption. These results were found to be in conformity with Mausumi Raychaudari *et al.,* (2003) [11] and Chavan *et al.,* (2013).

**C. Effect of Interaction**

The interaction effects between the inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of yield of groundnut.

**Harvest index (%)**

**A. Effect of Inorganic Fertilizers Levels**

The effect of inorganic fertilizer levels was found to be non-significant in respect of harvest index of groundnut. However, application of 75% RDF (18.75:37.5:0 kg NPK ha$^{-1}$) recorded the highest harvest index (41.74%) of groundnut, because of higher nitrogenous fertilization produce excessive haulm yield. There results are in conformity with the above finding of Kumaran (2000) [9].

**Table 2:** Mean dry pod yield, haulm yield, biological yield in (q ha$^{-1}$) and harvest index (%) of groundnut as influenced by different treatments

| Treatments | At harvest | | | |
|---|---|---|---|---|
| | Dry pod yield (q ha$^{-1}$) | Dry haulm yield (q ha$^{-1}$) | Biological yield (q ha$^{-1}$) | Harvest index (%) |
| **Inorganic Fertilizer Levels:** | | | | |
| $F_1$- 75% of RDF | 21.05 | 29.37 | 50.42 | 41.74 |
| $F_2$- 100% of RDF | 24.60 | 34.60 | 59.43 | 41.33 |
| $F_3$- 125% of RDF | 24.95 | 35.48 | 60.44 | 41.34 |
| S. Em± | 0.20 | 0.28 | 0.33 | 0.40 |
| C. D. at 5% | 0.60 | 0.84 | 1.00 | NS |
| **Biofertilizer Levels:** | | | | |
| $B_1$ – Control | 22.18 | 31.27 | 53.63 | 41.37 |
| $B_2$ - *Rhizobium spp.*+ PSB (Lignite based) | 24.42 | 34.32 | 58.77 | 41.60 |
| $B_3$ - *Rhizobium spp.*+ PSB (Liquid based) | 23.98 | 33.86 | 57.88 | 41.44 |
| S. Em± | 0.20 | 0.28 | 0.33 | 0.40 |
| C. D. at 5% | 0.60 | 0.84 | 1.00 | NS |
| **Interactions (F× B)** | | | | |
| S. E m± | 0.60 | 0.85 | 1.00 | 1.21 |
| C. D. at 5% | NS | NS | NS | NS |
| General mean | 23.53 | 33.15 | 56.76 | 41.47 |

**B. Effect of Biofertilizer Levels**

The effect of biofertilizer was found to be non-significant in respect of harvest index of groundnut. The dual inoculation of *Rhizobium* spp. + PSB (Lignite based) (41.60%) and dual seed inoculation with *Rhizobium* spp. + PSB (Liquid based) (41.44%) recorded highest harvest index numerical value of groundnut over the control.

**C. Effect of Interaction**

The effect of interaction between inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of harvest index of groundnut.

**Economic studies**

**Gross monetary returns (Rs ha$^{-1}$)**

**A. Effect of Inorganic Fertilizers Levels**

The application of 125% RDF recorded significantly highest gross monetary return (Rs 130569 ha$^{-1}$) of groundnut over 75% RDF treatments. However, it was comparable with 100% RDF (Rs 128681 ha$^{-1}$). Similar results reported by Lomte and Khupse (1990) [10] and Pawar *et al.,* (2011) [15].

**B. Effect of Biofertilizer Levels**

The application of dual seed inoculation with *Rhizobium* spp. + PSB (Lignite based) recorded significantly highest gross

monetary return (Rs 127769 ha$^{-1}$) of groundnut over control. However, it was comparable with dual seed inoculation with *Rhizobium* spp. + PSB (Liquid based) (Rs 125466 ha$^{-1}$). Similar results revealed by Mankar *et al.,* (2005) and Datta *et al.,* (2014) [5].

**C. Effect of Interaction**

The effect of interaction between inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of economics of different treatments of groundnut.

**Net Monetary Returns (Rs ha$^{-1}$)**

**A. Effect of Inorganic Fertilizers Levels**

The application of 125% RDF recorded significantly highest net monetary return (72348 Rs ha$^{-1}$) of groundnut over 75% RDF. However, it was comparable with 100% RDF (70513 Rs ha$^{-1}$). Similar results reported by Chavan *et al.,* (2014) [4], Kathmale *et al.,* (2000) [8], Karunakaran *et al.,* (2010) [7] and Waghmode *et al.,* (2017) [17].

**B. Effect of Biofertilizer Levels**

The highest net monetary return (69633 Rs ha$^{-1}$) of groundnut recorded significantly superior with application of dual seed inoculation with *Rhizobium* spp. + PSB (Lignite based) over control. However, it was comparable with dual seed inoculation with *Rhizobium* spp. + PSB (Liquid based) (67174 Rs ha$^{-1}$). Similar results revealed by Chatra Ram *et al.,* (2008) [3], Mankar *et al.,* (2005), Singh *et al.,* (2011) [16] and Datta *et al.,* (2014) [5].

**C. Effect of Interaction**

The effect of interaction between inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of economics of different treatments of groundnut.

**Benefit: Cost ratio**

**A. Effect of Inorganic Fertilizers Levels**

The application of 125% RDF recorded significantly highest B:C ratio (2.24) over 75% RDF. However, it was on par with 100% RDF (2.21). Here the B:C ratio increases with increasing inorganic fertilizer levels. Similar results reported by Bala and Nath (2015) [1], Chavan *et al.,* (2014) [4], Chaudhary *et al.,* (2015), Kathmale *et al.,* (2000) [8] and Waghmode *et al.,* (2017) [17].

**Table 3:** Mean cost of cultivation, gross monetary returns and net monetary returns as influenced by different treatments

| Treatments | Cost of cultivation (Rs ha$^{-1}$) | Gross monetary returns (Rs ha$^{-1}$) | Net monetary returns (Rs ha$^{-1}$) | B:C ratio |
|---|---|---|---|---|
| **Inorganic Fertilizers** | | | | |
| $F_1$- 75% of RDF | 57944 | 110032 | 52088 | 1.89 |
| $F_2$- 100% of RDF | 58170 | 128681 | 70513 | 2.21 |
| $F_3$- 125% of RDF | 58221 | 130569 | 72348 | 2.24 |
| S. Em± | - | 1029 | 1029 | 0.018 |
| C. D. at 5% | - | 3084 | 3084 | 0.054 |
| **Biofertilizer levels** | | | | |
| $B_1$ – Control | 57906 | 116048 | 58142 | 2.00 |
| $B_2$ - *Rhizobium spp*.+ PSB (Lignite based) | 58137 | 127769 | 69633 | 2.19 |
| $B_3$ - *Rhizobium spp*.+ PSB (Liquid based) | 58292 | 125466 | 67174 | 2.15 |
| S. Em± | - | 1028.78 | 1029 | 0.018 |
| C. D. at 5% | - | 3084.28 | 3084 | 0.054 |
| **Interactions (F × B)** | | | | |
| S. E m± | - | 3086 | 3086 | 0.054 |
| C. D. at 5% | - | NS | NS | - |
| General mean | 58112 | 123094 | 64983 | 2.11 |

**B. Effect of Biofertilizer Levels**

The application of dual seed inoculation with *Rhizobium* spp. + PSB (Lignite based) recorded significantly highest B:C ratio (2.19) over control. However, it was comparable with dual seed inoculation with *Rhizobium* spp. + PSB (Liquid based) (2.15). Similar results revealed by Chatra Ram *et al.,* (2008) [3], Singh *et al.,* (2011) [16] and Datta *et al.,* (2014) [5].

**C. Effect of Interaction**

The effect of interaction between inorganic fertilizer and biofertilizer levels were found to be non-significant in respect of B:C ratio.

**Conclusion**

1. The application of 100% of RDF was at par with 125% of RDF in respect of recording higher value of yield of summer groundnut resulting into higher dry pod and haulm yields. Hence, application of 100% RDF to summer groundnut found remunerative.
2. The dual seed inoculation of *Rhizobium* spp. + PSB (Lignite based) as well as *Rhizobium* spp. + PSB (Liquid based) were comperable in respect of higher values yield resulting into higher dry pod and haulm yields. Hence, dual seed inoculation of either *Rhizobium* spp. + PSB lignite based or liquid found suitable to summer groundnut found remunerative.
3. The application 100% RDF and 125% of RDF were comparable in respect of recording higher values of gross and net monetary returns as well as benefit cost ratio for summer production of groundnut. Hence, application of 100% RDF found remunerative for summer groundnut.
4. The dual seed inoculation of *Rhizobium spp*. + PSB (Lignite based) and *Rhizobium spp*. + PSB (Liquid based) were comparable in respect of recording higher values of gross and net monetary returns as well as benefit cost ratio for summer production of groundnut. Hence, application of *Rhizobium spp*. + PSB lignite based or liquid based found beneficial for summer groundnut.

**References**

1. Bala M, Nath K. Maximization of groundnut (*Arachis hypogaea* L.) yield by nutrient management practice. J of Exptl. Bio and Agril. Sci 2015, 3(3).
2. Bhalerao PD, Jadhao PN, Fuzele GR. Response of promising groundnut (*Arachis hypoagea* L.) genotypes to

fertilizer levels during summer. Indian J Agron 1993;38(3):505-507.
3. Chatra Ram, Singh HB, Patel RB, Kumar Gopal. Effect of application of manures and biofertilizers on yield, soil fertility and economics of groundnut (*Arachis hypogaea* L.) under middle Gujarat conditions. India. J Crop. Sci 2008;6(2):751-753.
4. Chavan AP, Jain NK, Mahadkar UV. Direct and residual effects of fertilizers and biofertilizers on yield, nutrient uptake and economics of groundnut (*Arachis hypogaea* L.)- rice (*Oryza sativa*) cropping system. Indian J Agron 2014;59(1):53-58.
5. Datta M, Yadav GS, Chakraborty, Sandip. Integrated nutrient management in groundnut (*Arachis hypogaea* L.) in sub-tropical humid climate of north- east India. Indian J of Agron 2014;56(2):322-326.
6. Gananamurthy, Balasubrimanian. Influence of phosphorus and potassium on rainfed groundnut (*Arachis hypoagea* L.). Indian J Agron 1992;37(4):775-757.
7. Karunakaran V, Rammohan J, Chellamuthu V, Poonghuzhalan R. Effect of integrated nutrient management on the growth and yield of groundnut (*Arachis hypogaea* L.) in coastal region of Karaikal. Indian J of Agron 2010;55(2):128-132.
8. Kathmale DK, Khadtare SV, Kamble MS, Patil RC. Integrated nutrient management in groundnut-wheat cropping system on vartisols of western Maharashtra plains zone. Indian J Agron 2000;45(2):248-252.
9. Kumaran S. Role of organic manure, fertilizer levels, split application of phosphorus and gypsum application on shelling percentage, harvest index, pod and oil yield of irrigated groundnut. Res. on Crops 2000;1:344-347.
10. Lomte MH, Khupse VS. Phosphorus and yield relationship of summer groundnut. J Maharashtra Agric Univ 1990;15(8):316-318.
11. Mausumi Raychandhuri, Ngachan SV, Raychaudhari S, Singh AL. Yield response of groundnut (*Arachis hypoagea* L.) to dual inoculation and liming of an acid hill ultisol of Manipur. Indian J Agril Sci 2003;73(2):86-88.
12. Patil DB, Pawar PP, Wadile SC, Patil HM. Effect of integrated nutrient management on growth and yield of *kharif* groundnut (*Arachis hypogaea* L.). Int. J of Hort., Agric. and Food Sci 2017;1(1):21-23.
13. Panse VG, Sukhatme PV. Stastical methods for agricultural research workers. ICAR publication, New Delhi 1967.
14. Panwar AS, Singh NP. Effect of conjunctive use of phosphorus and bio-organics on growth and yield of groundnut (*Arachis hypoagea* L.). Indian J Agron 2003;48(3):214-216.
15. Pawar KP, Bhagat AA, Navale PA. Study the effect of integrated nutrient management on performance of groundnut and wheat in groundnut-wheat-coriander system. J Agric. Res. Techol 2011;36(3):539-541.
16. Singh GP, Singh PL, Panwar AS. Response of groundnut (*Arachis hypogaea* L.) to biofertilizer, organic and inorganic sources of nutrient in north east India. Legume Res 2011;34(3):196-201.
17. Waghmode BD, Kambale AS, Navhale VC, Chendge PD, Mahadkar UV. Effect of plant population and fertilizer doses on yield attributes, yield and economics of summer groundnut. Int. J Curr. Microbiol. App. Sci 2017;6(11):2670-2675.