



## EFFECT OF INM ON GROWTH AND YIELD OF GROUNDNUT

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### Abstract

A field experiment was conducted during February 2017 at Semmedu village, Panruti Taluk, cuddalore district to study the effect of integrated nutrients management on growth and yield of groundnut (G-7). The experimental design adopted in this study was randomized block design with following thirteen treatments T<sub>1</sub> - Control, T<sub>2</sub> - 100% RDF, T<sub>3</sub> - 100% RDF + Pr.M @ 5 t ha<sup>-1</sup>, T<sub>4</sub> - T<sub>2</sub> + VC @ 5 t ha<sup>-1</sup>, T<sub>5</sub> - T<sub>2</sub> + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup>, T<sub>6</sub> - T<sub>2</sub> + Gypsum @ 200 Kg ha<sup>-1</sup>, T<sub>7</sub> - T<sub>2</sub> + K-humate @ 4 Kg ha<sup>-1</sup>, T<sub>8</sub> - 125% RDF, T<sub>9</sub> - T<sub>8</sub> + Pr.M @ 5 t ha<sup>-1</sup>, T<sub>10</sub> - T<sub>8</sub> + VC @ 5 t ha<sup>-1</sup>, T<sub>11</sub> - T<sub>8</sub> + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup>, T<sub>12</sub> - T<sub>8</sub> + Gypsum @ 200 Kg ha<sup>-1</sup>, T<sub>13</sub> - T<sub>8</sub> + K-humate @ 4 Kg ha<sup>-1</sup>. Each treatment was replicated thrice. The results of this experiment showed that combined application of 100 % RDF + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup> (T<sub>5</sub>) recorded highest growth and yield parameters viz., plant height (82.20 cm), leaf area index (2.76), dry matter production (5776.20 kg ha<sup>-1</sup>), number of pods plant<sup>-1</sup> (20.96), 100 kernel weight (49.76 g), shelling percentage (72.83), pod yield (2576.4 kg ha<sup>-1</sup>), haulm yield (3174.5 kg ha<sup>-1</sup>) and kernel yield (2044.46 kg ha<sup>-1</sup>), recorded with significantly higher values.

**Key words :** *Rhizobium* and *Phosphobacteria*, 100% RDF, growth and yield.

### Introduction

Groundnut (*Arachis hypogaea* L.) is a major oil seed crop in India and in many developing countries. It is native of South America and originated in Brazil, from where it spreads throughout the world. Mainly it is a crop of semi-arid tropics including Asia and African countries. It is grown under a wide range of environments encompassing latitude between 40° South and 40° North of equator. The crop is grown with an average rainfall of 500 to 1200 mm as a sole crop and as an intercrop during *kharif* and *rabi* seasons. Groundnut is unique and important oil seed crop in India, it is cultivated in 4.56 m ha with production of 6.77 m tonnes and a productivity of 1486 kg ha<sup>-1</sup> (2015-2016) (Indiastat.com). Tamilnadu ranks third in the country with an area of 346.6 lakh ha contributing 6.48 per cent and production of 892.3 lakh tonnes contributing 14.12 per cent with an average productivity of 2.57 per cent t ha<sup>-1</sup>. Among the districts of Tamilnadu, Cuddalore district has a wider area of 1.57 lakh hectares under groundnut crop with annual

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production of 2.42 lakh tonnes. Groundnut is a multipurpose crop providing cooking oil (44-50%), vegetable protein (26%) and is rich in vitamins A, B and B2 group. Processed groundnut cake flour and groundnut protein concentrates are being used on a wide scale in diets of infants and children.

Groundnut is the premier oilseed crop of India and contributed nearly 40 per cent of the total oilseed production. But the average yield of the crop in India is as low as 900 kg ha<sup>-1</sup>. Among the several constraints, improper nutrient management is the reason for low productivity. It is necessary to provide edible oil to the growing population on the basis of minimum requirement of oils and fats, it should be 5.49 million tonnes, against the present production of only 2.9 million tonnes leaving a gap of 2.6 million tonnes (Veeramani *et al.*, 2012). Peanut seed contains 25 to 30% digestible protein, 45 to 50% oil, 20% carbohydrate and 5% fibre and ash which make a substantial contribution to human nutrition (Ahmad and Rahim. 2007). Groundnut being a legume oilseed crop, P, S and Ca requirement is quite high.

Beneficial effects of *Rhizobium* inoculation has been observed by several workers (Naidu, 2000) who reported an increase in yield and oil content of groundnut with such inoculation. Phosphorus deficiency is probably the major limitation to the growth of legumes in many soils. *Phosphobacteria*, an organism turning the phosphate present in the soil from unavailable to available form, has an indirect but definite on the nodulation and yield of groundnut.

## Materials and Methods

A field experiment was conducted during February 2017 at Semmedu village, Panruti taluk, Cuddalore district to study the effect of integrated nutrients management on growth and yield of groundnut (G-7). The experimental design adopted in this study was randomized block design with following thirteen treatments.

T<sub>1</sub> - Control, T<sub>2</sub> - 100% RDF, T<sub>3</sub> - 100% RDF+Pr.M @ 5t ha<sup>-1</sup>, T<sub>4</sub>-T<sub>2</sub> + VC @ 5 t ha<sup>-1</sup>, T<sub>5</sub>-T<sub>2</sub> + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup>, T<sub>6</sub>-T<sub>2</sub> + Gypsum @ 200 Kg ha<sup>-1</sup>, T<sub>7</sub>-T<sub>2</sub>+K-humate @ 4 Kg ha<sup>-1</sup>, T<sub>8</sub> - 125%RDF, T<sub>9</sub>- T<sub>8</sub> + Pr.M @ 5 t ha<sup>-1</sup>, T<sub>10</sub>-T<sub>8</sub> + VC @ 5 t ha<sup>-1</sup>, T<sub>11</sub>-T<sub>8</sub> + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup>, T<sub>12</sub>-T<sub>8</sub> + Gypsum @ 200 Kg ha<sup>-1</sup>, T<sub>13</sub>-T<sub>8</sub> + K-humate @ 4 Kg ha<sup>-1</sup>. Each treatments was replicated thrice. The soil of Semmedu village was found to contain 74.6, 14.70 and 9.80 per cent sand, silt and clay respectively and comes under the textural class sandy loam. The bulk density, particle density, pore space, pH, electrical conductivity and cation exchange capacity of the soil were 1.18, 2.41 Mg m<sup>-3</sup>, 47 per cent, 6.5, 0.40 dSm<sup>-1</sup> and 8.56 cmol (p+) kg<sup>-1</sup> respectively. The organic carbon content of soil was 0.27 g kg<sup>-1</sup>. The available N, P and K content of soil was 207.00, 19.30 and 269.40 kg ha<sup>-1</sup> respectively. The available Sulphur content was 8.9 mg kg<sup>-1</sup>. The exchangeable calcium, magnesium, potassium and sodium content were 4.10, 2.60, 0.51 and 0.76 c mol(p+) kg of soil respectively.

The entire dose of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied as basal. The pod and haulm samples were collected at harvest stage analysed for the content of N, P and K using the standard procedures and uptake were calculated. At harvest pod and haulm yield were recorded.

## Results and Discussion

### Growth parameters

The data on growth parameters like plant height, leaf area index and dry matter production as influenced by

soil application of fertilizer, *Rhizobium* and *Phosphobacteria* are presented in table 1. The results of this experiment showed that combined application of 100 % RDF + Basal application *Rhizobium* and *Phosphobacteria* @ 2 Kg ha<sup>-1</sup> (T<sub>5</sub>) recorded highest growth parameters viz., plant height (82.20 cm), leaf area index (2.76), dry matter production (5776.20 kg ha<sup>-1</sup>). It was followed by the treatment (T<sub>11</sub>) 125% Recommended dose of fertilizers with *Rhizobium* and *Phosphobacteria* @ 2 kg ha<sup>-1</sup>. This was followed by treatments T<sub>6</sub>, T<sub>12</sub>, T<sub>4</sub>, T<sub>7</sub>, T<sub>2</sub>, T<sub>9</sub>, T<sub>13</sub>, T<sub>3</sub>, T<sub>10</sub> and T<sub>8</sub>. Whereas, the absolute control (T<sub>1</sub>) had the least effect in all other treatments.

More number of leaves per plant may also be positively contributed to more plant height in the inoculated plant with phosphorus solubilizing bacteria by giving sufficient phosphorus for leaves formation and growth. Seed inoculation with biofertilizers *Rhizobium*+PSM gave response on plant height as well as yield attributes. Biofertilizers inoculation resulted in greater nodulation. The additional supply of nitrogen and phosphorus helped in formation of new cell and thus, proliferation of growth. Phosphorus is an important constituent of co-enzymes involved in photosynthesis which might have been increased accumulation of photosynthesis. *Rhizobium* bacteria have the capacity to fix atmospheric nitrogen to soil and make it available to plant. Phosphorus solubilizing microorganisms reserved in available form of readily hydrolyzes organic phosphate and degrade them in the soil through production of organic acids. These findings are in agreement with those obtained by Panwar *et al.* (2002), Meshram *et al.*, (2004) in groundnut crop.

The increase in leaf area index could be attributed due to increase in cell division and leaf expansion. While more number of leaves were recorded due to beneficial influence of biofertilizers which release growth promoting substances along with enhancement of nitrogen availability. The application of chemical fertilizer in combination with organic fertilizer increased the fertilizer use efficiency of added chemical fertilizers, which helped in increasing nutrient availability and improved the physical and biological health of soil. Apart from that the organic manure also contains almost all the essential elements in variable quantities, which has synergistic effect with other essential elements for their availability. This effect might be reflected in increased plant height, spread, number of branches and leaf area in groundnut (Rayer, 1984). Different fertilizers levels did not significantly influence the plant height except 75% RDF which recorded lower plant height. Application of 100% RDF+ *Rhizobium* in 2016 and 125% RDF + *Rhizobium* in 2017 recorded higher number of pods which was on par with other

**Table 1:** Effect of INM on growth parameters of groundnut.

Treatments	Plant height (cm)	Leaf Area Index	Dry matter production (kg ha <sup>-1</sup> )
T <sub>1</sub>	37.37	1.38	2328.20
T <sub>2</sub>	62.10	2.20	4194.03
T <sub>3</sub>	48.73	1.80	3343.66
T <sub>4</sub>	70.73	2.46	4780.10
T <sub>5</sub>	82.20	2.76	5776.20
T <sub>6</sub>	77.50	2.61	5255.36
T <sub>7</sub>	66.23	2.32	4494.46
T <sub>8</sub>	41.20	1.54	2719.80
T <sub>9</sub>	57.90	2.07	3914.73
T <sub>10</sub>	44.93	1.67	3025.13
T <sub>11</sub>	81.23	2.74	5710.50
T <sub>12</sub>	76.23	2.59	5072.90
T <sub>13</sub>	53.30	1.94	3635.66
S.Ed	1.74	0.05	134.02
CD (P=0.05)	3.61	0.12	276.62
CV	3.48	4.13	3.93

treatments except 75% RDF in both the years. (ArunaandKarunaSagar, 2018).

### Yield components

The data on yield parameters like number of pods plant<sup>-1</sup>, 100 kernel weight, shelling percentage, pod yield, haulm yield and kernel yield as influenced by soil application of fertilizer, *Rhizobium* and *Phosphobacteria* are presented in table 2. The results of this experiment showed that combined application of 100 % RDF + Basal application *Rhizobium* and *Phosphobacteria* @ 2 kg ha<sup>-1</sup> (T<sub>5</sub>) recorded highest yield parameters viz., number of pods plant<sup>-1</sup> (20.96), 100 kernel weight (49.76 g), shelling percentage (72.83), pod yield (2576.4 kg ha<sup>-1</sup>), haulm yield (3174.5 kg ha<sup>-1</sup>) and kernel yield (2044.46 kg ha<sup>-1</sup>). It was followed by the treatment T<sub>11</sub> (125%) Recommended dose of fertilizers with *Rhizobium* and *Phosphobacteria* @ 2 kg ha<sup>-1</sup>. This was followed by treatments T<sub>6</sub>, T<sub>12</sub>, T<sub>4</sub>, T<sub>7</sub>, T<sub>2</sub>, T<sub>9</sub>, T<sub>13</sub>, T<sub>3</sub>, T<sub>10</sub> and T<sub>8</sub>. Whereas, the absolute control (T<sub>1</sub>) had the least effect in all other treatments.

The yield attributes like pod yield, haulm yield, kernel yield were significantly increased in the treatment T<sub>5</sub> - 100 % NPK + *Rhizobium* and *Phosphobacteria* @ 2 kg ha<sup>-1</sup> and followed by T<sub>11</sub> - 125% NPK + *Rhizobium* and *Phosphobacteria* (Fig. 3). An increase in yield by inoculation of bio fertilizers could be attributed to synergistic interaction among phosphate solubilizing microorganism and *Brady Rhizobium* which led to increase in nodulation and nitrogen fixation was also

reported by Jain and Trivedi (2005).

It might have provided that sufficient and balanced nutrients in readily available form throughout the growth period of the crop and the increased availability of plant nutrients, their uptake leading to the greater photosynthesis production of metabolites and enzymatic activities might have influenced into increased nodulation and extensive root system and the greater production of metabolites and their translocation to various sinks, especially the productive structures (pods and seeds) could have helped to increase into the number of pods per plant, besides increasing the over all growth. Results of the present investigation were in similar line with those of Sharma *et al.*, (2005).

Pod yield in all the treatment combinations were significantly higher than the untreated control. Beneficial role of *Rhizobium* in the N nutrition through nodulation and a consequently better growth or development attributed for this yield advantage (Subramaniyan and Kalaiselven, 2000). Balamurugan and Gunasekaran (1996) reported that the combined inoculation of *Rhizobium* and *Phosphobacteria* gave maximum crop growth, nodulation and yield in groundnut. Similar trend was followed in case of haulm yield.

Application of 100% RDF + *Rhizobium* recorded higher pod yield in 2017 which was on par with 100 and 125% RDF either with or without *Rhizobium* and 75% RDF with *Rhizobium*. Explicit role of *Rhizobium* in furnishing better rhizosphere for plant growth and supply of nitrogen might be the reason for the higher yield of groundnut. Maximum yield is attributed to the symbiotic relationship of *Rhizobium* with the roots of the leguminous plants which fix the atmospheric nitrogen in to the roots of the groundnut (Ahmad *et al.*, 2009).

Fertilizer of NPK nutrients to groundnut had the positive influence to increase the pod yield. Groundnut yield and yield attributing characters increased steadily with increasing levels of NPK nutrient application. The highest pod yield of groundnut (2911 kg/ha) was found with the application of 100% RDF (F3) which was followed by 125% RDF (F4) with 2910 kg/ha, 75% RDF (F2) with 2786 kg/ha and 50% of RDF (F1) with 2294 kg/ha. with increasing levels of inorganic fertilizer (NPK) and was found maximum with 100% RDF (20:60:40 kg/ha of N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O), thereafter, pod yield of groundnut decreased with further increased the fertilizer doses (125% RDF). (Gunri *et al.*, 2015). Hosamani and Janawade (2006) reported that 100 % RDF recorded the highest pod yield of groundnut. They also reported that beyond 100% RDF application to groundnut, pod yield decreased gradually. Similar trend was also observed in haulm yield of groundnut. The interaction effect did not exhibit significant results on pod and haulm yield.

**Table 2:** Effect of INM on yield parameters of groundnut.

Treatments	No.of pods plant <sup>-1</sup>	Shelling percentage (g)	100 kernel weight	Pod yield (kg ha <sup>-1</sup> )	Haulm yield (kg ha <sup>-1</sup> )	Kernel yield (kg ha <sup>-1</sup> )
T <sub>1</sub>	9.46	71.0	24.26	763.9	938.0	436.53
T <sub>2</sub>	15.83	72.1	39.56	1787.1	2205.1	1327.66
T <sub>3</sub>	12.66	71.64	31.80	1296.9	1564.1	942.46
T <sub>4</sub>	17.90	72.42	44.63	2144.6	2669.2	1633.33
T <sub>5</sub>	20.96	72.83	49.76	2576.4	3174.5	2044.46
T <sub>6</sub>	19.33	72.64	47.20	2340.7	2895.6	1835.40
T <sub>7</sub>	16.86	72.27	42.26	1959.3	2464.9	1467.20
T <sub>8</sub>	10.60	71.28	27.00	889.7	1116.4	562.30
T <sub>9</sub>	14.73	71.95	36.93	1624.9	1998.24	1229.56
T <sub>10</sub>	11.67	71.49	29.36	1033.4	1347.13	752.86
T <sub>11</sub>	20.43	72.77	49.60	2553.2	3148.2	2040.13
T <sub>12</sub>	19.03	72.56	47.00	2335.1	2888.1	1805.86
T <sub>13</sub>	13.73	71.80	34.23	1446.4	1757.9	1047.63
S.Ed	0.47	0.06	1.13	60.3	79.85	45.93
CD(P=0.05)	0.98	NS	2.35	124.4	164.81	94.81
CV	3.75	3.78	3.61	3.82	3.78	4.27

### Conclusion

Based on the results of the field experiment, it is concluded that among the different treatments tried, the application NPK 100% RDF along with Rhizobium and Phosphobacteria @ 2 kg ha<sup>-1</sup> T<sub>5</sub> was superior in performance with respect to growth and yield attributes of groundnut and also found to be effective in improving soil physical, chemical and biological properties. It can be recommended to the farmers to achieve more benefit cost.

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