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## Integrated nutrient management practices on the physiological and yield traits of irrigated groundnut (*Arachis hypogaea* L.)

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### Abstract

A field experiment was aimed to improve the physiological and yield traits of groundnut in sandy loam soil under the irrigated condition at Nakkambadi village, Ariyalur, Tamil Nadu during *Kharif*-2021, to evaluate the influence of various organic sources. The experiment was set up in Randomized Block Design (RBD) replicated thrice, comprised of twelve treatments *viz.*, farmyard manure, goat manure, poultry manure, bio-fertilizer along with foliar spray of Panchagavya, Dasagavya. Among the various organic sources, basal application of FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2 kg ha<sup>-1</sup> along with foliar spray of 3% Panchagavya at 30 and 45 DAS recorded significantly the highest pod and kernel yield (3406 and 2549 kg ha<sup>-1</sup>, respectively) and it was followed by basal application of FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2kg ha<sup>-1</sup> along with foliar spray of 3% Dasagavya at 30 and 45 DAS.

**Keywords:** FYM, PM, GM, Panchagavya, Dasagavya, *Rhizobium*, RDF

### Introduction

Groundnut (*Arachis hypogaea* L.) is considered one of the most important oilseed crops in tropical and subtropical countries. Oilseed crops have been the backbone of the agriculture and economy of India from time immemorial. Among the oilseed crops, Groundnut accounts for more than 40 percent of the acreage 60 percent of production in the country and ranks 1<sup>st</sup> place in India and 2<sup>nd</sup> place in production (Sridhar *et al.*, 2020) [15]. Groundnut is the “*King of Oilseed crops*” and also known as *poor man’s nut* or *Earth nut*, *Monkey nut*, *Goober peas*, *Jack nuts*, *Manila nuts* and *pig nuts* (Solaimalai *et al.*, 2020) [14].

Groundnut is an important oilseed and supplementary food crop. Globally, it covers an area of 29.5 m ha with the production of 48.5 m t with a productivity of 1647 kg ha<sup>-1</sup>. In India, the groundnut crop grows in an area of 6.09 m ha with the production of 10.21 m t and productivity of 1676 kg ha<sup>-1</sup>. In Tamil Nadu, it covers an area of 0.41 m ha with a production of 0.94 m t and productivity of 2310 kg ha<sup>-1</sup> (GOI, 2021). It contributes to more than 50 percent of edible oil production in the country and it contains high quality of 45- 50 percent edible oil and easily digestible protein of 26 percent with carbohydrates content of about 20 percent, 5 percent fiber and ash which make a sustainable contribution to human nutrition (Mehriya *et al.*, 2020) [6]. Its productivity is quite low compared to other countries like the USA, China, and Myanmar. Low productivity of groundnut is due to many reasons including which rainfed cultivation under hot and humid weather, lack of awareness about modern production technologies, low input use and loss of commodity at various stages of crop production by biotic and abiotic stresses are important. Integration of chemical fertilizers with organic manures is beneficial. The integrated approach to nutrient supply by using organic, inorganic and bio-fertilizers is gaining importance because this system not only reduces the use of costly inorganic fertilizers but also it is an eco-friendly approach to achieving sustainable high yields in food, nutritional security and environmental safety. FYM helps in maintaining soil fertility and productivity and not only retain moisture in the soil but also provides nutrient slowly synchronous with crop needs. Poultry manure helps to improve crop productivity and quality, the availability of nutrients in the soil and soil characteristics. Foliar application of nutrients along with soil application has several advantages in supplementing the nutritional requirements of crops such as rapid and efficient response by the plants (Singh *et al.*, 2021) [13]. Also, wherever soil application is impossible. Application of bio-fertilizers and other plant growth-promoting organisms to enhance the nutrient levels of soils which support growth and productivity in the agricultural field.

The use of FYM with other organic amendments like poultry manure, goat manure, panchagavya and Dasagavya provide a safer and environment-friendly way of applying nutrients to groundnut. Considering these facts in view an experiment was conducted to study the effect of different organic sources used on the growth and yield of groundnut.

### Materials and Methods

A field experiment was conducted at Nakkambadi village, Ariyalur District, Tamil Nadu, India during Kharif- 2021. The experimental farm is geographically situated at 11°26'14.4'' N latitude and 79°18'1.37'' E longitude with an altitude of about 77 m above the mean sea level (MSL). The experiment was laid out in Randomized Block Design (RBD) with three replications. There were altogether twelve treatments viz., (T<sub>1</sub> – control), (T<sub>2</sub> – FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2 kg ha<sup>-1</sup>), (T<sub>3</sub> – Poultry Manure @ 2.5 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2Kg ha<sup>-1</sup>), (T<sub>4</sub> – Goat Manure @ 2.5 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2 kg ha<sup>-1</sup>), (T<sub>5</sub> – T<sub>2</sub> + 3% Panchagavya at 30 and 45DAS), (T<sub>6</sub> – T<sub>3</sub> + 3% Panchagavya at 30 and 45 DAS), (T<sub>7</sub> – T<sub>4</sub> + 3% Panchagavya at 30 and 45 DAS), (T<sub>8</sub> – T<sub>2</sub> + 3% Dasagavya at 30 and 45 DAS), (T<sub>9</sub> – T<sub>3</sub> + 3% Dasagavya at 30 and 45 DAS), (T<sub>10</sub> – T<sub>4</sub> + 3% Dasagavya at 30 and 45 DAS), (T<sub>11</sub> – *Rhizobium* @ 2kg ha<sup>-1</sup> + 3% Panchagavya at 30 and 45 DAS), (T<sub>12</sub> – *Rhizobium* @ 2 kg ha<sup>-1</sup> + 3% Dasagavya at 30 and 45 DAS). The present study aims to identify the right source of organic nutrients to increase the growth and yield of groundnut. The soil of the experimental field is sandy loam with a pH of 8. The soil is medium in available nitrogen (271.4 kg ha<sup>-1</sup>), medium in available phosphorus (15.65 kg ha<sup>-1</sup>) and medium in available potassium (280.3 kg ha<sup>-1</sup>). The experimental field was irrigated with good quality irrigation water obtained from the bore well. FYM, Poultry Manure, Goat Manure, *Rhizobium* and RDF were applied 15 days before sowing for better decomposition. Groundnut variety VRI 2 was chosen for this study popularly cultivated in this region for its suitability and yield potentiality and it is sown at a spacing of 30 X 10 cm seeds were treated with *Pseudomonas fluorescence* @ 10 g kg<sup>-1</sup> of seed. Foliar spray of 3% Panchagavya and 3% Dasagavya at 30 DAS and 45 DAS. All the standard agronomic practices for the groundnut were adopted as per the recommendations (CPG, 2020).

### Results and Discussion

#### Growth and Yield Attributes

The study revealed that growth and yield attributes viz., plant height, number of pods, 100 kernel weight, shelling percentage and oil content of groundnut were significantly influenced due to integrated nutrient application of organic sources such as basal and foliar. The result revealed that application of FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2 kg ha<sup>-1</sup> + 3% Panchagavya at 30 and 45 DAS significantly recorded a higher plant height of (45.31 cm) at the harvest stage, Dry matter production (2913 kg ha<sup>-1</sup>) at the 60 DAS, respectively and no. of pods per plant<sup>-1</sup> (18.05), Leaf area index (2.32), 100 kernel weight (49.00), Pod yield (3406 kg

ha<sup>-1</sup>) and Kernel yield (2549 kg ha<sup>-1</sup>) superior over control than other all organic sources. It might be due to the integrated use of organic materials and inorganic fertilizers applied to groundnut along with the presence of beneficial microorganisms, nutrients and plant growth-promoting organisms like panchagavya. Previous research on the effect of organic manures in enhancing soil productivity has been reported by (Patil *et al.*, 2012) [8]. Similar findings were reported by (Ananda *et al.*, 2018) [11], that the treatment with panchagavya at 3% gave a higher leaf area index (3.20) at 60 DAS when compared to other treatments in groundnut.

Choudhary *et al.*, (2017) [3] reported that the application of panchagavya gave the maximum plant height, higher dry matter accumulation, and maximum leaf area index at branching and flowering stages in black gram. The highest yield was obtained under treatment of T<sub>5</sub> (FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2Kg ha<sup>-1</sup> + 3% Panchagavya at 30 and 45 DAS). This might be due to an adequate supply of nutrients at different growth stages of the crop and timely application had a significant effect on pod yield and kernel yield of groundnut (Patel *et al.*, 2018) [7].

Organic manure (FYM) combined with 100% RDF + application of Panchagavya 6% helpful to increase growth characteristics, like plant height and dry matter accumulation reported by (Sindhu *et al.*, 2022) [12]. Foliar application of major and micronutrients had a remarkable influence on crop yield which might be due to their critical role in growth, involvement in photosynthesis, respiration and other biological and physiological activities and thus helps in getting a higher yield of the crop as reported by (Saliyah *et al.*, 2013). The application of farmyard manure combined with bio-fertilizers increased the 100-grain weight, kernel yield and shelling percentage in groundnut was reported by Vala *et al.* (2017) [16], Sarade *et al.*, (2016) [10], Sengupta *et al.*, (2016) [11], Vekariya *et al.* (2014) [17]. Proper utilization and combination of nutrients have a significant effect on the proper growth which in turn enhances its yield attributes and yield (Das *et al.*, 2008) [4]. Kerenhap *et al.* (2007) [5] reported that organic manure has an important role as an N-fixing organism and the availability of P and K. The increase in yield and growth attributes in crops was probably because the application of organic manures improves the physicochemical conditions of soil and better supply of nutrients to crops.

### Conclusion

The results of the present study it was concluded that groundnut grown under irrigated conditions in the Cauvery delta zone of Tamil Nadu was highly responsive to this nutrient management practice. However, the result showed that application of farmyard manures 10 t ha<sup>-1</sup>, 50% recommended dose of fertilizer along with bio-fertilizer and 3% Panchagavya at 30 and 45 DAS. Panchagavya enhances productivity through the increase in growth-related parameters like the number of leaves, leaf area index, oil content, protein content, other quality and yield parameters. Thus, Panchagavya plays a very important role in the growth and yield parameters.

**Table 1:** Impact of different organic sources and foliar spray of panchagavya, and Dasagavya on physiological and yield traits.

Treatments	Pl.ht(cm)	DMP (kg ha <sup>-1</sup> )	LAI	Yield attributes			
	Harvest stage	60 DAS	30 DAS	No of pods plant <sup>-1</sup>	100 Kernel Wight (g)	Pod Yield (kg ha <sup>-1</sup> )	Kernel Yield (kg ha <sup>-1</sup> )
T <sub>1</sub>	30.43	1697	0.84	8.02	48.03	2008	1384
T <sub>2</sub>	37.40	2513	1.55	13.70	48.38	2653	1865
T <sub>3</sub>	36.52	2473	1.51	12.16	48.35	2558	1738
T <sub>4</sub>	35.64	2423	1.45	10.91	48.25	2476	1723
T <sub>5</sub>	45.31	2913	2.32	18.05	49.00	3406	2549
T <sub>6</sub>	41.36	2763	1.93	17.22	48.82	3136	2298
T <sub>7</sub>	40.05	2692	1.83	16.34	48.71	2994	2182
T <sub>8</sub>	42.43	2893	2.14	17.88	48.93	3288	2439
T <sub>9</sub>	39.50	2601	1.71	15.62	48.56	2870	2097
T <sub>10</sub>	38.95	2566	1.67	14.60	48.44	2775	1995
T <sub>11</sub>	34.76	2276	1.33	9.86	48.31	2394	1710
T <sub>12</sub>	33.88	2126	1.28	9.00	48.15	2289	1618
S.E(m)	1.51	103.97	0.04	0.40	1.98	80.52	57.80
CD(P=0.05)	4.26	306.91	0.14	1.20	NS	237.69	170.63

(T<sub>1</sub> – control), (T<sub>2</sub> – FYM @ 10 t ha<sup>-1</sup> + 50% RDF + *Rhizobium* @ 2 kg ha<sup>-1</sup>), (T<sub>3</sub> – PM @ 2.5 t ha<sup>-1</sup>+50% RDF + *Rhizobium*@ 2kg ha<sup>-1</sup>), (T<sub>4</sub> – GM @ 2.5 t ha<sup>-1</sup> + 50% RDF+ *Rhizobium* @ 2 kg ha<sup>-1</sup>), (T<sub>5</sub> –T<sub>2</sub> + 3% Panchagavya at 30 and 45 DAS), (T<sub>6</sub> –T<sub>3</sub>+3% Panchagavya at 30 and 45 DAS), (T<sub>7</sub> –T<sub>4</sub> + 3% Panchagavya at 30 and 45 DAS), (T<sub>8</sub> –T<sub>2</sub>+ 3% Dasagavya at 30 and 45 DAS), (T<sub>9</sub>– T<sub>3</sub>+ 3% Dasagavya at 30 and 45 DAS), (T<sub>10</sub>– T<sub>4</sub>+ 3% Dasagavya at 30 and 45 DAS), (T<sub>11</sub> – *Rhizobium* @ 2 kg ha<sup>-1</sup> + 3% Panchagavya at 30 and 45 DAS), (T<sub>12</sub> – *Rhizobium* @ 2 kg ha<sup>-1</sup> + 3% Dasagavya at 30 and 45 DAS)

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