



## Research Article

# INFLUENCE OF ORGANIC NUTRIENT SOURCES ON GROWTH, YIELD ATTRIBUTES, YIELD AND ECONOMICS IN RAINFED GROUNDNUT

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**Abstract:** In organic groundnut production, to improve use efficiency of organic nutrient sources and yield potential, the following study was formulated to study the effect of organic sources of nutrients on the growth, yield attributes and economics of groundnut field experiments were conducted during kharif seasons of three consecutive years (2009 to 2011) at Coconut Research Station, Tamil Nadu Agricultural University, Aliyarnagar, Tamil Nadu. The treatments were viz., farmers practice (control), Farm Yard Manure @ 7.5 t ha<sup>-1</sup> inoculated with microbes (15 Days Before Sowing), seed treatments (Biofertilizers and Biofungicides) along with foliar spray of either 1 % Pseudomonas, 5 % Neem Seed Kernel Extract (NSKE) and 3 % of Panchagavya at 40-45 DAS in Randomized Block Design with three replications. The results revealed that application of FYM @ 7.5 t ha<sup>-1</sup> inoculated with microbes (15 DBS) along with Seed treatment (Biofertilizers and Biofungicides) and Foliar spray of either 1 % Pseudomonas, 5 % NSKE and 3 % of Panchagavya at 40-45 DAS recorded the highest growth attributes, yield attributes and pod yield (2580 kg ha<sup>-1</sup>).

**Keywords:** Farm Yard Manure (FYM), Biofertilizers, Panchagavya, Neem Seed Kernel Extract (NSKE), Pseudomonas

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## Introduction

Groundnut (*Arachis hypogaea*) is the major oil producing crop and it is commonly known as pea nut or poor men's cashew and wonder nut. It is under legume family which is the important source of protein for the vegetarian population in India. The area occupied by groundnut is about 6.7 million ha and contributes 7.3 million tonnes towards the oilseed production. Groundnut seed contains 40 - 50 per cent oil, 20 - 40 per cent protein and 10 - 20 per cent carbohydrate depending on the variety. Green revolution posed a serious problem to human health and the environment due to excessive usage of chemical fertilizers and agro chemicals. The repeated use of inorganic fertilizers and reduced use of organic fertilizers has caused staggered or sustained yields in recent years due to reduction in soil organic carbon status of Indian soils.

Organic agriculture practices minimize the environmental hazards and use of locally available farm wastes for the source of nutrients. Organic agriculture protects long term fertility of soil and provides continues nutrients to the plant by the activity of microorganisms. Since the organically produced groundnut is of much demand and fetches premium prices in the world market. Organic manures produce residual effect on the plant nutrient availability and enhanced the productivity in the crops [1]. Increased groundnut yield and sustainability can be achieved only through organic farming practices [2]. Hence the present research was taken to study the effect of organic sources of nutrient on the growth attributes, yield attributes and economics of groundnut.

## Materials and Methods

Field experiments were conducted at Coconut Research Station, Aliyarnagar, Tamil Nadu, India, during three subsequent kharif seasons 2009 - 2011. Coconut Research Station, TNAU, Aliyarnagar, is located near Western Ghats (100 N latitude and 770 E longitude) in Western Zone of Tamil Nadu, 20 km south of Pollachi at an elevation of 260 meters with an undulating topography.

The soil of the experimental field was sandy loam in texture, organic carbon 0.45 %, pH 7.4, available nitrogen 228 kg ha<sup>-1</sup>, available Phosphorus 21 kg ha<sup>-1</sup> and available potassium 378 kg ha<sup>-1</sup>. The experiment comprised of seven treatments with T1 - Location specific farmer's practices (Recommended dose of inorganic fertilizers alone), T2 - Farm Yard Manure inoculated (7.5 t ha<sup>-1</sup>) with Microbes (Rhizobium and Phosphobacteria) 15 Days Before Sowing, T3 - T2 + Seed treatment with Bio fertilizers (Rhizobium and Phosphobacteria) and Bio pesticides (Pseudomonas), T4 - T3 + Foliar application of Pseudomonas @ 1 % at 40 - 45 DAS, T5 - T3 + Foliar application of Neem Seed Kernel Extract (NSKE) @ 5 % at 40 - 45 DAS, T6 - T3 + Foliar application of Panchagavya @ 3 % at 40 - 45 DAS, T7 - Control, respectively. The experiment was laid out in randomized block design with seven treatments and three replications. The crop was irrigated 7 to 9 times during its period of growth at different seasons. The test crop variety of VRI - 6 was used for the experiment with a spacing of 30 cm x 10 cm and recommended dose of fertilizer is 17:35:54 kg ha<sup>-1</sup>. All the growth and yield parameters were recorded at 20 DAS, 40 DAS and at harvest stage. The cost of cultivation, gross return and net return were computed for each treatment, considering the prevailing market rate for inputs, produce and the wages paid to the labourers at CRS, Aliyarnagar and expressed in Rs. ha<sup>-1</sup>. Statistical analysis for the crop data were carried out using the method [3]. Wherever statistical significance was observed,

## Results and Discussion

### Plant height and Root length (cm)

The plant height recorded at different growth stages registered no significant difference [Table-1]. However, the highest plant height of 41.8 cm and 69.3 cm during 60 DAS and at harvest stages were recorded in FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes + seed treatment with biofertilizer and biopesticide + foliar application of panchagavya @ 3 per cent at 40-45 days after sowing.

Table-1 Effect of different combinations of organic packages on plant dry matter production kg/ha at 40 DAS and at harvest and nodule number per plant and nodule DMP (g/plant) at 40 and 60 DAS of groundnut (Pooled data) 2009-2011

Treatments	Plant height in cm		Root length in cm		Plant dry matter production kg/ha		Root nodules in numbers /plant		Nodule DMP in g/plant	
	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	40 DAS	60 DAS	40 DAS	60 DAS
Location specific farmer's practices (T <sub>1</sub> )	25.7	63.7	9.8	12.1	960	4912	30.3	64.2	0.65	0.76
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes (T <sub>2</sub> )	28.5	66.4	10.8	12.7	1125	5282	32	62.1	0.71	0.87
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides (T <sub>3</sub> )	26.5	66.6	10.1	12.6	1256	5493	30.9	59.4	0.82	0.96
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of <i>Pseudomonas</i> @ 1 % at 40 -45 DAS (T <sub>4</sub> )	26.8	67.8	10.6	12.6	1324	6843	27.5	60.2	0.79	1.29
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of NSKE @ 5 % at 40 -45 DAS (T <sub>5</sub> )	27.2	68.4	10.4	12.3	1368	7012	28.6	55.3	0.84	1.35
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of Panchagavya @ 3 % at 40 -45 DAS (T <sub>6</sub> )	26.1	69.3	11.8	13.2	1389	7522	28.8	60.8	0.81	1.42
Control (T <sub>7</sub> )	27.2	62.2	10.4	11.7	638	3558	90.6	53	0.62	0.53
SE d	2.2	5.6	0.9	1	72	380	5.7	4.5	0.05	0.07
CD (P=0.05)	NS	NS	NS	NS	156	829	12.37	NS	0.12	0.15

Table-2 Effect of organic nutrients on yield attributes, yield and Economics of groundnut (Pooled data) 2009-2011

Treatments	Shelling (%)	Sound Matured Kernels	100 Kernel weight (g)	No. of Matured pods	Pod yield (kg ha <sup>-1</sup> )	Haulm yield (kg ha <sup>-1</sup> )	Net return (₹/ha)	BCR
Location specific farmer's practices (T <sub>1</sub> )	62.9	73	32	18.1	1864	2715	37712	1.7
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes (T <sub>2</sub> )	64.5	74.7	31.7	19.5	2038	2833	53942	2.23
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides (T <sub>3</sub> )	65.5	76	32.3	19.7	2106	2938	56610	2.28
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of <i>Pseudomonas</i> @ 1 % at 40 -45 DAS (T <sub>4</sub> )	68.4	80.8	34.1	22.3	2434	2542	78102	2.74
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of NSKE @ 5 % at 40 -45 DAS (T <sub>5</sub> )	68.4	81.9	33.7	23.1	2492	3528	82578	2.82
FYM inoculated (7.5 t ha <sup>-1</sup> ) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of Panchagavya @ 3 % at 40 -45 DAS (T <sub>6</sub> )	69.6	82.8	34.8	23.2	2580	3701	88872	2.98
Control (T <sub>7</sub> )	60.9	67.6	28.8	17.4	1403	1855	20036	1.95
SE d	1.8	0.9	1	1.4	136	192	-	-
CD (P=0.05)	4.1	2.1	2.2	3	296	419	-	-

Similar to the plant height, the root length also recorded no significant difference among treatments as a result of different sources of organic sources of nutrients at different crop growth stages. But, relatively higher root length (11.8 cm and 13.2 cm) at 40 DAS and at harvest stages was recorded in FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes + seed treatment with biofertilizer and biopesticide along with foliar application of panchagavya @ 3 % at 40 - 45 DAS. The increase in plant height and root length of groundnut crop might be due to application of FYM which stimulates the activities of microorganisms and facilitates the availability of plant nutrient to the crops [4].

#### Plant dry matter production (kg ha<sup>-1</sup>)

At 40 and 60 DAS treatments receiving comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DBS and seed treatment with bio fertilizers and bio pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) alone or along with foliar application of either *Pseudomonas* 1 % or NSKE 5 % or Panchagavya @ 3 % at 45 DAS recorded significantly highest plant DMP followed by FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DBS [Table-1]. The lowest PDMP was recorded with control (no application). The application of FYM inoculated with microbes increased the dry matter production, which might be due to increased release of macro as well as micronutrients and helping groundnut to have better absorption of nutrients [5]. Availability of potassium to crop would have increased with application of FYM, increasing moisture content of soils. Addition of FYM might have restored soil from potassium depletion, exhibit positive potassium balance and maximum P fixation [6].

#### Root nodules count and Nodule Dry Matter Production (NDMP)

The highest nodule count in numbers was recorded with control at 40 DAS and was followed by all other treatments which were comparable among themselves. The nodule count was non-significant at 60 DAS [Table-1]. Highest nodule DMP at 40 DAS was recorded with comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + Phosphobacteria @ 3 pkts / 7.5 t of FYM) on 15 DBS and seed treatment with bio fertilizers and bio pesticides (*Pseudomonas*) alone or along with foliar application of either *Pseudomonas* 1 % or NSKE 5 % or Panchagavya @ 3 % at 45 DAS. At 60 DAS comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DBS and seed treatment with bio

fertilizers and bio pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) along with foliar application of either *Pseudomonas* 1 % or NSKE 5 % or Panchagavya @ 3 % at 45 DAS recorded significantly higher nodule DMP. The lowest Nodule DMP was recorded with control. Poorter and Nagel (2000) [7] found that increased allocation of food material to roots in turn enhances the root volume and thereby weight of root nodules concomitantly.

#### Yield and yield attributes

The 100 Kernel Weight, Sound Matured Kernel, Shelling Percentage were non-significant. Suryanarayana Reddy (1991) [8] have reported application FYM increased the 10% shelling percentage, 100 kernel weight 32 %, numbers of pods and pod yield per plant in groundnut crop [Table-2]. The number of matured pods (2.8, 20.7, 19.9 no./plant), pod yield (3126, 2989, 2865 kg ha<sup>-1</sup>) and haulm yield of (4396, 4189, 4256 kg ha<sup>-1</sup>) were recorded with comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pockets / 7.5 tonnes of FYM) on 15 DAS and seed treatment with bio-fertilizers and bio-pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) followed by foliar application of *Pseudomonas* 1 % (T<sub>4</sub>) or NSKE 5 %, or Panchagavya @ 3 % at 45 DAS, respectively [Table-2]. The lowest number of matured pods (11.6) pod yield (937) and haulm yield (1378) was recorded with control. Balasubramanian and Palaniappan (1994) [9] reported that use of microbial inoculants in combination with FYM favored groundnut production. microbial inoculants (including e.g. Rhizobium and mycorrhizal fungal inoculants) introduced into soil or plant culture enhance plant productivity directly or indirectly [10]. The highest dry matter production in application of both Rhizobium and phosphobacterium was due to the fact that it produced maximum shoot length, higher number of branches per plant and leaf area index (LAI) [11]. The importance of organic to groundnut plants was emphasized by Ahmed et al. (1997) [12] who stated that the highest dry matter accumulation, kernel yield and oil content were achieved by fertilization with farmyard manure. Natarajan (2002) [13] opined increased yield of crop plants with panchagavya application is due to enhancement in the biological efficiency of crop plants.

#### Economics

The treatment with comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DAS and seed treatment with bio fertilizers and bio pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) and foliar application of Panchagavya @ 3 % at 45

DAS recorded highest BCR of 2.98, net return of ₹ 88872 ha<sup>-1</sup> [Table-2] and closely followed by comprehensive application of FYM inoculated (7.5 t ha<sup>-1</sup>) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DAS and seed treatment with bio fertilizers and bio pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) and foliar application of *Pseudomonas* @ 1 % at 45 DAS (2.74) and comprehensive application of FYM inoculated (7.5 t/ha) with microbes (Bio fertilizers, Rhizobium + PSB + PSN @ 3 pkts / 7.5 t of FYM) on 15 DAS and seed treatment with bio fertilizers and bio pesticides (*Pseudomonas*, PSB, PGPR, Trichoderma) and foliar application of NSKE @ 5% at 45 DAS (2.82). The farmer's practice recorded lowest BCR of 1.79 due to the high cost of cultivation. The control plot recorded 1.95. Application of FYM @ 21.9 t ha<sup>-1</sup> produced the highest DMP, pod yield and haulm yield, and gave higher net return and BCR [14]. Subrahmaniyan et al. (2000) [15] found that application of FYM @ 15t ha<sup>-1</sup> enhanced the pod yield of groundnut (2890 kg ha<sup>-1</sup>) and net return (Rs. 28607 ha<sup>-1</sup>) compared to lower level of FYM and control under rainfed condition.

## Conclusion

From the above study, it can be concluded that application of organic manures along with microbial consortia (Biofertilizer and Biofungicides) improve the mineralization of nutrients and make it easily available to plants. The soil characters also improve with the exudates of microbes and improves the root biomass and plant growth. Hence, application of FYM @ 7.5 t ha<sup>-1</sup> inoculated with microbes (15 DBS) along with Seed treatment (Biofertilizers and Biofungicides) and Foliar spray of either 1 % *Pseudomonas*, 5 % NSKE and 3 % of Panchagavya at 40 - 45 DAS can be recommended to achieve highest growth attributes, yield attributes and pod yield.

**Application of research:** In organic groundnut cultivation, to improve the efficacy of bulky organic manures. FYM inoculated (7.5 t ha<sup>-1</sup>) with Microbes + Seed treatment with Bio fertilizers and Bio pesticides + Foliar application of Panchagavya @ 3 % at 40 - 45 DAS can be recommended.

**Research Category:** Organic Agriculture

**Abbreviations:** DBS – Days Before Sowing, FYM Farm Yard Manure, NSKE Neem Seed Kernel Extract

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**Study area / Sample Collection:** Coconut Research Station, Aliyarnagar

**Cultivar / Variety / Breed name:** Groundnut / VRI - 6

**Conflict of Interest:** None declared

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