



## EVALUATION ON THE EFFECT OF ORGANIC PRACTICES ON THE GROWTH AND YIELD OF VARIOUS GROUNDNUT TYPES

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### Abstract

During the kharif season of 2021, a field experiment was conducted in field located at Sambaravalli pudhur, Coimbatore district, Tamil Nadu. The purpose of the experiment was to identify an appropriate groundnut variety for organic cultivation and examine the impact of different organic inputs on the growth and yield of groundnut. For this research, three groundnut varieties, namely Girnar 4, TMV 14, and VRI 8, were selected to evaluate the effects of various cultivation practices. The experiment followed a factorial randomized block design. The findings revealed that the treatment involving the application of 5 tons/ha of farm yard manure, along with 1 ton/ha of vermicompost, and foliar application of 3% panchagavya at 15 day intervals, yielded the best results for all groundnut varieties. Among the varieties, TMV 14 consistently exhibited favourable outcomes across all treatments.

**Keywords:** Groundnut, Farmyard Manure, Vermicompost, Panchagavya 3%, Organic Farming, Zero Budget Natural Farming

### INTRODUCTION

Organic method of farming is a technique of enhancing the ultimate source of energy in such a way that their energies are available for sustainable agriculture. This approach revolves around the recycling of natural organic matter and the practice of crop rotation. By employing these methods, organic farming maintains a harmonious balance of living organisms such as bacteria and earthworms in the soil. Not only are organic products free from harmful chemicals, but they also offer enhanced safety, health benefits, and superior taste. This holistic system of production management prioritizes and improves the overall health of the agro ecosystem, including biodiversity, biological cycles, and soil biological activities (Pathak *et al.*, 2004). Zero budget Natural Farming (ZBNF) is an agricultural approach primarily focused on enhancing plant health through natural means. It prioritizes the use of liquid organic manures, such as Jeevamruth and Beejamruth, derived from desi

cow dung and cow urine. The objective is to cultivate plants that are robust enough to withstand diseases and pests without relying on external interventions.

Groundnut (*Arachis hypogaea* L.) belonging to genus *Arachis* of family Leguminosae is the “King of oilseed” in India. It is an important crop for both oil and food. Globally, the crop is raised on 29.5 million hectares with a total production of 48.7 million MT (FAO, 2019). The average productivity is 1400 kg ha<sup>-1</sup>. In India, the crop is raised on 47 lakh hectares with a total production of 67 lakh tonnes. The average productivity is 1422 kg ha<sup>-1</sup> (Indiastat, 2018). Owing to its high content of digestible proteins (22-30%), vitamins (E, K & B group), minerals (phosphorus, calcium, magnesium and potassium) and phytosterols groundnut has gained importance as a food crop (Savage and Keenan, 1994). The oil content of the seed ranges between 44% and 50%, depending upon the varieties and agronomic conditions.

Choosing the right adaptive variety with balanced nutrient supply may solve the yield gap problems. In order to better understand the practices followed in organic farming and the responses of each variety as well as the cost saving and income gained by the farmers, the study was carried out.

## MATERIALS AND METHODS

### Experimental site, design and treatments

Field experiment was conducted at organically maintained field geographically located at 11°20' N latitude, 77°02' E longitude at an altitude of 426.7 m above mean sea level in Sambaravalli pudhur, Mettupalayam taluk, Coimbatore district during *kharif* 2021. The soil of the experimental site was sandy clay loam with organic carbon 0.8%, available N 204 kg/ha, P<sub>2</sub>O<sub>5</sub> 55 kg/ha, K<sub>2</sub>O 598 kg/ha. The field experiment was structured using a factorial randomized block design, involving two factors and three levels, which were replicated three times. Uniform spacing of 30 cm between row and 10 cm between plants was maintained throughout the crop growth. Appropriate crop production and protection measures were followed to raise a healthy crop. The experimental treatments comprise T1 – National project on Organic Farming (NPOF) - basal application of Farmyard Manure (@12.5 ton/ha) + Vermicompost (@1 ton/ha) at two split doses and foliar application of 3% Panchagavya at 15 days interval, T2 – Zero Budget Natural Farming (ZBNF) - seed treatment with Bijamritham + soil drenching of Jeevamritham at 15 days interval + straw mulching, T3 – Conventional cultivation package of practices as per TNAU crop production guide and T4 –

Absolute control. Three varieties of groundnut crop used are V1 – Girnar 4, V2 – TMV 14, V3 – VRI 8.

#### **Organic nutrient sources preparation:**

**Jeevamritham preparation** (Palekar, 2006): A plastic drum with a capacity of 200 litres was taken and 10 kg of cow dung was put into the drum. To the cow dung in the drum, 10 litres of cow urine was added and mixed well. Then 2 kg of jaggery, 2 kg of pulse flour and 100 g of soil was added and finally all the ingredients were mixed well with water. The volume was then made up to 200 litres. The drum was covered with a lid and kept in shade / dry place. The mixture was stirred well in clock wise direction twice or thrice in a day (morning, afternoon & evening) for about 1 minute regularly.

**Bijamritham preparation (for 100 kg seeds)** (Palekar, 2007): Take 5 kg of cow dung in a cloth, bound it with a tape/rope, and submerge in 20 litres of water for 12 hrs. Simultaneously, dissolve 50g of slaked lime in 1liters of water in a separate container and keep stable for overnight. After 12 hrs, squeeze this bundle of cow dung for thrice, thereby: all the essence of cow dung will be drawn to water (cow dung extract). Then add 1 kg of soil in cow dung extract by stirring it well. To this, pour 5liters of cow urine and lime water, and mix well.

**Panchagavya preparation** (Selvaraj *et al.*, 2007): Place a wide mouthed mud pot or a concrete tank or a plastic can open under shade and use a wire mesh or plastic mosquito net to cover the container from houseflies or mosquitoes or any pest from breeding and the formation of maggots in the solution. At first mix cow dung (7 kg) and cow ghee (1 litre) thoroughly then stir to the mixture twice a day both in morning and evening. After 3 days add cow urine (10 litres) and water (10 litres) to the prepared mixture and mix it well, keep it for 15 days with regular stirring in both morning and evening. Add cow's milk (3 litres), curd (2 litres), tender coconut water (3 litres), jaggery (3 kg) and well ripened banana (12 numbers ) to the prepared mixture and give a thorough stir daily, after 30 days panchagavya stock solution will be ready to be applied.

## **RESULT AND DISCUSSION**

### **Effect of the treatments on plant height**

From the results presented, it appears that organic manure and organic nutrients foliar applications has greatly increased the vegetative growth of the plant (Figure 1). Plant height

ranges from 13-22 cm at 30 DAS, 24-38cm at 60 DAS, 32-50 cm at harvest stages of the crop in this experiment. The plant height recorded at different growth stages registered that treatment with basal application of farmyard manure + vermicompost and foliar application of 3% panchagavya was significantly higher (20.0 cm, 37.1 cm and 48.1 cm respectively) at all growth stages in all the varieties (Table 1). The least plant height (15.6 cm, 25.1 cm and 35.8 cm respectively) was recorded at treatment T4 (control). The increase in plant height of groundnut might be due to stimulated activities of microorganisms facilitated by the application of organic manure to the soil and panchagavya spray at 15 days interval throughout the crop duration. This might also be due to the application of FYM and vermicompost that played an important role in improving the fertility and productivity of soils through its positive effects on soil physical, chemical and biological properties and balanced plant nutrition. Similar findings were given by Patil *et al.*, (2012) in which, application of panchagavya 3% at 15 days after flowering increased the plant height (37.01 cm) in chickpea. As reported by Jain *et al.*(2013) presence of various types of growth hormones like ABA, IAA, GA, also acts as an effective pest repellent thus enhanced the growth, and produced a healthy plant.

Table. 1. Effect of organic management practice on plant height of groundnut

Plant Height @harvest (cm)					
	T1	T2	T3	T4	Mean
V1	50.08	48.69	43.29	38.36	45.10
V2	47.05	45.40	44.95	36.22	43.41
V3	47.35	46.39	42.27	32.85	42.22
Mean	48.16	46.83	43.50	35.81	
	Variety (V)		Treatment (T)		Interaction (V X T)
SEd	0.43		0.49		0.86
CD	0.89		1.03		1.79

### Effect of treatments on plant dry matter production

Observations were recorded at 30 DAS, 60 DAS and at harvest stages in three groundnut varieties and in all the treatments. Among all the treatments, varieties that received basal application of farmyard manure + vermicompost and foliar application of 3% panchagavya showed significantly higher total dry matter production 585 kg/ha, 2274 kg/ha and 4695 kg/ha respectively in all the stages (Table 2). Lowest dry matter production was recorded in absolute control treatment at all the growth stages 432 kg/ha, 1866 kg/ha and

3769 kg/ha respectively. Availability of 2366 ppm N, 187 ppm P and 1354 K from panchagavya might have increased the availability of macro as well as micronutrients and helping groundnut to have better absorption of nutrients (Bishal *et al.*, 2019). Availability of potassium to crop would have increased with application of FYM thus increasing the moisture content of soils. Addition of FYM and vermicompost might have restored soil from potassium depletion, exhibit positive potassium balance and maximum P fixation. The increase might be due to presence of plant growth substance, enzymes, cow dung in *Panchagavya* that acts as a growth medium of beneficial microbes (Gunasekar *et al.*, 2018).

Table. 2. Effect of organic management practice on total dry matter production of groundnut

Total Dry Matter Production @Harvest (kg/ha)					
	T1	T2	T3	T4	Mean
V1	4841	4784	4316	3955	4473.8
V2	4757	4454	4101	3752	4265.6
V3	4490	4341	4086	3602	4129.6
Mean	4695.9	4526.2	4167.4	3769.3	
	Variety (V)		Treatment (T)		Interaction (V X T)
SEd	72.97		84.26		145.95
CD	151.3		174.7		NS

### Effect of treatments on yield and yield attributes

The result showed that the 100-kernel weight, shelling percentage were non-significant and there was a significant difference in the seed yield (Table 3 and 4). As soon as the vegetative stage finish, pods started to form until the harvest. The result suggest that the highest pod yield was obtained in the treatment T1 (2477 kg/ha) which was treated with basal application of farmyard manure + vermicompost and foliar application of 3% panchagavya. The result was on par to zero budget natural farming applied treatment which yielded 2433 kg/ha of kernel. Lowest pod yield was recorded in control treatment (2132 kg/ha). The yield parameters of groundnut varieties were influenced positively by organic nutrient management practice by the addition of manures and liquid manures. Suryanarayana Reddy (1991) have reported application of FYM increased the shelling percentage by 10%, 100 kernel weight by 32 %, numbers of pods and pod yield per plant in groundnut crop. Tejada and González (2009) discovered that vermicompost reduce the use of mineral fertilizers hence considered as a soil additive. This is in accordance with the research findings of Shariff *et al.*, (2017) as seen in the greengram in which higher pod yield (1263.68 kg/ha) and significantly higher

yield attributes were obtained. Kumawat *et al.* (2011) had an increase in pod yield (2347 kg/ha) of groundnut by the application of panchagavya @3 l/m<sup>2</sup> because of improvement in soil health, by increase in availability of micronutrients and soil microbial population, and decrease in soil pH and EC.

Table. 3. Effect of organic management practice on seed yield and harvest index of groundnut

Kernel yield (kg/ha)						Harvest Index					
	T1	T2	T3	T4	Mean		T1	T2	T3	T4	Mean
V1	2763	2608	2525	2461	2589	V1	0.38	0.35	0.34	0.30	0.35
V2	2383	2397	2116	1949	2211	V2	0.30	0.29	0.27	0.20	0.27
V3	2285	2294	2092	1985	2164	V3	0.31	0.29	0.27	0.21	0.27
Mean	2477	2433	2244	2132		Mean	0.33	0.31	0.29	0.25	
			SEd	CD (0.05%)					SEd	CD (0.05%)	
Variety (V)			18.89	39.18		Variety (V)			0.014	0.030	
Treatment (T)			21.81	45.24		Treatment (T)			0.017	0.035	
Interaction (V X T)			37.78	78.36		Interaction (V X T)			0.029	0.061	

Table. 4. Effect of organic management practice on 100 kernel weight and shelling percentage of groundnut

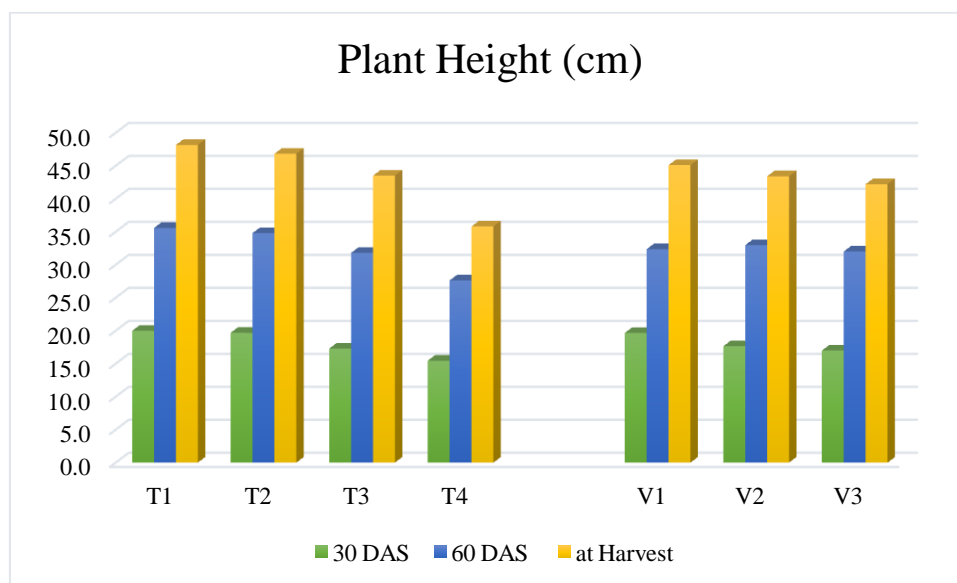
100 kernel weight (g)						Shelling percentage					
	T1	T2	T3	T4	Mean		T1	T2	T3	T4	Mean
V1	51.9	51.8	51.0	50.1	51.2	V1	70.8	70.5	69.7	69.8	70.1
V2	41.8	41.7	40.3	40.2	41.0	V2	70.3	70.0	70.1	69.6	70.1
V3	42.2	42.1	41.9	40.7	41.7	V3	69.6	69.7	69.5	69.2	69.5
Mean	45.3	45.2	44.4	43.7		Mean	70.4	70.0	69.8	69.4	
For comparing mean of			SEd	CD (0.05%)		For comparing mean of			SEd	CD (0.05%)	
Variety (V)			0.33	0.68		Variety (V)			0.39	0.81	
Treatment (T)			0.38	0.79		Treatment (T)			0.45	0.94	

Interaction (V X T)	0.66	1.37	Interaction (V X T)	0.78	1.63
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**Varietal differentiation on plant height**

Application of FYM + vermicompost and 3% panchagavya in NPOF treatment and seed treatment with Bijamritham + jeevamritham + straw mulching in ZBNF treatment positively influenced the plant height in all the varieties. The highest increase in plant height (21.0 cm, 35.9 cm and 50.0 cm respectively) was recorded in V1 (*Girnar 4*) under NPOF treatment in all the stages (Figure 1). Among the different varieties in plant height V1 (*Girnar 4*) and V2 (TMV 14) was on par and lowest plant height was recorded in V3 variety (13.8 cm, 26.7 cm and 32.8 cm respectively). Combined application of vermicompost (5 t/ha) to soil and foliar spray of *Panchagavya* 3% at ten days after sowing was recommended for yield and quality enhancement to *Amaranthus* cv. Co 2 (Rajendran *et al.*, 2006). Somasundaram (2007) substantiated that growth hormones like GA and IAA are present in *Panchagavya*.

Figure. 1. Effect of organic management practice on plant height of groundnut

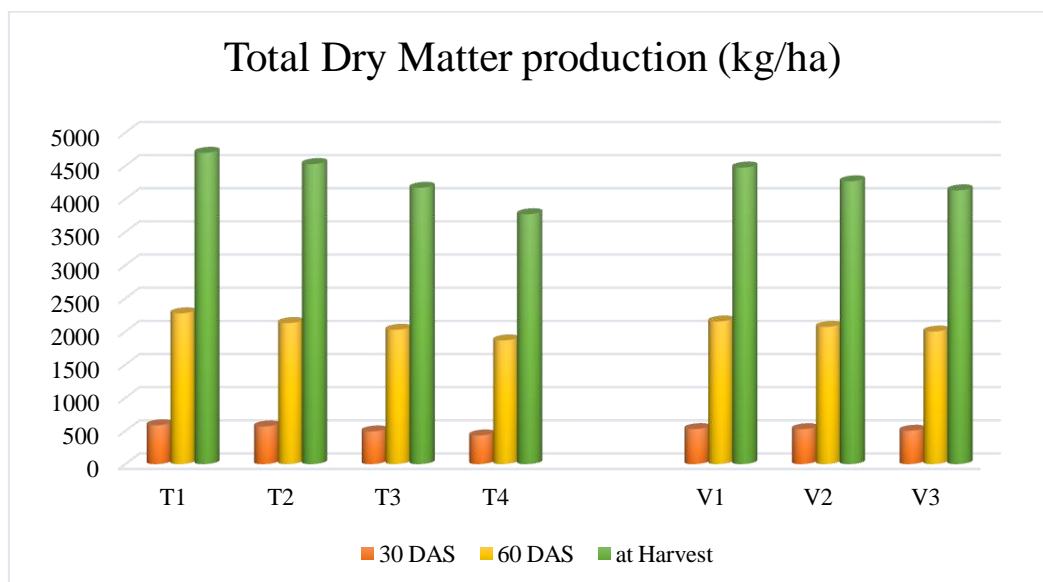


**Varietal differentiation on plant dry matter production**

At 30 DAS, 60 DAS and at harvest stages all the varieties receiving application of FYM + vermicompost and foliar application of 3% panchagavya showed to increase the growth hence total dry matter produced was higher than all other treatments (Figure 2). Variety *Girnar 4* (602.9 kg/ha, 2362.7 kg/ha and 4840.7 kg/ha respectively) had higher mean value statistically it was on par with TMV 14 (582.2 kg/ha, 2304.6 kg/ha and 4490.2 kg/ha

respectively). A combination of *Panchagavya* and vermicompost gave the highest pod yield for French bean variety Ooty 2. It was 36% higher than the conventional method (Selvaraj, 2007).

Figure. 2. Effect of organic management practice on total dry matter production of groundnut



### Varietal differentiation on yield

Application of FYM + vermicompost and foliar application of 3% panchagavya had a positive effect on agronomic parameters of all groundnut varieties. It significantly improved pod yield of all the varieties. Mean seed yield obtained are 2589 kg/ha in variety *Girnar 4*, 2211 kg/ha in variety *TMV 14* and 2164 kg/ha in variety *VRI 8* (Table 1). Compared to the provided average yield of the variety there was yield decrease in the mean yield of all the varieties. There was a 19% yield decrease in *Girnar 4*, 3.2% in *TMV 14* and 19.8% in *VRI 8*. Chemolithotrops and autotrophic nitrifiers (ammonifiers and nitrifiers) are present in *Panchagavya*, which colonize in the leaves to increase the ammonia uptake and enrich the total N supply (Papen *et al.*, 2002). This could be due to the availability and optimum nutrient supply to plants favourably influenced the flowering and seed formation, which eventually increased the pods.

### CONCLUSION

The study concludes that the organic inputs Farmyard Manure, Vermicompost and *Panchagavya* have a good potential to improve the growth and yield of groundnut crop. This will help in increase of the productivity and produce a chemical free healthy soil and crop.



From the results obtained there was 4% increase in the yield of TMV 14 variety under organic management practices than other varieties. Hence, it can be concluded that the application of FYM, Vermicompost and panchagavya serves to the best nutrient source and TMV 14 as best suitable variety based on the yield and its availability to Tamil Nadu

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