

Studies On Utilization of Organic Sources on Seed Yield, Quality, Nutrient Uptake, and Economics of Hybrid Sunflower (*Helianthus Annuus* L.) Kaveri Champ

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Abstract— A field experiment was carried out in the Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India during March 2024 to study on utilization of various organic sources on seed yield, quality, nutrient uptake, and economics of hybrid sunflower (*Helianthus annuus* L.). The experiment was laid out in Randomized Block Design (RBD) comprised of nine treatments and replicated thrice. The treatments are T₁ – Control, T₂ - FYM @ 12.5t ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₃ - Vermicompost @ 2.5t ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₄ - Press mud @ 10t ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₅ - Enriched FYM @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45DAS), T₆ - Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₇ - Enriched press mud @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₈ - 100% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₉ - 100% RDF alone. From the results, it was revealed that application of enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Foliar spraying of Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS) recorded the maximum seed yield (3227 kg ha⁻¹), quality, Nutrient uptake N (90.43 kg ha⁻¹), P (25.25 kg ha⁻¹), K (90.26kg ha⁻¹) and net return (113500.8) of hybrid sunflower.

Index Terms- Seed yield, quality, nutrient uptake, economics

I. INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the important oil seed crops grown worldwide. It contains about 45-50% oil and 26% protein. Sunflower hold

promise because of its short duration, thermo and photo insensitivity, drought tolerance, suitable in existing crop rotation, high oil content and having characteristics like wide adaptability with low diseases and insect incidence. In India, sunflowers occupy 0.7 million hectares and produce approximately 0.9 million tons with a productivity of 1300 kg ha⁻¹. Tamil Nadu comprises an area of 0.35 million hectares and produces 0.48 million tons, with a productivity of 1375 kg ha⁻¹ (Ministry of Agriculture farmers welfare, 2024). Sunflower is the world's third most significant oilseed crop.

Although excessive nitrogen fertilizer can generate environmental hazards, it may also affect sunflower grain quality and decrease its oil content. Combined application of fertilizer and organic manures improves the grain quality. Organic manures play an important role in increasing the productivity and use of organic sources such as traditional, generally helpful for improving soil aggregation, structure and fertility improve the moisture holding capacity and increasing crop yield (Cicek *et al.*, 2023).

Ndegwa *et al.* (2023), The organic matter found in manure helps to improve soil structure. This in turn leads to improved the water infiltration rate and greater water-holding capacity, which reduces crop water stress, soil erosion, and increased nutrient retention. Accor Wang *et al.* (2020), Organic manure greatly enhanced the amount of organic matter in the soil, its active components, and its ability to absorb nutrients. When inorganic fertilizers are not used, most organic manures have extremely low nutrient

concentrations, which are insufficient to meet the crops nutritional needs.

The most widely utilized organic manure in India is farmyard manure (FYM), which is made up of a combination of animal shed waste, including cow dung, urine, and household wastes like straw. It has both macro and micronutrients, and when added to soil, it greatly raises the amount of N-fixation, which improves the physical, chemical, and biological characteristics of the soil (Yadav *et al.*, 2022). Pressmud compost, a notable residue from the sugar industry, comprises essential macro and micronutrients. It serves as a valuable nitrogen (N) and phosphorus (P) source, enriching soil nutrients and enhancing the accessibility of micronutrients in crop systems (Sheikshalik and Sivakumar, 2024). An organic by-product of sugar mills is called pressmud, used to supply high-quality nutrient-rich organic matter that, when added to soil as manure, produces a more sustainable yield. About 25–30% of pressmud is made up of organic materials. Vermicompost is the result of aerobic decomposition by micro- and macroorganisms at room temperature with earthworm digesting. Vermicompost is stable fine granular organic manure that enriches soil quality by improving its physicochemical and biological properties (Siddiqui *et al.*, 2022)

Keeping this in view this study was conducted to study the impact of utilizing organic sources on seed yield, quality, nutrients uptake, and economics of hybrid sunflower.

II. MATERIALS AND METHODS

A field study was conducted during March – May 2024 at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu. The experimental farm is located at 11° 24' N latitude and 79° 24' E longitude, with an altitude of +5.79 m above mean sea level. The soil was medium black, with an initial soil fertility status of 230 kg ha⁻¹ low in available nitrogen, 21.50 kg ha⁻¹ medium in available phosphorous, and 279 kg ha⁻¹ high in available potassium. The experiment was designed in RBD with nine treatments and replicated thrice. The treatments were *viz.*, T₁ - Control, T₂ - FYM @ 12.5t ha⁻¹ + 50% RDF + Panchakavya @ 3%

(foliar spray twice at 30 and 45 DAS), T₃ - Vermicompost @ 2.5t ha⁻¹+ 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₄ - Press mud @ 10t ha⁻¹+ 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₅ - Enriched FYM @ 750 kg ha⁻¹+ 50% RDF + Panchakavya @ 3 % (foliar spray twice at 30 and 45 DAS), T₆ - Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₇ - Enriched press mud @ 750 kg ha⁻¹+ 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₈ - 100% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS), T₉ - 100% RDF alone. The hybrid sunflower KAVERI CHAMP was Selected for the study. Enriched vermicompost have the potential benefits over chemical fertilizer, which includes improvement in soil texture, enrichment of soil nutrients and consequently result in increased productivity, conservation of natural resources, improvements in crop yields (quantitatively and qualitatively). enriched pressmud is more effective than raw pressmud in increasing sugarcane yield and maintain soil fertility. Enriched FYM and compost is an effective way to improve soil health and crop productivity while minimizing negative environmental impacts. The net plot (4.8 x 3.6 m) provided the experimental data, which were then statistically analysed in accordance with Gomez and Gomez's (2010). The data for impact of organic nutrient management on yield, quality, uptake, and economics of hybrid sunflower. Standard agronomic practices were adopted.

III. RESULT AND DISCUSSION

• Yield

Application of Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS) recorded the higher seed yield (3227 kg ha⁻¹) and stalk yield (5386 kg ha⁻¹) (Table 1). It was followed by treatment T₇ - Enriched press mud @ 750 kg ha⁻¹+ 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS). T₁- (control) recorded the lowest seed and stalk yield by the crop. The increase in seed yield might be due to the role of Diammonium phosphate added to vermicompost, which contains phosphorous and urea, enhances the growth of the vegetative parts of the plant and has a role in the process of photosynthesis and resulting in

higher seed yield. In addition, vermicompost contains organic nitrogen and phosphorus, which are transformed into the mineral form due to the activity of microorganisms, which provides them with the energy and carbon sources necessary for biological processes. Nitrogen participates in increasing cell divisions, which leads to increased plant height, and nitrogen is involved in building the chlorophyll molecule, and therefore the relative chlorophyll content increases. Increasing the chlorophyll content leads to an increase in the process of photosynthesis and more dry matter accumulation resulting in higher stalk yield. (Ibrahim *et al.*, 2024).

Application of panchakavya increases the seed and stalk yield of sunflower. The quantity of IAA and GA present in panchagavya spray as well as the simplicity with which nutrients may be applied to plants by foliar spray may have stimulated the plant system, increasing the production of growth regulators in the cell system. Consequently, this encouraged the necessary growth and development in plants, improving seed yield. (Chaithra and Sujith, 2021).

- Quality characters

Application of Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS) – T₆ significantly increased the oil yield of sunflower might be due to nitrogen is radially available in initial stages of crop growth with the application of chemical fertilizer. Also, in case of application of enrich vermicompost nitrogen consumption of plant increases due to the nitrogen mineralization of vermicompost and panchakavya which helps in boosting nitrogen uptake by plants thereby increases the oil yield Mokariya *et al.* (2021). Oil content was non-significant due to the various organic resources. Oil content is an intrinsic property which is governed by various genetically traits and under normal condition it is not changed. This finding closely associated with those of Choudhary *et al.* (2017) and Vani *et al.* (2017). Oil yield is the function of oil content and seed yield.

- Nutrient Uptake

Application of Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS) recorded the higher N, P and K uptake (Table 2). It was followed by treatment T₇ -

Enriched press mud @ 750 kg ha⁻¹+ 50% RDF + Panchakavya @ 3% (foliar spray twice at 30 and 45 DAS). T₁ (control) recorded the lowest N, P and K uptake by the crop. The increase in nutrients content and uptake in plant might be due to increased availability of nutrients through chemical fertilizer at optimum quantity which has resulted increase in nutrient content and uptake. The increase in nutrients content and uptake by plant with the application of enriched vermicompost might be due to quickly build-up of soil micro flora and fauna which has consequently increased the enzymatic activity and helped in mineralization, solubilisation of native and applied nutrients and making them available in the soil for plant uptake. Further enriched vermicompost improved biological, physical and chemical environment of the soil might have helped in vigorous growth of the plant and root proliferation, and the increased biomass production resulted in higher uptake of the nutrients. The present findings are in accordance with those reported earlier by Toor *et al.* (2023)

- Economics

From the treatments, application of Enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + Panchakavya @ 3% (twice at 30 and 45 DAS (T₆) recorded higher net return (1,13,500.8) and B:C ratio (2.77). The higher gross return was mainly due to the higher seed yield of sunflower. The lowest net returns per rupee investment (3,32,47.8) was obtained in Control(T₁). which might be due to the higher cost of cultivation and lesser yields. Similar views were found by Pattanayak *et al.* (2024).

Table 1: Effect of organic nutrient management on yield & quality of sunflower

Treatment	Seed yield (Kg ha ⁻¹)	Stalk yield (Kg ha ⁻¹)	Oil yield (Kg ha ⁻¹)	Oil content (%)
T ₁	1465	3162	693.78	37.20
T ₂	2182	4135	906.91	37.60
T ₃	2501	4503	1006.63	37.22
T ₄	2287	4204	950.03	37.30
T ₅	2765	4734	1017.30	37.25

T ₆	3227	5386	1119.75	37.30
T ₇	2994	5001	1067.21	37.25
T ₈	1878	3771	845.25	37.50
T ₉	1680	3507	771.68	37.10
S. Em±	40.28	80.48	21.54	-
S. Ed	57.35	114.59	15.13	-
CD (p=0.05)	120.45	240.64	45.25	NS

Table :2 Effect of organic nutrient management on nutrient uptake & Economics

Treatments	Nutrient uptake (Kg ha ⁻¹)			Economics		
	N	P	K	Gross Income	Net Income	B:C
T ₁	57.82	14.35	57.14	78925	33247.8	1.72
T ₂	71.76	18.54	70.98	120010	55525.8	1.86
T ₃	78.67	21.49	78.61	137555	75770.8	2.22
T ₄	74.19	19.39	73.94	125785	56300.8	1.81
T ₅	81.83	22.40	81.72	152075	81590.8	2.15
T ₆	90.34	25.25	90.26	177485	113500.8	2.77
T ₇	85.55	23.73	85.52	164670	91185.8	2.24
T ₈	66.84	16.99	66.20	103290	50297.8	1.94
T ₉	62.19	14.35	61.66	92400	39707.8	1.75
S. Em±	1.07	0.33	0.92	-	-	-
S. Ed	1.52	0.48	1.31	-	-	-
CD(p=0.05)	3.2	1.01	2.76	-	-	-

CONCLUSION

From the above comparative results, it concluded that the application of enriched vermicompost @ 750 kg ha⁻¹ + 50% RDF + foliar spraying of Panchakavya @ 3% (twice at 30 and 45 DAS) was the optimal utilization of organic sources on seed yield, quality, nutrients uptake, and economics of hybrid sunflower.

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