



ENHANCING SUNFLOWER SEED YIELD THROUGH ORGANIC NUTRIENT MANAGEMENT PRACTICES AND THE IMPLEMENTATION OF SUPPLEMENTARY POLLINATION FOR IMPROVED SEED SETTING IN THE SUNFLOWER HYBRID (KAVERI CHAMP)

¹S.K Kartic Raj, ²D. Kumarimanimuthu veeral

¹PG Scholar, ²Assistant Professor

¹Department of Agronomy, Faculty of Agriculture,
Annamalai University, Chidambaram, Cuddalore district, Tamil Nadu - 608002

Abstract: Sunflower is an important oilseed crop in the world. However, poor nutrient management and inappropriate seed filling prevent this precious oil seed crop from producing its maximum yield. By implementing proper nutrient management practices and pollination methods, these physiological abnormalities of sunflower can be corrected. Based on this field study was conducted during June 2022 - August 2022 at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu, to enhance the yield and yield attributes of hybrid sunflower (KAVERI CHAMP) through organic nutrient management and supplementary pollination methods. The study comprised of ten treatments with four replications. The treatments are, T₁-Head to head pollination, T₂-Hand pollination, T₃-Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₄-Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₅- FYM 12.5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₆- FYM 12.5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₇- Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₈- Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₉- Pressmud 10 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₁₀- Pressmud 10 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination. The study revealed that the (T₈) Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination showed the highest value in terms of seed yield (3181 kg ha⁻¹), No of filled seeds per head (11231), 100 seed weight (5.09 g) and seed set percentage (93.85 %) follower by (T₁₀) Pressmud 10 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination. Head to head pollination (T₁) showed the lowest (Seed yield - 1281 kg ha⁻¹, No of filled seeds per head - 633, 100 seed weight - 4.06 g and seed set percentage - 65.05%) in all the yield parameters. Hand pollination increased seed yield per head, compared to Head to head pollination. Results indicated that the use of vermicompost along with hand pollination of sunflower improved the yield and yield attributes of sunflower.

Keywords: Hybrid Sunflower, hand pollination, head to head pollination, seed filling, seed set, hybrid seed yield.

I. INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important oilseed crop and is native to southern parts of USA and Mexico. The annual edible oil requirement for India is about 18.24 million tonnes of which only 8.04 million tonnes is met by local production and rest of the oil requirement about 9.34 mt is being imported. Sunflower is a major source of vegetable oil in the world. It is used for a variety of cooking purposes. Sunflower seed contains about 48 – 53 percent edible oil. The sunflower oil is considered premium compared to other vegetable oil as it is light yellow in colour, high level of linoleic acid and possesses good flavour and high smoke point. Sunflower oil is a rich source (64 percent) of linoleic acid which is good for heart patients. Linoleic acid helps in washing out cholesterol deposition in the coronary arteries of the heart (Kharbade et al., 2021). Sunflower is also a source of lecithin, tocopherols and furfural. It is used as nutritious meal for birds and animals. It is also used in the preparation of cosmetics and pharmaceuticals (Patil et al., 2022). Due to its favourable characteristics, including its short lifespan, photoperiod insensitivity, drought endurance, lower seed production rate, greater seed multiplication ratio, excellent quality of edible oil, and high amount of polyunsaturated fatty acids, the sunflower crop has been highly received by the farming community. However, poor seed germination and inappropriate seed filling prevent this precious oil seed crop from producing its maximum yield (Afzal et al., 2019). By implementing proper nutrient management practices and pollination methods these physiological abnormalities of sunflower can be corrected.

Keeping this in view this study was conducted to enhance the yield and yield attributes in sunflower through organic nutrient management practices by adopting supplementary pollination to enhance seed setting and seed yield.

II. MATERIALS AND METHODS

Field study was carried out during July, 2022 - September, 2022. at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu. The experimental farm is situated at 11° 24' N latitude and 79° 24' E longitude and an altitude of +5.79 m above mean sea level. The soil was medium black with initial soil fertility status was 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 laid out in RBD with ten treatment combination for Karif season. The treatments are, T₁-Head to head pollination, T₂-Hand pollination, T₃-Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₄-Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₅- FYM 12.5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₆- FYM 12.5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₇- Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₈- Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination, T₉- Pressmud 10 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination, T₁₀- Pressmud 10 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination. The individual plot size was 5 x 4 m with formed bunds and irrigation or drainage channel around. Ploughing and land preparation was done with mould board plough and cultivated without disturbing across plots. Data were recorded in net plots of 4.5 x 3.5 m, avoiding any possible border effect. General agronomical practices with regard to manures and manuring were done. Hand pollination and Head to head pollination was carried out every day in the morning 8-10 am for a period of 10-15 days of flowering period. Yield and quality parameters like % seed set, no of filled seeds per head, 100 seed weight, seed yield was recorded and the data was subjected for suitable statistical analysis.

III. RESULTS AND DISCUSSION

The study revealed that there were significant differences for all the quantitative and qualitative characters investigated among the different organic nutrient managements along with pollination methods (Table 1). The data indicated that the application of T₈ - vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination of sunflower recorded significantly highest in seed yield (3181 kg ha⁻¹), No of filled seeds per head (11231), 100 seed weight (5.09 g) and seed set percentage (93.85 %). The observed success can be attributed to the synergistic effects of vermicompost, Panchagavya, and EM solution, which likely enhanced nutrient availability, improved plant health, and positively influenced pollination efficiency. Vermicompost offers a balanced nutritional release pattern to plants, providing nutrients such as available N, soluble K, exchangeable Ca, Mg and P that can be taken readily by plants (Ramesh, 2017) and greater microbial diversity and activity and higher uptake of essential plant nutrients enhanced the activity of photosynthesis, which in turn improves translocation of photosynthates from source to sink resulting in higher seed and stalk production., while Panchagavya and EM solution, being organic inputs, may have stimulated plant growth and provided additional nutrients (Rasmi Krishnan and Usha, 2014). Manually transferring of pollen with hands covered with muslin cloth from one plant to another resulted in more pollen landing on the stigmas of the flower head, which can be a chain of events that ends in the making of more seeds, likely ensured better pollination efficiency compared to head-to-head pollination methods, leading to the observed superior yield and seed quality. This integrated approach demonstrates the potential for sustainable and organic practices in optimizing sunflower production.

Table 1: Effect of different organic nutrient management practices and pollination methods on seed setting (%), 100 seed weight (g), No. of filled seeds head-1 and seed yield (kg ha-1) of sunflower.

Treatment	Seed setting (%)	100 seed weight (g)	No. of filled seeds head ⁻¹	Seed yield (kg ha ⁻¹)
T ₁ -Head to head pollination	65.05	4.06	633	1281
T ₂ -Hand pollination	73.67	4.31	777	1727
T ₃ -Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination	69.42	4.19	693	1462
T ₄ -Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination	76.78	4.39	846	1982
T ₅ - FYM 12.5 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination	80.1	4.46	909	2247
T ₆ - FYM 12.5 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination	87.59	4.82	1056	2731
T ₇ - Vermicompost 5 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination	85.48	4.71	1012	2605
T ₈ - Vermicompost 5 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination	93.85	5.09	1231	3181
T ₉ - Pressmud 10 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Head to head pollination	82.06	4.52	949	2366
T ₁₀ - Pressmud 10 t ha ⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination	90.74	4.93	1138	2967
C.D. (P = 0.05)	2.76	NS	57.34	126.57
S.E(m)	0.93	NS	19.27	47.6

NS – Non significant

In a similar study with sunflower, Raj and Veeral (2023) reported that the Beehive + hand pollination showed the highest value in terms of seed yield (3669 kg ha⁻¹), number of filled seeds head-1 (1418), 100-seed weight (4.72 g) and seed set percentage (98.55 %) when compared to other pollination methods. In another study with sunflower, Sajjanar et al. (2022) found that the highest seed yield per acre (1131.98 kg), per cent filled seeds (97.20 %), test weight (7.52 g), volume weight (40.48 g/100 ml⁻¹), kernel percentage (79.78 %) and highest kernel to husk ratio (3.87) were recorded in hand + open pollinated plots, our findings of increased pollination using hand pollination in sunflower crop correspond to those of previous works. These results indicated that hand pollination could increase the yield due to increase in pollen landing. In another study with sunflower, Elankavi. (2017) found that application of vermicompost @ 5 t ha⁻¹ significant increase in total numbers of seeds head⁻¹ (1040.65), number of filled seeds head⁻¹ (925) and 100 seed weight (5.70) and yield of sunflower (2195.30 kg ha⁻¹). These results corroborate those found by Yasmin et al. (2022) and Kalaiyaran et al. (2019) who reported increased production of sunflower seed in area with application of vermicompost 5 t ha⁻¹. Present findings are also in agreement with Shindhe et al. (2020).

IV. CONCLUSION

The results clearly proved that the application of Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination of sunflower would be advisable to improve the qualitative and quantitative yield parameters of sunflower. The results confirmed previous reports of higher production of seed yield in sunflower with introduction of vermicompost and hand pollination. Therefore, the application of Vermicompost 5 t ha⁻¹ + Panchagavya 3 % foliar spray @ 30 and 45 DAS + EM solution 1 % foliar spray @ 30 and 45 DAS + Hand pollination of sunflower, is agronomically sound and an alternative to increase seed setting and seed yield in sunflower.

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