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RESEARCH PAPER

TITLE

SUNFLOWER GROWTH AND YIELD IN RESPONSE TO COMBINED APPLICATION OF FARMYARD MANURE AND INORGANIC FERTILIZERS (NITROGEN AND PHOSPHORUS)

Authors: Asif Ali Kaleri[1], Habibullah Rajper[2], Muzamil Hussain Awan[3], Murad Ali Magsi[1], Naseeruddin[4], Vijai kumar[1], Danish Manzoor[1], Imam Uddin Palal[2], Muhammad Taimoor Saeed[5], Ijaz Ahmed[6].

AFFILIATIONS

[1]Department of Agronomy, Sindh Agriculture University, Tando Jam, Sindh
[2]Department of Agri-Economics, Sindh Agriculture University, Tando Jam, Sindh
[3]Department of Plant Breeding and Genetics, Tando Jam, Sindh
[4]Department of Agronomy, Baluchistan Agriculture College Quetta.
[5]Directorate Agriculture Research Vegetable Seed Farm
[6]Agriculture Extension Baluchistan

***Corresponding Author:**

Asif Ali Kaleri

Department of Agronomy, Sindh Agriculture University, Tando Jam, Sindh

Email: asifalikaleri2013@gmail.com

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Abstract

The research was conducted in 2022 in the Agronomy Student's Experiment Farm at Sindh Agriculture University Tando Jam. It used a complete block design with randomization. The main goal was to evaluate how much adding different amounts of FYM and nitrogen-phosphorus affected the growth and seed production ability of sunflowers. The research had five different FYM options and nitrogen-phosphorus levels. The HO-1 variety was given these treatments. The assigned treatments were as follows: T1 = control (no FYM, 0 kg/ha nitrogen and 0 kg/ha phosphorus); T2 = adding a small amount of farmyard manure plus some extra nutrients in the form of nitrogen at a rate of 30kg per hectare, along with an additional quantity of 15 kg per hectare. The best results were seen in T5 (5 tons of farm FYM + fertilizers, with 120 kg per hectare of nitrogen and 50 kg per hectare of phosphorus). This method resulted in the most plants on a square meter (9.11), the tallest plant growth at about 248.8 cm high; T5 was closely followed with good results (a lot of FYM plus 120 kg per hectare nitrogen and 50 kg phosphorus). The research indicates that the optimal combination for enhancing sunflower growth and yield includes applying 120 kg ha-1 of nitrogen, 50 kg ha-1 of phosphorus, and incorporating 5 tons of FYM.

Key words: sunflower, growth, yield, nitrogen + phosphorus, farmyard manure.

1. Introduction

Sunflower (*Helianthus annuus* L.) is a significant oil seed crop known for its high oil quality (Nasim et al., 2011; Khan et al., 2014). In Pakistan, its cultivation commenced on a limited scale in 1960 and currently covers approximately 9% of the cropped area annually (FAO, 2013). Globally, sunflower ranks as the fourth-largest oil seed crop, following soybean, palm oil, and canola (Ahmad et al., 2011). Growing sunflowers is fun because their seeds have a lot of oil (36–52%) and protein (28–32%). Also, you can grow them twice in one year. This makes it even better! (Source: Rosa et al., 2009). The nation contends with a critical shortage of edible oil, primarily driven by relentless population growth, which has heightened demand. Domestic production in Pakistan considerably lags behind the escalating demand, creating a substantial disparity between production and consumption (Nhundu et al., 2022; Murad et al., 2023) The incorporation of farmyard manure boosts the organic matter content in the soil, serving as a reservoir for water and nutrients while preventing compaction and surface crusting (Simansky et al., 2019). In sunflower cultivation, nitrogen fertilizer is applied judiciously to enhance yield and quality. Nitrogen (N) plays a vital role as a mineral nutrient essential for plant growth and development. It promotes vegetative growth, increases the rate of photosynthesis, imparts a green color to the plants, and is a constituent of chlorophyll (Brady and Well, 2005). Nitrogen (N) is indispensable for plant biochemical processes, contributing to the synthesis of proteins and the augmentation of biomass (Lawlor, 2002; Kaleri et al., 2023). Maintaining optimal soil nitrogen content during both the vegetative and reproductive stages is crucial for producing high-quality grains (Muhammad, 2006). Likewise, phosphorus (P) is vital for biological processes. Although soils may harbor a substantial amount of phosphorus, its availability to plants is hindered by the

sources of application and/or soil pH (Shenoy and Kalagudi, 2005). Additionally, phosphorus plays a crucial role in flower formation, seed production, and the overall maturity of crops (Osman and Awed, 2010). Optimal phosphorus (P) levels were associated with increased grain weight and number, as reported by Khan et al. (2014). Alongside nitrogen (N) and phosphorus (P), they play a significant role in enhancing seed oil content, according to Tandon and Messick (2002). Furthermore, it improves the utilization efficiency of both nitrogen and phosphorus, as indicated by Najar et al. (2011). The study wanted to make the best use of nutrients in farm crops; lower farming costs, and protects nature. It focused on finding out how much nitrogen and phosphorus are needed for growing sunflower plants well together. Over the years, fertilizer use has contributed to increased yields, but it has also led to issues such as soil fatigue, desertification, and a decline in vitality over time. Consequently, farmers have shifted towards the adoption of organic fertilizers to enhance the physical and chemical structure of soils and facilitate nutrient absorption. With the growing demand for organic agriculture, expanding the use of organic fertilizers becomes imperative to mitigate environmental pollution, promote sustainable soils (Khodaei-Joghan et al., 2018), and reduce reliance on inorganic (nitrogen and phosphorus) fertilizers.

2. Material and Method

In autumn 2022, an experiment was done at a farm in Tandojam to test how sunflower plants grow and produce using natural yard waste manure along with nitrogen and phosphorus fertilizers. A "randomized complete block design was used for this study on plots that had sizes of six meters by five meters (30 square meters). As with the right way for growing sunflowers, machines were used to make a good place and get it ready well. The test was done three times. The treatments were as follows: T1 is the control (0-ton farmyard manure, no nitrogen or phosphorus added); T2 uses 5 tons of farmyard manure plus 30 kg ha-1 nitrogen and 15 kg ha-1 phosphorus. Also present are T3 with an extra bounty using the same amount but adding more nitrogen at 60 in each testing area. We picked five plants when they were fully grown. We measured things like the population of the plants (measured in square meters), how tall and wide their stems were, the size of the heads on top, the number of seeds on one head, as well as the weight of only that head—all while considering thousands or more seeds per gram! This helped us get a better understanding of seeds.

3. Statistical analysis

The ANOVA analysis of the collected data was conducted using the Statistix-8.1 computer program (Statistix, 2006).

CHARACTERISTICS OF SOIL

Characteristics	Units	Value (2020)
Soil depth	(cm)	0–15
		15–30
Texture	(Class)	Sandy clay loam
pH		7.5
		7.7
EC	(dS m−1)	2.31
		2.36
Organic matter	(%)	0.50
		0.60

Characteristics	Units	Value (2020)
Total nitrogen	(%)	0.041
		0.038
Available P	(mg kg−1)	0.5
		1.0

4. RESULTS

The results confirmed a significant difference ($p < 0.05$) in sunflower performance among various treatments involving farmyard manure, nitrogen, and phosphorus. Treatment T5, which received 5 tons of farmyard manure, 120 kg ha-1 of nitrogen, and 50 kg ha-1 of phosphorus, demonstrated the highest values across multiple parameters: maximum plant population (9.6) square meters, plant height (248.8 cm), largest plant girth (11.5 cm), head diameter (48.10 cm), highest number of seeds per head (1978.3), heaviest seed weight per head (70.5 g), seed index (34.16 g), and maximum seed yield (2730.7 kg ha-1). Similarly, Treatment T4, comprising 5 tons of farmyard manure, 80 kg ha-1 of nitrogen, and 45 kg ha-1 of phosphorus, showed notable performance, recording values such as plant population m-2 (8.5), plant height (230.1 cm), stem girth (11.5 cm), head diameter (48.10 cm), number of seeds head-1 (1978.3), seed weight head-1 (70.5 g), seed index (1000 seeds wt., g) (30.8), and seed yield (2451.7 kg ha-1). Conversely, the minimum values for plant population (5.99) square meters, plant height (188.0 cm), largest plant girth (6.98 cm), head diameter (22.1 cm), highest number of seeds per head (1360.0), heaviest seed weight per head (31.97 g), seed index (23.98 g), and maximum seed yield (2050.5 kg ha-1) were observed in Treatment T1, which served as the control without fertilizers (0-ton farmyard manure + 0 kg ha-1 nitrogen + 0 kg ha-1 phosphorus).

Table. 1 Growth and Yield Characteristics of Sunflower with Integrated Farmyard Manure and Nitrogen + Phosphorus Fertilization

Treatments	**Plant population (m^{-2})**	**Plant height (cm)**	**Stem girth (cm)**	**Head diameter (cm)**	**Number of seeds $head^{-1}$**	**Seeds weight $head^{-1}$ (g)**	**Seed index (1000-seeds wt., g)**	**Seed yield kg ha^{-1}**
T1-Control (0-ton FYM+0 kg ha^{-1} (Nitrogen +0 kg ha^{-1} Phosphorus),	5.99	188.0	6.98	22.1	1360.0	31.97	23.98	2050.5
T2-05, ton FYM+30 kg ha^{-1} Nitrogen + 15 kg ha-1 Phosphorus),	6.8	199.6	8.2	34.2	1500.5	35.2	23.66	2266.5
T3-05, ton FYM + 60 kg ha^{-1} Nitrogen + 30 kg ha-1 Phosphorus),	7.5	218.1	9.1	41.90	1580.0	43.20	26.2	2310.6
T4-05, ton FYM + 80 kg ha^{-1} Nitrogen + 45 kg ha-1 Phosphorus),	8.5	230.1	10.1	43.5	1711.7	53.2	30.8	2451.7
T5-05, ton FYM + 120 kg ha^{-1} Nitrogen + 50 kg ha-1 Phosphorus),	9.11	248.8	11.5	48.10	1978.3	70.5	34.16	2730.7
S.E. ±	0.277	2.4131	0.1215	1.325	21.612	3.6022	0.7012	55.770
P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5. DISCUSSION

In the discussion, T5 demonstrated the highest outcomes across various parameters, including plant population (9.6 plants per square meter), plant height (248.8 cm), largest plant girth (11.5 cm), head diameter (48.10 cm), highest number of seeds per head (1978.3), heaviest seed weight per head (70.5 g), seed index (34.16 g), and maximum seed yield (2730.7 kg ha-1). Conversely, T1 (control with no fertilizer) exhibited minimum results, with plant population (m-2) at 5.99, plant height (cm) at 188.0, stem girth (cm) at 6.98, head diameter (cm) at 22.7, number of seeds per head at 1360.0, seed weight per head (g) at 31.97, seed index at 23.98 g, and seed yield at 2050.5 kg ha-1. Sial et al. (2022) similarly observed that sunflower growth and productivity, including seed output and other agricultural features, were constrained in treatments without balanced fertilizer. This suggests that a well-balanced fertilizer application surpasses the efficacy of separate treatments, impacting sunflower yield significantly. The study recommends the use of well-balanced fertilizer to enhance sunflower yield and overall productivity. The discussion also delves into the influence of farmyard manure on sunflower development and yield, as explored by Nouraein et al. (2019). Farmyard manure, which is a great source of organic stuff that plants need to grow, gives soil the necessary food and makes it better at holding water, so the plants don't die if there isn't much rain. Alzamel et al. (2022) noted that the application of farmyard manure contributes to increased crop yields, including sunflower, aligning with similar findings in other studies. Various studies, such as those by Ozer et al. (2003) and Sefaoglu (2021), have reported varying head diameters in sunflower, while Gunay (2014) highlighted that organ mineral fertilizers not only increased sunflower yield and quality parameters but also enhanced nitrogen, phosphorus, and potassium contents. (Beyyavas et al. 2011 and Kaleri et al., 2019) found significant effects of fertilizer applications on grain weight, emphasizing the impact of nitrogen in combination with low-protein fertilizers on grain weight. The quantity of farmyard manure applied is determined by crop nutrient needs, soil type, and other factors, with soils deficient in essential nutrients benefiting significantly from increased farmyard manure application. However, caution is necessary to avoid excessive use, which may lead to nutrient imbalances and associated problems, as highlighted by Kalaiyarasan et al. (2019). Additionally, the discussion notes the impact of organic manure on flower size, suggesting a positive response in agronomic characteristics linked to yield. The increase in flower size is attributed to potential improvements in photosynthetic efficiency during the vegetative phase, resulting in increased head dry matter (Khan et al., 2022 and Soomro et al., 2023). Mehrparvar et al. (2021) also endorse the use of T5, which consists of 5 tons of farmyard manure, 120 kg per hectare of nitrogen, and 50 kg per hectare of phosphorus. They say this mix can help sunflowers grow faster while increasing seed yield. This approval makes it a very helpful habit for nearby farmers.

6. CONCLUSIONS

The results concluded that different levels of combined application of farmyard manure and inorganic fertilizers (nitrogen and phosphorus) had positive and significant effects on the growth and yield of sunflower. However, conclusions can be drawn from the finding that the best growth and yield of sunflower were obtained at 05 ton FYM + 120 kg ha-1 Nitrogen + 50 kg ha^{-1} Phosphorus., which are the best levels for better growth and yield of sunflower.

REFARANCES

Ahmad, A., A. Wajid and J. Akhter. 2011. Maize response to time and rate of nitrogen application. Pak. J. Bot. 43: 1935-1946.

Alzamel NM, Taha EM, Bakr AA, Loutfy N. Effect of organic and inorganic fertilizers on soil properties, growth yield, and physiochemical properties of sunflower seeds and oils. Sustainability. 2022 Oct 10;14(19):12928.

Beyyavas, Vedat, et al. "Determination of seed yield and yield components of some safflower (Carthamus tinctorius L.) cultivars, lines and populations under the semi-arid conditions." African Journal of Biotechnology 10.4 (2011): 527-534.

Brady, C.N. and R.R. Well. 2005. The nature and properties of soils. Pearson Education (Singapore) (Pvt). Ltd. pp. 560.

FAO, 2013. FAO STAT., Food and agriculture organization of the united nations. http://fao.org/nr/water/cropinfo sunflower.html.

Kalaiyarasan C, Jayaraman J, Jawahar S, Sriramachandrasekharan MV, Suseendran K, Ramesh S, Anandan P, Murugan G. Effect of organic and inorganic sources of sulphur on growth and yield of sunflower. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):1193-6.

Kaleri, A. A., Ansari, M. A., Rajper, H., Manzoor, D., Banbhan, G. M., Shakoor, A., Shahzadi, I., Faizan, M., Ahmed, M. M., Javed, M. U., Ashraf, A., & Rao, M. S. F. (2023). The Impact of Nitrogen Potassium and Zinc Concentrations on the Development and Productivity of Safflower (Carthamus tinctorius L.). Jammu Kashmir Journal of Agriculture, 3(3), 259–264.

Kaleri, A. A G. M. Laghari, A. W. Gandahi, A. H. Kaleri and M. M. Nizamani. (2019). Integrated foliar fertilizer effects on growth and Yield of sunflower. Pak. J. Agri., Agril. Engg., Vet. Sci., 35 (1): 25-28.

Khan, N.1, Ishaq, M.2, Khan, M. S.1, Tibpromma, S.3, Asad, S.4, Hu, Y.3 and Karunarathna, S. C. (2022). Effect of organic manure and chemical fertilizers on the growth, production and seed quality of sunflower (Helianthus annuus L.). International Journal of Agricultural Technology 18(2):579-594.

Khan, M. K., M. Akmal and M. Afzal. 2014. Fertilizer N- and P-rates Response on sunflower intercropping with Mungbean in North-West, Pakistan. Basic Res. J. Agric. Sci. Rev. 3(12): 146-160.

Khodaeı-Joghan, A., M. Gholamhoseını, A.A. Majid, F. Habıbzadeh, A. Sorooshzadeh and A. Ghalavand. 2018. Response of sunflower to organic and chemical fertilizers in different drought stress conditions. Acta agriculturae Slovenica 111(2): 271-284.

Lawlor, D.W. 2002. Carbon and nitrogen assimilation in relation to yield: mechanisms are the key to understanding production systems, J. Exp.Bot. 53: 773-787.

Muhammad, A.M. 2006. Nutritional management studies in spring-planted sunflower (Helianthus annuus L.). Unpublished Ph.D. Agronomy Thesis, Univ. Agric. Faisalabad.

Magsi, M. A., Ansari, M. A., Kaleri, A. A., Mangan, B. N., Lashari, M. S., Awan, M. H., Sheikh, Z. A., Kumar, V., Sardar, H., Manzoor, D., Memon, N. A., & Shahzadi, I. (2023). Effect of Various Levels of Potassium on the Growth and Yield of Sunflower (Helianthus annuus L.). *Jammu*

Kashmir Journal of Agriculture, *3*(2), 167–171.

Najar, G.R., S.R. Singh, F. Akthar and S.A. Hakeem. 2011. Influence of sulphur levels on yield,
uptake and quality of soybean (Glycine max) under temperate conditions of Kashmir valley. Ind.

J. Agric. Sci. 81(4): 340-353.

Nhundu K, Gandidzanwa C, Chaminuka P, Mamabolo M, Mahlangu S, Makhura MN. Agricultural supply response for sunflower in South Africa (1947–2016): The partial Nerlovian framework approach. African Journal of Science, Technology, Innovation and Development. 2022 Feb 23;14(2):440-50.

Nouraein M, Bakhtiarzadeh R, Janmohammadi M, Mohammadzadeh M, Sabaghnia N. The Effects of micronutrient and organic fertilizers on yield and growth characteristics of sunflower (Helianthus annuus L.). Helia. 2019 Nov 18;42(71):249-64.

Osman, E.B.A. and M. Awed. 2010. Response of sunflower (Helianthus annuus L.) to phosphorus and nitrogen fertilization under different plant spacing at new valley Ass. Univ. Bull. Environ. Res.13: 14-19.

Ozer, Hakan. "Sowing date and nitrogen rate effects on growth, yield and yield components of two summer rapeseed cultivars." European Journal of Agronomy 19.3 (2003): 453-463.

Rosa, PM., R. Antoniassi, S.C. Freitas, H.R. Bizzo, D.L. Zanotto, M.F. Oliveira and Castiglioni. 2009. Chemical composition of brazilian sunflower varieties. Helia. 32: 145-156.

Sefaoglu, F. (2021). Effect Of Organic And Inorganic Fertilizers Or Their Combinations On Yield And Quality Components Of Oil Seed Sunflower In A Semi-Arid Environment. Turkish Journal of Field Crops, 26(1), 88-95.

Shenoy, V.V. and G.M. Kalagudi. 2005. Enhancing plant phosphorus use efficiency for sustainable cropping. Biotech Adv. 23: 501–513.

Sial AK, Shankar T, Maitra S, Sairam M, Sagar L, Kumar PP, Thandra B, Rout RK. Effect of nutrient optimization on growth, yield and quality of sunflower under southern Odisha conditions. Crop Research. 2022;57(3):195-201.

Simansky, V., Srank, D., & Juriga, M. (2019). Differences in soil properties and crop yields after application of biochar blended with farmyard manure in sandy and loamy soils. *Acta fytotechnica et zootechnica*, *22*(1), 21-25.

Tandon, H.L.S. and D.L. Messick. 2002. Practical sulphur guide. The Sulphur Institute, Washington, D. C.

Soomro, Z. A., Memon, H. U. R., Kaleri, A., Magsi, M. A., Manzoor, D., Shahzadi, I., Javed, M. U., Rasool, M. W., Basharat, U., Ahmed, M. M., Asim, M., & Shakoor, A. (2023). Impact of Different Levels of Phosphorus on the Growth, Yield and Oil Content of Sunflower (Helianthus annuus L.). Jammu Kashmir Journal of Agriculture, 3(2), 137–143.

Nasim, W., A. Ahmad, A. Wajid, J. Akhtar and D. Muhammad. 2011. Nitrogen effects on growth and development of sunflower hybrids under agro-climatic conditions of Multan. Pak. J. Bot. 43: 2083-2092.