

Evaluating the effect of press mud farm manure and synthetic fertilizer alone and in combination under zinc priming on sunflower productivity

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ABSTRACT

Sunflower (*Helianthus annuus* L.) belongs to the family Asteraceae and the genus *Helianthus* is known as a very important oil crop. The genus *Helianthus* comprises 65 species and these species are being cultivated for 3000 years. Different biotic and abiotic stress induces negative effects on the growth and development of this crop which in turn reduce productivity. In the present scenario seed priming has diverted the attention of researchers towards it. Seed priming is crucial to enhance crop production by improving growth and development. The current study evaluates the response of organic and inorganic fertilizers on crop yield. The hybrid variety of sunflower (US-666) was studied against different treatments. Different concentrations of synthetic fertilizer, farm yard manure, and sugarcane press mud were used to study the effect on yield compared to control. The maximum value of the number of achene per plant, 1000 grain weight, achene yield per hectare, biological yield, and harvesting index was achieved with the application of sugarcane press mud and synthetic fertilizers under the application of zinc 1% solution in the form of priming. But these all yield-related parameters except the biological yield of sunflower reduced to the minimum in the control group (without priming). Split plot design along with statistics 8.1 to evaluate these parameters.

Keywords: Sunflower, Zinc priming, Yield, Press mud, Organic fertilizer

INTRODUCTION

Sunflower (*H. annuus* L.) is an important oil seed crop and the most preferred source for consumption [1]. Despite this importance, a large gap exists between the potential yield and the achieved yield of sunflowers. This gap is persistent through years cause of negligence in recommended practices. Among all recommendations, the balanced use of fertilizer is a very significant factor for yield determination.

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The crop needs access to all necessary components to ensure optimal growth and development. If all major and minor nutrients are not available, growth inhibition may result. Major metabolic pathways like respiration, photosynthesis, and the electron transport chain are regulated by micronutrients (like zinc) in trace levels [2]. Produce with low yield and quality can result from disruptions in physiological processes brought on by zinc deficiencies [3]. According to Hussain and Masood 2010 applying zinc will increase grain production, grain micronutrient concentration, and plant resilience to drought and salinity [4].

Nutritious material containing, inorganic fertilizers in various forms were used to provide plant nutrients. Fertilizers with high phosphate, potash, and nitrogen content are often applied to sunflowers and other crops. One macronutrient that is thought to be crucial for the growth and development of plants is nitrogen. The seed yield can be greatly increased by applying the right amount of nitrogen [5, 6]. According to Malik et al., 2004, different NPK combinations had a substantial impact on the yield and oil content of

achene. On the other hand, the persistent, careless application of chemical fertilizers has raised the possibility of environmental pollution [7, 8]. Consequently, it appeared that applying synthetic and organic manures together could provide both increased fertilizer usage efficiency and a solution to environmental issues.

The use of inorganic and organic fertilizers has several benefits and drawbacks. For instance, organic fertilizers distribute nutrients gradually. This suggests that crops may experience a period of initial hunger due to nutrient immobilization before mineralization occurs. Small farmers might not have easy access to them because they need to be used in large quantities [9, 10]. On the other hand, inorganic fertilizers guarantee that crops receive nutrients quickly [9]. In addition to endangering the environment by leaking nitrogen and poisoning water supplies, over-fertilizing sunflowers can also harm the grain's quality. Plant lodging frequently results in low oil content and yield decrease [11].

Overuse of inorganic fertilizers slows down the loss of nutrients in root zones because of nutrient lockup and leaching. Aquatic life is at risk because a significant portion of nutrients have been lost to the environment through volatilization and leaching. Thus, interest in employing organic manures has been growing daily in light of the drawbacks of synthetic fertilizers [12]. Press mud and mineral contents are the names given to the organic waste from sugar mills that are also utilized as animal feed. To avoid bacterial or fungal infections, the wastes are dried before making press mud. In addition, it contains vitamins, hormones, auxins, enzymes, and plant growth regulators, which enhance soil aeration and promote greater root proliferation. Given that it is non-toxic, it can be extensively promoted and aids in keeping the soil's moisture content [13].

The use of organic manures improves soil properties such as soil water holding capacity, soil aeration, tilth, and structure on a sustainable basis; however, inorganic fertilizer use is still necessary to maximize production potential [14]. According to Bokhtiar et al., 2001, press mud is a waste product that can be utilized as organic manure [15]. In addition to micronutrients that can improve the quality of the soil, press mud includes nitrogen, phosphorus, and potassium [16]. Farmers can sustain soil productivity and boost production by applying both organic and inorganic fertilizers [17]. When nitrogen fertilizer and organic manure were combined, grain and biological yield produced superior results [18]. When chemical fertilizers and organic manures were applied in combination using the zinc priming

technique, sunflower hybrids yielded a high crop [19].

In light of the problem of using synthetic fertilizer and low sunflower yield, it was proposed that applying both organic and inorganic manures simultaneously along with the various priming techniques increase sunflower productivity by improving the physical properties of the soil and supplying micronutrients. Therefore, the purpose of this field study was to investigate how to increase the productivity and net returns of spring-sown sunflowers under the Agro-climatic conditions of Multan, Punjab, Pakistan, using different organic and inorganic fertilizers, both alone and in combination. Additionally, the seed priming was also combined evaluate its effect on plant growth and development. various priming techniques.

Materials and Methods

Plant material

In the current study hybrid US-666 proved to be a good-yielding variety of sunflowers with different types of organic matter and the combination of organic matter with inorganic fertilizers under different types of priming agents. The hybrid US - 666 was purchased from Tara Agro Ltd.

Experiment layout

The experiment was conducted in the experimental area, Department of Agronomy, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, Multan, Pakistan for two consecutive years (spring 2022 and 2023) Weather data for both growing seasons was recorded (Fig. 1). The soil of experimental field was clay loam with EC_e , pH, organic, total nitrogen, available phosphorous, potassium and zinc ($2.45dSm^{-1}$, 8.6, 0.83%, 0.057%, 5.5, 01.54 and 0.38 $mg\ kg^{-1}$), respectively, during both growing seasons. The experiment was laid out in a Split Plot Design comprising priming agents with a net plot size of 5.0 m \times 6.0 m² and replicated thrice. The crop was sown with a single-row hand drill on March 07 and March 10 during both years of the trial by using a seed rate of 20kg ha⁻¹. Fertilizers were applied at T₁ = Control (No fertilizer), Synthetic fertilizer (SF), Sugarcane press mud (SPM), Farm Yard Manure, Sugarcane press mud (50%) + Farm yard manure (50%), Farm yard manure (50%) + Synthetic fertilizer (50%), Sugarcane press mud (50%) + Synthetic fertilizer (50%), Sugarcane press mud (33%) + Synthetic fertilizer (33%) + Farm yard manure (33%). All the di ammonium phosphate and sulfate of potash were used as basal dose. Nitrogen was used in three splits with irrigation treatments. All protection measures (weeds and insect pests' control) were taken

according to the recommendation of the sunflower crop.

Seed Priming and Fertilizer application

The priming techniques were detailed as control (no priming), Hydro priming (tube well water), and zinc priming (1% zinc solution). The seeds were soaked for priming treatments with a seed: primer ratio (1:5) for 12 hours and dried at laboratory temperature for 6 hours [20]. Different sources including organic and inorganic nutrients application were applied. Synthetic fertilizer was applied as a source of nitrogen, phosphorous and potassium were used in the form of di-ammonium phosphate (DAP), urea (N) and sulphate of potash (SOP). The recommended dose of Urea, DAP, and SOP was 155-60-60 kg ha⁻¹. All diammonium phosphate and sulphate of potash used as basal dose. Nitrogen was used in 3 splits.

Treatments

- Control= No fertilizer
- Synthetic fertilizer (SF) = (155-60-60 N: P: K kg ha⁻¹)
- Sugarcane press mud (SPM) = (2933 kgha⁻¹)
- Farm Yard Manure (FYM) = (58666 kgha⁻¹)
- Sugarcane press mud (SPM) (14666 kgha⁻¹) + Farm yard manure (FYM) (29333 kgha⁻¹)
- Farm yard manure (29333 kgha⁻¹) + Synthetic fertilizer (78-30-30 N: P: K kgha⁻¹)
- Sugarcane press mud (14666 kgha⁻¹) + Synthetic fertilizer (78-30-30 N: P: K kgha⁻¹)
- Sugarcane press mud (7333 kgha⁻¹) + Synthetic fertilizer (39-15-15 N: P: K kgha⁻¹) + Farm yard manure (14666 kgha⁻¹).

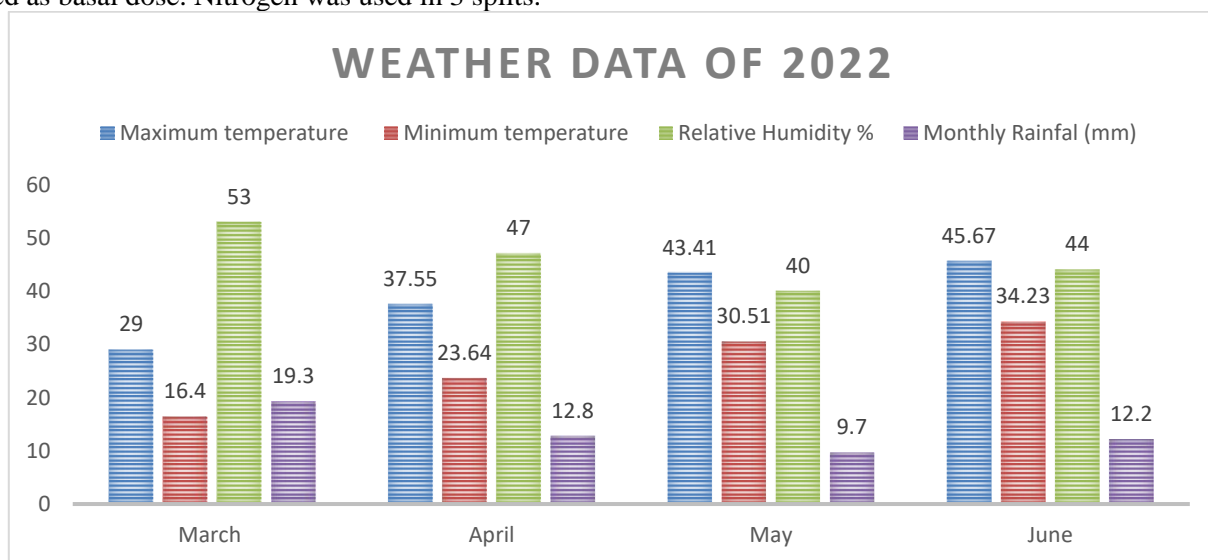


Fig 1. Weather data of the year 2022

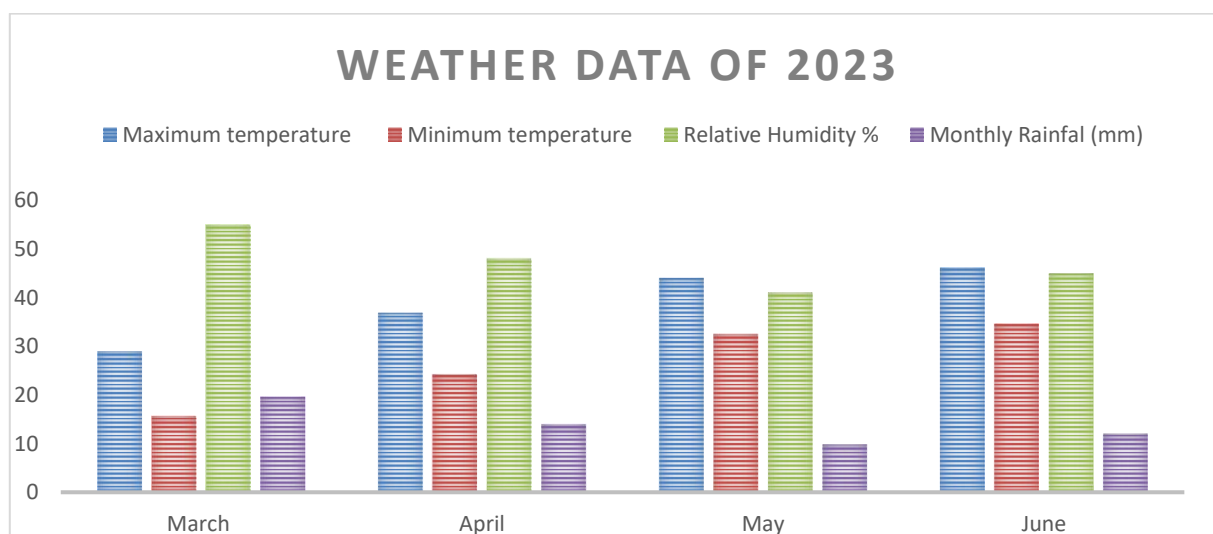


Fig 2. Weather data of the year 2023

Oil contents (%)

Seed samples were taken randomly from each subplot and oil contents were determined by NMR (Nuclear magnetic resonance) test [21]. NMR is a non-destructive and highly accurate method for determining oil content in seeds and other plant materials. It works by detecting the hydrogen nuclei in the fat molecules, providing a direct and rapid measurement of oil content. NMR is preferred for its ability to process large sample sizes efficiently with minimal preparation. Additionally, it doesn't require the use of solvents, making it safer and environmentally friendly compared to traditional extraction methods like Soxhlet extraction.

Protein contents (%) Nitrogen contents of a sunflower seed sample collected from each subplot were determined by the micro Kjeldahl method [22] and converted into crude oil percentage by multiplying 6.25. The micro Kjeldahl method is a well-established, accurate technique for determining total nitrogen content in a sample. It is widely used because of its reliability and ability to measure low concentrations of nitrogen in a variety of samples. Despite being labor-intensive and time-consuming, it remains a gold standard for protein analysis, especially in agricultural and food science research, due to its accuracy and reproducibility.

Yield and yield components At maturity, the one square meter (1m²) area from each experimental unit was harvested manually on June 20, in both years. The plants were tied into the bundles and weighed to record biological yield. These bundles were thrashed manually to determine achene yield, number of achene per plant, 1000 achene weight, and straw yield.

Statistical Analysis:

Fisher's Analysis of Variance (ANOVA) was chosen for the study because it is a powerful statistical technique used to compare means among different

treatment groups. In agricultural research, ANOVA is particularly useful when examining the effects of multiple treatments, such as seed priming, fertilizer applications, or other interventions on crop performance [23].

RESULTS

In the spring season of both years, Sugarcane press mud and synthetic fertilizers under the application of Zinc priming at the crop of sunflower Hybrid US-666 showed a significant difference between agronomic, yield-related, and quality-related parameters.

Effect of organic and inorganic fertilizers under different priming agents on agronomic traits

It shows very vital results on the agronomic traits of sunflowers. For example, the germination percentage was recorded as maximum in the control treatment under the application of zinc priming in both years. However, the minimum germination percentage was recorded in the treatment of sugarcane press mud and farm yard manure under no priming technique. In the case of stem diameter and plant height, we recorded the maximum reading under the treatment of sugarcane press mud and synthetic fertilizers under the application of zinc priming (Table 1). But in those plots in which we used sugarcane press mud, synthetic fertilizers, and farm yard manure (in proper concentration according to the treatments) under no priming technique we got the minimum values of plant height and stem diameter in the first year. In the second year, we got minimum results in the control treatment with no priming unit. The number of leaves and plant head diameter both increased under the application of sugarcane press mud and synthetic fertilizers under the application of zinc but their values decreased under control treatment and without priming technique (Table 2).

Table 1. Effect of organic and inorganic fertilizers under different priming agents on agronomic traits (germination count %, plant height, stem diameter, no. of leaves and plant head diameter) of sunflower under 2022

Treatments	Priming Units	GC%	PH (cm)	SD (cm)	No. of L	PHD (cm)
Control	C	89.37c	64.17p	2.04i	23.4s	6.08k
	HP	89.69b	64.71o	2.05i	23.8r	6.12k
	ZP	90.55a	65.84m	2.06i	24.27q	6.17k
SF	C	85.2f	66.28l	2.12g	24.2q	6.58j
	HP	85.935e	66.54k	2.147f	24.8p	6.65ij

	ZP	86.3d	66.91j	2.16ef	25.17o	6.75hi
SPM	C	73.26k	66.43kl	2.12g	25.7n	6.87gh
	HP	74.29j	66.84j	2.17ef	26.2m	7.1ef
	ZP	75.26i	67.28i	2.23b	26.7l	7.04ef
FYM	C	83.28h	68.86f	2.18de	26.3m	6.2k
	HP	83.34h	69.32e	2.21bc	26.8l	6.5j
	ZP	84.22g	69.6d	2.26a	27.2k	6.8h
SPM+FYM	C	68.5o	67.23i	2.17ef	29.4j	6.85h
	HP	69.49n	67.54h	2.18de	29.8i	7.01fg
	ZP	70.2m	67.897g	2.23b	30.17n	7.05ef
FYM+SF	C	84.58g	71.33c	2.09h	31.3g	7.02ef
	HP	85.5ef	71.77b	2.12g	31.8f	7.09ef
	ZP	86.3d	72.477a	2.15f	32.2e	7.16e
SPM+SF	C	72.44l	71.48c	2.17ef	33.53c	7.56bc
	HP	73.52k	71.897b	2.2cd	33.8b	7.65b
	ZP	74.4j	72.53a	2.23b	34.23a	7.85a
SPM+SF+FYM	C	73.58k	63.87q	1.79k	31.8f	7.17e
	HP	73.3k	64.197p	1.79k	32.2e	7.17cd
	ZP	74.4j	65.05n	1.84j	32.67d	7.17d
LSD (0.05)_p=		0.1102	0.1156	0.0165	0.102	0.0809

Table 2. Effect of organic and inorganic fertilizers under different priming agents on agronomic traits (germination count %, plant height, stem diameter, No. of leaves and plant head diameter) of sunflower under 2023

Treatments	Priming Units	GC%	PH (cm)	SD (cm)	No. of L	PHD (cm)
Control	C	87.17c	62.1p	2.08m	21.26w	5.97o
	HP	87.8b	62.55o	2.12l	21.66v	6.05n
	ZP	88.7a	63.16n	2.18ij	22.14u	6.11mn
SF	C	80.4f	63.34n	2.23ef	23.15t	6.35l
	HP	81.5e	64.3m	2.26cd	23.55r	6.5k
	ZP	82.5d	65.19k	2.29ab	23.9p	6.63ij
SPM	C	74.37j	64.18m	2.15k	23.32s	6.7i
	HP	75.47i	64.8l	2.22fgh	23.71q	6.87gh
	ZP	76.3h	65.23k	2.27bc	24.3o	6.97ef
FYM	C	79.37g	65.34k	2.2hi	24.5n	6.1m

	HP	80.2f	65.87j	2.25de	24.9m	6.3l
	ZP	81.3e	66.87i	2.29ab	25.41l	6.6jk
SPM+FYM	C	65.57p	67.3h	2.22fgh	27.7k	6.65i
	HP	67.3o	67.57g	2.25cd	27.95j	6.8h
	ZP	69.47n	68.22f	2.29ab	28.29i	6.9fg
FYM+SF	C	80.17f	69.41e	2.127l	29.93g	6.97ef
	HP	81.6e	69.91d	2.16ij	30.3e	7.03e
	ZP	82.3d	70.19c	2.21gh	30.84d	7.1d
SPM+SF	C	69.47n	70.08cd	2.23fg	31.48c	7.3c
	HP	70.4m	70.78b	2.27bc	31.92b	7.5b
	ZP	71.3l	71.32a	2.3a	32.28a	7.7a
SPM+SF+FYM	C	70.27m	60.33r	2.2p	29.6h	6.8h
	HP	71.38l	61.45q	1.93o	29.94g	6.97ef
	ZP	72.7k	62.33op	2.04n	30.14f	7.13d
	LSD (0.05)_p=	0.3249	0.2288	0.212	0.1407	0.0775

Abbreviations: C(Control), SF(Synthetic fertilizer), SPM(Sugarcane press mud), FYM(Farm Yard Manure), HP(Hydro priming), ZP(Zinc priming), GC(Germination count), PH(Plant height), SD(Stem diameter), No. of L(Number of leaves), PHD(Plant head diameter), LSD(Least Significant Difference).

Effect of organic and inorganic fertilizers under different priming agents on yield parameters

The yield-related parameters of sunflower show us the maximum value of the number of achenes per plant, 1000 grain weight, achene yield per hectare, biological yield, and harvesting index with the application of sugarcane press mud and

synthetic fertilizers under the application of zinc 1% solution in the form of priming (Table 3). But these all yield-related parameters except the biological yield of sunflower show us the minimum results with control treatment without priming (Table 4). However, biological yield reduces under the control treatment with zinc priming.

Table 3. Effect of organic and inorganic fertilizers under different priming agents on yield parameters (No. of achene per head, 1000 grain weight, Achene yield, biological yield and harvesting index %) under sunflower crop in 2022

Treatments	Priming Units	No. of A/H	1000 GW	AY (kg/ha)	BY (kg/ha)	HI %
Control	C	1187r	47.21x	2117t	8604.3i	24.62n
	HP	1215.3r	47.48w	2133.67t	8856i	24.09o
	ZP	1251q	47.67v	2186s	8560.9h	25.55kl
SF	C	1288p	51.19r	2394.3r	9477.71g	25.07m
	HP	1322o	51.43q	2418q	9587.64g	25.22lm
	ZP	1390.7n	51.43p	2457p	9546.5g	25.74k

SPM	C	1487.67m	51.43o	2618o	9754.3f	26.84j
	HP	1515.3m	51.43n	2644.3n	9766.07ef	27.08ij
	ZP	1565.67l	51.43m	2670m	9780.2ef	27.3i
FYM	C	1622.3k	51.43i	2894.3j	10359.1d	27.94h
	HP	1686.67j	51.43h	2916.67i	10396.9d	28.05h
	ZP	1762.67h	51.43g	2936.3i	10399d	28.24gh
SPM+FYM	C	1823f	51.43l	3417.3fg	11661.9c	29.3d
	HP	1877.3e	51.43k	3462.3e	11746.1bc	29.48e
	ZP	1952.3d	51.43j	3512.67d	11720.97bc	29.88ef
FYM+SF	C	1710.3ij	51.43f	3394h	11878.3ab	28.57g
	HP	1728i	51.43e	3413.67gh	11797abc	28.94f
	ZP	1784.3gh	51.43d	3435f	11820.37ab	29.06f
SPM+SF	C	2034c	51.43c	3702.3c	11927.67a	31.03c
	HP	2093.3b	51.43b	3726.3b	11847.67ab	31.45b
	ZP	2188a	51.43a	3814.3a	11939.6a	31.93a
SPM+SF+FYM	C	1808.67fg	51.43u	2687.67m	9916.57e	27.1ij
	HP	1831f	51.43t	2712.3l	9906.3ef	27.38i
	ZP	1880.67e	51.43s	2766k	9907.97ef	27.92h
LSD (0.05)_p=		15.611	0.0619	6.6041	107.83	0.323

Table 4. Effect of organic and inorganic fertilizers under different priming agents on yield parameters (no. of achene per head, 1000 grain weight, achene yield, biological yield, and harvesting index %) under sunflower in 2023

Treatments	Priming Units	No. of A/H	1000 GW	AY (kg/ha)	BY (kg/ha)	HI %
Control	C	1058r	45.11e	1919s	9638.37ij	19.91w
	HP	1095.3q	31.84f	1928.3s	9541.7ij	20.21v
	ZP	1130.7p	45.91e	1945.3s	9515.2j	20.56u
SF	C	1199.7o	48.3e	2153r	10293.5h	20.92t
	HP	1241.3n	48.84de	2224.3q	10371.5h	21.45s
	ZP	1288.3m	48.95de	2344.3p	10712.9fg	21.88r
SPM	C	1384.7l	49.58cde	2464.3mn	10312.3h	23.9q
	HP	1403.3l	51.29bcde	2553l	10635.97g	24hp
	ZP	1459k	51.94bcde	2624k	10862.47ef	24.2o
FYM	C	1560j	57.44abc	2735j	10915.2de	25.06n

	HP	1595i	58.36ab	2790.3i	11087.4c	25.17m
	ZP	1605.3i	58.98ab	2877h	11174.2abc	25.75j
SPM+FYM	C	1744.7f	56.53abcd	3152.3f	10707.57fg	29.44f
	HP	1788.7e	56.84abcd	3199e	10723fg	29.8e
	ZP	1834.3d	57.23abc	3229.3d	10719.2fg	30.13d
FYM+SF	C	1607i	58.49ab	3101.7g	11086.7cd	27.98i
	HP	1645h	58.94ab	3187.7e	11287.8a	28.24h
	ZP	1691g	59.29ab	3207.7de	11127.5bc	28.83g
SPM+SF	C	1909c	61.37a	3379c	11154.2abc	30.29c
	HP	1963.3b	61.95a	3429.3b	11203.27abc	30.61b
	ZP	2012a	62.21a	3488.3a	11273.77ab	31.22a
SPM+SF+FYM	C	1730f	46.37e	2398.3o	9487j	25.28l
	HP	1789.3e	46.88e	2441n	9541.3ij	25.58k
	ZP	1801.3e	47.24e	2490m	9652.3i	25.8j
LSD (0.05)_p=		13.54	4.8983	34.621	107.83	0.1033

Abbreviations: C(Control), SF(Synthetic fertilizer), SPM(Sugarcane press mud), FYM(Farm Yard Manure), HP(Hydro priming), ZP(Zinc priming), GC(Germination count), PH(Plant height), SD(Stem diameter), No. of L(Number of leaves), PHD(Plant head diameter), LSD(Least Significant Difference).

Effect of organic and inorganic fertilizers under different priming agents on quality traits

The application of different organic and inorganic fertilizers shows us the very important results of the quality traits of sunflowers. Like oil content, linoleic acid, oleic acid, palmitic acid, stearic acid, and protein content give the maximum results with the application of press mud and synthetic fertilizers under the application of zinc in the form of priming

(Table 5). However, all quality traits of sunflower (except palmitic acid) showed the minimum results under control treatment without any type of priming (Table 6). However palmitic acid showed minimum results under the application of only synthetic fertilizer without any type of priming.

Table 5. Effect of organic and inorganic fertilizers under different priming agents on quality traits (oil content %, linoleic acid %, oleic acid %, palmitic acid, stearic acid and protein content %) on sunflower in 2022

Treatments	Priming Units	OC (%)	LA (%)	OA (%)	PA (%)	SA (%)	PC (%)
Control	C	30.18r	68.48q	12.83s	2.7p	3.76p	15.26t
	HP	30.38q	69.04p	12.94rs	2.86o	3.80p	15.35t
	ZP	30.74p	69.51o	13.02qr	2.91n	3.85o	15.5s
SF	C	30.78op	72.96h	13.02qr	2.47s	4.55j	15.83r
	HP	30.9o	73.22g	13.13q	2.54r	4.65i	15.95r
	ZP	31.1n	73.7f	13.25p	2.65q	4.75h	16.1q
SPM	C	32.26m	71.94jk	15.23k	3.27m	4.83g	17.66p

	HP	32.5l	72.05j	15.43hi	3.36kl	4.9ef	17.85o
	ZP	32.75k	72.3i	15.59g	3.45hi	4.98cd	18n
FYM	C	32.35m	72.9h	15.37ij	3.42ij	4.95de	18.3m
	HP	32.57l	73.17gh	15.5gh	3.48h	5.03c	18.5l
	ZP	32.76k	73.57f	15.8f	3.54g	5.13b	18.7k
SPM+FYM	C	33.67j	75e	14.5o	3.33l	4.24n	20.3j
	HP	33.8j	75.15e	14.74n	3.38k	4.41m	20.57i
	ZP	34i	75.56d	14.88m	3.43ij	4.54jk	20.7h
FYM+SF	C	34.81h	71.19n	14.96m	3.39jk	4.48kl	22.27g
	HP	34.88h	71.5m	15.11l	3.47h	4.65i	22.52f
	ZP	35.2g	71.85jk	15.31jk	3.53g	4.87fg	22.7e
SPM+SF	C	39.01c	80.21c	17.03c	4.23c	5.02c	25.5b
	HP	39.16b	80.67b	17.19b	4.28b	5.13b	25.62b
	ZP	39.38a	81.09a	17.37a	4.32a	5.26a	25.74a
SPM+SF+FYM	C	37.95f	71.53lm	15.79f	3.7f	4.24n	23.15d
	HP	38.2e	71.74kl	15.93e	3.85e	4.43lm	23.27d
	ZP	38.6d	72.05j	16.19d	3.96d	4.55j	23.4c
	LSD (0.05)_{p=}	0.0729	0.0868	0.0431	0.014	0.0661	0.0436

Table 6. Effect of organic and inorganic fertilizers under different priming agents on quality traits (oil content %, linoleic acid %, oleic acid %, palmitic acid, stearic acid and protein content %) on sunflower in 2023

Treatments	Priming Units	OC (%)	LA (%)	OA (%)	PA (%)	SA (%)	PC (%)
Control	C	29.1k	65.3r	11.87t	2.37r	3.15p	13.27x
	HP	29.5k	66.3q	12.17s	2.7q	3.3o	13.73w
	ZP	30.4j	67.29p	12.48r	2.79p	3.45n	13.99v
SF	C	30.26j	70.35j	12.5r	2.15t	3.97m	14.96u
	HP	30.74j	71.81h	12.81q	2.24s	4.19jk	15.16t
	ZP	31.03j	72.6f	13.05p	2.39r	4.45h	15.36s
SPM	C	32i	68.47o	13.8o	2.9o	4.57g	16.19r
	HP	32.37hi	69.06n	14.33m	3.04n	3.74f	16.5q
	ZP	32.5hi	70.35j	14.9hi	3.19m	4.88e	16.92p
FYM	C	32.16i	70.3dj	14.59kl	3.32k	4.93de	17.08o
	HP	32.56ghi	71.36i	14.8ij	3.43h	4.996cd	17.38n

	ZP	32.79ghi	71.91h	15.06fg	3.6f	5.16b	17.89m
SPM+FYM	C	33.07fgh	72.33g	13.7o	3.26l	4.03lm	19.05l
	HP	33.29fg	73.35e	14.06n	3.34jk	4.25ij	19.32k
	ZP	33.78ef	73.95d	14.56l	3.49g	4.45h	20.03j
FYM+SF	C	34.19de	69.14mn	14.71jk	3.25l	4.05l	21.06i
	HP	34.66d	69.71l	14.94gh	3.39i	4.28i	21.32h
	ZP	34.92cd	70.08k	15.08f	3.6e	4.5g	21.61g
SPM+SF	C	37.34b	77.3c	16.08c	4.15c	5.05c	23.29c
	HP	37.92ab	77.9b	16.52b	4.24b	5.13b	23.95b
	ZP	38.38a	78.41a	16.93a	4.35a	5.38a	24.22a
SPM+SF+FYM	C	32.9gh	69.32m	14.93h	3.36j	4.03lm	21.9f
	HP	34.66d	69.91kl	15.21e	3.45h	4.14k	22.1e
	ZP	35.55c	70.3j	15.79d	3.69d	4.28i	22.93d
	LSD (0.05)_p=	0.4025	0.216	0.1208	0.0322	0.0697	0.0797

Abbreviations: C(Control), SF(Synthetic fertilizer), SPM(Sugarcane press mud), FYM(Farm Yard Manure), HP(Hydro priming), ZP(Zinc priming), GC(Germination count), PH(Plant height), SD(Stem diameter), No. of L(Number of leaves), PHD(Plant head diameter), LSD(Least Significant Difference).

DISCUSSIONS

The effect of organic and inorganic fertilizers shows us very significant results in this experiment. Germination percentage, which was not truly affected by the presence of any type of organic or inorganic fertilizer and we got the maximum results in the control treatment. It means that the germination percentage is not affected due to the presence of any type of fertilizer. It always depends on the quality of the seed [24]. However, stem diameter and plant height are both affected by the combination of sugarcane press mud and synthetic fertilizers with 1% zinc solution. This means that the increase in nitrogen level always affects the stem quality [25]. Zinc was also helpful in the ion transport chain within the body of plants. Which is very helpful in increasing the girth and height of the plants? But if the nitrogen exceeds the optimum level reduces the stem diameter and plant height (Table 1 & 2).

The number of leaves per plant and plant head diameter were also increased under the treatment of sugarcane press mud and synthetic fertilizers with zinc priming technique. With the application of such treatment, the nitrogen rates increased the sunflower growth traits such as stem, leaves, head, and fresh dry weight of plants [26]. In this way, the amount of photosynthesis also increased which should be very

helpful in increasing the plant head diameter and number of leaves. Zinc should be very helpful in increasing the electron transport chain. However, the number of leaves and plant head diameter reduces under control treatment due to the low presence of nitrogen as well as zinc. In such a way, nitrogen use efficiency and electron transport both reduced and reduced the growth of plants.

Organic and inorganic fertilizers show significant results on yield-related parameters of the crop of sunflower. The yield-related traits number of achenes per head, 1000 grain weight (g), achene yield (kg/ha), biological yield (kg/ha), and harvesting Index (%) increased at the combination of treatments of sugarcane press mud and synthetic fertilizers under zinc priming technique. The main reason is the increase in the nitrogen level, helpful in maximizing the yield of sunflowers [27]. When zinc is provided it should also be helpful in the electron transport chain which should help in increasing the uptake of nutrients by the plants [28]. So, in this way, the yield-related traits increase under such treatment with zinc priming.

However, the yield-related traits decreased except biological yield under the control treatments without any priming. Because, when there are no nutrients available to the plants in this way the production of plants will decrease [29].

Quality traits are affected by the use of organic and inorganic fertilizers. In this experiment, those plots that are treated with farm yard manure and synthetic fertilizers under zinc priming, give us the maximum value of oil content (%), linoleic acid (%), oleic acid (%), palmitic acid (%), steric acid (%), and protein content (%). This is due to the greater production of nitrogen, which is useful in increasing the quality and nutrition of the seeds of sunflowers [28]. When zinc is available in the form of priming, the improvement in electron transport in the body of the plant proceeds. The values of these quality traits also reduced under control treatment without any priming solution in both years, which shows that without any type of nutrient, the good production of plants cannot be possible [29]. So, in this way, all of the quality traits decrease under control treatment. There are so many ways in which the seed priming can improve the productivity and yield of the cultivated crops [30] by managing the abiotic stresses on the plants.

CONCLUSION

It may be concluded that the plots receiving the application of sugarcane press mud and synthetic fertilizer under zinc priming are recommended for achieving a high yield and good agronomic as well as quality traits of sunflower and increasing the farmers' income.

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