Research Article

Effects of seed rates on the growth and yield of different sunflower varieties

Hidayat Ali Panhwar¹, Ghulam Mustafa Laghari¹, Arshad Ali Kaleri², Mukesh Kumar Soothar^{3*}, Ayaz Ali Panhwar³, Jagdish Kumar Soothar¹, Muhammad Mukhtar Rajput³, Arshadullah Abro³ and Jay Kumar Soothar²

1. Department of Agronomy, Sindh Agriculture University Tandojam-Pakistan

2. Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam-Pakistan

3. Department of Soil Science, Sindh Agriculture University Tandojam-Pakistan

*Corresponding author's email: mukeshksoothar@gmail.com

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Abstract

The study was conducted at student's Experimental Farm, Department of Agronomy, Sindh Agriculture University Tandojam to evaluate growth and yield of sunflower varieties as affected by seed rates during 2015. The experiment was laid out three replicated randomized complete block design (RCBD) Factorial. The treatments included 03 seed rates and 03 sunflower varieties. Net plot size was used in the experiment 3m x 3m = 9m². The seed rates were kept as Factor A (S₁ = 5 kg, S₂ = 7.5 kg and S₃ = 10 kg ha⁻¹) and varieties as Factor B (V₁ = HO-1, V₂ = NKS-278 and V₃ = Hysun - 38). In the present study sunflower varieties tested with seed rates, showed maximum mean plant height (125.33) cm, stem girth (6.28) cm, seed weight head⁻¹ (44.94) g, seed index 1000 seed weight (69.89) g, head diameter (33.37) and seeds head⁻¹ (690) at the seed rate 5 kg ha⁻¹. Maximum mean seed yield kg ha⁻¹ (2276.8) and the maximum mean plant population m² (14.89) were recorded at the seed rate 10 kg ha⁻¹. Whereas, minimum mean stem girth cm (5.96), head diameter cm (31.02), seeds head⁻¹ (610), seed weight head⁻¹ (34.58), seed index 1000 seed weight g (52.33) were recorded at the seed rate 10 kg ha⁻¹. And minimum mean seed yield kg ha⁻¹ (1836.7) and plant population m² (7.22) were recorded at seed rate 5 kg ha⁻¹. In case of varieties maximum mean of plant population m² (11.78), plant height cm (184.8), stem girth cm (7.83), Head diameter cm (37.28), seeds head⁻¹ (1028), seed weight head⁻¹ g (64.63), seed index 1000 seed weight g (63.78) and seed yield kg ha⁻¹ (2061.7) were recorded in variety HO-1 whereas minimum mean of plant population m² (10.22), plant height cm (89.41), stem girth cm (4.54), seeds head⁻¹ (433), seed weight head⁻¹ g (26.67), seed yield kg ha⁻¹ (1990) were recorded in variety Hysun-38 and minimum head diameter cm (27.11), Seed index 1000 seed weight g (59.00) were observed in the variety NKS-278.

Keywords: Growth; Yield; Seed rates

Introduction

Sunflower (*Helianthus annuus* L.) is known as the significant wellspring of eatable oil

creation on the planet [1]. Sunflower seeds carry 25-48 per cent oil and 20-27 per cent protein. Though sunflower oil carries the

high rate of poly unsaturated fats (60%), acknowledged generally in eating regimen to lessen cholesterol in blood and in order to avoids heart diseases [2]. Sunflower oil is very acceptable and carries the dissolved vitamins A, D, E and K that recycled in synthesizing of margarine and cake as dairy cattle feed [3]. Pakistan imports, its more than 80 % edible oil for meeting the residential utilization all at the while 2012-13; as the regional edible oil generation rarely met 20 % of the household request. Sunflower can possibly extend up the crevice in the middle of interest and supply of eatable oil and it is all around adjusted to agro-environmental states of Pakistan. The oil obtained from sunflower was 101 thousand tons which was 16.67 % of the aggregate palatable oil creation locally [4]. The seed rate and plant population impacted the development qualities, for example, plant stature and stem distance across and the advancement rates. The harvest demonstrated a noteworthy resilience to dry season and the capacity to improve after times of high moisture stress. Populaces of 60,000 to 75,000 plants ha^{-1} at column spacing of 35 to 60 cm are prescribed for dry land creation [5]. The seed rates of sunflower going from 10.0 to 37.5 kg ha^{-1} . Seed rates of (10.0-15.0 and 27.5-37.5 kg) gave better yields of 2.5-6.5 g, linked and 10.0-11.8 g from seeding rate at (17.5-25.0 kg). Seed yield was very and emphatically associated with the quantity of units and mostly but pessimistic associated with the number of days to flowering or maturity and percentage flower drop [6]. The seeding rate in sunflower is affected by the dividing in the middle of lines and the separation between plants in succession. Entomb line dispersing had no noteworthy impact on yield and oil content. Higher seed rate did not demonstrate valuable while low thickness planting with 5 kg ha^{-1} seed rate brought about ideal results [7]. The seed rate

is a critical element to impact crop administration components and yields, mostly low plant populaces can diminish product by lessening seed yield and oil focus and vast heads, from low plant populace, may oblige longer to dry down and hard to gather [8]. The large portion of the development and yield contributing characteristics are all together and emphatically corresponded with the plant populace in sunflower [9]. Seeding rate can be the 15,000 to 25,000 plants for every section of land. Sunflower does not yield better in limited columns, while wide lines are ideal for developing [10]. The impact of cultivars and seed rates on yield and yield parts of sunflower. Column dispersing had no noteworthy impact on grain yield under either arrangement of creation [11]. Plant separating essentially influenced all evaluated character and plant dividing of 22.5cm was seen as a suitable plant thickness for acquiring the most extreme achene's yield (1920 kg ha^{-1}), whereas lower plant spacing (17.5cm and 20cm) resulted less yield [12]. The suitable harvest stand assumes a critical part to produce fancied product yields in sunflower and legitimate seed rate results in a decent yield stand. The seeding rates and target populaces in sunflower may be up to between 50,000–65,000 plants ha^{-1} . There are suggestions that higher dampness conditions might permit excessive sunflower seeding rates, which in turn could enhance seed and oil yields [13]. The sunflower can be grown at the seeding rate of 2-3 kg acre^{-1} , however this is relying upon the hybrid varieties, soil sort, accessibility of water and strategy for sowing. The seed rate of hybrid varieties with vast seed size ought to be much when contrasted with little size seeds. In watered ranges more seed ought to be utilized contrasted with downpour bolstered territories. Seed rate is diminished to 50 % if planted with new grower. For the most part

the execution of sunflower yield is better when it is dispersed at 60-75 cm separation. Plant populace ought to be between 35,000 to 55,000 plants ha⁻¹ with change made for soil sort and yield potential. Lower populaces are prescribed for lighter soils, soils with the less water retaining capacity and if precipitation is conflicting and deficient [14]. The seed rate has critical impact on the sunflower seed yield; and the positive effect because of seeding rate. The effect of seeding rate on plant stand attributes demonstrated that there was no checked impact of seed rate on plant stature, however head width fluctuate by seeding rate with the largest seed heads (15 cm) at the most reduced seeding rate (45,000 plants ha⁻¹). The littlest head width (11.25 cm) was in the most thickly seeded plots of 80,000 plants ha⁻¹ [15].

Material and methods

The study was carried out at Students' experimental farm, Department of Agronomy, Sindh Agriculture University Tando jam to evaluate growth and yield of sunflower varieties as affected by seed rates. The treatments included 03 seed rates and 03 sunflower varieties. The plot size was used in the experiment 3m x 3m (9 m²). Randomized complete block design Factorial was to in experiment with three replications. Factor A consisted of 3 Seed Rates as; S₁ = 5 kg ha⁻¹ S₂ = 7.5 kg ha⁻¹, S₃ = 10 kg ha⁻¹ and Factor-B consisted of 3

varieties; V₁ = HO-1, V₂ = NKS-278 and V₃= Hysun-38

Treatment combinations

T₁=S₁V₁, T₂=S₁V₂, T₃=S₁V₃, T₄=S₂V₁,
T₅=S₂V₂, T₆=S₂V₃ T₇=S₃V₁
T₈=S₃V₂ T₉=S₃V₃

Data analysis

The data was statistically analyzed through the MSTAT-C software; mean comparison was done using Duncan Multiple Comparison at 5% probability level (Gomez and Gomez, 1984).

Results

Plant population (m²)

The result for plant population m² of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 1 and their analysis for variance is presented in appendix – I.

The Table result showed that the maximum mean plant population m² was recorded (14.89) at seed rate 10 kg ha⁻¹ whereas the minimum mean plant population m² (7.22) was observed at 5 kg ha⁻¹. In varieties the maximum mean plant population m² (11.78) was observed in variety Ho-1 and minimum plant population (10.22) m² was recorded in variety Hysun 38. The interaction results showed the maximum plant population m² (15.67) at interaction of seed rate 10 kg ha⁻¹ x variety Ho-1 whereas the minimum plant population (7.00) plants m² at the seed rate 5 kg ha⁻¹ x varieties NKS-278 and Hysun-38.

Table 1. Plant population (m²) of different sunflower varieties as affected by various seed rates

Seed rates (kg ha ⁻¹)	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	7.67 g	7.00 h	7.00 h	7.22 C
7.5 kg ha ⁻¹	12.00 d	9.67 f	11.00 e	10.89 B
10 kg ha ⁻¹	15.67 a	14.00 c	15.00 b	14.89 A
Mean for varieties	11.78 A	10.22 C	11.00 B	

Plant height (cm)

The result for plant height (cm) of sunflower varieties significant for seed rates, varieties and their interaction indicated in Table 2 and their analysis for variance is presented in appendix – II.

The Table result indicated the maximum mean plant height (125.33) cm at seed rate 5 kg ha⁻¹ whereas the minimum plant height (119.16) cm observed at seed rate 10 kg ha⁻¹.

In varieties the maximum mean plant height (184.8) was observed in variety Ho-1 and minimum plant height (89.41) cm was recorded in variety Hysun-38. The interaction results showed the maximum plant height (195.00) cm at interaction of seed rate 5 kg ha⁻¹ x variety Ho-1, whereas minimum interaction result was observed (73.67) cm at the seed rate 5 kg ha⁻¹ x variety Hysun-38.

Table 2. Plant height (cm) of different sunflower varieties as affected by various seed rates

Seed Rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	195.00 a	107.33 d	73.67 i	125.33 A
7.5 kg ha ⁻¹	182.00 b	85.95 g	95.57 f	120.17 B
10 kg ha ⁻¹	177.33 c	78.13 h	102.00 e	119.16 B
Mean for varieties	184.8 A	90.5 B	89.41 B	

Stem girth (cm)

The result for plant height (cm) of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 3 and their analysis for variance is presented in appendix – III.

The Table result showed the maximum mean stem girth cm (6.28 and 6.21) at seed rates 5 and 7.5 kg ha⁻¹ whereas minimum mean stem girth (5.96) cm was observed at

10 kg ha⁻¹. In varieties the maximum mean stem girth (7.83) cm were recorded in variety Ho-1 and the minimum mean stem girth (4.54) cm was recorded in variety Hysun-38. In case of interaction results showed that the maximum stem girth cm (8.33) at seed rate 5 kg ha⁻¹ x variety Ho-1, whereas minimum interaction result were observed (4.33 and 4.63) cm at seed rates 10 kg and 7.5 kg ha⁻¹ x variety Hysun-38.

Table 3. Stem girth of different sunflower varieties as affected by various seed rates

Seed Rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	7.50 b	6.67 c	4.67 de	6.28 A
7.5 kg ha ⁻¹	7.67 b	6.33 c	4.63 de	6.21 AB
10 kg ha ⁻¹	8.33 a	5.03 d	4.33 e	5.96 B
Mean for varieties	7.83 A	6.03 B	4.54 C	

Head diameter (cm)

The head diameter (cm) result of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 4 and their analysis for variance is presented in appendix – IV.

The Table results showed the maximum mean head diameter cm (33.3 and 33.37 cm)

at seed rates 5 and 7.5 kg ha⁻¹ whereas minimum mean head diameter (31.02) cm was observed at 10 kg ha⁻¹. In varieties the maximum mean head diameter cm (37.28) was observed in variety Ho-1 and the minimum mean head diameter cm (27.11) was recorded in variety NKS- 278. The interaction results showed the maximum

head diameter (37.10, 37.58 and 37.00) cm at interaction of seed rates 5, 7.5 and 10 kg ha⁻¹ x variety Ho-1, whereas minimum

interaction results were observed (25.67) cm at the seed rate 7.5 kg ha⁻¹ x variety NKS-278.

Table 4. Head diameter (cm) of different sunflower varieties as affected by various seed rates

Seed rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	37.10 a	28.00 d	35.00 b	33.37 A
7.5 kg ha ⁻¹	37.58 a	27.67 d	34.13 b	33.13 AB
10 kg ha ⁻¹	37.00 a	25.67 e	30.40 c	31.02 B
Mean for varieties	37.28 A	27.11 C	33.18 B	

Seeds head⁻¹

The result for seeds head⁻¹ of sunflower varieties significant for seed rates, varieties and their interaction shown in Table 5 and their analysis for variance is presented in appendix – V.

The Table results revealed the maximum mean seeds head⁻¹ (690) seeds at seed rate 5 kg ha⁻¹ whereas minimum mean seeds head⁻¹ (610) were observed at seed rate 10 kg ha⁻¹.

In varieties the maximum mean (1028) for seeds head⁻¹ was observed in variety HO-1 and the minimum mean (433) seeds head⁻¹ were recorded in variety Hysun–38. The interaction results showed the maximum (1149) seeds head⁻¹ at the seed rate 5 kg ha⁻¹ x variety Ho-1, whereas minimum interaction result was observed (346) seeds head⁻¹ with the seed rates 7.5 kg ha⁻¹.x variety Hysun-38.

Table 5. Seeds head⁻¹ of different sunflower varieties as affected by various seed rates

Seed rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	1149.7 a	405.0 g	516.7 d	690.44 A
7.5 kg ha ⁻¹	998.3 b	506.0 d	346.7 h	617.00 B
10 kg ha ⁻¹	936.0 c	457.7 e	436.3 f	610.00 B
Mean for varieties	1028.0 A	456.2 B	433.2 C	

Seed weight head⁻¹ (g)

The result for seed weight head⁻¹ of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 6 and their analysis for variance is presented in appendix – VI.

The Table results revealed the maximum mean seed weight head⁻¹ (44.94, g) at seed rate 5 kg ha⁻¹ whereas minimum mean seed weight head⁻¹ (34.58) grams were observed at 10 kg ha⁻¹. In varieties the maximum

mean for seed weight head⁻¹ (64.63, g) were observed in variety HO-1 and minimum mean seed weight head⁻¹ (26.67, g) were recorded in variety Hysun–38. The interaction results showed the maximum seed weight head⁻¹ (73.08, g) were with the seed rate 5 kg ha⁻¹ x variety Ho-1 whereas minimum interaction result seed weight head⁻¹ (21.33, g) were observed at the seed rates 10 kg ha⁻¹ x variety Hysun-38.

Table 6. Seed weight head⁻¹ (g) of different sunflower varieties as affected by various seed rates

Seed rates	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 kg ha ⁻¹	73.08 a	36.58 d	25.17 g	44.94 A
7.5 kg ha ⁻¹	66.18 b	24.47 g	33.50 e	41.37 B
10 kg ha ⁻¹	54.50 c	27.91 f	21.33 h	34.58 C
Mean for varieties	64.63 A	29.66 B	26.67 C	

Seed index (1000 seed weight, g)

The result for seed index (1000 seed weight, g) of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 7 and their analysis for variance is presented in appendix–VII.

The Table results showed the maximum mean seed index (1000 seed weight, g) (69.89, g) were at seed rate 5 kg ha⁻¹, whereas minimum mean seed index (1000 seed weight, g) (52.33, g) were observed at seed rate 10 kg ha⁻¹. In varieties the

maximum mean for seed index (1000 seed weight, g) (63.78, g) were observed in varieties Ho-1, whereas the minimum mean seed index (1000 seed weight) (59.00) grams were recorded in variety NKS-278. The interaction results showed the maximum seed index (1000 seed weight, g) (71.67, g) at interaction of seed rate 5 kg ha⁻¹ x varieties Ho-1, whereas minimum interaction result of seed index (1000 seed weight) was observed (43.67, g) at the seed rates 10 kg ha⁻¹ x variety NKS-278.

Table 7. Seed index (1000 seed weight, g) of different sunflower varieties as affected by various seed rates

Seed rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 Kg ha ⁻¹	71.67 a	70.00 a	68.00 a	69.89 A
7.5 Kg ha ⁻¹	59.33 ab	63.33 a	62.67 a	61.78 B
10 Kg ha ⁻¹	60.33 ab	43.67 b	53.00 ab	52.33 C
Mean for varieties	63.78 A	59.00 A	61.22 A	

Seed yield (kg ha⁻¹)

The result for seed yield (kg ha⁻¹) of sunflower varieties significant for seed rates, varieties and their interaction presented in Table 8 and their analysis for variance is presented in appendix – VIII.

The Table results showed the maximum mean seed yield (2276.8) kg ha⁻¹ at seed rate 10 kg ha⁻¹, whereas minimum mean seed yield (1836.7) kg ha⁻¹ were observed at seed rate 5 kg ha⁻¹. In varieties the

maximum mean seed yield (2061.7) kg ha⁻¹ was recorded in variety HO-1, whereas the minimum mean seed yield (1990) kg ha⁻¹ were observed in variety Hysun–38. The interaction results showed the maximum seed yield (2366) kg ha⁻¹ at interaction of seed rate 10 kg ha⁻¹ x variety Ho-1, whereas minimum interaction result of seed yield (1725) kg ha⁻¹ were observed at the seed rate 5 kg ha⁻¹ x variety Hysun-38.

Table 8. Seed yield (kg ha⁻¹) of different sunflower varieties as affected by various seed rates

Seed rates kg ha ⁻¹	Varieties			Mean for seed rates
	Ho-1	NKS-278	Hysun-38	
5 Kg ha ⁻¹	1859.3 e	1925.0 de	1725.7 f	1836.7 C
7.5 Kg ha ⁻¹	1959.0 d	1944.0 de	2059.3 c	1987.7 B
10 Kg ha ⁻¹	2366.7 a	2277.3 ab	2186.3 b	2276.8 A
Mean for varieties	2061.7 A	2048.8 A	1990.4 B	

Discussion

Sunflower seeds differ in size, so seeding rate taking weight must consider into record seed size, however will be about 5 to 7 kg ha⁻¹ [10]. The experiment results showed that the enhanced plant population m² was recorded at seed rate 10 kg ha⁻¹ whereas the minimum plant population m² was observed at 5 kg ha⁻¹. In varieties the maximum plant population m² was observed in variety HO-1 and minimum plant population m² was recorded in variety Hysun 38. The interaction results showed the maximum plant population m² was recorded at interaction of seed rate 10 kg ha⁻¹ x variety HO-1 whereas the minimum plant population m² was found at the seed rate of 5 kg ha⁻¹ x varieties NKS-278 and Hysun-38 and results regarding head diameter cm showed that the maximum head diameter cm was recorded at seed rates 5 kg ha⁻¹ whereas minimum head diameter cm was observed at 10 kg ha⁻¹. In varieties the maximum head diameter cm was observed in variety HO-1 and the minimum mean head diameter cm was recorded in variety NKS- 278. The interaction results showed the maximum head diameter cm was recorded at interaction of seed rate 7.5 kg ha⁻¹ x variety HO-1, whereas minimum interaction results were observed at the seed rate 5 kg ha⁻¹ x variety NKS-278. Similarly [8] reported that seed rate is a critical component to impact crop administration variables and yields, Unnecessarily low plant populaces can lessen product esteem by decreasing seed yield and seed oil focus. The experiment

result showed the maximum seed index (1000 seed weight, g) were observed at seed rate 5 kg ha⁻¹, whereas minimum seed index (1000 seed weight, g) was recorded at seed rate 10 kg ha⁻¹. In varieties the maximum seed index (1000 seed weight, g) were observed in varieties Ho-1, whereas the minimum mean seed index (1000 seed weight) were recorded in variety NKS-278. The interaction results showed the maximum seed index (1000 seed weight, g) was observed at interaction of seed rate 5 kg ha⁻¹ x varieties Ho-1 and NKS-278, whereas minimum interaction result of seed index (1000 seed weight) was observed at the seed rates 10 kg ha⁻¹ x variety NKS-278. Similarly [14] built up a generation innovation that sunflower may be sown at the seeding rate of 2-3 kg acre⁻¹, however this is relying upon cross breed, soil sort, accessibility of water and system for sowing. The seed rate of crossovers with substantial seed size ought to be more when contrasted with little size seeds. Similar results were reported by Afroz *et al.* [16], who observed that 8 kg of mustard increased the seed index. The experiment result showed the maximum plant height (cm) was recorded at seed rate 5 kg ha⁻¹ whereas the minimum plant height cm observed at seed rate 5 kg ha⁻¹. In varieties the maximum height of plant was noted in Ho-1 and minimum plant height was observed in genotype hysun-38. The interaction results showed the maximum plant height was recorded at interaction of seed rate 5 kg ha⁻¹ x variety Ho-1, whereas minimum

interaction result was observed at the seed rate 10 kg ha⁻¹ x variety Hysun-38. Similarly [15] checked the effect of seeding rate on plant stand attributes quickly preceding harvest in sunflower. Head width did shift by seeding rate, with the most stretched out seed heads (5.9 inches) saw at the least seeding rate (20,000 plants section of land 1). The littlest head width (4.5 inches) was in the most thickly seeded plots (32,000 plants acre⁻¹). The experiment results showed the maximum seed yield kg ha⁻¹ at seed rate 10 kg ha⁻¹ due to more plant population m², whereas minimum seed yield kg ha⁻¹ were observed at seed rate 5 kg ha⁻¹. In varieties the maximum seed yield kg ha⁻¹ was recorded in variety HO-1, whereas the minimum seed yield kg ha⁻¹ were observed in variety Hysun-38. The interaction results showed the maximum seed yield kg ha⁻¹ at interaction of seed rate 7.5 kg ha⁻¹ x variety HO-1, whereas minimum interaction result of seed yield kg ha⁻¹ were observed at the seed rate 5 kg ha⁻¹ x variety Hysun-38. Similarly [11] directed a test to explore the impacts of varieties and seed rates on yield and yield parts of sunflower reported that size and number of seeds were fundamentally influenced by seed rate. The result of experiment revealed that sunflower treated with three seed rates (5, 7.5 and 10 kg ha⁻¹) among these seed rates highest plant population m² were observed at the seed rate 10 kg ha⁻¹, taller plants were recorded at the seed rate 5 kg ha⁻¹, thick stem girth at the seed rate 5 kg ha⁻¹, maximum head diameter at the seed rate 5 kg ha⁻¹, greater seeds head⁻¹ at the seed rate 5 kg ha⁻¹, higher seed weight head⁻¹ at the seed rate 5 kg ha⁻¹, maximum seed index 1000 seed weight at the seed rate 5 kg ha⁻¹ and higher seed yield kg ha⁻¹ were recorded at the seed rate 10 kg ha⁻¹. The result of experiment further revealed that three sunflower varieties (Ho-1, NKS-278 and Hysun-38) among these varieties Ho-1 significantly recorded

maximum plant population m², taller plants, thick stem girth, higher head diameter, more seeds head⁻¹, heavier seed weight head⁻¹, bolder seed index 1000 seed weight and highest seed yield kg ha⁻¹ were recorded at the seed rate 10 kg ha⁻¹. Similarly [17] assessed the near execution of different sunflower hybrid varieties for yield and its associated qualities. Twelve sunflower cross breeds, i.e. G-101 (H1), DK-4040 (H2), SF-187 (H3), S-278 (H4), Hysun-33 (H5), FH-37 (H6), Ausigold-61 (H7), Ausigold-62 (H8), FSS-50 (H9), NX-00989 (H10), NX-00997 (H11) and XIYU-12 (H12) were incorporated into the trail. It was watched that Hysun-33 demonstrated more important plant stature (148.47 cm) and achene head⁻¹ (682.70) than every single other cross breed, however if there should arise an occurrence of yield (3891.0 kg ha⁻¹) and other related characteristics, for example, number of plants m⁻², leaf territory list, head distance across and 1000-achene weight of SF-187 showed better execution by recording qualities (6.87), (4.33), (18.62) and (49.11g), individually, taking after Hysun-33 for a large portion of the attributes. From the outcomes it is inferred that the half and halves SF-187 and Hysun-33 demonstrated high profitability and are best adjusted to the climatic states of Faisalabad.

Conclusion

It is concluded that growth and yield parameters of sunflower was significantly affected by seed rate that sunflower crop production increased with the increasing of seed rate. Sunflower variety Ho-1 gave the highest yield at the seed rate 10 kg ha⁻¹ whereas variety NKS-278 and Hysun-38 also gave the better yield at the seed rate 10 kg ha⁻¹.

Authors' contributions

Conceived and designed the experiments: GM Laghari & HA Panhwar & AA, Panhwar, Performed the experiments: HA Panhwar, JKr Soothar, MM Rajput, A Abro

& J Kumar, Analyzed the data: GM Laghari
 & J Kumar, Contributed reagents/ materials/
 analysis tools: GM Laghari & J Kumar,
 Wrote the paper: AA Kaleri & MK Sothar.

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