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Research Article

Polygenic and Oligogenic analyses for metric traits in sunflower genotypes

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Abstract

Sunflower is a valuable oilseed crop that is beneficial both for animals and human beings. The current experiment aimed to study correlation analyses for various sunflower genotypes for yield and its related traits. The present research was carried out in Randomized Complete Block Design (RCBD) with three replications at the Oilseed section, Agriculture Research Institute (ARI), Tando Jam during the spring season of 2016. Variation was observed in sixteen sunflower lines compared with two check varieties. The trait's periods of flower initiation, periods to completion, plant stature (cm), head diameter (cm), and Seed yield (Kg/ha^{-1}) were observed significantly different at P≤0.01 probability level. The number of plants plot^{-1} and 100 seed weight (g) was insignificant. SF-16001 and SF-16012 showed maximum periods of flower initiation and periods of flower completion. Whereas, the SF-16013 line produced maximum periods of maturity, plant stature (cm), head diameter (cm), and seed yield (Kg/ha^{-1}) as compared with both check varieties.

Keywords: Genetic Variation; Head Diameter; Seed Yield; Sunflower

Introduction

Sunflower, (*Helianthus annuus* L.) is an oilseed cultivated plant that belongs to the compositeae family. The word genus *Helianthus* is obtained from the Greek words, helios means 'Sun' and Anthos means 'blossom' which is ordinarily known as 'Suraj Mukhi'. There are 67 species of this genus recognized, apart from the cultivated species, most are long-duration and ornamentals. It was also planted as an ensilage crop in the late 1800s and early 1900s. Expanding in world production the plantation of sunflower increased resulted primarily from the development of high-oil varieties by plant scientists and more recently by the development of hybrids. It's one of the most principal oilseeds' second crops throughout the world [1] following soybeans. Species of planted sunflowers (*Helianthus annuus* L.) have been considered the principal fount of edible oil in Russia, and eastern, European countries for decades. In the last 2 to 3 decades, the cultivation of sunflower has augmented manifolds due to the diversification of its production in several parts of the world [2]. Sunflower, which is a principal fount of good quality edible oil and

can fit in our cropping system, is contemplated as the frequent potential crop to narrow the space between the entire requirement and the domestic cultivation of edible oil in the country [3]. The productive characteristics of sunflowers in terms of seed yield, oil, and protein output are manipulated widely depending on various factors of the environment such as (climatic changes) like radiation [4], temperature [5, 6], and rainfall distribution.

Materials and Methods

The present research/experiment material was conducted on 8 lines including two checks viz. SF-16010, SF-16011, SF-16012, SF-16013, SF-16014, SF-16015, SF-16016, CHECK-1, CHECK-2, and current research was carried out at the oil seed research section at agriculture research institute Tandojam by using (RCBD) randomized complete block design within 3 replications. 5 plants were randomly selected and tagged at the time of maturity. Examinations were recorded based on these selected plants from each variety at different developing phases for eight characters viz Periods to initial flower, Periods to complication flower, Periods to maturity 75%, no. of plants plot^{-1}, plant height, head diameter, seed yield kg ha^{-1}, 100 seed weight gram to observe the mean performance among the lines and between line and check varieties and correlation among the different parameters.

Results and Discussion

Data analysis presented in (Table 1) showed a highly significant probability level among the genotypes for the majority of the characters under research. A significant difference was observed among all the traits except days to flower completion, which was non-significant. Statistical data analysis observed that dissimilarities in the mean values of sunflower varieties and check variety were highly significant as observed in periods to initial flowering ranging 40 (SF-16013) to 44 days (SF-16001) while days to 75% flowering ranging from 92.33 (SF-16015) to 96 days (CHECK-2), whereas according to days to maturity ranging from 42.33 (SF-16011) to 51 (SF-16001). The fluctuation in periods to flowering and maturity may be due to photo-period because other varieties responded differently to a particular photo-period. The greatest plant stature of 165cm was observed for CHECK-2, whereas a minimum plant stature of 83cm was observed for the genotype SF-16012. The dissimilarities in plant stature cause variations in the heredity makeup of other varieties. Climatic conditions also create variations including hormonal and cell division rates that result in variations in the height of plants of other sunflower cultivars [7] emphasizing a wide range of variability in polygenic traits among the sunflower cultivar. According to (Table 2), the biggest head diameter observed by the genotype SF-16013 was (23.00), whereas genotype SF-16016 produced a flower with the smallest head diameter of 13.33. The highest 100 seed weight was given by SF-16010 (8.33), whereas the genotypes SF-16011 and SF16012 showed a minimum 100 seed weight of (3.00). Comparable results were also found by former co-workers [8-11]. A maximum number of plant plot^{-1} 60 plants were produced by genotype SF-16016, whereas a minimum number of plant plot^{-1} showed by the genotype CHECK-2. Regarding the yield kg ha^{-1}, the maximum yield was given by the genotype Check-2 with 1807.7 kg, while genotype SF-16016 observed the maximum yield with 1167.7 kg, the same outcome was noted by [12-15].

Whereas (Table 3) interpreted the association among all the characters of genotype, studied at morphological level with in all three replication, which stated that, the most of character showed negative but non-significant association, as periods to initial flowering reveled negative and non-significant association to plant stature and

seed index, whereas periods to 75% flowering to plant stature, periods to maturity showed with head diameter, no. of plant plot^{-1} and 100 seed weight, while head diameter to 100 seed index only, whereas no. of plant^{-1} showed negative and non-significant correlation to the plant height, 100 seed index and yield kg ha^{-1} respectively, whereas it was noted positive but significant in characters i.e periods to initial flowering reveled to periods to 75% blooming and head diameter while periods to 75% flowering showed to the days to maturity only yet in case of head diameter, no of plant plot^{-1}, the positive but significant association was found to the yield kg ha^{-1}, respectively, while the negative and significant association was established by days to maturity to 100 seed weight, more over all the character showed the significant and non-significant but positive correlation association to the yield except plant stature. All these results conform to **[16, 17]**. From the analysis of co-efficient correlation, it could be stated that head diameter had a direct influence on yield kg ha^{-1}, Besides the number of plants plot^{-1} also exhibited a direct but low effect on yield as compared to other characters which showed some effective but not comparable results to yield.

Table 1. ANOVA (Analysis of variance) of different polygenic traits in sunflower

Trait	Replication D.F=2	Genotype D.F=17	Error D.F=34
Plant Stature	6.46	1275.38**	4.80
Periods to flowering	1.35185	5.99237**	1.70479
Periods to maturity	21.3519	15.2898**	4.7636
Periods to flower completion	1.38889	5.46078 n.s	3.68301
Head diameter	3.3519	20.0316**	4.3322
No. of plants/ plots	2.463	180.947**	2.463
seed yield kg/ ha	56.1	95253.3**	10.1
Seed weight	1.7963	24.4107**	2.5806

Table2. Mean performance of genotype for the various characters

Varieties	Periods to Flower Initiation	periods to Flower 75%	Periods to Maturity	No: plant plot^{-1}	Plant Stature (cm)	Head Diameter (cm)	Seed yield (kg/ha)	100-Seed weight (gram)
CHECK-1	42.667	96.000	45.000	35.333	124.33	15.000	1206.0	4.667
CHECK-2	43.667	96.333	47.000	32.667	165.00	16.333	1807.7	5.333
SF-16001	44.667	92.333	51.667	45.667	113.67	13.667	1427.3	5.333
SF-16002	41.333	91.333	47.333	43.667	122.00	14.667	1553.3	11.333
SF-16003	42.333	92.333	48.000	38.667	129.67	15.667	1343.3	13.667
SF-16004	42.333	93.333	48.667	50.000	85.67	17.333	1627.3	6.667
SF-16005	40.667	92.667	43.000	35.667	123.00	21.333	1367.0	6.667
SF-16006	40.000	95.000	45.000	44.000	104.33	15.000	1585.7	4.333
SF-16007	41.667	93.667	49.000	53.000	108.33	16.000	1448.0	3.333
SF-16008	42.667	93.667	46.000	40.000	104.33	14.000	1694.0	8.000

Table 3. The correlation coefficient for the different traits of sunflower genotypes

Traits	Periods to initial flowering	Periods to 75% flowering	Periods to maturity	Head diameter	No. plants/plot	Plant Stature	100 seed weight	Yield kg /ha
Periods to initial flowering	-							
Periods to75% flowering	0.3742**	-						
Periods to maturity	0.1861n.s	0.3761**	-					
Head diameter	0.3768**	0.0738 n.s	-0.1391 n.s	-				
No. plants/plot	0.2938 n.s	0.0788 n.s	-0.0204 n.s	0.2331n.s	-			
Plant Stature	-0.691 n.s	-0.3008 n.s	0.2268 n.s	0.0054 ns	-0.1027 n.s	-		
100 seed weight	-0.3639 n.s	0.0586 n.s	-0.8027**	-0.0323 n.s	-0.1794 n.s	0.0941n.s	-	
Yield kg /ha	0.0643 n.s	0.1910 n.s	0.3347 n.s	0.3852 **	0.4487 *	-0.0773 n.s	0.3710 n.s	-

Conclusion

The present research concluded that based on mean performance head diameter, 100 seed weight, minimum plant height, and yield kg ha^{-1}, a breeder could evolve a variety through the selection method, further, it is predicated that early flowering and maturing varieties have a direct effect on 100 seed weight and yield kg ha^{-1}.

Authors' contributions

Conceived and designed the experiments: B Ali & S Memon, Performed the experiments: B Ali & AA Baloch, Analyzed the data: B Ali, S memon & G Soomro, Contributed materials/ analysis/ tools: B Ali & Y Ali, Wrote the paper: B Ali.

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