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Relationships in Anthesis, Maturity and Yield of Some Sunflower (*Helianthus annuus* Linnaeus, Compositae) Genotypes under Rainfed Conditions

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Abstract: Relationships in anthesis, maturity and yield of different sunflower genotypes were studied in fourteen sunflower genotypes. It was observed that in different genotypes of sunflower there were variations in days to anthesis and maturity and on an average basis the anthesis in different genotypes initiated in about 8.3571 ± 1.0082 weeks after sowing of crop (34th week of 2000) and the genotypes matured after an average of 14 ± 0.8771 weeks after sowing. This period needed for maturity falls in the range of less than 100-120 days generally needed for the maturity of this crop. There were variations in the yield of different genotypes and the genotypes were also evaluated on the basis of this component. The highest yield obtained was of the genotype 9705 (1711.11 kg ha^{-1}) and the lowest of XF 263 (266.66 kg ha^{-1}). On an average basis, the yield was concluded as 855.0686 kg ha^{-1} and this yield falls in the range generally recorded from the rainfed sunflower crops. These studies concluded positive and significant correlation in weeks to anthesis, maturity and yield at 0.01 and 0.05 levels and the former two influenced the sunflower grain yield positively and significantly.

Key words: *Helianthus annuus* L., genotypes, yield component, correlation, anthesis, maturity

Introduction

Sunflower (an important non-conventional oilseed crop), can be grown twice a year in spring and autumn in different parts of the world (Aslam, 2000). It has great importance for medicinal actions. The seeds have diuretic properties. The seeds of sunflower contain 40-50% oil. The oil is quite palatable, contains soluble vitamins A, D, E, K and is used in salads, cooking and margarines and as a lubricant. Pakistan imported 1.9 million tons of edible oil spending US $ 788 million during the year 1999-2000 (GOP, 2000). According to Khan (2001), grain yield is the product of several interrelated factors which are highly susceptible to environment fluctuations. Date of sowing, anthesis (blooming of flowers) and maturity period (time), influence the yield of crop plants directly or indirectly. Shafiullah *et al.* (2001) reported that sunflower crop should be harvested 35 days after flower initiation or 25days after flower completion to get higher yield.

Khan (2001), described that seed yield in sunflower was positively correlated with maturity and flowering. The major objective of this study was to determine the relationships in weeks to anthesis, maturity and yield under rainfed conditions.

Materials and Methods

The experiment was carried out to know the relationships in anthesis, maturity and yield of different sunflower genotypes in fourteen sunflower genotypes including Hysun-777, XF-263, Award, T-562, 9706, 9707, 9705, PSF-025, Parsun-1, 1435, $JH_1$99S, $JH_2$99S, PNSF1 and Hysun-33 at Pind Gondal, Taxilla during Autumn 2000. The seed of fourteen genotypes of sunflower was collected from UGC/UAAR Sunflower Project and NARC, Islamabad.

The genotypes of sunflower (*Helianthus annuus* L.) were planted in randomized complete block design on 20-08-2000 (34^{th} week of 2000) at Pind Gondal. The experimental plot was 150 x 300 cm^2 with 25 cm plant to plant and 75 cm row to row distance. Planting was done by dibbling with three seeds per hill. On germination of all genotypes one plant per hill was maintained by thinning. All agronomic and the intercultural practices required for sunflower crop including fertilizing, thinning, hoeing, weeding out and earthing up etc. were also carried out adequately. The genotypes were sown under rainfed conditions and were subject to the availability of rain water.

Data pertaining to anthesis (blooming of flowers) and maturity were collected by taking observations of all the plants on daily basis. The data on the yield of different sunflower genotypes were collected when the plants of different genotypes were matured and harvested.

All the collected information was analyzed statistically by using statistical package, SPSS (1999) on computer. The correlations in weeks to anthesis, weeks to maturity and yield of different genotypes were computed with this statistical package.

Results and Discussion

The anthesis in different genotypes initiated in about 8.3571 ± 1.0082 weeks after sowing of crop and the genotypes matured after an average of 14 ± 0.87771 weeks after sowing (Table 1). In different genotypes there were variations in weeks to anthesis and maturity. Shafiullah *et al.* (2001) reported that sunflower crop should be harvested 35 days after flower initiation and 25 days after flower completion to get higher seed yield. Based on our studies the period between anthesis of flowering and maturity of plants lies between 5.6429 weeks. According to results, the sunflower crop matured in about 14 ± 0.87771 weeks (Table 1). Based upon Praveena *et al.* (2000), the sunflower crop requires less than 100 to 120days for maturity. There were variations in the yield of different genotypes. The yield of all genotypes on an average basis was 855.0686 ± 401.0977 kg ha^{-1} Praveena *et al.* (2000) reported that as a rainfed crop, it yields 800-1000 kg ha^{-1}, while under irrigation the yields are above 2000 kg ha^{-1}. The genotypes included in these studies were grown in the rainfed areas, so the yields obtained come in the range as given by Praveena *et al.* (2000). Based on FAO (1994), the national yield of sunflower is 1500 kg ha^{-1}. According to Badar (2002), the average yield of sunflower in Pakistan is 1810 Kg ha^{-1}. The variations in the yield are due to the fact that the average obtained is the average of 14 different genotypes planted under the rainfed conditions. Based on Khan (2001), grain yield is the product of several interrelated factors which are highly susceptible to environment fluctuations. Singh and Labana (1990), revealed that the seed yield was positively correlated with days to maturity.

The weeks to anthesis were positively and significantly correlated with weeks to maturity and yield at 0.01 level and $n = 14$ and weeks to maturity were also significantly correlated with yield at 0.05 level and $n = 14$ (Table 2). Although the relationship between genotypes, weeks to anthesis and weeks to maturity and yield was positive but it was not significant. Based on Khan (2001) complete flowering and maturity had a significant role in enhancing the seed yield. He further reported that seed yield was positively correlated with maturity and flowering. According to Khan *et al.* (1992) yield in sunflower was positively correlated with days to maturity.

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Table 1: Anthesis, maturity and yield of different sunflower genotypes at Pind Gondal

Genotypes	Anthesis (Weeks)	Maturity (Weeks)	Weeks to Anthesis	Weeks to Maturity	Yield (Kg ha^{-1})
Hysun-777	42	48	8	14	888.8
XF-263	41	47	7	13	266.66
Award	42	48	8	14	1131.11
T-562	42	48	8	14	786.66
9706	42	47	8	13	473.33
9707	42	47	8	13	1026.66
9705	43	48	9	14	1711.11
PSF-025	44	50	10	16	733.33
Parsun-1	42	48	8	14	951.11
1435	42	48	8	14	568.88
JH_1 99S	44	49	10	15	977.77
JH_2 99S	44	49	10	15	1466.66
PNSF1	41	47	7	13	488.88
Hysun-33	42	48	8	14	500.00
Means	-	-	8.3751 ± 1.0082	14.0 ± 0.8771	855.0686 ± 401.0977

Sowing of crop was done on 20-08-2000 in the 34th week. The weeks to anthesis have been computed from 34th week till the initiation of anthesis and weeks to maturity from 34th week till the maturity of the crop

Table 2: Correlation in variety, weeks to anthesis, weeks to maturity and yield at Pind Gondal

	Variety	Weeks to anthesis	Weeks to maturity	Yield
Variety	1.000	0.260	0.290	0.002
Weeks to anthesis	0.260	1.000	0.847**	0.620**
Weeks to maturity	0.290	0.847**	1.000	0.469*
Yield	0.002	0.620**	0.469*	1.000

** Correlation is significant at the 0.01 level (1-tailed) * Correlation is significant at the .05 level (1-tailed) (Spearman's rho), n = 14

Based upon the above discussions, it could be concluded that anthesis in sunflower initiated in about 8.3571 ± 1.0082 weeks after sowing and maturity took place in about 14 ± 0.87771 weeks Genotype 9705 gave the highest yield (1711.11kg ha^{-1}) and XF 263 the lowest (266.66 kg ha^{-1}) The average yield was concluded as 855.0686kg ha^{-1} and this yield falls in the range generally recorded from the rainfed sunflower crops. These studies concluded positive and significant correlation in weeks to anthesis, maturity and yield at 0.01 and 0.05 levels at n = 14 and the former two influenced the sunflower grain yield significantly and positively.

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