

AUTOGAMY AND SELF-COMPATIBILITY AS INFLUENCED BY
GENOTYPES AND PLANTING DATE IN SUNFLOWER

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ABSTRACT

About 50 sunflower types including hybrids, open pollinated populations and inbred lines including maintainers and restorers were evaluated for autogamy and self compatibility in summer as well as rainy seasons. The experimental lines were studied for percent seed set under open pollination, bagging and bagging with manual pollination. Across the genotypes and pollination methods achene yield per plant and oil content were significantly higher in summer than in rainy season. Achene yield was highest under open pollination(15.5q) followed by manual pollination with bagging(14.2q) and autogamous pollination (5.2q). The wide difference in seed set observed under bagging with manual pollination and autogamous pollination indicated that pollen is the limiting factor for seed set under autogamous pollination. The autogamy percent was higher in hybrids (57 percent) and certain inbred lines(48 percent) than in open pollinated populations(35 percent).

Achene yield under autogamous pollination had high positive correlation with achene yield under open pollination (0.79**) and manual pollination with bagging(0.81**). Lines with high autogamy and their utilization in the development of self-fertile populations are discussed.

INTRODUCTION

The percent seed set in sunflower(Helianthus annuus L) is one of the major factor in commercial cultivation of this crop. Insect pollinators are necessary in the field for growing open pollinated cultivars as most of the plants are in compatible

(Free and Simpsq, 1964) Sunflower suffered a set back in India during mid 1970's due to poor seed set. However, with the development of hybrid varieties, which are considered to be more self compatible, insect pollinators may be much less important(Fick and Rehder, 1977). So, development of self fertile lines is of primary importance in sunflower which necessitates screening of lines for fertility and utilize them to breed for high self fertile varieties or inbred lines. However, there are few data that describe the situation in quantitative terms.

The objectives of this study was primarily to evaluate large number of sunflower lines including hybrids, open pollinated varieties, inbreds restorers and maintainers for self fertility, autogamy and seed yield over seasons. Environmental influence on self compatibility has been reported(Vranceanu et. al 1978; Fernandez - Martinez and Knowles. 1978); secondly to differentiate between autogamous pollination and self fertility among genotypes and finally to study the relationship between autogamous pollination, self fertility and open pollination.

MATERIAL AND METHODS

Thirty five genotypes consisting of important hybrids, inbred lines, open pollinated varieties, maintainer and restorer lines of sunflower were selected for this study(Table-1b). The experiment was conducted both during kharif(Rainy season) of 1988 and summer of 1989. A split plot design with three replications was used. Main plot were genotypes with sub-plots being bagging using cloth bags(Autogamy), manual self pollination(heads were rubbed through the bag each

morning by hand) and open pollination(no bagging). All the treatments were applied to a single row of 4.5m. Each plant was spaced at 30 cm in a row with a row to row spacing of 60 cm. Standard cultural practices including irrigation were applied to each planting as needed during the growing season.

The percentage seed set and achene yield/plant for each treatment was determined from the mean of 5 random heads. The percentage of seed set was determined by counting filled and unfilled achenes in each of the selected heads.

Autogamous self pollination(George et al 1980) and self compatibility(self fertility) percentages were determined as follows.

$$\text{Autogamy} = \frac{\% \text{ seed set under autogamous pollination}}{\% \text{ seed set under open pollination}} \times 100$$

$$\text{Self fertility} = \frac{\% \text{ seed set under manual self pollination}}{\% \text{ seed set under open pollination}} \times 100$$

Oil content was determined with the help of 20 pi Minispec NMR Spectrometer.

STATISTICAL ANALYSIS

The mean of each replications for three treatments were subjected to statistical analysis and the significant differences between genotypes for self fertility(%) and autogamy(%) were tested. Pooled analysis of variance for seed yield was done

on the basis of mean values of each genotypes over the seasons. Correlation coefficients between seed yield under autogamous pollination, seed yield under manual pollination and seed under open pollination were calculated for the kharif as well as summer season.

RESULTS AND DISCUSSION

The analysis of variance carried out in both the seasons revealed highly significant effects for genotypes and bagging treatments autogamy and self fertility (Table-1a & 1b). A wide range of autogamy percentage was observed from 54.45%(MSFH-8) to 15.49%(No.18) in kharif while from 66.54%(MSFH-17) to 39.2%(EC-68414) in summer. Similarly self fertility ranged from 113.94% to 82.55% in kharif and from 101.60% to 95.67% in summer (Table-1a & 1b). The autogamy and self fertility percent of genotypes during kharif season was compared to summer season. In general, hybrids showed highest autogamy in both the seasons such environmental influence on seed set has been reported earlier (Seetharam, 1980).

The results also revealed some interesting results. The genotypes which had low percent of seed set and low autogamy percentage recorded higher percentage of seed set and self fertility under manual pollination. It implies that a genotype which is incompatible will exhibit higher self compatibility when pollen is made available by way of manual pollination. In some genotypes (EC-68414, EC-68415, CGP-13, 207B, 338B) the seed set under manual pollination was more than obtained

under open pollination. The seed set under exposed heads is mainly determined by insect pollinators, particularly honey bees. George and Shein(1980) reported variable seed set and bee attractiveness among hybrids. Hence under marginal bee levels, an attractive hybrid may out yield a less attractive type even though self compatibility and autogamous levels are same, whereas in manual pollination all the floret receive pollen for fertilization. Hence, in commercial plantings where bee populations are limited, the cultivars that are both self compatible and highly self pollinating are essential(George et al, 1980).

A perusal of the data on seed yield obtained over different pollination methods for the genotypes studied revealed significant differences in yield levels both in kharif and summer. In general, the genotypes recorded higher seed yield in summer as compared to monsoon.(Table-2b). Townsend(1965) and Vranceanu et al(1979) reported the influence of season on seed yield. This may be due to higher relative humidity, lower temperature, low bright sunshine hours, rainy days adversely affecting the seed yield. In contrast, crop raised in summer season under irrigated conditions had favourable conditions. In general the mean seed yield recorded in open pollination was superior followed by manual pollination(Table-2a). It is also evident that oil content is affected by environment as majority of the genotypes recorded higher oil content in summer season as compared to monsoon season.

The relationship between seed yield under autogamy, manual pollination and open pollination are presented in Table-3. Correlation between autogamous pollination, open pollination and manual pollination are highly significant. These results indicate that the lines producing higher seed

Table-2a: Mean values of pollination methods across the seasons and genotypes for seed yield

Pollination method	Mean values
Open pollination	15.48
Manual pollination	14.24
Autogamous pollination	5.19
Mean	11.63
S.Em ₊ =	0.13
C.D.5% =	0.37
C.V.% =	10.32

Table-2b: Mean values of seasons across the genotypes and pollination methods for seed yield

Seasons	Mean values
Rainy	10.62
Summer	12.65
S.Em ₊ =	0.11
C.D.5% =	0.31
C.V.% =	10.32

yield under autogamy also give higher yield under open pollination. Hence such lines could be used for future breeding work. In the present study apart from many inbred lines, restorer lines, four open pollinated varieties (EC-68415, No.430, 87R 1206/1 and 1105-4 x WG) were identified for high self fertility which could be used for isolating inbred lines with improved self fertility.

Table-3: Phenotypic correlation coefficients for three characters of sunflower for 'rainy' season

Character	X2	X3
X1	0.7944**	0.8143**
X2		0.9748**

** Significant at 1% level

X1 =Seed yield under autogamous pollination.

X2 =Seed yield under open pollination

X3 =Seed yield under Manual pollination

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