INFLUENCE OF DIVERSE CYTOPLASMIC MALE STERILE SOURCES ON YIELD AND YIELD COMPONENTS IN SUNFLOWER.

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Summary:

The first cytoplasmic male sterility source PET1 was originated from a cross between *Helianthus petiolaris* Nutt. and cultivated sunflower, and is being extensively used for commercial production in all the sunflower growing countries. This cytoplasmic uniformity or narrow genetic base represents a potential risk and high degree of genetic vulnerability in hybrid sunflower which was evident in case of maize. In order to overcome the probable occurrence of problems, diversified cytoplasmic sources have been identified in sunflower. Apart from the sterility, the cytoplasmic nuclear interactions are known to influence the stability of CMS and several other qualitative and quantitative characters. In order to study the influence of different alloplasmic male sterile lines on quantitative characters, three alloplasmic male sterile lines of the inbred line 852 were developed. The three different CMS sources used are CMS 852A (*H. petiolaris),* FMS 852A *(H. petiolaris ssp. petiolaris),* IMS 852A (*H. annuus ssp. lenticularis*). These three lines were crossed to three restorers Acc.Nos.1229 ,232 and TUB 365 producing 9 hybrids (3 hybrids in three different sources). These 9 hybrids along with their parents were evaluated during rainy season in the field by following randomized complete block design with three replications. Observations were recorded on seven quantitative characters. The mean values were used to study the effect of different cytoplasmic male sterility sources. The different CMS sources did not significantly influence the traits such as plant height, days to maturity, head diameter, per cent seed set, test weight and seed yield per plant. Thus alloplasmic hybrids were uniform suggesting that the new CMS sources can be commercially exploited like classical source with out any negative effect. However, in case of seed oil content the CMS source from *lenticularis* showed superiority over the classical cytoplasm by producing hybrids with significantly higher oil content. Therefore, these new male sterility sources can replace the classical sources of male sterility with added advantage.

Introduction:

Sunflower being a highly cross pollinated crop is ideally suited for exploitation of heterosis. The discovery of cytoplasmic male sterility (CMS) in sunflower by Leclereq (1969) and subsequent identification of genes for fertility restoration have resulted in the development of commercial hybrids since 1972. However, almost all sunflower hybrids grown have a single source of CMS discovered by Leclereq leading to homogeneity and potential risk. Diversification of CMS sources is inevitable in any hybrid breeding programme. Fortunately in sunflower more than 45 new CMS sources of different origin have been reported (Serieys, 1994) . The diversity of the new sources was assessed mainly based on cytoplasmic male sterility and fertility restoration systems. (Serieys and Vincourt, 1987; Serieys, 1994). Only a few investigators have described interactions between cytoplasms and nuclear genes in the expression of several qualitative and quantitative characters and beneficial cytoplasmic nuclear interactions have been reported in various crops (Jan. 1992). In sunflower , a unique cytoplasmic nuclear interaction caused reduction in chlorophyll, photosynthetic rate and overall reduction in vigour (Jan, 1992). and positive effect on oil content (Serieys, 1992). The objective of this study were to study the effect of cytoplasmic male sterility sources on yield and yield components to exploit them in hybrid development programmes.

Material and methods:

Alloplasmic male sterile line 852A in three different wild cytoplasmic male sterility background viz., *Helianthus annuus* ssp. lenticularis (IMS-852A); *Helianthus petiolaris* ssp petiolaris (FMS- 852A) and classical Leclereq cytoplasm (CMS- 852A) were used as females in this study .These three lines were crossed to three germplasm lines Acc. Nos. 1229, 232, and Tub-365 producing 9 hybrids -three hybrids in each cytoplasmic male sterility sources. These 9 hybrids and their parents were grown during rainy season in the field following randomized complete block design with three replications. Each entry was grown in a row length of 4.5 m/replication with a spacing of 6o x 30 cm. Along the border 3 rows of Morden was grown and on both the sides of the experiment a large segregating population of

sunflower was grown to provide sufficient quantity of pollen for male sterile hybrids, if any. Hand pollination during flowering was also carried out to ensure complete seed set in the hybrids . Five plants per replication were randomly chosen to record observations on eight quantitative characters .The mean values of different hybrids were compared to assess the influence of cytoplasm on selected characters.

Results and Discussion:

The mean performance of hybrids in three different cytoplasmic backgrounds are presented in Table-1 .The hybrids with IMS were taller and late maturing than the hybrids with FMS and CMS background. However, the differences were not high enough to be significant suggesting that different cytoplasms studied did not have significant influence on plant height and maturity. Serieys (1992) observed that some CMS sources produced taller hybrids with late maturity compared to Leclereq's source .In general hybrid based on new male sterile sources had delayed flowering and maturity, while the hybrids based on classical cytoplasm showed marginally superior seed yield per plant, head size and percentage of seed set. But the differences were not high and significant suggesting that there is no significant nuclear cytoplasm interaction for plant height, days to maturity, head diameter, percentage seed set, test weight and seed yield per plant such uniformity between different alloplasmic hybrids in sunflower was reported earlier (Serieys., 1992, Christov, 1992).

The hybrids developed based on new CMS sources (FMS and IMS) recorded significantly higher oil content compared to corresponding hybrids based on classical source. Similarly, Serieys (1992) showed that a new source EXT 1 acted positively on oil content.

These results revealed that the hybrid developed using two new CMS sources are similar to hybrids having classical *petiolaris* cytoplasm with respect to many quantitative traits with added advantage of higher oil content. Therefore, these new sources can replace the classical source if more number of restorers are identified . However, the new cytoplasmic sources identified are to be tested over different environments and seasons to asses their stability as sunflower is grown in wide range agroclimatic conditions in India.

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Table-1. Mean performance of hybrids in different cytoplasmic male sterility back ground.

CMS source	Plant height	Days to 50% flowering	Maturity	Head diameter	% seed set	100 seed weight	Yield (g/plant)	Oil content (%)
IMS (lenticularis)	156.97	62.11	87.66	10.33	76.34	2.85	13.07	34.60
FMS (petioloris)	149.95	61.55	87.66	10.77	79.38	2.99	13.80	34.15
CMS (Classical)	145.51	60.33	85.55	10.99	79.47	2.78	14.74	32.29.

Table -2. Performance of hybrids based on three alloplasmic lines for oil content in sunflower.

Background					
Cross	CMS	FMS	IMS	IMS-CMS	FMS-CMS
852A x 1229	31.54	34.74	33.86	2.32*	3.20*
852A x Tub365	31.16	31.40	34.23	3.07*	0.24
852A x232	34.16	36.32	35.72	1.56	2.16*
Mean	32.29	34.15	34.60		

* = Significant at 0.05 level.