Method of Conversion Synthetic Maintainer Lines Into CMS Lines in Sunflower

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Abstract

A new method of developing sunflower cytoplasmic male sterile (CMS) line was reported in this paper. A F_1 hybrid on the basis of CMS line was used as germplasm source to develop B-line and as CMS source to develop CMS line. Fist of all, three-way hybrids were obtained by crossing the hybrid with a maintainer, and then selfing selection was made to get recurrent parent plants which was backcrossed with CMS plants segregating from corresponding F_2, untill the progeny was generally similar to the recurrent parent except that it was male sterile. This method can be used to develop new CMS lines, it provided a new way to use the hybrids as germplasms. It can be used to increase seed set, oil content, and resistance to diseases of the breeding materials.

Key-Words: Sunflower, Hybrid, Selection, CMS line

Introduction

A F_1 sunflower hybrid can be used as germplasm to select restorer lines by selfing, but not to develop cms line. Most of registered hyrids are with good agronomic characters, resistance to diseases, high yield and oil content. Therefore, the hybrids are valuable for selecting inbred lines and cms lines.

The aim of this study was to use F_1 hybrids as germplasm for synthesizingnew maintainer line (B-line) and converting it into cms line (A-line). This breeding program will be of great help for the future development cms lines aiming at increasing seed set, oil content and resistance to diseases in China.

Materials and methods

1. Materials:
F_1 hybrids on the basis of CMS introduction from France, U.S.A. and Yugoslavia and local B-type.

2. Methods design:
2.1. Method of synthesizing B-lines was that crossed B-type as a mother and the F_1 hybrid as a father to obtain three-way hybrid which the genotype were 1/2 B-type and 1/2 half restoring type. And then selfing selection was made to get recurrent parent plants(maintainable type). The plants with restorer genes were discarded by backcrossing(see fig. 1).

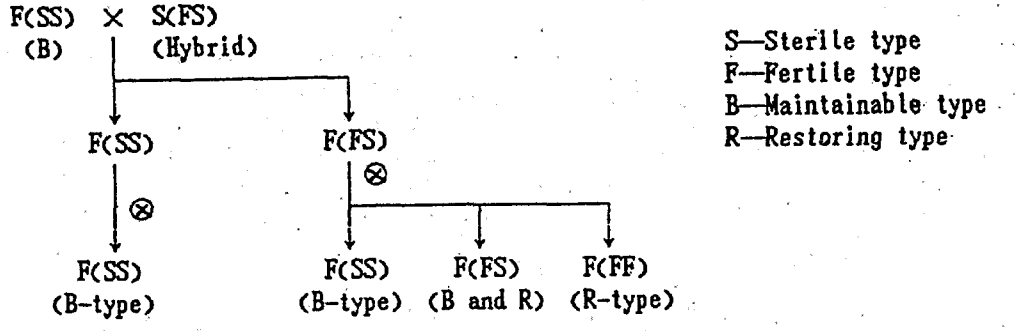

Figure 1. The mode of method of synthesizing B-lines.

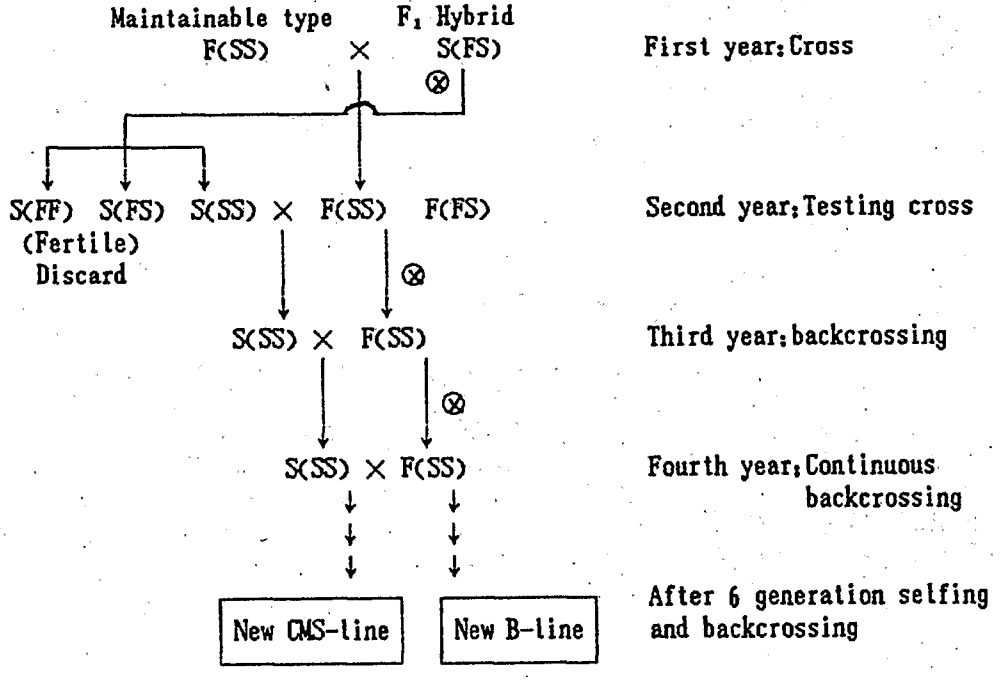

Figure 2. Method of conversion synthesizing B-line into CMS-line

2.2. Method of conversion into CMS type (see fig. 2).

2.2.1. Cross (first year): B-type as a mother and the F_1 hybrid as a father was crossed to obtain three-way hybrid. At the same time, the father (F_1 hybrid) was selfed.

2.2.2. Testing cross (second year): CMS plant segregating from corresponding F_2 as a mother, the three-way hybrid harvested from last year as a father (afterwards as recurrent parent) was made testing cross for testing Maintainable bility of the recurrent parent and keeping CMS of the F_1 hybid. The father plant was selfed. A pair of the mother and father was harvested for next year sowing.

2.2.3. Selfing and backcrossing (third year): the pairs of matierials obtained from last year were sown. At flowering time, CMS-families with 100% sterile plants and B-families with good agronomic characters, without branching plants were selected for backcrossing. The pairs of materials were harvested for next year sowing. the materials were measured oil content in seed.

2.2.4. Continuous backcrossing (fourth year): The pairs of materials harvested from last year were sown. The pairs of CMS- and B-family were continuous backcrossing from this year untill the progeny was generally similar to the recurrent parent except that it was male sterile. GCA, resistance to diseases, oil content and seed set were determined from this year.

Results and conclusion

25 CMS-lines with good agronomic characters have been developed by this method. Some of them showed in table 1. These results indicated that seed set (%), percentage of kernel (%) and oil content in seed (%) of developed new CMS lines were better than the check 74102A(parents of Baikuiza No.1 and 3).

Table 1. The characters of developed new CMS-lines compared with 74102A

CMS-lines	No. of leaves	Head diam.	No. of seeds per head	seed set (%)	100-seed weight(g)	Per. of kernel(%)	oil content in seed(%)
H-02A	33.2	20.5	1665	75.03	4.13	73.37	38.71
H-05A	27.1	18.5	696	71.08	4.00	75.00	36.46
H-10A	28.8	15.4	888	61.91	3.80	76.50	37.90
H-11A	33.5	18.5	732	47.53	3.23	74.30	37.92
H-16A	32.6	15.6	738	71.74	4.00	81.51	39.35
H-17A	28.0	17.2	703	56.91	4.10	79.36	38.31
H-18A	27.2	16.7	817	79.83	5.30	73.43	38.77
H-19A	33.9	19.9	855	74.79	5.10	79.02	37.95
H-20A	35.7	22.5	948	71.49	6.30	77.24	41.03
74102A	26.0	18.8	598	45.54	5.83	70.32	31.66

The results obtained indicate that F_2 generation of the hybrid should be sown enough plants (at least 60 plants) to select CMS-plants without branching for test cross. CMS-families with 100% sterile plants should be selected for backcrossing at first time backcross. General combining ability should be made at early generation (BC_3) when a large amount of materials are included in selection that is useful, because the materials with low combining ability can be discarded at early generation.

This method have provided a new way to use the F_1 hybrids as germplasms to develop new CMS lines for increasing seed set, oil content, and resistance to diseases of the breeding materials.