Seed Production of Hybrid Summer Rape : A Preliminary Study in Finland

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Abstract

The production of hybrid summer rape *(Brassica napus L.)* var. CS010 was carried out with three different A-line/R-line ratios (1:1, 1 1/2:1 and 2:1). The efficiency of pollination was increased with honeybees and with a nylon gauze. Increasing the row width of the A-line decreased its seed yield. At the same time, the seed yields in proportion to the total area used to the production increased. Pollination with the nylon gauze was found easy to organize although growing circumstances in the southern Finland offer good pollination conditions without the gauze.

Introduction

In an attempt to improve seed yield in summer rape *(Brassica napus L.)*, the development of hybrid varieties has played a central role recently. In many studies, summer rape hybrids have produced higher seed yields comparing to their parental lines or the conventional varieties (SERNYK and STEFANSSON 1983, BRANDLE and McVETTY 1989, VAN DEYNZE et. al., 1992). In order to make hybrid varieties widely accepted by the farmers, more knowledge and experience on practical hybrid seed production is needed.

Because we did not have any former experiences on hybrid seed production in Finland, we gathered information from Canada and France, where the hybrid studies have been going on for several years. Experiences from Canada can be adapted to Finnish conditions, because Canadian summer rape growing conditions have similarities to ours.

The preliminary study was established in 1992 at the experimental station of Mildola Oy near Porvoo in southern Finland. The study was continued later in a greenhouse at the department of crop husbandry (University of Helsinki). The primary purpose of the field test was to get more information about the pollination capability of the R-line to the seed parent A-line in our field conditions. The hybridity of the produced seed was estimated using a greenhouse growout of the seed sample from the F1-hybrid.

Materials and methods

The hybrid variety CS 010 used in field test is based on CMS-technology, where the pol-cytoplasm induces male sterility of the seed producing A-line. Production of hybrid seed was carried out by growing alternating rows of male sterile A-line and male fertile R-line. The A-line row had three widths : 4, 6 and 8 meters. In the middle of each A-line row was a 4 meter wide R-line row. Half of it was sown at the same time with the A-line and the other half one week later. The A-line/R-line ratio had therefore three values ; 1:1, 11/2:1 and 2:1. The efficiency of pollination of the A-line was increased with one hive of honeybees, which was moved to the seed block immediately after the beginning of flowering. A plenty of natural pollinators, mainly bomble bees, existed in that area as well. Half of the test block was also pollinated with a nylon gauze. The gauze was moved slowly crosswise over the rows in order to transfer pollen. The other half of the block acted as a control.

Seed yield of the A-line, number of pods in the main and side racemes and number of seeds in the pods were calculated to describe the efficiency of the pollination of the A-line. During the flowering season, the flowering rhythm of the parent lines was also observed. Later the F1-seed from each A-line row was grown in a greenhouse as a growout. At flowering, the number of plants bearing sterile and fertile flowers were determined. Plants bearing fertile flowers were considered hybrids.

Results and Discussion

The pollination of the A-line succeeded well in the field test. Compared to the control, rows pollinated with the gauze had better seed set, side racemes had more pods and the pods had more seeds. On the other hand, main racemes produced fewer pods.

Because increasing the efficiency of pollination with the gauze is easy to organize, it brings an alternative to the pollination problems in the areas with few pollinating insects or where the beehives are expensive to hire. Growing circumstances in the southern Finland offer however good pollination conditions without the gauze.

Increasing the row width of A-line slightly decreased the seed yield and the number of seeds in the pods. Seed yields in proportion to the total area used to the seed production increased clearly (Table 1). To find an optimal A-line/R-line ratio a further study is needed. Results given from the field test show that in our conditions parental ratio could be over 2:1.

The average percent hybridity of the seed lot produced was high : 85,4%. Exceptionally warm weather before the flowering season could induce some partial male fertility reversion of male sterile pol A-lines. According to FAN and STEFANSOON (1986), high temperature (in excess of 30°C) must be operative on buds at stage before archesporaial differentiation to promote normal development of the stamens.

The flowering period was about the same for both A-line and R-line sown at the same time. R-line started its flowering slightly before A-line and finished it shortly after the A-line. Flowering of the one week later sown part of the R-line was delayed noticeable comapring to the A-line. Therefore producing of the F1-hybrid CS 010, the flowering rhythm of the parent lines matches well and no reasons to delayed sowing of the R-line was found.

In the summary, one obvious conclusion can be drawn from this study : we have good possibilities to produce hybrid summer rape seed based on the pol CMS-system and the natural pollinators are available during the flowering period in Finland.

Table 1. Seed yields of A-line (kg/ha), percent hybridity, hybrid seed yield (kg/ha) and hybrid seed yield in proportion to the total area used to the seed production (kg/ha)

A-line/ R-line ratio	Seed yield kg/ha	Percent hybridi-ty	Hybrid seed yield kg/ha	Hybrid seed yield in pro. to tot. area kg/ha
1:1	2755	86,8 %	2391	1196
1½:1	2559	85,9 %	2198	1319
2:1	2634	83,6 %	2202	1468
Average	2642	85,4 %	2256	

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