UNTRADITIONAL METHODS OF YIELD INCREASES IN WINTER AND SUMMER RAPE

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Increases in wheat yields do not correspond to those of rape in ČSSR, even by using the seed yield increases in winter rape of the past fifteen years. The rapid progress in rape-seed quality improvement (modification to the nutritional or industrial suitability of oil and meal) has to be incorporated into higher yields. Yield factors should be given a higher priority. The rapid progress in rape-seed quality should be accompanied by new views toward the ideal rape plants for cultivation and obtaining higher yields.

Use of traditional plant types and present-day growing methods are insufficient for a needed seed yield increases. The new methods in cultivation such as growth retardants, short stem plants growing, intergeneric hybrids, were not found to have major effect on winter and summer rape productivity and could not compensate the winterkills associated with insufficient plant density (ASLAM, BECHYNE 1982, BECHYNE 1982, BECHYNE 1983).

The objective of this study was to evaluate the effect of new untraditional methods in cultivation -

inseeding of very early summer rape seed into winter rape stands with low density of plants and cultivation of summer turnip rape with four valved pods for yield increases.

MATERIALS AND METHODS

Jet Neuf cultivar and two new experimental lines - 185 and 227 - developed at the Plant Science Department, University of Agriculture in Prague, were grown in three years (1980 - 82) experiments at the University experimental station near Prague in a sugar beet growing region with fertile brown soils. The line 185 is a very early summer rape (Brassica vapus L.), 227 is yellow seeded four valved summer turnip rape (Brassica campestris L. ssp. sarson Prain) with increased number of seeds per pod.

The plants were grown in a randomized complete block design with 5 x 3 m plots, four times replications. The spacing was 25 cm in winter rape and 15x5-8 cm in summer types with 8 $kg.ha^{-1}$ seeding rates. Jet Neuf was sown on 25-30 August, the summer lines were sown at the end of March. The plots were cultivated according to usual experimental rules.

The growth stage key for observation of plant growth and development was the Campbell and Kondra´s modification of that proposed by Harper and Berkenkamp (CAMPBELL, KONDRA 1977).

The plants for postharvest analysis were chosen at random, 25 plants from each plot avoiding plants at the end of rows.

Plant height for each plot was taken at the time of maturity of the first pod on the main raceme. Plant density was determined just prior to harvesting of the plots on 1 m^2 of plot area. Number of main and other branches and number of pods was determined after harvest on 25 plants. Number of seeds per pod was determined by sampling 500 fertile pods from each plot at late pod fill. Seed yields were obtained by cutting the plots at 5.4 stage (maturity) allowing the plants to dry in cotton bags before threashing.

Analysis of variance were conducted on the plant characteristics.

RESULTS AND DISCUSSION

I. Comparison of growth, development and economic characteristics of very early summer rape and winter rape.

At the time of seeding of the line 185 the Jet Neuf cultivar reached the rosette stage (2.7) and was in 5-6 stage of growing point organogenesis. However at stage 3.0 (emergence of the terminal bud) the difference between the winter and summer type was 9-12 days and at the stage 4.13 (first flower on the secondary raceme) 6-8 days only. The difference was decreasing to 5 days at the stage 5.0 and 2-3 days at 5.4 (maturity).

Jet Neuf which was significantly higher in single yield components gave higher total yield (Table 1.).

All the characteristics between the two different types of rape are shown in Table 1 , were significantly different (LSD at the 5 % level). Regardless of this, the yield components of the very early summer rape are hight enough for obtaining sufficient yields and are suitable for increasing the scanty winter rape stands.

Table 1. Characteristic of yield components

Character	185	Jet Neuf
Plant density	122,6	67,0
No. of primary branches	3,78	5,93
No. of fertile pods per plant	92,5	146,1
No. of seeds per pod	10,9	14,9
No. of seeds per plant	978,5	2086,0
1000 - seed weight	3,8	4,6
Total yield ($t.ha^{-1}$)	2,36	2,94

The initial slow development of very early summer rape creates significant differences in the first stages, but later the differences slow down and minimize.

The maturation of winter rape is much slower and the stage of maturity is longer due to the higher number of pods per plant. This results to approximately the same time of technical maturity and harvesting.

II. Practical advantages in increasing seed yields by the use of four valved summer turnip rape.

227 plants with increased number of seeds per pod produced three row pods in 21,4 % and two rows ones in 4,9 % of the total counted pods. The rest of the pods were found to produce four valved pods. (The number of rows in a pod is under control of a single gene, but also an expression of recessive gen may be interrupted by some factors other than genetic, resulting in appe-

arance of 3 and 2 row pods on an otherwise 4-row plant.) (ASLAM, BECHYNE 1983)

There was a significant different vegetation period duration between 227 and Candle 227 was 6 days earlier.

The differences in vegetative and economic characteristics are shown in Table 2.

Table 2. Biological and economic characteristic of plants.

Character	Candle	227
Plant density	173,5	181,3
Plant height	86,1	72,5
Stem thickness (mm)	8,4	7,9
No. of primary branches	4,62	3,69
No. of fertile pods per plant	98,0	53,9
No. of seeds per pod	12,1	26,8
Seed weight per plant (g)	3,8	5,1
1000 - seed weight	3,4	4,1
Total yield ($t.ha^{-1}$)	2,60	3,37
Lodging (9 - 1)	7	5

The differences between Candle and 227 were found significant excluding plant density and stem thickness. Resistance against lodging was not calculated.

The higher production of seeds in 227 was due to increased number of seeds per pod and higher seed weight, even if there exists a substantial compensation among various yield components. Number of seeds per pod and seed size are much less influenced by environment than the number of pods and yield per plant (OLSSON 1960).

These two characteristics had strong influence upon the seed yield than the number of pods which has according to the cited author, by far the greatest influence upon the seed yield in Brassica. Significantly higher total seed yield per hectare indicates that the compensation in yield components can be overcome by genetically influenced characteristics, such as four valved pods with remarkable increased number of seeds with higher seed weights.

The results in the present study indicate positive effects of 227 upon seed yield and do not fully support the statement of SINGH, 1958, "that some strains with three or four pods appear to have no practical advantage in increasing seed yields". However the strains need some improving in seed quality and lodging resistance.

REFERENCES

ASLAM, M. Y., BECHYNE, M. 1982. Some observations on the interspecific hybridization within oilseed Brassicas. Sb. VŠZ Prague - Suchdol, A, 36: 169 - 177.

ASLAM, M. Y. and BECHYNE, M. 1983. In print.

BECHYNE, M. 1982. The response of spring oilseed crops upon CCC treatment. Sb. VŠZ, Prague, A, 36: 179 - 195.

BECHYNE, M. 1983. Use of some growth inhibitors in spring oilseed Brassicas. Proc. conf. growth. regulators in agriculture. VŠZ Prague, I.: 115 - 127.

CAMPBELL, D. C. and KONDRA, Z. P. 1977. Growth pattern analysis of three rapeseed cultivars. Can. J. Plant. Sci. 57: 707 - 712.

OLSSON, G. 1960. Some relations between number of seeds per pod, seed size and oil content and the effects of selection for these characters in Brassica and Sinapis. Hereditas 46: 29 - 70.

SINGH, D. 1958. Rape and mustard. Hyderabad, Indian Central Oilseeds Committee 105 p.