Characteristic of semi-dwarf mutants in rapeseed (*Brassica napus* L.)

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Abstract

The objective of present research was to study of morphological and physiological traits (photosynthetic and transpiration rate). Additionally tocopherols content was analysed of mutant lines (4 forms). Plant height of initial line DH-0120 ranges from 120,5 to 130,0 cm with averaged 125,5 cm. Mean plant height of mutant lines ranging from 93,0 to 110,0 cm. The remaining analyzed traits (number of branches, length of silique, number of seeds per silique and 1000 seed weight) were found to have a reduced variation range, particularly response to length of silique and 1000 seed weight. The photosynthetic rate of mutant lines was increased by 7,7 – 22,7 μmol-2s-1 in different stage on the beginning of flowering as compared to initial line DH-0120. There was found to any variability of transpiration rate of studied lines. The tocopherol content were in the range 484 – 394 mg/g^{-1} seeds in mutant lines as compared to the initial line 342,0 mg/g^{-1} seeds.

Key words: Rapeseed, mutation, selection, tocopherols, photosynthetic rate, yield components

Introduction

The improvement of rapeseed by introducing semi-dwarf genes is one of the main strategies use by oil seed breeders not only for lodging resistance but also for increased yield ability. Reduced plant height is an important traits in breeding programmes oilseed raps because cultivars with reduced plant height may be beneficial in limiting wind damage and lodging in the early silique development stage. Artificial mutagenesis techniques are required to induce new sources dwarf genes in oilseed rape. Clearly, for most of the induced mutants, have a plejotrofic effect on the traits. For breeding commercial programme increase of tocopherols content are the main goal of functional food. This compound are essential components of human and animal diets, therefore collectively know as vitamin E (Kamal-Eldin et al. 1996) tocopherols are an interesting aim for improvement of rapeseed oil quality for example by mutagenesis. Photosynthetic rate may be is connected with syntheses of tocopherols. For this reason in presented a paper was to study of photosynthesis.

Material and Methods

Initial breeding lines (DH-0120) and mutant lines obtained after treatment with chemical mutagens were evaluated for morphological traits yield components. All plants were isolated for self pollination and harvested at maturity. A short time before harvest following traits were measure: plant height, number of branches, length of silique, number of seeds per silique and 1000 seed weight.

Photosynthetic rate and transpiration rate were determined at 10, 20 and 30 days after post-flowering. This two parameters were measured in the uppermost three leaves with a portal photosynthesis syste (Licor 6200 Nebraska) at light saturating between 11.00 – 12.00 hr. Tocopherols content were determined by HPLC method (Nogala-Kałucka 2005).

Results and Discussion

The results of this experiment showed the widely variability of morphological and yield components of mutant lines (Table 1) was decrease as compared to initial line (DH-0120), particularly in plant height and length of silique. Similar variability of semi-dwarf mutant forms was observed by Turfing (1974) and Wang et al. (2004). As appeared form (Fig. 1) all mutant lines showed increased photosynthetic rate in the stage after flowering, as comparising to initial line (DH-0120). Probable it will be close connected with synthesis of tocopherols in leaves as is showed in Table 2. Additionaly it was found no difference in transpiration rate in analysed mutant lines. Selected breeding lines has been used in improved breeding programme of rapeseed in Poland.

Analysed mutant lines showed increased content of tocopherols (Table 2) as compared to initial line. A great variability of tocopherol content was presented by different authors (Goffman et. al. 2002; Marwende 2003; Marwende et. al. 2003).

Similar increased tocopherols content was found also by Olejniczak et al. (2000) in mutant lines of rapeseed.

Conclusions

As appeared from presented results mutagenesis is useful tools to improvement and increase variability of rapeseed.

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Table 1. Variability of agronomic traits of winter oilseed rape mutant lines

Forms	Plant height [cm]		No. of branches		Length of silique [cm]		No. of seeds per silique		1000 seed weight [g]	
	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$
DH-0120	120,5-130,0	125,5	4-6	4,9	8,8-10,4	9,6	17,8-24,0	23	23,4-4,9	4,2
SD-1	93,0-110	102,3	3-4	3,8	7,8-8,2	7,8	19,4-21,3	20,1	3,0-3,5	3,2
SD-2	95,1-115,2	101,9	3-5	3,7	7,7-8,6	7,9	18,1-20,3	19,3	3,5-4,0	3,7
SD-3	5,0-116,2	102,1	4-5	4,4	7,8-9,2	8,4	17,2-19,6	18,4	4,1-4,6	4,3
SD-4	102,0-110,0	103,1	4-6	4,6	8,6-9,4	8,8	18,4-21,0	19,1	3,4-3,8	3,6

Table 2. Tocopherols content in seeds of initial form and mutant line in winter rapeseed

Forms	Tocopherol content [mg/g^{-1}]
DH-0120	342,0
SD-1	394,0
SD-2	402,0
SD-3	450,0
SD-4	480,4

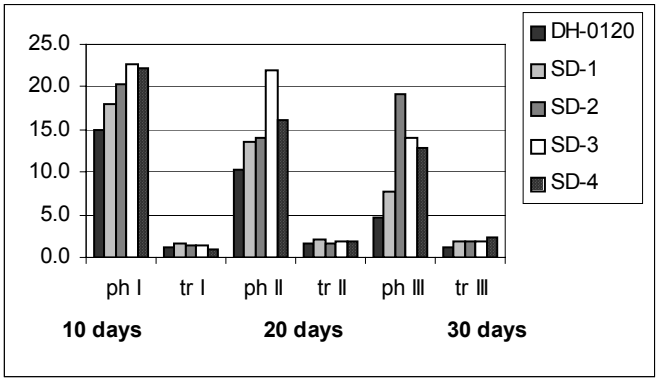

Fig. 1. Photosynthetic rate and transpiration rate in initial line DH-0120 and mutant lines in different stage after flowering rapeseed plants [μM m-2s-1]