Influence of growing intensity and variety on production markers and winter rapeseed quality (*Brassica napus* L. var. *napus*)

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Abstract

In Czech Republic the share of winter rapeseed crop cultivation is approximately 10 –11% of total acreage arable land. In practical cultivation is about 45 varieties of winter rapeseed. The restored hybrid varieties occupy 15 – 20% and the composite hybrids have a little share - about 3 –5%.acreage total of rapeseed.

The rapeseed cultivate approximately from 170 to 750 m above sea - level, on soils with content mould 1 – 1,5% as well 2,0 – 2,5%, mean annual precipitation 450 –500 mm and the average annual temperature from 7 – 8^0C to 9 – 12^0 C. The rapeseed cultivate always with herbicide and insecticide. In standard intensity of cultivation give 100 –150 kg N/ ha without fungicides and growth regulators. In a higher intensity of inputs applicates 190 - 220 kg N/ha with fungicide, regulators, stimulators and leaf fertilizers. Therefore the yields fluctuate general from 2,0 to 5,0 t/ha.

In trials on 8 localities in 2002/03, 2003/04, 2004/05 years observed reaction of winter rapeseed varieties at two different intensities of cultivation: the standard and the higher intensity of cultivation in relation with production and economy. The results show only about 3 – 4% difference in seed yields among hybrid and line varieties of rapeseed. Some line variety always occurred which overcame average hybrids in seed yields.

The standard intensity of cultivation showed average seed yields 3,72t/ha, the higher intensity 4,13t/ha (113%) during three years. In the successful rapeseed years the yield differences among intensities were low, but in critical years the differences increased. Therefore, the returns of the invested investments into the intensive technology need not be economically positive. The higher intensity of cultivation had about 10% more branches/m, about 7% more pods on terminal, 17% lower of dried up buds and oil content in seed was lower. Dry, warm years and localities had marked lower oil content.

Key words: winter rapeseed, growing technologies, hybrid, line, yield, quality

The aim of rapeseed production is profit. The profit depends on productivity of environment, level of inputs and managing of growing technology. Many complex technologies were designed for winter rapeseed. For example in Central and East Europe *Gajdaš et al.* (1998), *Cramer, Krostitz, Schultz, Stoltenberg* (1990), *Budzyński, Ojczyk et al.* (1996), *Vašák et al.* (2000), *Teréz* (2001*), Baranyk, Kazda et al.* (2005), *Walkowski* (2006) and many others. According to *Vašák and Mikšík* (2001) and also other authors, under soil deficiency conditions the method of high intensity - yield increasement is profitable. In higher yield are diluted fixed costs connected with basic running of the enterprise, establishment and harvest of crop.

Intensive rapeseed production is based on yield formation theory. Sturdiness and activity of the root system, long period of intensive assimilation, sufficiency of storage places and economy management with assimilates is required (*Petr et al., 1980).*

Materials and Methods.

The aim of our work is to compare two growing systems:
Standard with usual growing system of the CR
Intensive with many new proceedings
Main differences between growing systems shows Table 1

Experiments at 6-8 localities of the Czech Republic were realized during 2003-2006. There were mostly warm years during this time. Average temperature of the Czech Republic for 235 years of measurement is 9,44°C. However, in 2003 it was 11,16°C, 2004: 10,86°C, 2005: 10,88°C and year 2006 exceeds 10 maybe 11°C. Average year precipitations in dependence on years and localities are about 500-700 mm. Year 2003 had extremely freezing winter and very dry vegetation period. On the contrary year 2004 was quite perfect, with cold nights which reduced dissimilation. In 2005/06 very long winter uncovered soil under snow at the end of March and beginning of April – rapeseed was under permanent snow 90-105 days. But the harvest came in usual term around 26th of July.

Results and Discussion.

Survey of selected results show Tables 2 - 5. It appears, that seeds yield differs between technologies only by 380 kg/ha (about 10,5 %), it covers only about 50 % from extra invested costs.

Increase in seeds yield in Intensive technology results from higher number of branches per 1 m^2 (by 10%), decrease in generative organs fall by 17% and from higher number of pods at terminal (by 7%).

Table 1. Main Differences between Growing Technologies Standard and Intensive.

Proceeding/Growing system	Standard	Intensive
Soil preparation and sowing	Various, also without tillage	Sowing by 24 hours after tillage
Nitrogen dose before sowing (kg/ha)	0	30
Seeding rate (seeds/m^2)	60 hybrids, 80 lines	40-60 (hybrids and lines)
Herbicide	registered	without signs of phytotoxicity (*napropamid+trifluralin*)
Regulation in Autumn	No	Yes (azol + CCC)
Kg/ha of N spring (number of doses)	140-160 (2-3)	180-220 (4)
Foliar fertilizers (boron) and Atonik (phenols)	According to consideration (mostly not used)	Always
Spring regulation	No	Yes (azol, Rexan – aminobenzoic acid)
Insecticides	Stem weevil, Pollen Beetle	Stem weevil, Pollen Beetle
Fungicides	No	Yes
Maturation regulation	According to consideration	Always (desiccant + pinolen)
Harvest term	Standard	About five days after standard

Under the same growing conditions the differences between hybrid and line varieties are only small. It is +1% in Standard technology and up to +3% in Intensive technology. Increasement in yield does not cover increased costs on hybrid seed purchase.

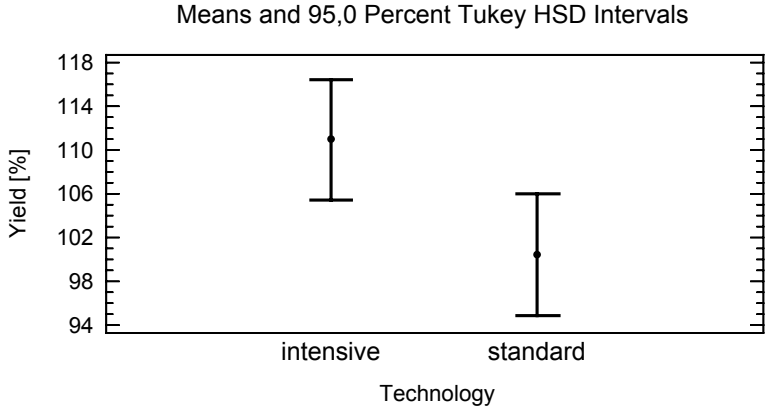
Oil content shows typical results according to many former works (e.g.. *Canvin* 1965, *Zukalová, Vašák, Preiningerová* 1988). The highest values are at cold localities and in lower growing intensity, especially with lower nitrogen doses.

Table 2. Yield of Rapessed by different growing technologies

Year	Intensive (%) *)	Standard (%) *)
2003	125, 105, 152, 165, 91	78, 72, 135, 140, 85
2004	117, 107, 108, 116, 111, 92, 124	114, 101, 84, 112, 104, 68, 117
2005	85, 99, 76, 140, 110	91, 105, 72, 127, 107
2006	113,104,108,103,116,110,99,98	107,94,108,83,123,107,93,85

*) 100% seeds yield = average of standard technology, which was in 2003: 2,55 t/ha, 2004: 4,77 t/ha, 2005: 3,88 t/ha, 2006: 4,13 t/ha

One-Way ANOVA - Yield [%] by Technology

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Multiple Range Tests for Yield [%] by Technology
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Method: 95,0 percent Tukey HSD
Technology    Count    Mean (%)      Homogeneous Groups
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standard      25       100,48          X
intensive     25       110,96          X
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statistically significant difference = 11,13
F-ratio = 3,58; P=0,064
100% seeds yield = average of standard technology, which was in 2003: 2,55 t, 2004: 4,77 t, 2005: 3,88 t, 2006: 4,13 t/ha

Table 3. Evaluation of selected markers during years 2003-2005 in Intensive growing technology.

Marker	Absolute	Relative (%)*
Number of branches (pieces per 1 m^2)	276	110
Number of stalks at terminal (pieces)	3,7	83
Number of pods at terminal (pieces)	43	107

* 100% = Standard growing technology.

Table 4. Averages of seeds yields in % in line and hybrid varieties. Harvest years 2003-2005.

Growing technology/Varieties	Line	Hybrid
Standard	100	101
Intensive	115	118

100% = 3,23 t/ha of seeds.

Table 5. Influence of locality and growing intensity on winter rapeseed oil content. Harvest years 2004 and 2005.

Growing locality	Growing technology	Oil content in dry matter of seed (%)	
lowlands (average of temperatures above 10,5°C)	Standard	44,6	44,2
	Intensive	43,7	
highlands (average of temperatures below 10,5°C)	Standard	46,6	46,5
	Intensive	46,3	

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