

Influence of crop management on winter oilseed rape yield formation - evaluation of first year of experiment

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Abstract: This project aims on the assessment of how appropriate are different ways of sowing rapeseed (*Brassica napus* L. var. *napus*) in the conditions of the Czech Republic. The main focus of this work is to quantify the influence, which has the way of sowing into differently broad lines on the final crop output. The basis of this project is a large half-operational experiment, based in two locations within the company AGRA Řisuty s.r.o. In this experiment we are testing sixteen different variants. There are four different rows spacings (12.5, 25, 35, 45 cm), two sowing rate (30, 40 seedes per m² on variant 12.5 and 25 cm and 20, 30 seedes per m² on variant 35 and 45 cm) and two different hybrid varieties of OSR. The highest yield from both sites was accomplished by DK Exquisite variety in Řisuty locality, 12.5cm row spacing and seeding rate 40 plants per square metre. Contrarily, the lowest yield was recorded by PR44D06 variety in Slabce area, 25 cm row spacing and seeding rate 40 plants per square metre. There was no demonstration of influence yield of rapeseed by changing the row width or changing the seeding rate in the first year of our experiment.

Key-Words: oilseed rape, row spacing, seeding rate, yield, oil content, thousand-seeds-weight

Introduction

Oilseed rape (Rapeseed) is the most grown oilseed crop both in Europe and the Czech Republic. Areas on which oilseed rape is grown are regularly increasing since 80's and currently there are more than 400 thousand hectares grown in the Czech Republic. This marks that we have already reached an upper boarder line of possible spread of this crop. Through maintaining crop rotation rules and proper agricultural practice futher production growth of oilseed rape seeds is possible only by greater yield. There we have still sizable room for improvement measured, for example, by outcomes of our German colleagues. And it is from Germany that the new technology of seeding into wider rows than 12.5 cm standard is being introduced to us.

Although oilseed rape has good compensation capacity, it can be employed only in case of even plant distribution per area [1]. Therefore stand organization and methods of crop establishment may have significant impact on living space of each plant as well as vegetation microclimate thus can greatly influence health, formation of yield components and finally total yield of grown crop. Boelcke et al. [5] even states that seedling

development, winter survival and yield of winter oilseed rape is directly depending on seeding rate and date and method of sowing. This is in agreement with the research of Bagheri et al. [4] who observed notable differences in yield between various (15, 30 and 45 cm) row spacings. On the contrary, in his work, yield was not affected by the distance of plants within the row. Older research of Morrison et al. [3] notes that number of pods per plant is the most affected component forming the yield. Number of pods is decreasing quadratically (squared) with increasing seeding rate. The largest plant height, the greatest dry matter, LAI, seed and straw yield was observed experimentally with lowest harvest index at 30 cm row spacing [6].

More and more of our agricultural businesses establishes their oilseed rape crops by seed drills primarily designed for sugar beets sowing, or by specialized drills of Horsch Focus type. This agronomical decision can seem as a step circa 40 years back when oilseed rape was grown as a root crop. Nevertheless new vigorous hybrid varieties require enough space for their development, which narrow rows cannot provide. In our conditions optimal number of individuals after winter should

be 40 - 60 plants per square metre, lower quantity is recommended for intense technology, circa 30 – 50 plants per square metre [1]. Alpmann [2] however states that lower seeding rate is suitable also in relation with plant habitus. Hybrids have good ability of branching which is positive for yield formation. On the other hand, higher competition among plants plays negative role in development of lateral branches and therefore in number of pods per plant. Too dense stands are more prone to lodging.

Material and Methods

Given that in the agricultural practices of the Czech Republic cases of sowing in rows wider than the traditional 12.5 cm are more common, we decided to check the merits of the agronomic decision in a half-operational experiment. Total number of 16 variants, four different row widths, two hybrid varieties of oilseed rape, each in two diverse seeding rates, were included in this experiment.

Seeding drills Vaderstadt Rapid were used for 12.5 and 25 cm row spacings, Horsch Focus TD for 35 cm row width and for 45 cm Monosem Meka seed drill for oilseed rape with specialized disc was employed. Seeding rate varied from 20 to 40 plants per square metre. Experiment was established on 25th August 2012 on two localities within the company AGRA Řisuty s.r.o. in Slánsko and Slabecko area. This locations are situated in a grain production area with medium soils and the climate in this region is classified as slightly warm dry.

Locations were prepared with minimal tillage of two different stubble depths. Vast drought during last August, made conditions on plots even more difficult because of large quantities of not decomposed crop residues, even though the gap between harvest and liquid nitrogen fertilizer application was more than 14 days.

As it was stated above, two different hybrid varieties of oilseed rape were selected as test variants, vigour hybrid DK Exquisite by Dekalb and semi-dwarf hybrid PR44D06 by Pioneer.

The stands were subsequently treated with identical methods including fertilization and pesticide application according to indication and need of crop, perpendicularly to seeding direction. During the year, vegetation was monitored and samples were collected. Unfortunately Ledce site was hit by hail and we have recorded 15% loss, however the field was affected evenly therefore we have decided to evaluate experiment in spite of the loss. Plots were harvested on 8th and 12th August, circa 14 days after desiccant and sealant application, using modern technique with active dividers on full length of cutter bar. Harvested material of each variant was weighted separately, moisture level was measured and samples for evaluation of thousand-seed weight and oil content were collected. Harvested area was calculated by multiplying frame of the combine and plot length, subsequently yield of each variant was gained.

Diagram 1 Indicative layout of experiment organization



Indicative scheme of the experiment (Plots may be in another order)

Results and Discussion

During the first year of experiment, over 18 tons of oilseed rape seeds were harvested on more than 6 hectares. Average yield of all variants was 2.99 tons per hectare, namely 3.10 tons per hectare in Řisuty locality and 2.88 tons per hectare in Slabece area. The highest yield from both sites was accomplished by DK Exquisite variety in Řisuty locality, 12.5cm

row spacing and seeding rate 40 plants per square metre. Contrarily, the lowest yield was recorded by PR44D06 variety in Slabece area, 25 cm row spacing and seeding rate 40 plants per square metre.

Tables 1 and 2 represent yield outcome of each variant. Last part of tables as well as the following Figure 1 display percentage growth, decrease respectively compared with control, which is always

the corresponding variety on each locality sown traditionally in 12.5 row spacing and seeding rate of 40 plants per square metre.

As it is evident from the results, the first year of experiments proved no significant effect on yield by varying row spacing or seeding rate. Variants with wider rows showed rather yield decrease, usually up to 10 %. Vigorous variety DK Exquisite was less influenced, in Slabce area we have recorded increase of yield by circa 10%, however this was not confirmed on second locality. Half-dwarf variety PR44D06 shown substantial decrease of yield, up to 20 % in some cases, but it displayed certain growth in yield in the widest row spacing, therefore we cannot speak about general decrease.

We haven't recorded any significant effect of row spacing on thousand-seed weight, however it clearly decreased with lower seeding rate in DK Exquisite variety on both localities. In PR44D06 variety thousand-seed weight was stable across all variants

(see Figure 2). Oil content in seeds varied among pots only in units of percent, and it can be said that it was more affected by variety and especially locality than the row spacing or seeding rate variability (see Figure 3).

Conclusion

First year results haven't shown any effect on yield by increasing row width or seedling rate yet, whereas results from each experimental locality are considerably variable. Therefore it is not possible to issue clear recommendation for agricultural practice, which would suggest certain row spacing for the best oilseed rape growth. In general we can say, that the outcome will depend on the chosen variety and specific locality. Thereafter for wider rows can be recommended sowing rather hybrid varieties with vigour growth type, for example DK Exquisite. Currently second year of this trial is established.

Fig. 1 Effect of row spacing and seeding rate on yield of oilseed rape in proportion to control (%)

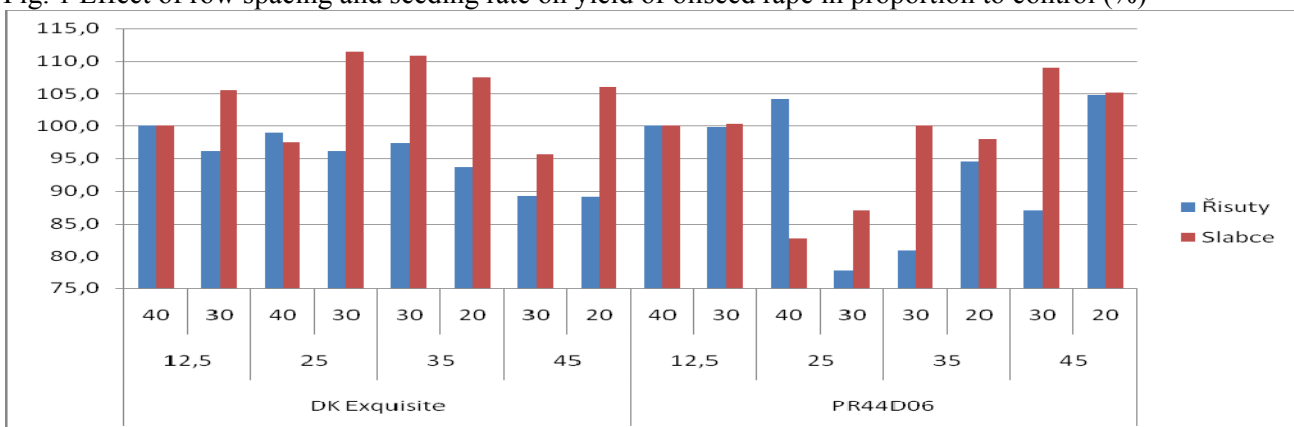


Fig. 2 Effect of row spacing and seeding rate on thousand-seed-weight of harvested oilseed rape (g)

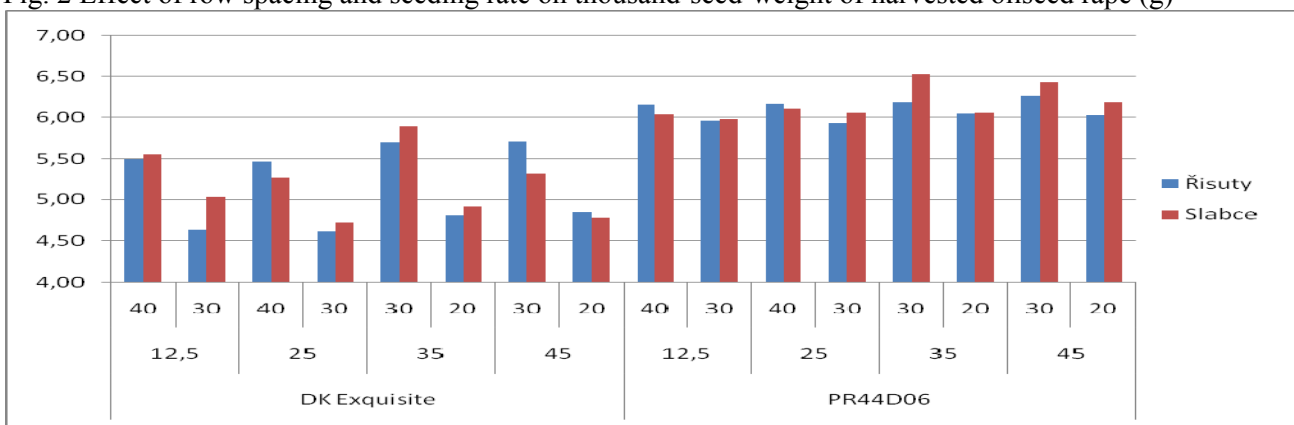


Fig. 3 Effect of row spacing and seeding rate on oil content of harvested oilseed rape (%)

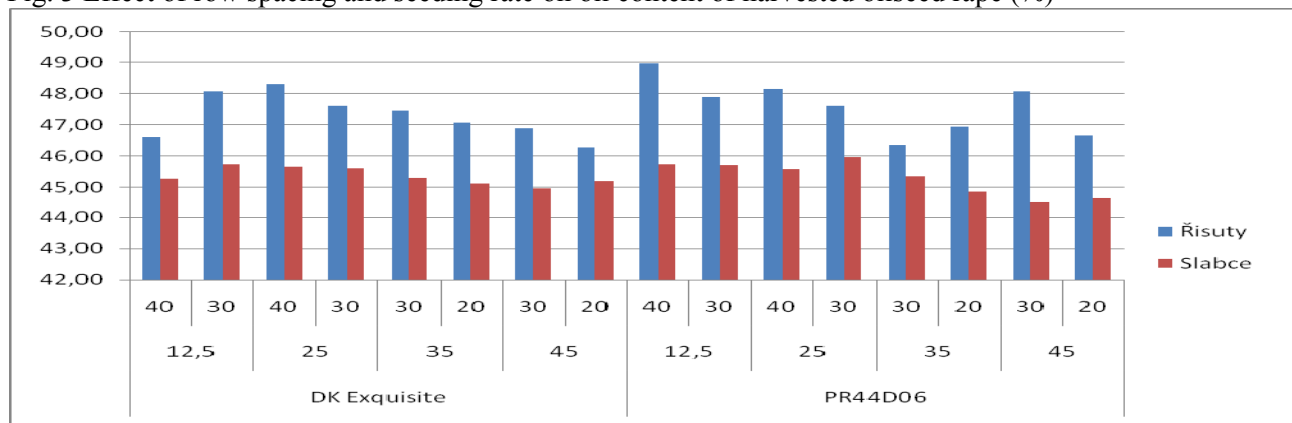


Table 1 Effect of row spacing and seeding rate on yield of oilseed rape, DK Exquisite variety

| <i>Variant</i> | <i>Row spacing (cm)</i> | <i>Seeding rate (plants/m²)</i> | <i>Yield (t/ha moisture 8%)</i> | <i>Yield (%)</i> |
|---------------------|-------------------------|--|---------------------------------|------------------|
| DK Exquisite Řisuty | 12.5 | 40 | 3.37 | 100.00 |
| DK Exquisite Řisuty | 12.5 | 30 | 3.24 | 96.08 |
| DK Exquisite Řisuty | 25 | 40 | 3.33 | 98.98 |
| DK Exquisite Řisuty | 25 | 30 | 3.24 | 96.13 |
| DK Exquisite Řisuty | 35 | 30 | 3.28 | 97.40 |
| DK Exquisite Řisuty | 35 | 20 | 3.16 | 93.65 |
| DK Exquisite Řisuty | 45 | 30 | 3.01 | 89.22 |
| DK Exquisite Řisuty | 45 | 20 | 3.00 | 89.14 |
| DK Exquisite Slabce | 12.5 | 40 | 2.79 | 100.00 |
| DK Exquisite Slabce | 12.5 | 30 | 2.95 | 105.55 |
| DK Exquisite Slabce | 25 | 40 | 2.72 | 97.45 |
| DK Exquisite Slabce | 25 | 30 | 3.11 | 111.45 |
| DK Exquisite Slabce | 35 | 30 | 3.10 | 110.87 |
| DK Exquisite Slabce | 35 | 20 | 3.01 | 107.57 |
| DK Exquisite Slabce | 45 | 30 | 2.67 | 95.62 |
| DK Exquisite Slabce | 45 | 20 | 2.97 | 106.12 |

Table 2 Effect of row spacing and seeding rate on yield of oilseed rape, PR44D06 variety

| <i>Variant</i> | <i>Row spacing (cm)</i> | <i>Seeding rate (plants/m²)</i> | <i>Yield (t/ha moisture 8%)</i> | <i>Yield (%)</i> |
|----------------|-------------------------|--|---------------------------------|------------------|
| PR44D06 Řisuty | 12.5 | 40 | 3.21 | 100.00 |
| PR44D06 Řisuty | 12.5 | 30 | 3.20 | 99.78 |
| PR44D06 Řisuty | 25 | 40 | 3.34 | 104.18 |
| PR44D06 Řisuty | 25 | 30 | 2.49 | 77.71 |
| PR44D06 Řisuty | 35 | 30 | 2.60 | 80.87 |
| PR44D06 Řisuty | 35 | 20 | 3.03 | 94.57 |
| PR44D06 Řisuty | 45 | 30 | 2.79 | 87.01 |
| PR44D06 Řisuty | 45 | 20 | 3.36 | 104.83 |
| PR44D06 Slabce | 12.5 | 40 | 2.91 | 100.00 |
| PR44D06 Slabce | 12.5 | 30 | 2.92 | 100.26 |
| PR44D06 Slabce | 25 | 40 | 2.41 | 82.75 |
| PR44D06 Slabce | 25 | 30 | 2.53 | 87.01 |
| PR44D06 Slabce | 35 | 30 | 2.91 | 100.09 |
| PR44D06 Slabce | 35 | 20 | 2.85 | 97.96 |
| PR44D06 Slabce | 45 | 30 | 3.17 | 109.06 |
| PR44D06 Slabce | 45 | 20 | 3.06 | 105.21 |

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