

Effect of spring fertilization with various nitrogen forms on growth and yield of winter rape varieties

Abstract

Due to the high nitrogen demand of oilseed rape plants a three year experiment (2014–2017) was carried out in the fields of the Institute of Agroecology and Plant Production in Pawłowice. The experiment had a split-plot design with two levels of experimental factors in which effect of applying different nitrogen fertilizers as a second spring dose on yielding and yield quality of three winter oilseed rape cultivars was analyzed. Winter oilseed rape cultivar (Jimmy, Alister, Kolumb) was the first experimental factor, and different nitrogen fertilizer (AN, urea, Alzon, UREAstabil) was the second. Spring nitrogen fertilization was divided into two parts. First dose of nitrogen was applied in the form of ammonium nitrate in the dose of 80 kg·ha⁻¹, while the second dose, also in the amount of 80 kg·ha⁻¹, was applied according to the experiment scheme.

On the basis of obtained results the following conclusions were drawn:

1. Fluctuating weather pattern in the research years had an effect on plants' growth, morphological features and yield components.
2. Years of research had a greater effect on plants' morphological features and yield components than cultivar features and applied nitrogen.
3. During vegetation period the concentration of nitrogen in plants leaves at the budding stage was determined by changeable weather pattern, whereas at the flowering stage the concentration was characterized by weather conditions and varieties
4. The chemical content of rape seeds and meal, was mostly affected by fluctuating weather conditions during years of experiment, and to a lesser degree by types of cultivars.
5. The lowest seed yields were obtained with the heterotic cultivar Jimmy, compared to Alister F1 and Kolumb F1. Hybrid cultivar seed yields were significantly higher by 10% and 8%, respectively. Similar results were observed in case of crude fat, total protein yield and meal yield.
6. Yield of seeds depended on type of the second nitrogen application. The highest yield was harvested while applying ammonium nitrate 3,77 t·ha⁻¹. Using urea, Alzon and UREAstabil decreased the seed yield by 6,9%, 6,1 % and 6,6%, respectively. Similar results were observed in case of crude fat, total protein yield and meal yield.
7. Significant differences were recorded in the glucosinolates concentration depending on variable weather pattern and the type of a cultivar. The totals of glucosinolate were the least

affected by Kolumb ($11,5 \mu\text{M}\cdot\text{g}^{-1}$) and the highest effect was recorded for Jimmy ($17,1 \mu\text{M}\cdot\text{g}^{-1}$). Among all glucosinolates the highest content of harmful progoitrin was recorded in all studied cultivars.

8. Nitrogen fertilization did not modify the glucosinolates composition.
9. It is recommended for commercial farms to use ammonium nitrate as a second dose of spring nitrogen fertilization, which, thanks to its quick availability to the plant improves the rape seed yield. Using slow-acting forms of nitrogen may result in a reduction of the seed yield, due to the high nitrogen demand of rapeseed plants during key stages: flowering and seed development.

Key words: oilseed rape, cultivars, nitrogen, inhibitors, seed yield, yield quality