THE INFLUENCE OF BIOSTIMULATORS ON WINTER OILSEED RAPE

Vliv biostimulátorů na ozimou řepku

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Abstract: The influence of biostimulators applied in fall and spring on the yield components and yield of hybrid winter oilseed rape cv. Kamilo was evaluated in a field experiment in 2014-2015. The analyzed biostimulators exerted a weak yield-forming effect in the 2014/2015 growing season. The ACC biostimulator, applied in fall at a dose of 1 l/ha, and the Alex biostimulator, applied in spring at a dose of 0.5 l/ha, had the most beneficial influence on the yield of winter oilseed rape. The observed improvement in yield resulted from a higher number of seeds per silique and higher 1000 seed weight.

Keywords: *winter oilseed rape, seed yield, yield components, growth biostimulators*

Souhrn: Vliv biostimulátorů, aplikovaných během podzimního a jarního období, na výnosotvorné prvky a výnos hybridní ozimé řepky Kamilo byl testován v rámci polního pokusu v letech 2014-2015. Analyzované stimulátory měly ve vegetačním období 2014/2015 slabý výnosotvorný účinek. Biostimulátor ACC, aplikovaný na podzim v dávce 1 l/ha, a biostimulátor Alex, aplikovaný na jaře v dávce 0,5 l/ha, měly na výnos nejpříznivější vliv. Zlepšení výnosu bylo zapříčiněno především zvýšením počtu semen v šešuli a větší HTS.

Klíčová slova: *ozimá řepka, výnos semen, výnosotvorné prvky, růstové biostimulátory*

Introduction

The production of winter oilseed rape continues to increase in the European Union and the world. The high demand for winter oilseed rape can be attributed to its growing significance in food and feed production and energy generation (Bielski et al. 2014). Optimal conditions for growth and development are key to increasing winter oilseed rape yields. Researchers and breeders continue to search for new solutions and strategies to minimize the negative impact of stress factors during the growing season and to improve the yield and quality of crops (Słowiński and Jarosz 2008, Kozak 2009). Biostimulators are widely used in agricultural production (Słowiński 2004). They stimulate and accelerate metabolic processes in plants and increase crops' resistance to adverse environmental conditions and abiotic stressors (Hayat et al. 2012, Złotek and Wójcik 2014). The Asahi SL biostimulator protected oilseed rape against the adverse consequences of a water deficit in spring, increased the number of side branches, improved 1000 seed weight, and increased seed yield by 9-19% (Malarz et al. 2008). Selected biostimulators do not exert a negative impact on the environment or the quality of the end product (Zodape et al. 2010, Kocira et al. 2016).

The aim of this study was to evaluate the influence of biostimulators applied in fall and spring on the yield components and yield of winter oilseed rape.

Materials and Methods

A hybrid cultivar of winter oilseed rape, ES Kamilo, was grown in a field experiment in the Agricultural Experiment Station in Bałcyny in 2014/2015. The experiment was performed in 4 replications. The experimental factor was the application method and the application date of the following biostimulators:

Treatment	Name and dose of biostimulator	Date of application
1	Control	—
2	ACC – 1 l/ha	BBCH 13-14
3	Zinc chelate – 2 l/ha	BBCH 13-14
4	ACC – 1 l/ha + Alex – 0,5 l/ha	BBCH 13-14
5	ACC – 0.5 l/ha + Helicur 250 EW – 0.5 l/ha	BBCH 13-14
6	ACC – 0.5 l/ha + Magnello 350 EC – 0.5 l/ha	BBCH 13-14
7	Rooter – 1 l/ha	BBCH 13-14
8	NP PGA – 0.75 l/ha	BBCH 21
9	Alex - 0.5 l/ha	BBCH 21

The experiment was established on Haplic Luvisol originating from boulder clay (IUSS Working Group WRB 2006). The preceding crop was a mixture of cereals and legumes grown for forage. Pre-sowing fertilization was applied at 30 kg N/ha, 80 kg P_2O_5/ha and 120 kg K_2O/ha. In spring, winter oilseed rape was fertilized with 100 kg N/ha during germination and 60 kg N/ha during bud formation. Foliar boron was applied three times: in autumn in the 6 leaves unfolded stage, in spring in the germination stage, and in the green bud stage. In the green bud stage, boron was applied as BorMnS fertilizer at 2 l/ha and Boronia Mo

6 fertilizer at 1 l/ha. Winter oilseed rape was sown at 50 germinating seeds per 1 m^2 in plots with an area of 15 m^2. Weeds were controlled with two herbicide applications in fall: Butisan Star 416 SC at 3 l/ha and Agil 100 EC at 0.5 l/ha. Two fungicide treatments were applied in spring: Li 700 at 0.5 l/ha + Magnello 350 EC at 0.8 l/ha + Topsin M 500 SC at 0.6 l/ha when rapeseed plants reached a height of 10-20 cm, and Galileo 250 SC at 0.5 l/ha + Impact 125 SC at 1 l/ha + Designer at 0.125 l/ha in the full flowering stage. Pests were controlled with three applications of the following pesticides: Rapid 060 CS at 0.05 l/ha + Dursban 480 EC at 0.6 l/ha (30 BBCH), Avaunt 150 EC at 0.12 – 0.17 l/ha (52 BBCH) and Mospilan 20 SP at 0.12 kg/ha (65 BBCH). Biostimulators were applied in accordance with the experimental design. Winter oilseed rape was harvested in two stages, at the optimal stage of ripening for industrial processing.

Results and Discussion

The habitat and weather conditions in the 2014/2015 growing season contributed to favorable plant habit before harvest (Table 1). Plant density was optimal at 39-42 plants per 1 m^2, and it supported the formation of productive siliques (115-137 siliques per plant) on 7 side branches. Biostimulators applied to winter oilseed rape in fall or spring decreased the number of siliques per plant (the highest number of siliques was noted in control plants) (Table 1). In a study by Matysiak et al. (2012), the number of siliques per plant was not influenced by Kelpak SL and Asahi SL biostimulators. Budzyński et al. (2008) reported a higher number of siliques per plant (6% increase) in plants treated with the Asahi SL biostimulator in stages BBCH 30 and 50.

Table. 1. Yield components and seed yield of winter oilseed rape

Application methods and application dates		Parameter				
		No. of plants before harvest	No. of siliques per plant	No. of seeds per silique	1000 seed weight (g)	Seed yield (t/ha)
Control	BBCH 13-14	39	137	21.3	5.64	5.84
ACC	BBCH 13-14	40	124	23.5	5.70	5.97
Zinc chelate	BBCH 13-14	40	122	23.4	5.67	5.87
ACC + Alex	BBCH 13-14	40	123	23.5	5.68	5.86
ACC + Helicur 250 EW	BBCH 13-14	40	126	22.7	5.70	5.88
ACC + Magnello 350 EC	BBCH 13-14	41	123	23.2	5.67	5.89
Rooter	BBCH 13-14	41	120	23.7	5.65	5.88
Nutri-Phite PGA	BBCH 21	42	118	23.5	5.68	5.90
Alex	BBCH 21	41	115	24.5	5.68	5.95

The number of seeds per silique was relatively low, and it ranged from 21.3 to 24.5. Biostimulators applied both in fall and spring increased the number of seeds per silique (Table 1). Similar results were noted by Budzyński et al. (2008) in winter oilseed rape treated with biostimulators. In a study by Matysiak et al. (2012), the number of seeds per silique increased under the influence of the Kelpak SL biostimulator applied in fall and spring or in spring only, and the Asahi SL biostimulator applied in spring, but only in a year with a water deficit in early spring.

In the present study, 1000 seed weight was high (5.64-5.70 g), and it was not influenced by the tested biostimulators or their application dates. In the control treatment (without biostimulators), 1000 seed weight was only 1% lower than in the experimental treatments (Table 1). A minor increase in the 1000 seed weight of rapeseed treated with biostimulators was also reported by Harasimowicz-Herman and Borowska (2006), and by Kozak and Malarz (2007). The above correlation was not observed by Matysiak et al. (2012).

In the current study, yield components significantly contributed to the yield of winter oilseed rape. In 2015, seed yield was high at 5.89 t/ha on average despite a water deficit in early spring. None of the evaluated biostimulators, applied in fall (BBCH 13-14) or in spring (BBCH 21), induced clear differences in the yield of winter oilseed rape. The average yield-forming effect of the analyzed biostimulators was estimated at only 1% (60 kg/ha in absolute terms). The most effective biostimulators were ACC applied in fall (BBCH 13-14) and Alex applied in spring (BBCH 21), which increased seed yields by 130 and 110 kg/ha, respectively, relative to control (Table 1). The absence of a strong response of winter oilseed rape to the tested products could point to low levels of environmental stress in the 2014/2015 growing season. In a study by Budzyński et al. (2008), the Asahi SL biostimulator increased rapeseed yield by 220-400 kg/ha. Rapeseed yield increased by 530-540 kg/ha under the influence of effective microorganisms (EM) and the Asahi SL biostimulator in a study by Jaskulski et al. (2012). Matysiak et al. (2012) treated rapeseed plants with Kelpak SL and Asahi SL biostimulators and reported an increase in seed yield of 590 and 570 kg/ha, respectively.

Conclusions

The evaluated biostimulators exerted a minor influence on seed yield in the 2014/2015 growing season. The highest increase in the yield of winter oilseed rape was noted under the influence of the ACC biostimulator applied in fall at 1 l/ha and the Alex biostimulator applied in spring at 0.5 l/ha.

The observed improvement in yield under the influence of the tested biostimulators resulted from a higher number of seeds per silique and higher 1000 seed weight.

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