PROJECT "TARGETED IMPLEMENTATION OF INTEGRATED PEST CONTROL UNDER CONDITIONS OF INTENSIVE FARMING", NO. 35BV-KK-17-1-03770-PR001

according to the Lithuanian Rural Development Programme 2014–2020 Measure "Cooperation", Activity Area "Support to EIP Operational Groups"

GROWTH REGULATORS FOR WINTER WHEAT AND RAPESEED

Recommendations

The applicant is **the Lithuanian Research Centre for Agriculture and Forestry.**

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1. USE OF GROWTH REGULATORS IN WINTER WHEAT

The use of growth regulators in intensively grown winter wheat crops is common in protecting crops against lodging. Crops can be sprayed once, twice or even three times, depending on the intensity of cultivation technology, plant variety characteristics, meteorological conditions, crop density, fertilization level, etc. The growth regulators used at different times shorten the stem and straw walls in different places (they become thicker), which makes the plant more resistant to lodging. The effectiveness of growth regulators depends on the time of their use, crop condition and environmental conditions. The more intensively the plant grows, the greater the effectiveness of the regulators, and vice versa. Therefore, their use should be avoided if the crop is poor, plants develop problematically or are in a stressful situation as well as when weather conditions are unfavourable (dry, cold, especially when frost is forecast).

While spraying the crop it is important:

- before using growth regulators, it is necessary to read the product label and make sure that the product is used for its intended purpose and under proper conditions;
- the sprayer must be in order to distribute the products evenly;
- favourable meteorological conditions, wind speed <4 m/s; do not spray before and after frosts, when there is abundant dew (wet plants); at least 2 hours should elapse after spraying before rain;
- the plant development stage corresponds to that indicated on the label, good plant growth;
- do not spray if the crop is poor and plants are under stress due to lack of moisture or other reasons.

Results of precision field experiments

A study of a medium-height winter wheat crop was conducted at the Institute of Agriculture, LRCAF, Akademija, Kėdainiai D. in 2019–2020 to compare the effectiveness of growth regulators and assess their impact on yield. Three growth regulators were used at different times: chlormequat chloride (1AR) at the beginning of stem growth (BBCH 30), trinexapac-ethyl (2 AR) when the second node was felt (BBCH 32), and ethephon (3 AR) at the last leaf stage (BBCH 39). The 1AR + 2AR mixture was also used at the growth stage BBCH 32.

Table 1. *Experimental scheme:*

Application	Growth regulator active ingredient	Rate g/ha	Application time	Abbreviation
1	not sprayed			
2	chlormequat chloride	750	BBCH 30	1 AR BBCH 30
3	trinexapac-ethyl	100	BBCH 32	2 AR BBCH 32
4	chlormequat chloride	750	BBCH 30	1 AR BBCH 30
	trinexapac-ethyl	100	BBCH 32	+ 2 AR BBCH 32
5	chlormequat chloride	300	BBCH 32	1 AR + 2 AR
	trinexapac-ethyl	50		BBCH 32
6	ethephon	240	BBCH 39	3 AR BBCH 39
7	chlormequat chloride	750	BBCH 30	1 AR BBCH 30
	ethephon	240	BBCH 39	+ 3 AR BBCH 39
8	trinexapac-ethyl	100	BBCH 32	2 AR BBCH 32
	ethephon	240	BBCH 39	+ 3 AR BBCH 39
9	chlormequat chloride	750	BBCH 30	1 AR BBCH 30
	trinexapac-ethyl	100	BBCH 32	+ 2 AR BBCH 32
	ethephon	240	BBCH 39	+ 3 AR BBCH 39

Figure 1. *Experiment on growth regulators in winter wheat, IA LRCAF HR, 2020.*

  **Height** 115–127 cm, on average **120 cm** **Lying down 54 %**	 105–122 cm, on average **111 cm** **23 %**	 99–111 cm, on average **105 cm** **5 %**	 90–106 cm, on average **99 cm** **0 %**
1. Not sprayed	**2. Sprayed at 1 AR BBCH 30**	**3. Sprayed at 2 AR BBCH 32**	**4. Sprayed at 1 AR BBCH 30 + 2 AR BBCH 32**
  **Height** 97–112 cm, on average **104 cm** **Lying down 0 %**	 100–115 cm, on average **107 cm** **6 %**	 93–107 cm, on average **101 cm** **0%**	 93–105 cm, on average **99 cm** **0 %**	86–94 cm, on average **90 cm** **0 %**
5. Sprayed at 1 AR + 2 AR BBCH 32	**6. Sprayed at 3 AR BBCH 39**	**7. Sprayed at 1 AR BBCH 30 + 3 AR BBCH 39**	**8. Sprayed at 2 AR BBCH 32 + 3 AR BBCH 39**	**9. Sprayed at 1 AR BBCH 30 + 2 AR BBCH 32 + 3 AR BBCH 39**

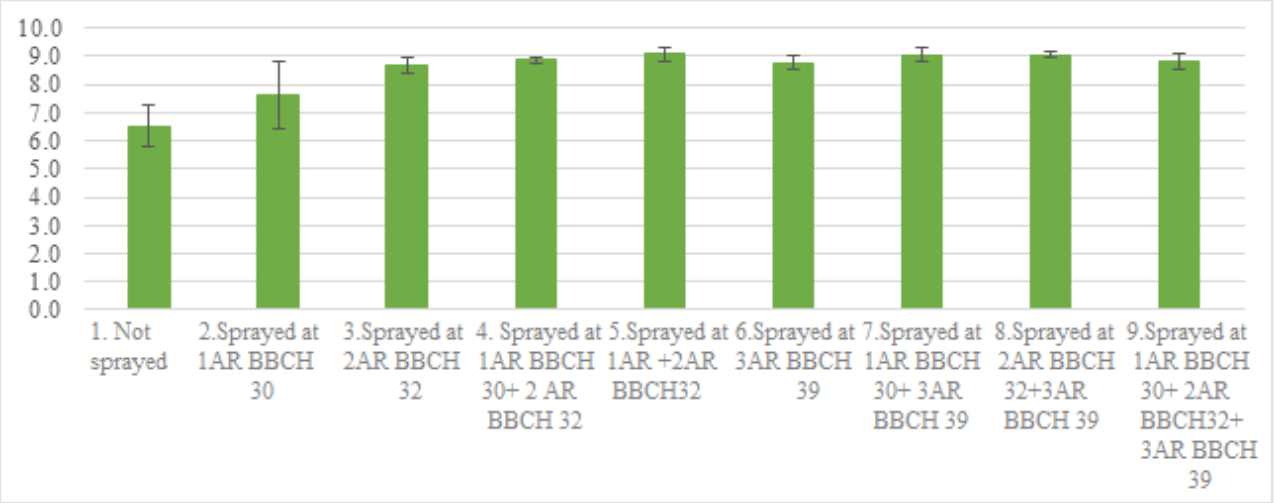

Figure 2. *Winter wheat yield t/ha IA LRCAF, 2020.*

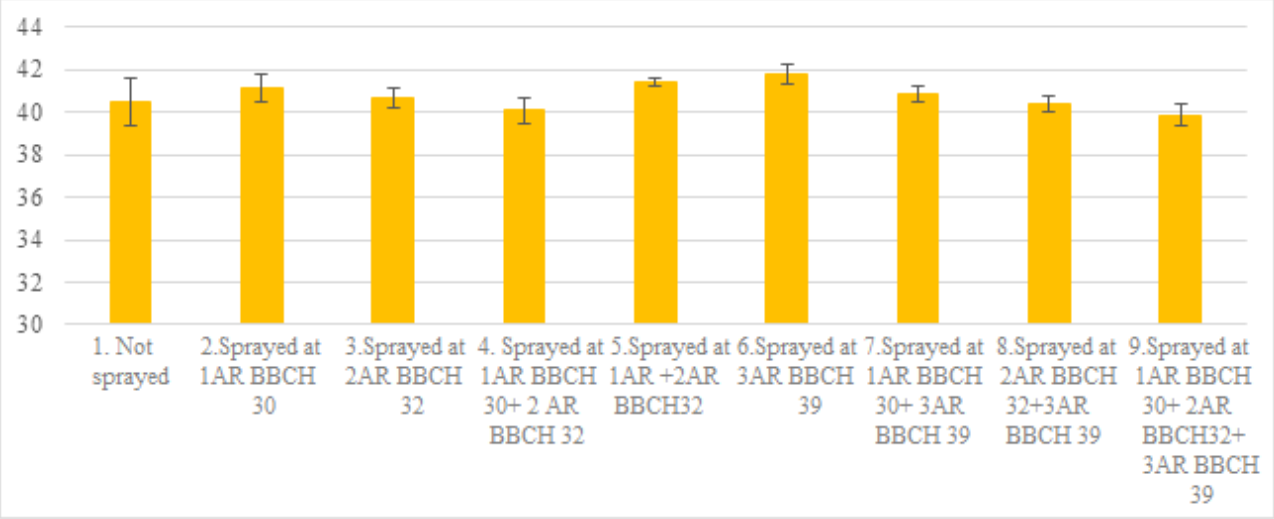

Figure 3. *1000 grain weight of winter wheat in g, IA LRCAF, 2020.*

Dry and cold spring of 2020 was unfavourable for wheat growth, therefore, the use of a growth regulator at the beginning of stem growth (BBCH 30) was not very effective. Wheat yields were not fundamentally different from those not sprayed. All other applications produced a substantial yield increase compared to non-sprayed ones, however, there were no significant differences between the applications. The weight of a thousand grains did not differ significantly between the applications. The regulator is recommended for use under favourable meteorological conditions, when plants grow intensively, especially if the variety tends to lodge (tall), and is richly fertilized with nitrogen fertilizers. Avoid using, if plants demonstrate poor growth, are in a stressful condition, especially if dwarf varieties of winter wheat are grown.

To optimize the use of growth regulators, it is <u>RECOMMENDED TO:</u>

- avoid monoculture,
- choose well-wintering, dwarf or medium-height varieties,
- sow treated seed,
- delay sowing time, not to increase seed rates,
- not to over fertilize plants with nitrogen fertilizers,
- control weeds in a timely manner so as not to create competition for plants,
- ensure timely and adequate protection against diseases and pests,
- use growth regulators according to crop development, meteorological conditions and forecasts.

2. USE OF GROWTH REGULATORS IN WINTER RAPESEED

The use of growth regulators in winter rapeseed crops is usually unavoidable. Warm weather allows plants to grow until late autumn, therefore, without stopping the growth rapeseed would overgrow and face wintering problems. Favourable weather conditions alone are not enough for plants to overwinter well. It is very important that the plants are properly developed. Prior to freezing, rapeseed should have at least 5 leaves, a root thickness of more than 5 mm and a length of more than 15 cm, and a tip of no more than 2 to 3 cm (ideally about 1 cm), i.e. plants should be neither too short nor too tall. A long, warm autumn prolongs the rapeseed growing period and at the same time increases the risk of its overgrowth, therefore, it is important to use growth regulators in a timely manner and prevent plants from elongating.

Use of regulators in autumn

If rapeseed was sown after mid-August and the crop is not very dense, one spray in autumn is enough as a rule. A regulator can be sprayed when rapeseed has 3–4 leaves at a lower rate, or a little later (4-6 leaves) at the full rate. However, if rapeseed was sown in early August or even earlier, the regulator may require using it twice. The first spraying should then be planned at the 3–5 leaf stage, and in the case of long growing season, the second spraying should be planned at 6–8 leaf stage, if the weather is still warm enough (no frost). If rapeseed was sown late (late August or even early September), it is likely that the regulator will not be required, however, there is a risk that the rapeseed will not reach the winter resistance stage. In all cases, when sowing early or late, it is necessary to monitor the crop, check the tip height, estimate crop density and follow the weather forecasts. If the crop is dense or very weedy (the soil is completely covered with plant leaves), the rapeseed will be more prone to elongation and the crop will be more sensitive to overwintering due to the risk of rot. The use of growth regulators will reduce the volume of plants, roots will develop 5 more compared to the upper part, and such plants will winter better. Sometimes even early sown rapeseed is sprayed once, as early autumn frosts slow down plant growth and act as a regulator.

Use of regulators in spring

In spring, growth regulators can be used in the stem elongation stage until the appearance of inflorescences. Rapeseed should reach at least 20–30 cm tall (1–3 nodes felt) to the flower buds (before the flower buds open). The purpose of this spraying is to equalize the crop height (when the crop is uneven), to encourage branching of plants and to reduce the overall height of the crop (usually tall varieties).

While spraying the crop it is important:

- before using growth regulators, it is necessary to read the product label and make sure that the product is used for its intended purpose and under proper conditions;
- the sprayer must be in order to distribute the products evenly;
- favourable meteorological conditions, wind speed <4 m/s; do not spray before and after frosts, when there is abundant dew (wet plants); at least 2 hours should elapse after spraying before rain;
- the plant development stage corresponds to that indicated on the label, good plant growth;
- do not spray if the crop is poor and plants are under stress due to lack of moisture or other reasons.

Figure 4. *Sprayed with growth regulators in spring* *Not sprayed with growth regulators in spring*

Results of precision field experiments

A study of tall and medium-height rapeseed varieties was carried out and the yield compared at the Institute of Agriculture, LRCAF, Akademija, Kėdainiai D. in 2018–2020. The growth regulator was used at the full registered rate (1N) in one experimental application in autumn, in another application it was used in autumn and spring, and in the third one the regulator was not used at all. Favourable wintering conditions, appropriate sowing time for rapeseed (19–21 August), even germination and optimal crop density led to excellent wintering of the plants, even in the fields not sprayed with growth regulators. In the spring of both 2019 and 2020, there was a lack of moisture and the conditions were not very favourable for rapeseed growth, therefore, the growth regulator effect was insignificant (plant height shortening was not practically visible). During both years of the study, rapeseed yields did not differ significantly between the applications, except for 2020 in the 6 case of the medium-height rapeseed variety, the yield of which was significantly lower when the growth regulator had been used in spring. It is usually sufficient to spray the rapeseed of subsequent sowings once, and sometimes spraying can be avoided. Early sown rapeseed crops may need to be sprayed twice. It is important that at the growing season end the rapeseed tip does not exceed 3 cm. In spring, regulators are recommended to use only under very favourable conditions, if the plants are fertilized. Avoid using regulator, if the plants demonstrate poor growth or are in a stressful state, under intensive growth, abundant fertilization with nitrogen or weather conditions are unfavourable (dry, cold, especially when frost is forecast).

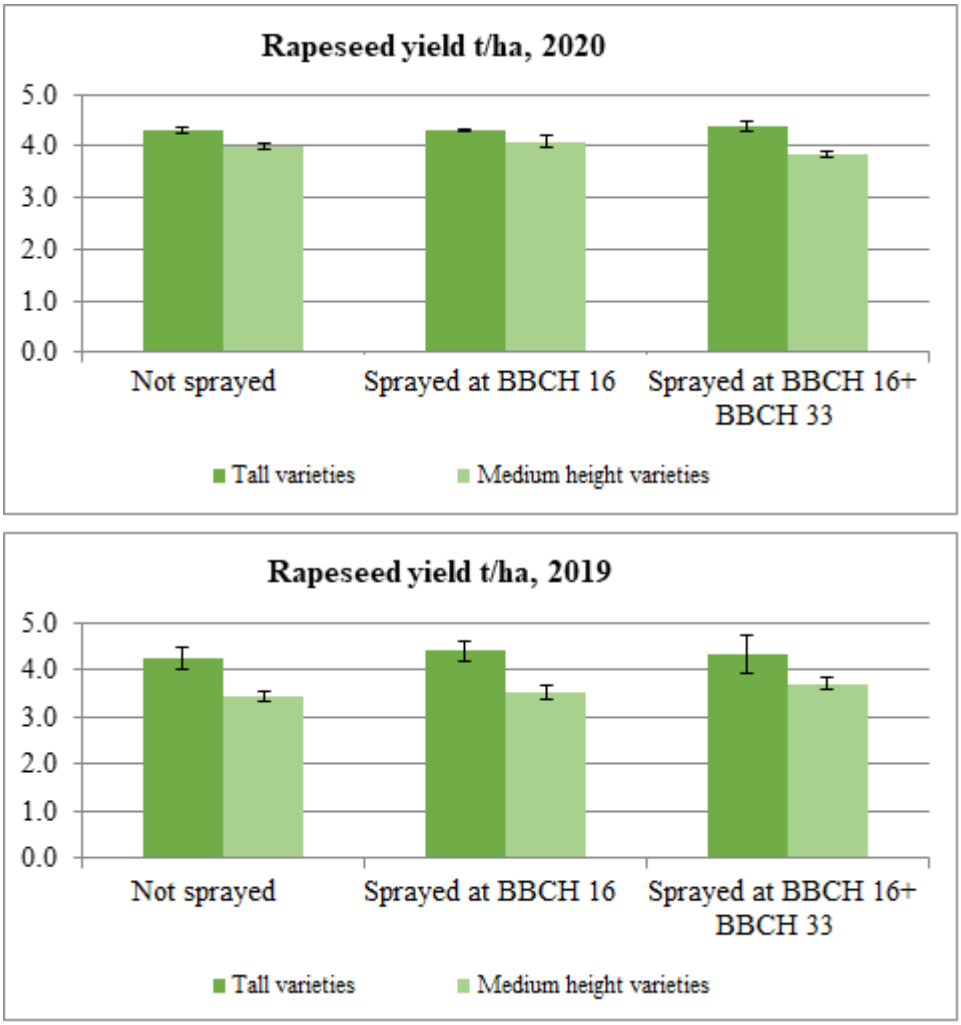

Figure 5. *Rapeseed yield t/ha, 2019–2020.*

To optimize the use of growth regulators, it is <u>RECOMMENDED TO</u>:

- sow certified seeds at the optimal time (August 10–25), not to increase the seed rate (~50 hybrid and ~70 pure line variety seeds m2);
- choose well-wintering varieties, giving priority to dwarf or medium height varieties;
- use growth regulators according to crop development, meteorological conditions and forecasts;
- not to over fertilize plants with nitrogen fertilizers in autumn;
- control weeds in a timely manner so as not to create competition for plants (avoid plant elongation);
- ensure timely and adequate protection against diseases and pests.