

# THE INFLUENCE OF MIXTURES OF GROWTH REGULATORS AND FUNGICIDES ON THE SPRING RAPE SEEDS YIELDS AND QUALITY

## AUGŠANAS REGULATORU UN FUNGICĪDU MAISIĀJUMU IETEKME UZ VASARAS RAPŠA RAŽU UN TĀS KVALITĀTI

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**Abstract.** *Our trial aims at investigating the impact performed by the mixture of a growing-regulator and fungicides upon summer rape productivity, the crop structure, and quality, to justify applying of agrochemicals in smaller doses thus eliminating environment pollution and winning labour-saving resource and financial applying per unit of sowing- fields, and per unit of the gained production. In 2001 – 2003, Research institute of Agriculture preparations during the trial were tested applying half doses ( $0,5 \text{ l ha}^{-1}$ ), creating the preparation mixtures: Moddus+ Folicur, Modus + Juventus; Cycocel + Folicur Cycocel + Juventus, through spraying them throughout plant floescence-bud formation (GS 50). Owing to the mixtures of preparations, the number of side branches increased, on average, for 1-2, the number of legumes on a plant – for 22-25, the number of seeds per legume for 2-4, the mass of 1000 seeds: from 3,7 to 4,2 g, at the same time the length of rape's stem's shorted down to 10-20 cm, and the branching height to 5-14 cm. The highest efficiency, however, was reached when applying the mixture of Cycocel and Juventus. On average, throughout all the three years, thanks to applying of growing-regulators and fungicides the summer oilseed rape harvesting essentially increased, if compared to the Control. The increase of harvest was  $0,53\text{-}0,81 \text{ t ha}^{-1}$  ( $\gamma_{0,05} 0,24 \text{ t ha}^{-1}$ ). During the trial-years the very best preparation mixture was nominated, and it was the Cycocel + Juventus, which, on average, provided the seed harvest  $3,31 \text{ t ha}^{-1}$ , and the oil output  $1409 \text{ kg ha}^{-1}$ . Other mixtures ensured a related seed output –  $3,03\text{-}3,15 \text{ t ha}^{-1}$ , and the oil output  $1270\text{-}1302 \text{ kg ha}^{-1}$ .*

**Keywords:** *spring oilseed rape, growing-regulator and fungicides mixtures, oilseed yield.*

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### Introduction

Plants grow and develop in a complex way interacting with phytohormones that stimulate stretching and growing of cellules (gibberellins, auxins), and those hindering the above-mentioned processes (growing-inhibitors, cytokinins etc.). Their concentration in plants is determined by many causes including external environment conditions and the genotype of a plant. The higher above sea level the place of growing, the less hormones; for instance, those stimulating stretching of plants [2, 4]. All growing-regulators, applied currently in sowing- fields, are enclosed in a gibberellins and auxins growing-hormone system. In the production branch better are the regulators of azoli group that increase in plants the cytokinins, which inhibit in plants the impact of gibberellins and auxins. The influence of the regulators of increase on the harvest of seeds was studied in essence on the winter rape, for the purpose of the shortening of the stem of plants, the stimulation of the formation of lateral flights and auxiliary buds, reduction in the danger of lodging, quaranteasing the high content of oil and uniform ripening of pods on the main and lateral flights [2, 3, 5]. For the first time under the conditions of Latvia, the strengthening actions of azole-preparations (fungicides) were used compounded with the regulators of increase on the basis of chlormequate and trineksapak-ethyl, for the purpose of influence on harvest and quality of the seeds of spring rape. Our trial aims at investigating the impact performed by the mixture of a growing-regulator and fungicides upon summer rape productivity, the crop structure, and quality, to justify applying of agrochemicals in smaller doses thus eliminating environment pollution and winning labour-saving resource and financial applying per unit of sowing- fields, and per unit of the gained production.

### Materials and Methods

Field trials were conducted in soddy- podzolic sandy clay pH- 6,2, organic matter content 33 r kg<sup>-1</sup> (method of Tiurin), phosphorus content (high) 195 kg ha<sup>-1</sup>, potassium content (medium) 147 kg ha<sup>-1</sup> (DL method). The clay parameters fit for cultivating oilseed rape. Its predecessor is autumn fallow. Conventional farming techniques were used. Prior to sowing spring oilseed rape `Olga`, there were applied mineral fertilizers P<sub>2</sub>O<sub>5</sub> 70 kg ha<sup>-1</sup> in the form of superphosphate, K<sub>2</sub>O 120 kg ha<sup>-1</sup> in the form of potassium chloride and nitrogen (N 120 kg ha<sup>-1</sup>) in the form of ammonium nitrate. In 2001–2003, Research Institute of Agriculture tested the following preparations with the aim to expound the impact performed by the applied growing-regulators/fungicide mixture on the growth and development of rape, the elements that determine harvest, seed quality and efficiency concerning disease elimination: Folicur – active substance: tebuconazole 125 g l<sup>-1</sup>, triadimephone 100 g l<sup>-1</sup>, fungicides that hold a lasting, protective system against diseases, in addition acting as plant-growing regulators. Juventus – natural substance: metconazole– 60 g kg l<sup>-1</sup>, a system effectiveness fungicide, and a plant-growing regulator. Moddus 250 e.k.: an active substance: trinexapac-ethyl 250 g l<sup>-1</sup>, a plant-growing regulator. Cycocel 750– an active substance: chlormequate chloride 750 g l<sup>-1</sup>, a plant-growing regulator. Preparations during the trial were tested applying half doses, creating the preparation mixtures: Moddus (0,5 l ha<sup>-1</sup>)+ Folicur (0,5 l ha<sup>-1</sup>), Modus (0,5 l ha<sup>-1</sup>) + Juventus (0,5 l ha<sup>-1</sup>) ; Cycocel (0,5 l ha<sup>-1</sup>) + Folicur (0,5 l ha<sup>-1</sup>); Cycocel (0,5 l ha<sup>-1</sup>) + Juventus (0,5 l ha<sup>-1</sup>), through spraying them throughout plant florescence-bud formation (GS 50). As a rule, preparation effectiveness within mixtures increased. Data analysis for significance was done by ANOVA [1]. Interactions between factors were calculated using by dispersion analysis. Meteorological conditions during the research period were extremely variable. In 2001, meteorological conditions during vegetation stage were changeable. Owing to the lack of precipitations the rape germination was belated. Frequent rainfalls with outrageous winds in June brought drooping rape sowing-fields. During florescence period, the crop was badly affected by frosts. Abundant precipitations during the final phases of florescence and ripening in July, promoted increase in rape branching, consequently, florescence and seed ripening were delayed. In 2002, the sow-period took place in congenial weather conditions. The optimal humidity provision within soil was satisfactory as well. Nevertheless, in the beginning of May and June, the plants were short of humidity, and this obstacle left a harmful impact on the plant development, and the formation of productive elements. Warm, humid weather conditions in July promoted the extension of plant diseases. On rape leaves and legumes the dark leaf spot of crucifers appeared. Rape ripened in the conditions of increased temperatures and was short of humidity. During the test-year 2003, meteorological conditions were rather unfavorable for summer rape growing. Rainy weather destructively affected growing of summer rape, as well as its florescence and seed ripening. The rape was drooping; the ripening was slow and heterogeneous, seeds in lower legumes started to germinate. Rape harvesting was troubled.

### Results

The results of field experiences confirm that the application of regulators of increase in the mixture with the fungicides had a positive impact on the harvest of the seeds of spring rape. Our summer rape research displays different harvests every year. This proves that meteorological conditions every year occupied an important place among other harvest-affecting factors. In 2001 the productivity of rape varied from 2,59-3,18 t ha<sup>-1</sup>. Analysis of the results showed, that actual the value of test  $F = 2,38 < F_{crit} = 3,06$  and  $P\text{-value} = 0,0982 > 0,05$ . It means between average by harvest on the versions with the application of preparations there are no significant differences (See Table 1).

Table 1.

**The influence of different of mixtures of growth regulators and fungicides on the spring rape „Olga” yields (2001 - 2003)**

Variations	Seed harvest t ha <sup>-1</sup>				Oil output kg ha <sup>-1</sup>			
	2001	2002	2003	On average	2001	2002	2003	On average
Control	2.59	1.97	2.95	2.50	1050	862	1186	1033
Moddus + Folicur	3.08	2.48	3.89	3.15	1248	1080	1579	1302
Moddus + Juventus	2.79	2.53	3.78	3.03	1135	1123	1551	1270
Cycocel + Folicur	2.84	2.79	3.61	3.08	1131	1267	1480	1293
Cykocel + Juventus	3.18	2.82	3.93	3.31	1314	1286	1628	1409
$\gamma_{0,05}$	0.34	0.24	0.53	0.24				

Applying the mixtures of Moddus + Folicur – 0,49, and Cycocel + Juventus - 0,59 t ha<sup>-1</sup>, essential increase of harvest was reached, if compared to Control data ( $\gamma_{0,05} = 0,34$  t ha<sup>-1</sup>). The influence of the mixtures of preparations into 2002 wassuschestvennym ( $F = 18,55 > F_{crit} = 3,06$ ;  $P\text{-value} = 1,13 \text{ E-}05 < 0,05$ ). Increase in the harvest of seeds was 0,51-0,85 t ha<sup>-1</sup> ( to the smallest essential difference  $\gamma_{0,05}$  0,24 t ha<sup>-1</sup>). Under the conditions 2003 influence of the mixtures of preparations to the harvest were essential ( $F = 4,38 > F_{crit} = 3,06$ ;  $P < 0,05$ ). Increase in the harvest it was 0,66-0,98 n ha<sup>-1</sup> ( $\gamma_{0,05} = 0,53$  t ha<sup>-1</sup>). However, the highest seed-harvests every year were achieved wherein Cycocel + Juventus was applied: in 2001- 3,18 t ha<sup>-1</sup>, in 2002- 2,82 t ha<sup>-1</sup>, and in the year 2003 - 3,93 t ha<sup>-1</sup>. The oil output, respectively, was 1314, 1286, and 1628 kg ha<sup>-1</sup>. In accordance with harvest data most outstanding was the year 2003 when as a result of the applying of plant regulator/ fungicide mixture there was gathered the highest harvest, and the highest harvest increase was achieved. In our experiences(2001-2003) the utilized mixtures of preparations had inpractive idential influence on the harvest of the seeds of rape( $F=0,81 < F_{crit}=3,48$ ;  $P = 0,54 > 0,05$ ). On average, throughout all the three years, thanks to applying of growing-regulators and fungicides mixtures the summer rape seed harvesting essentially increased, if compared to the Control. The increase of harvest was 0,53-0,81 t ha<sup>-1</sup> ( $\gamma_{0,05}$  0,24 t ha<sup>-1</sup>). During the trial-years the very best preparation mixture was nominated, and it was the Cycocel + Juventus, which, on average, provided the seed harvest 3,31 t ha<sup>-1</sup>, and the oil output 1409 kg ha<sup>-1</sup>. Other mixtures ensured a related seed output – 3,03-3,15 t ha<sup>-1</sup>, and the oil output 1270-1302 kg ha<sup>-1</sup>. Applying of the plant-regulators and fungicides mixtures influenced chemical composition of seeds as well. It was different every year (See Table 2).

Table 2.

**Full protein and Full grease content in the spring rape seeds „Olga” (2001 - 2003)**

Variations	Full protein, %				Full grease, %			
	2001	2002	2003	On average	2001	2002	2003	On average
Control	23.22	19.86	25.53	22.87	44.80	47.58	43.70	45.36
Moddus+ Folicur	24.16	20.02	24.42	22.87	44.06	47.32	44.13	45.17
Moddus+ Juventus	23.14	19.78	25.06	22.66	44.21	48.24	44.61	45.69
Cycocel+ Folicur	24.31	20.89	24.68	23.29	43.30	49.36	44.57	45.74
Cycocel+ Juventus	23.68	20.18	24.49	22.78	44.92	49.56	45.04	46.51

On average, and every single year, depending on the applied mixture, full grease was 45,17 – 46,51 %. On average, every single year, full grease content increased most, when Cycocel + Juventus mixture was applied. Among the plant diseases in rape sowing-fields, there prevailed the false blight, *Perenospora parasitica*, and the dry spotting *Alternaria brassica*. The highest efficiency while limiting the false blight, the dry rotting, *Phoma lingam*, and the white rotting, *Sclerotinia sclerotiorum*, was achieved when applying the variation of mixture Cycocel + Juventus (up to 80 %). Concerning the legumes, in order to limit the dry spotting and the dry rotting, the uppermost biological efficiency (up to 70 %) was achieved when applying the variation of Moddus and Juventus. The research proved: while applying the azoli preparations in mixture with the preparations of chlormequate and trinexapac-ethyl junctions and employing minified doses (Moddus + Folicur, Modus + Juventus, Cycocel + Folicur, Cycocel +Juventus), there was observed the impact on rape plant development, and harvest-structure formation elements (See Table 3).

Table 3.

**Influence of mixture of growth regulators and fungicides upon the harvest-formation elements of spring rape „Olga” (average figures, 2001 - 2003)**

Variations	Height of plant cm	Branching height, cm	Number of first grade branches	Number of legumes on plant	Number of seeds in legumes	Mass of 1000 seeds, g
Control	140	67	4	84	21	3,7
Moddus + Folicur	128	60	5	107	24	4,0
Moddus + Juventus	130	61	5	107	23	3,9
Cycocel + Folicur	126	62	6	106	24	4,0
Cycocel + Juventus	120	53	6	109	24	4,2

Owing to the mixtures of preparations, the number of side branches increased, on average, for 1-2, the number of legumes on a plant – for 22-25, the number of seeds per legume for 2-4, the mass of 1000 seeds: from 3,7 to 4,2 g, at the same time the length of rape’s stem’s shorted down to 10-20 cm, and the branching height to 5-14 cm. The highest efficiency, however, was reached when applying the mixture of Cucocel and Juventus. Throughout the research period it was

observed that plant-growing regulators if mixed with fungicides, provided evenness of florescence and legume ripening.

### Conclusions

1. Applying of fungicides and growing-regulators in mixtures, in minified doses, provides evenness of florescence and legume ripening, and grants essential increase of rape harvest, improving its quality as well.
2. The applications of the studied mixtures of preparations it ensured the addition of the harvest of seeds 0,53-0,81 t ha<sup>-1</sup> and oil outlet on 237-376 kg ha<sup>-1</sup>.
3. The applications of mixtures of Cucocel and Juventus it ensured the highest harvest of seeds 3,3 t ha<sup>-1</sup> and the significant addition of harvest 0,81 t ha<sup>-1</sup> ( $\gamma_{0,05} = 0,24$  t ha<sup>-1</sup>). The oil outlet together 1409 kg ha<sup>-1</sup>. Other mixtures ensured a related seed output – 3,03-3,15 t ha<sup>-1</sup>, and the oil output 1270-1302 kg ha<sup>-1</sup>.
4. The applications of mixtures of preparations positively it influence increase in the number of legumes stems, number of pods on the plant, the number of seeds in the pod and mass 1000 seeds.
5. Biological efficiency of the mixtures of preparations concerning the limitation of plant diseases is satisfactory in order to manage disease outspread in sowing-fields.

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