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THE INFLUENCE APPLICATION OF HERBICIDES LINTUR 70 WG AND PLANT GROWTH REGULATOR EMISTIM C ON THE FORMATION OF YIELD STRUCTURE OF SPRING WHEAT

The formation indices of yield structure of spring wheat as the number of stems, number of productive stems, productive layering, quantity and mass of grains in the ear under the application of herbicide Lintur 70 WG, at the rate of 120, 150 and 180g/ha both separately and in tank mixtures with plant growth regulator Emistim C was researched. It was established that the application of optimal herbicide rate facilitated these indices improvement and their highest levels were achieved under the application of Lintur 70 WG, water soluble granules, in the tank mixture with Emistim C. The application of maximum herbicide rate (180 g/ha) both separately and in the mixture with Emistim C inhibits the growth of spring wheat plants which results in lower indices of the yield structure of the crop.

Key words: *spring wheat, herbicide Lintur 70 WG, plant growth regulator Emistim C, plant stand, layering capacity, quantity and mass of grain, ear.*

Introduction. Cereals, three of which are wheat, maize and rice, play a significant role in food supply of mankind [1]. Meanwhile the researchers consider that the role of wheat will grow and it will become the most important one on the world. High cropping capacity of spring wheat can be formed only in such agro-coenosis, the parameters of which, namely, plant density, layering capacity, ear size, quantity and size of grains in the ear, will be optimal [3, 5, 6]. Herewith, as it was proved by many-year research and practice, weed infestation significantly reduces the crop productivity due to the fact that weeds can remove 1,2–1,5 times more nutritive elements than the wheat plants need. That is why weed control, mainly by means of chemical method, plays an important role in modern technologies of growing field crops. The application of herbicides in crop plantations makes the removal of nutritive elements by weeds 1,7–4,5 times lower [10].

The analysis of main researches and publications in which the solution of the problem was initiated. Literary sources prove that under the application of optimal rates of herbicides the plants develop, form layers better in comparison with the control without herbicides where high weed infestation inhibits the growth and development of plants. The application of chemical means of weed control has also a positive influence on the productivity of wheat ears and mass of 1000 grains. Thus, according to the data by V. V. Sakhneneko [8], active growth and development of plants in the areas, where the weeds were eliminated with the help of herbicides, facilitate the increase of the ear size, grains inside them and grain mass as compared to the control without herbicides.

At present a significant role in increasing the crop productivity is also played by modern plant growth regulators. According to the research data by S. P. Ponomarenko and B. M. Cheremha [7] the application of Emistim C increases the productivity of layering capacity of spring barley by 25–30%.

Purpose and tasks of the research. The purpose of the research was to study the influence of herbicide Lintur 70 WG, water soluble granules,, and plant growth regulator Emistim C on some indices of yield structure of spring wheat. The task of the research was to find out how herbicide Lintur 70 WG, water soluble granules, and plant growth regulator Emisitm C, applied separately and in tank mixture, influence the productivity of spring wheat stems, layering capacity coefficient, quantity and mass of grains in the ear.

Materials and methods. The experiments were laid out in the field and laboratory conditions of the department of biology of Uman National University of Horticulture on the areas under spring wheat variety of Kolektyvna 3 in the period of 2010–2012. Growing plants in the full layering phase were sprayed with herbicide Lintur 70 WG, water soluble granules, (120, 150 and 180 g/ha) and plant growth regulator Emistim C (10 ml/ha) both separately and in tank mixture.

The experiment was carried out three times on the podzolized heavy loamy black soil with the humus content in the top soil 3,2–3,3%. The level of soil profile saturation was within 89,8–92,5%, soil solution reaction was mean acid (pH_{kcl} 5,5), hydrolytic acidity – 1,93–2,26 smol/kg of soil, content of moving compounds of phosphorus and potassium (by Chirikov's method), – 120–132 mg/kg, nitrogen of alkaline hydrolysed compounds (by Cornfield's method) – 103 mg/kg of soil [2].

The preparations were sprayed with the help of OHN–600 sprinkler with the working solution flow rate 300 l/ha. The indices of yield structure of spring wheat were determined according to common methods [4].

Results and discussion. As a result of the conducted researches it was established that before harvesting spring wheat in 2010 the quantity of wheat stems per 1 m^2 under the application of 120 g/ha of Lintur 70 WG exceeded the control variant I by 19 pcs/м^2 while under the application of herbicide at the rate of 150g/ha the difference was 60 pcs/м^2 which under HIP_{05} 31 pcs/m^2 was trustworthy. Under the action of 180 g/ha of the preparation the quantity of stems was the smallest in the experiment variants with the application of herbicide without plant growth regulators, however it exceeded control I by 5 pcs/m^2 (table 1).

Under the combined application of Lintur 70 WG with Emistim C in 2010 the biggest quantity of stems per 1 m^2 was under the action of 120 g/ha of herbicide in the mixture with the plant growth regulator. Here, the crop density exceeded control I by 69 pcs./m^2 and under HIP_{05} 31 pcs/m^2 was trustworthy. In comparison with control I, the quantity of stems increased by 63 pcs/m^2 under the appication of 150 g/ha of Lintur in combination with the plant growth regulator and under the appication of 180 g/ha the difference comprised 13 pcs/m^2.

In 2011 weather conditions of the vegetation period were more favorable for the growth of spring wheat plants than in 2010, therefore, the crop density in 2011 was higher than in 2010. Thus, under the application of Emistim C the crop density increased by 21 pcs./m^2 in comparison with control I. Under the action of 120 g/ha of

Table 1

Number of stems spring wheat under application of herbicides Lintur 70 WG and plant growth regulator Emistim C

Experiment variant	Number of stems, pcs/m^2			
	2010 y.	2011 y.	2012 y.	Average in three years
Without preparations and hand weeding (experimental check I)	520	540	511	524
Without preparations plus hand weeding (experimental check II)	586	625	601	604
Emistim C	541	561	564	555
Lintur 70 WG 120 g/ha	539	568	554	554
Lintur 70 WG 150 g/ha	580	606	585	590
Lintur 70 WG 180 g/ha	525	550	545	540
Lintur 70 WG 120 g/ha + Emistim C	589	629	606	608
Lintur 70 WG 150 g/ha + Emistim C	583	618	599	600
Lintur 70 WG 180 g/ha + Emistim C	533	569	557	553
SED_{05}	*31*	*33*	*28*	

herbicide Lintur 70 WG without the plant growth regulator the quantity of spring wheat stems grew by 28 in comparison with control I. The application of 150 g/ha of Lintur 70 WG facilitated the

increase of spring wheat density by 66 pcs/m^2 in comparison with control I which under HIP_{05} 33 pcs./m^2 was trustworthy. The increase of quantity of spring wheat stems under the action of 180 g/ha of herbicide comprised 10 pcs/m^2 in comparison with control I but under HIP_{05} 33 pcs./m^2 was not significant.

Similar to 2010, the combined application of herbicide of Lintur 70 WG and Emistim C influnced the formation of density more efficiently. In particular, under the action of 120 g/ha of Lintur 70 WG in combination with the plant growth regulator, spring wheat density increased by 89 pcs./m^2 in comparison with control I and under 150 g/ha of herbicide with Emistim C – by 78 pcs/m^2, which under HIP_{05} 33 pcs/m^2 was trustworthy. The application of a maximum rate of herbicide in combination with the plant growth regulator did not help the significant growth of density.

In the process of determining the density of spring wheat plants in 2012 it was established that the quantity of stems was smaller in comparison with the previous years of the research which is connected with dry conditions of the vegetation period. However, the dependence of the quantity of spring wheat stems on the rates and methods of aplication of Lintur 70 WG and Emistim C remained the same as in the previous years. Thus, under the application of Emistim C the spring wheat density increased by 53 pcs/m^2 in comparison with control I which under HIP_{05} 28 pcs/m^2 was trustworthy. Under the application of Lintur 70 WG at the rate of 120 g/ha without the plant growth regulator the quantity of spring wheat stems exceeded control I by 43 pcs/m^2, and under 150 g/ha – by 74 pcs/m^2, which under HIP_{05} 28 pcs/m^2 was trustworthy. The increase of spring wheat plants density under the application of 180 g/ha of herbicide in comparison with control I was inessential.

Under the application of 120 g/ha of Lintur 70 WG in combination with Emistim C the quantity of spring wheat stems increased by 95 pcs/m^2 in comparison with control I which under HIP_{05} 28 pcs/m^2 was essential. The increase of density under the action of 150 g/ha of herbicide in combination with plant growth regulator (by 88 pcs/m^2 more than control I) is also essential. The application of 180g/ha of Lintur 70 WG with Emistim C did not lead to the essential increase of the quantity of spring wheat stems.

Having calculated the quantity of productive stems, which influence greatly the yield amount, it was established that their number changed depending on the rates and methods of applying the preparations. Thus under the application of Emistim C without the herbicide the number of productive stems of spring wheat plants increased on the average by 7% during the years of the research in comparison with control I (table 2).

Under the influence of 120 g/ha Lintur 70 WG, water soluble granules, water soluble granules, without Emistim C the number of productive stems exceeded control I by 6%, and under the application of 150 of the herbicide it was the highest among the experiment variants, where Lintur 70 WG, water soluble granules, without Emistim C was applied it was 16% more than control I. The effect of 180 g/ha of herbicide increased the number of productive stems of spring wheat by 4%.

Among the experiment variants with the application of Lintur 70 WG, water soluble granules, and Emistim C the productive stems were more actively formed under the joint effect of the preparations. Thus, under the application of 120 g/ha of the herbicide in the mixture with the plant growth regulator the quantity of productive stems increased by 19% in comparison with control I while under application of 150 g/ha it increased by 17%. The application of 180 g/ha of Lintur 70 WG, water soluble granules, in the mixture with Emistim C influenced the formation of productive stems less effectively, here their number exceeded control I by 6%.

While determining the coefficient of productive layering it was established that it also depended on the rates and methods of application of the preparations. Namely, under the application of Emistim C the coefficient of productive layering increased by 7% as compared to control I. Under the application of 120 g/ha of Lintur 70 WG, water soluble granules, without Emistim C the coefficient of productive layering exceeded control I by 7%, and under the influence of 150 g/ha it comprised 16%. The lowest index among the experiment variants with the application of the

herbicide without the plant growth regulator was received under the influence of 180 g/ha of the preparation, still it exceeded control I by 4% (table 2).

Table 2

Number of productive stems and productive layering under application of herbicides Lintur 70 WG and plant growth regulator Emistim C

Experiment variant	2010 y.	2011 y.	2012 y.	Average in three years
Without preparations and hand weeding (experimental check I)	445 0,99	450 1,00	432 0,96	442 0,98
Without preparations plus hand weeding (experimental check II)	513 1,15	535 1,21	522 1,17	523 1,16
Emistim C	468 1,04	472 1,05	486 1,08	475 1,06
Lintur 70 WG 120 g/ha	463 1,03	477 1,06	472 1,05	471 1,05
Lintur 70 WG 150 g/ha	508 1,13	517 1,15	508 1,13	511 1,14
Lintur 70 WG 180 g/ha	454 1,01	459 1,02	463 1,03	459 1,02
Lintur 70 WG 120 g/ha + Emistim C	517 1,15	540 1,20	526 1,17	528 1,17
Lintur 70 WG 150 g/ha + Emistim C	508 1,13	526 1,17	517 1,15	517 1,15
Lintur 70 WG 180 g/ha + Emistim C	463 1,03	477 1,06	472 1,05	471 1,05
SED 05	*8* *0,06*	*15* *0,08*	*9* *0,08*	

Note. Above the line – number of productive stems, pieces/ m^2 , under the line – productive layering.

The application of Lintur 70 WG, water soluble granules, in combination with Emistim C influenced more effectively the coefficient of productive layering of spring wheat as compared to the application of the preparations separately. Thus, the highest index of productive layering among the experiment variants was achieved under the effect of 120 g/ha Lintur 70 WG, water soluble granules, in the mixture with the plant growth regulator. Here it increased by 20% as compared to control I. The application of 150 g/ha of the herbicide together with the plant growth regulator facilitated the coefficient increase by 17% in comparison with control I. Under the effect of 180 g/ha of Lintur 70 WG, water soluble granules, productive layering exceeded control I by 7%.

During the research of the quantity and mass of grains in spring wheat ears it was established that during the years of the research under the application of Emistim C the average quantity of grains in the ear was equal to control I (table 3).

Under the application of 120 g/ha of herbicide Lintur 70 WG, water soluble granules, the quantity of grains in the ear increased by 2% as compared to control I, while under the influence of 150 g/ha it increased by 5%. The application of 180 g/ha of the herbicide did not influence the number of grains in the ear.

Under the joint application of Lintur 70 WG, water soluble granules, and Emistim C the quantity of grains in the ear was higher in comparison with the experiment variants where the herbicide was applied without the plant growth regulator. Thus, under the effect of 120 g/ha of Lintur 70 WG, water soluble granules, in combination with Emistim C the number of grains in the ear increased by 9% in comparison with control I, and under the application of 150 g/ha it was 6%.

The application of the maximum rate of the herbicide in the mixture with Emistim C did not influence this index.

Table 3

Quantity and mass of grains in the ear under application of herbicides Lintur 70 WG and plant growth regulator Emistim C

Experiment variant	2010 y.	2011 y.	2012 y.	Average in three years	To control, %
Without preparations and hand weeding (experimental check I)	23,2 0,82	23,8 0,85	21,0 0,74	22,7 0,80	100 100
Without preparations plus hand weeding (experimental check II)	24,9 0,92	26,0 1,00	22,9 0,85	24,6 0,92	108 115
Emistim C	23,3 0,84	23,8 0,87	21,0 0,75	22,8 0,82	100 102
Lintur 70 WG 120 g/ha	23,7 0,85	24,5 0,90	21,0 0,75	23,1 0,83	102 104
Lintur 70 WG 150 g/ha	24,2 0,89	25,5 0,94	21,7 0,79	23,8 0,87	105 109
Lintur 70 WG 180 g/ha	23,6 0,83	24,2 0,87	21,0 0,74	22,9 0,81	101 102
Lintur 70 WG 120 g/ha + Emistim C	25,0 0,93	26,2 1,01	23,0 0,86	24,7 0,94	109 117
Lintur 70 WG 150 g/ha + Emistim C	24,5 0,91	25,8 0,97	22,0 0,81	24,1 0,90	106 112
Lintur 70 WG 180 g/ha + Emistim C	23,8 0,87	24,5 0,91	21,7 0,78	23,3 0,86	103 107
SED 05	*0,5* *0,04*	*0,3* *0,03*	*0,6* *0,05*		

Note. Above the line – quantity of grains in the ear, pieces; under the line – mass of grains in the ear. gr.

Under the joint application of Lintur 70 WG, water soluble granules, and Emistim C the quantity of grains in the ear was higher in comparison with the experiment variants where the herbicide was applied without the plant growth regulator. Thus, under the effect of 120 g/ha of Lintur 70 WG, water soluble granules, in combination with Emistim C the number of grains in the ear increased by 9% in comparison with control I, and under the application of 150 g/ha it was 6%. The application of the maximum rate of the herbicide in the mixture with Emistim C did not influence this index.

While researching the mass of grains in the ear it was established that it also changed depending on the rates and methods of the preparations application. Thus, under the application of Emistim C the mass of grains in the ear increased by 2% on the average during the years of the research in comparison with control I. Under the application of 120 and 150 g/ha of Lintur 70 WG, water soluble granules, without Emistim C the mass of grains in the ear exceeded control I by 4 and 9% correspondingly (table 2).

Under the joint effect of the preparations the formation of the mass of grains in the ear was more active in comparison with the application of the herbicide and the plant growth regulator separately. Under the simultaneous application of 120 g/ha of Lintur 70 WG, water soluble granules, with Emistim C the mass of grains in the ear exceeded control I by 17%. Under the effect of 150 g/ha of the herbicide with the plant growth regulator this index decreased, however, it was 12% higher than control I. The application of 180 g/ha of Lintur 70 WG, water soluble granules, in combination with Emistim C facilitated the increase of the mass of grains in the ear by 6,9% in comparison with control I.

Conclusions. The analysis of the received data makes it possible to conclude that the highest indices of the researched elements of the yield structure of spring wheat (quantity of productive stems, coefficient of productive layering, quantity and mass of grains in the ear) are formed under the application of 120 g/ha of Lintur 70 WG, water soluble granules, in the mixture with Emistim C.

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Анотація

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Вплив гербіциду Лінтур 70 WG і регулятора росту рослин Емістим С на формування структури врожаю пшениці ярої

Досліджено формування таких показників структури врожаю пшениці ярої як загальна кількість стебел, кількість продуктивних стебел, продуктивна кущистість, кількість і маса зерен з колоса за внесення гербіциду Лінтур 70 WG у нормах 120, 150 і 180 г/га як окремо, так і у бакових сумішах з регулятором росту рослин Емістим С. Встановлено, що застосування оптимальних норм гербіциду сприяє покращенню цих показників, а найвищі їх значення спостерігаються у разі сумісного внесення 120 г/га Лінтуру 70 WG у баковій суміші з Емістимом С. Внесення максимальної норми гербіциду (180 г/га) як окремо, так і у суміші з Емістимом С має інгібуючу дію на рослини пшениці ярої, що проявляється в зниженні параметрів досліджуваних показників структури врожаю посівів культури.

Ключові слова: *пшениця яра, гербіцид Лінтур 70 WG, регулятор росту Емістим С, стеблостій, продуктивна кущистість, кількість і маса зерен, колос.*

Аннотация

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Влияние применения Линтур 70 WG. и регулятора роста растений Эмистим С на формирование структуры урожая пшеницы яровой

Исследовано формирование таких показателей структуры урожая пшеницы яровой как общее количество стеблей, количество продуктивных стеблей, продуктивная кустистость, количество и масса зерен с колоса при внесении гербицида Линтур 70 WG в нормах 120, 150 и 180 г/га как отдельно, так и в баковых смесях с регулятором роста растений Эмистим С. Установлено, что применение оптимальных норм гербицида способствует улучшению этих показателей, а наивысшие их значения наблюдаются при совместном внесения 120 г/га Линтура 70 WG в баковой смеси с Емистимом С. Внесение максимальной нормы гербицида (180 г/га) как отдельно, так и в смеси с Емистимом С имеет ингибирующее действие на растения пшеницы яровой, что проявляется в снижении исследуемых показателей структуры урожая посевов культуры.

Ключевые слова*: пшеница яровая, гербицид Линтур 70 WG., регулятор роста Эмистим С, стеблестой, продуктивная кустистость, количество и масса зерен, колос*