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FEATURES OF FORMATION OF SPRING BARLEY YIELD

It is shown regularities of control of elements of spring malting barley yield – the number of productive stems, number of grains spike and weight of large grains on the basis of growing technology-driven factors: the norms of application of fertilizers and seed standards.

Keywords: *spring barley, the number of productive stems, number of grains spike, weight of large grain, norms of fertilization, norms of seeding.*

Introduction. Every stage of development of grain crops by F.M. Kuperman is characterized by the appropriate requirements to complex environmental conditions. It was established that the temperature and length of the day affect the differentiation of the main elements of yield of spring barley. Slow vegetative growth leads to increased tillering and_formation of a larger number of spikelets, and therefore the grains of spike, this process is conditioned by low temperatures and short day [1]. The internal mechanism of these effects depends on the physiologically active substances, especially gibberellins and concentration of inhibitors. At first it is achieved the maximum number of stalks, spikelets, flowers and lots of grains in the development for consistency in the formation of spring barley yield. Quantitative expression of yield components occurs simultaneously. Intervals in the implementation of components of yield formation of spring barley enable to compensate on these shortcomings of previous stages. Low yields of the first element is enhanced by implementation of these and vice versa at higher expression of pre – weakened, that reduces the quantity or weight. This phenomenon is called compensation of yield elements and regularities – the law of compensation, that provides a basis of autoregulation in grain crops [1].

It is expedient to study management of elements of yield in the yield structure based on the use of technology-driven factors of spring barley growing. Exploration of the regularities of formation of grain crops yield was carried out by many scientists, M.S. Savytskyy, H. Hänsel, J. Petr, V. Hodan and others [2, 3, 4]. However, there is still no general theory of the formation of yield that could be the basis of crop production. However, the need to use in practice established in studies regularities concerning malting barley, where biochemical quality of the grown crop depends on the mass of grain, is indisputable.

The purpose of research – to establish regularities of yield formation of spring malting barley by yield structure elements depending on the influence of technological factors: seed regulations and standards of fertilizers applying.

Materials and methods. Researches are performed at the experimental field Kamyanets-Podilsky State Agricultural and Technical University during 2009–2011

years. Soil of test areas is typical black soil on carbonate loams. The humus content in the soil layer 0-30 cm determined by Tyurin method is 3,5-4,0%, alkaline hydrolyzed nitrogen by Kornfild method – 100-120 mg/kg soil, mobile phosphorus and exchangeable potassium by Chirikov method – 101-118 and 125-140 mg/kg of soil, the amount of absorbed bases by Kappen-Hilkovits method – 30-36 mh-ekv/100 g soil, the reaction of soil solution pH – electrolyte by potentiometric method – 6,7-7,0 g mh-ekv/100 g soil, hydrolytic acidity by Kappen method – 0,53-0,78 mh-ekv/100 g soil.

To ensure the efficiency of field sowing experiment was performed manually. High quality seeds were placed on compacted soil in a natural way to provide access to water by capillarity. Depth of wrapping was kept around 3 cm distance between seeds in a row was 2,7; 2,2; 1,9; 1,7 cm from each other according to the norms of seeding 250, 300, 350, 400 s./m^2. Spring tillage was consisted in loosening just before planting to a depth of seeding. The used variants of fertilization: $N_{30}P_{45}K_{45}$, $N_{60}P_{90}K_{90}$, $N_{90}P_{120}K_{120}$. Scarlet variety was used in studies. Sowing, depending on the research, was at the end of march – beginning of april. Statistical analysis of experimental data is made in the package Statistica 6.0 by methodological recommendations [5].

Results and discussion. As a result of studies it is found regularity by which increase the number of productive stems per unit area of crop yield in the formation of malting barley is accompanied by decrease in both grain spike and weight of large grains (*table 1*).

Table 1

Regularity of changes of productivity elements in the structure of spring barley yield, variety Scarlett

Norm of fertilizers, kg/ha	Seeding norms, units/m^2	Number of productive stems, units/m^2	Number of grains spike, units	Weight of large grains, mg	Productivity, t/ha
$N_{30}P_{45}K_{45}$	250	525	24,5	49,5	6,17
	300	574	24,0	48,9	6,54
	350	600	23,4	48,6	6,58
	400	625	23,0	48,0	6,54
$N_{60}P_{90}K_{90}$	250	640	24,2	49,0	7,32
	300	701	23,5	48,4	7,82
	350	739	22,8	48,2	7,89
	400	773	22,2	47,5	7,84
$N_{90}P_{120}K_{120}$	250	748	23,7	47,5	8,24
	300	818	23,4	46,8	8,75
	350	856	22,6	46,6	8,81
	400	889	22,0	46,0	8,76

Correlation dependence of the number of grains spike on the number of productive shoots was r = -0,76, degree of dependence of the indicator on the factor of variations on certain coefficients of determination – R^2=0,58. Analysis of the

dependence of the weight of large grains of barley on the number of productive stems showed that its parameters are largely determined by the factor of influence. Correlation coefficients and determination during the research were r=-0,94; R^2=0,88. Analytical interpretation of empirical data communication is characterized by approximation established regression equation WLG = 54,01979 – 0,00863 NPS. According to the forecast the theoretical value of the weight of large grains by increasing of the number of productive stems of spring barley by 1 m^2 to 100 units leads to a reduction of its weight by 0,9 mg. The regularity of the factor of experimental and calculated data is shown in *figure 1*.

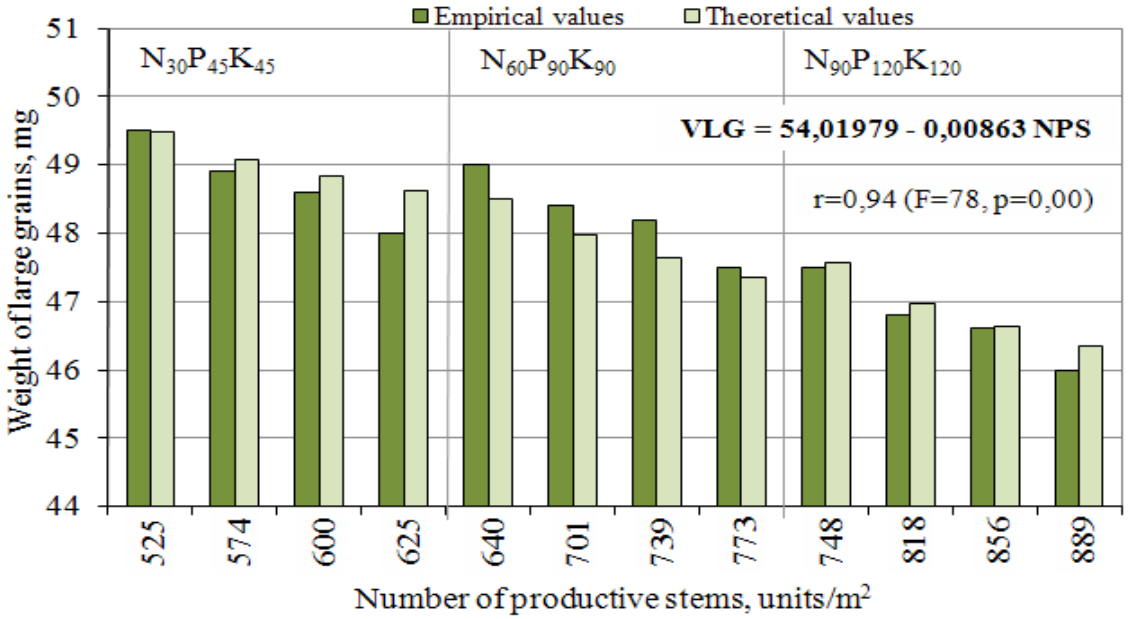

Fig. 1. The dependence of the weight of large grains of barley on the number of productive stems

Shown above analysis shows that the elements of productivity in the formation of spring barley yield were closely linked. It is important that the number of productive stems per unit area of crop largely depends on technological factors, including norms of seeding and fertilization. It almost allows to adjust the level of yield elements. These factors significantly affect the yield of the first element – the number of productive stems. Homogeneous groups established by many rank Duncan criteria show that technological factors vary considerably by the influence of each variant. They cause regular changes beyond their size. Thus, increasing of application norms of fertilizers and seed standards contributes significantly more productive shoots per unit area of crop.

According to the results of analysis it is proved that the action of technological factors are characterized by strong combined effect on the first element of the structure of spring barley yield. It is found multiple correlation coefficient $R_{y.xz}$=0,99 and received regression model with high reliability of dependence of the number of stems per unit area of crop on the effects of the independent variables, namely norms of fertilization and norms of seeding that are technologically manageable. It is estimated that deviation of empirical data from the theoretical are within acceptable values: NPS = 172,7899 + 1,1711 NPK + 0,8160 NS .

It is carried out the analysis of graphic image and obtained theoretical values of the dependent variable to assess the adequacy of the established regression models,_according to which there is a linear trend which describes well the regularities of relationships. Type of model for the three-year average data is shown in *figure 2*.

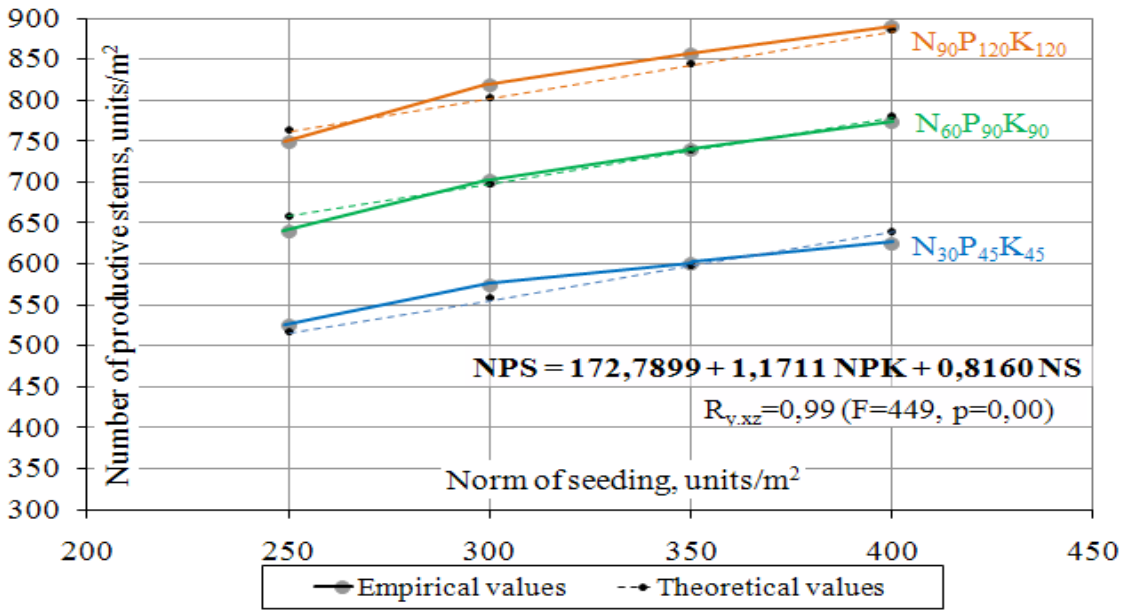

Fig. 2. Dependence of the number of productive stems of barley on the norms fertilization and seeding norms

The results justify the position that provided the same background of mineral nutrition can form yield of highly spring barley crops at different levels of each element of productivity. It is important to emphasize that changing of seeding rate provided 300, 350, 400 units/m^2 yield forms with varying degrees of implementation of a large mass of grains which determines brewing quality of grown products, but the level of grain yield, however, remains statistically the same.

The regularities of grain yield data by three building blocks when studying the factors influencing them – seeding norms and norms of fertilization is justified by established regression equation: P = -20,9998 + 0,0120 NPS + 0,4002 NGS + 0,2255 WLG.

Thus, the use of fertilizers and seeding norms allows for shown gradations to influence the grain yield of spring barley at different levels of implementation elements of yield according to the law of compensation, which is in the autoregulation of structural components.

Conclusions. It is shown capability of managing of implementation elements of grain yield when grown malting spring barley by the use of fertilizers and seeding norms. For the same backgrounds of mineral nutrition, seeding norms lead to changes in the number of productive stems per unit area of crop, number of grains spike and weight of large grains. Yield of grain at seeding norms 300, 350, 400 units/m^2 remains the same at seeding 250 units/m^2 reduces by only 6-7%.

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Анотація

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Особливості формування структури урожаю ярого ячменю

Показано закономірності управління елементами урожайності пивоварного ярого ячменю – кількістю продуктивних стебел, кількістю зерен колоса і масою крупної зернівки на основі застосування керованих факторів технології вирощування: норм застосування мінеральних добрив та норм висіву насіння.

Ключові слова: *ярий ячмінь, кількість продуктивних стебел, кількість зерен колоса, маса крупної зернівки, норми застосування мінеральних добрив, норми висіву насіння.*

Аннотация

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Особенности формирования структуры урожая ярового ячменя

Показана закономерность управления элементами урожайности пивоваренного ярового ячменя – количеством продуктивных стеблей, количеством зерен в колосе и массой крупной зерновки на основании использования технологических факторов выращивания: норм внесения минеральных удобрений и норм высева семян.

Ключевые слова: *яровой ячмень, количество продуктивных стеблей, количество зерен в колосе, масса крупной зерновки, нормы внесения минеральных удобрений, нормы высева семян.*