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CROP PRODUCTIVITY OF SPRING BARLEY VARIETY MONOMAKH UNDER THE INFLUENCE OF DIFFERENT SEEDING RATES AND FOLIAR ADDITIONAL FERTILIZING

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The results of the researches conducted during 2012-2014 on the experimental field of KhNAU named after V. V. Dokuchayev concerning the influence of application of different variants of seeding rates and crops foliar additional fertilizing with complex fertilizers and biological preparations on the variability of spring barley crop productivity variety Monomakh, selection of KhNAU named after V. V. Dokuchayev are given in the article.

The optimum seeding rate for the studied spring barley variety – 5.0 million/ha which provides the highest crop grain productivity formation was determined. The high efficiency of complex crops additional fertilizing was defined. In particular, the use of Crystalon special with biopreparation agro EM contributed to higher grain productivity compared with the control by 0.12 t / ha (5.2 %). During the conducted analysis the degree of connection between crops grain productivity and yield structure main elements was determined.

seeding rate, foliar fertilizers, biological preparations, spring barley, crop productivity, complex fertilizers, yield structural indices

Introduction. The formation of highly productive grain crops requires more than in other crops regulation of numerous factors that determine crop high biological and economic potential. This is due to the fact that during the growing season there is a growth and differentiation of vegetative and generative organs as well as the processes that determine not only the amount of produced substance, but also its distribution in the plant, in particular its accumulation in the organ that has the greatest economic value – grain. Therefore, crops productivity formation should be considered simultaneously with the factors that affect the index of overall biological productivity and its main part – crops grain productivity.

Previous publications analysis. Most scientists connect solution of the problem of highly productive crops formation primarily with the creation on the field spring barley stems of optimal density [1, 2]. The number of plants per crop area units is the basic foundation of crops formation. Plants are the biological means of production, coenotic interaction between plants largely depends upon their number which affects the implementation of all elements of the crops productivity structure. It is also necessary to pay attention to the technology perfection, one of the most important requirements of which are the capacity of approaching the number of plants per crop area units to the number of seeds sown. This allows strengthening of management efficiency of seeds sowing norms of agrophytocenoses set parameters. The more the number of plants is close to the set seeds sowing norms, the better the implementation of barley growing technology [3-5]. The scientific literature indicates: a necessary condition of highly productive crops is optimum number of plants per crop area units, evenly placed and equally developed [6].

Science and practice proved that one of the effective means to improve the implementation of barley biological potential and grain technological qualities is foliar nitrogen fertilization in the later phases of cereals development which eliminates nitrogen deficiency in the plant itself, not in the soil [7-9].

Microelements, especially boron, molybdenum, copper, zinc, iron, and manganese play an important role in improving the efficiency of plants mineral nutrition. Any plant cannot develop

normally at the absence of these elements because they are a part of the most important ferments, vitamins, hormones and other physiologically active substances. Microelements are involved in the processes of synthesis of proteins, carbohydrates, fats and vitamins. Under their influence there is an increase of pigments content in leaves, assimilative activity of the whole plant strengthens, the efficiency of photosynthesis increases; plant resistance against unfavourable conditions, disease affection and even pest damage grows. Plants tolerate micronutrient malnutrition much worse than their excess. Thus, the use of fertilizers with microelements is not only quantitative parameters of obtained yield, but its quality as well [10, 11].

Micronutrients application in the form of pure salts are unsuitable because they are poorly absorbed by plants, are toxic for plants in case of optimum application rate increase, in soil react with soil components and transform into inaccessible forms [12].

The use of chelate multi-compound substances in appropriate phases of growth and development enables not only quickly eliminate the deficit of certain types of macro-and micronutrients in plants, but also increase plants resistance to different stress factors.

The purpose of the researches was to determine the impact of seeding rates and various combinations of complex foliar additional fertilizing with chelate fertilizers and biological preparations on the realization of the biological potential of crops grain productivity of spring barley variety Monomakh, selection of KhNAU named after V. V. Dokuchayev taking into consideration the influence of abiotic factors.

Methods of the researches. To solve this problem fields experiments were conducted using split plots at the experimental field of KhNAU named after V. V. Dokuchayev during 2012-2014 using the widespread method [13]. In the experiment the plots of the first order were such variants of seeding rates as 4.0 million / ha; 4.5; 5.0 and 5.5 million / ha. The plots of the second order were such variants of crops foliar additional fertilizing with complex fertilizers and biological preparations: 1 – control (without additional fertilizing); 2 – Crystalon; 3 – Reakom; 4 – Crystalon + agro EM; 5 – Reakom + agro EM. The experiment was repeated for four times, the total number of accounted plots of the second order was 80 units. Accounted plot area is 20 m^2.

Agricultural machinery used in the experiment was wide spread for Eastern Forest Steppe region of Ukraine except the studied technology elements.

The soil of the experimental field was black soil (chernozem) typical, low humus, heavy loamy on calcareous loess and is characterized by the following agrochemical parameters: pH of salt extraction – 6,45-7,00; total humus content in the topsoil – 5.0%; P_2O_5 and K_2O contents – 102 mg and 179 mg per 1 kg of soil (by Chyrykov) appropriately.

The location of the researches has unstable moisture. The amount of annual precipitations according to the average long-term index is about 530 mm, from 250 mm in dry years to 800 mm in years with excessive rainfalls.

2012 and 2013 growing seasons were extremely dry (hydro thermal coefficient < 0.8), 2014 was sufficiently moistened (hydro thermal coefficient < 1.4). The precipitation distribution by months varied in a rather wide range. In 2012 and 2013 the amount of precipitations was accompanied by increased air temperatures that had an impact on the character of spring barley development and reduced the realization of their biological potential of crops grain productivity.

In general, the period during which the researches were conducted should be considered as typical for the region at all the meteorological parameters, with distinct unsteady moisture and temperatures indices fluctuations.

The results of the researches. All the studied variants of seeding rates provided significant changes of crops grain productivity of spring barley. Crops productivity indices for all seeding rates belonged to certain rank groups (Fig. 1). The highest crops grain productivity that differs significantly from other variants of the studied factor A (seeding rate) – 2.64 t/ha provided the seeding rate of 5.0 million/ha. Crops grain productivity gradually decreased with the increase of seeding rate. Thus, with the seeding rate increase from 4.0 to 4.5 million/ha crops grain productivity increased by 0.18 t/ha, with seeding rate increase from 4.5 to 5.0 million/ha crops grain productivity increased by 0.15 t/ha. Further seeding rate increase generally caused a significant decrease in crops grain productivity due to the sharp increase in competition between plants in crops.

The range of crops grain productivity fluctuation under the influence of factor B (foliar additional fertilizing) as compared to the seeding rate was significantly lower but at the same time the studied variants of foliar additional fertilizing also caused significant changes in crops grain productivity. Fluctuation of crops grain productivity under the influence of factor A was 14.0 % (from 2.31 to 2.64 t/ha), while under the influence of factor B it was 6.6 % (from 2.42 to 2.58 / ha).

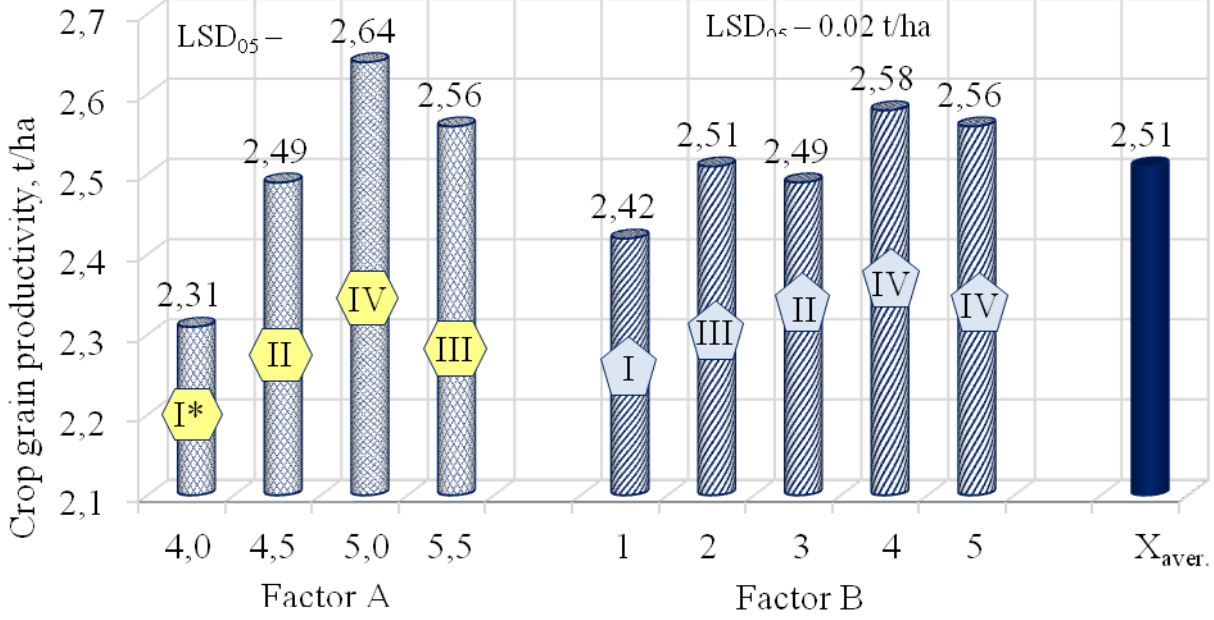
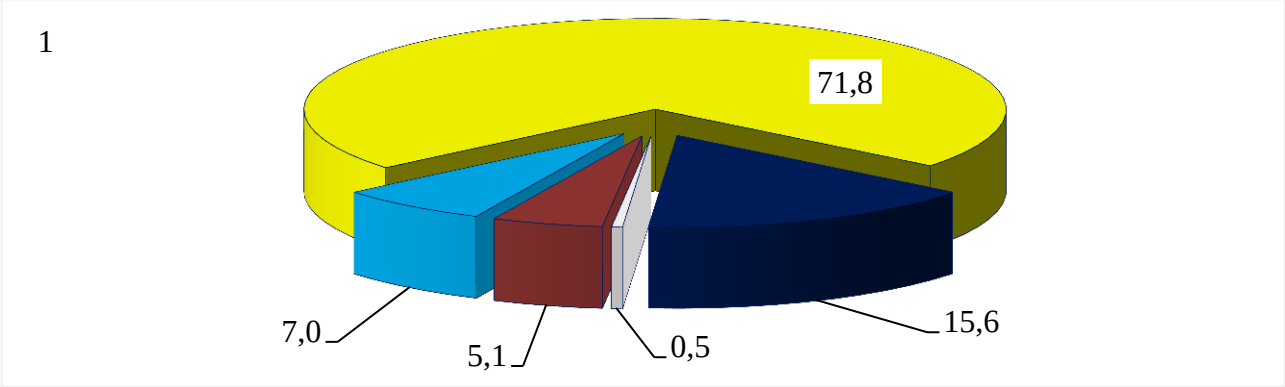


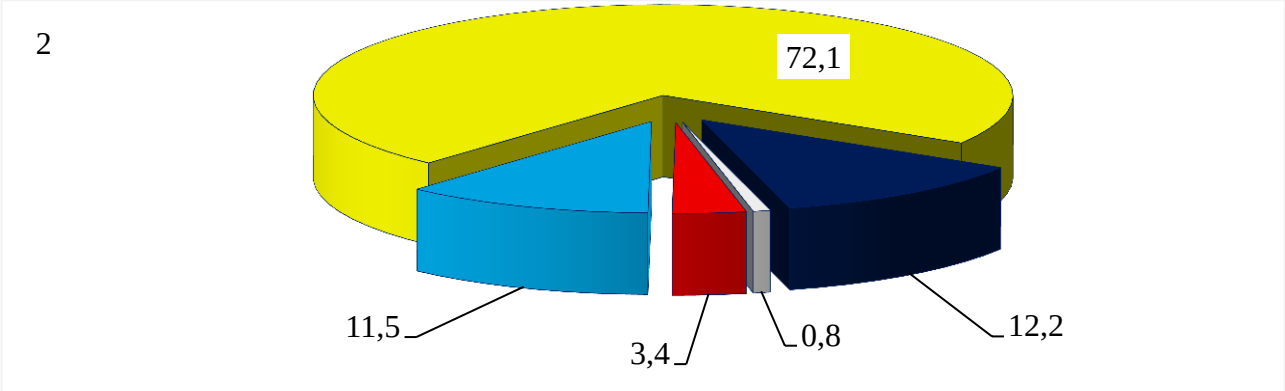
Figure 1. Crops grain productivity of spring barley variety Monomakh depending upon the seeding rates (factor A) and foliar additional fertilizing (factor B), t/ha. Average for the years 2012-2014. Symbols: * – rank groups: I – first; II – second; III – third; IV – fourth. Variants of foliar additional fertilizing: 1 – control; 2 – Crystalon; 3 – Reakom; 4 – Crystalon + agro EM; 5 – Reakom + agro EM; $X_{aver.}$ – the average crops grain productivity of the experiment.

The efficiency of foliar additional fertilizing increased with their complex using with biopreparation agro EM. On these variants crops grain productivity was significantly higher as compared to the other variants. Crops grain productivity indices on these variants (2.58 and 2.56 t/ha) belonged to the same rank group.

The seeding rate was the dominant source of variability of the studied index. Its share in the change of crops grain productivity was stable in 2012, 2013 and 2014 and it was 71.8 %, 72.1 and 77.8 % appropriately (Fig. 2). The share of foliar additional fertilizing in spring barley productivity variability was much smaller but significant. In 2012, 2013 and 2014 it was 15.6 %, 12.2 % and 14.6 % appropriately. According to the carried out analysis there is a tendency of increasing seeding rates role on condition the weather optimization during spring barley growing season. The significant influence of interaction of studied factors on the variability of spring barley productivity was not set any year. These indices were 0.5 – 1.0 %.

One of the tasks of the conducted experiments was to determine the nature of the connection between crops grain productivity and the main elements of the harvest. For the years of studies a similar regularity of close connection between crops grain productivity and the main elements of the harvest has been observed. In particular, crops grain productivity during all the years of the researches had direct close connection with the number of plants and shoots per unit area, plant length, grain weight per 1 m^2 of main and lateral shoots, as well as with the mass of straw per crops area unit (Figure 3) .





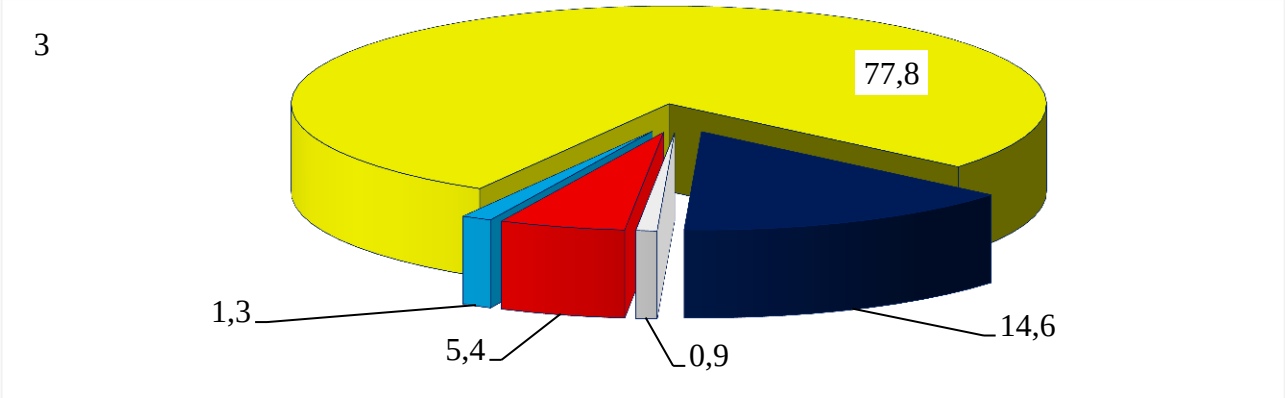


Figure 2. The contributions of the researched factors in the variability of spring barley crop productivity for the years of the researches, %. Symbols: – Factor A (seeding rate); – Factor B (foliar fertilizing); – AB interaction; – repetition; – errors. The year of the researches: 1 – 2012, 2 – 2013, 3 – 2014.

Feedback average strength in all the years of the researches between crops grain productivity and the number of productive spikes in the ear is naturally explained by the fact that the pairs in the analyses were compared using the seeding rate factor as well. This may also justify the feedback between plant productivity and ear length of the main plants shoot: with the increase of seeding rate to a certain degree crops grain productivity in general increases due to a larger number of productive shoots per crops area units, and the length of the ear gradually decreases due to increased coenotic tension among plants in crops.

On average for the years of the researches it was determined weak feedback between crops grain productivity and 1000 grain weight (r = - 0,357), as well as with grain weight from an ear of the main shoot (r = - 0,344). The connection between crops grain productivity and grain weight from a sheaf of the main shoots was closest (r = 0,978).

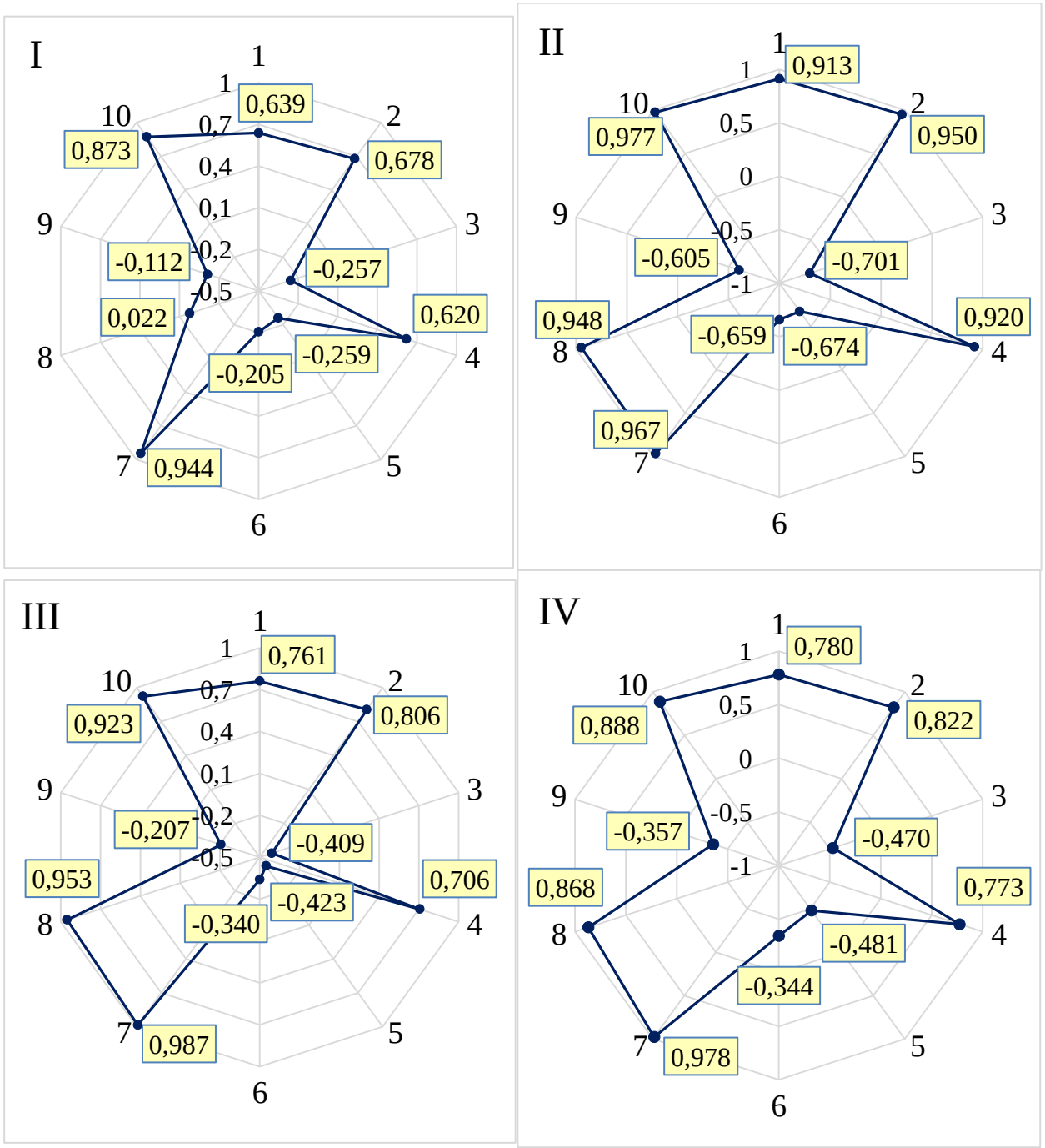


Figure. 3. The degree of connections (correlative connection) between crops grain productivity of spring barley variety Monomakh and their main biometric indices.

Conventional abbreviation:
1 – number of plants, pieces/m^2;
2 – total number of shoots, pieces/m^2;
3 – the number of productive spikes in the ear, pieces;
4 – plant height, cm;
5 – ear length, cm;
6 – grain weight from an ear of the main shoot, g;
7 – grain weight from the sheaf (main shoots), g/m^2;
8 – grain weight from the sheaf (lateral shoots), g/m^2;
9 – mass of 1000 seeds, g;
10 – weight of straw from the sheaf, g/m^2.
Years of the researches: I – 2012, II – 2013, III – 2014, IV – the average for 2012-2014.

Conclusions. The high efficiency of application of spring barley complex fertilizing with Crystalon special and biopreparation agro EM was established. Crops grain productivity on this variant was 5.0% higher as compared to the control. Seeding rate was the most significant factor on the variability of crops grain productivity during all the years of the researches. The optimum seeding rate for the researched variety of spring barley was 5.0 million / ha. Crops grain productivity increase at this seeding rate was over 14.0% as compared to the control.

Crops grain productivity has different strength connections with the structural elements within the studied variants among which the connection between grain weight of main and lateral shoots per crops area unit is more powerful.

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УРОЖАЙНІСТЬ ЯЧМЕНЮ ЯРОГО СОРТУ МОНОМАХ ЗА ВПЛИВУ НОРМ ВИСІВУ ТА ПОЗАКОРЕНЕВИХ ПІДЖИВЛЕНЬ

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норма висіву, позакореневі підживлення, біопрепарати, ячмінь ярий, урожайність, комплексні добрива, структурні показники врожаю

У статті наведено результати досліджень, проведених впродовж 2012-2014 рр. на дослідному полі ХНАУ ім. В. В. Докучаєва стосовно впливу застосування різних варіантів норм висіву та позакореневих підживлень посівів комплексними добривами і біопрепаратами на варіабельність урожайності рослин ячменю ярого сорту Мономах селекції ХНАУ ім. В. В. Докучаєва.

Визначено оптимальну норму висіву для досліджуваного сорту ячменю ярого – 5,0 млн /га, яка забезпечує формування найвищої урожайності зерна. Встановлено високу ефективність комплексних підживлень посівів. Зокрема застосування кристалону спеціального разом із біопрепаратом агро ЕМ сприяло підвищенню врожайності зерна порівняно з контрольним варіантом на 0,12 т/га (5,2 %). У ході проведеного аналізу визначено ступінь зв’язків урожайності зерна з основними складовими структури врожаю.

УРОЖАЙНОСТЬ ЯЧМЕНЯ ЯРОВОГО СОРТА МОНОМАХ В ЗАВИСИМОСТИ ОТ НОРМЫ ВЫСЕВА И ВНЕКОРНЕВЫХ ПОДКОРМОК

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норма высева, внекорневые подкормки, биопрепараты, яровой ячмень, урожайность, комплексные удобрения, структурные показатели урожая

В статье представлены результаты исследований, проведенных на протяжении 2012-2014 гг. на опытном поле ХНАУ им. В. В. Докучаева в которых изучается влияние применения различных вариантов норм высева и внекорневых подкормок посевов комплексными удобрениями и биопрепаратами на вариабельность урожайности растений ячменя ярового сорта Мономах селекции ХНАУ.

Установлена оптимальная норма высева для исследуемого сорта ячменя ярового – 5,0 млн /га, которая обеспечивает формирование наибольшей урожайности зерна. Отмечена высокая эффективность комплексных подкормок посевов. В частности, применение кристалона специального совместно с биопрепаратом агро ЭМ обеспечивало повышение урожайности зерна по сравнению с контрольным вариантом на 0,12 т/га (5,2 %). В ходе проведеного анализа определена степень связей урожайности зерна с основными составляющими структуры урожая.

YIELD CAPACITY OF THE SPRING BARLEY VARIETY MONOMAKH, DEPENDING ON SEEDING RATES AND FOLIAR FEEDING

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seeding rate, foliar feeding, biopreparations, spring barley, yield capacity, complex fertilizers, structural indices of harvest

The article presents the results of studies conducted in an experimental field of the Kharkiv National Agrarian University nd. a V.V. Dokuchayev over the period of 2012-2014, which examined the impact of different seeding rates and foliar feeding of crops with complex fertilizers and biopreparations on the variability of spring barley plant yield capacity in the variety Monomakh bred by the Kharkiv National Agrarian University.

The optimum seeding rate for the test spring barley variety was established: 5.0 million / ha, which ensures the highest grain yield. High efficiency of complex fertilization of crops was observed. In particular, application of *Crystallon Special* combined with the biopreparation *AGRO-EM* increased grain yield compared to the control by 0.12 t / ha (5.2%). The performed analysis defined the extent of relationship between grain yield and core components of the harvest structure.