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## **DEPENDENCE OF EXTRACTIVE ABILITY OF BREWING BARLEY ON FOLIAR TOP DRESSING OF PLANTS BY MICRO-FERTILIZER**

**The purpose.** To study effect of foliar top dressing of plants by micro-fertilizer «Nutrivant Plus brewing barley» on biochemical quality of grain of spring brewing barley on extractive index. **Methods.** Laboratory, statistical. **Results.** Dependence of extractive ability of spring brewing barley on foliar top dressing with micro-fertilizer «Nutrivant Plus brewing barley» on different backgrounds of mineral supplement is shown. **Conclusions.** Dose of micro-fertilizer «Nutrivant Plus brewing barley» at foliar top dressing of plants depends on mineral supplement. Strong correlative dependence of extractive ability on mineral supplements and dose of micro-fertilizer is fixed at foliar top dressing of plants of spring barley.

**Key words:** spring brewing barley, extractive ability, foliar top dressing, micro-fertilizer

Introduction. Extraction is one of the most important indicators of the quality of the brewing bar [1-4]. In Western European countries, it has the largest share in the integrated assessment system. The indicator depends on the amount of extract that goes into solution and is a power source that is essential for livelihoods, and accordingly, an active metabolism of beer yeast. The technological process of fermentation that is involved in brewing largely depends not only on the amount of the extract, but also on its quality. After the fermentation processes, the extract contains: glucose (provides initial fermentation), maltose (carbohydrate of the main fermentation), maltotriose (sugar digestion). Dextrins, proteins, gum-powders, pentoses, minerals are part of a non-fermentable extract group. These substances are needed to

ensure the biological activity of yeast. In particular, for the synthesis of protein, yeast proliferation, zinc is of great physiological value, because in its absence, the proliferation of yeast is slowed down, so-called friable fermentation occurs. Technologists are interested in getting zinc into the wort in a sufficient quantity from barley malt. It is known that only one fifth of the amount of zinc contained in the malt passes into the solution. If its in a wort is less than 0.10 - 0.15 mg / l, during fermentation there are problems that are solved through appropriate additional technological measures. However, these measures in most European countries are prohibited by the law on the purity of brewing. The conducted researches show that under the condition of high grain yield of barley menu, extractivity as a quality indicator decreases. Accordingly, in technological planning it is necessary to apply additional agrotechnical measures. Analysis of recent research and publications. Optimum plant nutrition is an important condition for obtaining high grain yield and its quality. It is known that for normal development of plants, not only nitrogen, phosphorus, potassium, but also trace elements that are involved in all physiological processes of growth and development of plants are required, as well as increase the efficiency of many enzymes and improve the assimilation of plant nutrients from the soil - that one. As a rule, most of the trace elements are catalysts that activate biochemical reactions and affect their orientation. In this regard, the trace elements can not be replaced by any other substances, their lack of influence negatively on the growth and development of plants [5]. VV Likhohvv believes that the lack of a few grams of one of the necessary trace elements may restrict the assimilation of other elements of life and stop further growth of yield even at high NPK backgrounds. At high rates of application of NPK, the rate and duration of micronutrient application increases dramatically. The trace elements can not be replaced by other nutrients [6]. Boron is an important trace element for the growth and development of many agricultural crops. Unlike other trace elements, boron is not part of enzymes, but it affects a significant amount of physiological and biochemical processes [7]. It has been established that in the background of high doses of phosphate

fertilizers, the need for plants in the bore increases. To ensure a high yield of grain from barley and its quality, phosphorus is introduced at least 60 - 90 kg / ha of the active substance and always more than nitrogen. Hence, the need for additional application of boron in the cultivation of barley. In relation to brewer's barley, the quality of grown produce is always relevant. It is known that all the components that provide the consumer value of beer are present in it only when the optimum conditions for the metabolism of yeast cells are created in the technology of its production. The quality of beer depends to a large extent on bioremediation - yeast, namely, on the metabolism of these microorganisms. Accordingly, the concern of the brewer is that, in the wort, which is the aqueous solution of the extracted substances from the malt, there must be a sufficient number of components that provide an effective functional function of the yeast: amino acids - necessary for the formation of the cells of the cells; phosphates - for the formation of ATP; fatty acids - for cellular membranes; sugars - for spare carbohydrates; salts, micronutrients - in particular zinc, which affects the synthesis of protein by yeast. These substances are extracted from the malt made from the barley menu.

Therefore, the task of brewing barley technology is to ensure both the high yield of grain and the required quality of the cultivated produce. Accordingly, the metabolism of yeast depends to a large extent on the minerals and some metal ions, which also include sulfur, potassium, sodium, magnesium, calcium, iron, manganese.

As brewing barley production in Ukraine is concentrated mainly on black currant and podzolized in the western forest-steppe zone, the problem of zinc deficiency, as a rule, manifests itself in providing the needs of yeast in it during fermentation. Two conditions are often attributed to this: insufficient content of mobile zinc in chernozems (0.2 mg / kg of soil) and a high level of grain yield of barley - more than 5 t / ha. An important role in the metabolism of yeast is given to potassium. It contributes to the improvement of all enzymatic transformations associated with ATP. Also important role of potassium is given to pH-regulation, which is associated with the exchange of hydrogen ions on potassium ions (ion pump) [8, 9]. Consequently,

application in brewing barley production technology in the case of frozen nourishment of plants in good crops, Nutrivant Plus Brew barley, should contribute to its brewing quality. The purpose of the research is to investigate the effect of the extra-root nutrition of plants with nitrogen fertilizer "Nutrivant Plus Brewer's Barley" on the biochemical quality of grains of brewer's barley on the basis of the extractivity. Research methodology. Scheme of experiment: factor A - norms of mineral fertilizers, variants -  $N_0P_0K_0$  (without fertilizers),  $N_{30}P_{45}K_{45}$ ,  $N_{60}P_{90}K_{90}$  (backgrounds of mineral nutrition); Factor B - norms of application of the microindustry "Nutrivant Plus Brewer's Barley" for three times holding of foliar fertilization of plants during the period of active vegetation, kg / ha of physical weight. The first post-root nutrition of plants is the beginning of the shrub phase, stage II of organogenesis; the second is the onset of the phenophase output into the tube, the IV stage of organogenesis, the transition of plants from the vegetative to the generative period of development; the third is the beginning of flowering, the VII stage of organogenesis.

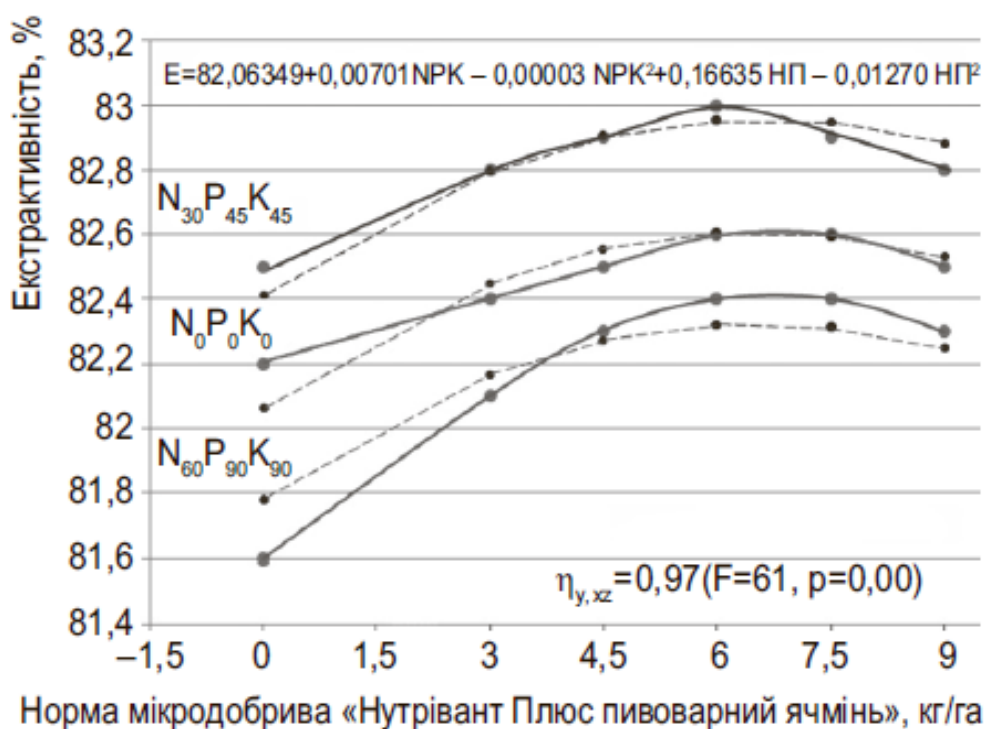
**Залежність екстрактивності ячменю від впливу позакореневого підживлення рослин мікродобривом «Нутривант Плюс пивоварний ячмінь», % (середнє за 2007–2009 рр.)**

Фон мінерального живлення	3-разове позакореневе підживлення мікродобривом «Нутривант Плюс пивоварний ячмінь», норма добрив, кг/га					
	0	3,0	4,5	6,0	7,5	9,0
$N_0P_0K_0$	82,2	82,4	82,5	82,6	82,6	82,5
$N_{30}P_{45}K_{45}$	82,5	82,8	82,9	83,0	82,9	82,8
$N_{60}P_{90}K_{90}$	81,6	82,1	82,3	82,4	82,4	82,3

Options: 1 st - control (without extra-root feeding of plants); 2nd - norm of microfertilizer use 3 kg / ha (1 kg + 1 kg + 1 kg); 3rd - 4.5 kg / ha (1.5 kg + 1.5 kg + 1.5 kg); 4th - 6 kg / ha (2 kg + 2 kg + 2 kg); 5th - 7.5 kg / ha (2.5 kg

+ 2.5 kg + 2.5 kg); 6 th - 9 kg / ha (3 kg + 3 kg + 3 kg). Microfertilizer "Nutrivant Plus Brewer's Barley" contains: water-soluble phosphorus ( $P_2O_5$ ) - 23%; potassium ( $K_2O$ ) - 42%; boron (B) - 0.1%; zinc (Zn) - 0.5%; acidity pH of 1% solution - 4,1 - 4,2; is well soluble in water at  $t = 20^\circ C$ . The outer view is yellowish-white small crystals. The object of the research is the plants of barley of the spring type Sebastian of Czech selection. Research results. The obtained results of microfertilizer application indicate the dependence of extracurricular activity on the main fertilization (table). To perform an analysis of the effect of the effect of foliar nutrition, a 2-factor statistical calculation was used, which makes it possible to determine the dependence of optimization on the background of the nutritional feed. These tables show that in the variant without application of mineral fertilizers  $N_0P_0K_0$  the norm of the microdriver 6.0 is effective; 7.5 kg / ha. It is known that, against the backdrop of mineral nutrition,  $N_{30}P_{45}K_{45}$  crops are formed under a somewhat homogeneous development of shoots, respectively, of vertical tier, which contributes to the improvement of the quality of cultivated products. However, the grain yield level of the mineral  $N_{30}P_{45}K_{45}$  is much higher compared to the NPK. Accordingly, the need to apply the technology of foliar feeding, thus has a logical justification. Without extracorporeal feeding extraction was 82.5%. According to the norm "Nutrivant Plus Brewer's Barley" 3 kg / ha extraction rate reached an average of 82.8% over 3 years. The amount of micronutrient fertilizer for single use at 1.5 kg / ha at a 3-time application (the general rate was 4.5 kg / ha) contributed to an increase in extractivity to 82.9%. In the case of further increase of fertilizer rates up to 6 kg / hectare extractivity will increase to 83%. Feeding plants at the rates of 7.5 and 9.0 kg / ha caused a decrease in the yield of malt extract made from such barley. As regards the  $N_{60}P_{90}K_{90}$  norm, ensuring higher yields of grain at a high background leads to a reduction in the extractive properties of barley [10]. According to the results, the expediency of foliar fertilization with "Nutrivant Plus Brewer's Barley" is obvious. Without application of the investigated technological measure, the extraction rate was 81.6%. For 3 times feeding at a rate of 1 kg / ha "Nutrivanta plus brewer's barley", the rate

was 82.1%. The application rate of 4.5 kg / ha contributed to an increase in extractivity to 82.3%, and microfertilizer rates of 6.0 and 7.5 kg / ha for 3 times non-root plant growth provided a solution to the optimization problem. Increasing the fertilizer rate for 3 times using up to 3 kg / ha each time resulted in a reduction in the yield of extracts, where the value was set at 82.3%.



**Екстрактивність ячменю залежно від впливу позакореневого підживлення рослин «Нутривант Плюс пивоварний ячмінь»**

The obtained results are statistically substantiated (figure). The plural correlation dependence of extraction from the background of mineral nutrition and the norms of microfertilizer "Nutrivant Plus Brewer's Barley" for non-root nutrition of plants has been established, the correlation coefficient  $\eta_{y,xz} = 0,97$ . The form of connection is described by the regression equation  $E = 82,06349 + 0,00701 NPK - 0,00003 NPK^2 + 0,16635 NP - 0,01270 NP^2$ . The

reliability of the equation is high. Rejection of theoretical data from empirical limits within tolerable errors.

## Conclusions

The norm for the use of microfertilizer "Nutrivant Plus Brewer's Barley" in the case of endocrine fertilization of plants depends on the background of mineral nutrition. In variant  $N_{30}P_{45}K_{45}$  optimum expenses of micronutrient fertilizers in the total amount for 3-fold use during vegetation of plants is 6 kg / ha, for each application 2 kg / ha. Under such an NPK background, the extraction rate is 83%, which corresponds to the regulatory requirements of high quality brewer's barley. On the background of the mineral nutrition  $N_{60}P_{90}K_{90}$  for the 3-time application of micronutrients, the total norms 2 + 2 + 2 kg and 2.5 + 2.5 + 2.5 kg (6.0 and 7.5 kg) per hectare are unequivocal. which results in an extraction of 82.4% of both options. The obtained regression equation and the constructed graphs describe the curvilinear form of the dependence of extraction on the factor of influence, the norms of application of the micronutrient fertilizer "Nutrivant Plus Brewer's Barley".

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