ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Disease Development And Yield Of Barley On Different Levels Of Mineral Nutrition.

VV Kosheliaev*, IP Kosheliaeva, and AA Volodkin.

Federal State Budget Educational Establishment of Higher Education, Penza State Agrarian University 30, Botanicheskaya St, Penza, Russian Federation, 440014.

ABSTRACT

Improvement in barley nutrition conditions increases the immune properties of plants, thereby inducing changes in the metabolism of the susceptible host to the pathogen unfavorable side. The higher resistance of plants to diseases and yield is manifested in agrophytocenosis against the background of a one-time application of mineral fertilizers in a dose of active substance N45P2O550 kg / ha. The change in the conditions of plant nutrition leads to a decrease in the development of brown rust in all varieties by 4.8 ... 6.2%, powdery mildew by 3.3 ... 7.8% and helminthosporium by 7.0 ... 20.4%. While estimating the manifestation of diseases on varieties of barley, it is noted that the variety Rakhat is destroyed by brown rust stronger than others. Volgar variety was destroyed by Septoria spot, helminthosporium and powdery mildew less than others in the fertilized background. When using fertilizers for barley seeds sowing it is important to create optimal nutrition conditions in order to form high yield of corresponding sowing quality. The highest yield in all varieties was formed in the variant with the use of additional mineral nutrition in the amount of N45P2O550 kg of active substance per hectare.

Keywords: mineral nutrition, barley, diseases, yield, agrophytocenosis.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Optimization of phytosanitary background in the conditions of ecological crop farming is getting more important nowadays. Stable varieties, seeds with high sowing properties, crop rotation, rational ways of soil treatment, optimal sowing time and rate, justified application of phosphate and potassium fertilizers, microelements, polymicrofertilizers can be successfully used against all soil epiphytotiological, airborne and transmissible groups of infections [1, 4 ,8, 9, 10,12,14,15].

The combination and practical use of pre-planned phytosanitary, agrobiological and technological optimal parameters allows effective management of agroecosystems with the purpose to improve the soil, seeds and crops, thus increasing the realization of potential yields of zoned varieties up to 72 ... 80% without using pesticides or minimal level of their use. In recent years, with the development of the brewing industry, much attention has been paid to the phytosanitary condition of the sowing of brewing barley. Requirement for the prepared primary produce are getting higher each year. The seed is required to be not only low-grained and low-protein with high extractivity, but also without high presence of fungal disease sporules in grain mass, as it leads to the change in grain color which is an important value during preparation.

Main pathogens inducing browning of barley grain during the development and storage are Helminthosporium sativum, Fusarium culmorum, Fusarium graminearum and varieties from Alternaria genus. With a strong development of the disease caused by fungi of the Alternaria genus, darkening passes to the seed bud and causes weak germination, a defect in the growth of the seed bud and total absence of root growth, thus reducing the quality of seeds [7,16,17].

When barley is cultivated, various agrotechnical methods are used that form different microclimate and the conditions of plant nutrition in the agrophytocenosis, this can contribute either to the manifestation of diseases, or to the increase of the immune properties of plants. That is why during the development of barley varieties cultivation methods it is important to know their reaction on manifestation of the most harmful diseases and yield, depending on the background of cultivation [3,5,18].

OBJECTS AND METHODS OF RESEARCH

The research was conducted on the fields of OOO NPP Innauchagrotsentr in 2014-2016. Meteorological conditions during the vegetation period were mainly favorable for the growth and development of barley.

Soil covering is represented by leached medium-humic medium-deep clay loam black soil. Humus content in plow layer is 6,5... 6,8%, content of easily hydrolyzable nitrogen is 125... 130 mg/kg of soil, content of labile phosphorus is 75...82 mg, content of exchangeable potassium is 165…187 mg/kg of soil, the reaction of the soil solution is weakly acidic (pH sol-5.3), hydrolytic acidity - 3.65 meq. per 100 g of soil, the sum of the absorbed bases is 37.0 meq. per 100 g of soil.

Experimental design: factor A: barley variants Nutans 642, Kharkovskii 99, Rakhat, Volgar; factor B: level of applied fertilizers: 1. Control variant (without fertilizers) 2. $N_{45}P_2O_550$ (nitrogen was applied before the sowing, phosphorus was applied during the sowing); 3: N_{30}+15 P_2O_550 (nitrogen in dosage of 30 kg of active substance was applied before the sowing and 15 kg during the phase of 3-4 leafs, phosphorus was applied during the sowing). Fertilizers were applied in the form of ready soluble salts of ammonium nitrate and superphosphate. The experiment was repeated 3 times, recorded area of working plot is 56 m^2.

RESULTS

Different level of mineral nutrition and methods of fertilizers application had a significant effect on the ratio of disease spread in agrophytocenosis. The change in the ration of healthy plants and plants affected by leaf disease to some extent depends on the weather conditions during the barley vegetation period (fig. 1).

ISSN: 0975-8585

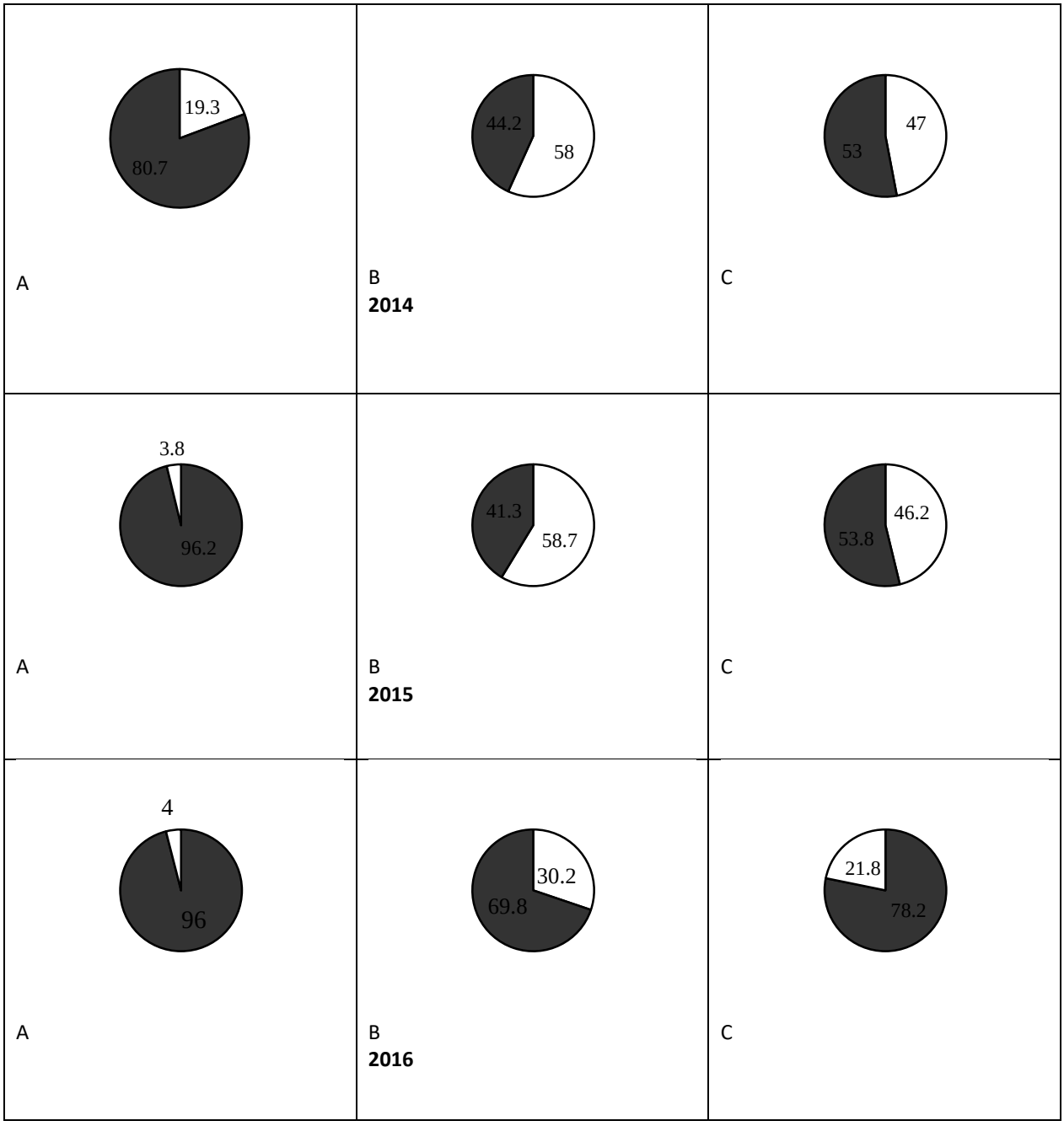

Fig 1 – Share of healthy and affected by the disease plants in agrophytocenosis in different cultivation backgrounds

Thus, in 2014, the share of healthy plants in sowing was quite high without the introduction of mineral fertilizers, and made up 19.3%, and in 2015 and 2016 this indicator significantly decreased to 3.8 and 4.0%, respectively. Analyzing the ratios of diseased and healthy plants in sowing with the use of fertilizers, it is also clear that if in 2014 and 2015 the share of plants without signs of aerogenic damage was approximately the same (55.8 ... 58.7%, 47, 0 ... 46.2%, respectively, in terms of backgrounds), then in 2016 their share dropped significantly (30.2 ... 21.8%).

Comparing the ratios of healthy and diseased plants depending on the methods of applying mineral fertilizers, it can be stated that over the years of research with the one-time application of N45 $P_2O_5$50 in the agrophytocenosis of barley, more favorable conditions for the growth and development of plants establish. This helps to increase the resistance of plants to diseases.

Together with the increase of resistance to diseases in agrophytocenosis and at the improvement of the plants nutrition, intensity of disease development also changes. Thus, in average among varieties, the development of powdery mildew on the plants in 2014 and 2015 without application of mineral fertilizers made up 15.3 and 16.5%, after one-time application (N45$P_2O_5$50) and divided (N30+15$P_2O_5$50) application of mineral fertilizers the disease development decreased by 3.3…6.1% in 2014 and by 5.6…7.8% in 2015.

Development of Septoria spot on the barley plants in 2014 and 2015 was not significant, nonetheless, the tendency of disease development decrease was noted after application of mineral fertilizers. The effect of fertilizers on the manifestation of this disease in 2016 was more noticeable. Thus, if the development of the disease without application of fertilizers made up 20.3% in average for varieties, then after application of N45$P_2O_5$50 and N30+15$P_2O_5$50 the disease development decreased up to 10.9 and 4.8% respectively.

The high level of plants damaged by helminthosporium in all varieties was recorded in all years. At the same time, on the background of fertilizers application, there was also a decrease in the development of this disease - by 10.8 and 9.6% in 2014; by 20.4 and 17.0% in 2015; by 8.6 and 7.0% in 2016.

T he change in nutrition conditions of the plants contributed to the manifestation of brown rust development in different stages. The improvement of conditions led to the decrease of disease development in average for all varieties by 4.8…6.2%.

When assessing the manifestation of diseases on barley varieties, it should be noted that Rakhat variety is damaged with brown rust stronger than others. Volgar variety on fertilized backgrounds was less affected by Septoria spot, helminthosporium and powdery mildew.

When using fertilizers for grain sowing of barley it is important to create optimal nutrition conditions in order to form high yield of required sowing quality.

The highest yield in all sorts of brewing barley on the background of mineral nutrition, was formed in 2016. In the same year Kharkovskii variety formed the maximum yield of grain 4.8 t/ha on the variant with fertilizers application in the following amount: nitrogen – 45 kg of the active substance per hectare, applied before the sowing, and 50 kg of phosphorus during the sowing. Nutans 642 and Rakhat demonstrated lower yield – 4.7 t/ha and the lowest yield was recorded in Volgar variety – 4.5 t/ha (table).

Taking into account that the weather conditions of the year were characterized by moderate moistening, it can be concluded that this year the most productive potential of varieties, especially the late-ripening variety Rakhat, was most fully realized on a variant with application of fertilizers in a dose of N45$P_2O_5$50.

Table – Yield of barley varieties depending on the level of mineral nutrition

Year	Level of mineral nutrition	Varieties			
		Nutans 642	Kharkovskii 99	Rakhat	Volgar
2014	Without fertilizers	3.9	4.0	2.8	3.9
	N45 $P_2O_5$50	4.4	4.4	3.4	4.3
	N30+15 $P_2O_5$50	4.3	4.2	3.3	4.1
Average for year		4.2	4.2	3.1	4.1
2015	Without fertilizers	2.8	2.8	2.3	2.9
	N45 $P_2O_5$50	4.2	4.4	3.3	4.2
	N30+15 $P_2O_5$50	4.0	3.9	3.3	4.0
Average for year		3.7	3.7	3.0	3.7
2016	Without fertilizers	4.1	4.3	4.1	4.2
	N45 $P_2O_5$50	4.7	4.8	4.7	4.5

	N30+15 $P_2O_5$50	4.2	4.2	4.4	4.1
Average for year		4.3	4.4	4.4	4.2

HCP_{05} of backgrounds in 2014 – 0.12 t/ha, in 2015 – 0.19 t/ha, in 2016 – 0.08 t/ha
HCP_{05} of varieties in 2014 – 0.14 t/ha, in 2015 – 0.09 t/ha, in 2016 – 0.09 t/ha
HCP_{05} of interaction in 2014 – 0.07 t/ha, in 2015 – 0.05 t/ha, in 2016 – 0.04 t/ha

The lowest yield in all varieties was noted in the unfavorable for water availability 2015. As well as in 2016, the highest yield was formed by Kharkiv 99 (4.4 t/ha) in variant N45 $P_2O_5$50. It should be noted that Nutans 642 and Volgar varieties were characterized by the same yield (4.2 t/ha), while Rakhat variety was significantly inferior in yield to all varieties (3.3 t/ha).

In terms of brewing barley productivity level the year 2014 took an intermediate position. Yield of studied grains in this year formed in the following way: the highest yield was formed by Nutans 642 and Kharkovskii 99 at growing on the fertilized background N45$P_2O_5$50 and it made up 4.4 t/ha, the lowest yield was formed by Rakhat variety on the variant without fertilizers (2.8 t/ha).

When analyzing the average yield, which developed during the years of study in 2014-2016, it can be seen that the higher productivity in all varieties was formed on the variant with the use of additional mineral nutrition in the amount of N45$P_2O_5$50 kg of active substance per hectare. So, for example, in 2014, it made up 4.1 tons per hectare on the variant N45$P_2O_5$50, which is 0.2 and 0.4 t / ha higher, respectively, than in variants with divided application of nitrogen in a dose of N30+15$P_2O_5$50 and without the use of fertilizers.

CONCLUSION

Thus, the improvement of barley nutrition conditions increases immune features of the plants, thereby inducing changes in the metabolism of the susceptible host to the side unfavorable to the pathogen. Higher resistance of plants to diseases and yield are manifested in agrophytocenosis on the background of one-time application of mineral fertilizers in the dosage of active substance N45 $P_2O_5$50 kg/ha.

REFERENCES

[1] Burlaka, G.A. Effect of agrotechnical methods on the wheat spike whiteness, caused by shield-backed bugs and root rot in forest-steppe of the Middle Volga region/ G.A. Burlaka, I.Sh. Shakurov// In collection: Issues of plants protection in Volga region. – Samara, 2002. P. 104-108.

[2] Vcherashnii M.B. Issues of brewing barley in Krasnoyarsk region and ways of solving them: author's abstract …Master of Agriculture. – Moscow, 1998. – 19 p.

[3] Glukhovtsev V.V. summer barley in the Middle Volga region (selection, agrotechnics, varieties)/ V.V. Glukhovtsev // Volga NII of selection and seedfarming. – Samara, 2014. – 151 p.

[4] Zamiatin S.A. Effect of minimal soil treatment on the phytosanitary condition of the barley sowing/ S.A. Zamiatin // Ways to solve the problems of increasing the adaptability, productivity and quality of grain and forage crops: materials of scientific and practical conference. – Samara, 2003. – P. 186-187.

[5] Kosheliaev V.V. Кошеляев, B.B. Scientific basis for the formation of the productivity of summer barley under the influence of techniques of cultivation in the forest-steppe of the Middle Volga region / V.V. Kosheliaev, G.A. Karpova. I.P. Kosheliaeva. – Penza: RIO PSAU 2013. – 218 p.

[6] Kosheliaeva I.P. Grounds of the technology of growing barley seeds of higher reproductions / I.P. Kosheliaeva // Niva Povolzhia. – 2009. No.3 – P. 49-53.

[7] Kosheliaeva I.P. Yield and seed quality of barley seeds at various levels of chemical protection of crops / I.P. Kosheliaeva // Niva Povolzhia. – 2012. –No. 1 (22). - P. 21-24.

[8] Lukhmenev V.P. Protection of crops from pests, diseases and weeds in the Southern Urals / V.P. Lukhmenev. – Orenburg: Publishing center OGAU, 2000. – 340 p.

[9] Mariin G.S. The role of greening the elements of plant protection in adaptive technologies of field cultures cultivation / G.S. Mariin, G.P. Martynova// Ways to solve the problems of increasing the adaptability, productivity and quality of grain and forage crops: materials of scientific and practical conference. – Samara, 2003. – P. 182-183.

[10] Mariina-Chermnykh O.G. Effect of fertilizers and protective equipment on the formation of the infectious potential of root rot / O.G. Mariina-Chermnykh, G.S. Mariina // Issues of plants protection in Volga region. – Samara 2002. – P. 39-41.
[11] Skorniakov N.N. Correspondence of indicator estimates in different links of the selection process of spring barley and choise of selection criteria: author's abstract …Master of Agriculture. - Moscow, 1998. - 17 p.
[12] Chulkina V.A. Results of the All-Union Meeting on the fundamentals of plant protection from diseases (20-23 of March, 1990, Novosibirsk) / V.A. Chulkina // Mycology and phytopathology, 1991. – Vol. 25. – No. 3. – P. 264-266.
[13] Chulkina V.A. Scientific and practical provision of plant protection on the threshold of XXI century/ V.A. Chulkina, E.Yu. Toropova // Agro XXI, 2000. – No. 6. – P.
[14] Chulkina V.A. Ways of plants protection development. / V.A. Chulkina, E.Yu. Toropova// Protection and quarantine of plants, 2001. – No. 10. – P. 24.
[15] Chulkina V.A. Agricultural ecosystem in plants protection/ V.A, Chulkina, Yu. I. Chulkin. – Novosibirsk, 1995. – 202 p.
[16] Basson, A.B.K. Effekt of black ends on gualitj characteristics of clipper barlej and malt / A.B. Basson, O.T. Villiers, C.J.Rabie // J. Am. Sos. Brew. Chem, 1990. – № 48. – P. 8-13.
[17] Johnston, R. Compedium of Barlej Diseases / R. Johnston // Universitj Boremam, Montana, 1997. – P. 53-55.
[18] Romani M. Intergenotypic competition and border effect in bread wheat and barley / M. Romani, B. Borghi, R Alberici, G. Delogu, J. Hesselbach, F. Salamini // Euphytica. 1993. - v. 69. - №1-2. – P. 19-31.