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THE EFFECT OF PHYSIOLOGICAL ACTIVE SUBSTANCES ON FUNGAL DISEASES OF WHEAT

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ABSTRACT
In this work data of field researches of influence of growth regulators on contamination of winter wheat plants are presented
KEYWORDS: *rust, abiotic, brown, growth regulators, winter wheat, parasitic illnesses*

INTRODUCTION

The wheat in Central Asia is considered to be the main grain industrial culture. At the same time winter wheat has several phyto-pathogens, the development of which considerably limits the potential opportunities of modern sorts of intensive types. More harmful ones are yellow and brown rust, also Erysiphe graminis – dedicated obligatory parasites. Harm of rust and Erysiphe graminis can reach 15 – 25 %. On the background of intensive technologies of cultivation of winter wheat, their harmfulness strengthens and the lost of harvest can be increased to 5 – 10 % [1].

Brown rust decreases endurance of plants to the unfavorable stressful factors, brings to premature of die off the leaves and stopping photo-synthesis, decreasing of sustainability of adolescent sowings and lost of harvest [2].

Erysiphe graminis is enlarged on widely. Leaves of sick plants are covered with white Erysiphe graminis incursion of conidial soporiferous fungus, get yellow, and in hot affection, die. On powdery coating can appear black dotted formations – cleistothecium of pathogens (ascigerous stage) [3].

The rust in Central Asia is widely introduced on wild grasses, some of them are considered to be natural reservatum of pathogens for agricultural plants [4].

The chemical specimen is used against rust and erysiphe graminis. Though, having effective fungicidal properties, they can have unfavorable influence on the growth and development of cultural plants, especially on winter wheat. The chemical protection of plants – is source of serious pollution of agrarian-ecological system, water and food products. More constant, long and safe protective effect brings biologically active substances. They optimize the functional condition of plants, at the same time initiate high sustainability level to the pathogens and other unfavorable environmental factors [5, 6].

As per A.O. Marchenko [7], the main factor which manages implementation of morphogenetic potential of organism is phyto hormones. In certain correlations and concentrations they are responsible for expression "necessary" genes, and consequently for implementation of genetic programs of plants. It is obvious, that with the laps of time the list of regulators and phyto hormones are increased. This widens our opinions about how the hormonal system regulates ontogenesis of plants and how it participates in response of plants to different outer reactions.

As cleared, so many plant parasites, such as fungous, as well as bacterial origins use different phyto hormones, which actively synthesize for "Chemical attack" on host plant [8, 9, 10]. Pathogens in the process of complicated evolution, produced adjustment complexes in order to extract necessary substances from plant tissue. Although, introduction of infectious structures disturbs the integrity of plant organism. Obligatory parasitism in its appearance is analogical to abiotic stress which doesn't kill the plant, but makes mobilize all system to high activeness for reparation. Y. T. Dyakov [11] points to activation of stressed metabolite synthesis on first stages on pathogen introduction. The plant opposes to the introduction of pathogens regardless of virulence but when it is perceptive to pathogens, response reactions on contamination proceeds inertly and parasite manages to form infectious hyphae and give spawn.

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Introduction of pathogens arouses the sustainable plant cascade of protective reaction which results localization of infectious hearth and appearance of system acquired sustainability in plant organism. Its formation connects with production of signal molecules in infected tissues and their translocation to uninfected parts of plant where they induce protective reactions, which promotes the decrease of sustainability to secondary infections [12].

One of the signal inductors of introduction of pathogens is considered to be arachidonic acid which belongs to the content of cellular hypha phyto pathogenic fungus [13].

There are familiar several secondary metabolites which protects brand plants from unfavorable organisms for them. One of these bonds exists in healthy tissues; others appear in response to the infection. Reasonable parts of protective belong to phenol bonds [14]. Oxide cinnamic acids – n-oxide cinnamic (n-coumaric acid), caffeic, ferulic and sinapic – exists in the plants, in free as well as bonded type. They have influence on the process of growth, and their productivity – oxide cinnamic spirits – initial components in bio synthesis lignin [15]. Lignifications of cellular side creates mechanical border to penetration ob infections.

Silicon plays the important role in starting stages of infectious process. H. Kuno with co authors [16] with the help of X-Ray microanalyses have shown the accumulation of Silicon and calcium in papillas in sites of interrelations of barley epidermis and agent of erysiphe graminis. Being implemented in plant tissues, having system of absorption and metabolizing of Silicon, the rust considerably increases its absorption from soil solution. At the same time Silicon appears in contact with fungus in mesophile cellular, also in bordered zone between haustorium fungus and host cytoplasm [17].

At this point with target of exogenous growth regulations is called “withdrawal” of plant organism from hormonal pathogen influence, increase of general sustainability to abiotic stresses, mobilization of elicitors of plant immune, promoting prevention or weakening the infections, and inputting easy accessible Silicon lets the plant create mechanical border in oppose to infections fast.

MATERIALS AND METHODS

Minor allotment experience was experimented in weakly salinated soil in 2004-2014 years by the method of randomized repetitions, in four times replication. Overall area of allotment contained 7,2 m^2 (3,6 m x 2 m), discount area of allotment – 1 m^2. Predecessor of winter wheat in testing in 2004-2006 years was cotton plant of second year exploitation, in 2007-2009 years medicago of seventh year exploitation, in 2010-2014 cotton plant.

After cutting permanent grasses in experimental field and decortications of stubbles were implemented ploughing with plough with coulter. In the experiment background dose of nourishing elements were increased till N100 P60 K60, additional input into spring extra nutrition of azophoska compound (N13 P19 K19) and ammonium nitrate (N 34).

Sowing were conducted on September 25, 2004-2006, on September 30, 2007-2009, on October 4, 2010-2014. The norm of seeding was 4 million piece per hectare. The sort of winter wheat is Dustlik.

The treatment of winter wheat were conducted with specimen to the end phase of stooling – starting of stalk shooting, knapsack spraying in evening time, with medicine doses.

The specimens DKM-1, DAG-1, DAG-2, GK-Cu, GK-Zn were used in concentration of $1x10^{-6}$ mohl/l, concentration of sodium silicate – 5% (was chosen in the preliminary research process). Experimental allotment were sprayed with water.

The diagnostic of contamination of plants were conducted to the phase of lactic condition of wheat. With every replication of studying version were taken 100 plants, were researched three top leaves. In order to identify the contaminant with rust there were calculated quantity of pustules on cutting, recalculation were conducted on 1 cm^2 top of the leaf. The diagnostics of contamination of erysiphe graminis were conducted based on per cent scale [18].

Preliminary researches, conducted on allotments till specimen treatment, didn’t show the hearth of rust and erysiphe graminis. On the leaves which passed the winter were necrotic spots and browned epidermis. The ends of leaves were dry, with visible spots of snow mold. On newly grown leaves were insignificant damages by leave flea and thrips. The pustules of brown rust and incursion of erysiphe graminis were diagnosed to the phase of starting of stalk shooting in all allotments, but level of contamination remained in low level.

RESULTS AND DISCUSSIONS

H. Massel [19] and Y. B. Konovalov together with co authors [20] recommended conducting the selection not for sustainability to pathogen contamination but for tolerance to diseases, i.e. ability to keep the harvest in high level in epiphytic years.

The following strategy is identical to the usage of economical threshold of contaminant, instead of expensive removal treatment. Regulators of growth in most situations do not have fungicidal, but fungi static activeness. They do not provide sustainability to the pathogen, but promotes decrease of disease contaminant to safe level.

The treatment with specimen was conducted till advancements of third leaf from the ear. So, the

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topic is about comparison of systematic action of specimen. The contaminant of leaves of different ages has significantly changed.

Although we noticed that the quantity of rust pustules on the second leaf from ear on control versions of year's researches was lower than on flagged one. This fact is not related to fall of precipitations (meteorological conditions significantly differed) or sporulating activeness of pathogens (during appearance of flagged leaf, second from ear has already experimented infection load). The probable explanation can be the appearance of received sustainability system of plants to the moment of appearance of second leaf and decreasing age sustainability to the appearance of flagged leaf [21]. The reason cab also be projective condition of leaves circle and related to them unequal precipitation of cryptogamic material. That is why it would be correct to compare the change of contaminant with control within one circle of leaves.

The given data in the table indicates that in 2004 the important role in decreasing the contaminant of erysiphe graminis played spraying sowing of winter wheat DKM-1 (copper component of glycyrrhizic acid) and sodium silicate. So the contaminant of the third leaf from ear has decreased to 17 and 16%, the 2nd – to 7 and 13% accordingly. The treatment of plants with specimen DAG-1 decreased the level of contaminant of the third leaf from the top to 12 %.

Researched specimens significantly influenced on contaminant of drown rust. By comparing the contaminant of leaves of different ages for control, may be judged of speed of response onset on specimen and prolongation of its action. So DAG-1 influenced on contaminant of the third leaf from ear appeared earlier to the moment of treatment, decreasing quantity of rust pustules to 59%. DKM-1 has also shown high efficiency on the leaves of older age. The quantity of pustules on the top of the third leaf decreased to 86%. Decreasing of contaminant of flagged and under-flagged leaves were considerable, but significantly low – 25 and 23% accordingly. Sodium silicate has invariably decreased the contaminant of leaves of different age. The quantity of pustules on the third leaf decreased to 54, the second to – 38, flagged to - 44%. Quite probably that access of the form of input let absorb Silicon in longer period or reutilize accumulated in the plant.

On the allotments where used DAG-2 the decrease of the quantity of rust pustules were as strong as the leaf was older than the period of treatment: on the top of the third leaf to 24, on the second – 31, on the flagged - 38%. GK-Cu considerably decreased the contaminant of leaves appeared close to the moment of treatment: the third leaf from ear to 43, the second – 38, when the flagged leaf was only – 25 %.

The specimen didn't practically influence on the length of leaf lamina. The decrease of this indication at flagged leaf can be marked on 15% during inputting GK-Zn and sodium silicate, also the second leaf from ear at 23% when spraying epin-extra.

DKM-1 didn't influence on the change of the quantity of rust pustules, but actively decreased the contaminant of erysiphe graminis. DAG-1 decreased the level of contaminant of erysiphe graminis of the third leaf from ear, considerably decreased the contaminant of erysiphe graminis. At the same time there was observed significant post-action of specimen. The action of sodium silicate and DAG-2 were adequate.

Reasonably decreasing the contaminant of under-flagged leaf of erysiphe graminis, GK-Cu increased infected rust. GK-Zn certainly decreased the contaminant of erysiphe graminis but decreased intensiveness of contamination with rust.

More effective immune-corrector was the specimen DKM-1. The spray promotes to decrease of contamination level of erysiphe graminis of flagged leaf to 10, the second leaf from ear – 28, the third – 26%. The quantity of rust pustules on the top of the third leaf decreased to 88 %.

In 2007-2009 the action of growth regulators on pathogenesis somehow differed from older ages, but had place and early shown conformity. In these years for period of active vegetation of precipitations were less than earlier. Necessary to point that decreasing the length of leaf lamina of all circles. The quantity of ryst pustules on the third leaf from ear decreased, and contamination of erysiphe graminis has increased. The following fact is related with the importance of existence of drop-liquid moisture for germination of brand spore – rain or dew. The conidia of erysiphe graminis can be germinated in the absence of liquid moisture. There are data that outbreak of erysiphe graminis confined with drought period when plants are in weak condition [22].

Spraying the plants this year with specimens DAG-1 and GK-Cu decreased the length of leaf lamina of all circles, and specimens DKM-1 and DAG-2 – the top of the third leaf from ear. Sodium silicate, instead, increased the length of the top of the third leaf to 20, GK-Zn under-flagged to – 28 %.

Specimens: DKM-1, sodium silicate, GK-Cu, DAG-1 strongly decreased the level of contamination of erysiphe graminis those leaves that appeared close to moment of treatment.

DAG-2 strengthened the contamination of flagged leaf of erysiphe graminis. Quite obvious that in drought conditions the plants of winter wheat prolonged the period of reparation which lead to weakening pathgenesis. On the versions of usage of GK-Zn level of contamination of erysiphe graminis plant was on control level.

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Spraying the plants with sodium silicate promoted to decreasing the quantity of rust pustules on the third leaf from ear to 55, the second – 72, flagged – 82 %. On the versions of usage GK-Zn the quantity of rust pustules on flagged leaf decreased to 58, the second from the ear - 61 %. GK-Cu stably decreased the quantity of rust pustules in all circles to 26 – 28 %.

The action of specimens DKM-1 and DAG-1 were ambiguously. On the third leaf from the ear happened considerable decrease of the quantity of pustules to 42 and 45 % accordingly. On under-flagged leaves the resistance sharply decreased, the quantity of pustules increased to 44 and 61 %. On flagged leaves newly happened the decrease of the quantity of pustules in comparison with the control to 39 and 33 %. Can be supposed that right after treatment of plants the specimens mobilized protective system with expenses of accumulated energy. Then came the phase of remission, and unfavorable conditions didn't let plants quickly recover reserve of power, as a result – decreasing the immune.

Like in previous years GK-Cu much stronger decreased the contamination of leaves of upper circles, appeared later than treatment period. More considerable was its action on flagged leaf. The quantity of rust pustules on exact photo-synthetically active center decreased to 36 %.

To summarize decade data, we can note that it decreased stronger the contamination of winter wheat with brown rust and erysiphe graminis sodium silicate and DKM-1.

Unquestionable participation of silicon in pathogenesis of parasite diseases proved by many scholars. Silicon absorbs and strengthens plats lamina; decreases lost of water and slow down the development of fungus infections. Simulating action of instant silicon, obviously related to strengthening of consumption of phosphor and molybdenum, also transfer of manganese in plant lamina. It is supposed that silicon strengthens phosphating and sugar synthesis that increases the supply of energy for metabolic processes and increase of intensive growth of plants [23, 24]. In a number of works, there were referred to phyto protective action of brassyn steroids against parasite diseases by authors [25, 26, 27].

GK-Cu considerably decreased the quantity of rust pustules on flagged and third leaves from ear and percentage of contamination of erysiphe graminis on the second and third top leaves.

CONCLUSION

Studying the action of growth regulators in field conditions partly brings to ambiguous results that involve many contradictions between the data of different researchers. The effectiveness growth regulators in general depend on soil-climatic factors of the area, weather conditions in the year of conducted experiment. Thanks to poly-functionality exogenous phyto hormones can affect on the current of physiological processes, strengthen or decrease the growth of the plant, change its tolerance to phyto pathogen.

In order to decrease contamination with parasite diseases and negative influence of factors to the environment we recommend spraying sowing of winter wheat with specimens DKM-1 GK-Cu, GK-Zn, DAG-1, and DAG-2. But positive influence of researched specimens limits with fungi static activeness. Specimens can be used in prophylaxis to decrease the contamination level of winter rust with fungus parasites.

Exceptionally positive role of sodium silicate says about importance of widely studying of silicon fertilizes and introduces it into the industry of corn culture. The ambiguous results of usage GK-Cu and GK-Zn for contamination of rust also demands further research of these specimens in the following aspect.

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