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YIELD AND GROWTH OF SPRING WHEAT AFFECTED BY USING OF THREE COMPLEX FERTILIZERS IN BELARUS

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Abstract

The research aims to find out the impact of three treatments of complex fertilizers 1st (Amino power antistress micro fertilizer), 2nd (Mineral extra fertilizer), 3rd (Mix of mono Cu fertilizer + mono Mn fertilizer + Organic fertilizer) on the yield and growth of spring wheat for two seasons 2014-2015. A field experiment was conducted using Randomize Complete Block Design (RCBD) with three replicates (in the field of Grodno State Agrarian University in the Republic of Belarus), the soil bioactivity represented by (cellules decomposition) was determined, a sample of seeds were collected to determine the content of Gluten, Nitrogen, Phosphor, Potassium and protein, growth indicators (number of spiklets/m^2, Biological weight t/h and harvest indicator %) were also studied, the yield of wheat was also determined, the results showed a significant decomposition of cellules for all treatment compared to con., and there was a significant decomposition between treatments, while the highest decomposition was in the 1st treatment (Amino power antistress micro fertilizer) 76%, the results illustrated a significant impact of fertilizers on the all of growth indicators for all treatment compared with con. and the highest impact was in the 3rd treatment, which was the No. of spikes.m^{-2} (676, 648), biological weight (16176, 15650) t/h for the two seasons 2014-2015 respectively, the results showed that the fertilization impacted the yield of spring wheat significantly for all treatments compared to con. and the highest yield was in the 3rd treatment which was (6852, 6803) kg/h for two seasons respectively.

Key words: Complex fertilizers, soil bioactivity, yield of spring wheat.

Introduction

The wheat is the most valuable and most common food crop. It gives almost 3% of world grain production and provides food more than half of the world population. It considered one of the main agriculture crops in the world, wheat providing 20% of energy in the diet of mankind. In addition that the wheat is the main source of protein in developing countries (Rezooki A.M. 2016). During the period 2006-2010 world markets sales of wheat was at the level of 135 million ton per year, Complex fertilizers became widely used after 1950's, especially in the USA, Canada, England, the Netherlands, Japan, France, Italy where the production of them is more than 50%. T he application of complex fertilizers with different ratio of macro nutrient litany and additional of micro nutrients, received a high attention in the world wide (Rezooki A.M. 2016). Recent research has shown that a small amount of nutrients (nitrogen, potash or phosphate) applied by foliar spraying increases significantly the yield of crops (Asenjo *et al.,* 2000; Gamiz *et al.,* 1998; Haq 2000). In fact, foliar fertilization does not totally replace soil applied fertilizer but it does increase the fertilizers is determined by the magnitude of the financial risk associated with the failure to correct a deficiency of a nutrient and the perceived likelihood of the efficacy of the foliar fertilization. Our current understanding of the factors that influence the ultimate efficacy of foliar nutrient applications is, however, incomplete (Fernández *et al.,* 2013; Kannan, 2010; Noack *et al.,* 2010). Many factors influence the performance of foliar nutrient sprays, but for simplicity they may be grouped under physicochemical properties of the formulation, the environment under which sprays are applied or the characteristics of the plant to which the spray is applied. Physics-chemical properties of the spray

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formulation such as molecular size, deliquescence of the formulations all play a major role in determining the efficacy of uptake of nutrient solutions by the foliage (Fernández *et al.,* 2009; Fernández *et al.,* 2013). At present, despite the obvious need to study the soil microbiology, this issue is given insufficient attention (Rezooki, 2016; Rezooki *et al.,* 2017). In 1 g soil contains 3-90 million bacteria, 0.1-35 million actinomycetes , 8-1000 thousand microscopic fungi, 100 thousand algae, etc., the mass of bacteria is 10 tons/ha, the same mass have microscopic fungi (Rezooki, 2016; Rezooki *et al.,* 2017).

Materials and Methods

One experiment was conducted to explain the effect of foliar fertilizers on soil bioactivity and the quality and yield of spring wheat in the experimental field of (Grodno State Agrarian University in Belarus) for two seasons 2014-2015, the samples of soil were collected from the experimental area before planting from 0-30cm depth, air dried grinded, sieved to pass through 2mm sieve to analyze the soil samples chemically and physically. The soil classified as sod-podzols sandy loam texture, and the soil properties shown in table 1. It can be seen from the characteristics of soil in table 1 that the soil availability of humus is medium, phosphorus is elevated, nitrogen is normal and exchange potassium is low, in general the soil is quite common in the conditions of the republic of Belarus and is suitable for the cultivation of spring crop. The studied crop was spring wheat “Daria” (Rezooki, 2016), the seeding rate was 210 $kg.ha^{-1}$. In this experiment, spring wheat was placed in a crop rotation after potatoes, this is one of the best predecessors. After harvesting, 70 $kg.ha^{-1}$ of phosphorus and 130 $kg.ha^{-1}$ of potassium fertilizers were applied while plowing. In the early spring after the onset of physical ripeness of the soil nitrogen solubility, or electric charge, pH, surface tension, retention,

Table 1: The characters of soil under study.

Character	Value	unit
Clay	101	mgm/kg
Sand	699	mgm/kg
silt	200	mgm/kg
Soil texture	Sandy loam	
O.M.	1.9 - 2.1	%
pH	5.9 - 6.1	
N	290-335	ppm
P_2O_5	210 – 245	ppm
K_2O	105 – 120	ppm
S	7.5	ppm
B	0.65	ppm
Cu	1.9	ppm
Zn	2.6	ppm

spreading, or point of decade of April. The experiment was laid as a randomized complete block design (RCBD), with three treatments:

1. Amino power antistress micro fertilizer defined as (APAMF).
2. Mineral extra fertilizer defined as (MEF).
3. Mix of mono Cu fertilizer + mono Mn fertilizer + Organic fertilizer defined as (m. Cu + m. Mn + O.F.) and the control treatment without fertilizer defined as (Con.).

The characteristics of the fertilizers which used in the research shown in table 2 (Rezooki, 2016).

The treatments were applied to plots measuring 4 × 6. Each treatment was replicated three times. The following indicators of growth was studied:

1. Number of $spikes.m^{-2}$: number of spikes counted after the full maturity of all plantsthen harvesting of quarter square meter of each plot and then convert it to $spikes.m^{-2}$. fertilizer in the form of Urea in a dose of

Table 2: The characteristics of fertilizers used in research.

Mineral Extra fertilizer %									
P2O5	**K2O**	**MgO**	**SO3**	**B**	**Cu**	**Fe**	**Mn**	**Mo**	**Zn**
25	20	10	22	0.05	0.6	0.11	0.01	0.001	0.04
Mono Mn Fertilizer %									
Amino acids	**N**	**S**	**Zn**	**Mn**					
	3	5.5	-	11.4					
Amino power anti stress micro%									
Amino acids	**Free amino acids**	**MgO**	**Se**	**Cu**	**Fe**	**Mn**	**Mo**	**Zn**	**B**
31	9	6	0.001	0.5	6	2	0.02	4	2
Mono Cu Fertilizer %									
Amino acids	**N**	**S**	**Zn**	**Cu**					
-	6	3	-	6					

60 kg.ha^{-1}. The sowing was done in the 3rd by multiplying the number of spikes by four (Rezooki *et al.,* 2017).

2. Biological weight t.h^{-1}: is the dray weight sample (straw weight plus the weight of grain) obtained by harvesting a quarter square for each plot and weight it then convert it to t.h^{-1} multiplying the weight by 40000 (Rezooki *et al.,* 2017).
3. The total weight (wheat yield) t.h^{-1}: Obtained by harvesting and weight of square meter of each plot after isolated of straw from grains, the weight of grains converted to t.h-1 by multiplying the weight of grains by 40000 (Rezooki *et al.,* 2017).
4. Harvest Indicators: A measurement of the efficiency of conversion of photosynthesis products to an economic products, calculated by dividing the grain yield on the biological weight × 100 at humidity 12-13% (Rezooki *et al.,* 2017).
5. The soil bioactivity: Estimated by determining the intensity of cellulose decomposition which measure by the degree of decomposition of filter paper in the soil, the filter paper (Whtman No. 42) of known mass sewed to a nylon mesh pocket placed in the depth of 0-30 cm in soil where three replicates done for each sample and remain in soil for about one month, and then the samples were removed from the soil and cleaned from the roots, hair and soil then dried and weight it, then extracted the difference between the weights (before and after placed in soil) was calculate in the percentage of cellulose decomposition in soil (Rezooki *et al.,* 2017).

Results and Discussion

The ANOVA variance analysis showed a significant increment of all growth indicators (No. of spikes/m^{-2}, biological weight, Harvest indicator) for all treatments compared to control and between treatments each other, for the seasons of 2014-2015 respectively, but the increment in 2015 was slightly less than in 2014 and the best increment of growth indicators was (676, 648 spikes/ m^{-2}), (16.2, 15.65 t/h) biological weight in the 3rd treatment mix of (m. Cu. F+ m. Mn. F), this came similar to (Gooding *et al.,* 1992; Rezooki *et al.,* 2017) which refers that the using of complex fertilizers as foliar increase the biological weight of plant and the rest of growth indicators table 3. The results showed a significant increment in the grains content of nutrients (Gluten%, N%, P%, K% and protein%) compared to control and the increment was significant between treatments each other for the two seasons 2014-2015 respectively, but the increment in 2015 was slightly less than 2014, only for gluten which was in 2015 slightly high than in 2014 for all treatments, the treatment of (m. Cu. F+ m. Mn. F) was the best content of Gluten % (31.2,32), N% (2.6, 2.56) and Protein % (16.2,16) for the 2014-2015 seasons, and the treatment (M.F.E) was best content of P% (0.56, 0.54), and K % (0.82, 0.79) for 2014-2015 seasons respectively, this results was similar to (Liew, 1988, Rezooki *et al.,* 2017)

Table 5: The effect of complex fertilizers on cellulose decomposition for 2014-2015.

treatment	Cellulose decomposition in soil %
Con.	57
APAMF	76
MEF	67
m. Cu. F+ m. Mn. F+ O.F.	73

Table 3: the effect of complex fertilizers on the growth indicators of spring wheat in the seasons 2014-2015.

treatment	2014			2015		
	No. of spikes/m^{-2}	biological weight t/h	Harvest Indicator %	No. of spikes/m^{-2}	biological weight t/h	Harvest Indicator %
Con.	481	11.3	34	460	10.82	35
APAMF	516	11.4	47	492	10.95	48
MEF	476	10.7	39	450	10.2	40
m. Cu + m.Mn + O.F.	676	16.2	42	648	15.65	43

Table 4: The effects of complex fertilizers on wheat grains content of nutrients for 2014-2015 seasons.

Treatments	Gluten%		N%		P%		K%		Protein %	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Con.	22.9	23.3	1.89	1.82	0.44	0.41	0.73	0.7	11.8	11.4
APAMF	28.6	29.2	2.54	2.5	0.46	0.45	0.75	0.71	15.9	15.6
MEF	27.8	28.5	2.51	2.47	0.56	0.54	0.82	0.79	15.7	15.4
m. Cu + m. Mn + O.F.	31.1	32	2.6	2.56	0.47	0.43	0.78	0.76	16.2	16

Table 6: The effect of complex fertilizers on the yield of spring wheat in 2014-2015 seasons.

Treatments	Yield kg/h		Increment to control kg/h		Increment to control %	
	2014	2015	2014	2015	2014	2015
Con.	3941	3800	-	-	-	-
APAMF	5380	5320	1439	1520	36	40
MEF	4172	4102	231	302	6	7
m. Cu. F+ m. Mn. F+ O.F.	6852	6803	2911	3003	73	76
LSD 0.5	5					

which refers that the use of complex fertilizers as foliar increase the protein content in grains and enhancing the quality of yield, (Rezooki *et al.,* 2017; Römheld *et al.,* 1999) which refers that the using of complex fertilizers as foliar increased the content of N%, P%, and K% in grains table 4.

The treatment of complex fertilizers affected on soil bio activity represented by the cellulose decomposition, the cellulose decomposition increased for all treatments compared to control, and the best increment was in the first treatment (amino power anti stress) 76% for the two seasons 2014-2015 table 5, as the scale of cellulose decomposition is very weak > 10: weak 10-30: moderate 30-50: strong 50-80: very strong > 80 (Rezooki, 2016; Rezooki *et al.,* 2017).

The results showed a significant increment of spring wheat yield for all treatment of complex fertilizers compared to control, and the increment was significant between treatments too for the two seasons 2014-2015 respectively, but the yield in 2015 was slightly less than 2014 table 6, and the best increment was in 3rd treatment the mix of (m. Cu. F+ m. Mn. F+ O.F.) (6852, 6803) kg/h for 2014-2015 respectively, this results came similar to (Mikhailovskaya, 2008; Rezooki *et al.,* 2017) which refers that the using of complex fertilizers as foliar increase the yield of wheat from 6-20 times according to the type of soil.

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