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SPRING WHEAT YIELD DEPENDING ON FERTILIZATION IN CONDITIONS OF WESTERN POLISSYA OF UKRAINE

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Setting of the problem. The main cereal crop in Ukraine is winter wheat, which exceeds other crops by its yield potential and provides a basis of the state bread balance. Nevertheless, as practice shows under unfavorable over-wintering conditions, when winter crops are lost, they are being repeatedly sown or supplemented with spring crops [1]. Among such kinds of crops the spring wheat dominates.

It is known that the spring wheat is characterized with increased requirements to cultivation conditions, is rather susceptible to high-tech agriculture and mineral fertilizers introduction. Modern cultivators of spring wheat are not inferior to other cereal crops in their yield. Efficiency of this crop production will be increasing, if cultivator and technological peculiarities of soft and hard wheat are taken into account [2]. For the most efficient realization of the yield potential a rational fertilization program should be developed, which considers biological peculiarities of the cultivator [3].

The main task of our researches is improvement of spring wheat growing technology for the purpose of reaching high indices of grain yield and quality.

Material and research methods. Field studies were carried out during 2011 – 2013 as part of temporary experiments of the crop growing and selection department of Volyn SARS AIWP NAAS. Soil of the plot under research – is sod-podzolic loam-sandy, containing the following substances in the plough layer: hydrolyze nitrogen – 5.8 mg/100 g of soil (by Cornfield), labile phosphorus – 13.6 – 24.5 mg/100 g of soil (by Kirsanov), exchange potassium – 8.4 – 14.2 mg/100 g of soil (by Kirsanov), pH – 5.3.

In the process of the research a one-time and a retail introduction of different doses of mineral fertilizers at various plants developmental phases have been examined. The spring wheat of cultivator Struna myronivska recommended for zone of Polissya was sown. Agricultural methods were conventional for this zone of growing. Accounting area of the plot – 35 m^2. The harvest was gathered by straight-combine method with full ripeness of grain.

Mineral fertilizers were introduced in the form of granular superphosphate (19%), potassium salt (40%) for basic treatment and of ammonium nitrate (34.4%) for nutrition according to the experimental scheme (Table 1).

Table 1

Experimental scheme:

Basic fertilizer		For pre-sowing cultivation	Nitrogen nutrition during the stages of organogenesis	
P_2O_5	K_2O	N	VIII	X
Control (without fertilizers)			-	-
-	-	30	30	-
20	-	30	30	-
40	-	30	30	-
60	-	30	30	-
120	-	30	30	-
120	60	60	30	-
120	120	60	30	-
120	120	60	30	30

Research results. As a result of the researches carried out it is established that the yield level of the spring wheat significantly depends on level of mineral fertilizers introduction. Thus, in comparison with the non-fertilized variant (control one) yield increments were achieved on all fertilized variants.

In average for 2011 – 2013 without application of mineral fertilizers the spring wheat formed yield at the level of 2.4 t/ha. Application of just nitrogen fertilizers at the rate of 30 kg/ha d.r. in the period of pre-sowing cultivation and at VIII stage of organogenesis ensured 0.39 t/ha of yield increment. The maximum yield level was reached due to introduction of $P_{120}K_{120}$ to the basic fertilizer, N_{60} for pre-sowing cultivation and N_{30} at VIII and N_{30} at X stage of organogenesis and made 4.25 t/ha respectively. Increment of the yield index owing to application of appropriate fertilization program was equal to 1.84 t/ha (Table 2).

Table 2

Spring wheat yield depending on fertilization level

Variants	Yield, t/ha				
	2011	2012	2013	average for years	± for control one
Control (without fertilizers)	2,96	3,26	1,54	2,40	-
N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,02	3,53	2,04	2,79	0,39
P_{20} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,18	3,59	2,20	2,89	0,49

P_{40} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,33	3,91	2,23	3,07	0,67
P_{60} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,27	3,81	3,04	3,42	1,02
P_{120} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,34	4,00	3,22	3,61	1,21
P_{120} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	3,42	4,10	3,95	4,03	1,62
$P_{120}K_{60}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation	3,48	4,22	4,11	4,17	1,77
$P_{120}K_{120}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation + N_{30} for grain filling	3,53	4,13	4,36	4,25	1,84
HIP_{05}, t/ha	0,39	0,40	0,42	-	-

According to the results of our researches fertilization level has a ponderable influence on grain quality characteristics. Grain of larger size was forming with increased doses of mineral fertilizers. Thus, with the absolute control mass of 1000 grains in average for three years of the research made 31.2 g. The maximum indices were registered when applying P_{120} + N_{30} for pre-sowing cultivation + N_{30} for ear formation and $P_{120}K_{60}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation and made 35.3 and 34.3 g respectively (Table 3).

Table 3

Quality and physical characteristics of spring wheat depending on fertilization level

Variants	Content in grain		Protein content hectare, t/ha	Gluten content per hectare, t/ha	Mass of 100 grains, g	Grain unit, g/l
	of protein, %	of crude gluten, %				
Control (without fertilizers)	11,3	20,4	0,27	0,4,9	31,2	684
N_{30} for pre-sowing	12,7	22,6	0,35	0,63	31,5	688

cultivation + N_{30} for ear formation						
P_{20} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	12,3	22,7	0,35	0,66	32,1	666
P_{40} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	12,1	22,2	0,37	0,68	32,8	677
P_{60} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	12,0	22,5	0,41	0,77	34,1	673
P_{120} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	12,4	22,7	0,45	0,82	35,3	677
P_{120} + N_{30} for pre-sowing cultivation + N_{30} for ear formation	12,9	22,7	0,52	0,91	33,1	667
$P_{120}K_{60}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation	13,0	23,3	0,54	0,97	34,3	677
$P_{120}K_{120}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation + N_{30} for grain filling	13,8	23,9	0,59	1,01	33,8	675

Important grain quality characteristics are content of protein, crude and starch in it. In our researches these characteristics were changing depending on amount of mineral fertilizers introduced, in particular, nitrogen ones. Protein content in grain on the control one (without fertilizers) was 11.3% and was rising up to 13.8% when introducing $P_{120}K_{120}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation + N_{30} for grain filling (Table 3).

Consequently, mineral fertilizers when growing the spring wheat in dose of $P_{120}K_{120}$ for basic fertilizer, N_{60} for pre-sowing cultivation and nutrition at VIII and X stages of organogenesis for 30 kg/ha d.r. promote growth of grain production from the unit of area in 2.8 times, of grain quality characteristics, in particular, protein content in 2.2 times and crude content in 2.1 times.

Conclusions

In conditions of Western Polissya of Ukraine the spring wheat realizes its biological potential on high level: from 2.40 up to 4.25 t/ha. Maximum yield level is formed when growing on the background $P_{120}K_{120}$ + N_{60} for pre-sowing cultivation + N_{30} for ear formation + N_{30} for grain filling – 4.25 t/ha.

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Summary

Influence of fertilization program of the spring wheat on grain yield and quality during the wheat growing was discovered. Efficiency of the retail introduction of nitrogen fertilizers was examined.