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RESEARCH REGARDING THE INFLUENCE OF FERTILIZERS ON WINTER WHEAT YIELD AND YIELD QUALITY IN THE REGION OF CAREI, SATU MARE COUNTY

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Abstract

Wheat is one the most important food crops and it is by far the most popular cereal in Europe. Romania is among the six important producers. Nowadays formers are trying to get high grain yields in line with food quality, but at the same time they are trying to minimize production costs and to use environmentally friendly technologies. The objective of this experiment was to clarily the impact of nitrogen fertilization on winter wheat yield and yield quality Nitrogen fertilizer affected significantly the gluten quality parameters of winter wheat. The two year research confirmed significant yield increase until the nitrogen fertilizer rate.

Key words: nitrogen fertilization, grain quality, winter wheat, yield

INTRODUCTION

Wheat is one of the oldest cultivated plants being one of the most adaptable crop plants at various environmental conditions, with a very wide ecological plasticity to pedo-climatic conditions, occupying the largest agricultural area (Bradshaw, 2016) and benefiting from efficient biological mechanisms in adaptation to soil conditions (Stoian et al., 2015).

Winter wheat is the most widely grown winter cereal in Romania and farms are increasingly striving to use agrotechnical measures that reduce production costs. Nowadays, not only yield amount but also the quality of the produced grain is important, because the quality of grains determines their direction of use. That is why formers are trying to get high grain yields in line with food (accepted for bread baking) quality, while minimize production costs and using environmentally friendly technologies.

Wheat flour plays a very important role in our daily diet, which is the basic material of many industries. The quality parameters of wheat can be affected by many agrotechnical factors (Erdei, Szaniel, 1975). Considering these factors, one of ten most important is proper nutritional supply, which can be achieved by artificial fertilizing (Gyori, Gyorine, 1998).

Optimal nutrient provision is an important factor to get high yield with high grain quality. Nitrogen is one of the most important elements of plant nutrition, which often to a great extent determines not only wheat yield level, but especially grain baking quality. It is also one of the most mobile plant nutrients in the soil. Therefore, it is important to evaluate the use of

high nitrogrn fertilizer rates, because unsuitable nitrogen doses lead to increased nitrate leaching which contributes to eutrophication of surface waters.

It is important to look cost effictive and environmentally friendly rates of N-fertilizers in different tillage systems with different forecrops for winter wheat.

The objective of this experiment was to clarity the nitrogen fertilization impact on winter wheat yield and yield quality.

The recommended optimal N-fertilizers dosage is between 120-150 kg/ha (Asthir et al., 2017) to realize yield and quality potential of the genotype, to avoid nitrogen leaching out and plant lodging. Nitrogen fertilizing can affect significantly the ratio and the amount of gluten proteins (Wieser, Seilmeier, 1998), therefore the baking test volume and the gluten spreading (GS) as well (Pollhamer, 1973).

Balanced fertilization ensures high productivity of wheat and nitrogen is considered as the most influential factor for good bread making quality. Accordingly, there are many studies concerning correlations between fertilization and yield components or quality parameters for wheat.

The important changes in fertilization practices are associated with aforementioned environmental aspects but also economic ones: fabrication of mineral nitrogen is costly and energy consuming (Buchi et al., 2016).

Other important aspect is related with nitrogen fertilizer type and application manner in order to obtain the best yield and quality parameters. There are inconsistent opinions regarding comparisons between liquid and dry nitrogen sources for wheat crop.

Some studies concerning the efficiency of splitting of nitrogen doses on yield indicated that the application of nitrogen in more than two splits increased grain weight per year. It is recomended to add 120 kg/ha in four splits to obtain the best result of qualitity and quality of the wheat.

MATERIAL AND METHOD

Experimental research was carried ont in the region of Carei, Satu Mare county, for this experiment were chosen Combin, Falado and Sorrial varieties.

The studies were carried out between 2018 and 2020 using the above mentioned winter wheat varietes on a 3 ha lot, each winter wheat variety was cultivated on 1 ha, the soil type was Cambic chernozem. The area had medium humus content, medium phosphorus and potassium supply and neutral PH. The forecrop of the experiment was maize. For all three wheat varieties were adopted the same technology and phytosanitary treatments. The 50% of nitrogen and the whole amount of the phosphorus and

potassium were applied in autumn, the remaining 50% of the nitrogen fertilizer applied in spring as top dressing.

In the experiment were used NPK 16:16:16, calcium ammonium Nitrate (CAN) with 27% N, ammonium nitrate (AN) with 33,5% N and liquid fertilizer urea ammonium nitrate (UAN) with 32% N.

Solid fertilizers CAN and AN were applied in March an April, respectively using a dose of 300 kg/ha composed from 200 kg/ha (CAN) and 100 kg/ha (AN) and totalising 120 kg N/ha. Liquid fertilizer, UAN, applied in a dose of 300 kg/ha that was split in three equal fractions that contributed with 128 kg N/ha. The sowing was done in October, first decade and harvesting in July, the third decade.

Table 1

Fertilization (solid vs. liquid fertilizers) and treatments

Period of time	Fertilizer and phytosanitary treatments		Dose	
October, 1st decade	NPK 16:16:16		200 kg/ha	
March, 1st decade	CAN	*UAN*	200 kg/ha	*100 kg/ha*
April, 1st decade	Gamma Cyhalothrin (insecticide)		0.08 L/ha	
	40 g/L proquinnazid + 160 g/L tebuconazole + 320 g/L prochloraz (fungicide)		1 L/ha	
	69 g/L fenoxaprop-P-ethyl + 34.5 g/L cloquintocet-mexyl (herbicide)		1 L/ha	
	250 g/L thifensulfuron methyl + 250 g/L tribenuron methyl (herbicide)		40 g/ha	
April, IInd decade	AN	*UAN*	100 kg/ha	*100 kg/ha*
May, 1st decade	-	*UAN*	-	*100 kg/ha*
May, IInd decade	Plonvit Opty (foliar fertilizer)		3 L/ha	
	Tebuconazole 200 g/L + Trifloxystrobin 100 g/L (fungicide)		1 L/ha	
	Thiacloprid 240 g/L (insecticide)		0.3 L/ha	

RESULTS AND DISCUSSION

Meteorological conditions in all two years differed from a year to the other. Autumn of 2018 was long and cool, in 2019 was relatively warm and dry. The winters were mild and favourable for good wheat overwintering. The vegetation renewed in mid March in all two years, in 2020 spring was moderately warm and wet, however summer in June and August was dry,

but July was characterized by high rainfall. The results showed that the average wheat grain yield was very high in all two years of research.

After harvesting the whole plots, yield was weightened, grain purity and moisture content detected, and yield data was recalculated to standard moisture (14%) and 100% purity. The nitrogen fertilization rate increased significantly the average grain yield in all two years.The maize forecrop did not exploit the nutrient and water supplies of the soil and created favourable conditions for winter wheat.

The results concerning yield related to mineral fertilization and wheat varieties indicated that using liquid fertilizer (UAN) by splitting the total dose (300 kg/ha) in three equal fractions lead to the highest yields for all three wheat varieties.

The results imdicated that yusing liquid fertilizer (UA/n) bu splitting the total dose (300 kg/ha) in three equal fractions lead to the highest yields for all three wheat varieties in the two years of research (6830 kg/ha in 2018-2019 for Combin, 6790 kg/ha in the years 2019-2020), the other two types had the following results: in the years 2018-2019, Sorrial: 6510 kg/ha, Falado: 6500 kg/ha; in the year 2019-2020 the results were similar for these two types: Sorrial 6480 kg/ha, Falado 6460 kg/ha.

Table 2

Influnce of wheat variety and of mineral fertilization on yield (kg/ha) in the years 2018-2019

Yield, kg/ha			
fertilization / wheat variety	Starter	Starter+CAN+AN	Starter+UAN
Combin	5810	6190	6830
Falado	5650	6020	6510
Sorrial	5610	5980	6500

Table 3

Influnce of wheat variety and of mineral fertilization on yield (kg/ha) in the years 2019-2020

Yield, kg/ha			
fertilization / wheat variety	Starter	Starter+CAN+AN	Starter+UAN
Combin	5770	6080	6790
Falado	5610	5940	6480
Sorrial	5560	5880	6460

Comparing all three wheat varietes it may be noticed that the same fertilization level conducted to higher yields for Combin.

CONCLUSIONS

Winter wheat yield has been significantly affected by nitrogen fertilizer rate, conditions of growing year. Average yield increased significantly until the nitrogen fertilizer. The gluten quality parameters of winter wheat were significantly influenced by fertlizing and cultivers.

The experimental results allowed obtaining the conclusions below:

1. The application of liquid fertilizer UAN in three fractions produced the highest yields for all three wheat varieties.
2. Wet gluten and protein contents increased with nitrogen fertilization and fractionate application of UAN.

The results of the study suggested that choice of nitrogen fertilizers might be important in winter wheat culture, with positive results obtained with UAN explained by reduced mineralization of these fertilizers due to dry weather conditions in spring inducing better nitrogen availability during protein storage.

As a general conclusion, application of fertilizers by splitting the total dose in three equal fractions, conducted to the best values for yield components and quality parameters.

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