EFFICIENCY OF FOLIAR FERTILIZATION ON WHEAT PRODUCTION IN CONVENTIONAL AND CONSERVATION AGRICULTURE

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Abstract

The paper presents the leaves fertilization influence upon wheat yield in two experiments carried out in conventional agriculture and conservative systems. The experimental fields comprised 6 leaves fertilizers variants and a control and were laid out at SCDA Teleorman on a Haplic Phaeozem. Two treatments were applied with 1.25% leaves fertilizer on a N90P40K0 agrochemical background proceeded from a complex 20-20-0 fertilizer, in the autumn, before sowing, and 50 kg N/ha Nitrocalcar, applied in the spring. Leaves fertilization, applied in the conservative system experiment, didn't bring forth a significant yield increase as compared to the control. Significant and distinctly significant increases of the wheat yield were obtained in the conventional agriculture system, from 5,795 kg/ha in the control up to 7,373 kg/ha in the Nutrifert S variant. The average conventional agriculture yield (6,978 kg/ha) was higher than the conservative agriculture one (5,457 kg/ha) by 27.8%.

Key words: leaves fertilizers, conservative agriculture

The World's population growth is the major leading force behind the food demand increase. Population will continue to grow and is expected to reach 9.2 billion by 2050 (FAO, 2007). Assessment is that agricultural yields should augment by 70% as compared to the present ones in order to feed this population (FAO, 2009).

In order to assess if this objective can be attained the fact must be considered that three of the Earth's natural limits are already involved in the slowdown of the World's food production increase: ocean fishing tenable production, freshwater quantity produced in the hydrologic cycle, and the fertilizers quantity that can be actually used for the existing crops *(*Brown R. *et al, 1995).*

Food demand increase requires agriculture enhancement which implies some hazards too. A weak management can lead to soil erosion, pressure on water supply, increase of nitrates level in surface and ground water, salinization and increase of water and air pollution due to husbandry refuses.

Furthermore, the prognosis is that climate changes will affect in several directions (sometimes positively) the agriculture and forest systems by temperature increase, higher carbon dioxide concentrations, changed rainfall, weeds, diseases, and pests pressure increase. In the short run the frequency of extreme climatic events such as droughts, heat waves, floods, and severe storms is expected to increase (FAO, 2009 b).

Soil resources degradation and deterioration demands new soil works technological systems based on sustainable development, soil preservation, and environment protection principles. Nutrients (phosphorus and nitrogen) losses resulted from agriculture activities bestir serious problems of surface and ground waters pollution, that's why establishing fertilizers doses that ensure optimum plant nutrition and growth must be done in the perspective of sustainable agriculture practice.

Due to the soil degradation processes determined by the technological mistakes and conventional agriculture practice conservative agricultural technologies have been studied and implemented in the last decades. The conservative systems could develop and expand on one hand due to chemical industry progress through weed killers assortment diversification and on the other hand due to agricultural machines and equipment industry development, especially the seeders that allow direct sowing (Dumitru E., 2005).

A modern and efficient agriculture implies, beside a high mechanization degree, optimum fertilization which contribution to agricultural

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yield completion represents 40-45%, followed by pesticides, weed killers, and fungicides application with a 20-25% share. Using liquid fertilizers represented a most radical progress in mineral fertilizers modern technology (Cioroianu T., 2009).

Also, in the process of fertilization efficiency increase in modern agriculture, development of production technologies and extra radicular fertilizers application methods is demanded.

Extra radicular fertilizers use, obtained from hydrolyzed collagen with bio stimulating role in an NPK classic fertilizer matrix, determined significant yield increases in wheat production ranging from 15 to 40% (Carmen Sîrbu, 2009).

Tejada M. (2004) studied the leaves fertilization effects when a mineral fertilizer enriched with humic substances is applied. The obtained results showed that leaves fertilization lead to micronutrients iron (Fe), copper (Cu), zinc (Zn), and manganese (Mn) and macronutrients nitrogen (N) and potassium (K) concentrations increase in plants, to A, B chlorophyll contents increase by photosynthesis process stimulation. Leaves fertilization led to a significant 22% increase of protein concentration in cereals and the starch concentration increased with approximately 5%.

Conversion from the conventional agriculture system to a conservative one also demands taking-up a new fertilization system which leads to yields significant increases while ensuring environment protection.

Statistical data show that very low organic and mineral fertilizers quantities (918-910 kg/ha, respectively 41.1-46.6 kg/ha NPK in the 2007-2012 period) are used in Romania. The level of fertilizers usage limited at a very low level which determined some farmers to apply leaves fertilizers due to the much smaller price without taking into consideration the specialists recommendations which adverted to considering leaves fertilizers as supplements to usual soil fertilization with organic and mineral fertilizers optimum doses and nowise their substitute.

The specialists show that recovery of plants after hail or pests attack, physiological optimization of macro and micro elements contents of seeds and sowing material, stimulating additional fertilization for reaching some quality indices (protein in cereals, sugar and organic acids in fruits), conservation durability, commercial aspect (dimensions, color intensity and uniformity), with protection role against acid depositions, enhancement of plant endurance to pests and diseases attack, depletion of nitrate and nitrite nitrogen and nitrosamines contents of agricultural products made for animal feed are recommended for remedial interventions in negative vegetation states caused by plants mineral nutrition factors (deficiencies, excesses, disequilibria).

As a large spread of leaves fertilizers usage was noticed (128 leaves fertilizers were authorized until 30.03.2007) we organized experiments to highlight the effect of leaves fertilizers in the two types of agriculture: conventional and conservative.

MATERIAL AND METHODS

Two experimental fields were set at SCDA Teleorman in conventional and conservative agriculture systems, on a Haplic Phaeozem type soil material, clayey loam, formed on loamy clay deposits with the following characteristics: 3.0-3.6% humus content, 45-48% clay content (0-45 cm), 0.186% total nitrogen, 76 mg/kg mobile phosphorus, 250 mg/kg mobile potassium, 6.3 pH (water).

Six types of leaves fertilizers (*Table 1*) were tested in three replicates. Two treatments were applied in 1.25% doses and a control unfertilized variant. Three NPK type fertilizers were chosen with completely chelated microelements and three variants which have, beside the NPK matrix, microelements and natural organic substances proceeded from hydrolized protein and humic compounds.

The test plant was Izvor breed wheat and the preceding plant was soy bean. After harvesting the preceding crop the vegetal remains remained on the soil surface. Preparing the field and sowing were done in no-till system, with no preparing of the seedbed, with a single pass of the seeder directly in the stubble. A Fabimag FG-01 63A175 model seeder was used combined with the CASE-7340 tractor.

The influence of fertilizers upon yield, grain nitrogen content and MMB was followed. A basic fertilization was done in the autumn before sowing with 200 kg/ha 20-20-0 complex fertilizers and 200 kg/ha Nitrocalcar applied in the spring.

The wheat grain nitrogen was determined according to STAS 7184/2-85, SR EN ISO 20483:2007, SR EN ISO 3696:2002.

Variance analysis was used for the results statistic computing.

RESULTS AND DISCUSSIONS

The influence of leaves fertilization upon wheat yield grown in conventional agriculture system

The control variants which received only basic fertilization (N90P40K0) ensured a 5,795

kg/ha average yield. It is noticed that fertilization with NPK and completely chelated microelements leaves fertilizers (Nutrifert S, Nutrifert Sol and Plantfert F) led to significant (Plantfert F) and distinctly significant yield increases as compared to the control without leaves fertilization. The wheat grain yield increase was 27% for the Nutrifert S and Nutrifert Sol fertilization *(figure 1).*

Table 1

Chemical composition of the leaves fertilizers used in the two agriculture systems

Composition g/l	Nutrifert Plus	Nutrifert S	Nutrifert Sol	Aminofert NPK	Plantfert F	Humifert
N	120	100	225	110	10	170
P_2O_5	70	80	30	100	145	35
K_2O	60	75	25	9	135	40
B	0.3	0.3	0.3	0.3	0.4	0.3
Co	0.01	0.01	0.01	0.01	0.01	-
Cu	0.2	0.15	0.15	0.3	0.2	0.2
Fe	0.5	0.4	0.4	0.6	0.5	0.4
Mg	0.35	0.25	0.25	0.3	0.3	0.3
Mn	0.3	0.25	0.25	0.4	0.2	0.2
Mo	0.01	0.01	0.01	0.01	0.01	-
S	2	1.5	1.5	1,00	0.6	25
Zn	0.15	0.2	0.2	0.3	0.1	0.2
Hydrolizate HO		-	-	-	-	-
Organic substances	-	-	-	38.11	-	27
Humic substances collagen proteins	13.7	-	-	19	-	-
Humic compounds	-	-	-	-	-	15

We assess that the distinctly significant yield increase obtained for the Nutrifert S and Nutrifert Sol fertilization is due to the higher nitrogen content (100 and 225 g/l N) as compared to the Plantfert F fertilizer which only contains 10 g/l N.

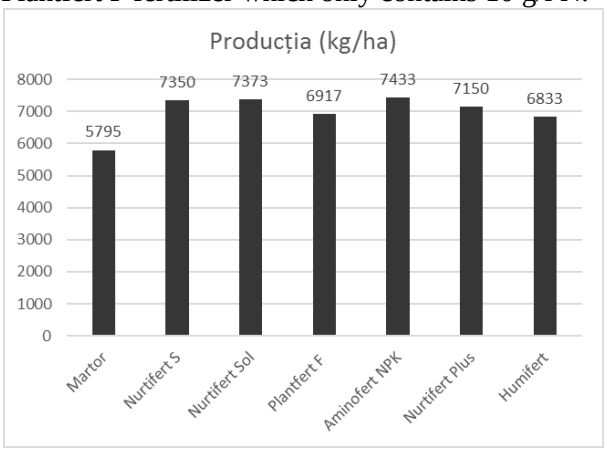

Figure 1 **Wheat yield obtained in conventional agriculture system**

Significant (Humifert) and distinctly significant (Aminofert NPK and Nutrifert Plus) increases were obtained for the fertilization with leaves fertilizers obtained based on hydrolyzed protein (Aminofert NPK and Nutrifert Plus) and humic compounds (Humifert) which also contain an NPK matrix with completely chelated microelements. The increases varied between 18 and 28% as compared to the control without leaves fertilization.

The wheat grain nitrogen content in conventional agriculture and leaves fertilization is presented in *figure 2*. The highest values of the grain nitrogen contents were noticed in the variants fertilized with Plantfert F and Humifert which had significant yield increases.

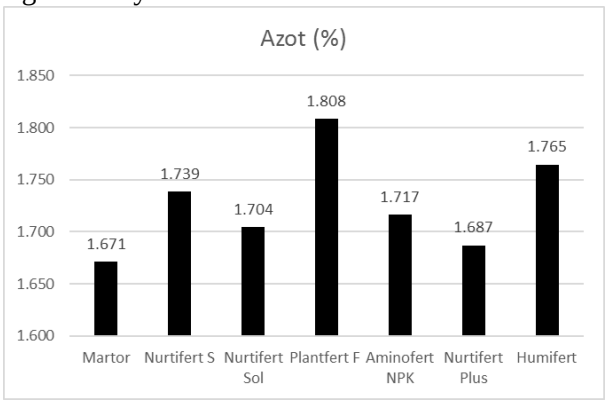

Figure 2 **Nitrogen content in wheat grain grown in conventional agriculture system**

The influence of leaves fertilization upon wheat yield grown in conservative agriculture system

Yield results obtained in conservative agriculture system for wheat under the influence of leaves fertilization are presented in *figure 3*.

A 5,190 kg/ha wheat production was obtained under the influence of basic N90P40K0 fertilization of the control without leaves fertilization, with 605 kg/ha (11%) smaller than the conventional agriculture control. The highest yield (5,800 kg/ha) was obtained by Nutrifert S fertilization which ensured 11.7% yield increase, and the lowest after Nutrifert Plus fertilization

which brought about an only 2.3% yield increase. The other leaves fertilizers provided low yield increases: Aminofert NPK 5.9%, Humifert 3.4%, Nutrifert Sol 6.8%, and Plantfert F 5.8%.

The highest grain nitrogen content (1.765%) was obtained by Humifert fertilization (*figure 4*). Although significant, the lowest grain nitrogen level was obtained by Nutrifert Plus leaves fertilization. The other variant ensured very significant increases of wheat grain nitrogen.

Researches carried out by *Dumitru* (2005) showed that direct sowing leads to a 5-15% smaller yield, depending on the climatic conditions, as compared to the conventional technological variant. The yield losses are economically compensated by the same measure of energetic costs decrease.

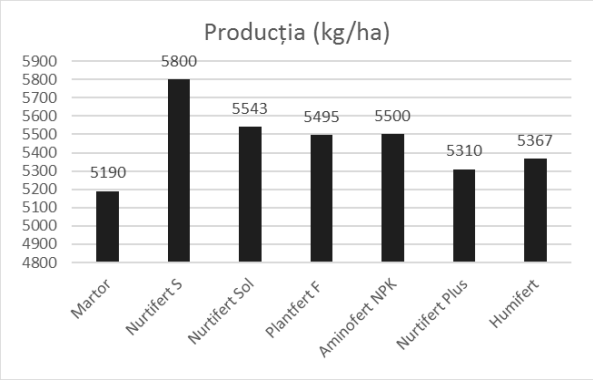

Figure 3 **Wheat yield obtained in conservative agriculture system**

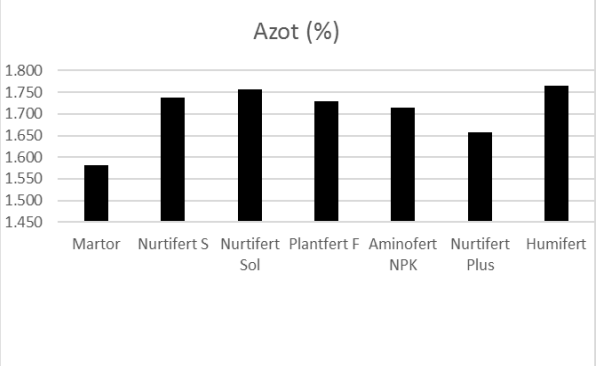

Figure 4 **Nitrogen content in wheat grain grown in conservative agriculture system**

CONCLUSIONS

1. The average yield in conventional agriculture (6,978 kg/ha) was higher than in conservative agriculture (5,457 kg/ha) with 27.8%.
2. The highest yield increases were obtained with fertilizers with high nitrogen content and with those with natural organic substances preceded from hydrolyzed proteins.
3. When comparing the controls without leaves fertilization the fact was noticed that the yield was 5,795 kg/ha in the conventional system as compared to 5,190 kg/ha in the conservative system, at the same doses applied as basic fertilization
4. The wheat yield obtained in the conservative agriculture system was, on an average, with 27.8% lower than the one obtained in conventional agriculture.
5. The nitrogen and implicitly the protein content of the wheat grain had higher values in the variants grown in conservative system as compared to the variants grown in conventional system.

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