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STUDIES REGARDING DYNAMICS OF WATER AND NUTRIENTS ABSORPTION IN WINTER BARLEY AND WHEAT

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Abstract

Experience regarding the dynamics of water and nutrient absorption in plants of barley and winter wheat was made in agriculture year 2012 - 2013, in North Baragan Plain on a typical chernozem soil using different doses of fertilizers. Humidity and nitrogen, phosphorus and potassium elements were determined in different phases of vegetation, in the soil and in plants. We determined dry matter accumulation in plant and plant density also, in order to chase their accumulation dynamics in barley and wheat plants. Based on the results, it could make correlations between soil quality indices and content of macro-elements in plants, in order to apply the correct doses of fertilizer to prevent pollution and achieve higher yields possible.

Key words*: sowing density, sowing time, winter barley, Braila Plain.*

INTRODUCTION

The various elements required by the plant are not equal and the needs of various minerals amounts of another group of plants of one species to another and even from one kind to another. Thus, the critical nutrition is the appearance of the third leaf and early tillering. Maximum consumption period begins after tillering and extends up to flowering.

Studies have included soil and plant chemical analysis, biometric measurements and observations were made in dynamic irrigated wheat and winter barley to observe the morphological changes during vegetative growth and some physiological and biochemical indices characterizing metabolic processes in the plant, in correlation with agronomic measures applied. The literature reveals that the growth of wheat and barley plants, capacity tillering and stages of organogenesis are clues that are closely related to environmental factors, particularly temperature and humidity, but each variety having a specific period of organogenesis in function by its biology. Multiannual results on similar experiences showed that hardy and productive varieties are those that are characterized by a fast growth and development throughout the vegetation, which advocated the promotion and expansion of the production of wheat and barley who had the qualities mentioned.

On the other hand, observing the dynamics of absorption of water and mineral elements by plants compared to supply state of the soil, agro-technical measures that can be taken to encourage increased production of grain per hectare.

MATERIALS AND METHODS

Experience concerning by study on dynamics of water and mineral elements absorption in plants of wheat and winter barley was conducted in agricultural year 2012 - 2013, in the EC Chiscani of ARDS Braila, on a typical chernozem soil using different doses of urea fertilizer in winter with 2 graduations (100 kg/ha and 200 kg/ha).

The biological material used was represented by the Boema and Glosa varieties of wheat and Cardinal winter barley cultivar. Experience was located in subdivided plots, with 3 repetitions for each variable in the two graduations of nitrogen fertilization doses (Figure 1).

This experience represents a sub-experience within a complex experience with seeding densities and different sowing times. determined in different phases of vegetation, humidity and total content of dissolved salts (conductivity method) content of mineral

elements: nitrogen, phosphorus and potassium in soil and in plants, in the forms of nitrate, nitrite, phosphate, total phosphorus, phosphorus pentoxide, total potassium and potassium oxide (Photometric method) and dry matter accumulation in plant (drying oven).

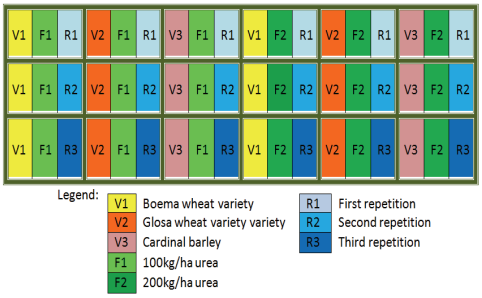

Figure 1. Experience locating in field

Dynamics of nitrogen, phosphorus and potassium absorption by plants during vegetative period was observed by analyzes of soil and plant extracts in the following vegetation stages: 1 leaf, 3 leaves, early tillering, end tillering, and dormant.

Also have done biometrics on plants, in the same phase of vegetation and plant density in order to study the dynamics of water and mineral elements absorption.

Based on the results, we could make correlations between indexes of soil quality and content of nitrogen, phosphorus and potassium elements in plants, in order to correct doses of fertilizer application to avoid pollution and getting higher yields possible.

RESULTS AND DISCUSSIONS

It is known that nitrogen in adequate quantities provide good tillering and rooting of plants, increases resistance to low temperatures, increases the number of fertile flowers in the ear, and improves the grain content in protein substances. If an excess of nitrogen occurs frequently danger of falling grain cereals.

Climatic characterization of the vegetative period of experimental variants revealed the following elements described below.

In terms of precipitation, autumn water intake was recorded precipitation of 68 mm, 28 mm below the multiannual average (96 mm), and in winter were more abundant precipitation (220 mm), providing the rain and December snow exceeding half of the intake and multiannual average (87 mm) by 133 mm.

Table 1. The main climatic elements of agricultural year 2012 – 2013

Climatic elements		Month values												Total agricultural year
		IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Precipitation (mm)	Normal	29	31	36	33	27	27	29	36	52	63	47	42	29	452
	Agricultural year 2012-2013	35	26	7	107	66	47	31	16	56	44	49	27	60	536
	Deviation	+6	-5	-29	+74	+39	+20	+2	-20	+4	-19	+2	-15	+31	+84
Air Temperature s (°C)	Normal	17,5	11,7	5,6	0,4	-2,5	-0,3	4,6	10,9	16,9	20,7	22,8	22,1	17,5	10,9
	Agricultural year 2012-2013	18,8	13,6	7,4	-1,5	-1,2	2,8	4,5	13,0	19,3	22,2	22,9	23,2	16,1	11,8
	Deviation	+1,3	+1,9	+1,8	-1,9	+1,3	+3,1	-0,1	+2,1	+2,4	+1,5	-0,6	+1,1	-1,4	+0,9
Air Humidity (%)	Normal	62	74	78	83	83	79	72	70	67	66	64	65	62	73
	Agricultural year 2012-2013	72	81	90	89	92	70	75	68	69	75	67	63	72	76
	Deviation	+10	+7	+12	+6	+9	-9	+3	-2	+2	+9	+3	-2	+10	+3

Meteorological Station of Braila

In terms of temperatures, autumn was warmer than multiannual monthly values from 1.3 to 1.9°C, and in winter there were these differences: December was 1.9°C cooler and the other two months were warmer than the multiannual, with 1.3°C-3.1°C in January and February (Figure 2).

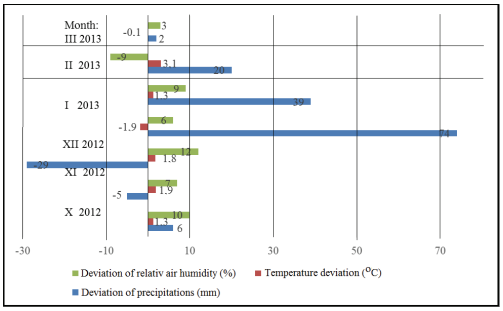

Figure 2. Deviations of climatic elements compared to normal in experimental period

Indices chemical analyzes on soil, in vegetation stage studies showed an increase in the total content of soluble salts in the first three phases and lower on end tillering and dormant stages (Figure 3), while agrochemical indices were a growing trend to early tillering and then gradually declined, so the dormant period reached based values (Figure 4).

Biometric measurements performed in different stages of vegetative period of winter wheat and barley are represented in Figure 5, where it can observing that wheat variety Glosa recorded an average number of leaves and tills than variety Boema, until the dormant. The Cardinal winter barley variety formed in tillering stage an

average number of eight tills to dormant, in conjunction with increased absorption of nitrogen in tillering stage.

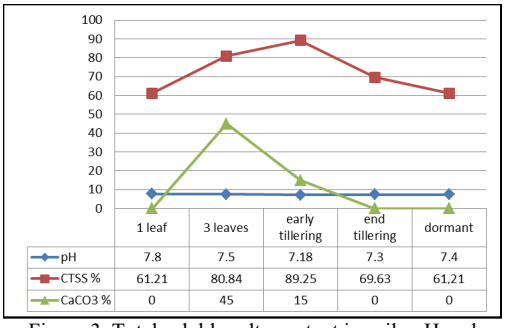

Figure 3. Total soluble salts content in soil, pH and calcium carbonate in soil, on vegetative period

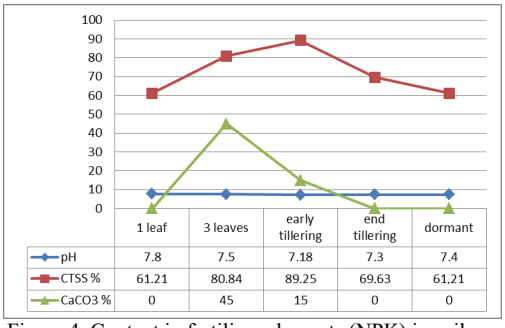

Figure 4. Content in fertilizer elements (NPK) in soil, on different stages of vegetative period

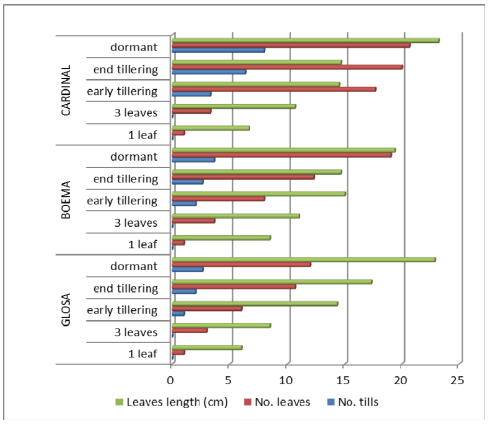

Figure 5. Results of biometric meansurements made in vegetative period

Based on the determination of water content from the soil and plants in the five phases of the vegetative period, it was observed root water uptake dynamics in these two species (Figure 6).

Positive correlation between soil water content and plant, indicating that the absorption of water by root cells must be in a hypotonic environment and the vacuolar juice must be hypertonic. The result of this situation is materialized through endosmotic current, i.e. a current penetration of water into the root cells, increasing their moisture (Figure 7).

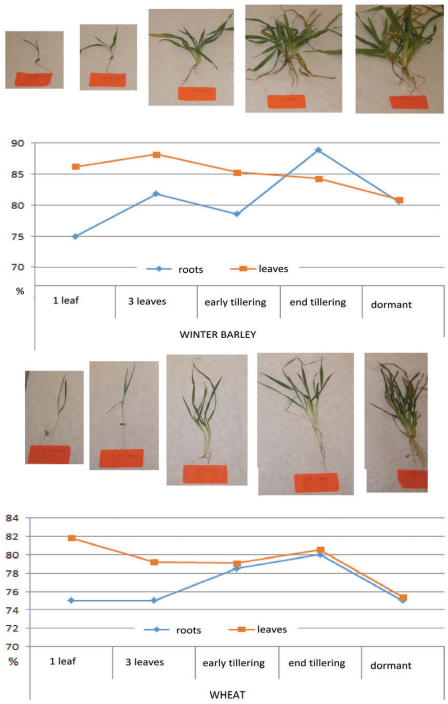

Figure 6. Water dynamics on plants

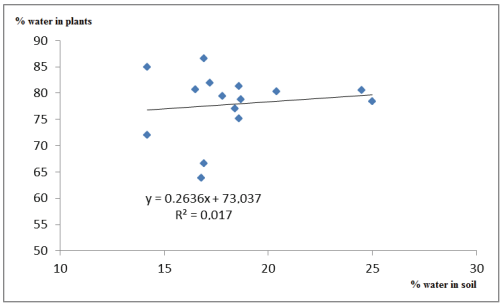

Figure 7. Correlation of water content in soil and plants

Analysis of dry matter content of plants showed similar dynamics in the two species studied. The dry matter content in root is higher than the dry matter content of leaves in the early stages of vegetation by the end tillering, when the

difference decreases and becomes equal in dormant stage (Figure 8).
Total content of dissolved salts in the plant extract 1:5 was between 52.8 and 92.06% values, with the maximum recorded in early tillering stage (Figure 9).

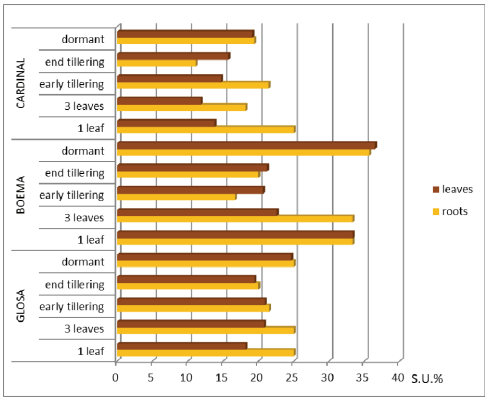

Figure 8. Dry matter content in plants in vegetative period

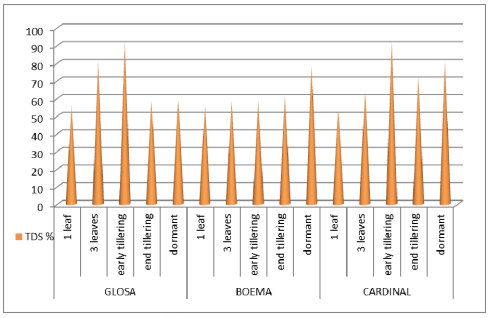

Figure 9. Total dissolved salts in plants extract in different stages of vegetative period

Laboratory analysis results showed that the absorption of nutrients (N, P, K) is very high in one leaf stage, then declines during the 3-4 leaf, then increase by 15-20% during tillering stage and falls again in dormant stage until the formation of straw, when it grows again with 20 to 25% (Figure 10).
Although the vegetation period of wheat and winter barley is longer, most of the nutrients are absorbed in a very short time at the beginning of training to baking straw in milk: 78-92% nitrogen, 75-88% phosphorus, potassium 85-88%. In this short time, wheat and barley cannot to secure to give high yields, the necessary nutrients from soil reserves only. Therefore, fertilization complex at seedbed preparation and corrective fertilization with nitrogen in winter are very necessary.
The influence of high doses of urea application on wheat and winter barley productivity elements was not very significant for normal plant densities of 500-600 pl. / Sq. (Figure 11).

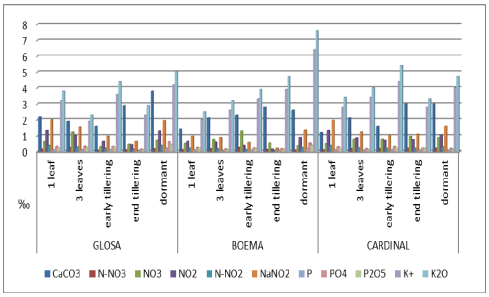

Figure 10. Dynamics of nitrogen, phosphorus and potassium content in vegetal extract, in different stages of vegetation

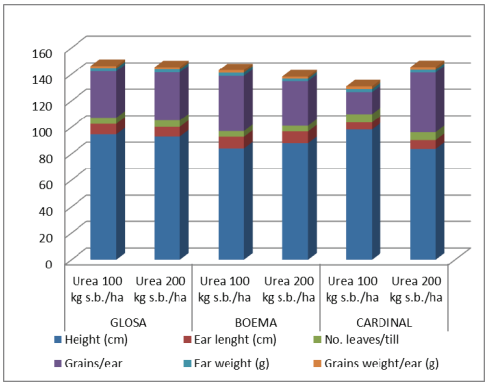

Figure 11. Graphic of biometric meansurements results at harvest time

But in the case of lower sowing densities and some late planting dates, fertilization with a higher dose of urea in winter (200 kg/ha) had favorable influence for increasing ear length, number of grains per ear, and grains weight per ear (Figure 12).
Therefore, it can be concluded that the administration of urea in an amount of 200 kg/ha, when it notice a decrease in density of plants per square meter, can increase the grain weight per ear by 40-50%, while on the normal or high densities, the influence of fertilization with the higher dose of urea on the growth of grains in the ear mass is below 15%.
Influence of urea corrective fertilization amount 200kg in the production was significant on both wheat and winter barley variants, with

increase of production by 3.18% for Glosa variety and 15.83% for Boema variety and only by 1.04% barley from Cardinal winter barley variety (Figure 13).

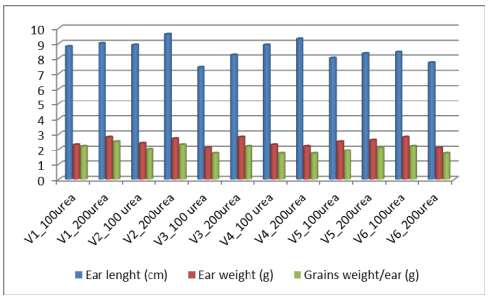

Figure 12. Fertilizer influence with urea on different density of sowing for ear lenght, ear wieght and grains weight per ear

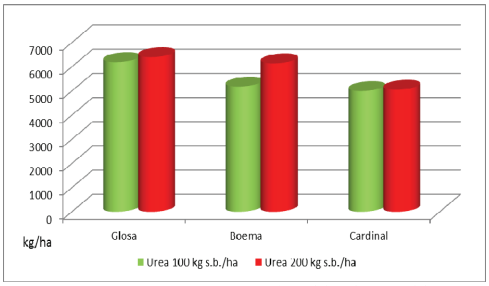

Figure 13. Differences of yields obtained by experimental variants with different fertilizer doses

CONCLUSIONS

Water absorption by barley and wheat plants is very high in 3-leaves stages and during tillering, then decrease in the winter period.

Tillering phase is the first critical phases of nutrition in winter wheat and winter barley during vegetative period, then decrease in winter, but immediately in spring the absorption increases by 20% in the training phase of the straw.

Corrective dose of nitrogen applied in late winter or in spring greatly influences grain yield in winter wheat and winter barley by increasing ear length and grain weight per ear.

In low densities of plants per square meter, we recommends the application of high doses of nitrogen in spring, calculated in correlation with the state of the soil supply in this element to prevent soil pollution.

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