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INFLUENCE OF ENVIRONMENTAL CONDITIONS ON THE SUPPLY OF NUTRIENTS TO HUNGARIAN SAINFOIN PLANTS

Abstract. For plants are easily accessible all soluble, as well as exchange-absorbed of forms of fertilizer elements. The other compounds directly are not available for plants and can be assimilated by them only after the transition to a more accessible form.

Research data on the absorption of mineral nutrition elements by plants allow to conclude that the process of feeding depends on the availability of all the elements. Generally, increasing the concentration in the environment of any element causes not only an increase of its content in plants, but also affects the contents of other elements.

Increased nitrate content can be caused by many reasons, in particular the rise in the rate of nitrogen fertilizer.

Thus, the same ions can act positively or negatively on the absorption of others. With that the orientation steps may vary depending on the condition.

Key words: sainfoin, soil, x-ray analysis, elements of nutrition, nitrogen, phosphorus, potassium.

Introduction. The absorption of nutrients from the soil is an active physiological process associated with the life of not only the root system, but also the entire plant. An integral part of the metabolism of root cells, including growing cells, are breathing and the synthesis of substances carrying out ion transport, income process of the elements of mineral nutrition.

The productivity of plants and absorption by them of macro and micronutrients are directly dependent on the content of mineral elements in the soil.

Fertilizer elements in the soil can be in the soil solution (various mineral and organic soluble compounds), in the organic substance of soil (plant residues, humic substances, microorganisms) and in solid mineral phase of soil [1, 2].

For plants are easily accessible all soluble, as well as exchange-absorbed of forms of fertilizer elements. The other compounds are not directly available for plants and can be assimilated by them only after the transition to a more accessible form (as a result of the destruction of the primary minerals during weathering, mineralization of organic substances and other processes).

It should be noted that under the influence of changes of external conditions, some of macro- and micronutrients in the soil, can change to the indigestible form (by changing the reaction environment, strengthening the microbiological fastening of nutrients and a number of other processes), which causes a decrease of their uptake by plants. The plants themselves provide significant impact on the availability of a variety of the soil nutrients. Changing the reaction environment under the influence of various substances, released by plants, facilitates the transition of a number of inaccessible soil compounds into digestible form.

Continuous improvement of methods of fertilizer application is possible on the basis of in-depth study not only the properties of soils and fertilizers, but also the ever-changing needs of plants for nutrients, nutrient substances admission mechanism and other issues, related to the physiology, plant biochemistry, soil science [3, 4].

Taking into accountthe forgoing, the studies have been conducted on the effect of environmental conditions on the supply ofplants nutrients and optimization of plant nutrition, the use of fertilizers, soil fertility, and taking into account bioclimatic potential to produce high and qualitative agricultural products.

Production experiments were laid out on the farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region. Under the rules of strip system of farming, the area of 100 hectares was divided into 3 sections: 1st section - control - pure sowing of perennial grasses; 2nd section - sowing of perennial grasses under barley cover with doses of mineral fertilizers $N_{60}P_{40}$ K_{30}; 3rdsection - perennial grasses under barley cover with doses of mineral fertilizers $N_{80}P_{50}K_{40}$.

To determinethe chemical composition of plants were taken sainfoin samples on the X-ray spectral analysis.

Experimental. Daniel Piz, 1969. JosephI, Goldstein, 1981. Experiences were held at temperature 22,3^{0}C, humidity 56% at the Research Center of Radio Ecological Researches of Shakarim SU of Semey.

Study on definition of vitamins was conducted by the method of Bendryshev A.A., Pashkov E.B.at temperature 22,2 ^{0}C with humidity less than 59% [5], and the amino acids were determined according to AUSS 32195-2013 [6].

Results and discussion. Plant nutrition should be evaluated both in terms of quantity, i.e. on the dynamics of the assimilation of nutrients during the growing season, and quality, that is, the ratio of nutrients, absorbed by plants in different phases of development.

Studies have shown that in the assimilation of mineral elements by plants an important role plays the ratio of ions in the environment. Each type of plants requires a certain ratio of nutrients, which varies during the growing season. Observance of this ratio has a determining effect on plant productivity and sainfoincrop quality.

In our studies, potassium enters the root system faster than other macronutrients, although the diameter of the hydrated ions of other elements is greater than in the sainfoinstem than potassium. Similarly, calcium enters the roots faster than aluminum ions and sulfur. It should be noted that the ions relationship in the nutriculture medium is not limited by this.

Experimental data showed the following effect of the elementsratios in the environment on their release and accumulation in sainfoin (table 1).

Table 1 – Experimental data on the chemical composition determination of sainfoin by X-ray analysis

#	Name of samples	Place of sample collection	Chemical composition, %	
1	Sainfoin (stem)	Farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region	O – 90,16 Mg – 1,18	K – 1,14 Ca – 7,51
2	Sainfoin (leaves)	Farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region	O – 80,28 Mg – 2,85 Al – 0,93 Si -2,31	P – 0,90 S – 0,56 K– 7,99 Ca – 3,13 Mn – 1,06
3	Sainfoin (flowers)	Farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region	O – 85,40 Mg – 1,74 P – 2,53	S – 1,42 K – 5,35 Ca – 3,55
4	Soil	Farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region	O - 51,17 Na – 0,96 Mg – 1,62 Al – 8,66	Si – 26,05 K – 2,82 Ca – 1,26 Ti – 0,52 Fe – 6,94
Note: f/e – farming enterprise.				

In our experiments, the close relationship was demonstrated between the iron supply in the plant and its concentration in solution. It is found that by plant nutrition from a solution containing a mixture of elements, especially from the soil solution, a substantial role does not play concentration buta substantial roleplays the ratio of elements and their mutual influence.

Changing the supply level of nutrients causes numerous responses of the body. In particular, in the case of a sudden excess of any required element of a mineral nutrition, the defense reaction of plant can appear in an increase in the absorption of other elements. A slight excess of one of the macronutrients,

when the plant is not yet threatened with destruction, usually causes a sharp decline in revenue of other mineral elements. Excess of nutrients can be partially eliminated by the introduction of other elements.

It should also be noted that by input into plants the individual macro- and microelements, a lack of which is tested before it, activates a number of metabolic reactions, thereby improving the overall physiological state of the plant, which in turn leads to an increase in needs of other supply elements.

Growth aboveground plant organs and root system development depend on the physiological balance of the nutrient solution. All the nutrient salts necessary for normal growth and development of the plant, should be in the optimal concentrations and ratios in the physiologically balanced solution.

Mono salt solution cannot meet the nutritional needs of plants, even for a short period, as it is physiologically unstable.

Of great importance in the study of absorption consistency of fertilizer elements is a length of experience since by long exposures usually occur appreciable changes in the physiological state of sainfoin experimental plant, particularly in absorbing ability of the root system.

The presence of nitrogen phosphorus and potassium in the nutrient medium largely determines the rate of plant growth and uptake by them of other mineral nutrients. Increasing the level of nitrogen nutrition increases the supply in plants of P, K, Ca, Mg, Fe and Mn. Effect of nitrogen on receipt in plants ofabove mentioned elements is reversed in its excess dosage depends on its shape.

Excess phosphorus dose reduces delivery of copper, iron, manganese in plants.

With the increasing of availability of plants by basic nutrients (N, P, K) the need of microelements in plants increases. In turn, microelements play an important role in improving the efficiency of macronutrients and their uptake by plants. Thus, in the experiments the nitrogen flow in the plants was reduced by deficiency of iron, manganese.

According to our observations, nitrogen use improved the application of molybdenum and cobalt. In the literature, there is evidence that the uptake of phosphorus by plants increased in the presence of copper, zinc, calcium, molybdenum, but decreased under the influence of magnesium and iron [7, 8]. Admission to the plant of potassium declined under the influence of copper, manganese, nickel, zinc, molybdenum, iron and boron, and increased with the introduction of chlorine [9, 10]

In the absorption of essential mineral nutrients there is close interrelation. Deviation of the concentration of one element by 30-100% of its optimal content of the substrate leads to the absorption change of other nutrients by the plant, the increase in the number of elements found in a lack of concentration, promotes the absorption of other elements, and excess of any element prevents the entry of other elements.

In sharp deviations (100-times or more) of concentrations from the optimum (deficiency or excess) the relative content of other elements is increased; at the same time the absolute value of their receipt decreases due to the abrupt deceleration of plant massincrease. However, a slight decrease in the concentration of one element in the substrate as compared with the optimum limits the absorption of other fertilizer elements by plants.

Data for interaction with anions absorption is considerably less than for cations. As to cations, it shows the presence of antagonism and synergy in the interaction of the individual anions.

According to laboratory tests the total content of the elements in the soil is quite different. Thus, the calcium content in soils varies in 1310 times the content of phosphorus, magnesium, iron, manganese –in 100-300 times. Not less significant fluctuations of these elements, soluble in 1N hydrochloric acid: manganese content in the range 70, and iron - 1420 times. The lowest fluctuation of nitrogen and potassium in soilis observed (about 10).

The root system of plants is differentially related to incoming nutrients. Fertilizer elements that are in shortage, comes firstin a root, while unwanted ions to the plant can be output in the soil again. Vacuoles of root cells smooth content fluctuation of fertilizer elements in the environment. They irreversibly retard unwanted items and can store elements that are currently in large quantities in the space surrounding the root [2].

Of great importance to create crop plants is the plants ability to reuse elements of mineral nutrition.

In assessing the sufficiency of plantsby nutrients should be taken into account that some of them can be reutilize (reused), for example, by the outflow from the leaves to reproductive organs. However, such

elements as calcium, iron, manganese, boron, copper and zinc, are not reutilized; Sulfur in part is used in the organic compounds. Nitrogen, phosphorus, potassium, magnesium can be used repeatedly. According to our observations, it may be noted that the deficit of reusable elements manifests primarily in the older leaves. On older plant organs appear sharper symptoms of elements excess unsuitable to recycle and abundant in the environment.

Also, research was conducted to determine the amino acids and vitamins in sainfoin (Table 2, 3).

Table 2 – The experimental data on the determination of vitamins

Name of samples	Place of sample collection	Content of vitamins, mg/100g			
		B_1, thiamin	B_2, riboflavin	B_6, pyridoxin	C, antiscorbutic vitamin
Plant sainfoin	Farm "Ertay" of Beskaragaidistrict of the East Kazakhstan Region	0,97236	2,34961	3,14421	–

Experimental data show that in sainfoin pyridoxine in 3.14421 mg / 100 g, riboflamin in 2.34961 mg / 100 g., Thiamine less than 0.97236 mg / 100 g., which is part of a series of enzymes that regulate carbohydrate metabolism as well as exchange of amino acids, and antiscorbutic vitamin is absent.

Table 3 – Experimental data for determining amino acid

Name of samples	Place of sample collection	Name of amino acids	Units	Real content rate of amino acids
Sainfoin	Lab.sample	Valine	mg/100 g	7,05
		Leucine	mg/100 g	1,45
		Phenylalanine	mg/100 g	3,26
		Tryptophane	mg/100 g	1,02
		Methionine	mg/100 g	2,66
		Isoleucine	mg/100 g	2,74
		Arginine	mg/100 g	10,09
		Lysine	mg/100 g	1,62

Conclusion. Numerous data on the absorption of mineral nutrition elements by plant sallow to conclude that the process of feeding depends on the availability of all the elements. Generally, increasing the concentration in the medium of any element not only causes an increase of its content in plants, but also affects the contents of other elements.

At different levels of availability of mineral nutrition elements the interaction between them flows differently and can be seen the rapid transitions of antagonism in synergism, and vice versa. Reducing of the temperature and illumination increases the effects of excessive doses of mineral nutrients, and humidity increase slightly reduces the negative effects of excessive amounts of mineral elements.

Thus, the same ions can act positively or negatively on the absorption of others. In this orientation steps may vary depending on the conditions.

The study results were implemented in f/e "Ertay".

The right systematic soil cultivation and its fertilization provide its annual improvement of its fertility and increasing of crop yield. According to our observations we can conclude that at different stages of life the sainfoin consumes nutrients in various quantities.

Thus, it is recommended, in the period of active growth - after seed germination until the formation of the first flowers - sainfoin absorbs most nitrogen, since it is a building material in the formation of plant tissue.

During the formation of generative organs - the buds, flowers - sainfoin need the most phosphorus, in preparation of sainfoin for the winter - the important role plays potassium.

Also soil cultivation should be drawn up for each crop rotation, taking into account the requirements of sown crops and technologies of their cultivation, soil characteristics, fore crop, scheduled doses and methods of fertilizer application and to diversify the structure of sown areas, to increase the proportion of perennial grasses in the sown areas structure.

REFERENCES

[1] Agriculture / C. A.Vorobyov, A.N.Kashtanov, A.M.Lykov, I.P. Makarov; Ed. S.A. Vorobyov. M.: Agropromizdat, 1991. P. 527. (Textbooks and learning aids for students in of higher educational institutions).

[2] Smirnov P.M., EA Muravin E.A., Agrochemistry / 3rd ed., Rev. and Sub.-M.: Agropromizdat, 1991. 288 p. (Textbooks and Teaching aid for students ofhigher educational institutions).

[3] Trapeznikov V.K., Ivanov I.I., Talvinskaya N.G. Local plants nutrition. Publisher "Gilem". UFA, 1999. 260 p.

[4] Yagodyn B.A., Zhukov Yu. P., Kobzarenko V.I. Agrochemistry / Ed. B.A. Jagodina. M.: Mir, 2003.

[5] Bondryshev A.A., Pashkov E.B., Pirogov A.V., Shpigut O.A. Determination of water-soluble vitamins in the vitamin premix, dietary supplements pharmaceutical preparations by high-performance liquid chromatography with gradient elution. Vest. Mosk. User. 2. Chemistry, 2010. vol. 51, N 4. P. 315-324.

[6] GOST 32196-2013 (13903: 2005) MULTI-STANDARD FEED, FEED. Determining method of the amino acid content.

[7] Workshop on Agricultural Chemistry / V.V.Kidin, I.P.Deriugin, V.I.Kobzarenko and others; ed. V.V.Kidin. M.: KolosS, 2008. – 599 p. (Textbooks and teaching aids for students of higher education institutions).

[8] Eleshev R.E., Ramazanova R.H., Balgabaev A.M. Agrochemistry workshops textbook A., 2011 pub. Corporation "Dulat" 16.5 p.

[9] Eleshev R.E., Sapahova Z. Environmental aspects of the use of mineral fertilizers in the Republic of Kazakhstan "The rational use of soil resources and ecology» // Materials of the International scientific-practical conference. Almaty, 2012. P. 386-390.

[10] Mineev, V.G. Agrochemicals:. M: Moscow State University M.: KolosS, 2004. 720 p. (Classical university textbook. Gr.). - ISBN 5-211-04795-8; 5-9532.

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ҚОРЕКТІК ЭЛЕМЕНТТЕРДІҢ ЭСПАРЦЕТПЕН СІҢІРІЛУІНЕ ҚОРШАГАН ОРТА ЖАГДАЙЫНЫҢ ӘСЕРІ

Аннотация. Өсімдіктер үшін барлық жақсы еритін, сондай-ақ алмаспалы сіңірілетін қоректік элементтер жетімді. Қалган қосылыстар өсімдіктер үшін тікелей жетімді емес, олар тек қажетті формага ауысқан жағдайда гана өсімдіктермен сіңіріледі. Зерттеу қорытындысы бойынша келесіні тұжырымдауга болады, яғни өсімдіктердің қоректену процессі тікелей барлық элементтермен біркелкі қамтамасыз етілуіне байланысты. Ережеге сәйкес, ортада кез-келген элементтің концентраиясының жогары болуы, оның өсімдікте көп болып жиналуына гана емес, сонымен қатар өсімдікпен басқа элементтердің сіңірілуіне де әсерін тигізеді. Нитраттардың жогарылауы көптеген себептермен түсіндірілуі мүмкін, көп жағдайда азот тыңайтқыштарының көп берілуіне байланысты. Осылай бірдей иондар басқа элементтердің өсімдікпен сіңірілуіне оң және теріс әсер етуі мүмкін. Солай бола тура оның багыты орта жагдайына байланысты өзгерін отырады.

Түйін сөздер: тыңайтқыш, қоректік зат, эспарцет, топырақ, рентгеноспектральді сараптама, қоректік элемент, , азот, фосфор, калий.

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ВЛИЯНИЕ УСЛОВИЙ ОКРУЖАЮЩЕЙ СРЕДЫ НА ПОГЛОЩЕНИЕ ЭЛЕМЕНТОВ ПИТАНИЯ ЭСПАРЦЕТОМ

Аннотация. Для растений хорошо доступны все растворимые, а также обменно-поглощенные формы элементов питания. Остальные соединения непосредственно недоступны для растений и могут усваиваться ими только после перехода в более доступную форму. Исследовательские данные по поглощению элементов минерального питания растениями позволяют заключить, что процесс питания зависит от уровня обеспеченности всеми элементами. Как правило, повышение концентрации в среде какого-либо элемента вызывает не только увеличение содержания его в растениях, но и влияет на содержание других элементов. Повышение содержания нитратов может быть вызвано многими причинами, в частности повышением норм азотных удобрений. Таким образом, одни и те же ионы могут положительно или отрицательно действовать на поглощение других. При этом направленность действия может изменяться в зависимости от условий.

Ключевые слова: удобрение, питательное вещество, эспарцет, почва, рентгеноспектральный анализ, элементы питания, азот, фосфор, калий.