UDK 631.82:546.22:635.64/65:631.445.4

EFFICIENCY OF APPLICATION OF FERTILIZER FOR GROWING SOYBEAN AND TOMATOES ON THE TYPICAL CHERNOZEM IN RIGHT-BANK FOREST-STEPPE OF UKRAINE.

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There are the results of studies on the influence of sulfur fertilizer on soybean yield and tomatoes and quality indices of corn and fruits. It is shown that the use of ammonium sulfate with humates on typical chernozem humus was more effective than the traditional ammonium nitrate and ammonium sulfate.

Traditional ammonium sulfate, ammonium sulfate with humate, ammonium nitrate, black soil type, soybean, tomatoes, yield, quality.

Intensification of natural farming is to put all new and new challenges. The guarantee of high soil fertility, increasing crop productivity and environmental safety environmental components are balanced on all elements of mineral nutrition on the basis of content, distribution and transformation of nutrients in the soil. Along with elements such as nitrogen, phosphorus and potassium is sulfur - second after nitrogen proteyinohen [1, 2].

Sulfur, similar cycle of nitrogen cycle is oxidation in soil and recovery plant. Both of these elements are contained in organic compounds covalent bonds with carbon. They are not available to plants in the elemental form, and digested them only in the oxidized form (SO42-, NO3-). In soil sulfur occurs in two forms: mineral and organic. Gypsum and anhydrite are the basic sulfates and pyrite and sphalerite - primary sulfides soil. In saline soils are present sulfates of alkali and alkaline earth metals. All of these compounds with elemental sulfur present form mineral soil. In the humus-accumulative horizons sulfur accumulates mainly in the form of organic compounds. They contain the bulk soil sulfur. As a result of microbiological processes is oxidized to sulfates, which are then absorbed by plants and can

accumulate them to 0, 02-1, 8%. Due to poor absorption of sulphates contained in the soil in very small amounts [2, 3].

Lack of sulfur as oxide reduces protein synthesis, with outward signs of sulfur deficiency plants almost completely coincides with signs of nitrogen deficiency. Installed absolute necessity for the processes of respiration, photosynthesis, nitrogen and carbon metabolism [4]. Sulphur is a component of antibiotics (penicillin), vitamins (thiamine, biotin), enzymes, amino acids (cysteine, methionine). It is important in the activation of enzymes and helps to fix nitrogen from the atmosphere by plants [3].

The positive effect of sulfur on yields often left unnoticed , since it affects mainly not only on its size , but the quality of the product. Simultaneously removal of sulfur from the soil with the harvest of crops is almost similar to the removal of phosphorus , and in some cases even surpasses it. Earlier power plant sulfur satisfied without additional costs , then to the present and future resource revenues of the soil is reduced , and the need for it is growing agriculture due to increased demand for high-quality agricultural products [5].

In many respects the prevailing market economies fail to comply with the existing technologies of crops, which leads to an imbalance between revenues and the removal of the battery. This in turn reduces soil fertility and crop yields and making dangerous changes in the ecological situation agrocenosis. Comparing resources and consumption of sulfur in agriculture, many scientists have come to the conclusion that increases the risk of sulfur deficiency, particularly in areas with annual rainfall more than 500 mm per year, underdeveloped industry, as well as medium and light soil particle size distribution [2,5] .

The basic condition for an increase in the deficit is to reduce the sulfur content of sulfur dioxide in the atmosphere, replacing ordinary fertilizers concentrated mixtures with sulfur, increase crop yields and increase the removal of sulfur from it.

In this regard, the production and use of sulfur-containing fertilizer is important, and research on their impact on the productivity of crops noteworthy.

The purpose of research− providing comparative assessment of different types of ammonium sulfate for soybean and tomato on a typical black soil humus.

Materials and methods of research. In the experiment studied the effectiveness of ammonium nitrate, ammonium sulfate and traditional ammonium sulfate with humates on a background of balanced phosphorus-potassium fertilization on yield and quality of soybean and tomato fruits.

Studying the effectiveness of fertilizers in experiments conducted with soybean in 2009-2011 under the scheme: 1. Control 2. $R_{60}K_{60}$ - background 3. Background + N_{30}(Naa) 4. Background + N_{30}(Na), 5. Background + N_{30}(Na with humates) 6. Background + N_{60}(Naa) 7. Background + N_{60}(Na) 8. Background + N_{60}(Na with humates) 9. Background + N_{90}(Naa) 10. Background + N_{90}(Na) 11. Background + N_{90}(Na with humates).

The area of cultivated land − 100m^2, accounting - 65m^2, repetition of the experiment − Triple, systematic placement options. Object of study − Anushka soybean varieties. Rules listed in the register of plant varieties that are suitable for distribution in Ukraine since 2007, which is recommended for all climate zones and recognized national standard for mature varieties.

Comparative evaluation of the effectiveness of fertilizers for tomato cultivation was carried out in 2010-2012 under the scheme: 1. Without fertilizer (control), 2. $N_{80}P_{90}K_{90}$(Naa) 3. $N_{80}P_{90}K_{90}$(Na) 4. $N_{80}P_{90}K_{90}$(Na with humates).

The area of cultivated land - 150m2, accounting - 104m2, Triple repetition of the experiment, the systematic placement options. Object of study - tomato Meek, who landed in the optimum timing for that zone.

Technology of both cultures is common for the Right-Bank Forest-Steppe of Ukraine.

Soil research areas typical black soil humus roughly silty light loam on loess, which is characterized by an average supply of hydrolyzed alkaline nitrogen, high phosphorus and moving average rate of potassium.

Fertilizers made in the spring, before the early spring cultivation. In experiment studied the effect of ammonium nitrate (34,5% N) (HOST 2-85) simple granuled

Superphosphate (19,5% P_2O_5) (HOST 5956-78), Potassium Chloride (for soybeans) (60% K_2O) (HOST 4568-95) and Potassium-magnesium (for tomatoes) (28% K_2O, 8% Mg) (TU 05743160.002-94) also traditional ammonium sulfate (21% N and 24% S) and new nitrogen fertilizer humic- ammonium sulfate (21% N and 24% S and 1% some humic substances) developed National Technical University of Ukraine "Kyiv Polytechnic University" (TU 00203826.007-94).

Harvesting was carried out separately on versions of the experiment. Defining quality soybean and tomato fruits was performed by standard methods in agricultural chemistry.

Studies. To obtain a stable and sustainable gross grain harvest agricultural crops very important timely and efficient conduct of activities aimed at improving yields and improve product quality. Increased capacity productive grades possible on account of the level bases of mineral power soil climatic conditions, predecessors implementation of soil farming.

In our studies, fertilization has a positive effect on the yield of soybean (Table 1).

Thus, the control variant soybean grain yield was 2.06 t / ha. In the background option, it increased by 0.12 t / ha or 5.83%. By making the background N30 P60K60 yield rose to 2.26 (an increase of 0.27 to control) - 2.48 t / ha (growth control to 0.42 t / ha). Using N60 on the background phosphorus - potassium fertilizers yield was the highest and reached 2.77 t / ha for the use of ammonium nitrate, 2.93 t / ha - the traditional ammonium sulfate and 3.13 t / ha - the study of ammonium sulfate with humates. With further increase standards of nitrogen fertilizer to increase yield of N90 was observed - it ranged from 2,38-2,66 t / ha, on 0,32-0,60 t / ha higher relative to control.

The use of fertilizers and positive effect on the basic parameters of grain quality of soybean (tabl. 2.)

1. Influence of fertilizers on soybean yield, t / ha, the average for 2009 to 2011.

Version of the experiment	Yield, t/ha	Increase to control	
		t/ha	%
1. Without fertilizers (control)	2,06	–	–
2. $P_{60}K_{60}$ –background	2,18	0,12	5,83
3. Background + N_{30} (Naa)	2,26	0,20	9,71
4. Background + N_{30} (Na)	2,33	0,27	13,1
5. Background + N_{30} (Na with humates)	2,48	0,42	20,4
6. Background + N_{60} (Naa)	2,77	0,71	34,5
7. Background + N_{60} (Na)	2,93	0,87	42,2
8. Background + N_{60} (Na with humates)	3,13	1,07	51,9
9. Background + N_{90} (Naa)	2,38	0,32	15,5
10. Background + N_{90} (Na)	2,56	0,50	24,3
11. Background + N_{90} (Na with humates)	2,66	0,60	29,1
The least significant difference $_{095}$, t/ha	*0,09*		

Thus, protein and fat under control were 44,1 and 20,3%, respectively. In the background option − for use $P_{60}K_{60}$ the figures were 44,3 and 20,7%.

Thus, protein and fat under control were 36,9 and 18,9%, respectively. In the background option − for use $P_{60}K_{60}$ the figures were 37,0 and 19,8%. By making the background phosphorous N_{30} − potassium fertilization protein and fat increased to 37,2-37,4 and 20,3-20,9%, respectively. The highest content of protein and fat were observed by making the background phosphorous N_{60} − potassium fertilization and were 39,1 and 20,6% for the use of ammonium nitrate, 39,8 and 21,0 − traditional ammonium sulfate and 40,1 and 21,4 - ammonium sulfate with humates. With further increase of nitrogen fertilizer norm these rates ranged 38,7-39,0 and 20,4-21,0%, respectively.

2. Influence of fertilizers on the main indicators of quality of soybean, the average for 2009 to 2011.

Version of the experiment		Contents, %			
		proteins	fats	ash	cellulose
1.	Without fertilizers (control)	36,9	18,9	4,53	8,40
2.	$P_{60}K_{60}$ ю–background	37,0	19,8	4,78	8,24
3.	Background + N_{30} (Naa)	37,2	20,3	4,84	8,17
4.	Background + N_{30} (Na)	37,2	20,6	5,05	8,05
5.	Background + N_{30} (Na with humates)	37,4	20,9	5,12	7,96
6.	Background + N_{60} (Naa)	39,1	20,6	5,28	7,75
7.	Background + N_{60} (Na)	39,8	21,0	5,35	7,64
8.	Background + N_{60} (Na with humates)	40,1	21,4	5,58	7,35
9.	Background + N_{90} (Naa)	38,7	20,4	5,19	7,91
10.	Background + N_{90} (Na)	38,9	20,8	5,26	7,90
11.	Background + N_{90} (Na with humates)	39,0	21,0	5,34	7,78
The least significant difference $_{095}$, t/ha		*0,05*	*0,35*	*0,11*	*0,07*

The highest ash content was observed by introducing the background phosphorous N_{60}-potassium fertilizers and consequently was 5,58% for making ammonium sulfate humatamy, 5,35 traditional ammonium sulfate and 5,28 − for the use of ammonium nitrate, the contents of the index option 4,53% and the background − 4,78%. By making the background phosphorous N_{90}-potassium fertilizer ash content was slightly lower and therefore was 5,34, 5,26 and 5,19% for making ammonium sulfate humatamy, traditional ammonium sulfate and ammonium nitrate. In embodiments using the N_{30} on the background phosphorus-potassium fertilizer ash content ranged from 4,84 to 5,12% depending on the variant of the experiment.

The content of crude fiber − a technology index that reduces the quality of feed crop production. In our studies, the highest fiber content was observed in the control variant and was 8,40%. In the background option of making phosphorus – potassiumfertilizer fiber content slightly decreased and amounted to 8,24%.

The lowest fiber content was observed by introducing the background phosphorous N_{60}-potassium fertilizers and consequently was 7,35% for making ammonium sulfate humatamy, 7,64 traditional ammonium sulfate and 7,75 − for the use of ammonium nitrate. By making the background phosphorous N_{90}-potassium fertilizer fiber content was slightly higher and ranged from 7,78−7,91%, while the use of N_{30} in the background phosphorus – potassium7,96–8,1% depending on the variant of the experiment.

Thus, the introduction of soybean $N_{60}P_{60}K_{60}$ contributed to obtaining the highest yield of soybeans with the highest quality of grain , with the use of ammonium sulfate with humates was more effective than the introduction of other nitrogen fertilizers.

An indication of the effectiveness of any measure crop yield is grown culture, which is influenced by the specific soil and climatic conditions and cultivation technology elements that determine plant productivity and determine the size and quality of the crop . Get high yields possible only to ensure the life of the plant organism , in which all the processes required to create yield will occur optimally.

As a result of the research, it was found that during tomato fertilizer significantly increased the amount of yield relative to control (Table 3). By entering $N_{80}P_{90}K_{90}$ (nitrogen as ammonium nitrate) to control crop growth was 5,2t/ha (12,9%) due to the increase mostly substandard berries. Tomatoes responded positively to changing ammonium nitrate to ammonium sulfate in the fertilizer as growth yield was 7,10t/ha the previous version by increasing the fraction conditioned and non-conditioned fruit.

The use of potassium humate in the fertilizer effectively influence the yield of tomatoes, because under these conditions has been achieved maximum level of 53,1t/ha, which increase crop to make ammonium sulfate without humitiv was 5,6t/ha, with a growing number of both conditioned and non-conditioned fruit.

3. Effect of fertilizer application on yield, t / ha, the average for 2010 -2012.

Option experiment	Fruit yield, t / ha					To gain control					
	Total, t/ha	conditioned		substandard		Total		conditioned		substandard	
		t/ha	% from total	t/ha	% from total	t/ha	%	t/ha	%	t/ha	%
Without fertilizers (control)	40,4	15,6	38,6	24,8	61,4	–	–	–	–	–	–
$N_{80}P_{90}K_{90}$ (Naa)	45,6	19,0	41,7	26,6	58,3	5,20	12,9	3,40	21,8	1,80	7,3
$N_{80}P_{90}K_{90}$ (Na)	47,5	19,9	41,9	27,6	58,1	7,10	17,6	4,30	27,6	2,80	11,3
$N_{80}P_{90}K_{90}$ (Na with humates)	53,1	22,6	42,6	30,5	57,4	12,70	31,4	7,00	44,9	5,70	23,0
The least significant difference $_{095}$, t/ha	*3,21*										

4. Effect of fertilizer application on the main indicators of quality, the average for 2010 -2012.

Option experiment	Vitamin Cmg%	total acidity,% of dry weight	sugars, %	sugar-acid index	NO_3^-, mg/kg	
					beginning of fruit ripening	end of ripening berries
Without fertilizers (control)	7,25	0,48	6,38	13,3	29,5	20,4
$N_{80}P_{90}K_{90}$ (Naa)	5,40	0,35	5,00	14,3	35,2	21,5
$N_{80}P_{90}K_{90}$ (Na)	6,45	0,40	5,31	13,3	35,9	22,9
$N_{80}P_{90}K_{90}$ (Na with humates)	11,0	0,41	5,33	13,0	37,5	24,4

In modern conditions of society and the accession of Ukraine to the World Trade Organization competitiveness, primarily determined by its quality. Quality of products also pose processors both within the country and abroad. Therefore, quality indicators, when grown crop production received much attention. With growing tomatoes in the first place, pay attention to such factors as products: vitamin C content of organic acids, sugar content and nitrate content.

We found the impact of fertilizers on the quality of tomato (Table 4). By fertilizing normally $N_{80}P_{90}K_{90}$ (nitrogen as ammonium nitrate) vitamin C content decreased from 7,25 to 5,40mg% relative to control, since according to previous studies fertilizers cause decrease of this indicator of quality. By changing the nitrogen fertilizers ammonium sulfate, the figure was lower compared to the control, but increased relative zastosuvannyaNH_4NO_3 to 1,05%, indicating that its action more effective. The maximum level of vitamin C was achieved using potassium humate consisting of ammonium sulfate, where it was 11,0 mg%, a 3,75% increase compared to control and to 4,55% in relation to the use of the same fertilizer without humates.

During fertilization, the figure was reduced relative to control. But the use of ammonium sulfate indication acids on growth of 0,05% on a dry weight compared to making the same rate of nitrogen as ammonium nitrate. Using potassium humate fertilizer resulted in the total acidity of tomatoes on the same level.

By use of fertilizers sugar content in tomato decreased relative to control at 1,05 – 1,38%, which does not contradict the results of previous studies. By introducing ammonium sulfate sugar level increased by 0,31% compared to the use of ammonium nitrate in the fertilizer. Effect humitiv this figure was not detected.

To characterize the quality of tomatoes plays an important role sugar- acid code, since it determines the taste of berries. As a result of the research it was found that the rate varied in different ways depending on the applied nitrogen fertilizer. Thus, the introduction of ammonium nitrate , the index increased relative to controls at 1.00 and constrained slightly sour taste of tomatoes from moderately acidic - the index option. By introducing ammonium sulfate fertilizer in the sugar- acid index was almost at control. The use of potassium humate in the ammonium sulfate resulted in

no significant decrease it by 0,30 % compared to making pure ammonium indication weakly sour berries.

Application of fertilizer resulted in reduction of nitrate levels in berries from the beginning to the end of their maturation. Note that the maximum content of early maturation was the use of ammonium sulfate with Humate (37.5 %), and at the end of maturation - the application of potassium humate consisting of fertilizers (24.4 %), which may be due to higher content of nitrate forms of nitrogen in the soil as a result of transforming its compounds in layer , because the use of $(NH_4)_2SO_4$ nitrogen fertilizer remains in the soil for more than a nitrogen ammonium nitrate , in fact, a form of nitrate fertilizers are quickly lost if not used by the plant. It should be noted that from the beginning to the end of ripening berries nitrate levels in products was within their maximum allowable concentrations for tomatoes fertilizer for all options.

Thus, the use of ammonium sulfate with potassium humate incorporates performance found by fertilizing tomatoes. In his introduction received the highest yield of berries – 53,1 t / ha for the maximum concentration conditioned (42,6%) and sub-standard fruit (57,4%), sugar content – 11,0% and other best quality.

Conclusions

1. Adding N_{60} in the form of ammonium sulphate on the background of humates $P_{60}K_{60}$ helps to ensure the highest soybean yield at 3,12 t / ha for growing in typical black soil humus .

2. The highest content of protein, fat and ash with minimal fiber observed by introducing N_{60} in the form of ammonium sulfate with humates $P_{60}K_{60}$ the background and therefore are 47,3, 23,8, 7,04 and 6,26 %.

3. Adding N_{80} in the form of ammonium sulphate on the background of humates $P_{90}K_{90}$ helps to ensure the highest yield of tomatoes at 53,1 t / ha for growing in typical black soil humus .

4. The very best of conditioned fruits helps make $N_{80}P_{90}K_{90}$, the use of a new ammonium sulfate with humates.

5. The highest sugar content for an optimal combination of other indicators as observed by introducing different types of ammonium sulphate within the recommended standards fertilizers.

6. The use of ammonium sulfate with humates for soybean and tomato on a typical humus chernozem steppes in Right-bank Ukraine was more effective than the traditional ammonium nitrate and ammonium sulfate.

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