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Influence of Mixture Vermicompost and Sulfur Per Liter Containing Waste On the Growth and Development of Potato.

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ABSTRACT

In this article presented the result of studies on establishing possibilities of use mixture of vermin compost and sulfur per liter containing waste of sulfuric acid production as growth regulator of potato. The effect is identified from using of a fertilizer-ameliorating mixture for increasing the yield, improving product quality and increasing potato resistance to adverse biotic and abiotic factors. Pre sowing seed contributed to the production of potato root crop productivity to gain to an average of 23.3 t/ha, as well as contributed to the reduction of nitrites and nitrates, respectively, from 1.44 mcg/g to 0.90 mcg/g with 11.0 mcg/g to 5.31 mcg/g.
Keywords: potato, vermin compost, sulfur per liter, containing waste, gray soil, yield.

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INTRODUCTION

Potatoes, as the staple food, it is considered one of the important crops used as a raw material for industrial production of a number of valuable products in all countries. Ethanol received from potato is still indispensable in the pharmaceutical, perfume and liquor industries. Potato tubers contain very high quality protein, vitamins, starch and other substances. Potato starch is widely used in the manufacture of confectionery products in the light industry. Potato is a good fodder for livestock, it is digestibility and nutrient content compared to grasses and cereal crops (except maize) is in the first place [1-2].

Potatoes are widely cultivated by private producers and private households of the population of the CIS countries, including our country. In our country potato acreage (more than 170 thousand hectares) are mainly concentrated in North Kazakhstan, East Kazakhstan, Almaty and Akmola regions. In recent years sharply reduced gross harvest of this crop, the yield declined from 139 kg/ha to 134 kg/ha. In this regard, It is given special attention on increasing productivity, improving quality in environmental terms. This is evidenced by the numerous number of research projects aimed at improving the quantity, quality and environmental safety of the potato crop [3-4].

One of the ways of successful development of the potato is a need for wide implementation of the agricultural science achievements in the production. One of the reserves to increase potato yields is the use of biologically active substances which has growth promoting, immune modulators and other useful properties.

In agricultural practice, it is known to use gibberellic and succinic acids for pre- treatment of potato as plant growth stimulants, particularly potatoes [5-6]. However gibberellic acid is photo chemically unstable and as succinic acid has a relatively low activity.

Analysis of the literature [6-11], and the results of our studies [12] suggest that modern technologies of cultivation of vegetable crops require the use of more efficient, a new generation of multifunctional growth regulator to optimize the power to stimulate the growth and development of plants, induce the stability of crops to adverse factors, to increase productivity and improve the biochemical composition of the crop without compromising the quality of agro-ecology and the products obtained.

The purpose of this work is to study of changes in productivity, quality and structural composition of potatoes during pre-treatment of seed tubers drug “Vermiser”.

MATERIAL AND METHODS

Research was conducted using gray soils. The humus content in the layer (0-30 cm) - 1.2-1.5%, total nitrogen 0,10-0,22%, mobile phosphorus - 12,0-29,5 mg/kg and the sum of exchangeable bases 18,4-23,2 mEq/100 g of soil.

Determination of total nitrogen was performed by titri metrically method, nitrite nitrogen with reagent Lunga - Griess (disulfonic method), nitrate nitrogen by measuring the electrical conductivity using eco-tester “SOEKS”, the determination of available phosphorus in the soil by the method of Machigin, humus by Tyurin method, the amount of absorbed bases by Kappenu – Gilkovitsu method. As a stimulant medication “Vermiser” is used, which is a mixture of vermin compost (75 % wt.) and sulfur per liter containing waste of sulfuric acid production (25 % wt.).

RESULTS AND DISCUSSION

We conducted research with a mixture of vermin compost and sulfur per liter containing waste LLP “SKZ-U” to establish the possibility to use a potato as growth regulators. Its use is intended not only to increase the yield, but also to improve product quality and increase potato resistance to adverse biotic and abiotic factors.

The purpose of these tests is to establish the optimal dose of the preparation “Vermiser”. In order to do this, the potato tubers were soaked in solutions of the preparation suspension. The content of the preparation in the contact synthesized slurry solution ranged from 0.1 to 0.0001 %. To compare the quality

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control of taken tubers, soaked in water as a reference tubers, soaked in solutions of succinic acid (0.002%) and fospinola (0.0001%).

In Table 1 presented the research data obtained during the study of effects of the mixture of waste vermin compost and sulfuric acid production ("Vermiser" preparation) on awakening potatoes buds.

Table 1: Effects of preparation on the awakening of the kidneys of potato tubers (laboratory experiment)

Types of testing	Concentration, %	Quantity of awaken buds				% to control
		total	of them			
			top	Side part	Umbilical	
Test experiment (water)	0	5.0	3.8	1.2	0	100.0
Amber acid	0.002	5.5	3.9	1.5	0.1	110.0
Fospinol	0.0001	5.6	3.8	1.7	0.1	116.6
"Vermiser"	0.1	2.5	2.0	0.5	0	50.0
"Vermiser"	0.01	4.5	1.7	2.2	0.6	90.0
"Vermiser"	0.001	7.7	3.4	2.6	0.9	154.0
"Vermiser"	0.0001	6.2	3.8	2.0	0.4	124.0

Usually potatoes start to grow the main buds of apical eyes, lateral buds, and especially kidney of umbilical buds starts to grow slowly and often do not germinate, that is still asleep. This reduces the number of shoots, produced stem and negatively affect the potato crop.

As seen from the results of laboratory tests when processing "Vermiser" potato tubers at concentrations of 0.001 and 0.0001% there increases germination kidney compared to controls by 54.0 and 24.0 %. Moreover, an increase of buds awakening takes place due to the awakening of the buds of side parts and umbilical side of tubers. During processing with higher concentrations (0.1 % and 0.01) buds conversely delay growth.

In the field with using a 0.001 % suspended solution "Vermiser" it is studied the effect of the preparation on the growth, development and productivity of potato. The data obtained during phenological observations by phases of development and biometric counts are shown in Tables 2-3.

Table 2: The morphological changes of potato plants under the influence of growth factors

Types of testing	Days of sampling (2015 y.)					
	21 July		3 August		17 August	
	scapes / leaves for one bush					
	piece	gr	штук	gr	piece	gr
Test experiment (water)	4.0 58.5	120.0 262.0	3.9 103.0	160.0 315.0	4.1 201.0	170.0 320.0
"Vermiser" 0,001%	6.3 104.2	201.0 289.0	6.0 151.0	189.0 405.0	6.2 268.0	192.0 416.0
Fospinol 0,0001%	4.3 64.0	145.0 270.0	4.3 104.0	166.0 344.0	4.8 220.0	185.0 333.0

Table 3: Effect of preplant preparation of tubers "Vermiser" potato yield

Types of testing	Potato yield, t/ha	Crop yields		Fractional composition of the harvest, t/ha		
		t/ha	%	commodity	seminal	non-marketable
Test experiment (water)	17.8	-	-	8.4	7.9	1.5
"Vermiser" (0.001%)	22.7	5.3	23.3	12.5	10.0	0.4
Fospinol (0.0001%)	19.8	2.0	10.1	9.7	8.9	1.2

On the basis of the development of the potato observations it is established that the studied preparation by stimulating the germination of tubers, accelerate the emergence of seedlings for two days, and the plants for 2-3 days earlier come into the phase of budding and flowering (*Table 2*). The withering away of the tops in potato of advanced options started 2-3 days later than the tested one (water treatment).

When treating tubers in a concentration 0.001% of studied preparation, the result shows that germination of large number of buds in eyes across the tuber surface increases.

Analyzing the obtained experimental data, it can be noted that the foliage mass, where the tubers are exposed to "Vermiser" preparation at the optimal concentration (10 mg/l) exceeds the mass of foliage of testing and sample with the standard, in other words it also observed the acceleration of the development of foliage in plants

Throughout the growing season, there was the best growth and development of potato treated with the preparation "Vermiser".

These data confirm the growth promoting activity expressed in a new mixture of vermin compost and sulphur per liter containing waste sulfuric acid production. Increasing the number of stems and the best growth of the test plants have increased the area of the bush leaves (visual observation), in other word under the influence of growth stimulants observed vigorous growth of assimilation surface.

Thus, a growth factor "Vermiser" was a factor affecting the growth of assimilation surface, and ultimately to improve the productivity of the potato.

Formation of a crop depends not only on the assimilation of the leaf surface, but also on the number of tubers formed, so we carried out monitoring of the action "Vermiser" on the process of tuber formation.

From the analysis of the structure of the bush, it is clear that the studied preparation increases the number of stems in it (*Table 3*). For example, when using "Vermiser" number of stems increases as compared with the tested one 2.2 - 2.4 pieces, and sample with a standard 1.9 - 2.0 pieces in sampling on 21 July and 3 August, respectively. This pattern also observed relative to the number of leaves, in other words carrying out pre- processing treatment of the tuber with growth promoting preparation promotes plentiful growth of leaves, which is role in the life of plants is huge.

As evidenced by the experimental data, test preparation "Vermiser" a beneficial effect on the formation of tubers. Thus, in determining the first period (July 21) in the control bush 1 had 7.0 tubers with a drug in an embodiment "Vermiser" - 8.8 tubers, and on the reference - 8.0 units. Increasing the number of tubers in the application of a mixture of "Vermiser" is set as the second and third periods of observation. Thus, the treatment of tubers drug "Vermiser" in optimal dose stimulated potato tubers. As can be seen from Table 3, the rapid growth and development of plants, the increase in the number and weight of tubers under the influence of "Vermiser" drug helped increase potato yield. So pre-treatment of potato tubers preparation "Vermiser" in 0.001% concentration will provide the additional yield compared with the control and fospinol.

As can be seen from Table 3, tuber growth with stimulants is higher than test experiment. Analysis of experimental data shows increase in the yield of seed and marketable potato yield fraction at preplant seed treatment agents "Vermiser".

Table 4: Qualitative characteristics of potato (work experience)

Dosing of the preparation	Measure	
	Nitrite, mcg/g wet weight	Nitrates * mcg/g wet weight
Without treatment	1.44±0.21	11.0±0.6
Pre-treatment of seed with preparation "Vermiser"	0.90±0.09	5.31±0.14

* According agrochemical service and SES for potato MAC nitrate ions is equal to 80 mg/kg. WHO consider acceptable nitrate contents in dietary products and vegetables NO_3- to 300 mg per 1 kg of raw material.

Also there been conducted studies to determine the quality of the crop. To determine the quality of the harvest, tubers of the new collection of products were tested for the content of nitrates and nitrites analytical method. The experimental data is presented in *Table 4*.

As can be seen from the results of the production tests of nitrite and nitrate content in tubers are much higher in comparison with the results of experiments carried out with the use of the preparation "Vermiser" for processing before sowing seed.

The content of nitrates and nitrites in processed potato tubers decreased by 1.5 times (Table 4), in other words quality and environmental safety of finished products rose significantly. The findings suggest that the use of the preparation "Vermiser" preliminary treatment of seeds prevents the accumulation of nitrate and nitrite in the plant by activating their consumption for the synthesis of complex organic compounds that are useful for human food. The use of this drug makes it possible to realize the vast potential of biological plant organism that is embedded in its genotype.

It is known that the accumulation of nitrates and nitrites in the human body has a negative impact on human health [13]. It is found that 90 % of the daily dose of nitrate entering the human body with a balanced diet comes from vegetables. Receipt of a human body with a large amount of nitrate vegetables causes disorders of the gastrointestinal tract or other adverse events. With the accumulation of large quantities of nitrosamines formed in the body, which are characteristic of carcinogenic properties. Especially dangerous are the accumulation of nitrite, as they interact with the oxyhemoglobin of blood to form insoluble methemoglobin, thus dramatically reduced the transport of oxygen to the tissues. In addition, the compound blocks the redox reaction in the cell leads to hypoxia condition in the tissues, causing symptoms of poisoning. At present, doctors believe that the main cause of diseases such as stroke, heart attack, thrombosis is the formation of insoluble precipitates in the blood.

CONCLUSIONS

It was determined that revitalization of growth and development and yield gain of the potato in treating seed material before planting with preparation "Vermiser" containing in its composition vermi compost and sulfur per liter containing waste of sulfuric acid production.

Pre sowing seed contributed to the production of potato root crop productivity to gain to an average of 23.3 t/ha, as well as contributed to the reduction of nitrites and nitrates, respectively, from 1.44 mcg/g to 0.90 mcg/g with 11.0 mcg/g to 5.31 mcg/g.

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