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Research Article

Application of hymatomelanic acid as a growth regulator of the varieties of Rosalind potato

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ABSTRACT:
The article presents the results of studying the influence of hymatomelanic acid as a growth regulator of the varieties of Rosalind potato by determination of the biological activity (determination of catalase and the enzymes of peroxidase), determination of starch from tubers and yield of potato.

Keywords: soil, peat, humic acids, hymatomelanic acids, potato, biological activity, enzymes, catalase, peroxidase, yield, starch.

1. INTRODUCTION

In recent years, interest in the use in crops of different growth factors, that can significantly strengthen the physiological and biological processes in plant tissues and, thus, affect the yield and quantity of production has increased due to the sharp rise in prices for mineral fertilizers [1-2]. Humic acids have diverse mode of action: stimulation of metabolism, improvement of the penetration of nutrition elements through the plasma membrane, enhancement or inhibition of enzyme systems, increase the adaptive properties of the plant organism [3-6]. Due to these properties, humic acids are used as growth regulator.When using humic acid as plant growth regulators, physiological activity have not humic acid, but their salts of monovalent alkali metals and ammonium. This is because humic acids are not soluble in water and cannot be absorbed by plants, while the salts soluble in water, and become available to plants [6]. Humic acids are widely used as a growth regulator on a variety of plants (potatoes, tomatoes, cucumbers etc.). The potato is a tuberous plant of the family Solanaceae. Its homeland is South America. 23.7% of the potato tuber is dry matter constituted predominantly of starch. Also it has a small amount of protein, sugar, minerals and other substances.

Use of hymatomelanic acids as a growth regulator was studied rather poorly, like the properties of hymatomelanic acids. Hymatomelanic acids belong to the group of humic acids, which are obtained by extraction directly from a sample of peat of oxygen-containing reagents. We performed the extraction with ethanol in Soxhlet apparatus and then concentrated in a rotary evaporator in our work.

2. METHODS OF RESEARCH.

Biological activity of hymatomelanic acid has been studied in the varieties of the Rosalind potato by assessing the activity of enzymes (catalase and peroxidase) in leaves. Peroxidase and catalase are enzymes that belong to the class

of oxireductases. Oxireductases interact with the peroxide as acceptor, peroxidase. Catalase is a catalyst in the reaction of decomposition of hydrogen peroxide to water and molecular oxygen. [1, 3, 6]Catalase activity was determined with the gasometrical method, based on the oxygen evolved as the result of catalytic action of the leaves on hydrogen peroxide, using Tris-buffer pH 7,2 and 3% hydrogen peroxide. Catalase activity is expressed in milligrams of oxygen in 5 g of leaves for 2min. Activity of peroxidase was determined by the method of L.A. Koryagina, N.A. Mikhaylovskaya. The activity of peroxidase is expressed in milligrams of benzoquinone in 10 g of leaves for 1 hour at 30^0C.

Microbalance experiments in the experimental field of State agrarian University of Northern Zauralye were also carried out. Square of the microplots was 21 m^2. Moist control was also used, and market image drug Rostok was used for comparison in two different concentrations.

The experience was conducted at the experimental field in 2014 - 2016. The soil in this area is strongly leached, thin, heavy argillaceous, siltyuliginousChernozem on calcareous loam.The chemical composition of the soil of experimental plot is characterized by an average content of humus in the topsoil of 6.5%.

The tubers were planted without pre-treatment growth stimulants. Foliar treatment (spraying) with hymatomelanic acid and humic acid Rostock was conducted during the summer. Processing took place in two terms, on 20 June and on 18 July, in the intense phase of growth – seedling and flowering.

3. RESEARCH RESULTS.

The results of studies of enzyme activity in 2014 - 2016 demonstrated that hymatomelanic acid 0.01% had shown inhibitory effect on the enzyme activity of catalase (Table 1), which indirectly indicates a slowing of the consumption of carbohydrates during respiration and carbohydrate accumulation in the organs of potato plants.

Table 1: The activity of the enzyme catalase for 2014 - 2016

Variations	The activity of the enzyme catalase (an average)		
	2014	2015	2016
Monitoring (water)	1,80	0,76	0,84
Hymatomelanic acid 0,01%	0,90	0,74	0,82
Hymatomelanic acid 0,001%	0,40	0,83	0,92
Rostok 0,01%	0,10	0,71	0,71
Rostok 0,001%	0,50	0,81	0,82

The same tendency is evident in the activity of peroxidase enzyme (Table 2), the action disappears during diluting the solution.

Table 2: The activity of peroxidase enzyme for 2014- 2016

Variations	Активность фермента пероксидазы (средняя)		
	2014	2015	2016
Monitoring (water)	1,81	1,1,4	1,32
Hymatomelanic acid 0,01%	1,76	1,0,6	1,29
Hymatomelanic acid 0,001%	1,95	1,1,6	1,39
Rostok 0,01%	1,79	1,1,2	1,20
Rostok 0,001%	1,89	1,1,3	1,51

Statistical processing of field experiment (Table 3) demonstrates the reliability of the data on effect of humic preparations on the yield of potatoes. On average, the yield of potatoes amounted to 308, 332, and 333 dt/ha respectively. There was the heaviest yield with application of hymatomelanic acid 0.01% and commercial humic preparation Rostok 0,01% in 2014 - 2016.

Table 3: Yield of the Rosalind potato

Variations	Yield of the potato in dt/ha		
	2014	2015	2016
Monitoring (water)	228	226	254
Hymatomelanic acid 0,01%	366	382	365
Hymatomelanic acid 0,001%	310	362	371

Rostok 0,01%	358	380	356
Rostok 0,001%	308	310	316

Table 4: An average content of stretch in the Rosalind potato tubers

Variations	Strech content ,%		
	2014	2015	2016
Monitoring (water)	12,03	11,96	12,72
Hymatomelanic acid 0,01%	12,15	12,10	12,85
Hymatomelanic acid 0,001%	11,96	11,80	12,53
Rostok 0,01%	11,86	11,90	12,25
Rostok 0,001%	12,86	12,16	12,87

4. DEDUCTIONS

1. Hymatomelanic acids of 0.01% exhibit inhibitory effect on catalase and peroxidase, and the dilution of solutions inhibitory effect disappears.
2. Hymatomelanic acids approve themselves as growth regulators, affect the potato yield. The yield increase to the monitoring was 52,3% at a concentration of 0.01% to, and 47% at a concentration of 0.001%.
3. The highest accumulation of starch in the potato tubers has been seen when hymatomelanic acid of 0.01% used as a growth regulator.

5. CONCLUSION

The research results show that humic drugs increase the potato yield. On average, the potato yield amounted to 308, 332, and 333 kg/ha respectively. The heaviest yield with application of hymatomelanic acid of 0.01% and commercial humic preparation Rostok of 0,01% was in 2014 - 2016.

CONFLICT OF INTERESTS

The author confirms that the submitted data does not contain conflict of interest.

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