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Economic efficiency of application of liquid phosphate fertilizers at growing potato on dark grey podzolized soil

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The purpose. To determine economic efficiency of application of liquid phosphate fertilizers under potato at growing on dark grey podzolized soil in Left-bank Forest-steppe. **Methods.** Field, statistical. Regular disposition of alternatives. **Results.** It is established that application of liquid phosphate fertilizers in standard dose of P_{35} has positive economic benefit: conditional-net profit makes 18,2 thousand hrn/hectare. At augmentation of doses of these fertilizings up to P_{70} expenditures for growing have increased, but income was high — 30,1 thousand hrn/hectare. Addition in fertilizer system of fertilizers with Ca, Mg and B promoted augmentation of manufacturing costs on 1550 – 1770 hrn/hectare, but because of smaller productivity the level of profitableness in these alternatives has decreased on 18,2 – 26,3% in comparison to alternatives in which applied fertilizers only with NPK. The highest economic indicators characterized alternatives with importation of liquid combined fertilizers of brand 11- 37 in dose of P_{105} and foliar top dressing Atonikom Plus (0,20% solution) where conditional-net profit made 70 thousand hrn/hectare, and level of profitableness — 75,1%. **Conclusions.** By the probes it is established that application of LCF 11-37 with foliar top dressing Atonikom Plus is economically justified and is of great importance for practical application. Affirming to that — high economic indicators in alternative with importation of liquid combined fertilizers of brand 11-37 in dose of P_{105} and foliar top dressing Atonikom Plus (0,20% solution) where conditional-net profit attained peak figure (70 thousand hrn/hectare), and level of profitableness — 75,1%.

Key words: *economic efficiency, potato, LCF 11-37.*

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In modern market situation economic efficiency for crop production systems are the most role such as competitiveness factor. The increasing of the supplies, plant protection preparations and mineral fertilizers caused increasing of their part in products cost. So, the implementation of the crop production systems, that can to supply increasing of the crop yields and effective materials using and can adaptive to soil and weather conditions, is very important today [1,2]. The development of these crop production systems is possible if the research results and every element of crop production system are analyzed. It is supplied increasing of the production volume and decreasing of the croduction costs [4,5,6]. The using of the liquid phosphorus fertilizers is one of the most practical operations in answer for this problem. These fertilizers have high accessibility of the nutrients for plants. It let to get better results accoding to other fertilizers forms [7,8].

The goal of investigation is to determine economic efficiency of phosphorus fertilizers application under potato dining for it growing on dark-grey forest soil in

conditions of Forest-Steppe of Ukraine.

Materials and methods for investigation. The field trials was located in field of LTD “Biotech LTD” in borispil destrict Kyiv region (field trials of Department of quality of agrochemistry and plant products quality named by Alexander Dushechkin) during 2015-2017. The square of research plot was 40 m^2. The research pols are organized in tree replication with systematical placing. The mid-late variety Motsart was taken for our investigation. The originator of this variety is HZPC in Holland. In field trials

was used the next fertilizers: ammonium nitrate (ДСТУ 7370:2013), liquid complex fertilizer (LCF) 11-37 (ТУ – 2186-627-00209438-01), potassium sulphate (ГОСТ 4145-74), magnesium sulphate, Bosfoliare Boron (B-21%). The soil of research plot was dark-grey forest soil. It has weekly acid reaction of soil solution (5.20), low mineral nitrogen content (13.4 mg/ha), high supplying of available phosphorus components (168 mg/ha) and exchangeable potassium compounds (174 mg/ha) and midlle supplying of exchangeable calcium (7.42 mg eq/100 g soil) and magnesium (1.64 mg eq/100 g soil). Economic efficiency was calculated using the prices in 2015-2017.

The results and discussion of the investigation. We determined that highest economic indexes was in variants with LXF 11-37 application in rate P_{105} and foliar application by Atonic Plus. The profit was 70,000 UAH/ha and it profitability was 75.1 % (табл.1). These economic indexes was less in variant with same fertilizers rate without foliar application. And prifit was 54,400 UAH/ha and profitability was 59 %. The using of the liquid phosphorus fertilizers in rate P_{35} had positive effect too. The profit was 18,200 UAH/ha in this variant. The application P_{70} caused increasing of the production costs but the profit was high and it was 30,100 UAH/ha. The including of the Ca, Mg and B in fertilizers system for potato caused increasing of the production costs to 1550-1770 UAH/ha. But the tuber yield was lower in these variants and profitability was lower too. It was 18.2-26.3 % for these variants in comparative to variants only with NPK.

Table 1. The economic efficiency for potato production system according to fertilization, 2015-2017.

№	Variant of investigation	Tuber fraction, t/ha			Tuber yield cost, thousand . UAH/ha				Production costs, thousand. UAH/ha		Profit thousand. UAH/ha a	profitability, %
		>50 mm	50-35 mm	35> mm	>50 mm	50-35 mm	35> mm	whole	Fertilizers application consts	whole		
Without foliar aplication												
1	Without fertilizers (control)	11,8	8,48	2,45	41,0	14,4	1,72	57,2	-	76,9	-	-
3	$N_{120}P_{35}K_{180}$	27,3	7,56	1,66	94,5	12,8	1,16	108	12,9	90,2	18,2	20,2
4	$N_{120}P_{70}K_{180}$	30,5	8,58	1,62	105	14,6	1,13	121	13,6	91,2	30,1	33,0
5	$N_{120}P_{105}K_{180}$	37,0	9,96	2,26	128	16,9	1,58	147	14,3	92,3	54,4	59,0
7	$N_{120}P_{35}K_{180}$ $Ca_{21}Mg_{15}B_{1,5}$	22,1	9,05	2,47	76,7	15,4	1,73	93,8	14,8	92,1	1,7	1,9
8	$N_{120}P_{70}K_{180}$ Ca_{21} $Mg_{15}B_{1,5}$	26,7	7,65	1,54	92,6	13,0	1,08	106	15,5	92,9	13, 8	14,8
9	$N_{120}P_{105}K_{180}$ $Ca_{21}Mg_{15}B_{1,5}$	31,2	8,79	1,89	108	14,9	1,32	125	16,2	93,9	30,7	32,7
With foliar application by Atonic Plus												
10	Without fertilizers (control)	14,7	8,77	1,68	51,1	14,9	1,17	67,2	-	78,3	-	-
12	$N_{120}P_{35}K_{180}$	34,4	7,88	1,25	119	13,4	0,87	133	13,7	91,4	42,1	46,0
13	$N_{120}P_{70}K_{180}$	41,2	6,38	1,50	143	10,8	1,05	155	14,4	92,4	62,3	67,4
14	$N_{120}P_{105}K_{180}$	42,9	8,09	1,22	149	13,8	0,85	163	15,1	93,2	70,1	75,1
16	$N_{120}P_{35}K_{180}$ $Ca_{21}Mg_{15}B_{1,5}$	31,1	7,48	1,13	108	12,7	0,79	121	15,6	93,1	28,1	30,1
17	$N_{120}P_{70}K_{180}$ Ca_{21} $Mg_{15}B_{1,5}$	34,6	8,61	1,69	120	14,6	1,18	136	16,3	94,1	41,8	44,4
18	$N_{120}P_{105}K_{180}$ $Ca_{21}Mg_{15}B_{1,5}$	40,3	9,49	1,23	139	16,1	0,86	157	16,9	95,1	61,5	64,7

Today foliar application for crops is effective and scientific argumentative for crop production systems [9]. The changes of the climate caused studying influence of the new fertilizers on plants, especially growth-action effect fertilizers. They optimize plant metabolism in negative effect on plants of the environmental stresses [10].

So, the including in potato production system foliar application by growth-action effect fertilizer Atonic Plus in variant with P_{35} application caused profit increasing by 23,847 UAH/ha to same variant without foliar application. The profit addition was 32,184 UAH/ha in variant with P_{70} application with foliar application to same variant without plant spraying. In variant with P_{105} the profit addition was 15,627 UAH/ha caused by foliar application. In variant with LXF 11-37 application in rate P_{35} with $Ca_{21}Mg_{15}B_{1,5}$ and foliar application by Atonic Plus the profitability was decreased by 15.9 % in comparative to variants with only NPK application. And, same tendency was in variants with P_{70} application. The profitability was decreased by 23 %.

Conclutions

The liquid phosphorus fertilizers application in rate P_{105} on background $N_{120}K_{180}$ in composition with foliar application by Atonic Plus in rate 0.6 l/ha (fertilizer solution rate was 300 l/ha) caused high economic efficiency of the potato production system. The profit was 70,000 UAH/ha and profitability was 75.1 %.

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