

The efficiency of using siderate crops in increasing soil fertility and yield of potato

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Abstract

The purpose of the research is to study the influence of various siderate crops on the growth, development, yield formation, yield and seed quality of potato varieties, as well as soil fertility elements, and on their basis the selection of the best siderate and varieties, allowing to obtain a stable high healthy seed potato.

In 2016-2019, studies were carried out on old-irrigated medium loamy typical gray-earth soils with a ground-water table of 5-7 m. The soils were characterized by favorable agrophysical properties and a low content of humus, nitrate nitrogen, mobile phosphorus, and an average content of exchange potassium. We studied early ripe varieties Kuvonch-1656m, mid-early varieties Bahro-30, Sante and Kondor for the following summer and winter siderates - rapeseed, oil radish, barley, peas, mustard, and peas+oil radish. Winter plowing served as control. The highest biomass productivity (29,9-34,5 t/ha) was observed in summer and winter siderate crops - peas, rapeseed, oilseed radish and pea+oil radish. With these siderates, the proportion of macroaggregates (>0,25 mm) in the 0-30 cm layer was 1,6–8,6 (summer), 5,8–9,6% more (winter), and the bulk mass was 0,04–0,07 g/cm³ lower in comparison with the control. After the best siderates (peas, rapeseed and peas + oil radish), the humus content in the arable layer increases by 0,01-0,02%, nitrate-nitrogen 7,40-10,05 mg/kg, mobile phosphorus 14,4-16,3 mg/kg, potassium exchange 10,36-21,10 mg/kg compared with the control. Potato planting after selected siderate crops the germination of seed tubers was 99,6-99,9% by variety, seedlings were accelerated by 2-6 days, and the growing season was extended by 4-8 days, the leaf surface area was 20,6- 21,7 thousand m² more, the harvest of tubers from the bush is 206,0-223,7 g more than the control. At the same time, the highest yield of marketable (30,0-35,0 t/ha) and seed tubers (21,5-25,4 t/ha) with a reproduction ratio (6,5-7,7) was obtained.

When planting seed tubers of the studied potato varieties grown after the best siderates (peas and peas + oil radish), it was found that the infection of plants with viruses decreased by 9,7-10,2% (in the explicit form), and in a latent form by 21,9 -22,2%. The proportion of degenerated tubers decreases by 3,0-3,4% and contributes to a healthy harvest of seed potatoes.

Keywords: Siderate crops, potato varieties, productivity, reproduction coefficient, seed quality.

INTRODUCTION

Potatoes are the main strategic crop and are important in ensuring the country's food security. It is highly responsive to food elements, humidity, and soil fertility.

It is known that the use of siderates, which have a significant positive effect on the quantity and quality of the crop, especially on reducing infection with viruses of seed potatoes, gives great opportunities to preserve and increase soil fertility.

The influence of siderate crops on the soil fertility of crops, growth, development, infection of plants with weeds, diseases, and yield of cotton, grain, and other crops has been studied in our Republic (Gorelov & Oripov, 1972; Oripov 1988; Ernazarov, 1988; Kholikov, 2004), and in potato growing (Berdnikov & Kosyanchuk, 1999; Svist & Maruhlenko, 2010; Grishin&Brisozovskii, 2010; Terekhov, 2015).

However, the influence of summer and autumn siderate crops on the elements of soil fertility of crops, growth, development, crop formation, quantity and quality of the crop in the context of potato varieties has not been sufficiently studied.

Purpose of research. Study of the influence of siderate crops on the growth, development, crop formation, yield and seed quality of potato varieties, as well as elements of soil fertility and on their basis, selection of the best siderates and varieties that allow to get a stable high-quality healthy crop of seed potatoes for these conditions.

MATERIALS AND METHODS

Field experiments were carried out in the conditions at long-term irrigated tipicserozem of the farm "Hisor" in the Yakkabag district of Kashkadarya region in 2016-2019. The mechanical composition of the soil is medium-loamy, with the occurrence of groundwater 5-7 m. In the experimental plot humus content in the topsoil (0-30 cm) made up 1.08-1.12%, the bulk soil 1,26-1,29 g/cm³ and specific gravity is 2,5-2,7 g/cm³, a total nitrogen 0,092-0,096%, phosphorus - 0,148-0,162%, potassium of 2.7-2.8%, nitrate nitrogen - 5,18-6.56 mg/kg, mobile phosphorus 18-23 mg/kg and exchange potassium 286-298 mg/kg.

The object of the study was 1-reproduction of seed material of early-ripening Kuvonch-1656 m, medium-early Bahro-30 (selection of our Institute), as well as medium-early varieties Sante and Kondor introduced from the Netherlands.

The following siderate crops were studied for these potato varieties:

I-variants for summer cover siderates (winter green manuring): 1. Winter plowing (control); 2. Rape – Nemerchansky variety-2268; 3. Oilseed radish - Raduga variety; 4. Barley - Timur variety; 5. Peas - Vostok variety-55; 6. Blue mustard - Yubileynaya variety; 7. Peas+oilseed radish.

II-variants for winter cover siderates (spring green manuring): 1. Winter plowing (control); 2. Spring plowing; 3. Rape - Nemerchansky variety-2268; 4. Oilseed radish- Raduga variety; 5. Barley - Timur variety; 6. Peas - Vostok variety-55; 7. Blue mustard - Yubileynaya variety; 8. Peas+oilseed radish.

Area of plots on siderates is 224 m², and on varieties of 14 m², repeated experience three to four-fold. Seeding of siderate crops was carried out in 2 terms: in the summer of July 26-28, in the autumn of October 14-19, the seeding rate: rapeseed-16.0; barley-160; peas-70; mustard-14.0; oilseed radish-20.0 kg/ha, and when combined crops were seeded, the norm was taken in half. Fertilizers were applied at a rate of N-30 P-100 K-60 kg/ha. After sowing, summer siderates were watered 9 times with a norm of 500-600 m³/ha, and winter siderates were watered 2 times-in autumn and spring.

In winter siderate crops 10-12 days before planting potatoes, and in summer siderates in late autumn, the yield was determined during the period of mass flowering or earing then using the KIR-1,5, it was crushed, disked and plowed to a depth of 28-30 cm.

In field and production experiments, all records, analyses, observations, and activities were carried out on the basis of generally accepted methods and agricultural recommendations (Dospekhov, 1985, Methods of research on potato culture, 1967). Statistical processing of the received data was carried out by means of program Microsoft Excel and SPSS (Statistical Package for Social Science).

DISCUSSION OF RESEARCH RESULTS

Growth and yield of biomass of siderates.

Observations have shown that summer siderate crops in the 2nd decade of October were characterized by strong growth and development-peas and rapeseed-flowering, barley-earring, and oilseed radish - formation of the aboveground part (Table.1). The density of standing in summer siderate crops changed significantly and the density of standing 1 m² in rapeseed was 556.0, oilseed radish - 466.5, barley - 478.3, peas - 102.9, mustard blue - 412.0 and in combined sowing of peas+oilseed radish - 416.0 pieces, the height of plants was in rapeseed - 64.6, oilseed radish - 59.6, barley - 70.0, peas - 61.3,

Table 1. Growth and yield of biomass of siderate crops

№	Types of siderate crops	Summer siderate				Winter siderate			
		Plants per 1 m ² , pcs.	Plant height, cm	Yield, t/ha		Plants per 1 m ² , pcs.	Plant height, cm	Yield, t/ha	
				Green weight	Dry weight			Green weight	Dry weight
		Terms of plowing biomass in the soil							
24-25.X.2016-2018					02-05.04.2017-2019				
1	Rapeseed	556,0	64,6	22,4	4,5	470,0	105,0	27,7	5,5
2	Oilseed radish	466,5	59,6	30,0	6,0	478,6	114,6	34,5	6,9
3	Barley	478,3	70,0	18,7	3,7	354,0	62,8	21,9	4,4
4	Peas	102,9	61,3	22,7	4,5	195,3	103,4	26,8	5,4
5	Grey mustard	412,0	69,2	24,0	4,8	471,6	92,3	29,2	5,8
6	Peas+oilseed radish	461,0	61,3	29,9	6,0	487,3	111,4	31,6	6,3
S_̄(%) =				2,0-2,3		1,6-1,8			
NSR_{0,5} (t/ha)=				1,6-1,8		1,5-1,7			

mustard blue - 69.2 and in the combined sowing of peas+oilseed radish - 65.3 cm, that by results of the dispersive analysis are confirmed.

The winter dormancy period for winter siderate crops was spent on seedlings-rapeseed, oilseed radish and peas, and barley-in the tillering phase. In winter siderats, the density of standing plants per 1 m² was 470,0 for rapeseed, 478,6 for oil radish, 354,0 for barley, 195,3 for peas, 471,6 for mustard and 487,3 for peas+oilseed radish, 105,0 for rapeseed, 114,6 for oil radish, 62,8 for barley, 103,4 for peas, 92,3 for mustard and peas+oilseed radish - 111,4 cm.

The distribution of the root system across the soil layers varied depending on the types and timing of seeding of siderate crops. In rapeseed, the root system was formed in the soil layer of 1,0-1,5 m, oilseed radish root crops in the layer of 0-20 cm, the main root system-0,8-1,2 m, barley-0,8-1,0 m, peas in the layer of 0,8-1,2 m.

The biomass yield of summer siderate crops was 18,7-30,0 t/ha. The highest biomass yield (29,9-30,0 t/ha) was obtained from oilseed radish and peas+oilseed radish siderates. In winter siderate crops, the biomass yield by type was 21,9-34,5 t/ha. The highest biomass yield (34,5 t/ha) was observed in oilseed radish siderate, with a relatively high yield (31,6 t/ha) when sowing peas+oilseed radish.

Influence of siderates on the physical properties of the soil.

When using summer siderates, the proportion of macroaggregates higher than 0,25 mm was 1,6-8,6% higher compared to the control. The largest (13,1-17,8%) proportion of microaggregates (>0,25 mm) in comparison with the control was observed in the pea+oilseed radish siderate.

In winter sideral crops-peas and peas+oilseed radish, the proportion of microaggregates (>0,25 mm) in the 0-30 cm layer was 14,6-19,2% or 5,8-9,6% higher than the control.

In summer siderata, the volume mass of the soil (0-30 cm) before the 1st watering of the vegetation of potato varieties was lower 0,04-0,07 g/cm³ compared to the control. The greatest decrease (1,20-1,24 g/cm³) in the volume mass of the soil was observed in the pea+oilseed radish and pea siderates. During subsequent watering, a significant decrease (0,04-0,07g/cm³) in the volume mass of the soil was observed after siderate crops peas+oilseed radish and peas and amounted to 1,21-1,26 g/cm³. In winter siderats, before the 1st watering of potato varieties, the volume mass of the soil (0-30 cm) was 1,20-1.24 g/cm³ or 0,06-0,07 g/cm³ was lower after the siderate crops-peas and mustard. After all vegetation watering, an insignificant increase in the volume mass of the soil was observed after the pea+oilseed radish siderate.

Influence of siderates on the nutrient regime of the soil.

In summer and winter terms, the use of peas+oilseed radish and peas as a siderate provided the highest humus content (1,13-1,16%). With combined seeding of siderates, the S:N ratio was favorable and ultimately enhanced the humification of plant biomass.

In winter and summer terms, peas and peas+oilseed radish were used as siderate with the highest content of N-NO₃ (13,8-23,56 mg/kg). And the highest accumulation of mobile phosphorus in the soil (35,4-38,4 mg/kg) in summer and winter terms was observed after sowing rapeseed and peas+oilseed radish. The content of mobile phosphorus was significantly changed after winter cover crops. With an increase in the content of nitrate nitrogen (N-NO₃) under the influence of siderates, the content of mobile phosphorus also increases. The highest content of exchange potassium (312,5-319,6 mg/kg) was obtained after the rapeseed and pea siderates+oilseed radish.

The influence of siderate crops on growth, development, yield formation, productivity and seed quality of potato varieties.

Phenological observation.

The options for summer cover crops the research of potato cultivars revealed that seedlings appeared on 11-19 days after planting. At the same time, the field germination of seed tubers was 98,3-99,8%. Field germination of potato tubers in the variants of siderate crops is 1,6-2,5% higher, seedlings appeared 3-6, budding-3-5, flowering-1-5 days earlier, the growing season is extended by 3-8 days compared to the control. The studied potato varieties have the highest field germination (99,8-99,9%), the emergence of seedlings for 5 days, budding and flowering for 4-5 days, the duration of the growing season for 6-8 days was noted after planting siderate crops - peas. After siderate-pea+oilseed radish, field germination was 2,5-2,9% higher, seedlings were 3-4 days old, budding and flowering 3-5 days earlier, and the growing season was 6-7 days longer than the control period.

A similar pattern was observed, and winter cover crops early-ripening varieties of potatoes Sante and Kondor. The highest indicators are the field germination of tubers by 2.3% more, shoots for 3 days, budding and flowering for 2-5 days earlier, the

growing season is extended by 2-6 days compared to the control after pea siderate. The relatively high rate of germination of sprouting, budding, flowering and period of vegetation of plants was observed at the siderate of pea+oilseed radish and mustard PPE.

Dynamics of plant growth.

The study of growth, development and formation of vegetative organs (stems, leaves and lateral shoots) of plants of the studied potato varieties (early-ripening Kuvonch-1656 m, middle-early - Sante, Kondor and Bahro-30) showed that summer siderate cultures compared to control on 30th day of the growing season was 2,3-10,4 cm tall, subsequent every decade of the growing season was 5,0-14,0 cm above. Especially, when planting potato varieties after pea siderate, the plant height was the highest, and on the 30th day of the growing season, compared with the control, it was 6,3-10,4 cm higher, in subsequent accounts it was 10,0-15,0 cm tall. Relatively tall plants of potato varieties were observed after siderate peas+oilseed radish and the height of the plants was 8,5-12,0 cm higher.

In winter siderates, the study of medium-early varieties of potatoes Sante and Kondor found that the tallest plants were marked after pea siderate. At the same time, the height of plants in the studied potato varieties on the 30th day of vegetation was 7,1-7,4 cm, and in the following decades 10,7-12,0 cm higher. Relatively tall plants were observed after siderate peas+oilseed radish and grey mustard.

In summer siderate study of changes in the vegetative organs of potato varieties, the highest indicators were on the 40th day of vegetation of plants - from one bush the number of leaves by 13,5-17,5, stems by 1,3-1,9, side shoots by 0,2-1,2 pieces, on the 50-70 day of vegetation the number of leaves 28,1-29,6, side shoots by 0,6-1,7 pieces more than the control when planting potatoes after siderate-peas. The relatively high rates by grade 40 day vegetation from the bush of leaves on 3,0-18,7, stems 1,1-1,7 m, lateral shoots 0,2-1,1 units, and in the 50-70 day of the growing season, leaves 24,1, lateral shoots 0,6-1,4 units more compared to the control for the studied varieties were obtained after pea siderate+oilseed radish.

Such regularities have winter cover crops identified in the study of medium early potato varieties. The highest vegetative organs during the growing

season formed when planting after pea siderate or on the 40th day of vegetation of plants, the number of leaves by 14,0-17,0, stems by 2,1-2,3, side shoots by 0,8-1,1 pieces, on the 50-70 day of vegetation of leaves by 22,1-32,1, side shoots by 1,6-1,8 pieces more compared to the control. When planting potato varieties after pea siderate+oilseed radish, respectively, were 10,8-13,7; 1,9-2,0; 0,8; and on the 50-70 day of vegetation, the number of leaves is 15,8-29,3; side shoots are 1,4-1,6 more than the control ones.

Changes in the leaf surface of plants with different siderates. For different variants of summer siderates, we studied changes in the leaf surface of potato varieties Kuvonch-1656 m (early-ripening), Bahro-30, Sante and Kondor (mid-early) on the 40-70 day of vegetation. In the variants of summer siderates, the leaf surface for potato varieties per hectare was 63,4-70,4 thousand m² or 14,3-19,7 thousand m² more in relation to the control. The greatest leaf area by species per hectare (68,7-70,4 thousand m²) differed after siderate of peas. A relatively high leaf surface area (67,9-69,8 thousand m²) was obtained using pea+oilseed radish siderate, or 18,8-19,1 thousand m² more than the control.

This pattern was observed in winter siderates when studying the average early varieties of potatoes Sante and Kondor, where peas served as a siderate and the leaf surface area per hectare was 70,1-71,8 thousand m² or 20,6-21,7 thousand m² more in relation to the control. A relatively high leaf surface (69,9-70,0 thousand m² / ha) was obtained after the pea+oilseed radish siderate.

Effect of siderates on the formation of yield and productivity of potato.

When the summer planting dates of potatoes after peas as siderate at 60th day of vegetation tuber yield per bush was 69,0-125,1, mass of one tuber, 10,7 and 16,2 grams, the number of tubers in the bush of 0,5-0,6 pcs more, 90th day of vegetation tuber yield per bush on 209,0-250,2, mass of one tuber 18,9-20,0 g, and the number of tubers in the bush of 1,0-1,4 pcs more compared to the control. Relatively high rates were observed after the pea+oilseed radish siderate.

At winter siderate in the study of medium early potato varieties Sante and Kondor after siderate of peas on the 60th day of vegetation tuber yield per bush at 64,0-130,0, mass of one tuber 11,2-18,4 grams, the

number of tubers by 0,2-0,6 units, and the 90th day of vegetation tuber yield per bush on 206,0-246,6, the weight of one tuber 19,6-20,3 g, the number of tubers 0,9-1,4 pcs more compared to the control. When planting potatoes after sideratepeas+oilseed radish on the 90th day of vegetation of plants, the yield of tubers from one bush was 175,7-223,7, the weight of one tuber is 15,4-17,5 g more compared to the control.

With summer cover crops, the highest productivity of potato varieties (633,1-653,3 grams) was obtained after siderate of peas. When planting potatoes after sideratepeas+oilseed radish, the productivity from the bush was 602,0-617,6 g. A similar pattern after siderate peas or peas+oilseed radish was observed for the Kuvonch-1656m variety on the 60-80th day of vegetation of plants.

The same pattern was observed in winter siderate in the study of potato cultivars Sante and Kondor. At the same time, the highest productivity (641,3-658,6 g) was obtained after pea siderate. Relatively high productivity (the yield of tubers from the bush by 175,7-223,7, the mass of one tuber by 15,4-17,5 grams, the number of tubers by 0,9-1,4 pcs. more than the control) of potatoes was noted after planting sideratepeas+oilseed radish.

The yield of potato varieties under different siderates.

The density of standing potato plants on each hectare with different siderates and varieties was the same and amounted to 68,0-70,5 thousand plants. The yield of the studied potato varieties when using summer siderates was 5,0-46,7% higher than the control. The highest increase in yield (8,1-9,8 t/ha or 36,7-46,7%) in the tested potato varieties was obtained after planting pea siderate. And after pea siderate+oilseed radish the increase of the crop by varieties was 29,4-39,0 per cent.

A similar pattern was observed in the study of medium early potato varieties Sante and Kondor, after the winter crops of siderate. The highest productivity on grades (32,0-35,5 t/hectares) or an increase of a crop of 10,2-12,3 t/hectares was authentic and (Table 2) is received after siderate-peas. And relatively high productivity (to 29,4-31,7 t/ha) of potato varieties observed after planting of sideratepea+oilseed radish or mustard PPE.

Yield of commercial and seed crops, as well as the coefficient of reproduction of potato varieties

Table 2. Influence of winter siderates on the yield of potato varieties

№	The variants of siderate	Yield by year, t/ha			Average yield, t/ha	Compared to control	
		2016	2017	2018		t/ha	%
In the Sante variety							
1	Winter plowing (control)	21,0	22,5	22,0	21,8	-	100
2	Spring plowing	19,0	20,4	20,0	19,8	-2,0	90,8
3	Rapeseed	27,4	28,3	27,8	27,8	6,0	127,5
4	Oilseed radish	26,0	27,1	26,8	26,6	4,8	122,0
5	Barley	23,9	25,0	24,6	24,5	2,7	112,4
6	Peas	31,4	32,6	32,1	32,0	10,2	146,8
7	Grey mustard	28,6	30,0	29,6	29,4	7,6	134,9
8	Peas+Oilseed radish	31,1	31,7	31,4	31,4	9,6	144,0
	$S_{\bar{x}}(\%) =$	1,6	1,1	1,6			
	NSR_{0,5} (t/ ha)=	1,2	0,9	1,2			
The Kondor variety							
9	Winter plowing (control)	24,0	23,5	22,2	23,2	-	100
10	Spring plowing	21,5	21,1	20,7	21,1	-2,1	90,9
11	Rapeseed	28,0	29,4	28,8	28,7	5,5	123,7
12	Oilseed radish	27,5	28,8	28,6	28,3	5,1	122,0
13	Barley	26,9	27,6	27,4	27,3	4,1	117,7
14	Peas	35,1	35,8	35,6	35,5	12,3	153,0
15	Grey mustard	30,1	31,6	31,0	30,9	7,7	133,2
16	Peas+Oilseed radish	31,1	32,3	31,8	31,7	8,5	136,6
	$S_{\bar{x}}(\%) =$	1,6	1,3	1,7			
	NSR_{0,5} (t/ ha)=	1,3	1,1	1,4			

in different siderate crops. It was found that the cultivation of potato varieties after different siderate crops, the yield of commercial and seed non-degenerate tubers with a high multiplication coefficient largely depends on the type and timing of sowing of siderates, as well as the potato variety.

When using summer siderate crops, the yield of commercial tubers of the Sante variety was 1,8-9,7 t/ha, the yield of seed tubers was 2,6-9,4 t/ha, the reproduction coefficient was 0,8-2,8 higher, and the proportion of degenerate tubers was 1,7-2,7% lower compared to the control (Table.3).

The above pattern was observed in other studied potato varieties Kondor, Kuvonch-1656m and Bahro-30.

It should be noted that the highest yield of commercial tubers(30,0-31,8 t/ha), seed tubers (21,5-23,0 t/ha) and the multiplication coefficient (6,5-7,0) was obtained after summer pea siderata.

For winter sideral crops and pea siderate, these indicators were still high and for varieties were 31,2-35,0; 22,4-25.4 and 6,7-7,7.

The influence of siderate crops on seed quality of potato tubers.

When planting seed tubers of potato varieties grown against the background of summer siderats, field germination on the 20th day after planting for varieties was 94,7-97,5 or 3,4-5,5% higher than control, seedlings appeared 3-6 days earlier,

Table 3. Influence of summer siderate crops on the yield of commodity and seed tubers, as well as the multiplication coefficient of potato varieties (2016-2018)

№	Siderate crops	Total yield, t/ha	Including the yield				Planting rate, t/ha	Multipli-cation factor	Percentage of degenerate tubers	
			Commodity		seed				t/ha	%
			t/ha	%	t/ha	%				
In the Sante variety										
1	Winter plowing (control)	22,1	19,7	89,0	11,5	58,2	3,3	3,5	1,02	5,2
2	Rapeseed	26,5	25,3	95,4	17,0	67,4	3,3	5,2	0,68	2,7
3	Oilseed radish	25,1	23,5	93,6	15,6	66,8	3,3	5,1	0,68	2,9
4	Barley	23,2	21,5	92,7	14,1	65,6	3,3	4,3	0,75	3,5
5	Peas	30,2	29,4	97,4	20,9	71,3	3,3	6,3	0,73	2,5
6	Grey mustard	28,2	27,0	95,8	18,6	69,0	3,3	5,6	0,81	3,0
7	Peas+oilseed radish	28,8	27,8	96,5	19,3	69,5	3,3	5,8	0,72	2,6
The Kondor variety										
8	Winter plowing (control)	23,5	21,0	89,4	12,7	60,3	3,3	4,2	1,07	5,1
9	Rapeseed	28,1	27,0	96,2	18,5	68,7	3,3	5,6	0,67	2,5
10	Oilseed radish	26,8	25,2	94,3	16,9	67,3	3,3	5,6	0,65	2,6
11	Barley	26,0	24,3	93,4	16,1	66,5	3,3	4,9	0,82	3,4
12	Peas	32,3	31,8	98,5	23,0	72,4	3,3	7,0	0,82	2,6
13	Grey mustard	29,6	28,6	96,7	20,0	70,2	3,3	6,1	0,74	2,6
14	Peas+oilseed radish	30,4	29,5	97,3	20,9	71,1	3,3	6,3	0,73	2,5
In the variety Kuvonch-1656 m										
15	Winter plowing (control)	21,0	18,7	89,0	11,0	59,0	3,3	3,3	0,97	5,2
16	Rapeseed	27,6	26,3	95,6	17,9	68,2	3,3	5,4	0,71	2,7
17	Oilseed radish	26,1	24,4	93,7	16,3	67,0	3,3	4,8	0,68	2,8
18	Barley	24,0	22,2	92,8	14,7	66,2	3,3	4,5	0,82	3,7
19	Peas	30,8	30,0	97,6	21,5	71,9	3,3	6,5	0,84	2,8
20	Grey mustard	28,3	27,2	96,2	18,9	69,6	3,3	5,7	0,81	3,0
21	Peas+oilseed radish	29,2	28,3	97,0	19,9	70,6	3,3	6,0	0,79	2,8
In the variety Bahro-30										
22	Winter plowing (control)	22,7	20,2	89,2	12,0	59,5	3,3	3,6	1,03	5,1
23	Rapeseed	27,7	26,6	96,3	18,2	68,5	3,3	5,5	0,69	2,6
24	Oilseed radish	26,3	24,6	93,8	16,5	67,4	3,3	5,0	0,66	2,7
25	Barley	24,3	22,5	92,9	14,9	66,6	3,3	4,5	0,78	3,5
26	Peas	31,1	30,4	98,0	21,8	72,0	3,3	6,6	0,82	2,7
27	Grey mustard	28,7	27,7	96,5	19,6	71,0	3,3	5,9	0,80	2,9
28	Peas+oilseed radish	29,5	28,6	97,2	20,3	71,2	3,3	6,1	0,77	2,7

the growing season was extended by 3-8 days, the plant height was 6,1-15,3 cm higher, the number of stems from the bush was 0,4-1,9 latent form at 18,2-23,4; including viruses X-5,3-5,7; S-10,7-10,8; Y-4,8; M-1,0%.

When planting seed tubers of the studied potato varieties grown against the background of summer pea seedling, the highest field germination was observed (96,3-97,5%), seedlings appeared 5-6 days earlier, the growing season was extended by 7-8 days, the plants were 11,9-15,3 cm higher, the number of stems from the Bush was 1,3-1,9 more, infection with plant viruses decreased by 9,7-10,2% (in the explicit form), and in the latent form by 21,9-22,2; with viruses X-5,3-5,7; S-10,7-10,8; Y-4,8; M-1,0%.

When planting of seed tubers grown against the background of summer pea siderate, the yield per hectare for varieties was 23,8-24,6 t, of which 22,6-23,6 t is a commercial crop, the share of degenerate tubers is 3,0-3,2% lower compared to the control.

Similar research results were obtained while planting of seed tubers grown against the background of winter siderate culture-peas. At the same time, it was revealed that the highest commodity yield for varieties was (23,4-25,6 t or 95,3-96,7%) or 6,5-7,5 t/ha more, the share of degenerate tubers decreased by 3,1-3,4% compared to the control.

CONCLUSIONS

-The study of summers and autumn periods as siderate crops-rape seed, oilseed radish, barley, peas, gray mustard and peas+oilseed radish, in conditions of old-irrigated typical gray-earth soils showed that the biomass yield of these crops is 18.7-30.0 t/ha in autumn, and 21.9-34.5 t/ha in the spring. The highest yield of biomass in both terms was obtained as a sideration of oilseed radish and peas+oilseed radish. Winter cover crops provide 3.2-4.5 t/ha, the yield of biomass than the summer siderates cultures.

- The use of biomass of summer and winter siderates as green fertilizers contributes to the improvement of mechanical, physical, water properties and microbiological processes in the arable layer of the soil. In winter siderate crops - rape seed, peas and peas+oilseed radish, in the arable

horizon of the soil, the humus content increases by 0,01-0,02%, gross nitrogen-0,006-0,008%, phosphorus – 0,029-0,030%, potassium – 0,09-0,19%, nitrate nitrogen – 7,4-10,05 mg/kg, mobile phosphorus – 14,4-16,3 mg/kg, exchange potassium – 10,36-21,1 mg/kg in relation to control (winter plowing).

- Autumn and summer siderate significantly affect the field germination of seed tubers, the intensity of emergence, growth and development of plants, the duration of the growing season of the studied potato varieties. After application of siderates-peas and peas+oilseed radish, field germination of seed tubers was 99,6-99,9% for varieties, sprouting was accelerated for 2-6 days, budding and flowering for 2-5 days, and the growing season was extended for 4-8 days in relation to control (winter plowing). At the same time, the area of the leaf surface was 20,6-21,7 thousand m² more than the control, plant height 11,9-14,4 cm, number of stems 2,0-2,6 units, the tuber yield per bush on 206,0-223,7 g and the number of tubers with hive 0,9-1,4 pcs more than autumn plowing (control).

- The yield of potato varieties after siderate crops was 26,1-32,0 t/ha or provided an increase in the yield of 5,1-10.2 t/ha (27,6-46.8 %). After the best siderate crops-peas and peas+oilseed radish, the highest yield was obtained for varieties per hectare 31,4-35,5 t or the increase in yield was 9,6-12,3 t/ha in relation to the control.

- The highest commodity yield (30,3-35,0 t/ha), seed yield (21,2-25,4 t/ha) and reproduction coefficient (6,4-7,7) of the studied potato varieties were observed after planting selected siderates - peas and peas+oilseed radish. At the same time, the proportion of degenerate tubers not exceeded by 2,3-2,9% and contributes to a healthy crop of seed potatoes, which is the infection of plants with viruses decreases by 10,7-11,1% (in explicit form), by 23,8-24,5% (in latent form) in relation to control.

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