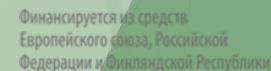




Partner 3: **FSBSI VIZR**

Project interim report 2020

Grant contract 1905165- KS1798 –Environmentally Friendly Smart Organic Agriculture (EFSOA)





Partner 3: **FSBSI VIZR**

Tasks and work activities



- Working up stock cultures and inoculums for liquid and solid-phase fermentation of strains producing biologics.
- Producing pilot trial batches of biologics for field trials: Kartofin, SC and Phytolar, G and their quality assessment.
- Pre-planting treatment of potato tubers with biologics and setting up field trials for assessment of their efficacy on the potato variety “Udacha” at the Experimental Station of the Institute for Engineering and Environmental Problems in Agricultural Production.



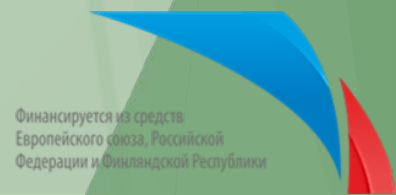


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Tasks and work activities



- Producing trial batches of the biologic Kartoffin, SC and its quality assessment for treatment of potato tubers before their storage (variety “Udacha”).
- Efficacy assessment of the biologics Kartoffin, SC and Phytolar, G in organic technologies for growing potatoes of the variety “Udacha”.
- Statistical processing of the data obtained in field trials for efficacy of the biologics Kartoffin, SC and Phytolar, G in organic technologies for growing potatoes of the variety “Udacha”.
- Assessing yield quantity and quality of the ware and standard potato tubers obtained with the use of biologics.





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Materials and research objects

- *Bacillus subtilis* I-5 12/23 (Kartofin, SC strain-producer) with complex target antagonist activity.
- *Trichoderma asperellum* T-36 (Phytolar, G strain-producer) with complex cellulolytic and antagonist target activity.
- Substrates for liquid-phase and solid-phase fermentation: liquid nutrient medium (molasses – 15 g/l, corn extract – 30 g/l, pH=7.8); waste multibiorecycled substrates (waste after sequential double cultivation of edible mushrooms *L. edodes* 4080 (shiitake) and *P. ostreatus* NK-35 (oyster mushroom) on agroindustrial waste (oak and mixed sawdust + 10% crude mixed bran).
- Nutrient media for obtaining inoculums and stock cultures:
pancreatic hydrolyzate sprat – 15 g/l, NaCl – 4.59 g/l, agar – 20 g/l, pH=7.2; liquid and agarized aqueous extracts of the multibiorecycled substrate (200 g/l).
- Kartofin, SC and Phytolar, G pilot trial batches.



ППС 2014-2020
Россия - Юго-Восточная Финляндия

Финансируется из средств Европейского союза, Российской Федерации и Финляндской Республики



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Research methods

Inoculums, stock cultures and pilot trial batches of biologics were produced in accordance with the approved regulations, technical specifications and toxicological passports of producer strains.

- Preparing inoculums and stock cultures
- Preparing waste substrates for multibiorecycling
- Producing pilot trial batches of biologics
- Determining spore productivity (titer)
- Quality assessment of pilot trial batches of biologics
- Conducting field trials
- Evaluation of field results
- Statistics and visualization





Field Test Scheme for Application of Biologics Kartofin, SC and Phytolar, G



Potato biological protection system	Biologic	Application rate	Working fluid flow rate	Disease/harmful object	Way and time of treatment, limitations	Number of treatments
Base Option	Kartophin, SC	3 l/t	10-15 l/t	Blackspot, late blight of potato, bare patch, fusarioses, blackleg	Pre-planting treatment of tubers	1
		3 l/ha	250-300 l/ha		Spraying plants subsequently at a 10-day intervals during the vegetation period	3
		3 l/t	10-15 l/t	Potato Tuber Diseases (potato scabs, bare patch, bacterioses)	Processing of tubers before storage	1
Modified Base Option	Phytolar, G	10 kg/ha	-	Soil-inhabiting phytopathogenic micromycetes	Soil application during planting	1
	Kartophin, SC	3 l/ha	300 l/ha	Blackspot, late blight of potato, bare patch, fusarioses, blackleg	Spraying plants subsequently at a 10-day intervals during the vegetation period	3
		3 l/t	10-15 l/t	Potato Tuber Diseases (potato scabs, bare patch, bacterioses)	Processing of tubers before storing	1

Field Test Scheme for Biologics Kartofin, SC and Phytolar, G efficacy assessment



Variant No	Organic fertilizer (BIOHUM) dosage	Biologics
1	0	0
2	80 kg N/ha	0
3	0	Kartofin, SC
4	80 kg N/ha	Kartofin, SC
5	80 kg N/ha	Kartofin, SC + Phytolar, G



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Results



- Batches of liquid and granular formulations of the following biologics were produced for efficacy field trials on potatoes of the “Udacha” variety: Kartofin, SC based on *Bacillus subtilis* I-5 12/23 – 5 l, 8.2×10^{10} CFU/ml; 1.5 l, 9.3×10^{10} CFU/ml; 1.5 l, 8.7×10^{10} CFU/ml; Phytolar, G based on *Trichoderma asperellum* T-36–3.5 kg, titer 1.3×10^{11} CFU/g;
- Quality assessment of the trial batches showed no contamination with foreign microbiota. Each trial batch contained only the producer strain with the specified production titer.





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Results



All the pilot trial batches of biologics were transferred for their application to the Experimental Station of the Institute for Engineering and Environmental Problems in Agricultural Production.

Treatments were carried out in accordance with the Work Program of the Grant Contract 1905165 – KS1798 “Environmentally Friendly Smart Organic Farming” (EFSOA).

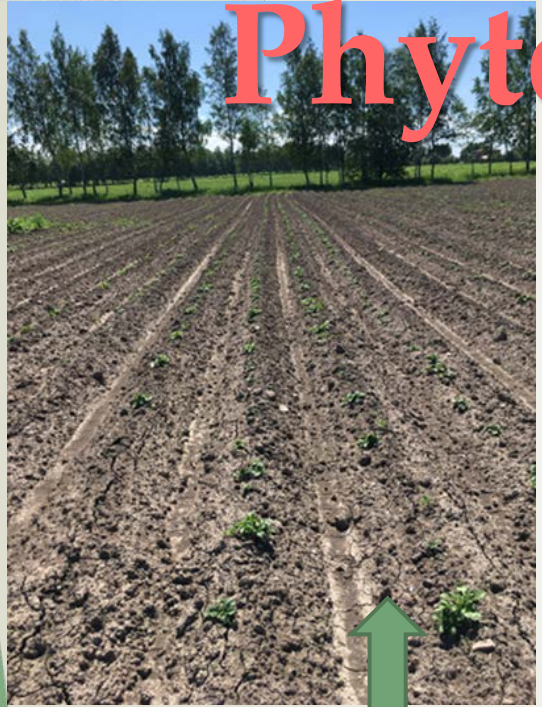


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Results



Phytohormonal activity



Seedlings in the phase of 1-2 leaf tiers

Variants with Biologics treatment

Control 1 (without treatment)

Effect of biologics on potato plants' biometrics in the variety "Udachya"

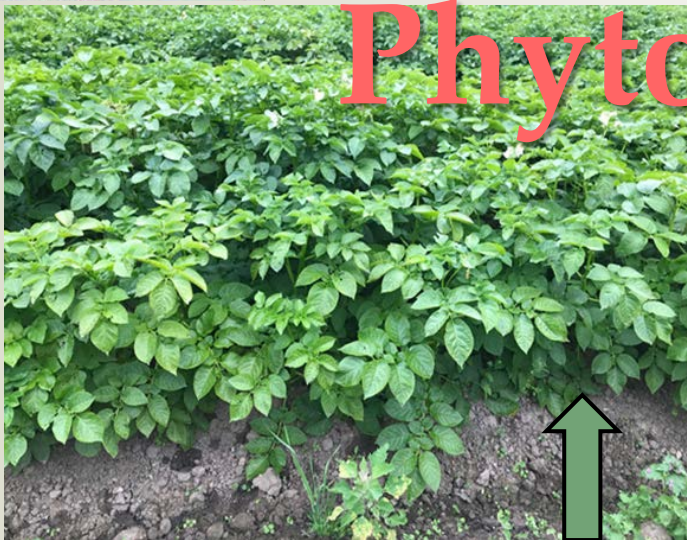


Biologics	Plant height, sm ± SEM		Productive/flowering stems number, ± SEM		Leaf tiers number, ± SEM	
	budding phase	flowering phase	budding phase	flowering phase	budding phase	flowering phase
Control 1 (without treatment)	23.8±0.4	37.3±0.8	3.6±0.1	0.7±0.1	5.2±0.1	6.6±0.1
Control 2 + N80 (without treatment)	24.1±0.5	39.2±0.7	3.6±0.1	0.7±0.1	5.1±0.1	6.5±0.1
Kartofin, SC	27.9±0.3 ***/**	36.4±0.4	4.3±0.1 ***/**	1.1±0.1 ***/**	5.9±0.1 ***/**	8.3±0.1 ***/**
Kartofin, SC + N80	29.3±0.3 ***/**	39.1±0.6	4.3±0.1 ***/**	1.5±0.1 ***/**	5.9±0.1 ***/**	9.3±0.1 ***/**
Kartofin, SC + Phytolar, G + N80	25.1±0.3 */**	39.6±0.4 **/*	4.4±0.1 ***/**	1.8±0.1 ***/**	5.5±0.1 **/**	9.5±0.1 ***/**

Partner 3: FSBSI VIZR Results



Phytosanitary state



Kartofin, SC



Kartofin, SC
+ Phytolar, G
+ 80 kg N/ha



Control 1
(without treatment)

Control 2
(BIOHUM
80 kg N/ha)



Kartofin, SC
+ 80 kg N/ha



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Results

Diseases



Alternaria
disease



Virus



Rhizoctonia
disease



Phytophthora
disease



Efficacy of biologics on “Udachya” potatoes in control of diseases (Disease Incidence)



Biologics	Biological efficacy, %			
	budding phase	flowering phase	plant closing phase	before harvesting
Control 1 (without treatment)	0	0	0	0
Control 2 + N80 (without treatment)	100.0	43.8	49.3	24.4
Kartofin, SC	100.0	86.8	82.2	57.1
Kartofin, SC + N80	100.0	89.9	86.1	37.1
Kartofin, SC + Phytolar, G + N80	100.0	94.5	80.8	53.1



Efficacy of biologics on “Udacha” potatoes in control of diseases (Disease Development)



Biologic	Biological efficacy, %			
	budding phase	flowering phase	plant closing phase	before harvesting
Control 1 (without treatment)	0	0	0	0
Control 2 + N80 (without treatment)	100.0	48.8	46.1	25.6
Kartofin, SC	100.0	88.7	81.2	66.1
Kartofin, SC + N80	100.0	92.1	84.8	43.8
Kartofin, SC + N80 + Phytolar, G	100.0	95.3	83.8	67.3

Efficacy of biologics on “Udacha” potatoes in control of tubers diseases



Biologic	Biological efficacy, %	
	Disease Incidence	Disease Development
Control 1 (without treatment)	—	—
Control 2 + N80 (without treatment)	0	6.8
Kartofin, SC	7.7	8.9
Kartofin, SC + N80	2.1	22.3
Kartofin, SC + N80 + Phytolar, G	12.5	36.2

Effect of Biologics on the yield of potato tubers in the variety "Udachya"



Biologics	Biological yield, t/ha ± SEM	Standard yield, t/ha ± SEM
Control 1 (without treatment)	20.8±0.6	20.2±0.5
Control 2 (N80)	25.1±1.7	24.1±1.8
Kartofin, SC	23.1±2.4 ^{*/*}	22.5±2.3 ^{*/*}
Kartofin, SC + N80	25.8±1.7 ^{**/*}	25.1±1.7 ^{**/*}
Kartofin, SC + Phytolar, G + N80	27.4±3.6 ^{**/**}	25.3±3.6 ^{***/*}

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Conclusions



➤ Field trials of the polyfunctional biologics Kartofin, SC and Phytolar, G to protect the potato crop from diseases during organic cultivation, have shown a high efficacy in reducing the fungal diseases incidence (*Alternaria*, late blight, the stem form of the *Rhizoctonia* disease) and a decrease in their development: biological efficacy ranged from 80.8% to 94.2% and from 81.2% to 95.3%, respectively.



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Conclusions

- Against the background of organic fertilizer BIOHUM (N80), the biological efficacy of biologics use was 3 times higher in protecting potato plants from fungal diseases during the vegetation period and 5 times higher in preventing tubers diseases of “Udacha” variety.
- In the Leningrad Region, under 2020 weather and climatic conditions on well-cultivated soil using biologized protection technology, 20.2 t/ha of standard tubers and 20.8 t/ha of commercial ones were obtained in the control variant (without any treatment).



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Conclusions



- Use of biologics (the best variants: BIOHUM at a dose of 80 kg N/ha + Kartofin, SC and BIOHUM N80 + Kartofin, SC + Phytolar, G) increased the yield of standard tubers up to 25.1–25.3 t/ha, and ware ones up to 25.8–27.4 t/ha.
- The positive effect of the applied biologics was reliably established in organic farming of potatoes.



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The results obtained allow us to recommend the use of polyfunctional biologics Kartofin, SC and Phytolar, G for the organic production of potatoes.

THANKS FOR YOUR KIND ATTENTION!!!



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