

Fertilizer "Agrolinija-S" effect on corn yield and its quality

REPORT 2019

1. Testers and location:

Alexander Stulginsky University

2. Fertilizer: Organic fertilizer-biostimulant - **Agrolinija-S**

3. Culture under study: Corn, hybrid Talisman

4. Soil

4.1. type: loam;

4.2. mechanical composition: loose sand:

4.3. humus content: 1.58%;

4.4. Acidity: pH 5.40;



4.5. availability of macro- and microelements: P₂O₅ - 410 mg / kg, K₂O - 180 mg / kg. The content of mobile forms of copper (1.0 M HCl) - 2.0 mg / kg, zinc (Zn) (1.0 M HCl) - 3.3 mg / kg, manganese exchange (1.0 M KCl) - 2.6 mg / kg, water-soluble boron - 0.65 mg / kg.

5. Agrotechnical test conditions:

5.1. precursor of the plant on which the tests are carried out: spring barley;

5.2. tillage: plowing to a depth of 25 cm (17.10.2018), tillage to a depth of 12 cm (10.04.2019);

5.3. Application of fertilizers: mineral fertilizers (long-term): basic - phosphorus - 60 kg / ha, potassium - 150 kg / ha (2018-10-17), nitrogen - 140 kg / ha (2019-04-10);

organics: cattle manure 60 t / ha (2018-10-17);

5.4. Sowing date: 2019-04-12;

5.5. sowing rate: 100 thousand/ μ l. seeds / ha;

5.6. the name and time of the activity of crop care (planting): treatment with the herbicide Meister Power - 1.5 l / ha (2016-10-05);

6. Agrometeorological test conditions (general characteristic):

Precipitation in mm during the growing season: long-term average - 311 mm, in the test year - 232 mm. Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 ° C is 2134 ° C, in the test year - 2432 ° C.

In general, meteorological conditions during the corn growing season were arid, since during that period the air temperature was above the long-term average values, and the amount of precipitation was below the long-term average values.

7. Type of study: field.

8. Size (m²) and plot allocation: total plot area 56 m², accounting area of the plot 37.8 m², distribution of the plot at random;

number of repetitions of the experiment: 4 times.

9. Test scheme:

9.1. plot variant: **N₁₄₀P₆₀K₁₅₀ +60 t / ha of cattle manure –Background;**

9.2. **Background + test fertilizer: Agrolin-S - norm -2.0 l / ha.**

10. Duration of fertilizer application: vegetation of plants

Dates: 06/04/2019, 06/06/2019

11. Fertilizer spraying method: **spraying through the leaves**

12. During the application of fertilizers in the phase of plant development: **1 - 5-6 leaves, 2 - 8-10 leaves.**

13. Information on the compatibility of tested fertilizers with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not observed.

15. Information on the effect of fertilisers on biochemical product quality indicators:

The use of fertilizers Agrolin-S, in comparison with the background variant, significantly increased the nitrogen content in corn grains (0.12%) and, accordingly, green and digestible proteins. The levels of phosphorus (0.03-0.04%) and Potassium (0.03%) also increased. (Table 1)

Table 1. The effect of "Agrolinija-S" fertilizers on the quality indicators of corn grains

Options	Crude protein,%	digestible proteins,%	N,% in dry mass	P ₂ O ₅ ,% in dry mass	K ₂ O,% in dry mass
N ₁₄₀ P ₆₀ K ₁₅₀ + 60 t / ha cattle manure -Background	7,91	6,41	1,33	0,28	0,4
Background + Agrolinija-S	8,63	7,00	1,45	0,32	0,43

16. Assessment of the economic efficiency of fertilizers (with the indication of the minimum significant difference):

In the course of research, it was found that spraying through the leaves, fertilizer Agrolin-S, increased the yield of corn grains by 1.7 t / ha compared to the background version (Table 2).

Table 2. The effect of Agrolinija-S fertilizers on the yield of corn grains.

Options	Yield t /ha,	Additive in comparison with the background, t/ha	Additive in comparison with the background, %
N ₁₄₀ P ₆₀ K ₁₅₀ + 60 t / ha cattle manure -Background	16,8		
Background + Agrolinija-S	18,5	1,700	10,2

When carrying out two sprayings with Agrolinia-S fertilizers, there was a tendency to increase the mass of one cob, grain from one cob , as well as 1000 grains (Table 3).

Table 3. The effect of Agrolinija-S fertilizers on the structure of corn crops

Options	mass, g		
	single cob, g	grain from the cob, g	1000 Grain, g
N ₁₄₀ P ₆₀ K ₁₅₀ + 60 t / ha cattle manure -Background	226	159	305,9
Background + Agrolinija-S	245	173	315,3

17. Conclusion:

Fertilizer "Agrolinia-S" additional application when fertilizing through the leaves to background fertilizing for corn crops, at the stages of 5-6 and 8-10 leaves, increased the grain yield by -1.7 t / ha. or 10.2%.

Fertilizer "Agrolinija-S" effect on the yield of perennial misty grasses and its quality

REPORT 2019

1. Testers and location:

Alexander Stulginsky University

2. Fertilizer: Organic fertilizer-biostimulant - **Agrolinija-S**

3. Culture to be tested: misty grasses, matthews + clover, year of second replanting

4. Soil

4.1. type: loam;

4.2. mechanical composition: loose sand;

4.3. humus content: 1.55%;

4.4. acidity: pH 6,9;

4.5. supply with macro- and microelements: P₂O₅ - 271 mg / kg, K₂O - 150 mg / kg. The content of mobile forms of copper (1.0 M HCl) - 1.9 mg / kg, zinc (Zn) (1.0 M HCl) - 4.5 mg / kg, manganese exchange (1.0 M KCl) - 1.5 mg / kg, water-soluble boron - 0.75 mg / kg.



5. Agrotechnical test conditions:

5.1. precursor of the test plant: maize;

5.2. tillage: -

5.3. Fertilization (by f.weight): nitrogen - 60 kg / ha, phosphorus - 60 kg / ha, potassium - 150 kg / ha (in two times);

5.4. term, method of sowing: in the crop (barley);

5.5. sowing rate: 30 kg / ha in the mixture;

5.6. name and time of the crop care (planting) activity: not carried out;

6. Agrometeorological test conditions (general characteristic):

Precipitation in mm during the growing season: long-term average - 355 mm, per year of testing - 284 mm.

Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 ° C is 2458 ° C, in the test year - 2739 ° C.

In general, meteorological conditions during the growing season of perennial grasses were arid, since during this period the air temperature was above average long-term values, and the amount of precipitation was below the average long-term values.

7. Type of study: field.

8. Size (m²) and field distribution: the total area of the field is 50 m², the reference area of the field is 24 m², the method of field allocation is random; number of repetitions of the experiment: 4 times.

9. Scheme of experience:

9.1. option: N60K150 - background;

9.2. test fertilizers: Agrolinija-S - 2 l / ha.

10. Duration of fertilizer application: in the vegetation of plants.

Spraying dates: 2019-04-15, 2019-06-06, 2019-07-15

11. Fertilizer spraying method: spraying through the leaves.

12. Stages of plant development through fertilization: 1st - spring regrowth, 2nd - after the first mowing, 3rd - after the 2nd mowing.

13. Information on the compatibility of tested fertilisers with other fertilisers, plant protection products and other substances: not examined.

14. Identified side effects: not observed.

15. Information on the effect of fertilisers on biochemical product quality indicators:

When carrying out three fertilizations of perennial misty grasses through the leaves with fertilizers Agrolinija-S, an increase in the amount of nitrogen and digestible proteins was observed (Table 1). The use of Agrolinija-S in comparison with the background did not significantly affect the content of phosphorus and potassium in the dry mass of legume grasses.

Table 1. The effect of the compound fertilizer "Agrolinija-S" on the quality indicators of the dry mass of perennial misty grasses (average of two mowings)

Options	Digestible proteins, %	N, %	P ₂ O ₅ , %	K ₂ O,%
N60K150 - background	13,2	2,75	0,27	2,22
Background + Agrolinija-S	13,5	2,8	0,28	2,21

16. Assessment of the cost-effectiveness of fertilisers (with an indication of the least significant difference):

Fertilizer Agrolinija-S, increased the yield of green mass of perennial misty grasses by 5.7 t / ha (Table 2).

Table 2. The effect of Agrolinija-S fertilizers on the yield of perennial misty grasses (the sum of two mowings)

Options	Harvest, t/ha	Harvest supplement, t/ha
N60K150 - background	30,9	
Background + Agrolinija-S	36,6	5,7
HCP ₀₅	23,3	

17. Conclusion:

Fertilizer "Agrolinija-S" additional application when fertilizing through the leaves to background fertilizing, spraying through the leaves three times, -in the phase of spring regrowth, after the first and second mowing, the yield of green mass of perennial misty grasses increased by 5.7 t / ha or 19%.



Lietuvos agrarinių ir miškų mokslų centras Žemdirbystės institutas

Organinės trąšos AGROLINIJA-S efektyvumas žirnių produktyvumui

2019 metais darytų tyrimų ataskaita

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Santrauka

Lauko eksperimento su žirniais „Respect“ taikant skirtingas sėklų apvėlimo ir papildomo tręšimo per lapus produktu „Agrolinija-S“, bei skirtingus tręšimo NPK trąšomis lygius atliktas 2019 metais LAMMC Žemdirbystės institute. Žirnių derlingumas siekė 3,356 – 3,479 t/ha. Grūdų kokybiniai rodikliai – 1000 grūdų masė ir baltymingumas variavo paklaidų ribose. 2019 metų žemės ūkio augalų vegetacijos sezoną galima apibūdinti kaip itin sudėtingą – pavasaris ir pirmoji vasaros pusė buvo sausi, su aukštesnėmis temperatūromis nei įprastai, o tai galėjo limituoti žirnių produktyvumo potencialo išnaudojimą ir riboti tiriamojo produkto efektyvumo potencialą.

Tikslas

Lauko eksperimente įvertinti produkto „Agrolinija-S“ skirtingų panaudojimo technologijų skirtinguose tręšimo fonuose efektyvumą žirnių produktyvumui ir grūdų kokybiniams rodikliams.

Metodai ir sąlygos

1. Eksperimentinės sąlygos

1.1. Bandymo sąlygos

<i>Bandymo tipas</i>	Lauko bandymas
<i>Augalas</i>	Žirniai
<i>Veislė</i>	„Respect“
<i>Priešsėlis</i>	Vasariniai kviečiai
<i>Naudoti pesticidai</i>	Herbicidai: Fenix, norma 3,0 l/ha; Insecticidai: Decis, norma 0,15 l/ha;
<i>Dirvos tipas</i>	karbonatingasis giliau stagniškas išplautžemis (IDj2-k - <i>Calc(ar)i-Endohypostagnic Luvisol</i>). Granuliometrinė sudėtis – smėlingas lengvas priemolis. Dirvožemio pH _{KCL} artimas neutraliam, jame santykinai mažai organinių medžiagų ir vidutiniškai augalų pasiekiamo fosforo ir kalio.
<i>Dirvos dirbimas</i>	Tradicinis
<i>Sėjos data</i>	2019 m. balandžio 18 d.
<i>Sėklos norma</i>	280 kg ha ⁻¹
<i>Tarpueilių plotis</i>	12,5 cm
<i>Tręšimas</i>	Tręšimo fonai pagal techninėje užduotyje numatytus fonus, naudotos NPK 7-20-28 trąšos.

1.2. Bandymo schema ir planas (laukelių išdėstymas)

Lauko bandymas vykdomas 4-iais pakartojimais. Pradinis laukelio dydis – 20 m². Apskaitomas laukelio dydis – 15 m².

Variantai:

- 1 var. 100 % NPK trąšos;
- 2 var. 100 % NPK trąšos + 2 purškimai organinėmis trąšomis;
- 3 var. 70 % NPK trąšos + sėklų apvėlimas ir 2 organinių trąšų purškimai per lapus;
- 4 var. 50% NPK trąšos + sėklų apvėlimas ir 2 organinių trąšų purškimai per lapus;

Žirnių foninis trešimas prieš sėją:

esant 100%: NPK 7-20-28 – 400 kg/ha; azoto norma ~N30;

esant 70%: NPK 7-20-28 – 280 kg/ha; azoto norma ~ N20;

esant 50%: NPK 7-20-28 – 200 kg/ha; azoto norma ~ N15.

Laukelių išdėstymo planas:

Žirniai

4	2	1	3	2	4	1	3
1	3	4	2	1	2	3	4

2. Stebėjimų būdas, registravimas ir matavimas

2.1 Meteorologiniai duomenys

2019 metų pavasaris buvo neįprastai sausas. Balandžio mėn. meteorologinės sąlygos buvo itin ekstremalios – kritulių nebuvo iš vis, o vidutinė mėnesio temperatūra buvo aukštesnė nei klimatinė norma, ypač šiltas oras buvo III -ąją balandžio dekadą (1 lentelė). Gegužės mėnesio pradžioje orai gerokai atvėso, naktimis pasireiškė šalnos, o kritulių kiek daugiau buvo tik gegužės pabaigoje. Birželis vėl buvo gerokai šiltesnis ir veik be didesnio lietaus. Liepos mėnuo šiltesnis nei įprastai, kritulių buvo, tačiau mažiau nei įprastai turėtų būti. Šilti ir sausi orai labai spartino augalų vystymąsi ir brendimą, taip limituodami augalų produktyvumo potencialo išnaudojimą.

1 Lentelė. Meteorologiniai duomenys, fiksuoti 2019 metais Dotnuvos meteorologijos stotyje.

Mėnuo	Dekada	Oro temperatūra, °C		Krituliai, mm	
		Dekados	Standartinė klimatinė norma	Dekados	Klimatinė norma
2019 m.					
Sausis	Vidurkis	-4,4	-5.5	48,8	30.6
	I	-4,3		23,5	
	II	-2,4		12,3	
	III	-6,4		13,0	
Vasaris	Vidurkis	1,2	-4.6	39,2	25.7
	I	0,5		26,6	
	II	2,2		12,6	
	III	0,7		0	
Kovas	Vidurkis	3,3	-0.8	37,8	27.9
	I	2,5		16,9	
	II	2,6		13,6	
	III	4,8		7,3	
Balandis	Vidurkis	8,9	5,6	0	36,8
	I	5,8		0	
	II	6,7		0	
	III	14,2		0	
Gegužė	Vidurkis	12,9	12,3	55,4	52,2

	I	8,6		8	
	II	14,3		4,7	
	III	15,5		42,7	
Birželis	Vidurkis	20,6	15,8	16,1	62,3
	I	19,9		0,1	
	II	21,9		16,0	
	III	20		0	
Liepa	Vidurkis	17,3	17,0	66,0	74,7
	I	15,2		19,4	
	II	16,5		22,4	
	III	20,1		24,2	
Rugpjūtis	Vidurkis	18,2	17,2	107,0	62,0
	I	16,4		48,7	
	II	19,0		3,1	
	III	19,1		55,2	

2.2. Stebėjimų tipas, laikas ir dažnumas

Bandymas darytas laikantis LAMMC Žemdirbystės institute taikomų lauko eksperimentų atlikimo metodikų.

2.3. Derlius

Žirnių derlius nukultas kombainu „Wintersteiger Delta“ 2019 m. liepos 19 d. Žirnių baltymingumas nustatytas analizatoriumi „Infratec“. 1000 sėklų masė nustatyta vadovaujantis ŽŪM ir VAT patvirtinta „Žemės ūkio augalų veislių ūkinio vertingumo tyrimų metodika“.

2.4. Duomenų statistinė analizė

Derliaus ir kitų kokybinių rodiklių statistinė analizė buvo atliekama taikant vienfaktorinę dispersinę analizę (ANOVA), (Clewer and Scarisbrick, 2001). Esmingumo nustatymui naudoti tokie kriterijai – Fišerio kriterijus (F), Stjudento kriterijus (t). Esmingumo lygis darbe naudotas $p < 0,05$.

3. Rezultatai

2019 m. žirnių derlingumas pasiekė 3,356 – 3,479 t/ha priklausomai nuo taikytos technologijos ir tręšimo lygio (2 lentelė). Nors statistiškai esminių skirtumų tarp variantų nenustatyta, tačiau 4-ajame variante kur naudota tik 50 % NPK trąšų norma ir pasėlis purkštas 2 kartus „Agrolinija-S“ produktu, derlingumas buvo 3,7 % didesnis nei kontrolinio varianto. Derlingumo rezultatai rodo, kad mažinant NPK trąšų normą ir apveliant sėklas „Agrolinija-S“ produktu derlingumas didėjo 2,2 – 3,7 %. Galima daryti prielaidą, kad apvelus sėklas produktu „Agrolinija-S“ ir sėklai patekus į dirvožemį, produkte esantys komponentai padėjo aplink sėklas susikurti palankią terpę, kuri paskatino šaknų gumbeliams susidaryti reikalingų mikroorganizmų veiklą, kuri efektyviai veikė produktyvumą. Taip pat esant drėgmės stygiui papildomas tręšimas per lapus „Agrolinija-S“ produktu leido efektyviau augalams įsivirti reikalingas maisto medžiagas.

Žirnių baltymingumas tarp variantų neturėjo esminių skirtumų, tačiau didžiausias buvo 4-ajame variante – 1,4 proc. daugiau nei kontroliniame variante. 1000 grūdų masė tarp variantų skyrėsi 0,1 – 0,6 % ir variavo paklaidų ribose.

2 lentelė. Žirnių derlingumas ir grūdų kokybiniai rodikliai, 2019 m.

Variantas	Derlius, t/ha	% nuo kontrolės	1000 grūdų masė, g	% nuo kontrolės	Baltymai, %	% nuo kontrolės
1. 100 % NPK trąšos	3,356 ab	100	250,75 b	100	21,9 ab	100
2. 100 % NPK trąšos + 2 purškimai organinėmis trąšomis	3,379 ab	100,7	249,31 ab	99,4	22,1 ab	100,9
3. 70 % NPK trąšos + sėklų apvėlimas ir 2 organinių trąšų purškimai per lapus	3,429 ab	102,2	250,42 ab	99,9	21,9 ab	100,0
4. 50 % NPK trąšos + sėklų apvėlimas ir 2 organinių trąšų purškimai per lapus	3,479 b	103,7	249,93 ab	99,7	22,2 b	101,4
<i>Vienodomis raidėmis pažymėti rezultatai nėra statistiškai esmingai skirtingi.</i>						

Išvados

Lauko eksperimento su žirniais, kuriame taikytos skirtingos produkto „Agrolinija-S“ panaudojimo technologijos ir NPK trąšų normos, atlikto 2019 metais LAMMC Žemdirbystė institute rezultatai parodė, kad derlingumas tarp variantų variavo paklaidų ribose, o skirtumai siekė iki 3,7%. Didžiausias žirnių grūdų derlingumas pasiektas 4 variante, kur prieš sėją panaudota 50% NPK trąšų lyginant su kontroliniu variantu, o žirnių sėkla buvo apvelta produktu „Agrolinija-S“, o augalų papildomam tręšimui per lapus „Agrolinija-S“ panaudota 2 kartus. Grūdų kokybiniai rodikliai – baltymingumas ir 1000 sėklų masė tarp variantų variavo paklaidų ribose, ir esminių skirtumų neturėjo.

Apibendrinant gautus žirnių derlingumo rezultatus, galima daryti išvadą, kad produktas „Agrolinija-S“ turėjo teigiamų tendencijų žirnių produktyvumo didėjimui, tačiau iš vienerių metų lauko eksperimentų rezultatų sudėtinga padaryti korektiškas išvadas apie panaudotų priemonių efektyvumą atskleidžiant augalų produktyvumo potencialą, nes neretai ir meteorologinės sąlygos lemia lauko bandymo rezultatus. Tikėtina, kad esant palankesnėms meteorologinėms sąlygoms augalų vegetacijos metu labiau išryškėtų tiriamojo produkto efektyvumas žirnių produktyvumui.

EIP projektas „Tvarus žemės ūkis – tvarus dirvožemis ir augalinė žaliava“

Pagrindinis tyrimų tikslas – panaudojus sukurtas inovatyvias granuliuotas ir skystas organines trąšas gerinti dirvožemio agrochemines savybes, didinti jo biologinį aktyvumą, užtikrinant dirvožemio derlingumo didėjimą, humuso kaupimąsi dirvožemyje, likviduojant dirvožemio degradacijos procesus, užtikrinant gausesnius ir geresnės maistinės kokybės žemės ūkio augalų derlius, didinant ūkininkų ūkių ekonominį efektyvumą ir konkurencingumą rinkoje.

EIP projekto tyrimai buvo atlikti šiuose ūkiuose:

- **Vytauto Račicko** ekologinės gamybos ūkis (Vytauto g.10, Purvininkų k., Prienų r.);
- **Violetos Giknienės intensyvios gamybos** ūkis (Draugystės g. 17, Padotnuvys, Kėdainių rajonas.).

Tyrimai buvo vykdomi su šių rūšių žemės ūkio augalais:

Vytauto Račicko ekologinės gamybos ūkyje (Vytauto g.10, Purvininkų k., Prienų r.,)

buvo auginamos ir tiriamos šios daržovės:

- Valgomoji morka (*Daucus carota* L.) veislė ‘Nantes 3’;
- Aliejinis moliūgas (*Cucurbita pepo* var. *oleifera*) veislė ‘Miranda’;
- Valgomoji bulvė (*Solanum tuberosum*) veislė ‘Vineta’;
- Daržinė pupelė (*Phaseolus vulgaris* L.) veislė ‘Zlota saxa’;
- Valgomasis svogūnas (*Allium cepa*) veislė ‘Sturon’.

Trąšų naudojimas daržovėms:

Gelinės organinės trąšos Biogelis buvo naudojamas prieš sėją/sodinimą, išlaistant į dirvą po 301 ha⁻¹. Purškimai buvo atliekami kai dirvos temperatūra siekė ne mažiau kaip 8-10 °C. Taip pat trąšos buvo naudojamos vegetacijos metu: per lapus buvo purškiama anksti ryte arba vakare, nevėjuotą dieną.

Daržinės žemaūgės pupelės buvo purškiamos 2 kartus trąšomis: dviejų porų lapelių tarpsnis ir žydėjimo pradžioje, skiedimo norma 1:100.

Valgomosios morkos buvo purškiamos 2 kartus trąšomis: 3-4 lapų tarpsnis ir po 15 dienų, skiedimo norma 1:100.

Aliejiniai moliūgai buvo purškiamos 2 kartus trąšomis: 4-6 lapelių tarpsnis arba 3-5 dienos po daigų sodinimo ir žydėjimo pradžioje, skiedimo norma 1:100.

Valgomieji svogūnai buvo purškiamos 2 kartus trąšomis: susiformavus lapijai ir po 12-15 dienų, skiedimo norma 1:100.

Bulvės buvo purškiamos 2 kartus trąšomis: susiformavus lapijai ir žydėjimo pradžioje, skiedimo norma 1:200.

Violetos Giknienės ūkyje (Draugystės g. 17, Padotnuvys, Kėdainių rajonas.) buvo auginami ir tiriami šie kultūriniai augalai:

- Žieminiai kviečiai veislė '*Inforner*';
- Žieminiai rapsai veislė '*Dominator*'.

Trąšų purškimo variantai:

1. Kontrolė vanduo 100 l ha⁻¹;
2. Agrolinija S 3.0 l ha⁻¹;
3. Biogelis 30 l ha⁻¹;
4. Makalūzas 30 l ha⁻¹.

Išpurškimas preparatų buvo vykdomas 40-45 cm dirvos gylyje. Bendras išpurškimo tirpalo kiekis 100 l ha⁻¹.

Eksperimentinio laukelio dydis 1 m². Žieminių kviečių ir rapsų ėminiai imti iš trijų atsitiktinių vietų ir tada derlius pasvertas.

Augalinėse žaliavose standartiniais metodais buvo nustatyta:

- apskaičiuotas valgomųjų bulvių, morkų šakniavaisių, moliūgų, svogunų, daržinių žemaūgių pupelių derlius t ha⁻¹ – pasveriant jų masę iš eksperimento laukelio;
- sausųjų medžiagų kiekis % – džiovinant mėginius 105 °C temperatūroje iki nekintamos masės (LST ISO 751:2000);
- baltymų kiekis % – Kjeldalio metodu (LST 1532:1998);
- pelenų kiekis % – gravimetrijos metodu, tiriamą medžiagą sausai sudeginus (Januškevičius ir Mikulionienė, 2004);
- ląstelienos kiekis % – Henebergo-Štomano metodu (Methodenbuch – VDLUFA, 1983–1999);
- bendras fenolinių junginių kiekis – spektrofotometriniu metodu, naudojant Folin – Coicalteu reagentą.
- vitamino C kiekis – Murio metodu (LST ISO 6557- 2:2000);
- β-karoteno kiekis - karoteno kiekis nustatytas spektrofotometriniu metodu (LST ISO 6558- 2:2002);

Javų grūduose standartiniais metodais buvo nustatyta:

- žieminių rapsų ir kviečių derlingumas $t\ ha^{-1}$ apskaičiuotas – pasveriant jų masę iš eksperimento laukelio;
- sausųjų medžiagų kiekis % – džiovinant mėginius $105\ ^\circ C$ temperatūroje iki nekintamos masės (LST ISO 751:2000);
- baltymų kiekis % – Kjeldalio metodu (LST 1532:1998);
- pelenų kiekis % – gravimetrijos metodu, tiriamą medžiagą sausai sudeginus (Januškevičius ir Mikulionienė, 2004);
- ląstelienos kiekis % – Henebergo-Štomano metodu (Methodenbuch – VDLUFA, 1983–1999).

Tyrimo duomenų statistinės analizės metodai

Tyrimų duomenys įvertinti dispersinės analizės metodu (ANOVA), naudojant kompiuterinę programą STATISTICA. Statistinis patikimumas tarp duomenų buvo įvertintas Fišerio LSD testu, kuomet patikimumas didesnis nei 95% ($p \leq 0,05$).

REZULTATAI

Tręšimo įtaka valgomųjų bulvių veislės ‘*Vineta*’ stiebagumbių kokybei ir derlingumui

Ekologiniuose ūkiuose pagrindinė augalų maisto medžiagų (NPK) balanso reguliavimo priemonė yra natūralios organinės trąšos: mėšlas, kompostas ir įvairios kitos natūralios kilmės mineralinės medžiagos (Tripolskaja, 2005; Pekarskas ir Bičius, 2009). Labai svarbu yra subalansuoti žemės ūkio augalų mitybą, kuri yra pagrindinė ilgalaikio produktyvumo sąlyga (Ahlvik, Ekholm, Hyytiäinen, & Pitkänen, 2014).

Bulvės – vienas dažniausiai Respublikoje auginamų augalų. Jų plotai Lietuvoje užima 5,0–5,2 % visų pasėlių. Tai – reiklūs dirvožemiui ir meteorologinėms sąlygoms augalai. Joms tinka geros struktūros, humusingi dirvožemiai. Bulvių derlius glaudžiai susietas su vegetacijos periodo orais, dirvožemio savybėmis, pasėlių priežiūra ir mityba (Antanaitis ir Švedas, 2000).

Tręštuose ir netręštuose dirvožemiuose matomas bulvių gumbuose sukauptų sausųjų medžiagų, baltymų, vitamino C kiekio ne esminis pamažėjimas, o ląstelienos, mineralinių medžiagų ir krakmolo

padidėjimas (1 lentelė). **Bulvių patręšimas turėjo esminės įtakos tik bendro fenolinių junginių kiekio padidėjimui.**

1 lentelė. Tręšimo įtaka bulvių vesilės ‘*Vineta*’ stiebagumbių kokybės rodikliams

Rodikliai	Tręšimo variantai	
	Netręšta (kontrolė)	Tręšta
Sausosios medžiagos, %	20,53 a	20,07 a
Baltymai, %	6,66 a	6,55 a
Lašteliena, %	2,15a	2,21a
Mineralinės medžiagos, %	5,16 a	5,62 a
Krakmolas, %	17,62 a	17,83 a
Bendras fenolinių junginių kiekis, mg 100 g ⁻¹	29,25b	31,35 a
Vitaminas C, mg 100 g ⁻¹	1,65 a	1,69 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

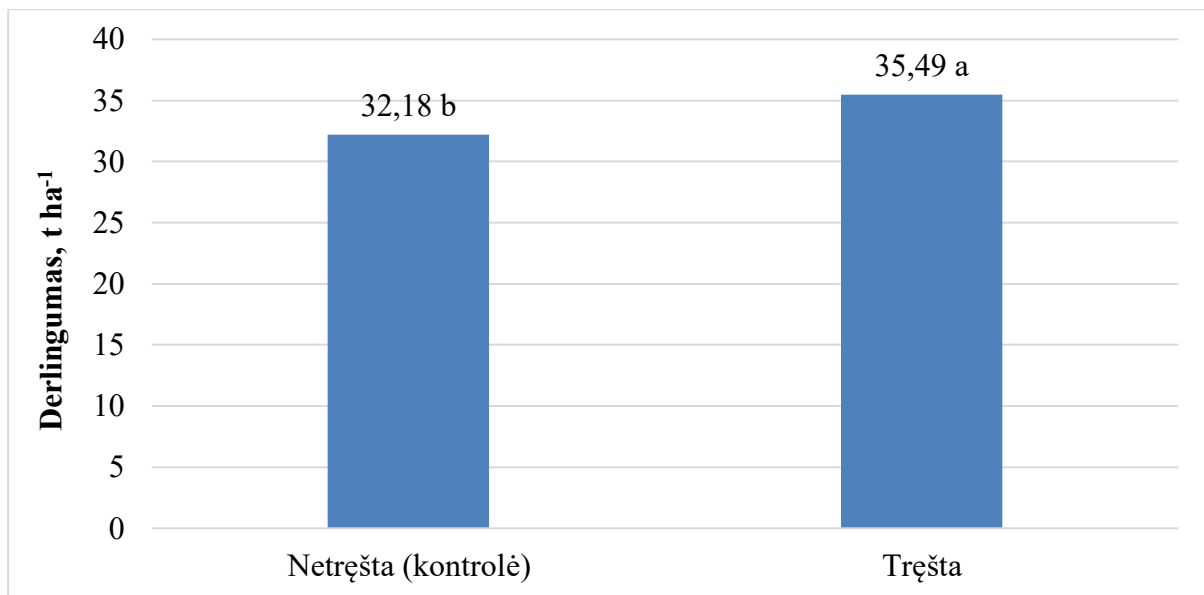
Pagal Lietuvos rinkos prekių (paslaugų) kokybės priežiūros priemonių maistinių bulvių kokybės reikalavimus (Dėl maistinių bulvių kokybės..., 2002) bulvių gumbai skirstomi į keturias frakcijas: smulkius – iki 40 mm; vidutinius – 40-80 mm; stambius – nuo 80 ir daugiau mm. Smulkios frakcijos bulvių stiebagumbių tręštame dirvožemyje surinkta esmingai daugiau, bei jų masė buvo esmingai didesnė.

Trąšų panaudojimas esmingai padidino stambių stiebagumbių masę, tačiau vidutinio dydžio stiebagumbių skaičiui ir masei esminės įtakos neturėjo.

2 lentelė. Tręšimo įtaka valgomųjų bulvių vesilės ‘*Vineta*’ vieno kero stiebagumbių kiekiui ir masei

Tręšimo variantai	Stiebagumbių skaičius, vnt.	Stiebagumbių masė, g	Smulkių stiebagumbių (iki 40 g) skaičius, vnt.	Smulkių stiebagumbių (iki 40 g) masė, g	Vidutinio dydžio stiebagumbių (40-80 g) skaičius, vnt.	Vidutinio dydžio stiebagumbių (40-80 g) masė, g	Stambių stiebagumbių (nuo 80 g) skaičius, vnt.	Stambių dydžio stiebagumbių (nuo 80 g) masė
Netręšta (kontrolė)	8,00 a	715,05 b	1,00 b	24,07 b	3,29 a	212,98 a	3,71 a	486,28 b
Tręšta	8,86 a	788,70 a	1,71 a	46,24 a	2,43 a	142,42 a	4,71 a	599,54 a

Išaugintas bulvių stiebagumbių derlius buvo esmingai 9,33 proc. didesnis tręštame dirvožemyje nei kontrolinio varianto bulvių derlius (1 pav.).



Pastaba: duomenų vidurkiai pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

1 pav. Tręšimo įtaka valgomųjų bulvių veislės ‘*Vineta*’ stiebagumbių derlingumui

Tręšimo įtaka aliejinių moliūgų veislės ‘*Miranda*’ vaisių kokybei ir derlingumui

Siekiant daržo augalų sortimento optimizavimo, patartina auginti įvairių veislių moliūgus, pasižyminčius vertingomis savybėmis žmogaus organizmui. Ekologiškai, t.y. be sintetinių cheminių medžiagų, užauginti moliūgai atitinka visus sveikai aplinkai ir mitybai keliamus reikalavimus. Jie priskiriami prie nedidelį nitratų kiekį kaupiančių daržovių ($200\text{--}280\text{ mg kg}^{-1}$), yra nekaloringi 100 g energetinė vertė – 15–29 kcal, turi nemažai biologiškai aktyvių medžiagų, pasižymi dietinėmis ir gydomosiomis savybėmis.

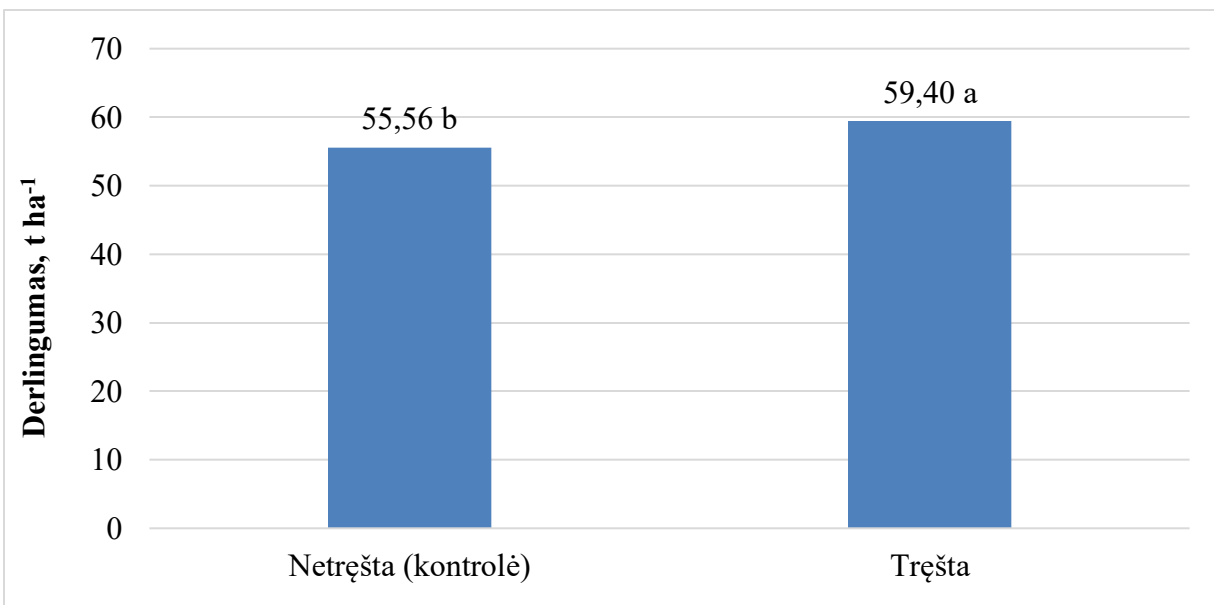
Aliejinių moliūgų auginime panaudotos trąšos buvo efektyvios sausųjų medžiagų, ląstelienos ir β -karoteno kiekiui, kurį padidino atitinkamai 21,0, 6,20 ir 14,5 proc., tačiau baltymų kiekiui esminės įtakos neturėjo (3 lentelė). Kai tuo tarpu bendras fenolinių junginių ir vitamino C kiekis tręšimo fone netgi esmingai pamažėjo.

3 lentelė. Tręšimo įtaka aliejinių moliūgų veislės 'Miranda' vaisių kokybės rodikliams

Rodikliai	Tręšimo variantai	
	Netręšta (kontrolė)	Tręšta
Sausosios medžiagos, %	7,16 b	9,06 a
Baltymai, %	2,92 a	2,49 a
Lašteliena, %	18,15 b	19,35 a
Mineralinės medžiagos, %	5,59 a	5,92 a
Bendras fenolinių junginių kiekis, mg 100 g ⁻¹	90,82 a	82,06 b
β-karoteno kiekis, mg kg ⁻¹	6,55 b	7,66 a
Vitaminas C, mg 100 g ⁻¹	7,04 a	4,75 b

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Aliejinių moliūgų suminis derlingumas apskaičiuotas vaisiams pasiekus vartojimo brandą. Moliūgų derlius priklauso ne tik nuo meteorologinių sąlygų, tręšimo, bet ir pasirinktos veislės.



Pastaba: duomenų vidurkiai pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

2 pav. Tręšimo įtaka aliejinių moliūgų veislės 'Miranda' vaisių derlingumui

Rezultatai rodo, kad **moliūgų derliui esminės įtakos turėjo tręšimas ir jis buvo 1,07 karto didesnis nei netręštuose plotuose (2 pav.).**

Tręšimo įtaka valgomųjų morkų veislės ‘Nantes 3’ šakniavaisių kokybei ir derlingumui

Morkų šakniavaisių kokybę lemia ne tik genotipas, bet ir augimo sąlygos, tręšimas, dirvožemis ir kt. Ekologiškai auginant morkas, labai svarbus jų tręšimas. Jei trūksta maisto medžiagų, išauginamas mažesnis ir prastesnės kokybės šakniavaisių derlius. Kiekvienos veislės morkos skirtingai reaguoja į augimo sąlygas, sėjos laiką (Salo ir kt., 2001; Zalatorius ir kt., 2006; Pekarskas, 2008). Todėl vienas svarbiausių uždavinių šiuolaikiniame žemės ūkyje yra sukurti ekologiškai švarias daržovių auginimo technologijas, neteršiančias aplinkos, nenualinančias dirvožemio, išsaugančias dirvožemių derlumą ir leidžiančias auginti švarią ir kokybišką produkciją.

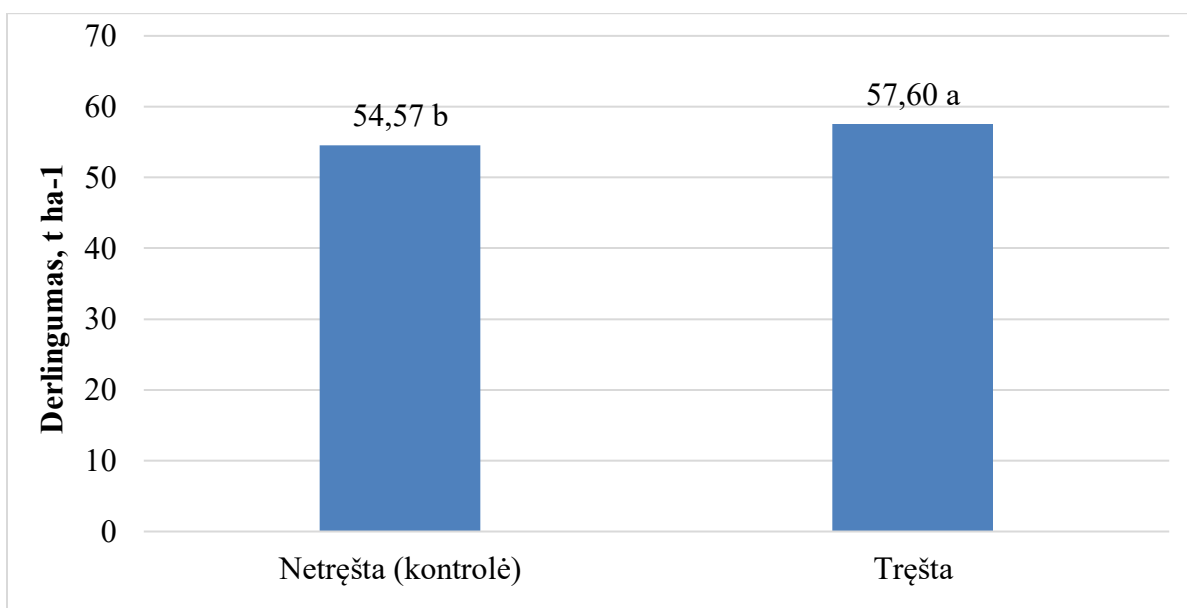
Panaudotos trąšos buvo neefektyvios morkų šakniavaisių sausųjų medžiagų, mineralinių medžiagų, ląstelienos ir vitamino C kiekiui ir esminės įtakos neturėjo (4 lentelė). **Tręšimas turėjo teigiamos įtakos β-karoteno ir baltymų kiekiui morkose**, kai tuo tarpu bendras fenolinių junginių kiekis tręšimo fone netgi esmingai pamažėjo 11 proc.

4 lentelė. Tręšimo įtaka valgomųjų morkų veislės ‘Nantes 3’ šakniavaisių kokybės rodikliams

Rodikliai	Tręšimo variantai	
	Netręšta (kontrolė)	Tręšta
Sausosios medžiagos, %	13,80 a	13,03 a
Baltymai, %	4,31 b	7,45 a
Ląsteliena, %	10,23 a	10,41 a
Mineralinės medžiagos, %	8,06 a	8,01 a
Bendras fenolinių junginių kiekis, mg 100 g ⁻¹	94,73 a	84,20 b
β-karoteno kiekis, mg kg ⁻¹	25,00 b	26,54 a
Vitaminas C, mg 100 g ⁻¹	1,76 a	1,76 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Auginant morkas be trąšų, buvo prikasta 54,57 t ha⁻¹ šakniavaisių. **Bendras derlius patręšus esmingai padidėjo 5,26 proc., ir buvo 57,60 t ha⁻¹.**



Pastaba: duomenų vidurkiai pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

3 pav. Tręšimo įtaka valgomųjų morkų veislės ‘*Nantes 3*’ šakniavaisių derlingumui

Tręšimo įtaka daržinių žemaūgių pupelių veislės ‘*Zlota saxa*’ ankščių kokybei ir derlingumui

Pupiniai augalai dažniausiai yra jautrūs fosforo trūkumui, nes azotą fiksuojančių bakterijų vystymuisi reikalingas fosforas, kuris įeina į ATF ir ADF sudėtį ir dalyvauja energijos pernašos ląstelėse procesuose. Todėl azotinių trąšų trūkumas gali turėti įtakos pupelių kokybiniais rodikliams.

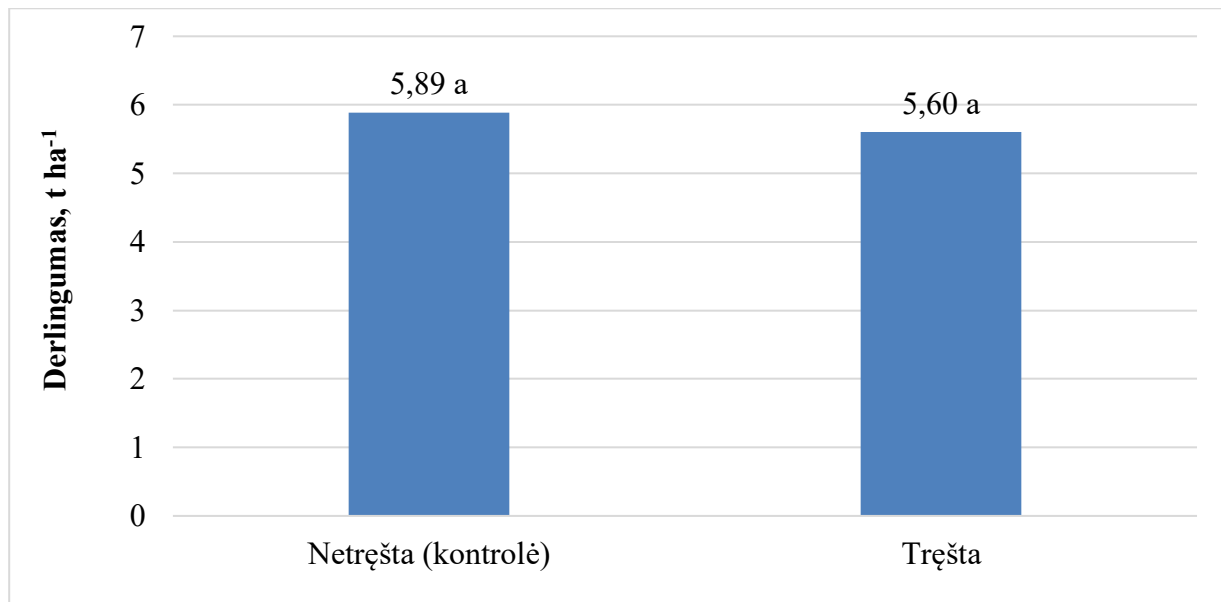
Daržinių žemaūgių pupelių tręšimas esmingai didino sausųjų medžiagų, baltymų, mineralinių medžiagų, bendrą fenolinių junginių ir vitamino C kiekį, atitinkamai (13 proc., 6 proc., 14 proc., 4,81 proc. ir 50 proc.) (5 lentelė). Tačiau tręšimas neturėjo esminės įtakos ląstelienos kiekiui pupelių ankštyse.

5 lentelė. Tręšimo įtaka daržinių žemaūgių pupelių veislės ‘*Zlota saxa*’ ankščių kokybės rodikliams

Rodikliai	Tręšimo variantai	
	Netręšta (kontrolė)	Tręšta
Sausosios medžiagos, %	9,43 b	10,88 a
Baltymai, %	18,61 b	19,74 a
Ląsteliena, %	4,99 a	5,11 a
Mineralinės medžiagos, %	5,74 b	6,03 a
Bendras fenolinių junginių kiekis, mg 100 g ⁻¹	23,45 b	27,20 a
Vitaminas C, mg 100 g ⁻¹	1,68 b	3,36 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Daržinės pupelės vertinamos kaip ankstyvosios daržovės, nes kai kurių veislių ankštys tinka maistui jau liepos mėnesį, kai kitų lauko daržovių dar nedaug. Tręšimas neturėjo esminės įtakos pupelių derlingumui ir svyravo nuo 5,60 iki 5,88 t ha⁻¹ (4 pav.).



Pastaba: duomenų vidurkiai pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

4 paveikslas. Tręšimo įtaka daržinių žemaūgių pupelių veislės '*Zlota saxa*' ankščių derlingumui

Tręšimo įtaka valgomųjų svogūnų veislės '*Sturon*' ropelių kokybei ir derlingumui

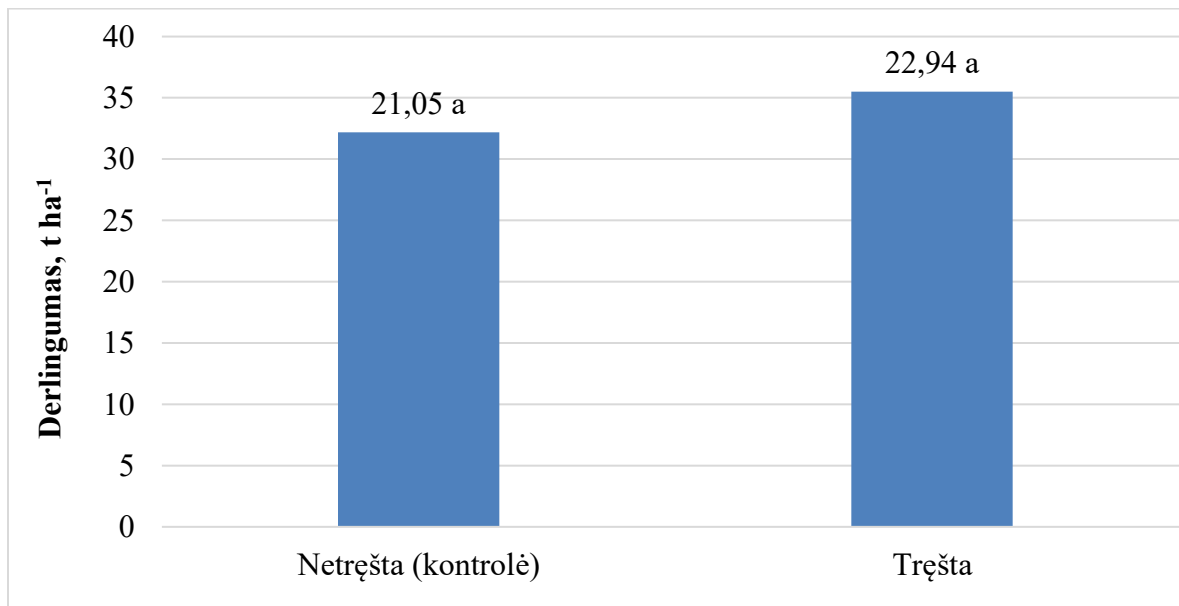
Svogūnai yra viena iš labiausiai vartojamų daržovių Lietuvoje. Juos užauginti ekologiškai gana sunku. Jie yra jautrūs tręšimui ir didesnėms druskų koncentracijoms dirvoje dėl biologinių ir botaninių savybių, kaip paviršinė ir silpna šaknų sistema. Juos dažnai puola ligos ir kenkėjai. Todėl ekologiškai užauginti gausų ir geros kokybės svogūnų derlių, tinkamai ir subalansuotai netręšiant ir netaikant tinkamos augalų apsaugos, labai sunku.

Atliktų tyrimų duomenimis, tręšimas didino sausųjų medžiagų, baltymų, mineralinių medžiagų ir vitamino C kiekį svogūnuose, atitinkamai 8,5 proc., 5 proc., 10,87 proc. ir 35 proc. (6 lentelė). Tačiau tręšimas neturėjo įtakos lątelienos ir bendram fenolinių junginių kiekiui.

6 lentelė. Tręšimo įtaka valgomųjų svogūnų veislės ‘Sturon’ ropelių kokybės rodikliams

Rodikliai	Tręšimo variantai	
	Netręšta (kontrolė)	Tręšta
Sausosios medžiagos, %	12,25 b	13,38 a
Baltymai, %	8,88 a	9,36 b
Lašteliena, %	5,12 a	5,26 a
Mineralinės medžiagos, %	4,1 b	4,6 a
Bendras fenolinių junginių kiekis, mg 100 g ⁻¹	35,81 a	34,53 a
Vitaminas C, mg 100 g ⁻¹	1,71 b	2,63 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$



Pastaba: duomenų vidurkiai pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

5 pav. Tręšimo įtaka valgomųjų svogūnų veislės ‘Sturon’ ropelių derlingumui

Naudotos trąšos tendencingai didino svogūnų derlių 8,24 proc., tačiau esminės įtakos nenustatyta (5 pav.).

Tręšimo įtaka žieminių kviečių veislės ‘Inforner’ grūdų kokybei ir derlingumui

Atlikus sausųjų medžiagų skaičiavimus, nustatyta, kad patikimai didesnis jų kiekis buvo žieminiuose kviečiuose kur naudotos trąšos (7 lentelė). Tręštų kviečių grūdai sukauptė esmingai daugiau vidutiniškai 1,64 proc., sausųjų medžiagų, lyginat su kontrolio varianto grūdais.

7 lentelė. Tręšimo įtaka žieminių kviečių veislės „Inforner“ grūdų kokybės rodikliams

Tręšimo variantai	Rodikliai			
	Sausosios medžiagos, %	Baltymai, %	Lašteliens, %	Mineralinės medžiagos, %
Kontrolė (netręšta)	84,15 b	11,04 a	3,9 a	6,8 b
Agrolinija S	85,23 a	11,29 a	3,9 a	7,2 a
Biogel	85,91 a	10,33 a	3,8 a	7,3 a
Makalūzas	85,52 a	10,88 a	3,8 a	6,6 b

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Baltymai turi du su jais siejamus komponentus - tai šių baltymų kiekis ir kokybė. Abiems šiems komponentams įtakos turi azoto ir sieros atsargų kiekiai augalo audiniuose įvairiais vystymosi tarpsniais. Žinoma, kad, esant dideliame derlingumui, baltymų kiekis grūduose sumažėja. Azotas yra pagrindinis aminorūgščių - kviečių grūdų baltymų sudedamosios dalies - komponentas. Todėl auginant kviečius, turinčius didelį baltymų kiekį, azoto kontrolė yra svarbi. Grūdų baltymai yra ypatingai naudingi, kadangi jie parodo, ar augalams yra skiriama optimali azoto kontrolė. Mūsų tikslas įvertinti, kaip auginant kviečius juo veikė ekologiškos trąšos. Gauti rezultatai parodė, kad naudotos trąšos neturėjo esminės įtakos kviečių baltymingumui ir lašteliens kiekiui ir jis svyravo atitinkamai nuo 10,33 iki 11,29 proc. ir 3,8 iki 3,9 proc. (7 lentelė). Naudotos Agrolin S+Biogel ir Agrolin S trąšos esmingai padidino mineralinių medžiagų kiekį žieminiuose kviečiuose.

8 lentelė. Tręšimo įtaka žieminių kviečių veislės ‘Inforner’ grūdų derlingumui

Tręšimo variantai	Parametrai	
	g m ²	t ha ⁻¹
Kontrolė	692,67 b	6,93 b
Agrolinija S	692,33 b	6,92 b
Biogel	755,33 a	7,55 a
Makalūzas	769,67 a	7,70 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Variantuose, kuriuose buvo naudotos Agrolin S+Biogel ir Makalūzas trąšos, nustytas esmingai didžiausias žieminių kviečių derlius. Lyginant su kontroliniu variantu, Agrolin S naudojimas neturėjo esminės įtakos kviečių derlingumui (8 lentelė).

Tręšimo įtaka žieminių rapsų veislės '*Dominator*' sėklų kokybei ir derlingumui

Įvertinus tręšimo įtaką rapsams, nustatyta kad trąšų kompleksas: Agrolin S+Biogel ir Agrolin S esmingai padidino sausųjų medžiagų ir baltymų kiekis, lyginant su kontrolinio varianto rapsais (9 lentelė). O Makalūzas neturėjo esminės įtakos šiems rodikliams. Kviečių ląstelienos ir mineralinių medžiagų kiekiui naudotos trąšos esminės įtakos neturėjo.

9 lentelė. Tręšimo įtaka žieminių rapsų veislės '*Dominator*' sėklų kokybės rodikliams

Tręšimo variantai	Rodikliai			
	Sausosios medžiagos, %	Baltymai, %	Ląsteliena, %	Mineralinės medžiagos, %
Kontrolė	91,34 b	16,08 b	6,46 a	4,1 a
Agrolin S	92,19 a	18,42 a	6,49 a	4,3 a
Biogel	92,39 a	17,77 a	6,74 a	4,3 a
Makalūzas	91,70 b	16,15 b	6,48 a	3,9 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Esmingai didžiausias žieminių rapsų derlius nustytas variantuose, kur buvo naudotos Agrolinija S+Biogel ir Makalūzas trąšos. Agrolin S naudojimas neturėjo esminės įtakos rapsų derlingumui, lyginant su kontroliniu variantu (10 lentelė).

10 lentelė. Tręšimo įtaka žieminių rapsų veislės '*Dominator*' sėklų derlingumui

Tręšimo variantai	Parametrai	
	g m ²	t ha ⁻¹
Kontrolė	364,33 b	3,64 b
Agrolin S	373,67 b	3,74 b
Biogel	414,67 a	4,15 a
Makalūzas	416,33 a	4,16 a

Pastaba: duomenų vidurkiai pateikti toje pačioje eilutėje pažymėti skirtingomis mažosiomis abėcėlės raidėmis, statistiškai patikimai skiriasi, kai $p < 0,05$

Išvados

1. Naudotos Biogel trąšos esmingai padidino bendrą fenolinių junginių kiekį bulvėse; sausųjų medžiagų, ląstelienos ir β -karoteno kiekį aliejiniuose moliūguose; β -karoteno ir baltymų kiekį morkose; sausųjų medžiagų, baltymų, mineralinių medžiagų, bendrą fenolinių junginių ir vitamino C kiekį daržinių žemaūgių pupelių ankštyse ir svogūnuose.

2. Esmingai didžiausias valgomųjų bulvių veislės 'Vineta' stiebagumbių, aliejinių moliūgų ir morkų derlius nustatytas variante, kur buvo panaudotos Biogel trąšos. Tačiau šių trąšų naudojimas neturėjo esminės įtakos valgomųjų svogūnų ir pupelių ankščių derlingumui.
3. Patikimai didesnis sausųjų medžiagų kiekis buvo nustatytas žieminiuose kviečiuose, kur naudotos trąšos Biogel, Agrolinija S ir Makalūzas. Agrolinija S+Biogel ir Agrolinija S esmingai padidino sausųjų medžiagų ir baltymų kiekį žieminiuose rapsuose, ir mineralinių medžiagų kiekį kviečiuose, lyginant su kontroliniu variantu.
4. Esmingai didžiausias žieminių kviečių ir rapsų derlingumas nustatytas variantuose, kur buvo panaudotos trąšos Agrolinija S, Biogel ir Makalūzas.

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The Pot Trial of Agrolinija S and SaproForte



Methods

- Crop : Ganges Amaranth
- Transplanting date : 2023/5/3
- Fertilizers treatment :
 - Basal fertilizer : apply 2 g of 17-10-13 per plant on 2023/5/3.
 - Irrigation : apply testing liquid fertilizers on 2023/5/5, 2023/5/12, and 2023/5/19, respectively. See Table 1.
- Harvest date : 2023/5/31

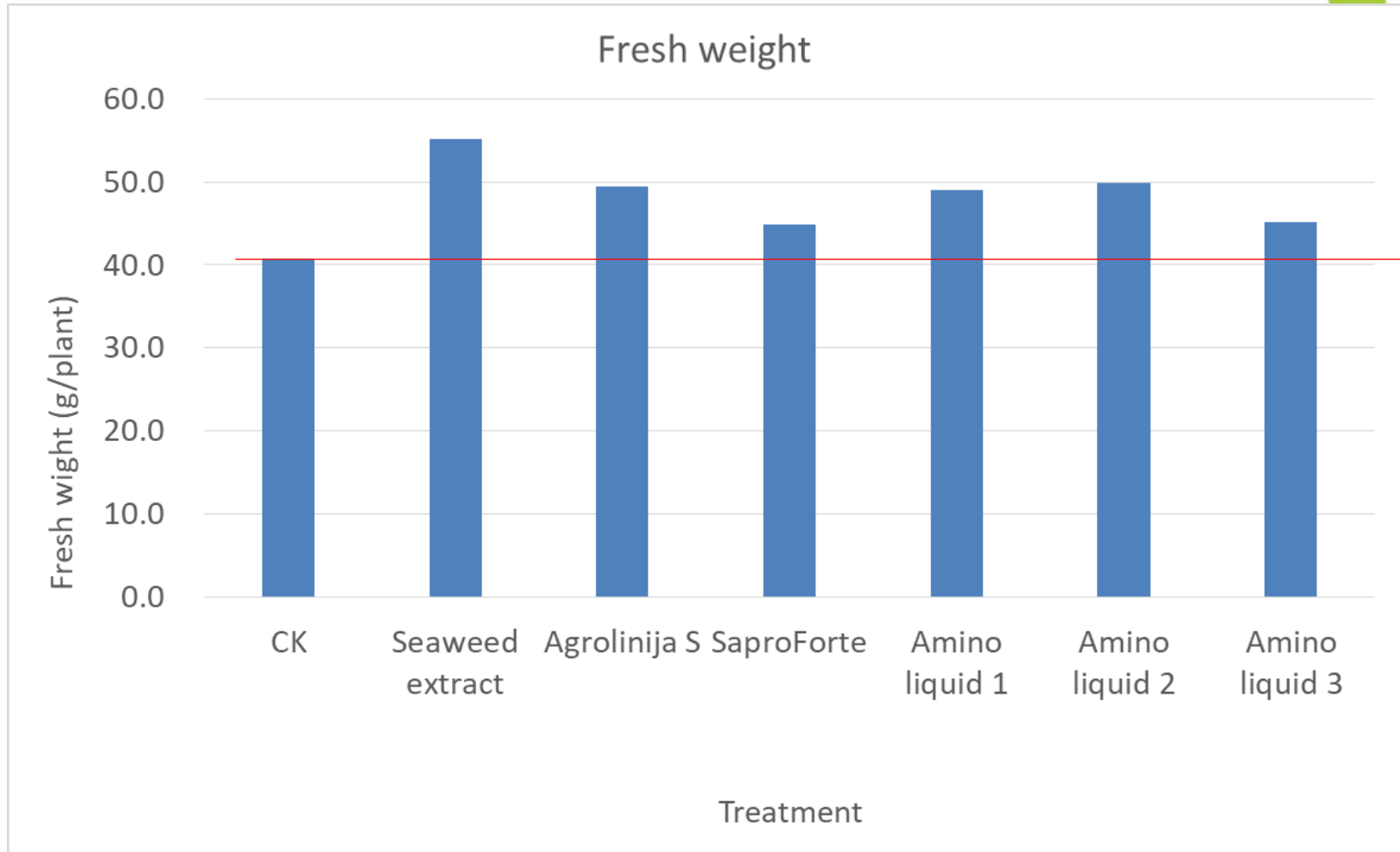
Methods

Table 1. Fertilizers treatment

No.	Treatment	Application
1	CK	Irrigation with water · 50 mL/plant
2	Seaweed extract	Irrigation with 800 times dilutes · 50 mL/plant
3	Agrolinija S	Irrigation with 150 times dilutes · 50 mL/plant
4	SaproForte	Irrigation with 800 times dilutes · 50 mL/plant
5	Amino liquid 1	Irrigation with 500 times dilutes · 50 mL/plant
6	Amino liquid 2	Irrigation with 500 times dilutes · 50 mL/plant
7	Amino liquid 3	Irrigation with 500 times dilutes · 50 mL/plant

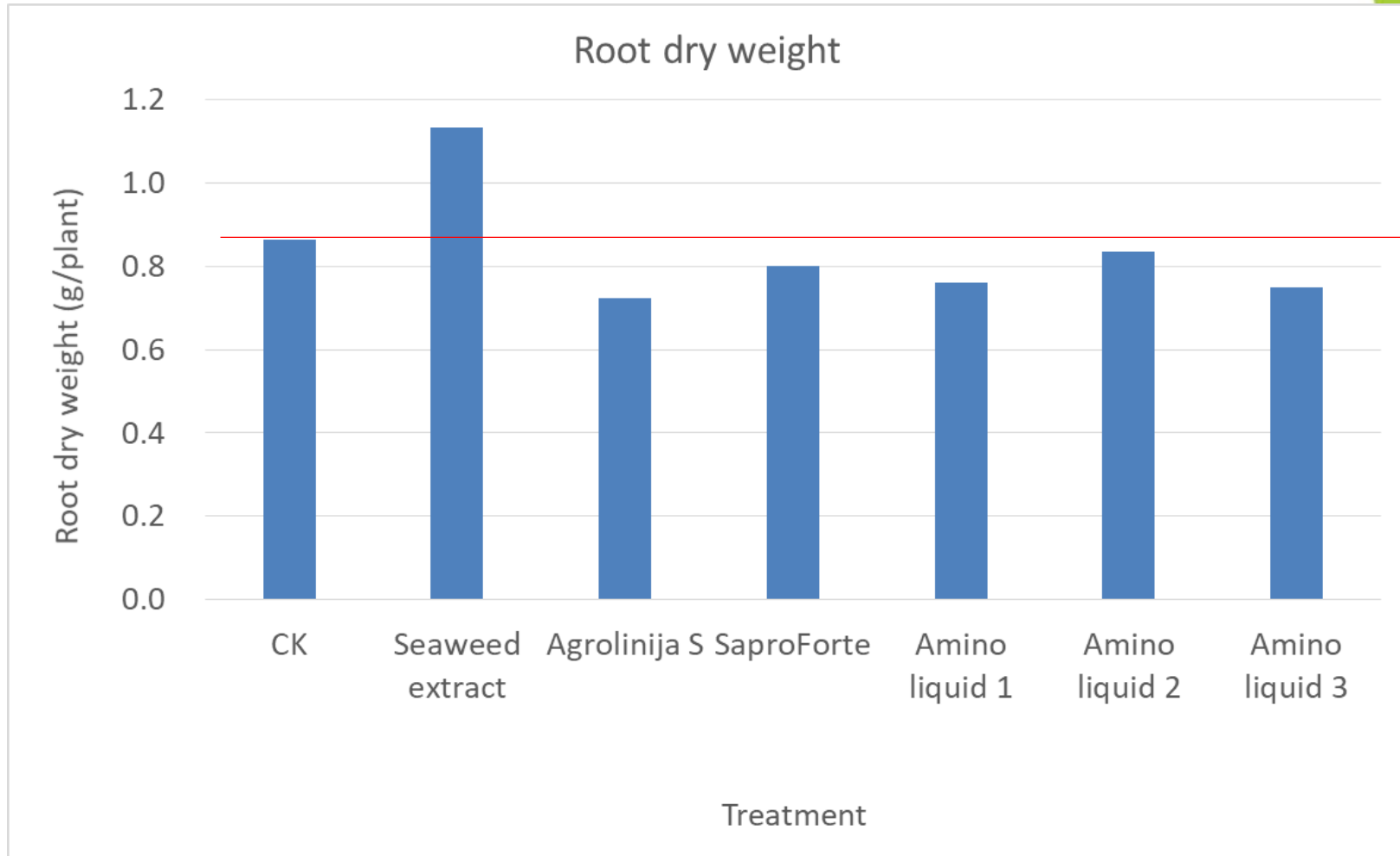
Results

Shoot fresh weight



Result

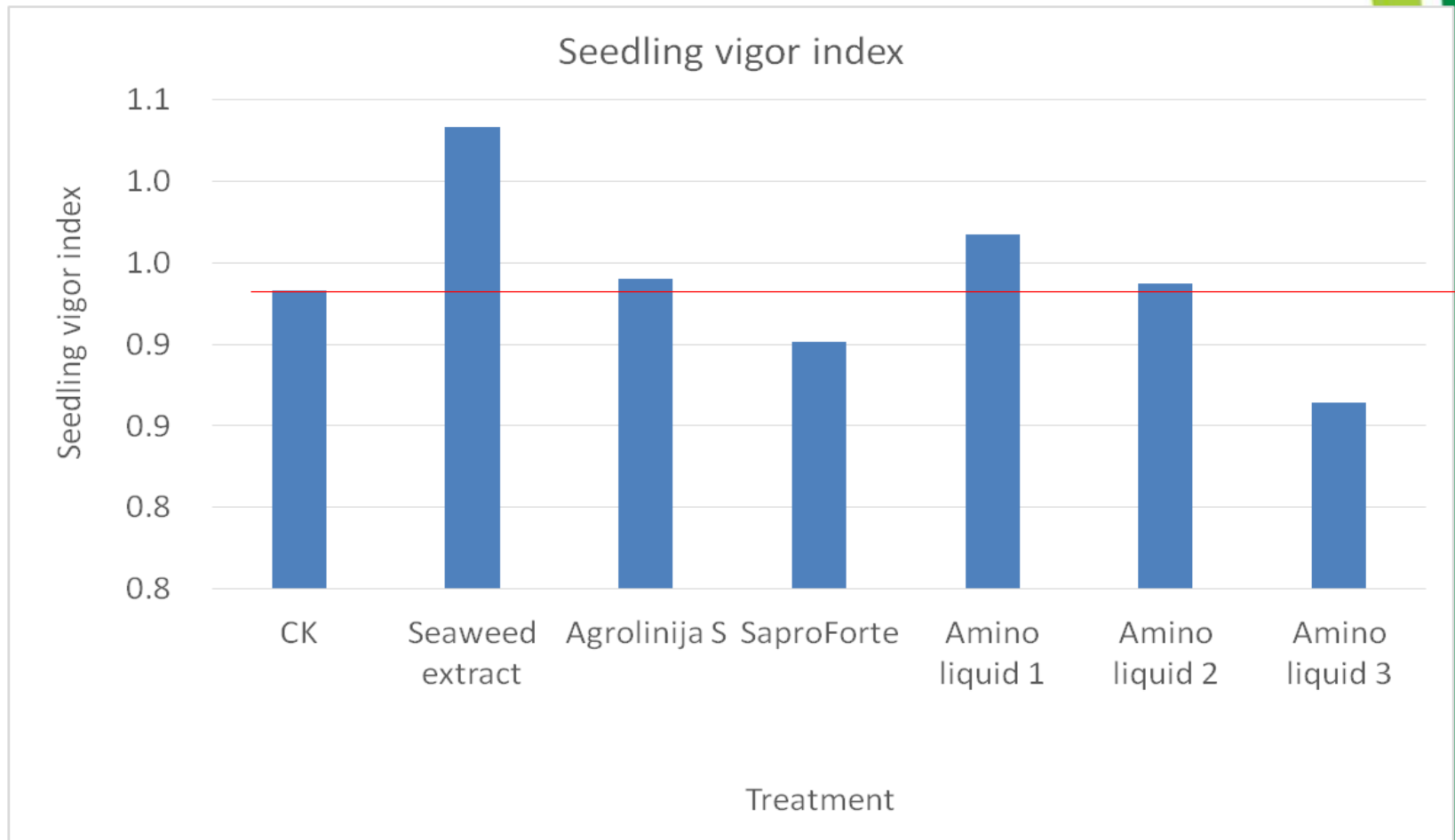
Roots dry weight



Results

Seedling vigor index

Seedling vigor index = shoot fresh weight / seedling height



Results



1=CK

2=Seaweed extract

1=CK

3=Agrolinija S

Results



1=CK

4=SaproForte



1=CK

5=Amino liquid 1

Results



1=CK

6=Amino liquid 2



1=CK

7=Amino liquid 3

Results

- The results showed that the shoot fresh weight of Agrolinija S and SaproForte treatments were higher than CK. However, the shoot fresh weight increases of Agrolinija S and SaproForte were no significant differences compared with seaweed extract or amino liquids in this test.
- The seaweed extract was the only one treatment which significantly enhance the growth of roots.



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REPORT
**on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S
and the quality of the winter wheat harvest in 2018**

- 1. Place of the test:** educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28.
- 2. Fertilizer:** Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.
- 3. Plant on which the fertilizer was applied during the test:** winter wheat, variety Yadvisya.
- 4. Soil**
 - 4.1. Type:** agrosod-podzolic;
 - 4.2. Mechanical composition:** cohesive sand;
 - 4.3. Humus content:** 1.85%;
 - 4.4. Acidity:** 6.09;
 - 4.5. Availability of macro- and microelements:** P₂O₅ – 250 mg/kg, K₂O – 169 mg/kg. Content of mobile forms of copper (1.0M HCl) – 1.70 mg/kg, zinc (Zn) (1.0M HCl) – 2.5 mg/kg, exchangeable manganese (1.0M HCl) – 0.86 mg/kg, water-soluble boron – 0.68 mg/kg.
- 5. Agrotechnical conditions for the test:**
 - 5.1. Predecessor of the plant on which the tests are carried out:** oil radish;
 - 5.2. tillage:** plowing to a depth of 25 cm (17.08.2017), cultivation to a depth of 12 cm (31.08.2017);
 - 5.3. Application of fertilizers (a.i.):** main – phosphorus – 60 kg/ha, potassium – 120 kg/ha (17.08.2017), the first fertilization – nitrogen – 60 kg/ha (29.03.2018), the second fertilization – nitrogen – 40 kg/ha (29.04.2018); the third fertilization – nitrogen – 30 kg/ha (18.05.2018);
 - 5.4. Sowing (planting) period:** 03.09.2017;
 - 5.5. Seed seeding rate:** 5 million germinating seeds/ha;
 - 5.6. Name and timing of crop (planting) care measures:** herbicidal treatment (32nd stage) with Bomba herbicide – 0.03 kg/ha (24.04.2018), fungicidal treatment (51 stages) with Kolosal fungicide – 1.0 l/ha (31.05.2018), insecticidal treatment (51 stages) with Borey insecticide – 0.1 l/ha (31.05.2018)
- 6. Agrometeorological conditions of the test (general characteristics):**

Precipitation in mm for the growing season: the average long-term precipitation is 257 mm, in the year of testing - 209.5 mm.

Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 °C is 1738°C, in the year of testing - 1955.2°C.



In general, meteorological conditions during the growing season of the crop were dry, as the air temperature during this period was higher than the long-term average, and the amount of precipitation was 47.5 mm less.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 25 m², the area of the accounting plot is 16 m², the location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N130R60K120 – Background;

9.2. Standard: Hydrohumin – 1 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 2.5 l/ha.

10. Fertilizer application period: for vegetative plants.

Dates: 19.04.2018, 25.04.2018, 03.05.2018

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st – in the phase of spring renewal of vegetation; 2nd – in the phase of emergence into the tube; 3rd – in the phase of flag leaf.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

When carrying out three foliar fertilizations of winter wheat with Agrolinija-S fertilizer, there was a tendency to increase the number of grains in the ear, as well as the weight of 1000 grains (Table 1).

Table 1 - Effect of Agrolinija-S humic acid-based fertilizer on the structure of winter wheat yield

Variant	Productive bushiness, pcs/m ²	Number of grains per ear, pcs.	Weight 1000 grains, g
1. N130R60C120 – Background	452	20,2	36,2
2. Fon + Hydrohumin - Etalon	465	24,3	39,5
3. Background + Agrolinija-S	464	24,2	40,3

The use of Hydrohumin and Agrolinija-S fertilizers did not significantly change the phosphorus and potassium content in winter wheat grains compared to the background version, but contributed to an increase in the content of nitrogen, crude protein and gluten (Table 2).

Table 2 - Effect of fertilizer based on humic acids Agrolinija-S on the quality indicators of winter wheat grain

Options	Crude protein, %	Gluten, %	N, % dry weight	P ₂ O ₅ , % dry weight	K ₂ O, % dry weight
1. N130R60C120 – Background	11,5	22,5	1,85	0,78	0,54



2. Fon + Hydrohumin - Etalon	12,1	24,0	1,95	0,76	0,56
3. Background + Agrolinija-S	12,0	24,2	1,94	0,78	0,54

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The studies found that foliar fertilization with fertilizers based on humic acids Hydrohumin and Agrolinija-S contributed to an increase in the yield of winter wheat grain by 12.2 and 13.5 q/ha, respectively, compared to the background variant (Table 3). Three-fold foliar fertilization with Agrolinija-S fertilizer made it possible to obtain a yield slightly higher than in the reference variant..

Table 3 - Effect of Agrolinija-S humic acid-based fertilizer on winter wheat grain yield

Options	Yield, q/ha	Increase to the background, q/ha
1. N130R60C120 – Background	32,3	-
2. Fon + Hydrohumin - Etalon	44,5	12,2
3. Background + Agrolinija-S	45,8	13,5
NSP 5	2,8	

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer based on humic acids in foliar fertilization of winter wheat crops in the phases of spring vegetation renewal, emergence into the tube and flag leaf against the background of mineral fertilizers contributes to an increase in grain yield by 13.5 q/ha. Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex. We consider it expedient to expand the registration of Agrolinija-S fertilizer for other winter grain crops (winter rye, winter triticale, winter barley).

Regulations for the use of Agrolinija-S fertilizer in the agro-industrial complex:

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Frequency of application



<p style="text-align: center;">Agrolinija-S</p> <p>(UAB "Biodynamika", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%</p>	2,5	Winter cereals (winter wheat, winter triticale, winter rye, winter barley)	<p>Foliar feeding:</p> <p>1st – in the phase of spring vegetation renewal;</p> <p>2nd - in the phase of exit into the tube;</p> <p>3rd – in the flag list phase.</p> <p>Spray solution consumption is 200 l/ha.</p>	3
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Performer:

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REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the spring wheat harvest in 2018.

- 1. Place of the test:** educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28.
- 2. Fertilizer:** Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.
- 3. Plant on which the fertilizer was applied during the test:** spring wheat, variety Daria.



4. Soil

4.1. **Type:** agrosod-podzolic;

4.2. **Mechanical composition:** cohesive sand;

4.3. **Humus content:** 1.91%;

4.4. **Acidity:** 6.0;

4.5. **Availability of macro- and microelements:** P₂O₅ – 262 mg/kg, K₂O – 196 mg/kg. Content of mobile forms of copper (1.0M HCl) – 1.8 mg/kg, zinc (Zn) (1.0M HCl) – 2.5 mg/kg, exchangeable manganese (1.0M HCl) – 0.84 mg/kg, water-soluble boron – 0.68 mg/kg.

5. Agrotechnical conditions for the test:

5.1. **Predecessor of the plant on which the tests are carried out:** corn;

5.2. **tillage:** plowing to a depth of 25 cm (28.09.2017), cultivation to a depth of 12 cm (05.04.2018);

5.3. **Application of fertilizers (a.i.):** basic – nitrogen 60 kg/ha (05.04.2017), phosphorus – 60 kg/ha, potash – 120 kg/ha (28.09.2017); fertilization – nitrogen 40 kg/ha (21.05.2018)

5.4. **Sowing (planting) period:** 09.04.2018;

5.5. **Seed seeding rate:** 5.5 million germinating seeds/ha;

5.6. **Name and timing of crop (planting) care measures:** herbicidal treatment (25th stage) with Bomba herbicide – 0.03 kg/ha (15.05.2018), fungicidal and insecticidal treatment (34th stage) with Kolosal fungicide – 1.0 l/ha and Borey insecticide – 0.1 l/ha (29.06.2018).

6. Agrometeorological conditions of the test (general characteristics):

the average long-term is 204 mm, in the year of testing - 182.1 mm.

Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 °C is 1372 °C, in the year of testing - 1687.7 °C.

In general, meteorological conditions during the growing season of the crop were dry, as the air temperature during this period was higher than the long-term average, and the amount of precipitation was 21.9 mm less.

7. **Type of test:** field.

8. **Size (sq. m) and location of the plot:** the total area of the plot is 25 m², the area of the accounting plot is 16 m², the location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. **Plot option:** N₁₀₀P₆₀K₁₂₀ – Background;

9.2. **Standard:** Hydrohumin – 1 l/ha;

9.3. **Tested fertilizer:** Agrolinija-S – 2.5 l/ha.

10. **Fertilizer application period:** for vegetative plants.

Dates: 07.05.2018; 24.05.2018; 07.06.2018

11. **Method of fertilizer application:** spraying (foliar feeding).

12. **Phases of plant development during the fertilizer application period:** 1st – in the tillering phase; 2nd – in the phase of the beginning of emergence into the tube; 3rd – in the flag-leaf phase.

13. **Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances:** not studied.

14. **Identified side effects:** not noted.

15. **Information on the effect of fertilizer on biochemical indicators of product quality:**



When carrying out three foliar fertilizations of spring wheat with fertilizers based on humic acids Hydrohumin and Agrolinija-S, there was a tendency to increase the number of grains in the ear, as well as an increase in the weight of 1000 grains (Table 1). The maximum weight of 1000 grains (32.8 g) and the number of grains in the ear (21.5 pieces) were noted in the variants with the use of Agrolinija-S fertilizer.

Table 1 - Effect of Agrolinija-S humic acid-based fertilizer on spring wheat yield structure

Variant	Productive bushiness, pcs/m ²	Number of grains per ear, pcs.	Weight 1000 grains, g
1. N130R60C120 – Background	440	18,3	32,0
2. Fon + Hydrohumin - Etalon	443	20,0	32,4
3. Background + Agrolinija-S	446	21,5	32,8

The use of Hydrohumin and Agrolinija-S fertilizers did not significantly change the chemical composition of spring wheat grain compared to the background variant (Table 2).

Table 2 - Effect of Agrolinija-S humic acid-based fertilizer on the quality of spring wheat grain

Options	Crude protein, %	Gluten, %	N, % dry weight	P2O5, % dry weight	K2O, % dry weight
1. N130R60C120 – Background	14,5	29,2	2,38	0,36	0,65
2. Fon + Hydrohumin - Etalon	14,8	29,3	2,38	0,35	0,64
3. Background + Agrolinija-S	14,6	29,0	2,36	0,36	0,63

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The studies found that foliar fertilization with Hydrohumin and Agrolinija-S fertilizers contributed to an increase in the yield of spring wheat grain by 3.3 and 6.3 q/ha, respectively, compared to the background variant (Table 3). Three-fold foliar fertilization with Agrolinija-S fertilizer made it possible to obtain a yield that was significantly higher than in the reference option.

Table 3 – Effect of Agrolinija-S humic acid-based fertilizer on spring wheat grain yield

Options	Yield, q/ha	Increase to the background, q/ha
1. N130R60C120 – Background	25,0	-
2. Fon + Hydrohumin - Etalon	28,3	3,3
3. Background + Agrolinija-S	31,3	6,3
NSR05	2,3	



17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S complex fertilizer in foliar fertilization of spring wheat crops in the tillering phases, the beginning of emergence into the tube and in the flag leaf phase against the background of mineral fertilizers contributes to an increase in grain yield by 6.3 q/ha. We consider it expedient to expand the registration of Agrolinija-S fertilizer for other spring cereals (spring barley, spring triticale, oats).

Regulations for the use of Agrolinija-S fertilizer in the agro-industrial complex:

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Frequency of application
<p>Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%</p>	2,5	Spring cereals (spring barley, spring wheat, spring triticale, oats)	<p>Foliar feeding:</p> <p>1st – in the tillering phase;</p> <p>2nd – in the phase of exit into the tube;</p> <p>3rd – in the phase of the flag list</p> <p>Spray solution consumption is 200 l/ha.</p>	3

Performer:

Head. Head of the Department of Agrochemistry,
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2018

REPORT
**on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S
and the quality of sugar beet in 2018**

1. Place of testing, name of the institution and its address:

Grodno State Agrarian University, 28 Tereshkova Street, Grodno, 230008;

2. Fertilizer: Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. Plant on which the fertilizer was applied during the test: sugar beet, Ventura hybrid.

4. Soil

4.1. Type: agrosod-podzolic;

4.2. Mechanical composition: cohesive sand;

4.3. Humus content: 1.85%;

4.4. Acidity: 6.13;

4.5. Availability of macro- and microelements: P₂O₅ – 218 mg/kg, K₂O – 189 mg/kg. Content of mobile forms of copper (1.0M HCl) – 1.69 mg/kg, zinc (Zn) (1.0M HCl) – 2.95 mg/kg, exchangeable manganese (1.0M HCl) – 0.96 mg/kg, water-soluble boron – 0.68 mg/kg.

5. Agrotechnical conditions for the test:

5.1. predecessor of the plant on which the tests are carried out: spring barley;

5.2. tillage: plowing to a depth of 25 cm (03.10.2017), cultivation to a depth of 12 cm (12.04.2018);

5.3. Fertilization (a.i.):

Application of mineral fertilizers (a.i.): main - phosphorus - 70 kg/ha (03.10.2017), potash - 120 kg/ha (03.10.2017), - nitrogen - 80 kg/ha (12.04.2018), fertilization - nitrogen - 40 kg/ha (17.05.2018).

application of organic fertilizers: cattle manure – 60 t/ha (03.10.2017).

5.4. Sowing (planting) period: 23.04.2018;

5.5. Seed seeding rate: 1.2 p.u./ha;

5.6. Name and timing of crop (planting) care measures : herbicides: Mitron – 1.5 l/ha + Betaren Super – 1 l/ha (12.05.2018), Mitron – 1.5 l/ha + Betaren Super – 1 l/ha + Chimera 1 l/ha (22.05.2018), herbicide Mitron – 1.5 l/ha + Betaren Super – 1 l/ha (02.06.2018), treatment against diseases with Strazh fungicide – 0.5 l/ha (10.08.2018).

6. Agrometeorological conditions of the test (general characteristics):

Precipitation in mm for the growing season: the average long-term precipitation is 342 mm, in the year of testing - 269.5 mm.

Air temperature for the growing season: the average long-term value of the sum of active temperatures above 10°C is 2368°C, in the year of testing - 2846.6°C.



In general, meteorological conditions during the growing season of the crop were dry, as the air temperature during this period was higher than the long-term average, and the amount of precipitation was 72.5 mm less.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 30 m², the area of the accounting plot is 21.6 m², the method of placing the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: 60 t/ha o.u. + N_{120R70K120} – Background;

9.2. Standard: Hydrohumin – 4.5 l/ha;

9.3. Fertilizer under study: Agrolinija-S – 3.0 l/ha.

10. Fertilizer application period: for vegetative plants.

Date: 06.06.2018, 20.06.2018

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st - in the phase of closing the tops in the rows, 2nd - in the phase of closing the tops in the rows.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

Two foliar fertilizations of sugar beet with Hydrohumin and Agrolinija-S fertilizers showed a tendency to increase the sugar content of root crops (Table 1). The maximum sugar content of root crops (16.9%) was obtained in the version with the use of Agrolinija-S fertilizer. The use of complex fertilizers Hydrohumin and Agrolinija-S in comparison with the background version did not have a significant effect on the content of the main nutrients in sugar beet roots.

Table 1 - Effect of Agrolinija-S complex fertilizer on the quality indicators of sugar beet roots

Options	Sugar content, %	N, % dry weight	P ₂ O ₅ , % dry weight	K ₂ O, % dry weight
1. 60 t/ha o.u. + N _{120R70K120} – Background	16,5	0,39	0,30	0,71
2. Fon + Hydrohumin - Etalon	16,7	0,38	0,32	0,70
3. Background + Agrolinija-S	16,9	0,39	0,30	0,72

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The studies have established that the use of organic and mineral fertilizers in doses of 60 t/ha o.s. + N_{120P70K120} made it possible to obtain a yield of sugar beet roots of 535 q/ha (Table 2).

Table 2 – Effect of Agrolinija-S complex fertilizer on the yield of sugar beet roots



Options	Yield, q/ha	Increase to the background, q/ha
1. 60 t/ha o.u. + N120R70K120 – Background	535	-
2. Fon + Hydrohumin - Etalon	579	44,0
3. Background + Agrolinija-S	582	47,0
NSR05	28,0	

Foliar fertilization with fertilizers based on humic acids Hydrohumin and Agrolinija-S contributed to an increase in the yield of root crops by 44.0 and 47.0 q/ha, respectively, compared to the background option. The fertilizers used had an equivalent effect on the yield of sugar beet roots.

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer based on humic acids in foliar fertilization of sugar beet in the phase of closing the tops in the rows and the phase of closing the tops in the rows against the background of the organo-mineral fertilizer system contributes to an increase in the yield of root crops by 47 centners per hectare.

Regulations for the use of Agrolinija-S fertilizer for use in the agro-industrial complex:

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Frequency of application
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	3,0	Sugar beet	Foliar feeding: 1st – in the phase of closing the tops in the rows; 2nd – in the phase of closing the tops in the aisles Spray solution consumption is 200 l/ha.	2

Performer:

Head. Head of the Department of Agrochemistry, soil science, and agriculture. Ecology

Candidate of Agricultural Sciences. Doctor of Medicine, Associate Professor

E.B. Losevich



CLAIM
Vice-Rector for Research
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_____ S.A. Tarasenko
_____ 2018

REPORT
about the biological and economic efficiency of the *Agrolinija-S* fertilizer
and the quality of the cucumber harvest in 2018

1. **Place of the test:** educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28;

RUAI "Grodno Vegetable Factory", Grodno District, Grodno Region.

2. **Fertilizer:** Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. **Plant on which the fertilizer was applied during the test:** cucumber of protected ground, the first (spring-summer) crop rotation; hybrid Yani F1.

4. Soil

4.1. **Type:** substrate – mineral wool;

4.2. **Mechanical composition:** –;

4.3. **Humus content (%):** –;

4.4. **Soil acidity:** pH of the starting solution is 5.5, pH in cubes is 5.7.

4.5. **Provision of macro- and microelements:** –.

5. Agrotechnical conditions for the test:

5.1. **Predecessor of the plant on which the tests are carried out:** protected ground tomato – in the second rotation of 2017.

Before laying the first (spring-summer) crop rotation in 2018 - a complete replacement of the substrate.

5.2. **tillage:** – ;

5.3. **Fertilization (a.i.):** The system of mineral nutrition for growing cucumbers grown in protected ground using low-volume technology corresponded to the generally accepted one.

In accordance with the requirements of cucumber culture, in the phase of growth, flowering, active fruiting and fruit filling, fertilizers during the growing season were applied in the form of nutrient solutions containing macro- and microelements, at the rate of 90-100 ml / plant.

Composition of the solution for saturating cubes for sowing and watering seedlings (mmol/l):

NH_4^+	K ⁺	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	B	Cu	Mo
1.25	6.75	4.5	3.0	16.75	2.5	1.25	20.0	10.0	5.0	30.0	0.75	0.5

Composition of mat saturation solution (mmol/l):

NH_4^+	K ⁺	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
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1.1	5.8	5.5	2.0	15.55	2.55	1.25	20.0	10.0	4.0	30.0	0.5	0.5
Starter solution (mmol/l):												
NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.5	7.8	6.0	2.25	22.0	0.925	1.95	15.0	10.0	5.0	25.0	0.75	0.5
Standard solution (mmol/l):												
NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.0	7.55	5.3	2.25	15.65	3.3	1.4	15.0	10.0	5.0	25.0	0.75	0.5
Generative solution (mmol/l):												
NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.0	8.5	5.0	2.25	14.25	4.25	1.25	15.0	10.0	5.0	25.0	0.75	0.5

5.4. Sowing (planting) period: sowing seeds for seedlings – 28-29.12.2017; seedlings were put in a greenhouse in a permanent place (planting) – 22-25.01.2018;

5.5. Seed seeding rate (planting): 23600 plants/ha;

5.6. Name and timing of crop care (planting) measures: During the cultivation of seedlings against cucumber root rot, the fungicide Previcur, EC (2.4 l/ha) was applied, repeated watering with the drug after transferring the seedlings to the greenhouse with a rate of 4.8 l/ha.

During the growing season, 5-fold application (with an interval of 12-14 days) was carried out against root rot through the automatic watering system of plants with alternation of biopesticides Betaprotectin, f. (application rate 50 l/ha) and Ecogrin, f. (50 l/ha). During the vegetation period, the fungicide Switch, WDG (1 kg/ha) was applied by spraying plants 2 times with a 0.1% working solution against gray rot and ascochytosis.

In the first crop rotation, protection against a complex of pests was provided mainly by the biological method. From the moment the seedlings were put in a permanent place in the greenhouse, multiple releases of biological agents were carried out: against the common spider mite and tobacco thrips - predatory mites *Phytoseiulus persimilis* (50 individuals/m²) and *Amblyseius swirskii* (30 individuals/m²); against the greenhouse whitefly - the macrolophus bug *Macrolophus caliginosus* (5 individuals/m²) and *Encarsia formosa* (5-10 pupae/m²). Entomophages and acariphages were used at intervals of 7 to 14 days. In case of exceeding the level of EPV in the foci of tick infestation, the following biological preparations were applied: Bitoxybacillin, SP (in 0.7% concentration of the working solution) or Aktophyt, 0.2% EC (0.5% working solution).

6. Agrometeorological conditions of the test (general characteristics):

During the growing season in protected ground, the air temperature in the daytime ranged from +21 to +32°C, at night – not lower than +17-+20°C. Relative humidity was maintained within the optimal range (75–90%) and the CO₂ level was regulated. The temperature of the nutrient solution applied under the plants varied from 20 to 24°C.

7. Type of test: production.

8. Size (sq. m) and location of the plot: the total area of the plot is 0.25 ha (2500 m²), the area of the accounting plot is 0.2 ha (2000 m²), the location of the plots is sequential;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. plot option: option without fertilizer application - Background;



9.2. Standard: Fon + Hydrohumin, 3.6 l/ha (during the period of active growth) + Hydrohumin, 3.6 l/ha (14 days after the first treatment);

9.3. Fertiliser to be tested: Background + Agrolinija-S, 3.0 l/ha (during active growth) + Agrolinija-S, 3.0 l/ha (14 days after the first treatment)

10. Fertilizer application period: during the growing season, 2 times: 11.05 and 25.05.2018.

11. Method of application of the fertilizer: foliar feeding of plants.

12. Phases of plant development during the period of fertilizer application: during the period of active growth and fruiting of cucumber plants.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

The use of Agrolinija-S fertilizer in foliar feeding has a positive effect on the formation of the generative organs of the cucumber. Double treatment increases the number of female flowers per 1 plant (1.3 times), the number of greens (1.4 times), the length and weight of the fruit (1.2 and 1.11 times respectively) in comparison with the background variant (Table 1).

Table 1 - Effect of Agrolinija-S complex fertilizer on the formation of generative organs of cucumber plants in protected ground (production experience, RUAI "Grodno Vegetable Factory", Yani F1)

Variant	Number of female flowers, pcs./plant	Number of fruits (greens), pcs./plant	Fruit length, cm	Fruit weight, g
1. Fertilizer-free option – Background	19	12	20	210
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	23	15	23	225
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	25	17	24	233

The use of Agrolinija-S fertilizer during the cucumber growing season did not affect the dry matter content of the fruit. The amount of sugars increased by 0.5%, the content of ascorbic acid - by 0.4 mg/100 g relative to the background variant. At the same time, an increase in the content of nitrogen and phosphorus in the dry mass was noted for both comparisons. The nitrate content in fruits slightly increased relative to the background (by 5-6 mg/kg), which did not exceed the MPC (Table 2).

Table 2 - Effect of Agrolinija-S fertilizer on the quality indicators of cucumber fruits in protected ground (production experience, RUAI "Grodno Vegetable Factory", Yani F1)



Options	Moisture content, %	Dry matter content, %	Vitamin C, mg/100 g	Total sugars, %	N, % dry weight	P2O5, % dry weight	NO3, mg/kg
1. Fertilizer-free option – Background	96,2	3,8	6,8	2,1	0,62	0,03	124
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	96,1	3,9	7,0	2,5	0,68	0,04	130
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	96,1	3,9	7,2	2,6	0,70	0,05	129

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The results of the research showed that the application of the Agrolinija-S fertilizer contributed to an increase in the yield of cucumbers to 27.9 kg/m², which turned out to be significantly higher than the level of the background option - 26.0 kg/m² (taking into account the HCP, there is a difference), and also corresponded to the level of the standard - 27.3 kg/m² (taking into account the HCP, there is no difference).

The economic efficiency of the tested Agrolinija-S fertilizer in 2018 in the first (spring-summer) crop rotation was 7.3% with 5.0% in the reference variant (Table 3)

Table 3 – Effect of Agrolinija-S complex fertilizer on cucumber yield in protected ground (production experience, Grodno Vegetable Factory, Yani F1)

Options	Yield as of 1.05.2018, kg/m ²	Yield as of 1.07.2018, kg/m ²	Adding to the background	
			kg/m ²	%
1. Fertilizer-free option – Background	21,9	26,0	-	-
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	22,2	27,3	1,3	5,0
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	22,0	27,9	1,9	7,3
NSR05	1,5	1,1	-	-

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:



The use of Agrolinija-S fertilizer in foliar fertilization of cucumbers in protected ground contributes to an increase in fruit yields by 1.9 kg/m², or 7.3%.

Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex and retail sale to the population.

Regulations for the use of Agrolinija-S fertilizer:

for the agro-industrial complex

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	3,0	Cucumber protected ground	Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days. Spray solution consumption – 1000 l/ha	2

for use and retail sale to the public

Applicant trade name, preparative form, composition	Norm fertilizer consumption, ml per 10 liters of water	Culture	Method and terms Application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%,	30	Cucumber protected ground	Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days.	2



potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%			The consumption of the working fluid is 10 liters per 100 m ² .	
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Performers:

Head. Head of the Department of Agrochemistry,
soil science and agriculture. Ecology

Candidate of Agricultural Sciences. Doctor of Medicine, Associate Professor
E.B.Losevich

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CLAIM
Vice-Rector for Research
Grodno State Agrarian University

S.A. Tarasenko

2018

REPORT
about the biological and economic efficiency of the Agrolinija-S fertilizer
and the quality of the cucumber harvest in 2018

1. **Place of the test:** educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28;

RUAI "Grodno Vegetable Factory", Grodno District, Grodno Region.

2. **Fertilizer:** Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. **Plant on which the fertilizer was applied during the test:** protected ground cucumber, second crop rotation; SV3506CV F1 hybrid.

4. Soil

4.1. **Type:** substrate – mineral wool;

4.2. **Mechanical composition:** –;

4.3. **Humus content (%):** –;

4.4. **Soil acidity:** pH of the starting solution is 5.5, pH in cubes is 5.7.

4.5. **Provision of macro- and microelements:** –.

5. Agrotechnical conditions for the test:

5.1. **Predecessor of the plant on which the tests are carried out:** cucumber of protected ground – in the first rotation of 2018.

5.2. **tillage:** – ;

5.3. **Fertilization (a.i.):** The system of mineral nutrition for growing cucumbers grown in protected ground using low-volume technology corresponded to the generally accepted one.

In accordance with the requirements of cucumber culture, in the phase of growth, flowering, active fruiting and fruit filling, fertilizers during the growing season were applied in the form of nutrient solutions containing macro- and microelements, at the rate of 90-100 ml / plant.

Composition of the solution for saturating cubes for sowing and watering seedlings (mmol/l):

NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	B	Cu	Mo
1.25	6.75	4.5	3.0	16.75	2.5	1.25	20.0	10.0	5.0	30.0	0.75	0.5

Composition of mat saturation solution (mmol/l):

NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.1	5.8	5.5	2.0	15.55	2.55	1.25	20.0	10.0	4.0	30.0	0.5	0.5

Starter solution (mmol/l):



NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.5	7.8	6.0	2.25	22.0	0.925	1.95	15.0	10.0	5.0	25.0	0.75	0.5

Standard solution (mmol/l):

NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.0	7.55	5.3	2.25	15.65	3.3	1.4	15.0	10.0	5.0	25.0	0.75	0.5

Generative solution (mmol/l):

NH_4^+	K^+	Ca^{2+}	Mg^{2+}	NO_3^-	SO_4^{2-}	$H_2PO_4^-$	Fe	Mn	Zn	In	Cu	Mo
1.0	8.5	5.0	2.25	14.25	4.25	1.25	15.0	10.0	5.0	25.0	0.75	0.5

5.4. Sowing (planting) period: sowing seeds for seedlings – 06/19/2018; seedlings were put in a greenhouse in a permanent place (planting) – 07/04/2018;

5.5. Seed seeding rate (planting): 23500 plants/ha;

5.6. Name and timing of crop (planting) care measures: During the period of growing seedlings against cucumber root rot, the fungicide Previcure, EC (2.4 l/ha) was applied, repeated watering with the drug after transferring the seedlings to the greenhouse with a rate of 4.8 l/ha. g. (consumption rate 50 l/ha) and Ecogrin, f. (50 l/ha). During the vegetation period, the fungicide Switch, WDG (1 kg/ha) was applied by spraying plants 2 times with a 0.1% working solution against gray rot and ascochitosis.

In the second, first crop rotation, protection against a complex of pests was provided by a combination of biological and chemical methods. From the moment the seedlings were put in a permanent place in the greenhouse, multiple releases of bioagents were carried out at intervals of 7 to 14 days: against the common spider mite and tobacco thrips - predatory mites *Phytoseiulus persimilis* (50 individuals/m²) and *Amblyseius swirskii* (30 individuals/m²); against greenhouse whitefly – macrolophus bug *Macrolophus caliginosus* (5 individuals/m²) and encarsia *formosa* (5-10 pupae/m²). In case of exceeding the level of EPV in the foci of tick settlement, biological preparations Fitoverm, EC (3 l/ha) or Aktophyt, 0.2% EC (5 l/ha) were applied, in case of aphid appearance - the insecticide Imidor, VRK (0.3 l/ha).

6. Agrometeorological conditions of the test (general characteristics):

During the growing season in protected ground, the air temperature in the daytime ranged from +21 to +32°C, at night – not lower than +17-+20°C. Relative humidity was maintained within the optimal range (75–90%) and the CO₂ level was regulated. The temperature of the nutrient solution applied under the plants varied from 20 to 24°C.

7. Type of test: production.

8. Size (sq. m) and location of the plot: the total area of the plot is 0.25 ha (2500 m²), the area of the accounting plot is 0.2 ha (2000 m²), the location of the plots is sequential;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. plot option: option without fertilizer application - Background;

9.2. Standard: Fon + Hydrohumin, 3.6 l/ha (during the period of active growth) + Hydrohumin, 3.6 l/ha (14 days after the first treatment);

9.3. Fertiliser to be tested: Background + Agrolinija-S, 3.0 l/ha (during active growth) + Agrolinija-S, 3.0 l/ha (14 days after the first treatment)

10. Fertilizer application period: during the growing season, 2 times: 28.08 and 11.09.2018.



11. Method of application of the fertilizer: foliar feeding of plants.

12. Phases of plant development during the period of fertilizer application: during the period of active growth and fruiting of cucumber plants.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

The application of Agrolinija-S fertilizer to foliar feeding has a positive effect on the formation of the generative organs of the cucumber. It was revealed that the double application of this fertilizer during the growing season increases the number of female flowers per 1 plant (1.5 times), the number of greens (1.3 times), the weight of the fruit (1.16 times) in comparison with the background variant. The length of the fruits has not changed much, because in this hybrid the greens usually do not overgrow, meeting the standard (Table 1).

Table 1 - Effect of Agrolinija-S complex fertilizer on the formation of generative organs of cucumber plants in protected ground (production experience, Grodno Vegetable Factory, SV3506CV F1)

Variant	Number of female flowers, pcs./plant	Number of fruits (greens), pcs./plant	Fruit length, cm	Fruit weight, g
1. Fertilizer-free option – Background	16	18	10	92
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	22	20	11	103
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	24	24	11	107

The analysis of the quality indicators of cucumber fruits made it possible to find out that the use of Agrolinija-S fertilizer during the growing season did not affect the dry matter content in cucumber fruits. A slight increase in the content of nitrogen and sugars was noted for both comparisons. The nitrate content in fruits increased slightly, remaining within the MPC (Table 2).

Table 2 - Effect of Agrolinija-S fertilizer on the quality indicators of cucumber fruits in protected ground (production experience, RUAI "Grodno Vegetable Factory", SV3506CV F1)

Options	Moisture content, %	Dry matter content, %	Total sugars, %	N, % dry weight	P2O5, % dry weight	NO3, mg/kg
1. Fertilizer-free option – Background	95,2	4,8	2,4	0,61	0,03	102



2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	94,6	5,4	2,8	0,65	0,04	108
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	94,9	5,1	2,7	0,66	0,04	109

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

According to the results, the application of Agrolinija-S fertilizer contributed to an increase in the yield of cucumber in the second crop rotation to 17.7 kg/m², which turned out to be significantly higher than the level of the background option - 16.1 kg/m² (taking into account the HCP), and also exceeded the level of the standard - 17.1 kg/m² (taking into account the HCP, there is a difference).

The economic efficiency of Agrolinija-S in 2018 in the second (summer-autumn) turnover reached 9.9%, compared to 6.2% in the reference variant (Table 3).

Table 3 – Effect of Agrolinija-S complex fertilizer on cucumber yield in protected ground (production experience, Grodno Vegetable Factory, SV3506CV F1)

Options	Yield as of 25.08.2018, kg/m ²	Yield as of 15.10.2018, kg/m ²	Adding to the background	
			kg/m ²	%
1. Fertilizer-free option – Background	9,6	16,1	-	-
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	9,7	17,1	1,0	6,2
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	9,6	17,7	1,6	9,9
NSR05	0,45	0,53	-	-

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer in foliar fertilization of cucumber protected ground contributes to an increase in the yield of cucumber fruits by 1.6 kg/m², or 9.9%.

Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex and retail sale to the population.

**Regulations for the use of Agrolinija-S fertilizer:
for the agro-industrial complex**



Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	3,0	Cucumber protected ground	Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days. Spray solution consumption – 1000 l/ha	2

for use and retail sale to the public

Applicant trade name, preparative form, composition	Norm fertilizer consumption, ml per 10 liters of water	Culture	Method and terms Application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	30	Cucumber protected ground	Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days. The consumption of the working fluid is 10 liters per 100 m ² .	2



Performers:

Head. Head of the Department of Agrochemistry,
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Candidate of Agricultural Sciences. Doctor of Medicine, Associate Professor
E.B.Losevich

Assistant of the Department of Entomology
and Biological Plant Protection

E.G.Shinkorenko

CLAIM
Vice-Rector for Research
Grodno State Agrarian University
_____ S.A.Tarasenko
_____ 2018

REPORT
on the biological and economic efficiency of *Agrolinija-S* fertilizer
and the quality of the tomato harvest in 2018

1. **Place of the test:** educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28;

RUAI "Grodno Vegetable Factory", Grodno District, Grodno Region.

2. **Fertilizer:** Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. **Plant on which the fertilizer was applied during the test:**

protected ground tomato, extended crop rotation;

Torero Hybrid F1

4. **Soil**

4.1. **Type:** substrate – mineral wool;

4.2. **Mechanical composition:** –;

4.3. **Humus content (%):** –;

4.4. **Soil acidity:** pH not lower than 5.5.

4.5. **Provision of macro- and microelements:** –.

5. **Agrotechnical conditions for the test:**

5.1. **Predecessor of the plant on which the tests are carried out:** protected ground tomato – in



extended circulation in 2017.

Before the establishment of the 2018 crop rotation - a complete replacement of the substrate.

5.2. tillage: – ;

5.3. Fertilization (a.i.): The system of mineral nutrition for growing tomatoes grown in protected ground using low-volume technology corresponded to the generally accepted one.

Composition of nutrient solutions used for protected tomato

Macro- and micronutrients	Quantity
NO ₃ ⁻	13.5 mmol/l
H ₂ PO ₄ ⁻	2.0 mmol/l
SO ₄ ⁻	3.5 mmol/l
NH ₄ ⁺	0.5 mmol/l
K ⁺	9.5 mmol/l
Ca ⁺⁺	4.75 mmol/l
Mg ⁺⁺	1.5 mmol/l
Fe ⁺⁺⁺	20-25 μmmol/l
Mn ⁺⁺	10 μmmol/l
Zn ⁺⁺	5 μmmol/l
B ⁺	25 μmmol/l
Cu ⁺⁺	0.75 μmmol/l
Mo ⁺⁺	0.5 μmmol/l

5.4. Sowing (planting) period: sowing of tomato seeds – 15.12.2017.

Planting in a permanent place in a greenhouse – 01/19/2018

5.5. Seed seeding rate (planting): 22000 plants/ha;

5.6. Name and timing of crop (planting) care measures: Against rot roots on protected ground tomatoes, the fungicide Previcure Energy, VK was applied by watering plants: during the period of growing seedlings (consumption rate 3 ml/m²) and again - 4 days after putting plants in a greenhouse in a permanent place (3 l/ha).

Against the stem form of gray rot, prophylactic spraying of plant stems with the fungicide Switch, WDG (1 kg/ha) was carried out. For the prevention of late blight, tomato plants were treated during the growing season with the fungicide Akrobat MC, WDG (2 kg/ha), 2 times.

Control of greenhouse whiteflies and common spider mites on tomato plants during the entire vegetation period was carried out using the biological method by weekly releases of entomophages and acariphages: *Encarsia formosa* (5-10 pupae/m²), *Eretmocerus californicus* (from 2 to 20 individuals/m²), *Macrolophus caliginosus* (5 individuals/m²), *Phytoseiulus persimilis* (50-100 individuals/m²), *Amblyseius swirskii* (30-50 individuals/m²).

6. Agrometeorological conditions of the test (general characteristics):

During the growing season in protected ground, the air temperature in the daytime averaged 20-25°C during the day and 16-18°C at night.

The humidity of the substrate was maintained at the optimal level and in the initial vegetation period it was 65-75% of HB with a relative humidity of 60-70%. During the fruiting period, the humidity of the substrate was increased to 80-85%, the air humidity to 75-85%, with active ventilation of greenhouses.



7. Type of test: production.

8. Size (sq. m) and location of the plot: the total area of the plot is 0.25 ha (2500 m²), the area of the accounting plot is 0.2 ha (2000 m²), the location of the plots is sequential;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: option without fertilizer - Background;

9.2. Standard: Fon + Hydrohumin, 3.6 l/ha (during the period of active growth) + Hydrohumin, 3.6 l/ha (14 days after the first treatment);

9.3. Fertiliser to be tested: Fon + Agrolinija-S, 3.0 l/ha (during active growth) + Agrolinija-S, 3.0 l/ha (14 days after the first treatment)/

10. Fertilizer application period: during the growing season, 2 times – 26.07 and 9.08.2018.

11. Method of application of the fertilizer: foliar feeding.

12. Phases of plant development during the period of fertilizer application: during the period of active growth and fruiting of tomato plants.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

When applying Agrolinija-S fertilizer to tomatoes protected ground, a positive effect on the formation of generative organs of plants during the growing season can be traced. The average leaf length in the experiment decreased by 1.17 times compared to the background variant, which indicates the generative type of development of tomato plants against the background of the application of the tested fertilizer and its growth-regulating properties. It has been established that the number of fruits in a truss increases by 1.25 times in comparison with the background variant. The weight of tomato fruits increased from 210 to 242 g, or by 15.2% (Table 1).

Table 1 - Effect of Agrolinija-S fertilizer on the formation of vegetative and generative organs of protected tomato plants (production experience, RUAI "Grodno Vegetable Factory", Torero F1)

Variant	Average leaf length, cm	Number of fruits in a truss, state.	Fetal weight	
			G	%
1. Fertilizer-free option – Background	35	4,0	210	100
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	32	4,5	235	109,5
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	30	5,0	242	115,2

The analysis of the quality indicators of tomato fruits showed that the use of Agrolinija-S fertilizer contributed to a decrease in water content and an increase in the dry matter content in



fruits by 0.9% compared to the background variant. There is a tendency to a slight increase in the content of nitrogen and sugars in fruits. The nitrate content in tomato fruits also increased slightly, remaining within the MPC (Table 2).

Table 2 - Effect of Agrolinija-S fertilizer on the quality indicators of tomato fruits (production experience, Grodno Vegetable Factory, Torero F1)

Options	Moisture content, %	Dry matter content, %	Total sugar, %	N, % dry weight	P2O5, % dry weight	NO ₃ ⁻ , mg/kg
1. Fertilizer-free option – Background	95,2	4,8	2,95	0,3	0,02	69
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	94,5	5,5	3,00	0,5	0,03	75
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	94,3	5,7	3,02	0,7	0,03	72

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

It was found that the application of Agrolinija-S fertilizer by foliar feeding during the growing season of plants contributed to an increase in the yield of tomato fruits from 32.6 to 35.1 kg/m², which corresponded to the level of the standard - 34 kg/m² (taking into account the HCP, there is no difference). Double application of the studied fertilizer made it possible to obtain an additional 2.5 kg/m² of products, or 7.7% in comparison with the background option (Table 3)

Table 3 – Effect of Agrolinija-S fertilizer on the yield of protected ground tomatoes (production experience, RUAI "Grodno Vegetable Factory", Torero F1)

Options	Yield as of 1.07.2018, kg/m ²	Yield as of 1.09.2018, kg/m ²	Adding to the background	
			kg/m ²	%
1. Fertilizer-free option – Background	18,4	32,6	-	-
2. Background + Hydrohumin, 3.6 l/ha + Hydrohumin, 3.6 l/ha – Etalon	18,8	34,0	1,4	4,5
3. Background + Agrolinija-S, 3.0 l/ha + Agrolinija-S, 3.0 l/ha	18,7	35,1	2,5	7,7



NSR05	0,98	1,34	-	-
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17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer in the phase of active growth and fruiting of plants on protected tomato contributes to an increase in tomato yield by 2.5 kg/m², or 7.7%, which corresponds to the level of the standard.

Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex and retail sale to the population.

Regulations for the use of Agrolinija-S fertilizer:

for the agro-industrial complex

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	3,0	Protected tomato	Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days. Spray solution consumption – 1000 l/ha	2

for use and retail sale to the public

Applicant trade name, preparative form, composition	Fertilizer consumption rate, g, ml per 10 liters of water	Culture	Method and terms Application, restrictions on use	Application rate



<p style="text-align: center;">Agrolinija-S</p> <p>(UAB "Biodinamika", Lithuania)</p> <p>humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%</p>	30	Protected tomato	<p>Foliar feeding of plants: the first - in the phase of active growth; again - after 14 days. Spray solution consumption – 10 liters per 100 m²</p>	2
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Performers:

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Assistant of the Department of Entomology
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REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the winter rapeseed harvest in 2018.

1. Place of the test: educational institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova str., 28.

2. Fertilizer: Agrolinija-S - fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter - 54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. Plant on which the fertilizer was applied during the test: winter rapeseed, Brentano hybrid.

4. Soil

4.1. Type: sod-podzolic;

4.2. Mechanical composition: cohesive sand;

4.3. Humus content: 1.88%;

4.4. Acidity: 6.05;

4.5. Availability of macro- and microelements: P₂O₅ – 228 mg/kg, K₂O – 173 mg/kg. Content of mobile forms of copper (1.0 M HCl) – 1.65 mg/kg, zinc (Zn) (1.0 M HCl) – 2.8 mg/kg, exchangeable manganese (1.0 M HCl) – 0.78 mg/kg, water-soluble boron – 0.64 mg/kg.

5. Agrotechnical conditions for the test:

5.1. predecessor of the plant on which the tests are carried out: spring barley;

5.2. tillage: plowing to a depth of 25 cm (11.08.2017), cultivation to a depth of 12 cm (21.08.2017);

5.3. application of fertilizers (a.i.): phosphorus – 80 kg/ha, potassium – 120 kg/ha (11.08.2017), the first fertilization – nitrogen – 80 kg/ha (13.04.2018), the second fertilization – nitrogen – 40 kg/ha (25.04.2018);

5.4. Sowing (planting) period: 23.08.2017;

5.5. Seed seeding rate: 1 million germinating seeds/ha;

5.6. Name and timing of crop (planting) care measures: post-emergence application of Galera herbicide – 0.3 l/ha (25.09.2017), fungicidal treatment – Karamba Turbo fungicide – 1.0 l/ha (26.09.2017), insecticidal treatment – Fastak insecticide (0.15 l/ha) (25.04.2018).

6. Agrometeorological conditions of the test (general characteristics):

Precipitation in mm for the growing season: the average long-term precipitation is 251 mm, in the year of testing - 211 mm.

Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 °C is 1656°C, in the year of testing - 2131°C.

In general, meteorological conditions during the growing season of the crop were dry, as the air temperature during this period was higher than the long-term average, and the amount of precipitation was 40 mm less.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 25 m², the area of the accounting plot is 16 m², the location of the plot is single-row, sequential;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N120R80K120 – Background;

9.2. Standard: Hydrohumin – 3 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 3 l/ha.

10. Fertilizer application period: for vegetative plants.

Date: 25.04.2018, 03.05.2018

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st - in the phase of the beginning of budding, 2nd - in the phase of the end of budding.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

Two foliar fertilization of winter rapeseed with fertilizers based on humic acids Agrolinija-s and Hydrohumin showed a slight increase in the weight of 1000 seeds and the content of crude fat compared to the background variant (Table 1). We also noted a slight multidirectional change in the content of nitrogen, phosphorus and potassium in winter rapeseed oilseeds.

Table 1 - Effect of Agrolinija-s humic acid-based fertilizer on the quality of winter rapeseed oilseeds

Options	Crude fat, %	Weight of 1000 seeds, g	N, %	P2O5, %	K2O, %
1. N120R80C120 – Background	43,9	4,32	2,82	0,82	0,88
2. Background + Hydrohumin (Standard)	44,5	4,40	2,84	0,79	0,85
3. Background + Agrolinija-S	44,9	4,45	2,87	0,79	0,89

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The studies found that foliar fertilizers based on humic acids Agrolinija-s and Hydrohumin contributed to an increase in the yield of winter rapeseed oilseeds compared to the background option by 3.5 and 4.8 q/ha, respectively. Double foliar fertilization with Agrolinija-s fertilizer made it possible to obtain a higher yield than in the reference option.

Table 2 – Effect of Agrolinija-s humic acid-based fertilizer on the yield of winter rapeseed oilseeds

Options	Yield, q/ha	Increase to the background, q/ha
1. N120R80C120 – Background	31,6	-
2. Background + Hydrohumin (Standard)	35,1	3,5
3. Background + Agrolinija-S	36,4	4,8
NSR05	2,35	

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-s humic acid-based fertilizer in foliar fertilization of winter rapeseed crops in the phase of the beginning of budding and in the phase of the end of budding against the background of mineral fertilizers contributes to an increase in the yield of oilseeds by 4.8 q/ha.

Trade name, composition, preparative form, applicant	Fertilizer consumption rate, kg/ha	Culture	Method and timing of application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamika", Lithuania)	2,5	Winter rapeseed, spring rapeseed	Foliar feeding of plants:	2

<p>humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%</p>			<p>1st – in the phase of the beginning of budding; 2nd – in the phase of the end of budding. Spray solution consumption – 200 l/ha</p>	
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Performer:

Associate Professor of the Department of Agrochemistry,
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Candidate of Agricultural Sciences. Sciences

S.I. Yurgel



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Vice-Rector for Research
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2020

REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the corn harvest in 2019.

1. Test Location:

Educational Institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova Street, 28.

PK named after V.I. Kremko, 231705, Grodno region, Grodno district, agro-town Kvasovka, Yubileynaya st., 3

2. Fertilizer: Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. Plant on which the fertilizer was applied during the test: corn, hybrid Talisman

4. Soil

4.1. Type: agrosod-podzolic;

4.2. Mechanical composition: loose sand;

4.3. Humus content: 1.58%;

4.4. Acidity: 5.40;

4.5. Availability of macro- and microelements: P₂O₅ – 410 mg/kg, K₂O – 180 mg/kg. Content of mobile forms of copper (1.0M HCl) – 2.0 mg/kg, zinc (Zn) (1.0M HCl) – 3.3 mg/kg, exchangeable manganese (1.0M KCl) – 2.6 mg/kg, water-soluble boron – 0.65 mg/kg.

5. Agrotechnical conditions for the test:

5.1. predecessor of the plant on which the tests are carried out: spring barley;

5.2. tillage: plowing to a depth of 25 cm (17.10.2018), cultivation to a depth of 12 cm (10.04.2019);

5.3. Application of fertilizers: mineral fertilizers (a.i.): basic – phosphorus – 60 kg/ha, potash – 150 kg/ha (17.10.2018), nitrogen – 140 kg/ha (10.04.2019);

organic: cattle manure 60 t/ha (17.10.2018);

5.4. Sowing period: 12.04.2019;

5.5. Seed seeding rate: 100 thousand seeds/ha;

5.6. Name and timing of crop care (planting) measures: herbicide treatment with the herbicide



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Meister Power – 1.5 l/ha (10.05.2019);

6. Agrometeorological conditions of the test (general characteristics):

Precipitation in mm for the growing season: the average long-term precipitation is 311 mm, in the year of testing - 232 mm.

Air temperature for the growing season: the average long-term value of the sum of active temperatures above 10 °C is 2134 °C, in the year of testing - 2432°C.

In general, meteorological conditions during the maize growing season were dry, as the air temperature was above the long-term average and the amount of precipitation was below the long-term average.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 56 m², the area of the accounting plot is 37.8 m², the location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N140R60K150 +60 t/ha of cattle manure – Fon;

9.2. Standard: Hydrohumin – 1 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 2 l/ha.

10. Fertilizer application period: for vegetative plants.

Dates: 04.06.2019, 18.06.2019

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st – 5-6 leaves, 2nd – 8-10 leaves.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

The use of Hydrohumin and Agrolinija-S fertilizers significantly increased the content of nitrogen in corn grain (by 0.12%) and, respectively, crude and digestible protein content in corn grain compared to the background variant (Table 1). The phosphorus content also increased (by 0.03-0.04%). Only Agrolinija-S fertilizer had a positive effect on the percentage of potassium in corn grain.

Table 1 - Effect of fertilizer based on humic acids Agrolinija-S on the quality indicators of corn grain



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Options	Crude protein, %	Digestible protein, %	N, % dry weight	P2O5, % dry weight	K2O, % dry weight
1. N140R60K150 + 60 t/ha of cattle manure – Background	7,91	6,41	1,33	0,28	0,40
2. Fon + Hydrohumin - Etalon	8,63	7,00	1,45	0,31	0,40
3. Background + Agrolinija-S	8,63	7,00	1,45	0,32	0,43

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The studies have established that foliar fertilization with fertilizers based on humic acids Hydrohumin and Agrolinija-S contributed to an increase in the yield of corn grain by 12.0 and 17.0 c/ha, respectively, compared to the background variant (Table 2). Double foliar fertilization with Agrolinija-S fertilizer made it possible to obtain a yield slightly higher than in the reference option, but this difference was within the NSP05.

Table 2 - Effect of Agrolinija-S humic acid-based fertilizer on corn grain yield

Options	Yield, c/ha	Increase to the background, c/ha
1. N140R60K150 + 60 t/ha of cattle manure – Background	168	-
2. Fon + Hydrohumin - Etalon	180	12,0
3. Background + Agrolinija-S	185	17,0
NSR05	7,6	

When carrying out two foliar fertilization of corn with Agrolinija-S fertilizer, there was a tendency to increase the weight of one ear, the weight of grain from one cob, as well as the weight of 1000 grains (Table 3).

Table 3 - Effect of fertilizer based on humic acids Agrolinija-S on the structure of corn yield

Variant	Weight, g
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	one cob	grains from one cob	1000 grains
1. N140R60K150 + 60 t/ha of cattle manure – Background	226	159	305,9
2. Fon + Hydrohumin - Etalon	249	174	314,1
3. Background + Agrolinija-S	245	173	315,3

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer based on humic acids in foliar fertilization of corn crops in the phases of 5-6 and 8-10 leaves against the background of organic and mineral fertilizers contributes to an increase in grain yield by 17.0 c/ha. Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex.

Regulations for the use of Agrolinija-S fertilizer in the agro-industrial complex: Trade name, composition, preparative form, applicant	Fertilizer consumption rate, l/ha	Culture	Method and timing of application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	2	Maize	Foliar feeding of plants: 1st – in the phase of 5-6 leaves; 2nd – in the phase of 8-10 leaves. Spray solution consumption – 200 l/ha	2



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_____ 2020

Performer:

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Candidate of Agricultural Sciences. Doctor of Medicine, Associate Professor
E.B.Losevich



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Vice-Rector for Research
Grodno State Agrarian University

V.V.Peshko

2020

REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the potato harvest in 2019.

1. Place of testing, name of the institution and its address:

Educational Institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova Street, 28.

PK named after V.I. Kremko, 231705, Grodno region, Grodno district, agro-town Kvasovka, Yubileynaya st., 3

2. Fertilizer: Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. Plant on which the fertilizer was applied during the test: potatoes, Red Scarlet variety

4. Soil

4.1. Type: agrosod-podzolic;

4.2. Mechanical composition: loose sand;

4.3. Humus content: 1.29%;

4.4. Acidity: 5.8;

4.5. Availability of macro- and microelements: P₂O₅ – 270 mg/kg, K₂O – 340 mg/kg. Content of mobile forms of copper (1.0 M HCl) – 2.0 mg/kg, zinc (Zn) (1.0 M HCl) – 3.2 mg/kg, exchangeable manganese (1.0 M HCl) – 4.5 mg/kg, water-soluble boron – 0.59 mg/kg.

5. Agrotechnical conditions for the test:

5.1. predecessor of the plant on which the tests are carried out: winter wheat;

5.2. tillage: plowing to a depth of 25 cm (28.10.2018), cultivation to a depth of 12 cm (16.04.2019);

5.3. application of fertilizers (a.i.): mineral: nitrogen 100 kg/ha (16.04.2019), phosphorus – 60 kg/ha, potash – 150 kg/ha (28.10.2018);

organic: 60 t/ha (28.10.2018);

5.4. Sowing (planting) period: 25.04.2019;

5.5. Tuber planting rate: 54 thousand / ha;

5.6. Name and timing of crop (planting) care measures: single pre-emergence loosening of row spacing, treatment with Zencor herbicide – 0.6 l/ha (15.05.2019), treatment with Aktara insecticide – 0.07 kg/ha (19.06.2019), fungicidal treatments against late blight: Orvego, KS, 0.8



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l/ha (01.06.2019; 15.06.19), Acrobat MC, VDG, 2 kg/ha (30.06.19; 16.07.19), Tridex, VDG, 1.6 kg/ha (31.07.19; 08.08.19; 18.08.19).

6. Agrometeorological conditions of the test (general characteristics):

Precipitation in mm for the growing season: the average long-term precipitation is 278 mm, in the year of testing - 222 mm.

Air temperature during the growing season: the average long-term value of the sum of active temperatures above 10 °C is 1904 °C, in the year of testing - 2117°C.

In general, meteorological conditions during the growing season of potatoes were dry, as the air temperature was above the long-term average and precipitation was below the long-term average.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 42 m², the area of the accounting plot is 22.4 m², the location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N_{100R60K150} + 60 t/ha of cattle manure – Fon;

9.2. Standard: Hydrohumin – 4 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 3 l/ha.

10. Fertilizer application period: for vegetative plants.

Dates: 02.06.2019; 23.06.2019;

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st – in the phase of closing the tops in the rows, 2nd – in the phase of the end of budding – the beginning of flowering.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

When carrying out two foliar fertilization of potatoes with fertilizers Agrolinija-S and Hydrohumin, a tendency to increase the biochemical indicators of tubers was noted: the content of vitamin C, starch, nitrates, nitrogen). The phosphorus and potassium content did not change significantly (Table 1).

Table 1 – Effect of complex fertilizer based on humic acids Agrolinija-S on the quality indicators of potato tubers



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Options	Vitamin C content, mg-%	Starch content, %	Nitrate content, mg/kg	N, % dry weight	P2O5, % dry weight	K2O, % dry weight
1. N100R60K150 + 60 t/ha of cattle manure – Background	14,3	11,1	123	1,94	0,26	2,55
2. Fon + Hydrohumin - Etalon	14,9	11,3	142	1,98	0,25	2,57
3. Background + Agrolinija-S	15,0	12,8	139	2,00	0,26	2,49

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

Version.

The studies carried out made it possible to establish that the use of mineral fertilizers in doses of N100P60K150 + 60 t/ha of cattle manure made it possible to obtain a yield of potato tubers of 333 c/ha (Table 2). Foliar fertilization with fertilizers based on humic acids Agrolinija-S and Hydrohumin contributed to an increase in tuber yields by 20 and 17 c/ha, respectively, compared to the background option.

Table 2 – Effect of complex fertilizer based on humic acids Agrolinija-S on the yield of potato tubers

Options	Plant height, cm	Yield, c/ha	Increase to the background, c/ha
1. N100R60K ₁₅₀ + 60 t/ha of cattle manure – Background	32,8	333	-
2. Fon + Hydrohumin - Etalon	37,5	350	17



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3. Background + Agrolinija-S	0,7	353	20
NSR05		15,1	

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S complex fertilizer in foliar fertilization of potatoes in the phase of closing the tops in the rows and in the phase of the end of budding - the beginning of flowering against the background of organic and mineral fertilizers contributes to an increase in tuber yields by 20 centners / ha.

Regulations for the use of Agrolinija-S fertilizer in the agro-industrial complex:

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Frequency of application
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	3	Potato	Foliar feeding of plants: 1st – in the phase of closing the tops in the rows, 2nd – in the phase of budding – flowering. Spray solution consumption – 200 l/ha	2

Performer:

Head. Head of the Department of Agrochemistry,
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REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the strawberry harvest in 2019.

1. Place of testing, name of the institution and its address:

Educational Institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova Street, 28.

PK named after V.I. Kremko, 231705, Grodno region, Grodno district, agro-town Kvasovka, Yubileynaya st., 3

2. Fertilizer: Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.

3. The plant on which the fertilizer was applied during the test: strawberry, Honey variety;

4. Soil

4.1. Type: agrosod-podzolic;

4.2. Mechanical composition: cohesive sand;

4.3. Humus content: 2.0%;

4.4. Acidity: 4.9;

4.5. Availability of macro- and microelements: P₂O₅ – 454 mg/kg, K₂O – 243 mg/kg. Content of mobile forms of copper (1.0M HCl) – 2.7 mg/kg, zinc (Zn) (1.0M HCl) – 4.9 mg/kg, exchangeable manganese (1.0M HCl) – 2.5 mg/kg, water-soluble boron – 0.58 mg/kg.

5. Agrotechnical conditions for the test:

5.1. predecessor of the plant on which the tests are carried out: spring barley;

5.2. Tillage: loosening of row spacing (1.04.2019, 16.04.2019)

5.3. application of fertilizers (a.i.): nitrogen – 20 kg/ha, phosphorus – 40 kg/ha, potassium – 60 kg/ha, microfertilizers Ecolist Monobor – 1 l/ha (beginning of budding), Ecolist Standard – 1 l/ha (beginning of flowering);

5.4. Planting date: 2017;

5.5. Planting method: single-line, planting scheme 38 x 70 cm;

5.6. Name and timing of planting care measures: herbicides: Betanol Expert – 1.5 l/ha (10.04.2019, 01.05.2019), Fusilad Forte – 2.0 l/ha (15.04.2019), fungicides: Horus – 0.7 kg/ha (10.04.2019), Luna Experience – 0.75 l/ha (03.05.2019);

Mulching between rows with straw May 25-30, 2019

Throughout the growing season, the plantings were watered as necessary.

6. Agrometeorological conditions of the test (general characteristics):



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Precipitation in mm for the growing season: the average long-term precipitation is 355 mm, in the year of testing - 284 mm.

Air temperature for the growing season: the average long-term value of the sum of active temperatures above 10 °C is 2458 °C, in the year of testing - 2739°C.

In general, meteorological conditions during the growing season of strawberries were dry, as during this period the air temperature was higher than the long-term average, and the amount of precipitation was lower than the long-term average.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 49 m², the area of the accounting plot is 28 m², the method of location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N20R40K60 – Background;

9.2. Standard: Volat-6 – 2 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 2 l/ha.

10. Fertilizer application period: for vegetative plants.

Date: 13.05.2019, 28.05.2019

11. Method of fertilizer application: spraying (foliar feeding).

12. Phases of plant development during the period of fertilizer application: 1st - in the phase of budding, 2nd - in the phase of berry growth;

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

Foliar feeding of garden strawberries with Volat-6 and Agrolinija-S fertilizers did not have a significant impact on the quality indicators of strawberries (Table 1).

Table 1 - Effect of Agrolinija-S complex fertilizer on the quality indicators of strawberries

Options	Total sugars, %	Ascorbic acid content, %	N, % dry weight	P2O5, % dry weight	K2O, % dry weight
1. N20R40K60 – Background	7,5	0,08	1,35	0,27	1,91
2. Fon + Volat-6 - Etalon	8,0	0,07	1,33	0,28	1,90
3. Background + Agrolinija-S	7,6	0,08	1,37	0,28	1,93



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16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

The use of humic fertilizers increased the yield of strawberries by 10.1-10.7 c/ha (Table 2). Agrolinija-S provided a higher increase than Volat-6, but the difference was within the NDS.

Table 2 – Effect of Agrolinija-S complex fertilizer on strawberry yield

Options	Yield, c/ha	Increase to the background, c/ha
1. N20R40K60 – Background	38,6	-
2. Fon + Volat-6 - Etalon	48,5	10,1
3. Background + Agrolinija-S	49,3	10,7
NSR05	8,23	

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:

The use of Agrolinija-S fertilizer based on humic acids in foliar fertilization of strawberries during the budding phase and the phase of berry growth against the background of the mineral fertilizer system contributes to an increase in berry yields by 10.7 c/ha. Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus. We believe that for the proposed fertilizer, it is possible to expand the registration for garden strawberries as well.

Applicant trade name, preparative form, composition	Fertilizer consumption rate, l/ha	Culture	Method and timing of application, restrictions on use	Application rate
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen	2	Strawberries, garden strawberries	Foliar feeding of plants: 1st – budding; 2nd – berry growth.	2



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(N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%			Spray solution consumption – 300 l/ha	
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Performer:

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REPORT

on the biological and economic efficiency of the fertilizer based on humic acids Agrolinija-S and the quality of the yield of perennial leguminous grasses in 2019.

1. Place of testing, name of the institution and its address:

Educational Institution "Grodno State Agrarian University", 230008, Grodno, Tereshkova Street, 28.

PK named after V.I. Kremko, 231705, Grodno region, Grodno district, agro-town Kvasovka, Yubileynaya st., 3

2. Fertilizer: Agrolinija-S is a fertilizer based on humic acids - humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%.



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3. Plant on which the fertilizer was applied during the test: timothy + clover of the 2nd year of use

4. Soil

4.1. Type: agrosod-podzolic;

4.2. Mechanical composition: loose sand;

4.3. Humus content: 1.55%;

4.4. Acidity: 6.9;

4.5. Availability of macro- and microelements: P₂O₅ – 271 mg/kg, K₂O – 150 mg/kg. Content of mobile forms of copper (1.0M HCl) – 1.9 mg/kg, zinc (Zn) (1.0M HCl) – 4.5 mg/kg, exchangeable manganese (1.0M HCl) – 1.5 mg/kg, water-soluble boron – 0.75 mg/kg.

5. Agrotechnical conditions for the test:

5.1. Predecessor of the plant on which the tests are carried out: corn;

5.2. Tillage: -

5.3. Fertilizer application (a.i.): nitrogen – 60 kg/ha, phosphorus – 60 kg/ha, potash – 150 kg/ha (for two mowing in total);

5.4. Date, method of sowing: for cover crop (barley);

5.5. Seed seeding rate: 30 kg/ha in a mixture;

5.6. Name and timing of measures for the care of crops (plantings): not carried out;

6. Agrometeorological conditions of the test (general characteristics):

Precipitation in mm for the growing season: the average long-term precipitation is 355 mm, in the year of testing - 284 mm.

Air temperature for the growing season: the average long-term value of the sum of active temperatures above 10 °C is 2458 °C, in the year of testing - 2739°C.

In general, meteorological conditions during the vegetation period of perennial grasses were arid, since during this period the air temperature was higher than the average long-term values, and the amount of precipitation was lower than the average long-term values.

7. Type of test: field.

8. Size (sq. m) and location of the plot: the total area of the plot is 50 m², the area of the accounting plot is 24 m², the method of location of the plots is randomized;

Number of repetitions of the experiment: 4 times.

9. Scheme of the experiment:

9.1. Plot option: N60K150 – Background;

9.2. Standard: Hydrohumin – 1 l/ha;

9.3. Tested fertilizer: Agrolinija-S – 2 l/ha.

10. Fertilizer application period: for vegetative plants.

Dates: 15.04.2019, 3.06.2019, 15.07.2019

11. Method of fertilizer application: spraying (foliar feeding).



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12. Phases of plant development during the period of fertilizer application: 1st – spring regrowth, 2nd – after the first mowing, 3rd – after the 2nd mowing.

13. Information on the compatibility of the tested fertilizer with other fertilizers, plant protection products and other substances: not studied.

14. Identified side effects: not noted.

15. Information on the effect of fertilizer on biochemical indicators of product quality:

When carrying out three foliar fertilization of perennial leguminous grasses with Hydrohumin and Agrolinija-S fertilizers, a tendency to increase the content of nitrogen and digestible protein was noted (Table 1). The use of Agrolinija-S compared to the background version did not have a significant effect on the phosphorus and potassium content in the dry mass of leguminous grasses.

Table 1 - Effect of Agrolinija-S complex fertilizer on the quality indicators of dry weight of perennial leguminous grasses (average for two cuts)

Options	Digestible protein, %	N, %	P2O5, %	K2O, %
1. N60K150 – Background	13,2	2,75	0,27	2,22
2. Fon + Hydrohumin - Etalon	13,4	2,78	0,28	2,28
3. Background + Agrolinija-S	13,5	2,80	0,28	2,21

16. Assessment of the economic efficiency of the fertilizer (indicating the smallest significant difference):

Fertilizers based on humic acids Hydrohumin and Agrolinija-S contributed to an increase in the yield of green mass of perennial leguminous grasses by 50-57 centners per hectare (Table 2).

Table 2 – Effect of Agrolinija-S fertilizer on the yield of perennial leguminous grasses (sum of two cuts)

Options	Yield, c/ha	Increase to the background, c/ha
1. N60K150 – Background	309	-
2. Fon + Hydrohumin - Etalon	359	50
3. Background + Agrolinija-S	366	57
NSR05	23,3	

17. Conclusions and proposals. Regulations for the use of the tested fertilizer recommended for state registration:



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Three times the use of Agrolinija-S fertilizer based on humic acids in foliar fertilization of perennial leguminous grasses in the phase of spring regrowth, after the 1st and 2nd cutting, contributes to an increase in the yield of green mass by 57 c/ha. Agrolinija-S fertilizer is recommended for state registration in the Republic of Belarus for use in the agro-industrial complex.

Regulations for the use of Agrolinija-S fertilizer for use in the agro-industrial complex:

Applicant trade name, preparative form, composition	Norm fertilizer consumption, l/ha	Culture	Method and terms Application, restrictions on use	Frequency of application
Agrolinija-S (UAB "Biodynamics", Lithuania) humic acids - 45%, fulvic acids -13.75%, amino acids -1-2%, dry matter -5.6%, organic matter -54%, nitrogen (N) -3.75%, phosphorus (P) -1.96%, potassium (K) -7.15%, Ca, Mg, Na, S, Fe, B, Co, Cu, Mo, Mn, Zn <1%	1,0	Perennial legumes-grasses	Foliar feeding: 1st – spring regrowth, the 2nd - after the 1st cutting, the 3rd - after the 2nd cutting. Spray solution consumption is 200 l/ha.	3

Performer:

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