REFERENCES

APPLICATION TESTS

PARTNERS

CVRV PIEŠŤANY

Plant Production Research Center

Report on the results of development experiment focused on application ROKOHUMIN liquid fertilizer in winter wheat

Customer	Contractor	Report identification number
ROKOSAN s.r.o. Kolárova 446, 078 01 Sečovce	**CVRV Piešťany** Bratislavská cesta 122, 921 68 Piešťany	**06/2012/106** wheat

testing workplace address: Plant Production Research Center CVRV Piešťany
Research – cultivation station Malý Šariš
Malý Šariš 221, 080 01 Prešov

employee responsible for test course: RNDr. Darina MUCHOVÁ
contact: +421 51 7711674 / +421 51 7711760 / muchova@vurv.sk

report elaborated on: 7th Nov. 2012

report elaborated by: RNDr. Darina MUCHOVÁ

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1. experiment conditions

crop: winter wheat **type:** SULTAN
pre-crop: winter rape

area / soil type: potato growing area / medium heavy soil
soil preparation: standard

seeding date: 5th Oct. 2011 **harvest date:** 29th July 2012

seeding amount: 4.5 mil. germinating seeds.ha^{-1} / 189 kg.ha^{-1}
seeding depth: 40.0 mm
parcel area: 10m^2 **experiment form:** randomized blocks with 4 repetitions

2. realized agro technical interventions / fertilization

- under plaster
- basic storage fertilization
- tillage processing (2x plate discs)
- before seeding soil preparation (2x rotary tiller)
- seeding

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2a. fertilization

BBCH 00	NPK 8:24:24	200 kg / ha	
BBCH 22	Yara Bela Sulfan	150 kg / ha	(24% N; 6% S)
BBCH 32	Yara Bela Sulfan	150 kg / ha	(24% N; 6% S)

last organic fertilization: 2011 / amount 7.5 t.ha^{-1} (rape straw)
type of organic fertilizer: rape straw

pesticides application: realized standardly according to needs of overgrowth

3. experiment results

	variant	dosage lit. ha^{-1}	Grain harvest (t.ha^{-1})					
			repetition				Average	%
			A	B	C	D		
1.	control	-	10.55	9.67	10.45	10.15	10.20	100.00
2.	ROKOHUMIN (2 applications)	2.5 + 2.5 lit.	10.91	10.78	10.48	10.77	10.73	105.20

*** values recalculated to standard 14% humidity**

variant:
1. control (without leaf fertilizing)
2. ROKOHUMIN in dosage 2.5 lit./ha in the end of rooting – beginning of stalks (BBCH 29–32)
   ROKOHUMIN in dosage 2.5 lit./ha in phase of appearance of last leaf (BBCH 37)

conclusion:
From the results of small plot experiment with winter wheat results that leaf fertilizer ROKOHUMIN application led to an increase in grain harvest of 0.53 tons per 1 ha, which in relative terms, is a gain of 5.20%.

Crops of wheat were after hard winter less offshoot than in previous years. An increase grain harvest was due to the maintenance of a large number of productive offshoots of treated variant compared to the untreated control. The results confirm that leaf nutrition during stalks period is crucial for limiting the reduction of productive offshoots.

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Plant Production Research Center

Report on the results of development experiment focused on application ROKOHUMIN liquid fertilizer on winter sown barley

Customer	Contractor	Report identification number
ROKOSAN s.r.o. Kolárova 446, 078 01 Sečovce	**CVRV Piešťany** Bratislavská cesta 122 921 68 Piešťany	**06/2012/106** barley

testing workplace address: Plant Production Research Center (CVRV Piešťany)
Research and Breeding Station Malý Šariš
Malý Šariš 221, 080 01 Prešov, Slovak Republic

employee responsible for test course: RNDr. Darina MUCHOVÁ
contact: +421 51 7711674 / +421 51 7711760 / muchova@vurv.sk

report elaborated on: 7th Nov. 2012

report elaborated by: RNDr. Darina MUCHOVÁ

1. experiment conditions

crop: winter sown barley **type:** SEBASTIAN
pre-crop: winter wheat

area / soil type: potato growing area / medium heavy soil
soil preparation: standard

seeding date: 22th March 2012 **harvest date:** 1st August 2012

seeding amount: 4.2 mil. germinating seeds.ha^{-1}
seeding depth: 40.0 mm
parcel area: 10.00 m^2 **experiment form:** randomized blocks with 4 repetitions

2. realized agro technical interventions / fertilization

- dragging
- compactor
- seeding

2a. basic fertilization

BBCH 00	NPK 8:24:24	200 kg / ha	
BBCH 11	Yara Bela Sulfan	150 kg / ha	(24% N; 6% S)

last organic fertilization: 2009
type of organic fertilizer: peas for green fertilization
pesticides application: realized standardly according to needs of overgrowth

3. experiment results

	variant	dosage lit. ha^{-1}	grain harvest (t.ha^{-1})					
			repetition				Average	%
			A	B	C	D		
1.	**control**	-	8.21	8.57	8.30	8.70	8.45	100.00
2.	ROKOHUMIN (2 applications)	2.5 + 2.5 lit.	8.81	8.77	8.99	8.91	8.87	105.00

*** grain harvest recalculated to 14% humidity**

variant:

1. control (without leaf fertilizing)

2. ROKOHUMIN in dosage 2.5 lit./ha at the end of off shooting – in the beginning of stalks (BBCH 29–31)
3. ROKOHUMIN in dosage 2.5 lit./ha in the phase before spikes (BBCH 45)

conclusion:
From the results of small plot experiment with common sunflower results that leaf fertilizer ROKOHUMIN application led to an increase of harvest in individual variants as follows:

Crops of barley were due to optimum growing conditions congested. A very high number of productive offshoots proved as counterproductive factor because, while maintaining all the less efficient offshoots there occurred a growth of smaller spikes with lower grain deployment. Foliar nutrition brought a positive outcome in the sense that it optimizes the number of offshoots and contributed to the development of more productive spikes. The increase in harvest was in this case achieved by a higher number of grains per spike.

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Report on the results of development experiment focused on application ROKOHUMIN liquid fertilizer in sow corn grown for grain

Customer	Contractor	Report identification number
ROKOSAN s.r.o. Kolárova 446, 078 01 Sečovce	**ÚKSÚP Bratislava** Matúškova 21, 833 16 Bratislava	Corn for grain 2012

testing workplace address: Central Control and Testing Agricultural Institute (ÚKSÚP Bratislava)
regional department Košice
testing station Haniska - Valaliky
044 57 Haniska pri Košiciach

employee responsible for test course: Ing. Ján BUJŇÁK
contact: +421 55 6930 261 / jan.bujnak@uksup.sk

report elaborated on: 8th Nov. 2012

report elaborated by: Ing. Ján BUJŇÁK

1. experiment conditions

crop: sow corn grown for grain **hybrid:** LG 33.50
pre-crop: spring barley

area / soil type: corn area / medium heavy soil
soil preparation: standard

seeding date: 2nd May 2012 **harvest date:** 12th Oct. 2012

seeding amount: 80 000 germinating seeds.ha^{-1}
seeding depth: 80.0 mm
parcel area: 16.80 m^2 **experiment form:** randomized blocks with 3 repetitions

2. realized agro technical interventions / fertilization
- deep tillage
- dragging
- cultivating
- compactor
-seeding

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2a. basic fertilization

18th April 2012 NPK 60 kg nitrogen (N) / 60 kg phosphor (P_2O_5) / 60 kg potassium (K_2O)
30th May 2012 ammonium nitrate NH_4NO_3 70 kg nitrogen (N)

last organic fertilization: September 2011 / amount 40.0 t.ha^{-1}
type of organic fertilizer: stable manure

pesticides application: realized standardly according to needs of overgrowth

3. experiment results

	variant	dosage lit. ha^{-1}	Grain harvest (t.ha^{-1})					**Grain harvest (t.ha^{-1}) calculated to 14% humidity**	**%**
			repetition			Average	humidity		
			A	B	C				
1.	control	-	20.40	19.60	24.60	21.53	22.1 %	**11.61**	**100.00**
2.	ROKOHUMIN (1 application)	2.5 lit.	22.60	25.00	23.40	23.67	22.2 %	**12.74**	**109.70**
3.	ROKOHUMIN (1 application)	5 lit.	23.40	24.10	24.40	23.97	22.1 %	**12.92**	**111.30**

variant:

1. control (without leaf fertilizing)
2. ROKOHUMIN in dosage 2.5 lit./ha in phase of 8-10 leaves at plant height app. 90cm (almost connected plants, 20th June 2012)
3. ROKOHUMIN in dosage 5 lit./ha in phase of 8-10 leaves at plant height app. 90cm (almost connected plants, 20th June 2012)

conclusion:
From the results of small plot experiment with corn results that leaf fertilizer ROKOHUMIN application led to an increase of harvest in individual variants as follows:

variant 2 / (applied 2.5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 1.13 tons at 1 hectare, what in relative terms represents increase by 9.73 %

variant 3 / (applied 5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 1.31 tons at 1 hectare, what in relative terms represents increase by 11.28 %

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Report on the results of development experiment focused on application ROKOHUMIN liquid fertilizer on common sunflower

Customer	Contractor	Report identification number
ROKOSAN s.r.o. Kolárova 446, 078 01 Sečovce	**ÚKSÚP Bratislava** Matúškova 21, 833 16 Bratislava	Common sunflower 2012

testing workplace address: Central Control and Testing Agricultural Institute (ÚKSÚP Bratislava)
regional department Košice
testing station Haniska - Valaliky
044 57 Haniska pri Košiciach

employee responsible for test course: Ing. Ján BUJŇÁK
contact: +421 55 6930 261 / jan.bujnak@uksup.sk

report elaborated on: 14th Nov. 2012

report elaborated by: Ing. Ján BUJŇÁK

1. experiment conditions

crop: common sunflower **type:** Fabiola CS
pre-crop: spring wheat

area / soil type: Beet-barley production type / medium heavy soil
soil preparation: standard

seeding date: 27th April 2012 **harvest date:** 12th Sept. 2012

seeding amount: 75 000 germinating seeds.ha^{-1}
seeding depth: 60.0 mm
parcel area: 11.20 m^2 **experiment form:** randomized blocks with 4 repetitions

2. realized agro technical interventions / fertilization

- harvest field disking
- rolling
- Deep plowing
- prevention
- dragging
- cultivating
- seeding

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2a. basic fertilization

19th Oct. 2011	Potash salt	130 kg potassium (K_2O)
	Amofos NP 10-46	10 kg nitrogen (N) / 55 kg phosphorus (P_2O_5)
23rd April 2012	ammonium nitrate NH_4NO_3	70 kg nitrogen (N)

last organic fertilization: 2009
type of organic fertilizer: peas for green fertilization

pesticides application: realized standardly according to needs of overgrowth

3. experiment results

	variant	dosage lit. ha^{-1}	Grain harvest (kg / 1 parcell)						**Grain harvest(t.ha^{-1}) recalculated to 8% humidity**	**%**
			repetition				Average	humidity		
			A	B	C	C				
1.	**control**	-	4.14	3.92	3.76	-	3.94	6.40 %	**3.59** ton.ha^{-1}	**100.00**
2.	ROKOHUMIN (1 application)	2.5 lit.	4.76	3.84	4.17	4.18	4.24	6.80 %	**3.85** ton.ha^{-1}	**107.20**
3.	ROKOHUMIN (1 application)	5 lit.	4.61	5.00	4.72	4.34	4.67	5.70 %	**4.29** ton.ha^{-1}	**119.50**

*** grain harvest recalculated to 8% humidity**

variant:

1. control (without leaf fertilizing)
2. ROKOHUMIN in dosage 2.5 lit./ha in phase of 14-16 leaves at crop height app. 80-90cm (application 20th June 2012)
3. ROKOHUMIN in dosage 5 lit./ha in phase of 14-16 leaves at crop height app. 80-90cm (application 20th June 2012)

conclusion:
From the results of small plot experiment with common sunflower results that leaf fertilizer ROKOHUMIN application led to an increase of harvest in individual variants as follows:

variant 2 / (applied 2.5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 0.26 tons at 1 hectare, what in relative terms represents increase by 7.20 %

variant 3 / (applied 5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 0.70 tons at 1 hectare, what in relative terms represents increase by 19.50 %

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Central Control and Testing Agricultural Institute

Report on the results of development experiment focused on application ROKOHUMIN liquid fertilizer on on sown soya

Customer	Contractor	Report identification number
ROKOSAN s.r.o. Kolárova 446, 078 01 Sečovce	**ÚKSÚP Bratislava** Matúškova 21, 833 16 Bratislava	sown soya 2012

testing workplace address: Central Control and Testing Agricultural Institute (ÚKSÚP Bratislava)
testing station Vranov nad Topľou
009 03 Vranov nad Topľou

employee responsible for test course: Ing. Alena SKLIŇÁROVÁ
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report elaborated on: 14th Nov. 2012

report elaborated by: Ing. Peter SKLIŇÁR

1. experiment conditions

crop: sown soya **type:** CARDIFF
pre-crop: spring wheat

area / soil type: Beet-barley production type / medium heavy soil
soil preparation: standard

seeding date: 10th May 2012 **harvest date:** 24th Sept. 2012

seeding amount: 0.8 mil. germinating seeds.ha^{-1}
seeding depth: 60.0 mm
parcel area: 13.50 m^2 **experiment form:** randomized blocks with 4 repetitions

2. realized agro technical interventions / fertilization

- disking / rolling
- Deep plowing
- dragging
- prevention
- cultivating
- seeding

2a. basic fertilization

19th Oct. 2011	Potash salt	130 kg potassium (K_2O)
	Amofos NP 10-46	10 kg nitrogen (N) / 55 kg phosphorus (P_2O_5)
10th May 2012	ammonium nitrate NH_4NO_3	40 kg nitrogen (N)

last organic fertilization: 2009
type of organic fertilizer: peas for green fertilization

pesticides application: realized standardly according to needs of overgrowth

3. experiment results

*** grain harvest recalculated to 12% humidity**

	variant	dosage lit. ha^{-1}	Grain harvest (kg / 1 parcell)						**Grain harvest ($t.ha^{-1}$) recalculated to 12% humidity**	**%**
			repetition				Average	humidity		
			A	B	C	D				
1.	**control**	-	2.77	3.18	3.36	3.28	3.15	17.10 %	**2.20** $ton.ha^{-1}$	**100.00**
2.	ROKOHUMIN (1 application)	2.5 lit.	3.54	3.18	3.17	3.01	3.22	16.10 %	**2.28** $ton.ha^{-1}$	**103.60**
3.	ROKOHUMIN (1 application)	5 lit.	3.15	3.75	3.48	3.73	3.53	16.40 %	**2.49** $ton.ha^{-1}$	**113.20**

variant:

1. control (without leaf fertilizing)
2. ROKOHUMIN in dosage 2.5 lit./ha in phase of 5-6 leaves at crop height app. 25-30 cm (application 19th June 2012)
3. ROKOHUMIN in dosage 5 lit./ha in phase of 5-6 leaves at crop height app. 25-30 cm (application 19th June 2012)

conclusion:
From the results of small plot experiment with common sunflower results that leaf fertilizer ROKOHUMIN application led to an increase of harvest in individual variants as follows:

variant 2 / (applied 2.5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 0.08 tons at 1 hectare, what in relative terms represents increase by 3.60 %

variant 3 / (applied 5 lit. of leaf fertilizer ROKOHUMIN)
- harvest increase comparing to control higher by 0.29 tons at 1 hectare, what in relative terms represents increase by 13.20 %

Crop yields when applying liquid organic fertilizer Rokohumin – 2015

Table 1 – The impact of organic-mineral fertilizer Rokohumin on grain yield of winter wheat (type Sailor) on sod-podzolic loamy soil – 2015.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Control	70,8	-	-
$N_{80+40}P_{90}K_{150}$	84,7	13,9	-
$N_{80+40+30}P_{90}K_{120}$ + Rokohumin 2,5 + 2,5 l/ha	86,7	15,9	2,0
$N_{80+40+30}P_{90}K_{120}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	91,1	20,3	6,4
$N_{80+40+30}P_{90}K_{150}$	85,7	14,9	-
$N_{80+40+30}P_{90}K_{150}$ + Rokohumin 2,5 + 2,5 l/ha	90,8	20,0	5,1
$N_{80+40+30}P_{90}K_{150}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	92,5	21,7	6,8
the least significant difference$_{05}$	3,1		

Table 2 – The impact of organic-mineral fertilizer Rokohumin on grain yield of winter wheat (type Bogatka) on sod-podzolic sandy soil - 2015.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	22,4	-	-
$N_{80+40}P_{60}K_{120}$	33,5	11,1	-
$N_{80+40}P_{60}K_{120}$ + Rokohumin 2,5 + 2,5 l/ha	34,9	12,5	1,4
$N_{80+40}P_{60}K_{120}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	36,2	13,8	2,7
$N_{80+40+30}P_{60}K_{120}$	34,8	12,4	-
$N_{80+40+30}P_{60}K_{120}$ + Rokohumin 2,5 + 2,5 l/ha	35,8	13,4	1,0
$N_{80+40+30}P_{60}K_{120}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	38,4	16,0	3,6
the least significant difference$_{05}$	2,8		

Table 3 – The impact of organic-mineral fertilizer Rokohumin on grain yield of barley (type Stratus) on sod-podzolic loamy soil – 2015.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	41,3	-	-
$N_{60}P_{15}K_{30}$	60,6	18,9	-
$N_{60}P_{15}K_{30}$ + Rokohumin, 2,5 + 2,5 l/ha	62,5	21,2	1,9
$N_{60}P_{15}K_{30}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	65,1	23,8	4,5
the least significant difference	1,8		

Table 4 – The impact of organic-mineral fertilizer Rokohumin on grain yield of barley (type Stratus) on sod-podzolic sandy soil (at average humidity 11 %) – 2015.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	13,8	-	-
$N_{60+30}P_{60}K_{120}$	27,3	13,5	-
$N_{60+30}P_{60}K_{120}$ + Rokohumin, 2,5 + 2,5 l/ha	29,1	15,3	1,8
$N_{60+30}P_{60}K_{120}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	33,0	19,2	5,7
the least significant difference	2,3		

Table 5 – The impact of organic-mineral fertilizer Rokohumin on seeds of spring rape (type Mirakel) on sod-podzolic loamy soil (at humidity 11 %) – 2015.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	19,4	-	-
$N_{90+30}P_{20}K_{30}$	26,0	6,6	-
$N_{90+30}P_{20}K_{30}$ + Rokohumin, 2,5 + 2,5 l/ha	27,6	8,2	1,6
$N_{90+30}P_{20}K_{30}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	28,2	8,8	2,2
the least significant difference	1,1		

Table 6 – The impact of organic-mineral fertilizer Rokohumin on seeds of spring rape (type Mirakel) on sod-podzolic sandy soil (at humidity 9 %).

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	7,8	-	-
$N_{90+30}P_{60}K_{120}$	12,0	4,2	-
$N_{90+30}P_{60}K_{120}$ + Rokohumin, 2,5 + 2,5 l/ha	13,6	5,8	1,6
$N_{90+30}P_{60}K_{120}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	14,1	6,3	2,1
the least significant difference	1,2		

Crop yields when applying liquid organic fertilizer Rokohumin – 2014

Table 7 – The impact of organic-mineral fertilizer Rokohumin on grain yield of winter wheat (type Sailor) on sod-podzolic soft loamy soil – 2014.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	42,6	-	-
$N_{60}P_{25}K_{35}$	64,9	22,3	-
$N_{60}P_{25}K_{35}$ + Rokohumin 2,5 + 2,5 l/ha	67,2	24,6	2,3
$N_{60}P_{25}K_{35}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	66,1	23,5	1,2
$N_{60+40}P_{25}K_{35}$	70,7	28,1	-
$N_{60+40}P_{25}K_{35}$ + Rokohumin 2,5 + 2,5 l/ha	71,9	29,3	1,2
$N_{60+40}P_{25}K_{35}$ + Rokohumin 2,5 + 2,5 + 2,5 l/ha	71,3	28,7	0,6
the least significant difference$_{05}$	2,12		

Table 8 – The impact of organic-mineral fertilizer Rokohumin on grain yield of barley (type Stratus) on sod-podzolic sandy soil – 2014.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	41,4	-	-
$N_{80}P_{70}K_{160}$	55,8	14,4	-
$N_{80}P_{70}K_{160}$ + Rokohumin, 2,5 + 2,5 l/ha	57,6	16,2	1,8
$N_{80}P_{70}K_{160}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	59,1	17,7	3,3
the least significant difference	3,11		

Table 9 – The impact of organic-mineral fertilizer Rokohumin on seeds of spring rape (type Mirakel) on sod-podzolic loamy soil – 2014.

Option	Prolificnes s, c/ha	+/-, c/ha	
		To control	Background
Without fertilization	13,6	-	-
$N_{90}P_{20}K_{30}$	14,1	0,5	-
$N_{90}P_{20}K_{30}$ + Rokohumin, 2,5 + 2,5 l/ha	14,8	1,2	0,7
$N_{90}P_{20}K_{30}$ + Rokohumin, 2,5 + 2,5 + 2,5 l/ha	15,1	1,5	1,0
the least significant difference	0,91		

REPORT
about the test of organic-mineral fertilizer ROKOHUMIN used on winter wheat in the region of northern steppe of Ukraine (2014-2015)

1. The place of the test:
Dnipropetrovsk experimental station IOB NAAS
52041 Dnipropetrovsk Oblast, Dnipropetrovsk District, village Oleksandrivka, 1 Doslidna Street.

2. Fertilizer: Universal liquid organic-mineral fertilizer ROKOGUMIN containing 5 % nitrogen, 3 % phosphorus and 3 % potassium, 5 % humic acids, and 18 % organic matter. Fertilizers also contain sulfur, iron, boron, zinc, copper, manganese.
Physical form - dark liquid with a specific smell.

3. The plant, on which the fertilizer was used: winter wheat, type Antonovka.

4. Soil
4.1. type: ordinary chernozem (black-coloured soil)
4.2. grain size: clay.
4.3. humus content – 3,2 – 3,4 %; humus homogeneous color depth 40 – 45 cm.
4.4. acidity: pHkCl – 7,0 – 7,2
4.5. availability of trace elements: content of mobile forms of phosphorus – 8,7 mg/100 g, potassium – 32,5 mg/100g in the soil.

5. Agro-technical conditions of the test.
5.1. the predecessor of the plant on which the tests are conducted: early potatoes 0, sunflower.
5.2. tillage: after potatoes – tilling the soil with disc harrow in depth 16 – 17 cm, cultivation of KPS-4 in depth 10 – 12 cm, preplant cultivation – 8 – 10 cm;
After sunflower – tilling the soil twice with disc harrow in depth 16 – 17 cm, preplant cultivation in depth 8 – 10 cm.
5.3. fertilization: KAS – 100 l/ha;
Organic-mineral fertilizer ROKOSAN used as a single treatment in foliar fertilizer – first on potatoes: 5 l/ha; 2,5 l/ha; 2,5 l/ha, secoond on sunflower – 5 l/ha; 5 l/ha; 5 l/ha at a rate of 200 l/ha of working solution
Terms: KAS applicated during the phase of spring tillering; organic-mineral fertilizer ROKOHUMIN was applicated once in accordance with the experiment scheme: during the autumn at the the formation of the fourth fifth leaf on wheat; during the spring – during the phase of tillering; the beginning of stem elongation.
5.4. term of sowing: 15 – 18. 9. 2014
5.5. seeding rate: 4,5 – 5,0 mil./ha of similar seeds.
5.6. the name and the term of the activities of caring the crops: sowing of winter wheat against weeds processed by herbicide Granstar at the phase of tillering of flowers on the rate of 25 g/ha (15. 4. 2015); treatment of crops against diseases two

times – at the the beginning of stem elongation and at the appearance of flag leaf by fungicide Falcon 460 КЕ, - 0,6 l/ha (5. 5., 18. 5. 2015); treatment of crops against pests with insecticide, Karatel – 0,2 l/ha at the appearance of flag leaf (18. 5. 2015)

6. Agrometeorological conditions of the tests (general description): rainfall in milimeters (mm) during the growing season (April - July): medium-term 195,4 mm, during a year of research 227,2 mm.

The temperature during the growing season (April - July): medium-term – 2525 °C, during a year of research – 2702 °C.

7. Type of test: in the field.

8. The size and location of plots: Area of research – 1,25 ha, placing of the experimental plots, repetition of the experiment – twice.

9. Scheme of the experiment:

Number	Predecessor	Option	Term of the fertilizer
1		Fon – KAS – 100л/га (control)	tillering
2	potatoes	Fon + Rokohumin 5 л/га	4 – 5 leaves at autumn
3		Fon + Rokohumin 2,5 l/ha	tillering in spring
4		Fon + Rokohumin 2,5 l/ha	at the stem elongation
5	sunflower	Fon – KAS – 100 l/ha	tillering
6		Fon + Rokohumin 5 l/ha	4 – 5 leaves at autumn
7		Fon + Rokohumin 5 l/ha	tillering in spring
8		Fon + Rokohumin 5 l/ha	at the stem elongation

10. Fertilizer application: on crops of potatoes processed by Rokohumin – 3. 11. 2014, 12. 4. 2015, 24. 4. 2015 of sunflower – 10. 11. 2014, 18. 4. 2015, 28. 4. 2015.

11. Method of fertilizer application: uniform treatment of crop by sprayers all over the plot area.

12. The phases of development of plants during fertilizer application: on winter wheat Rokohumin was applied at the formation of the fourth fifth leaf, in the spring – at the phase of tillering and at the stem elongation.

13. Information about the compatibility of fertilizer Rokohumin with other fertilizers, plant protection products and other substances: compatibility has not been studied.

14. Designated side effects: Side effects were not found.

15. Effect of organic-mineral fertilizer Rokohumin on productivity of winter wheat.

Number	Predecessor	Variant	yield capacity c/ha	Growth of yeld	
				c/ha	%
1	potatoes	Fon – KAS – 100l/ha (control)	60,7	-	-
2		Fon + Rokohumin 5 l/ha	68,8	8,1	13,3
3		Fon+ Rokohumin 2,5 l/ha	70,3	9,6	15,8
4		Fon+ Rokohumin 2,5 l/ha	67,2	6,5	10,7
5	sunflower	Fon – KAS – 100 l/ha	42,5	-	-
6		Fon + Rokohumin 5 l/ha	47,8	5,3	12,5
7		Fon + Rokohumin 5 l/ha	49,6	7,1	16,7
8		Fon + Rokohumin 5 l/ha	46,9	4,4	10,4

The maximum yield in experiment – 70,3 c/ha obtained from the use of fertilizer Rokohumin against the backdrop of fertilizer KAS – 100 l/ha.

16. conclusions and proposals.

Applying an organic-mineral fertilizer ROKOHUMIN on a winter wheat with a dose of 5 l / ha at the formation of 4-5 leaves in autumn, 2,5 – 5,0 l/ha at the phase of tillering and at the stem elongation positively affects the yield of winter wheat.

Director of
IOB NAAN **V. F. Zavertalyuk**
Senior Researcher
IOB NAAN **PhD. V. O. Bogdanov**

LLC Sosnovka Agro, Novodolazhskiy District, Kharkiv Oblast
Winter wheat: One treatment with 5 liters / g of Rokohumin held during the autumn, 08. 11. 2014, phase of the process – the beginning of tillering at 3-4 leaves on the winter wheat (photo taken on 24. 11. 2014, top – control, bottom – processed by Rokohumin).

LLC Vostok, Izyumskiy District, Kharkiv Oblast
Winter wheat: One treatment with 5 liters / g of Rokohumin held during the autumn, 5. 11. 2014, phase of the process – the beginning of tillering at 3-4 leaves on the winter wheat (photo taken on 20. 11. 2014, top – control, bottom – processed by Rokohumin).

LLC Norma, Novodolazhskiy District, Kharkiv Oblast
Winter wheat: One treatment with 5 liters / g of Rokohumin held during the spring, 12. 05. 2015, phase of the process – the beginning of stem elongation of winter wheat (photo taken on 20. 5. 2015, left side – processed by Rokohumin, right side - control).

LLC STV Agro, Balkonovskiy District, Kharkiv Oblast
Winter wheat after one treatment with 5 liters / g of Rokohumin held during the autumn 3. 11. 2014 phase of the process – the beginning of tillering at 3-4 leaves on the winter wheat (photo taken on 10. 5. 2015, right side – processed byRokohumin, left side - control).

LLC Norma, Novodolazhskiy District, Kharkiv Oblast
Corn: one treatment with 5 liters / g held during the phase of 3-4 leaves on the corn. (Photo taken on 23. 6. 2015.) **The corn is monitored.**

Functional group Paraskaveya, Novovodolazhskiy District, Kharkiv Oblast
Vegetables: Sweet pepper, Late cabage, treatment with 5 liters / g of Rokohumin held on 23. 6. 2015. **(The vegetables are monitored.)**


17 :22 23 JUN 2015


17 :23 23 JUN 2015

RWA
SLOVAKIA spol. s r.o.

Ján Gutten
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Dear Colleagues,

I was asked by a representative of company ROKOSAN s.r.o. to process the materials that would objectively evaluate the specifics of mutual cooperation and also collected and reviewed the results of the application of liquid foliar fertilizer ROKOHUMIN® at selected customers of our company in Slovakia. I would like to emphasize that the processed material is the result of our personal experiences in a standard agricultural practice in Slovakia, and therefore, when reviewing the possibilities of cooperation in other European region, we suggest evaluating the individual specifics of each particular region with a representative of the company Rokosan.

Our company began negotiation with the company Rokosan as with liquid foliar fertilizer producer, which offered us a cooperation in the distribution of fertilizers ROKOHUMIN®, fundamental building block of which is a processed animal waste which constitutes 90% of the protein keratin, and loosely bound amino acids in it.

Negotiations with Rokosan were led by me as I am responsible for the purchase and sale of products of foliar nutrition and assortment of plants protection in RWA Slovakia. As a representative of RWA Slovakia I also work as an editor of the specialist monthly AGROMANUAL that in the Czech and Slovak Republic professionally deals with problems of protection and nutrition of plants.

1. Rokosan s.r.o. from RWA Slovakia point of view

Company Rokosan impressed us during negotiations with the idea of delivery of foliar fertilizers by processing animal waste based on keratin, since exactly these wastes are a source of free amino acids in which is the nitrogen bound in organic form. Company RWA registers for a long time among its customers in Slovakia, an increasing number of producers of organically grown crops and therefore it proceeded to discuss the possibility of purchase of fertilizers ROKOHUMIN®. During the negotiations we set a condition that the product has sufficient dry matter, organic matter content, and possibly the highest content of humic acids. Another important criterion for evaluating the potential of cooperation was the ability of the candidate to provide foliar fertilizer for RWA Slovakia in a sufficient volume and in related speed and complexity of delivery. During a visit to the production facility Rokosan I was introduced to the production process and the daily production capacity at level of approximately 20 thousand liters of liquid fertilizer per day, what from the perspective of our company satisfies the requirements of RWA Slovakia or other subsidiaries RWA AG.

RWA SLOVAKIA spol. s r.o.

2. Product assortment

Slovakia can be considered as a country with intensive agricultural production. From our perspective, this means that in a comprehensive package have products of the foliar nutrition, in addition to seeds, basic fertilizers and plant protection products, an important place in the assortment. We have therefore decided to include ROKOHUMIN® foliar fertilizer in assortment as well as foliar fertilizer ROKOHUMIN® B75, which is mainly the subject of autumn offer for the nutritional needs and wintering of oilseed rape.

We have included ROKOHUMIN® in the assortment as a universal liquid organic-mineral fertilizer, which is applicable to all types of plants and crops. The condition of selection was also miscibility with commonly used types of pesticides and the possibility of application in organic agriculture. Since we offer within assortment a wide range of mineral foliar fertilizers in liquid and also water-soluble form, the condition was to select a product that contains predominantly organic ingredients. Fertilizer ROKOHUMIN® met these criteria and it was thus included in the distribution in standard 50 liter and 1000 liter packs.

3. cooperation in actual year 2012

During 2012 the company RWA Slovakia bought and distributed total of 100 thousand liters of fertilizer ROKOHUMIN®. It is not the dominant component of the related assortment within volume of distributed liquid fertilizer, on the other hand, we registered an increasing trend and we expect a similar trend for future years. Sold amount is 85% of the standard form of fertilizer ROKOHUMIN®, the remaining 15% is ROKOHUMIN® B75 version with enhanced level of boron. This version is offered in the Slovak Republic only to producers of oilseed rape.

Logistics of deliveries was based on deliveries to our central warehouse in western Slovakia and in fact met the usual standards of cooperation with suppliers from the EU countries. In 2012, we did not register in the assortment of liquid fertilizers ROKOHUMIN® any claims, the only case was the claim at delivery of ground solid fertilizers ROKOHUMIN® for the needs of winemakers - in this case, the claim was settled by Rokosan in express manner and thus did not disturb the structure of our regular distribution of products to customers. Based on this experience I can designate Rokosan proactive approach as common standard to which we are used to in cooperation with the major suppliers in the market.

4. prices and marketing support

Product price was 50% criterion in the decision making. Supply structure at the Slovak market by far exceeds the capacity of the existing demand, but with respect to the price level of comparable products it is possible to determine ROKOHUMIN® as product with acceptable price level. Price is with respect to the composition of the fertilizer a significant factor of competitive advantage.

Rokosan is in terms of our mutual cooperation responsible for the development and preparation of all printed and electronic promotional materials. Materials are made out on order by RWA Slovakia with that it incorporates our observations, design and logo labels, catalogs and presentations. During the whole of 2012 Rokosan provided catalog ROKOHUMIN® printing processed to classical RWA design at its own expense. Cooperation in the fields of sales promotion can thus be viewed as a positive.

5. outlook to 2013, negatives and suggestions for improvement

In 2013, RWA Slovakia plans to purchase in amount of 800 thousand liters of fertilizer ROKOHUMIN®. The year 2012 was an extremely dry year, which resulted in a rapid reduction of harvest virtually in the entire territory of Slovakia (predominantly the drought was demonstrated on the corn and wheat, and currently on the poor quality of oilseed rape). We therefore assume that, given the current volume of harvested crops, our customers will be inclined to foliar nutrition application at least in this volume as during 2012.

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We perceive as negative the poor awareness of the product in other EU countries. Many growers from other EU countries who are engaged in agricultural also in Slovakia do not know the product, they are becoming aware of the term ROKOHUMIN® and ROKOSAN® as the brand for the first time only in Slovakia, which makes our position as potential suppliers difficult. We were able, however, to place ROKOHUMIN® already to part of this customer segment and if Rokosan will invest in marketing product support also outside the Slovak Republic it is possible to achieve much better sales in this segment.

2012 RESULTS

6. General characteristics of 2012, comparison to 2011 season

Slovak Agricultural and Food Chamber (SPPK) published data under which were in the beginning of September 2012 thickly sown area of cereals harvested at about 97%. Hectare average of 3,21 tons is almost 25% lower than in 2011. The worst in recent years is also hectare harvest of oilseed rape, which was at the level of 2,04 tons. Extreme drought in this year has affected virtually all crops, so much that the differences between the various regions of Slovakia are in some cases quadruplicate.

At business partners of RWA Slovakia, who decided in the year 2012 to apply foliar fertilizer ROKOHUMIN® in the recommended terms and in recommended doses, occurred a positive effect and impact of applied fertilizer. Crops despite extreme year (lack of rainfall), better managed stress, were characterized by deep green color, better health and more. Effect of fertilizer application occurred in all crops, from vegetables, vines and ending by corn. The average increase of hectare crops, despite the adverse year, was in average at wheat (+ 6%), oilseed rape (+7%), sunflower (+9%).

Bratislava, the 17th of September 2012

Ján Gutten
Head of plant protection, fertilizers and oil department

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State enterprise Forests of the Slovak Republic
Branch Beňuš, Beňuš 455, 976 64 Beňuš

ROKOSAN s.r.o.
Kolárova 446
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Your letter / from	Our number	Responsible / line	Beňuš
	211/2012	Citterberg Zd.	26.6.2012

Subject: **Evaluation of the application of product ROKOSAN® at the artificial renewal of calamity glade on Branch Beňuš**

After whirlwind calamity in 2004 Branch Beňuš applied to increase the success of seedlings establishment at calamity areas a number of supporting products, fertilizers, hydrogels and other products especially in high altitudes. To ensure good establishment of seedlings in these areas is very demanding and securing MLP (young forest stands) may take even ten years.

One of these products was also the organic-mineral fertilizer ROKOSAN® from the company ROKOSAN s.r.o.. This preparation was applied by spot to the dogged hole under the root system of naked-root plants at trees spruce, fir and beech. Application dose was determined by the manufacturer, and this was also used. The manufacturer gives the possibility to apply several times in the form of granules to the holes to plant - we used this opportunity in some extreme locations.

Preparation ROKOSAN® was applied over the years and that is in the calamity areas in high altitudes of the Low Tatras and Slovenské rudohorie. During these years, we have assessed visually as well as professionally in cooperation with National Forest Centre (Mrs. Tučekova) purpose and effect of this product. And especially in terms of whether the product has helped boost the growth of plants in these conditions and also what establishment seedlings had after use of the preparation. Visually, we can say that the seedlings had more dense colors of needles and the shock from replanting did not occurred that much. Professionally, we can conclude that establishment of seedlings under which the organic-mineral fertilizer ROKOSAN® was applied was good on average around 91%. Positive effect on the development of fine capillary system was demonstrated (Mrs. Tučekova - National Forest Centre) thus positively affecting the growth parameters of aboveground parts. Use of the product in combination with hydrogels positively affected establishment but also the overall adaptation process of planted seedlings. Positive and supportive effects last about three years from the application of the product and it is essential for establishment and start of growth of planted seedlings on extreme calamity areas.

After our experience with the application of preparation ROKOSAN® and proving support and the positive effects of this product in the first three years, we can recommend also to other candidates for application of this preparation in calamitous areas and that is for woods-spruce, fir and beech.

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The product met our expectations, and in particular:

- Supported the growth and development of fine capillary root system, thus supporting the growth of the above ground part and positively affected the thickness of the seedlings in the neck of the root.

- Positively affects replanting shock - the seedlings are looking healthier and have more dense colors.

- The positive effect lasts for the first three years of the application.

- Finally, this is what we needed - to ensure good establishment of seedlings, reduce the shock from replanting and boost the growth of seedlings in the first years.

Elaborated by: Citterberg Zd.
Grower of Branch Beňuš

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NATIONAL FOREST CENTRE ZVOLEN
Forest Research Institute

Re: **Reference to the products of the company Rokosan, s.r.o.**

The National Forest Center is performing during a long period also the forest monitoring and monitoring of measure effectiveness in forest incl. also liming of the earth and forest stand. The National Forest Center has monitored the effectiveness of mineral fertilizers produced by the company Rokosan during the last ten years (2004-2012) as a part of various research projects. In 2004 (then as Forest Research Institute Zvolen) were assessed results of the aerial spraying of organic and mineral fertilizers on 120 ha in the model area (Čadečka). In 2008 was decided on extensive monitoring system in 3 model areas (Saling, Habovka, Ľadová) for almost 2000 ha, where was organized aerial spraying of the working substance (Rokosan) in withered and damaged spruce woods. The exploring intervention in other areas of more than 1000 ha has been extended in 2011 (Tvrdošín, Jasov). Even when the short-time results produced not distinctive positive results as improvement of the state of health in damaged woods concerns, the effect will be further monitored in long-term perspective. Since 2007 were by the National Forest Center started exploration areas with Rokosan application during artificial renewal of galls (Kysuce, Orava, Nízke Tatry) and extreme locations (air sands of Záhorie). During the first year of application were gathered positive impact results on the growth and development of root systems (spruce, beech, maple, pine). Extremely positive effects were observed in the combination of the fertilizer Rokosan with hydrogels (water binding conditioners).

The aforementioned experiences recommend the application of the Rokosan s.r.o. products, in particular for the specific renewal of the forested area (primarily during unplanned renewal of galls caused by calamity) and positive effects can be achieved as increase of wood substance (plantations, areas of firewood), or in higher carbon fixing inside of landscape (non-forest vegetation, parks, founding of forests on non-forest lands). The higher effect can be achieved in meeting as targets for large-area application where the effects can be improved through multiple repetitions. The application in older and full grown woods, damaged woods with poor state of health, endangered by abiotic pests or on improper places (endangered by drought) can be actually considered as non-effective.

Prepared by: V. Šebeň, 20.4.2012

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Ing. Milan Lalkovič
CEO

Salaš, P. (ed): *"Rostliny v podmínkách menícího se klimatu"*. Lednice 20.- 21. 10. 2011, Úroda, scientific annex, 2011, p. 550 – 555, ISSN 0139-6013

Growth of European larch (*Larix decidua* Mill.) and European beech (*Fagus sylvatica* L.) seedlings after ROKOSAN® fertilizer application

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Abstract:
The thesis analyzes the results of European larch and European beech seedlings cultivation from experiments with ecological, organic-mineral fertilizer ROKOSAN®. European beech seedlings grew in polythene greenhouse, European larch seedlings on free nursery beds. In particular variants of tree species was studied an influence of liquid and solid ROKOSAN® fertilizer on horn base. Positive influence of ROKOSAN® was observed in all biometric characteristics, statistically significantly and maximally it influenced the European larch stem height and diameter of root crown. Fertilizers with horn content belong to perspective kinds of biofertilizers whose effect on growth of planning stock will be verified also in next seeding and planting experiments.
Key words: *Larix decidua, Fagus sylvatica,* seedlings, ROKOSAN® fertilizer

Introduction

Currently, many authors deal with health condition and damage to trees in changing climate conditions (Lukáčik, Buga, 2009). Status of environment devastation requires the effort to find materials that would impair the least the components of ecosystems. One of the ways to prevent further deterioration of soil quality and thereby improve the condition and health of trees is the use of natural materials (Sarvašová, 2007). Sorption complex, biological activity and pH of some soils change by anthropogenic effects and climate changes to the extent that there is not possible the seedlings survival in it (Tučeková, 2008), respectively the seedlings must be necessary tested for resistance especially against abiotic stress (Sarvaš, 2003, Sloup and Salaš, 2009).
Appropriate physical, chemical and biological properties of soil and substrate in nursery centers provide conditions for optimal growth and the successful functioning of root system during cultivation of seedlings and plants. Vitality of seedling aboveground part growth depends on the health of the root. The roots of seedlings and plants must expand its volume and surface in soil in order to be able to adequately supply the plant with water, nutrients, supporting structures of precursor proteins, enzymes, thereby ensuring growth of seedling or plant. It is these missing substances on sites with unfavorable nutrient state, where it is recommended the application of environmentally friendly fertilizer (biofertilizers, bacterial and mycorrhizal preparations) to promote vitality of woods and treatment of chemistry and biological activity of soil.

The aim of our investigation is to verify the effect of organic biofertilizer ROKOSAN® on growth of biomass production and quality of seedlings *Larix decidua* and *Fagus sylvatica* in pilot conditions.

Material and methods

ROKOSAN® Characteristics

ROKOSAN® is an organic-mineral fertilizer with horn content. It is used for storage fertilization where slow nitrogen decomposition runs during the three-year cycle. According to the manufacturer there is a uniform, stable and significantly faster formation of wood mass. Preparation also acts preventively, it increases resistance to fungal diseases, and by organic odor it repels insects.

In our experimental woods growing were used three types of ROKOSAN® :

ROKOSAN® UNIVERSAL (Rokosan Univerzál) with nutrition content: N 9 %, P_2O_5 5 %, K_2O 9 %, MgO 3 %, trace elements.

ROKOSAN® CONIFERS (Rokosan Ihličnany) with nutrition content: N 8 %, P_2O_5 8 %, K_2O 12 %, MgO 4 %, trace elements.

LIQUID ROKOSAN® (Tekutý Rokosan) with nutrition content expressed in g/l, N 12.0 NO^3 (N) 10.5, P_2O_5 20.2, K_2O 42.5, Ca 10.0 Mg 3.33, B 0.033, Cu 0.007, Fe 0.133, Mn, 0.033, Mo 0.007, Zn 0.007

Experiment establishment

Experimental areas were established in tree nurseries of Arboretum "Borova hora". Altitude of nursery site is 291 m above sea level; the average annual temperature is 8.8 °C, during the growing season 15.6 °C. The average annual rainfall is 640 mm, in the vegetation period 399 mm (average data are calculated from the years 1978-2004). In the experiment were sown two tree species: beech (*Fagus sylvatica L.*), originating 26533ZV-695 and larch (*Larix decidua Milo.*) originating 13153TN – 014. Beech was sown into foil cover with sowing rate 350 g. m^{-2}, larch to free bed with sowing rate 400 g. m^{-2}. To the experimental bed, to area 9.6 m^2 (8 x 1.2 m), in which was sown the seed of larch, was incorporated a solid fertilizer ROKOSAN® CONIFERS (Rokosan Ihličnany) in dose 100 g/m^2. Another 8 current meters of bed, were not treated with fertilizer, which represents control variant of larch sowing. In the foil cover, where the seed of beech was sown, 8 linear meters seedbed (9.6 m^2) were allocated to experiment. Experimental sowing area was divided into four equal parts (by 2.4 m^2), four variants. Variant 1 was used as a control for variant 2, where was applied a LIQUID ROKOSAN® (Tekutý Rokosan) once in every 2 weeks at dose of 240 ml in 16 liters of water, in the months of May, June, July and August. Variant no. 3 is a control variant to variant 4, where was incorporated the ROKOSAN® UNIVERSAL (Rokosan Univerzál) in dose of 100 g/m^2. Seeds were buried with 5 mm layer of the substrate. Seed substrate consisted of peat and perlite in ratio of 10:1. Only in the variant no. 1 and 2, the substrate constituted of pure fresh peat. Larch and also beech seedlings grew under operating conditions, they were commonly agro technically treated. In the fall were beech and also larch seedlings randomly picked up in the number of 90 pieces of each experimental variant.

Laboratory processing and statistical evaluation

In the laboratory was evaluated aboveground and underground part of seedlings. By caliper were measured: height of above ground parts (from the root collar to the top of terminal bud), thickness of the root collar. Dry weights of each seedlings part were determined after 72 hours of drying in an oven (at 60 °C). Acquired biometric variables were evaluated by variance analysis of single-factor test. Testing of results was carried out at reliability level of 95 and 99%. Normality of selection values distribution was tested by chi-square test of good compliance. Homogeneity of variances was verified by Bartlett test. To assess the significance of differences between variants of ROKOSAN® and control was used a Tuckey test. Software *Statistica* was used for the statistical data processing.

Results and Discussion

Analysis of variance for beech and larch confirmed statistically significant differences in all tested biometric characteristics, which are listed in Table 1 and 3. All calculated F-test characteristics of beech seedlings significantly exceeded at the significance level $\alpha = 0.01$ and also $\alpha = 0.05$ a tabulated value ($F_{tab0,\ 05\ (3,\ 356)} = 2.62$, $F_{tab0,\ 01\ (3,\ 356)} = 4.61$), at larch ($F_{tab0,\ 05\ (1,\ 178)} = 3.90$, $F_{tab0,\ 01\ (1,\ 178)} = 6.80$), so their sample averages values can be considered affected by the cultivation method, thus using LIQUID

ROKOSAN® (Tekutý Rokosan), ROKOSAN® UNIVERSAL (Rokosan Univerzál) and ROKOSAN® CONIFERS (Rokosan Ihličnany).

Based on the results shown in Table 1, the most significantly affected characteristics of beech seedlings were above ground height and thickness of the root collar, where the calculated value of the test criterion F more than five times exceeds the table value at significance level α = 0.01. In larch is the situation similar, used fertilizer significantly affected the growth of individuals, mostly the height of above ground part (almost 28 times of the tabular value F), dry weight of stem without needles (nearly 8 times of tabular value F).

Tab. 1 The results of single-factor variance analysis for European beech seedlings (*Fagus sylvatica* L.)

Biometrical Value[6]	SS	df	MS	F	p-level	ERROR SS	ERROR df	ERROR MS
Stem height[1]	3 458.8	3	1152.9	22.26	0.0000	18433	356	51.8
Diameter of root collar[2]	68.05	3	22.68	21.2	0.0000	380.87	356	1.07
Above ground part weight in dry matter[3]	32.28	3	10.76	18.93	0.0000	202.31	356	0.5683
Underground part weight in dry matter[4]	48.36	3	16.12	16.58	0.0000	345.94	356	0.9718
Total dry matter weight[5]	158.45	3	52.82	18.98	0.0000	990.21	356	2.781

** SS - Sum of variations squares, df – degree of freedom between factor levels, MS – variance between factor level, F – F testing criteria, p – level – significance level, MS Error – variance inside (residual), df Error – degree of freedom inside the factor*

Tables 2 and 4 state the average values of the examined characteristics, the data variability (standard deviation and coefficient of variation). In the last column of the table are quantified differences in mm, cm and g between beech variants that have been grown with the addition of liquid and solid fertilizers ROKOSAN®, at larch with the addition of ROKOSAN® CONIFERS (Rokosan Ihličnany). Different small letters stated after the average values document significant difference between variants verified by Tuckey test.

Statistical analysis confirmed that in all tested parameters there is a positive difference in the increases comparing to the control variants. If we compare the average values of tested characteristics, we conclude that the best results were achieved at larch seedlings in variant ROKOSAN® CONIFERS (Rokosan Ihličnany), where the average height of treated subjects was almost 10 cm (Table 4) higher, while at the beech the average height of fertilized variants ranged from 2.5 - 6 cm. Thickness of root collar, which belongs to the most important and statistically the most significant indicator of seedlings and plants growth reached higher average increases at beech than at larch, and that is in the variant 2 (Table 2, almost 1 mm, use of LIQUID ROKOSAN® (Tekutý Rokosan)).

Tab. 2 Growth characteristics of European beech seedlings (*Fagus sylvatica* L.)

Biometrical value	**Variant**	**n**	***x***	**sx**	**sx%**	**(Xp - *Xk*)**
Stem height (cm)	**1**	90	16,63a	4,454	26,77	
	2	90	22,61b	4,670	20,67	+5,98
	3	90	22,55b	9,375	41,57	
	4	90	25,05b	8,806	35,16	+2,5
Diameter of root collar (mm)	**1**	90	3,47a	0,7784	22,42	
	2	90	4,41b	1,107	25,12	+0,94
	3	90	3,50a	1,112	31,78	
	4	90	4,29b	1,101	25,66	+0,79
Above ground part weight in dry matter (g)	**1**	90	0,5426a	0,3037	55,96	
	2	90	0,9313b	0,5001	53,70	+0,3889
	3	90	0,9662b	0,9636	99,73	
	4	90	1,3886b	1,001	72,09	+0,4224
Root part weight in dry matter (g)	**1**	90	0,9915a	0,5546	55,94	
	2	90	1,3321a	0,6712	50,39	+0,3406
	3	90	1,3685a	1,030	75,27	
	4	90	2,0061b	1,4387	71,67	+0,6376
Weight in dry matter total (g)	**1**	90	1,5342a	0,8078	52,65	
	2	90	2,2634b	1,1223	49,58	+0,7292
	3	90	2,3347b	1,9658	84,19	
	4	90	3,3947c	2,3128	68,13	+1,06

1) biometrical value, 2) stem height l, 3) diameter of root crown, 4) top dry weight, 5)) root dry weight 6) total dry weight

Tab. 3 The results of single-factor variance analysis for European larch (*Larix decidua* Mill.)

Biometrical Value[1]	SS	df	MS	F	p-level	Error SS	Error df	Error MS
Stem height[2]	4478.03	1	4478.03	190.15	0,0000	4191.9	178	23.55
Diameter of root collar[3]	6.498	1	6.498	17.732	0,00004	65.23	178	0.366
Above ground part weight in dry matter[4]	3.449	1	3.449	36.023	0.0000		178	0.0957
Weight of needles in dry matter[5]	0.3707	1	0.3707	16.906	0.00006	3.9025	178	0.0219
Weight of stem in dry matter[6]	1.558	1	1.558	54.012	0.0000	5.167	178	0.0288
Underground part weight in dry matter[7]	0.0947	1	0.0947	5.1825	0.02401	3.255	178	0.0183
Total dry matter weight[8]	4.6882	1	1.6882	26.055	0.0000	32.02	178	0.1799

** SS - Sum of variations squares, df – degree of freedom between factor levels, MS – variance between factor level, F – F testing criteria, p – level – significance level, MS Error – variance inside (residual), df Error – degree of freedom inside the factor*

Also in other, mass parameters was confirmed a statistically highly significant effect of cultivation method. All non-fertilized seedlings have the lowest average mass values of individual aboveground and underground parts, confirming the significant positive impact of horn preparation on average weight of dry matter of all parts of specimens of analyzed trees. As it can be read in the last column of Table 4 the smallest differences in dry matter weight between the variants are in the weights of needles and root system at larch and in the root system at beech seedlings. The most obvious increase in weight was at the dry matter weight of stem without needles, where fertilized larch variant almost doubled its weight. The worst growth was at the beech seedlings in pure, fresh peat in variant 1, where according to soil conditions analyzes of tested substrates variants was the lowest content of essential nutrients. Use of more intensive fertilization with LIQUID ROKOSAN® (Tekutý Rokosan) during the growing period on pure peat substrate was justified as it improved soil environment, increased nutrient

intake and biomass production of beech seedlings. If we compare this method of fertilization with storage fertilization with solid ROKOSAN® UNIVERSAL (Rokosan Univerzál), we see that the use of LIQUID ROKOSAN® (Tekutý Rokosan) reflected much more in the growth of beech seedlings, it was more effective. Positive effects on the growth of root system at the use of natural preparations (alginit, Baktomix UN) are documented also by Jaloviar, 2010, Sarvašová, 2009. Natural sorbent alginit both retains moisture in the soil and also serves as a natural fertilizer. Bacterial preparat Baktomix UN supplies to the soil so called „useful" bacteria and thus improve soil environment and plant uptake of nutrients by tree. When using Baktomix UN weight of root system in dry matter increased by 20%.

Tab. 4 Growth characteristics of European larch seedlings (*Larix decidua* Mill.)

Biometrical value[1]	**Variant**	**n**	***x***	**sx**	**sx%**	**(Xp - *Xk*)**
Stem height (cm)[2]	**control**	90	13.36a	4.631	34.67	
	ROKOSAN®	90	23.33b	5.065	21.7	+9.97
Diameter of root collar (mm)[3]	**control**	90	2.19a	0.626	28.59	
	ROKOSAN®	90	2,57b	0.5837	22.71	+0.38
Above ground part weight in in dry matter (g)[4]	**control**	90	0.4021a	0.2806	69.79	
	ROKOSAN®	90	0.6789b	0.3358	49.46	+0.2768
Weight of needles in dry matter (g)[5]	**control**	90	0.2051a	0.1430	69.76	
	ROKOSAN®	90	0.2958b	0.1529	51.69	+0.0907
Weight of stem in dry matter (g)[6]	**control**	90	0.1970a	0.1480	75.13	
	ROKOSAN®	90	0.3832b	0.1892	49.40	+0.1862
Root part weight in dry matter (g)[7]	**control**	90	0.2137a	0.1346	62.99	
	ROKOSAN®	90	0.2596b	0.1358	51.69	+0.0459
Weight in dry matter total (g)[8]	**control**	90	0.6158a	0.4015	65.2	
	ROKOSAN®	90	0.9385b	0.4457	47.49	+0.3227

The following characteristics examining the amount of produced biomass of seedlings are the ratio of roots to above-ground parts of seedlings and plants. According to norm STN 48 22 11 the ratio should be 1:2 at larch seedlings, at beech seedlings 1-1. Comparisons of root systems (RS) and aboveground parts (AP) in the experiment revealed the following: the ratio (RS: AP) at larch cultivated by us nearly meets the standards prescribed, but at beech seedlings it does not. At beech, variant 1 the weight of above ground part strongly falls behind the weight of the roots system, in variant 4, it's the opposite, weight of roots is significantly higher than the weight of aboveground parts, also compared with variants 2 and 3, where are the weights of roots and above ground parts in balance. A similar result was reached by Sarvaš et al. (2007), whose recommends fertilizer ROKOSAN® in changed ecological conditions in reforestation of calamity glades. According to authors, important is the internal structure of fertilizer mixture that ensures slow release of nutrients into the soil environment and thus there is no effect of "fast burst of" nutrients or effect of "over-fertilization" of site.

Conclusion

All kinds of tested biofertilizer ROKOSAN® had a positive effect on the studied plants. Individuals from fertilizated variants achieved better results in the measured quantitative characteristics. Acquired knowledge point mainly to higher wood production and total aboveground biomass of beech and larch seedlings. Against the aboveground part, biomass production of roots was less affected by fertilization, but statistical analysis also demonstrated its positive impact. Research results can be considered partial, on their basis it is possible to say that in our experiment achieved higher quality the seedlings of beech and larch, treated with a perspective fertilizer ROKOSAN® with horn content.

Thanks to

Thesis was elaborated within the solution of research grant VEGA 1/0587/09.

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