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INSTITUTE FOR TOBACCO
Belgrade

EXPERTISE

(1980 – 1983)

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ИНСТИТУТ ЗА ДУВАН — БЕОГРАД

Улица Далматинска број 22 — Телефон 331-407

ADDITION TO RESEARCH OF EFFECTS OF AGROSTEMIN ON YIELD AND CHEMICAL STRUCTURE OF TOBACCO VARIETY "BURLEY–T"

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Contents: *Effect of Agrostemin on yield and quality of leaves variety "Burley–T" was examined. Chemical structure of the components with produced tobacco was followed and in particular: humidity, ash, pH, nicotine, total amount of total nitrogen, protein nitrogen, proteins, carbohydrates, polyphenols, total reduction, Schmuck number.*

Introduction

From the moment a man has perceived the opportunities of nature, he has not ceased to fight against its tempers, especially when he realized that the wealth's of nature are not inexhaustible. With his long–years' experience in cultivation of crop plants, he realized that he has to do something to increase their yield, quality and resistance to diseases. For the same purpose, in agriculture of many countries and bioregulators too are applied, a Yugoslav patented product (patent No. 32749/YU) Agrostemin–bioregulator with vegetal origin by its application on different crop plants has proven itself as a means with multiple positive bioregulation effect. The use of this bioregulator has shown positive results on: industrial plants, grains, fruit, vegetables, forest plants, as well as flowers. It is used in a form of powder for seed treatment, or in a form of a solution by foliar sprinkling. It is of such effect that through an increased growth of the root system, it gives greater chances to the plant to take nutrients, it increases the plant's green mass, all of which has an effect on an intensified process of photosynthesis. The colors of crops and produces are more prominent, and the plants are more resistant as well.

Considering that in the recent years the consumption of large–leaf tobacco in our country has significantly increased, yet tobacco market is scarce with the quality tobacco, great efforts are being put into production in order for it to expand both with individual producers and in public sector. The increase of tobacco production by variety and quantity predicted for the following period should enable primarily further development in production of world contemporary blend cigarettes in our factories as well. The world at this moment feels deficit in all tobacco varieties, and especially in Burley which has become the grounds for the production of a worldwide contemporary blend cigarette which represents a mix of Virginia, Burley and a small quantity of oriental tobacco. This is why now a moment has come to put maximum efforts into growing production of quality tobacco.

Perceiving the significance of yield, quality and especially significant changes in chemical components increase, we considered the right application of Agrostemin–bioregulators on tobacco to be able to give good results as well, and with the purpose of reaching greater yield and better quality of tobacco.

In the previous statement the results of effects of Agrostemin on yield and quality of tobacco variety "Burley–T" cultivated at the experimental station Zrenjanin during the year 1980 are shown.

Tobacco variety Burley dates back to 1860 only to be conveyed to Europe, more exactly to Italy in 1891. In our country, a more intensive cultivation of this tobacco variety has begun in recent years together with the production of the cigarettes of American type. The usable value of Burley lies in its features of a strong additive absorbent, which is presented as significant for creation of American type of cigarettes.

The purpose of our research during the cultivation of tobacco variety "Burley–T" is to treat the same variety with different concentrations of Agrostemin, keeps the track of yield and its chemical structure, and thus collect as much extensive material as possible for unbiased estimation on effects of Agrostemin bioregulators on quantity and quality of the obtained product, which then serves as an important component in the production of quality cigarettes of American type.

Materials and working methods

Setting up experiments and processing of data acquired were conducted in Experimental station in Zrenjanin and Chemical laboratory of the Institute for tobacco in Belgrade, during 1980.

The experiment is set in three alternatives + control in two repeated treatments (1st during the replanting, 2nd in the field after replanting):

Alternative 1.	C o n t r o l – untreated plants
Alternative 2.	A – 0.005 g of Agrostemin per one stalk (120 g/ha);
Alternative 3.	B – 0.010 g of Agrostemin per one stalk (240 g/ha);
Alternative 4.	C – 0.025 g of Agrostemin per one stalk (600 g/ha);

Replanting of tobacco was carried out manually on 28th May, 1980, at a distance of 70 x 60 cm. Nursery was treated in garden bed (1 treatment) with the solution of Agrostemin of a specific concentration and after replanting in the field, all three alternatives are scheduled for the second treatment with the same dosage of Agrostemin. C o n t r o l was planted with untreated nursery. In each alternative there were 100 stalks planted. Treatment of Alternatives 2, 3, and 4 with different concentrations of Agrostemin (concentrations A, B, C) was carried out on 17th July 1980, when most of the plants were developed equally at the stage of 10–12 leaves, just before lush growth. Harvest of the experiment was carried out by insertion, interleaving is done mechanically, by drying under the polyethylene. For chemical analysis of each variant leaves of medium insertion were taken.

For the purpose of getting insight into changes on chemical components important for grading the quality of analyzed tobacco, following specifications are undertaken:

1. Moisture was determined by standardized process of drying a certain quantity of tobacco at a temperature 90–93 ° C.

2. pH – value is determined by standard procedure in the aqueous extract of the sample (4).

3. Ash is determined by the Bruckner method (4).

4. Nicotine is determined spectophotometrically on the spectrophotometer Beckman DU–2 by Coresta method (5).

5. Total nitrogen, protein nitrogen and proteins were determined with the method by Foster (4).

6. Polyphenols and sugars were determined by Bertrand method (1).

Results of the research and discussion

Death rate of total number of planted stalks for every variant is separately given in Table 1.

The influence of concentration of Agrostemin on tobacco yield expressed in g/stalk and percent is given in Table 2.

The results show that the period of vegetation for treated tobacco was slightly longer comparing to the C o n t r o l, but the yield was very good for both, especially for Alternative 3 (concentration B) where the yield was increased by 44% comparing to the C o n t r o l (untreated) plants.

In Table 3 the results of chemical structure of leaf "Burley–T" are given, (leaves of medium insertion) treated with water solution of Agrostemin (concentration A, B, C).

Analyzing the results of chemical structure of tobacco leaf variety "Burley–T" treated with water solution of Agrostemin of different concentration, a difference in the change in the quantity of nicotine, total nitrogen, protein nitrogen and proteins is visible, especially of samples treated with concentration B of Agrostemin (Alternative 3) comparing to C o n t r o l. The amount of nicotine in C o n t r o l is 2.28 while in plant samples treated with the concentration B is almost twice less – 1.24. Overall nitrogen in C o n t r o l is 4.61 and in the concentration B is 3,46. Nitrogen protein from 1.62 in the C o n t r o l dropped to the value of 1.40, and proteins from 10.12 to 8.72. Schmuck number with the control and concentration B regardless of different quantities of carbohydrates and proteins staying the same. Major differences in the amount of carbohydrates and polyphenols in C o n t r o l and samples treated with concentration B of Agrostemin were not diagnosed.

Table 1 Number of dead stalks in percent

Ordinal No.	Alternative	Concentration	Number of stalks		Number of empty spaces	% dead stalks
			replanted	left		
1	1.	Control (ø)	100	94	3	6
2	2.	A	100	93	4	7
3	3.	B	100	95	2	5
4	4.	C	100	97	2	3

Table 2 Yield of tobacco type "Burley–T" treated with different concentrations of Agrostemin

Ordinal No.	Alternative	Concentration of Agrostemin	Botunization	Blooming	Yield (g/stalk)	%
1	1.	Control (ø)	27/7	10/8	63,19	100
2	2.	A	3/8	11/8	70,52	111
3	3.	B	2/8	14/8	91,39	144
4	4.	C	3/8	11/8	70,43	111

Table 3 Results of chemical structure of tobacco leaf type "Burley–T" treated with water solution of Agrostemin of different concentration

Alternative	Concentration of Agrostemin	Moisture (%)	Ash (%)	pH	Nicotine (%)	Nitrogen (%)		Proteins (%)	Carbohydrates (%)	Polyphenols (%)	Total reduction (%)	Schmuck number
						Total of	Proteins					
1.	ø	8,10	17,68	5,95	2,28	4,61	1,62	10,12	0,99	2,53	3,52	0,10
2.	A	8,17	24,27	6,00	2,08	3,64	1,38	8,62	0,48	l,20	1,68	0,06
3.	B	8,45	16,93	5,80	1,24	3,46	l,40	8,72	0,93	2,61	3,54	0,10
4.	C	8,25	16,67	5,80	1,87	4,70	1,55	9,72	0,54	1,30	1,84	0,06

Conclusion

The results of these examinations have shown that foliar application of Agrostemin on tobacco type "Burley–T" has positive effect not only on yield (an increase to 44% with dose B), but also on chemical structure of treated tobacco. This indicates that we should proceed with experiment setup and research in this direction in order to obtain absolutely reliable data, significant not only from the scientific point of view, but significant for tobacco industry as well as for economy generally speaking.

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ИНСТИТУТ ЗА ДУВАН — БЕОГРАД

Улица Далматинска број 22 — Телефон 331-407

R E P O R T
on scientific research for the year 1982

Title of scientific research project:

"SCIENTIFIC GROUNDS OF BIOREGULATORS APPLICATION ORIGINATED FROM PLANTS ON QUALITATIVE AND QUANTITATIVE INCREASE OF PRODUCTION"

Subproject:

"RESEARCH ON EFFECT OF AGROSTEMIN ON INCREASE OF PRODUCTION AND IMPROVEMENT OF YIELD QUALITY IN PLANT PRODUCTION"

Task:

"The effect of bioregulators of Agrostemin on qualitative and quantitative increase of tobacco yield"

Belgrade, 1983

ИНСТИТУТ ЗА ДУВАН — БЕОГРАД

Улица Далматинска број 22 — Телефон 331-407

EFFECT OF BIOREGULATORS OF AGROSTEMIN ON QUALITATIVE AND QUANTITATIVE INCREASE OF TOBACCO YIELD

Introduction

The purchase of large–leaf tobacco in recent years, as well as their consumption in our factories has been significantly increased. Such state of purchase for large–leaf tobacco will be expressed in the following years, which indicates the need for putting efforts in order to increase qualitative and quantitative production of large–leaf tobacco.

The Institute for tobacco from Belgrade has during its two –year research (years 1980 and 1981) acquired certain positive experience in the application of patented bioregulator of Agrostemin (patent number 32749 YU) on tobacco. The results have shown that, having in mind the influence of climate factors, the application of bioregulators with specific concentration in specific phenophase increases the yield of 13–44%. Considering the significance of yield increase and changes within chemical components which represent one of the key factors for estimation of tobacco quality, The Institute has scheduled a research in order to state the effect of bioregulators of Agrostemin concerning concentrations used and time spent on yield treatment, randman and chemical changes and to check the results of research from years 1980 and 1981.

Our research in year 1982 comprised:

1. The research of the effects of different concentrations of bioregulators and the time of treatment on vegetation increase of tobacco nursery type "Burley–T" and Virginia.

2. The effect of different concentrations of bioregulators on yield, randman and chemical changes with tobacco type "Burley–T".

3. Mutual influence of bioregulators and agri–technical–protection measures of topping on yield, randman and chemical changes with tobacco type Virginia.

In recent years a very important agri–technical and protection measure which is being paid much more attention (it is well known in spoken and written forms) by both individual producers and Basic Organization of Associated Labor for the production and processing of tobacco is sprout removing together with inevitable struggle against sprouts by application of contact and systemic physiotrops. Research data and results which can be found in domestic foreign literature[1, 2, 3, 4],as well as the results obtained by the Institute [5] that this is one of the important measure with a positive influence on yield and utility value of large–leaf tobacco. According to data from the literature, topping of inflorescence contributes to the growth of root system and thereby increases the ability of a plant to take nutrients and to create nicotine. The removal of inflorescence and sprouts leads to reduced parting of organic mineral compounds from leaves which are necessary for the growth of tobacco plant, so these measures affect not only the increase of leaves contents but their weight as well.

By introducing topping / detasseling into practice, the unavoidable fight against sprouts by the use of physiotrops, would produce tobacco which would be much more widely used in domestic market, and the possibility of export of tobacco raw materials obtained in such a way could be significantly increased. The purpose of our examination among other things was to keep the track of yield, randman and chemical changes on tobacco variety Virginia by combined application of bioregulators and topping.

Material and working methods

1. For the purpose of keeping the track of the effects of different concentrations and time of Agrostemin bioregulators treatment on vegetation growth of tobacco nursery, two experiments have been set up.

EXPERIMENT ONE – without the repetition of alternatives, it was set in "Bosanac" from Orašje, a Basic Organization of Associated Labor for tobacco production and processing on scions of tobacco nursery Virginia. Tobacco The sowing was carried out je with germinated seed on 25th March, 1982. The production of tobacco nursery scions was carried out in a regular manner in semi–warm garden beds which were prepared and covered with polyethylene foil in early spring. Afterwards, disinfection with methylbromide in the dose of 0,5 kg/10m^2 was carried out. Replanting in garden beds (surface2 m^2) was treated in the phase of crossing. The treatment was carried out on 15th April, 1982 with backstroke sprayer CP–3. 5 alternatives plus control were taken. The alternatives were presented by different concentrations of used bioregulator as follows:

Alternative	Concentration
1.	0,1000 g/10 m^2
2.	0,1500 g/10 m^2
3.	0,2000 g/10 m^2
4.	0,3000 g/10 m^2
5.	1,0000 g/10 m^2
6.	Control

All necessary agri–technical and protection measures were undertaken together with jobs on regular nursery breeding. In order to obtain reliable results and to avoid any kind of subjectivity of bioregulators' effect, the nursery was not fertilized.

Immediately before replanting the weights of whole scions and their roots were registered.

EXPERIMENT TWO was set in the Institute for tobacco from Belgrade in IAU of resident production in Bavanište on scions of tobacco nursery "Burley – T". The experiment was set up by randomized block system with a random layout of alternatives.

The sowing was carried out on 30th March, 1982. The production of scions was carried out in the same way as in experiment one. Scions in garden beds of a surface 4 m^2 were treated in the phase of leaf–lifting. The treatment was performed on 10th May, 1982. with a backstroke sprayer CP–3. 4 alternatives plus a control were taken. The alternatives are presented by different concentrations as follows:

Alternative	Concentration
1.	0,1000 g/10 m^2
2.	0,1500 g/10 m^2
3.	0,2000 g/10 m^2
4.	0,3000 g/10 m^2
5.	Control

Immediately before replanting, the weights of whole scions and their roots were registered. All necessary agri–technical and protection measures were carried out as in the experiment one.

2. *In order to keep the track of the effect of different concentrations of bioregulators on yield, randman and chemical changes with tobacco type "Burley–T" the experiment was set up in IAU Zrenjanin of the Institute for tobacco from Belgrade. Chemical research and processing of acquired data are performed in the chemical laboratory of the Institute in Belgrade.*

The experiment is set up as follows:

Replanting of tobacco was carried out manually on 24th May, 1982, at the distance of 70x60 cm. Three alternatives plus a control were taken. The alternatives were presented by different concentrations of the bioregulator used. The treatment of all plants was carried out in the phase of growth from 9th–11th leaf, on 3rd August, 1982 whereby a backstroke sprayer CP–3 was used. Each of the stated alternatives was set in 4 repetitions with a layout by random block system. Each repetition comprised two rows with 50 plants in each. The alternatives of the experiment were the following:

Alternative	Concentration
1.	0,0070 g/stalk
2.	0,0100 g/stalk
3.	0,0150 g/stalk
4.	Control

Protection and necessary agri–technical measures were carried out together with jobs in plantation production. Experimental plants were neither fertilized nor watered. Harvest of leaves was carried out in the phase of technical maturity of specific insertions. The interleaving was carried out mechanically and drying was carried out under polyethylene curing barns. In order to keep the track of the changes of chemical components, a sampling was carried out by singling out only the leaves from middle picking (bottom middle, first middle and upper middle leaves) by variants.

3. In order to keep the track of mutual influence of topping and different concentrations of bioregulators on yield, randman and chemical changes with tobacco type Virginia, an experiment was set up in Basic Organization of Associated Labor for tobacco production and processing "Bosanac" from Orašje.

The experiment was set up as follows:

Replanting was carried out manually on 10th May, 1982 at a distance of 80x50 cm. 10 alternatives were taken. The first five alternatives were presented with different concentrations of used bioregulator without with no topping undertaken and treatment with MH–30 (maldehyde – 20). The other 5 alternatives were presented by different concentrations of the bioregulator used and performed topping by using MH–30. Each alternative consisted of 50 plants in a row. Treatment by the bioregulator was performed in the phase from 9th–11th leaf, on 2nd June, 1982. The topping of the plants was performed in the phase of early blooming at the height of 18th leaf. The treatment with MH–30 was performed immediately upon topping on 10th August, 1982 with sprayer Solo (working pressure 4 atmospheres). The concentration of the physiotrop used was 8% (15 cm^3/plant).

The alternatives of the experiment were as follows:

Alternative	Concentration of bioregulators	Removed inflorescence treated with MH–30
1.	0,0100 g/stalk	..... –
2.	0,0100 g/ stalk	..... +
3.	0,0150 g/ stalk	.....–
4.	0,0150 g/ stalk	..... +
5.	0,0200 g/ stalk	..... –
6.	0,0200 g/bunch	..... +
7.	0,0300 g/ stalk	..... –
8.	0,0300 g/ stalk	..... +
9.	0,1000 g/ stalk	..... –
10.	0,1000 g/ stalk	..... +
11.	Control	

Protection and necessary agri–technical mere were carried out together with jobs in typical production. Experimental plants were not fertilized. The harvest of the leaf was carried out in the phase of technical maturity of specific insertions. The interleaving was carried out manually and drying was carried out in curing barns with warm air. In order to carry out the chemical analysis, sampling was carried out by taking the leaves of bottom, middle and upper insertions according to alternatives.

For the purpose of acquiring data about changes in chemical components, following specifications are undertaken:

1. Moisture was determined by standardized process of drying a certain quantity of tobacco at a temperature 90–93 ° C.

2. pH was determined by standard procedure in the aqueous extract of the sample.

3. Ash was determined by Bruckner method.

4. Nicotine was determined spectophotometrically on the spectrophotometer Beckman DU–2 by Coresta method.

5. Total nitrogen, protein nitrogen and proteins were determined with the method by Kjeldal.

6. Polyphenols and sugars were determined by Bertrand method.

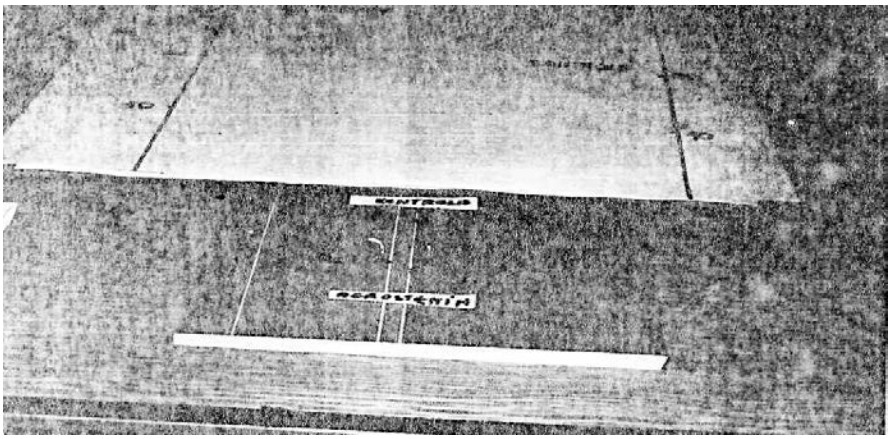
Results of research and discussions

Data on weight of scions and the root of tobacco nursery Virginia are given in Table 1.

The obtained results have shown that the biggest average weight in comparison to control is found with scions treated with bioregulators' concentration of 1,0000 g/10 m^2 and the smallest is found with scions treated with the concentration of bioregulators of 0,1000 g/10 m^2.

Comparing to the control, the biggest average root weight is found with scions treated with a bioregulator of 1,0000 g/10 m^2 concentration, and the smallest is found with a bioregulator of 0,2000 g/10 m^2 concentration.

In Picture 1 the roots of treated and untreated scions of tobacco nursery Virginia are shown.



Picture 1

Table 1 Average weights of scions and root of tobacco nursery Virginia

Concentration of bioregulators (g/10 m^2)	Number of measurements	Average weight in grams			
		5 scions	roots 5 scions	20 scions	roots 20 scions
1	*2*	*3*	*4*	*5*	*6*
0,1000	1.	5,00	0,40	4,65	0,29
	2.	5,20	0,30		
	3.	4,20	0,24		
	4.	4,20	0,22		
0,1500	1.	7,60	0,30	5,58	0,23
	2.	5,80	0,22		
	3.	4,80	0,20		
	4.	4,10	0,20		
0,2000	1.	7,0	0,22	5,35	0,21
	2.	5,4	0,20		
	3.	5,2	0,22		
	4.	3,8	0,20		
0,3000	1.	6,00	0,40	5,15	0,31
	2.	5,80	0,38		
	3.	4,80	0,22		
	4.	4,00	0,24		
1,0000	1.	7,20	0,40	5,92	0,36
	2.	5,90	0,38		
	3.	5,80	0,36		
	4.	4,80	0,30		
Control	1.	5,00	0,20	4,72	0,20
	2.	6,00	0,20		
	3.	4,00	0,20		
	4.	3,90	0,20		

Results on weights of scions and root of tobacco nursery "Burley T" are given in Table 2.

Table 2 Average weights of scions and root of tobacco nursery "Burley T"

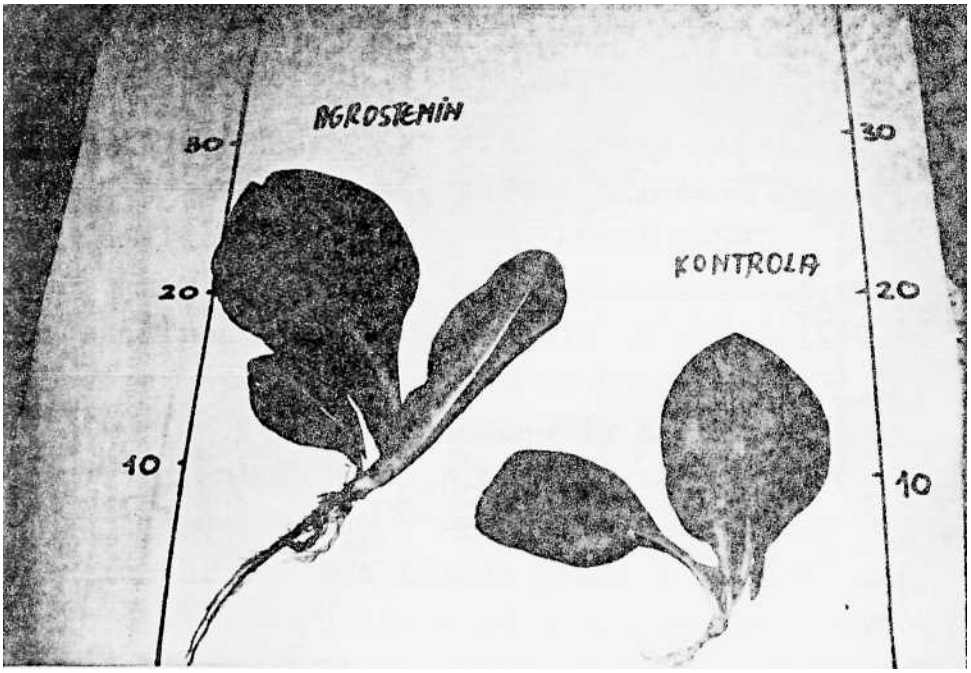
Concentration of bioregulators (g/10 m^2)	Number of measurement	Average weight in g			
		25 scions	roots 25 scions	100 scions	roots 100 scions
0,1000	1.	22,32	0,75	18,34	0,67
	2.	15,92	0,46		
	3.	17,58	0,62		
	4.	17,54	0,84		
0,1500	1.	17,60	0,73	20,06	0,73
	2.	23,34	0,79		
	3.	13,72	0,55		
	4.	25,58	0,83		
0,2000	1.	24,50	0,98	22,83	0,83
	2.	23,84	1,07		
	3.	18,28	0,58		
	4.	24,68	0,68		
0,3000	1.	29,58	1,14	20,38	0,76
	2.	20,40	0,78		
	3.	13,62	0,54		
	4.	17,92	0,56		
Control	1.	11,14	0,44	18,03	0,61
	2.	19,12	0,65		
	3.	19,82	0,71		
	4.	22,02	0,64		

From Table 2 it can be stated that the biggest average weight regarding control is found with the scions of tobacco nursery "Burley T" which were treated with the concentration of bioregulators of 0,2000 g/10 m^2 and the smallest is found with the ones treated with the concentration of 0,1000 g/10 m^2. The biggest average root weight is found with the scions treated with the concentration of 0,2000 g/10 m^2 0, and the smallest is found with the ones treated with the concentration of 1000 g/10 m^2.

In Picture 2 and Picture 3 the scions of tobacco nursery "Burley T" are shown, which are treated with Agrostemin bioregulator in comparison to the control (untreated scions).

Picture 2

Picture 3



Picture 4 shows treated and untreated scions of tobacco nursery "Burley T" in the field.

Picture 4

Table 3 shows the data on a number of replanted, left and dead stalks in the experiment on "Burley T" set up in IAU Zrenjanin where an influence of the most optimal concentration of bioregulators applied in the phase of growth from 9^{th}–11^{th} leaf on yield, randman and chemical changes was examined.

Table 4 shows the data on correction of leaf yield due to dead stalks.

Table 5 shows the quantity of unfermented tobacco by classes type "Burley–T" calculated by the cost price for the year 1982. The same table shows financial accounting of average randman classes according to alternatives: I. 0,0700 g/stalk, II. control, III. 0,0150 g/stalk and IV. 0,0100 g/stalk.

Table 3 Review on number of replanted, left and dead stalks

Alternative of experiment	Concentration (g/stalk)	Repetition	Number of stalks							
			replanted	left	dead	%	Total			
							replanted	left	dead	%
1.	0,0070	a	100	94	6	94	400	383	17	95,75
		B	100	96	4	96				
		c	100	96	4	96				
		d	100	97	3	97				
2.	0,0100	a	100	98	2	98	400	388	12	97,00
		B	100	97	3	97				
		c	100	97	3	97				
		d	100	96	4	96				
3.	0,0150	a	100	93	7	93	400	386	14	96,50
		B	100	96	4	96				
		c	100	99	1	99				
		d	100	98	2	98				
4.	Control (ø)	a	100	99	1	99	400	392	8	98,00
		B	100	98	2	98				
		c	100	98	2	98				
		d	100	97	3	97				

Table 4 Correction of lives yield due to dead stalks

No parcel and repetition	Experiment alternative	Number of stalks			Sum	Quotient	Yield (g)	
							measured	corrected
		R	O	P	O+P/2	r = 1/(O+P/2)	B	B_K=B x r
I/1	0,0070 g/stalk	100	94	3	95,5	1,0471	6740	7057
I/2		100	96	2	97,0	1,0309	8160	8412
I/3		100	96	2	97,0	1,0309	8250	8505
I/4		100	97	1	97,5	1,0256	6600	6764
IV/1	0,0100 g/stalk	100	98	2	99,0	1,0101	9920	10027
IV/2		100	97	3	98,5	1,0152	11800	11979
IV/3		100	97	1	97,5	1,0256	12940	13271
IV/4		100	96	1	96,5	1,0362	8350	8652
III/1	0,0150 g/stalk	100	93	2	94,0	1,0638	11220	11936
III/2		100	96	2	97,0	1,0309	7490	7721
III/3		100	99	1	99,5	1,0471	12400	12984
III/4		100	98	1	98,5	1,0152	9250	9391
II/1	Control (ø)	100	99	1	99,5	1,0050	7190	7226
II/2		100	98	1	98,5	1,0152	10190	10345
II/3		100	98	2	99,0	1,0101	7750	7834
II/4		100	97	2	98,0	1,0204	7120	7265

R – replanted ("ras." – ?)
O – picked ("obr." – ?)
P – empty ("praz." – ?)
r – quotient for the correction of yield by parcel
B – measured yield of leaves by parcel in grams
B_K – corrected yield of leaves by parcel in grams

Table 5 Randman class per experiment alternatives

Experiment alternative			Redemption price of unfermented tobacco (din)					Total	Average (din/kg)
			C l a s s						
parcel	repetition	Unit of measurement	I	II	III	IV	V		
			l00,50	92,00	80,50	66,00	37,00		
1. experiment alternative (concentration of bioregulators 0,0700g/stalk)									
I	1	kg	1,80	1,60	1,97	0,90	0,47	6,74	83,66
		din	180,90	147,20	158,60	59,40	17,40	563,50	
	2	kg	3,65	1,45	1,27	1,42	0,37	8,16	86,98
		din	366,80	133,40	102,20	93,70	13,70	709,80	
	3	kg	4,25	1,80	1,100	0,90	0,20	8,25	90,65
		din	427,00	165,60	88,50	59,40	7,40	747,90	
	4	kg	2,00	2,20	1,10	1,20	0,10	6,60	87,10
		din	201,10	202,40	88,50	79,20	3,70	574,80	
2. experiment alternative (concentration of bioregulators 0,0100 g/stalk)									
IV	1	kg	3,35	4,32	1,30	0,40	0,55	9,92	89,26
		din	336,70	397,40	104,60	26,40	20,35	885,45	
	2	kg	3,00	3,00	4,40	1,40	–	11,80	86,79
		din	301,50	276,00	354,20	92,40	–	1024,10	
	3	kg	2,75	3,15	4,07	1,97	1,00	12,94	81,98
		din	276,40	289,80	327,60	130,00	37,00	1060,80	
	4	kg	1,95	3,19	2,42	0,82	–	8,35	88,37
		din	196,00	293,50	194,80	54,10	–	737,90	

Table 5 continued

Experiment alternative			Redemption price of unfermented tobacco (din)					Total	Average (din/kg)
			C l a s s						
parcel	repetition	Unit of measurement	I	II	III	IV	V		
			l00,50	92,00	80,50	66,00	37,00		
3. experiment alternative (concentration of bioregulators 0,0150 g/stalk)									
III	1	kg	5,98	0,75	3,05	1,12	0,35	11,22	89,10
		din	598,00	69,00	245,50	73,90	12,90	999,30	
	2	kg	3,95	0,95	1,77	0,70	0,12	7,49	90,45
		din	397,00	87,40	142,50	46,20	4,40	677,50	
	3	kg	6,86	2,05	2,92	0,57	–	12,40	92,80
		din	689,40	188,60	235,10	37,62	–	1150,72	
	4	kg	3,70	3,70	0,85	0,40	0,60	9,25	89,65
		din	371,90	340,40	68,40	26,40	22,20	829,30	
4. experiment alternative (**control** – untreated)									
II	1	kg	1,90	2,60	1,84	0,85	–	7,19	88,22
		din	190,90	239,26	148,10	56,10	–	634,30	
	2	kg	4,60	3,15	0,87	1,02	0,55	10,19	89,28
		din	462,30	289,80	70,00	67,30	20,40	909,80	
	3	kg	4,3	1,10	1,10	0,750	0,50	7,750	89,02
		din	432,20	101,20	88,50	49,50	18,50	689,90	
	4	kg	1,90	1,90	2,30	0,87	0,15	7,120	86,22
		din	190,90	174,80	185,20	57,40	5,60	613,90	

In Table 6 according to data from Table 4 and Table 5 for calculation of randman classes the values in din/ha according to alternatives are shown.

Table 6 Average values of tobacco in din/ha according to alternatives

Experiment alternative		Tobacco weight (kg)	Quotient for correction	Corrected yield (kg)	Average price (din/kg)	Tobacco value	
						din/parcel	din/ha
1. I	1	6,74	1,0471	7,06	83,60	590,22	141652,80
	2	8,16	1,0309	8,41	86,98	731,50	175560,00
	3	8,25	1,0309	8,51	90,65	771,43	185143,20
	4	6,60	1,0256	6,77	87,10	589,67	141520,80
2. IV	1	9,92	1,0101	10,03	89,26	895,28	214867,20
	2	11,80	1,0152	11,98	86,79	1039,74	249537,60
	3	12,94	1,0256	13,27	81,98	1087,87	261088,80
	4	8,35	1,0362	8,65	88,37	764,40	183456,00
3. III	1	11,22	1,0638	11,94	89,10	1063,85	255324,00
	2	7,49	1,0309	7,72	90,45	698,27	167584,80
	3	12,40	1,0471	12,98	92,80	1204,54	289089,60
	4	9,25	1,0152	9,39	89,65	841,81	202034,40
4. II	1	7,19	1,0050	7,23	88,22	637,83	153079,20
	2	10,19	1,0152	10,35	89,28	924,05	221772,00
	3	7,75	1,0101	7,83	89,02	697,03	167287,20
	4	7,12	1,0204	7,27	86,22	626,82	150436,80

In Table 7 final results of experiment for tobacco yield "Burley–T" according to alternatives are shown

The results have shown that by treatment of tobacco in the phase of growth from 9th–11th leaf with the standard dose of Agrostemin (0,0100 g/stalk) the biggest yield increased by 34% is obtained in comparison to untreated plants. The yield increased by 28% in comparison to control is obtained by treatment with a dose of 0,0l50 g/stalk. The treatment with a dose of 0,0070 g/stalk in this year has not affected on the increase of yield.

Table 7 Yield of unfermented tobacco in finding the most optimal concentration of Agrostemin bioregulators

Experiment alternative					
label		1.	2.	3.	4.
parcel		(I)	(IV)	(III)	(II)
concentration		0,0070 g/stalk	0,0100 g/stalk	0,0150 g/stalk	Control (ø)
Corrected yield per parcel in dkg	Repetitions 1	70,57	100,27	119,36	72,26
	2	84,12	119,79	77,21	103,45
	3	85,05	132,71	129,84	78,34
	4	67,69	86,52	93,91	72,65
Average [1]		76,86±4,5	109,82±10,23	105,08±11,97	81,67±7,39
Mean square error average [2]		20,25	104,75	143,25	54,58
Difference in g [3]		–4,18	28,15	23,41	–
Mean square error difference [4]		74,83	159,33	197,83	–
Mean error difference [5]		8,65	12,62	14,07	–
Quotient of reliability [6]		0,5561	2,2305	1,6638	–
Relation to standard 100%		94,11	134,47	128,66	100,00
Rank		4	1	2	3

[1] $M \pm m_{(M)}$
[2] $(m_{(M)})^2$
[3] D
[4] $(m_{(D)})^2 = (m_{(M)})^2 + (m_{(M1)})^2$
[5] $m_{(D)}$
[6] $D / m_{(D)}$

In Table 8 financial results according to alternatives are shown.

According to the results acquired it can be stated that the value of tobacco (din/ha) is by the application of Agrostemin increased by 31% in comparison to untreated plants. A dose of 0,0070 g/stalk in this year has not given any positive results either.

Table 8 Financial results in din/ha

Experiment alternative					
label		1.	2.	3.	4.
parcel		(I)	(IV)	(III)	(II)
concentration		0,0070 g/stalk	0,0100 g/stalk	0,0150 g/stalk	Control (ø)
Financial result in din/ha — Repetitions	1	141652,80	214867,20	255324,00	153079,20
	2	175560,00	249537,60	167584,80	221772,00
	3	185143,20	261088,80	289089,60	167287,20
	4	141520,80	183456,00	202034,40	150436,80
Average [1]		160969,20 ± 11360,60	227237,40 ± 17590,34	228508,20 ± 27082,65	173143,80 ± 16626,28
Mean square error average [2]		129062580	309420050	733469990	276433230
Difference in din/ha [3]		–12174,60	54093,60	55364,40	–
Mean square error difference [4]		405495810	670633730	1009903220	–
Mean error difference [5]		20137	25896	31779	–
Quotient of reliability [6]		0,6046	2,0888	1,7422	–
Relation to standard 100%		92,97	131,12	131,97	100,00
Rank		4	2	1	3

[1] $M \pm m_{(M)}$
[2] $(m_{(M)})^2$
[3] D
[4] $(m_{(D)})^2 = (m_{(M)})^2 + (m_{(M1)})^2$
[5] $m_{(D)}$
[6] $D / m_{(D)}$

The results of chemical determination of treated samples are shown in Table 9.

Table 9 The results of chemical determination of samples treated with bioregulator in %

Contents	Alternative			
	1.	2.	3.	4.
	0,0070 g/stalk	0,0100 g/stalk	0,0150 g/stalk	Control
Moisture	5,10	6,20	7,00	3,65
Ash	21,60	21,14	20,59	20,76
pH	5,74	5,80	5,62	5,60
Nicotine	1,50	1,20	1,64	1,50
Nitrogen total	4,40	4,58	4,32	4,49
Nitrogen proteins	2,04	1,68	2,22	1,70
Proteins	12,75	10,50	13,87	10,62
Carbohydrates	1,40	0,67	0,94	1,31
Polyphenols	0,90	0,36	2,94	0,65
Total reduction	2,30	1,03	3,88	1,96
Schmuck number	0,11	0,06	0,07	0,12

According to the results from Table it can be stated that:

– the amount of ash with alternative No. 1 and 2 in comparison to control is increased while with alternative No. 3 it is reduced;

– The reduction of nicotine in comparison to control was given within alternative No. 2 (standard dose of 0,0100 g/bunch) while with the alternative No. 3 the amount of nicotine is increased;

– % of total nitrogen in comparison to control it is bigger with alternative No. 2 while with the alternative No. 1 and 5 it is reduced;

– the amount of nitrogen proteins in comparison to control is increased with alternative No. 1 and No. 3 while with the alternative No. 2 it is slightly reduced;

– % of proteins in comparison to control is increased with alternative No. 1 and No. 3 while with the alternative No. 3 (standard dose) it is slightly reduced;

– the amount of carbohydrates in comparison to control with alternative No. 1 is increased, while with alternatives No. 2 and 3 it is reduced;

– total reduction in comparison to control is increased with alternatives No. 1 and 3 and with alternative No. 2 it is reduced.

Table 10 shows amounts of tobacco of variety Virginia by classes, calculated according to cost price for the year 1982. Financial calculation of average randman according to alternatives is also shown.

Table 10 Randman class of tobacco variety "Virginia" by experiment alternatives

Redemption price of unfermented tobacco							Total	Average (din/kg)
Class	I	II	III	IV	V	VI		
Price (din.)	162,00	133,00	110,00	83,00	53,00	31,00		
1. experiment alternative (concentration of bioregulators 0,0100 g/stalk)								
kg	0,200	0,130	1,180	0,595	0,265	0,060	2,430	100,72
din.	32,40	17,29	129,80	49,38	14,04	21,86	244,77	
2. experiment alternative (concentration of bioregulators 0,0100 g/stalk + topped)								
kg	1,535	0,930	0,440	0,840	0,360	0,085	4,190	122,24
din.	248,67	123,69	48,40	69,72	19,08	2,63	512,19	
3. experiment alternative (concentration of bioregulators 0,0150 g/stalk)								
kg	0,920	0,580	0,640	0,810	0,260	0,060	3,270	116,03
din.	149,04	77,14	70,40	67,23	13,78	1,86	379,45	
4. experiment alternative (concentration of bioregulators 0,0150 g/stalk + topped)								
kg	0,935	1,330	0,435	0,150	0,770	0,105	3,725	116,16
din.	151,47	176,89	47,85	12,45	40,81	3,25	432,72	
5. experiment alternative (concentration of bioregulators 0,0200 g/stalk)								
kg	0,400	0,260	0,910	1,140	0,320	0,220	3,250	97,80
din.	64,80	34,58	100,10	94,62	16,96	6,82	317,88	

Table 10 Continued

Redemption price of unfermented tobacco							Total	Average (din/kg)
Class	I	II	III	IV	V	VI		
Price (din.)	162,00	133,00	110,00	83,00	53,00	31,00		
6. experiment alternative (concentration of bioregulators 0,0200 g/stalk + topped)								
kg	0,670	0,340	1,360	1,300	0,280	0,110	4,060	105,79
din.	108,54	45,22	149,60	107,90	14,84	3,41	429,51	
7. experiment alternative (concentration of bioregulators 0,0300 g/stalk)								
kg	0,370	0,560	1,320	1,200	0,590	0,085	4,125	100,15
din.	59,94	74,80	145,20	99,60	31,27	2,63	413,12	
8. experiment alternative (concentration of bioregulators 0,0300 g/stalk + topped)								
kg	1,020	0,590	1,835	1,210	0,195	0,065	4,915	113,59
din.	165,24	78,47	201,85	100,43	10,33	2,01	558,33	
9. experiment alternative (concentration of bioregulators 0,1000 g/stalk)								
kg	1,285	0,630	0,560	0,570	0,305	0,085	3,435	122,17
din.	208,17	83,79	61,60	47,31	16,16	2,63	419,66	
10. experiment alternative (concentration of bioregulators 0,1000 g/stalk + topped)								
kg	0,665	0,575	1,215	0,770	0,290	0,130	3,645	110,05
din.	107,73	76,47	133,65	63.91	15,37	4,03	401,16	
11. experiment alternative (**control** – untreated)								
kg	0,284	0,530	0,671	0,760	0,480	–	2,725	102,31
din.	46,00	70,49	73,81	63,08	25,44	–	278,82	

Percentage ratio of specific classes according to alternatives is obtained by grading and measurement on the basis of valid criteria for classification of tobacco variety Virginia (Yugoslav standard "Official Gazette of the SFRY" number 5/1969.)

Table 11 Randman class of tobacco according to alternatives

Alternative	Classes in %							
	I	II	III	IV	V	VI	I–III	IV– VI
1. Agrostemin	8,32	5,34	48,55	24,48	10,94	2,46	62,12	37,88
2. topped	36,63	22,19	10,50	20,05	8,59	2,04	69,32	30,68
3. Agrostemin	28,13	17,73	19,57	24,77	7,95	1,85	65,43	34,57
4. topped	25,10	35,70	11,67	4,05	20,67	2,81	72,47	27,53
5. Agrostemin	12,33	8,00	28,00	35,05	9,85	6,77	48,33	51,67
6. topped	16,50	8,40	33,50	32,00	6,90	2,70	58,40	41,60
7. Agrostemin	8,97	13,58	32,05	29,05	14,30	2,05	54,60	45,40
8. topped	20,75	12,00	37,35	24,62	3,96	1,32	70,10	29,90
9. Agrostemin	37,40	18,34	16,33	16,59	8,87	2,47	72,07	27,93
10. topped	18,24	15,80	33,33	21,12	7,95	3,56	67,37	32,63
11. Control	10,42	19,44	24,62	27,88	17,67	–	54,48	45,5

According to data from Table 11 it can be stated that with all samples treated with a bioregulator and topped, a randman class is good. Share from class I to III with the control totaled 54,48% while with other samples share from class I to III is between 58,40% to72,47%.

Randman class with samples treated only with bioregulator is also good. Share from class I–III is between 54,60% to 72,07% leaving out only sample No. 5 where share of class I to III is 48,33%.

According to data from Table 10, yield in kg/ha and dinar value per hectare (Table 12) are calculated.

The results from Table 12 have shown that yield with all samples treated with bioregulator and topped is increased. The percent of increase is in range from 34% (0,1000 g/stalk) to 80% (0,0300 g/stalk).

Table 13 shows the results of chemical determination with the experiment with bioregulator treatment and topping.

Table 12 Tobacco yield in kg/ha and dinar value

Alternative	kg/parcel	kg/ha	% increase	din/ha
1. Agrostemin	4,86	1 215	89	122 385,00
2. topped	8,38	2 095	154	256 095,00
3. Agrostemin	6,54	1 635	120	189 725,00
4. topped	7,45	1 862	137	216 360,00
5. Agrostemin	6,50	1 625	119	158 940,00
6. topped	8,12	2 030	149	214 755,00
7. Agrostemin	8,25	2 050	150	206 560,00
8. topped	9,83	2 457	180	279 165,00
9. Agrostemin	6,87	1 717	126	209 830,00
10. topped	7,29	1 822	134	200 580,00
11. Control	5,45	1 362	100	139 410,00

Table 13 Results of chemical determination with tobacco variety Virginia

Alternative												
Agrostemin (g/stalk)	number	topped	Moisture	Ash	pH	Nicotine	Nitrogen total	Nitrogen proteins	Proteins	Carbohydrates	Polyphenols	Total reduction
0,0100	1.	–	2,65	12,94	5,31	1,17	2,87	1,36	8,50	14,39	1,56	15,95
	2.	+	2,75	14,49	5,23	1,26	2,91	1,49	9,31	15,06	3,22	18,28
0,0150	3.	–	7,25	13,15	5,20	1,27	2,69	1,36	8,50	15,96	4,06	20,02
	4.	+	2,85	19,22	5,27	1,34	3,52	1,67	10,44	6,18	2,38	8,56
0,0200	5.	–	7,35	12,40	5,25	1,22	2,36	1,17	7,31	22,42	3,76	26,18
	6.	+	7,60	13,96	5,24	1,28	2,73	1,20	7,50	16,53	6,15	22,68
0,0300	7.	–	6,45	12,81	5,28	1,24	2,40	1,32	8,25	22,36	4,71	27,07
	8	+	7,20	13,89	5,24	1,49	2,75	1,40	8,75	19,93	5,49	25,42
0,1000	9.	–	7,15	13,46	5,22	1,54	2,82	1,20	7,50	14,78	2,87	17,65
	10	+	6,65	14,89	5,20	1,47	2,96	1,23	7,69	16,57	3,45	20,02

If the results of chemical determination are observed by comparison of the obtained values (in%), for only samples treated with bioregulator, with values of samples treated with bioregulator and topping, following can be stated:

1. The amount of ash with all samples treated with bioregulator and topped, compared to samples which are only treated with bioregulator, is increased and is in range from13,89% (0,0300 g/stalk) to 19,22% (0,0150 g/stalk).

2. The amount of nicotine is increased with all samples except with sample No. 10 where it is reduced. The increase of the amount of nicotine is in range from 1,26% (0,0100 g/stalk) to 1,49% (0,0300 g/stalk).

3. The percent of total nitrogen is increased with all samples from2,73% (0,0200 g/stalk) to 3,52% (0,0150 g/stalk).

4. The amount of nitrogen proteins is increased with all samples and is in range from 1,20% (0,0020 g./stalk) to 1,67% (0,0150 g/stalk).

5. The percent of proteins is increased with all samples from 7,50% (0,0200 g/stalk) to 10,44% (0,0150 g/stalk).

6. The amount of carbohydrates varies as follows: of samples treated with Agrostemin, the biggest % of carbohydrates is found in sample No. 7 (0,300 g/ bunch) and is 22,36% whereas the smallest amount is found in sample No. 1 (0,0100 g/ bunch) and is 14,39%. With samples No. 2 (0,100 g/bunch + topping) and No. 10 (0,100 g/bunch + topped) the amount of carbohydrates increases compared only to treated plants. With other samples No. 4, 6 and No. 8 (conc. 0,0150 g/bunch, 0,0200 g/bunch, 0,0300 g/bunch) which are topped and treated, the amount of carbohydrates reduces compared only to treated plants.

7. The amount of polyphenols with all samples except with sample No. 4 (0,0150 g/bunch + cut off) is increased and is in range from 3,22% (0,0100 g/bunch) to 6,15% (0,0200 g/ bunch).

Conclusion

The results of survey have shown the following:

1. Significant differences in the increase of vegetation and root mass of nursery compared to untreated plants were noticed considering experiments with an aim to check the effect of bioregulators on vegetation increase of tobacco nursery. Providing the treatment is performed in the phase of nursery crossing it is necessary to apply bigger concentrations of bioregulators because in this phase the scions have a smaller foliar surface, thus a loss of used bioregulator solution occurs.

2. By treating of tobacco plant of tobacco type "Burley–T" in the phase of growth from 9th–11th leaf with standard dose of bioregulator (0,0100 g/stalk), the yield is increased by 34% compared to untreated plants. Randman class of such treated tobacco plants is good an affects financial results expressed in din/ha per annum. The

results of chemical research have shown that with all chemical components of samples treated with bioregulator there are differences compared to untreated plants, which can affect the improvement of the quality of tobacco raw materials. Certain pattern concerning the effect of increase and reduction of bioregulator concentration on the quantity of chemical components have not been noticed.

3. By application of bioregulators of different concentration and important agri–techincal protection measures of topping together with a necessary application of systemic physiotrop MH–30 good results concerning yield, randman class and financial results can be achieved on tobacco variety Virginia.

The results of chemical research have shown that by application of bioregulators and topping, tobacco of a quality much higher than with the one grown in a classical manner is obtained. According to this year's results a concentration which has shown best results should be determined and an experiment set up by randomized block system with a random layout of alternatives.

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ИНСТИТУТ ЗА ДУВАН — БЕОГРАД

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RECOMMENDATION FOR APPLICATION OF AGROSTEMIN ON TOBACCO TYPE "BURLEY"

According to four–year study of effects of Agrostemin bioregulators on tobacco type Burley, following can be stated:

The best results were achieved by spraying tobacco plants in the phase of growth from the ninth to the eleventh leaf in concentration of 240 g/ha.

Spraying of 1 ha requires to dissolve indicated quantities of Agrostemin into 600 liters of water.

CHIEF RESEARCHER,

Dragana Maričić, dipl. hem. sp.

DIRECTOR OF THE INSTITUTE,

dr Lazar Nikolić

INSTITUTE FOR STUDY OF HERBS "JOSIP PANČIĆ"
B e l g r a d e

STUDY OF EFFECTS OF BIOREGULATORS OF AGROSTEMIN ON SEED QUALITY AND QUANTITATIVE AND QUALITATIVE FEATURES OF PLANTS, HERBS AND TOBACCO

dr Slobodan B. Dražić

R E P R I N T

C O N T E N T S

R E P O R T No. 3

(Topic II / Task 1 / Work year I)

Topic:

EFFECT OF AGROSTEMIN BIOREGULATORS ON TOBACCO SEED GERMINATION

Task:

LABORATORY RESEARCH
(first year of work)

RESEARCH USER:
Dragomir Stajković, dipl. inž.
– adviser –

RESEARCH REALIZATION:
dr. Slobodan Dražić

Material and working methods

Tests have included all types of tobacco for cigarettes that are grown here. These tobacco products differ primarily in their practical value (besides the differences in the biological, morphological and productive properties),

Table 1

Seed germination was determined by analyzing the average samples taken from the groups prepared for sowing. Considering the tobacco seeds high vitality, samples were taken from 2, 4 and 6 years old seeds. Preparation of samples for the analysis and germination test was done according to standard methods (Table 2).

Seeds that are used in this work, had a purity of 98% and moisture content to 10%. Tests have included the following treatments:

1. Seed of Burley variety of tobacco (Burley DKH–28),
   - Age of seeds: 2, 4, 6 years;
   - T_1– control: seed is not sprayed with Agrostemin;
   - T_2– seed sprayed with Agrostemin in period of 48 hours.
2. Seed of Virginia variety of tobacco (Srem 47),
   - Age of seeds: 2, 4, 6 years;
   - T_1– control: seed is not sprayed with Agrostemin;
   - T_2– seed sprayed with Agrostemin in period of 48 hours.
3. Seed of Additional variety of tobacco (Otlja MD 159–78),
   - Age of seeds: 2, 4, 6 years;
   - T_1– control: seed is not sprayed with Agrostemin;
   - T_2– seed sprayed with Agrostemin in period of 48 hours.
4. Seed of Oriental variety of tobacco (Jaka MD–80),
   - Age of seeds: 2, 4, 6 years;
   - T_1– control: seed is not sprayed with Agrostemin;
   - T_2– seed sprayed with Agrostemin in period of 48 hours.

It should be stated that the spraying or application of product is made by using magnetic stirrer. On the basis of consumption of Agrostemin for treatment, there is the data that for 1 kg of tobacco seed needs about 200 grams of this preparation.

Germination percentage is expressed in amount of normal seeds from a sample taken for analysis. The test consisted of 100 seeds, and each analysis was done in 4 repetitions (trials). Based on this it is obvious that for each type of tobacco 24 samples was treated, which together amounted to 96 samples (test).

The differences in germination changes are expressed with absolute and relative values.

Results of research and discussion

For better insight in results of testing the influence of Agrostemin on increasing seed germination, Table 3 is given. The values in this table indicate that Agrostemin in general influenced the increase in germination, which in the average was higher by 7 seeds, which in relative value is 12%.

The biggest impact this product had on seeds from Jaka MD 80 variety, which germination increased by 22 seeds in absolute values, which represents an increase of 36%.

In Burley DKH–28, it is obtained 8 more seeds or 11%. It should be stated that Agrostemin had bigger impact on germination energy of this variety (+36%), than on its general germination (Table 3).

Treating seeds of Virginia variety Srem 47 and seeds Otlja MD 159–78 variety (additional tobacco) in general, did not cause changes in germination.

a) TREATMENT OF 2 YEARS OLD SEED

The value of tobacco seed germination in control testings was high for all varieties except for Jaka MD–80 variety (Table 4). Unsprayed seed of this variety had low value of germination – 32% (this kind of seed cannot be put on market, because the minimum germination for putting on market is 70%).

Treating this seed the germination energy was increased from 32 to 88%, and germination from 32 to 90%. Expressed in absolute values this amounts between 56 and 58 more seeds, and in relative values between 175% and 181% (Table 4).

Effect of this bioregulator with other types and their varieties was not determined, as a result of high germination of these seeds, as outlined in the previous analysis.

b) TREATMENT OF 4 YEARS OLD SEED

With Burley DKH–28 and Jaka MD–80 variety germination of unsprayed seeds was 57 and 56%, while with varieties Srem 47 and Otlja MD 159–78 it was higher (Table 5). By treating Burley DKH–28 seeds, the increase of germination energy for 7 more seeds or 32% was obtained, and germination for 13 more seeds or 23%. Also, with variety Jaka MD–80 germination energy and total germination were increased (Table 5).

Spraying of Srem 47 variety seed had very small effect on germination changes, while spraying of Otlja MD 159–78 variety gave the same values (Table 5).

c) TREATMENT OF 6 YEARS OLD SEED

Very high values of germination of untreated 6 years old seeds were detected with Jaka MD–80 variety, Burley DKH–28 and Srem 47, while with Otlja MD 159–78 variety, germination was 48%, which is under the standards (Table 6). Relatively largest increase in germination after spraying seeds, was obtained with Burley DKH–28. In this case Agrostemin had greater effect on germination energy than on the total germination, which is desirable, because the germination rate and togetherness are very important for making nursery.

With other varieties of tobacco germination energy and germination of treated seeds was at the level of control, as expected.

Conclusion

Based on tests performed to determine the effect of bioregulator Agrostemin on improving the seed germination of different types and varieties of tobacco, that was 2, 4 i 6 years old, following conclusions can be made:

Agrostemin in general had positive effect on improving the seed germination of tested varieties;

Agrostemin had greater effect on seed with low value of germination, than on the seeds with high value of germination, which justifies this research,

Agrostemin had positive effect on germination energy which is the indicator of germination rate and togetherness of seed germination, that is denoted as: germination energy. This is very emphasized in oriental varieties Jaka MD–80 and Burley DKH–28. Energy of tobacco seeds germination is very important in making the production of nursery.

Table 1 – Important properties of the studied types of tobacco and their varieties

Ordinal No.	Type	Use of raw material	Curing methods	Variety	Average yield t/ha
1.	Burley	It is used as raw material for American type cigarette blend. It is specially used in production of sauced cigarettes. It is used for pipe and chewing	In shade (air–cured)	Burley DKH–28	2,5–3
2.	Virginia	It is used for making American type cigarette blend, is an important component of domestic cigarettes, especially for the production of cigarettes of English type.	Artificial, with warm air (flue–cured)	Srem 47	2,1–2,5
3.	Additional	Gives a neutral material, which is used as filling material for making of cigarettes – primal tobacco.	In the Sun (sun–cured)	Otlja MD 159–78	2,4 – 2,8
4.	Oriental	Because of the intense and noble aroma, they are used for aromatization of fine and luxury cigarettes.	In the Sun (sun–cured)	Jaka MD–80	1,2–1,6

Table 2 – Quality norms and conditions of tobacco seed germination

Ordinal number	Purity (%)	Total germination – minimum –(%)	Humidity (%)	Base	Temperature (°C)	Germination energy (days)	Total germination (days)	Procedures for stopping seed dormancy	Sample size (g)
1.	97	70	10	NF	20–30	7	16	KNO_3	0,5

Table 3 – Effect of bioregulator Agrostemin on germination of tobacco seed of 2, 4, 6 years of age

Type of tobacco and variety	Seeds age (years)	Germination energy (%)		Germination (%)		Difference				Germination range (%)
						absolute		relative		
		K	T	K	T	EK	KL	EK	KL	
Burley Burley DKH–28	2	39	61	84	87	+22	+ 3	156	104	2
	4	53	70	57	70	+17	+13	132	123	
	6	74	89	82	89	+15	+ 7	120	108	
	Average	55	73	74	82	+18	+ 8	136	111	
Virginia Srem 47	2	94	90	94	90	– 4	– 4	96	96	4
	4	62	66	63	67	+ 4	+ 4	107	106	
	6	74	78	80	81	+ 4	+ 1	105	101	
	Average	77	78	79	79	+ 1	0	101	100	
Additional Otlja MD 159–78	2	75	76	76	76	+ 1	0	101	100	3
	4	78	78	81	80	0	– 1	100	99	
	6	45	46	48	49	+ 1	+ 1	102	102	
	Average	66	67	68	68	+ 1	0	102	100	
Oriental Jaka MD – 80	2	32	88	32	90	+56	+58	275	281	1
	4	56	67	56	69	+11	+13	120	123	
	6	95	91	95	91	– 4	– 4	96	96	
	Average	61	82	61	83	+21	+22	134	136	

K=control; T=tested; EK=germination energy; KL=germination

Table 4 – Effect of bioregulator Agrostemin on germination of 2 years old tobacco seed

Type of tobacco and variety	Repetitions	Germination energy (%)		Germination (%)		Difference				Germination range (%)
						absolute		relative		
		K	T	K	T	EK	KL	EK	KL	
Burley Burley DKH–28	I	41	62	81	89	+21	+ 8	151	110	2
	II	40	63	86	87	+23	+ 1	158	101	
	III	37	60	84	88	+13	+ 4	162	105	
	IV	38	59	85	84	+21	– 1	155	99	
	Average	39	61	84	87	+22	+ 3	156	104	
Virginia Srem 47	I	97	87	97	87	–10	–10	87	87	4
	II	92	91	92	92	– 1	– 1	99	99	
	III	92	89	92	89	– 3	– 3	97	97	
	IV	95	93	95	93	– 2	– 2	98	98	
	Average	94	90	94	90	– 4	– 4	96	96	
Additional Otlja MD 159–78	I	72	74	73	74	+ 2	+ 1	103	101	3
	II	74	77	74	77	+ 3	+ 3	104	104	
	III	77	74	78	74	– 3	– 4	96	95	
	IV	77	79	79	79	+ 2	0	103	100	
	Average	75	76	76	76	+ 1	0	101	100	
Oriental Jaka MD– 80	I	31	89	31	89	+58	+58	287	287	1
	II	35	87	35	90	+52	+55	249	257	
	III	33	91	33	91	+58	+58	276	276	
	IV	29	85	29	90	+56	+61	293	310	
	Average	32	88	32	90	+56	+58	275	281	

K=control; T=tested; EK=germination energy; KL=germination

Table 5 – Effect of bioregulator Agrostemin on germination of 4 years old tobacco seed

Type of tobacco and variety	Repetitions	Germination energy (%)		Germination (%)		Difference				Germination range (%)
						absolute		relative		
		K	T	K	T	EK	KL	EK	KL	
Burley Burley DKH–28	I	52	71	56	71	+ 19	+ 15	137	127	
	II	56	69	58	70	+ 13	+ 12	123	121	
	III	50	72	52	72	+22	+20	144	138	1
	IV	54	68	60	68	+ 14	+8	126	114	
	Average	53	70	57	70	+ 17	+ 13	132	123	
Virginia Srem 47	I	64	62	64	66	–2	–2	97	103	
	II	58	68	62	68	+6	+6	117	117	
	III	60	65	60	65	+5	+5	108	108	3
	IV	66	69	66	69	+4	+4	105	105	
	Average	62	66	63	67	+4	+4	106	106	
Additional Otlja MD 159–78	I	79	80	80	81	+ 1	+ 1	101	101	
	II	73	76	77	80	+3	+3	104	104	
	III	77	74	84	76	–3	–8	96	91	4
	IV	83	82	83	83	–1	0	99	100	
	Average	78	78	81	80	0	–1	100	99	
Oriental Jaka MD– 80	I	57	63	57	67	+ 10	+ 10	111	118	
	II	56	70	56	70	+ 14	+ 14	125	125	
	III	52	69	52	71	+ 19	+ 19	133	137	2
	IV	59	66	59	68	+9	+9	112	115	
	Average	56	67	56	69	+ 11	+ 13	120	117	

K=control; T=tested; EK=germination energy; KL=germination

Table 6 – Effect of bioregulator Agrostemin on germination of 6 years old tobacco seed

Type of tobacco and variety	Repetitions	Germination energy (%)		Germination (%)		Difference				Germination range (%)
						absolute		relative		
		K	T	K	T	EK	KL	EK	KL	
Burley Burley DKH–28	I	77	90	82	90	+ 13	+8	117	110	1
	II	70	85	84	85	+ 15	+ 1	121	101	
	III	74	92	85	92	+8	+7	124	108	
	IV	75	89	79	89	+ 14	+ 10	119	113	
	Average	74	89	82	89	+ 15	+7	120	109	
Virginia Srem 47	I	70	82	82	82	+ 12	0	117	100	3
	II	78	77	78	78	–1	0	99	100	
	III	73	74	85	85	+1	+ 1	101	101	
	IV	75	79	76	79	+4	+3	105	104	
	Average	74	78	80	81	+4	+1	105	101	
Additional Otlja MD 159–78	I	46	42	46	53	–4	+7	91	115	2
	II	44	47	50	47	+3	–3	107	94	
	III	41	50	47	50	+9	+3	122	106	
	IV	49	45	49	46	–4	–3	92	94	
	Average	45	46	48	49	+1	+1	102	102	
Oriental Jaka MD– 80	I	90	87	90	87	–3	–3	97	97	4
	II	97	94	97	94	–3	–3	97	97	
	III	94	90	94	90	–4	–4	96	96	
	IV	99	93	99	93	–6	–6	94	94	
	Average	95	91	95	91	–4	–4	96	96	

K=control; T=tested; EK=germination energy; KL=germination

R E P O R T No. 3

(Topic II / Task 2 / Year of work I)

Topic:

EFFECT OF AGROSTEMIN BIOREGULATORS ON TOBACCO SEED GERMINATION

Task:

FIELD GERMINATION
(first year of work)

RESEARCH USER:
Dragomir Stajković, dipl. inž.
– advisor –

RESEARCH REALIZATION:
dr. Slobodan Dražić

Introduction

In terms of production, the life cycle of tobacco is divided in two main periods: the period of nursery production and the period of development in the field.

The period of nursery production includes the following phases:

- seed germination,
- sprouting,
- fixing of roots and
- maturing of nursery.

The following conditions are needed for seed germination:

- heat,
- humidity,
- aeration, and above all
- seed with high germination.

In low field germination, weaker plants are obtained and a small number of plants in the nursery. With increase of filed germination, grows the number of sprouted plants in the nursery. This gives the opportunity to the producer for selecting the strongest plants, which is the precondition for number of plants surviving till the harvest of leaves.

Material and working methods

Tests have included all types of tobacco for cigarettes that are grown here.

Seed germination was determined by analyzing the average samples taken from the group prepared for sowing.

Considering the tobacco seeds high vitality, samples were taken from 2, 4 and 6 years old seeds. Seeds that are used in this work, had a purity of 98% and moisture content to 10%.

Tests have included the following treatments:

- T_1– control: seed is not sprayed with Agrostemin;
- T_2– seed sprayed with Agrostemin (duration 4–8 hours)

Types of tobacco and varieties:

1. Seed of Burley tobacco; Burley DKH–28.
2. Seed of Virginia tobacco; Srem 47.
3. Seed of additional tobacco; Otlja MD 159–78.
4. Seed of Oriental tobacco; Jaka MD–80.

Spraying (application of product) is made by using magnetic stirrer.

Before setting up the experiment, seed germination was determined in laboratory.

Determination of field germination was done according to standard methods in 4 replications.

Filed germination is expressed as a percentage relative to the number of sowed seeds (1 trial=300 seeds/1 m^2). Area of experiment was 96 m^2.

The differences in germination changes are expressed with absolute and relative values. Interdependence between treatments was determined through correlation coefficients.

Results and discussion

Values of field germination in all cases were lower than laboratory germination. They ranged between 68–85% with the control in field conditions of laboratory germination. Field germination of treated seeds was 70–83% of value of germination of treated seed in laboratory conditions. Based on these values it can be stated that filed germination of untreated seed was lower for 15–32%, and 17–30% for treated seed. Relatively smaller difference is noticed with treated seed. (Table 1, Table **2** and Table 3).

Analysis of the average results of tests in field conditions showed the following:

–average number of germinated seeds in control for all genotypes was 17 seeds less comparing to laboratory germination;

–the smallest difference is with Jaka MD–80 variety (–13) and the biggest with Burley DKH–28 and Srem 47 (–20), Table 4.

–with treated seeds the difference is approximate to the untreated seeds and has value of –13, in other words, –23 germinated seeds less;

–the smallest difference is with Otlja MD 159–78 variety and the biggest with Burley DKH–28 variety, Table 4.

The change of field germination due to the influence of spraying the seeds, expressed in absolute and relative values was (regardless of seed age) from 1–36 germinated seeds more compared with untreated seeds . (Table 1, Table **2** and Table 3).

a) FIELD GERMINATION OF 2 YEAR OLD SEED

Seed germination from control tests was high with all varieties, except with Jaka MD–80 (Table 1). Untreated seed of this variety had a very low germination, amounted with 27%. By treating this seed, 36 germinated seeds more were obtained, so that the total germination amounted with 63%, which in relative values presents an increase of 133% (Table 1).

The effect of Agrostemin was not stated with other genotypes, which naturally is a consequence of high germination of their seed.

b) FIELD GERMINATION OF 4 YEAR OLD SEED

With varieties Burley DKH–28 and Jaka MD–80, field germination of sprayed seed ranged between 53 and 50% and it was higher by 8, i.e. 5 germinated seeds compared to control. Treatment of the seeds with higher germination did not affect the increase of their germination, which is seen from the value produced by the seed variety Srem 4–7 and Otlja MD 159–73 (Table 2).

c) FIELD GERMINATION OF 6 YEAR OLD SEED

Field germination of untreated seed ranged between 36% with Otlja MD 159–78 to 72% with Jaka MD–80 (Table 3). Treatment of the seed of these genotypes has not affected cardinal changes of germination, which is indicated by the values for the number of germinated seeds (2–5 germinated seeds more) (Table 3).

The interest of this research was stating the interdependence of the treatments applied. According to data in Table 5 it can be stated that older seeds in laboratory conditions depended on treatment with the product more than younger seeds. In the case of field germination, it is noticed that only the 4 – year – old seed significantly depended on treatment, which was not the case with other alternatives. Finally, seed germination in field conditions had a significant dependence on laboratory germination.

Conclusion

The results of examinations performed have shown the following:

– field germination of untreated seed depended on the amount of laboratory germination;

– seed age did not affect the amount of field germination;

– reatment of the seed had a bigger effect on changes of laboratory rather than field germination;

– treatment of the seed had a higher positive effect on the seed of a lower than with the seed of a high germination.

Table 1 – Results of research on field germination
a) seed age: 2 years

Ord. No.	Variety	Indicator	Treatments		Difference	
			T_1	T_2	A	R
1.	Burley DKH–28	–laboratory germination (%)	84	87	+3	+4
		–field germination (%)	61	62	+1	+2
		–% compared to laboratory germination	72	71	–	–
2.	Srem 47	–laboratory germination (%)	94	90	–4	–4
		–field germination (%)	73	73	–	–
		–% compared to laboratory germination	77	81	–	–
3.	Otlja MD 159–78	– laboratory germination (%)	76	76	–	–
		– field germination (%)	61	63	+2	+3
		–% compared to laboratory germination	80	83	–	–
4.	Jaka MD–80	–laboratory germination (%)	32	90	+58	+181
		–field germination (%)	27	63	+36	+131
		–% compared to laboratory germination	85	70	–	–

T_1 – control; T_2 – treated; A – absolute; R – relative

Table 2 – Results of research on field germination
b) seed age: 4 years

Ord. No	Variety	Indicator	Treatments Difference			
			T_1	T_2	A	R
1.	Burley DKH–28	– laboratory germination (%)	57	70	+13	+23
		– field germination (%)	45	53	+ 8	+18
		–% compared to laboratory germination	79	76	–	–
2.	Srem 47	– laboratory germination (%)	63	67	+ 4	+ 6
		– field germination (%)	50	52	+ 2	+ 4
		–% compared to laboratory germination	80	78	–	–
3.	Otlja MD 159–78	– laboratory germination (%)	81	80	– 1	– 1
		– field germination (%)	63	64	+ 1	+ 1
		–% compared to laboratory germination	77	80		
4.	Jaka MD–80	– laboratory germination (%)	56	69	+13	+17
		– field germination (%)	45	50	+ 5	+12
		–% compared to laboratory germination	80	72	–	–

T_1 – control; T_2 – treated; A – absolute; R – relative

Table 3 – Results of research on field germination
c) seed age: 6 years

Ord. No.	Variety	Indicator	Treatments Difference			
			T_1	T_2	A	R
1.	Burley DKH–28	– laboratory germination (%)	82	89	+7	+9
		– field germination (%)	57	62	+5	+9
		–% compared to laboratory germination	70	70	–	–
2.	Srem 47	– laboratory germination (%)	80	81	+1	+1
		– field germination (%)	54	57	+3	+6
		–% compared to laboratory germination	68	70	–	–
3.	Otlja MD 159–78	– laboratory germination (%)	48	49	+1	+2
		– field germination (%)	36	38	+2	+6
		–% compared to laboratory germination	75	77		
4.	Jaka MD–80	– laboratory germination (%)	95	91	–4	–4
		– field germination (%)	72	75	+3	+4
		–% compared to laboratory germination	75	82	–	–

T_1 – control; T_2 – treated; A – absolute; R – relative

Table 4– Effect of Agrostemin bioregulators on field germination
d) seed age: 2, 4 i 6 years

Ord. No.	Variety	Seed age (god.)	Germination (%)				± difference	
			laboratory		field		Number of germinated seeds	
			T_1	T_2	T_1	T_2	$T_1 - T_{1P}$	$T_2 - T_{2P}$
1.	Burley DKH–28	2	84	82	61	62	+23	+25
		4	57	70	45	53	+12	+17
		6	82	89	57	62	+25	+27
		Average:	74	82	54	59	+20	+23
2.	Srem 47	2	94	90	73	73	+21	+17
		4	63	67	50	52	+13	+15
		6	80	81	54	57	+26	+24
		Average:	79	79	59	61	+20	+18
3.	Otlja MD 159–78	2	76	76	61	63	+15	+13
		4	81	80	63	64	+18	+16
		6	48	49	36	38	+12	+11
		Average:	68	68	53	55	+15	+13
4.	Jaka MD–80	2	32	90	27	63	+5	+27
		4	56	69	45	50	+11	+19
		6	95	91	72	75	+23	+16
		Average:	61	83	48	63	+13	+20

T_1 control; T_{1P} control – field germination
T_2 treated; T_{2P} treated – field germination

Table 5 – Coefficients of correlation between analyzed treatments

Treatments	Seed age (year)	r
Laboratory germination T_1 / T_2	2	0,184
	4	0,897 ^{x}
	6	0,974 ^{xx}
Field germination T_1 / T_2	2	0,229
	4	0,952 ^{xx}
	6	0,751
Laboratory/field germination	2	0,992 ^{xx}
	4	0,999 ^{xx}
	6	0,889 ^{x}

T_1 control; T_2 treated; ^{x} , ^{xx} – significant on the level of 0,05 and 0,01


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WORLDWIDE RECOGNITIONS

Gold Medal of World Organization for Intellectual property (WIPO)

ORGANISATION MONDIALE DE LA PROPRIÉTÉ INTELLECTUELLE

DIPLÔME

YOUGOSLAVIE 1987

La médaille d'or de l'OMPI
pour la meilleure femme-inventeur
de Yougoslavie en 1987
est décernée

au **Docteur Danica Gajic**

pour **l'invention «AGROSTEMIN»**

Genève et Dubrovnik
Mai 1988

Arpad Bogsch
Directeur général de
l'OMPI