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INFLUENCE OF SOME FOLIAR SUBSTANCES IN THE PRODUCTION OF TOBACCO SEEDLINGS

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ABSTRACT

Study on the effect of some foliar products in tobacco seedlings production was conducted in 2012 at the Experimental field of Tobacco Institute - Prilep. Trials were performed with four organic foliar products (Slavol, SCD Probiotics – EMa, Bioflor and Energy) combined with one fertilization with ammonium-nitrate and two fertilizations with foliar products, including three fertilizations with foliar products only.
The investigated products have a positive effect on plants with roots, increasing their length from 20.00% to 33.68% and on plants without roots, which were 35.84% to 56.22% longer compared to the check.
They also have positive effect on the number of plants suitable for transplanting. In the variant fertilized with ammonium nitrate and Bioflor, the number of these plants was 38.33% higher compared to the check.
The investigated foliar products did not give positive results in the increase of the root system length.
It can be stated that investigated organic products (Slavol, Bioflor, SCD Probiotics – EMa and Energy) can be used for foliar fertilization of tobacco seedlings, individually or in combination with easily soluble mineral fertilizer ammonium nitrate.

Keywords: tobacco seedlings, foliar fertilization, Slavol, SCD Probiotics -EMa, Bioflor

ВЛИЈАНИЕ НА НЕКОИ ФОЛИЈАРНИ СРЕДСТВА ВО ПРОИЗВОДСТВОТО НА ТУТУНСКИ РАСАД

Испитувањата за влијанието на некои фолијарни средства во производството на тутунски расад се извршија во 2012 година на Опитното поле од Научниот институт за тутун – Прилеп. Испитувањата се направени со четири органски фолијарни средства (Slavol, SCD Probiotics – EMa, Bioflor и Energy во комбинација со едно прихранување на амониум-нитрат и две прихранувања од фолијарните средства, како и три фолијарни прихранувања само со фолијарните средства.
Испитуваните средства за прихранување имаат позитивно влијание врз зголемувањето на должината на растенијата со корен од 20,00% до 33,68%, а растенијата без корен од 35,84 до 56,22% во однос на контролата.Тие влијаат позитивно и врз зголемувањето на бројот на растенија погодни за расадување. Кај варијантата прихранувана со амониум нитрат и со фолијарното средство Bioflor, бројот е зголемен за 38,33% во однос на контролата.
Испитуваните фолијарни средства недале позитивни резултати во зголемувањето на должината на кореновиот систем во однос на контролата.

Од испитувањата се констатира дека органските средства Slavol, Bioflor, SCD Probiotics – EMa и Energy може да се употребуваат за фолијарно прихранување на тутунскиот расад, посебно или во комбинација со лесно растворливото минерално ѓубре амониум нитрат.

Клучни зборови: тутунски расад, фолијарно прихранување, Slavol, SCDProbiotics -EMa, Bioflor

INTRODUCTION

Foliar fertilization is a technique of feeding plants through the leaves. It is not a substitute for basic or initial fertilization, but allows rapid compensation of plant needs for some important nutrients. With foliar fertilization, utilization of nutrients increases to almost 90% and with soil fertilization it is only 10%. All nutrients that can be received through the root can also be received through the leaf. Scientific research on foliar fertilization dates from about 40 years ago.

In recent years, foliar fertilizers have been obtained by extraction of organic fertilizers from Californian worms, applying the technology of beneficial microorganisms, along with addition of biostimulators, plant hormones, certain mineral elements and natural components for protection from diseases and pests. These fertilizers directly affect the biochemical and physiological processes in plants and indirectly the increase of microbiological activity of soil, which results in increase of nutrient uptake by the plants.

Little research has been done on the use of organic foliar fertilizers in the production of tobacco seedlings. For this reason, the subject of this paper is to study the application of several foliar fertilizers, separately or in combination with easily soluble nitrogen fertilizer. Our aim was to determine the effects of their application in obtaining healthy and good quality seedlings, as a condition for stable and efficient tobacco production. The available literature data mainly refers to nutrition of tobacco seedlings with easily soluble nitrogen fertilizers (Chile saltpeter NaNO3 and nitromonkal KAN), but also to the number and time of their application.

Benkovic (1964) recommends feeding of tobacco seedlings with KAN and states that the best time for application is when young seedlings develop the first pair of true leaves with approximate size of a nail. Then it is necessary to apply a single fertilization with 150 - 200 g/10 m^2 KAN per seedbed. However, previously non-fertilized soils need a second fertilization with 150g KAN per seedbed. The second fertilization usually takes place seven days after the first one. Donev (1981) reports that the first feeding should be performed with 10 g/m^2 ammonium nitrate when the seedbed is completely green, the second prior to the rapid growth stage with 15-20 g/m^2 and the third one with the same amount of fertilizers, depending on the condition of seedlings. Seedlings should not be fertilized the last ten days before transplanting in field. Dražic (1995) recommends the first feeding to be done with the emergence of the first pair of leaves and the second one 7 to 10 days after, with 15-20 g/m^2 amount of KAN.

Dimitrov et al. (2005) recommend the first feeding to be made in the 4th-leaf stage with 15 g/m^2, the second one in the stage of rapid growth with 20-25 g/m^2 and the third with 10-15 g/m^2 ammonium nitrate.

Gveroska at al., (2012) reported that tobacco seedlings treated with probiotic ProBio Origina ^{tm} have the highest length of the root system, which is particularly important for successful transplanting.

MATERIAL AND METHODS

Aromatic oriental tobacco Prilep P-66-9/7 was used as material for work. Investigations were carried out at the Experimental field of the Scientific Tobacco Institute - Prilep in 2012 with the following variants:

1. Check (Ø) – non-fertilized

2. Ammonium nitrate (34.4%) –first feeding with 10 g/m^2, second feeding with 15 g/m^2 and third feeding with 20 g/m^2
3. Ammonium nitrate (34.4%) - one feeding with 10 g/m^2 + two foliar feedings with 1% Slavol solution
4. Ammonium nitrate (34.4%) - one feeding with 10 g/m^2 + two foliar feedings with 0.1% Energy solution
5. Ammonium-nitrate (34.4%) – one feeding with 10 g/m^2 + two foliar feedings with 10% Bioflor solution
6. Ammonium nitrate (34.4%) - one feeding with 10 g/m^2 + two foliar feedings with 10% SCD Probiotics -EMa solution
7. Slavol - three foliar feedings with 1% solution
8. Energy - three foliar feedings with 0.1% solution
9. Bioflor - three foliar feedings with 10% solution
10. SCD Probiotics -EMa - three foliar feedings with 10% solution

The first foliar feeding of seedlings was applied on 29.4.2012, the second on 7.5.2012 and the third one on 16.5.2012. The required preventive treatments were also applied to protect seedlings from diseases and pests.

Total length of seedlings (stalk and root), length of seedlings without root, length of root, seedlings weight, leaf number of the seedlings, number of plants suitable for transplanting and length of the period of seedlings production were the subject of this research.

The following mineral and organic-mineral fertilizers were used in the research: Ammonium nitrate - the nitrate salt of ammonium, with chemical formula NH_{4NO3}. It contains 34-35% nitrogen, half of which is in the form of ammonium (NH4), and the other half in the form of nitrate (NO3). Producer – Russia.

ENERGY – organic foliar fertilizer rich in organic bioactive substances extracted from the mineraloid leonardite. It is composed of humic acid, fulvo acid, plant extracts and natural biostimulators (vitamins, ferments). Producer – Agromarket Igor, Strumica, R. Macedonia.

BIOFLOR – liquid organic microbiological fertilizer. The basis of Bioflor is the manure obtained from Californian worms. Producer – Indus Dooel, Skopje, R.Macedonia

SCD PROBIOTICS - EMa - liquid organic microbiological fertilizer. composed of natural ingredients, based on the principle of "effective microorganisms (EM). Presently, it consists of four groups of microorganisms: lactic acid bacteria, photosynthetic bacteria, yeasts and actinomycetes. Producer – SCD Probiotics, USA.

SLAVOL - natural bioorganic fertilizer containing bacteria (nitrogen-fixing bacteria and phosphate-mineralizators), natural vitamins and growth stimulators. It is universally certified fertilizer that can be used in organic and traditional farming. Producer – Agrounik, doo Beograd, Serbia.

RESULTS AND DISCUSSION

Foliar feeding is often called "strengthening" of tobacco seedlings. According to the investigations, all tested products show stimulating effects on growth and quality of tobacco seedlings and on the number of plants suitable for transplanting. The presented data represent the average values obtained from 10 replicates. The obtained results of foliar application will be compared with variant 1 (non-fertilized check) and variant 2 (traditional mode of feeding).

Total length of seedlings (stalk and root)

The applied foliar products have a positive impact on seedlings length, i.e. on their growth and development.

The length of seedlings ranged from

approximately 19.0 cm in the check variant 1 (non-fertilized) to 22.8 cm in variant 2,fertilized only with ammonium nitrate (Table 1).

Table 1. The effect of foliar feeding on seedlings length (cm)

No.	Variants		%	%	%
1	Non-fertilized check (Ø)	19.0	100.00	83.33	-
2	$AN^{0)}$ 34.4% - $F^{3)}$	22.8	120.00	100.00	-
3	$AN^{0)}$ 34.4% - $F^{1)}$ + Slavol–$F^{2)}$	23.8	125.26	104.38	100.00
4	$AN^{0)}$ 34.4% -$F^{1)}$+ SCD Probiotics –Ema–$F^{2)}$	23.5	123.68	103.07	100.00
5	$AN^{0)}$ 34.4% - $F^{1)}$ + Bioflor–$F^{2)}$	22.8	120.00	100.00	100.00
6	$AN^{0)}$ 34.4% - $F^{1)}$ + Energy–$F^{2)}$	25.4	133.68	111.40	100.00
7	Slavol –$F^{3)}$	24.7	130.00	108.33	103.78
8	SCD Probiotics –Ema – $F^{3)}$	24.9	131.05	109.21	105.96
9	Bioflor – $F^{3)}$	24.2	127.36	106.14	106.14
10	Energy – $F^{3)}$	23.2	122.10	101.75	91.34

$AN^{0)}$ –Ammonium nitrate	LSD
$F^{1)}$ - One feeding	5% = 0.73 cm
$F^{2)}$ – Two feedings	1% = 0.97 cm
$F^{3)}$ –Three feedings	0.1% = 1.26 cm

Compared to the check, the length of seedlings in variants with combined fertilization increases from 20.00% in variant 5 to 33.68% in variant 6; compared to variant 2 the increase of length ranges from 3.07% in variant 4 to 11.40% in variant 6.

Variants 7,8,9 and 10 fertilized only with foliar products also increased the seedlings length from 22.10% in variant treated with Energy to 31.05% in variant treated with SCD Probiotics-Ema. Compared to variant 2, the increase ranged from 1.75% with Energy to 9.21 % with SCD Probiotics-Ema.

Compared to combined fertilization, fetilization with foliar products only increased the length of the seedlings from 3.78% with Slavol to 6.14 % with Bioflor, and with application of Energy the length decreased for 8.66%. The highest increase was obtained in variant 6, fertilized with combination of ammonium nitrate and Energy.

The statistical analysis of data shows significant differences in all variants fertilized with foliar product compared to the check.

Length of seedlings without root

The length of tobacco seedlings without root is another important trait for determination of quality. Some of the seedlings are stunted in growth, with unusually developed root. These plants should not be transplanted in field because they give lower yields.

From the presented data on the length of tobacco seedlings without root (Table 2), the same conclusion can be made as for the seedlings with root: in all variants where foliar treatment was applied, the length of the stalk with leaves is greater compared to the check variant.

Table 2. The effect of foliar feeding on the length of seedlings without root (cm)

No.	Variants		%	%	%
1	Non-fertilized check (Ø)	13.2	100.00	72.52	-
2	$AN^{0)}$ 34.4% - $F^{3)}$	18.2	137.35	100.00	-
3	$AN^{0)}$ 34.4% - $F^{1)}$ + Slavol – $F^{2)}$	19.2	144.90	105.49	100.00
4	$AN^{0)}$ 34.4% - $F^{1)}$ + SCD Probiotics –Ema – $F^{2)}$	19.7	148.67	108.24	100.00
5	$AN^{0)}$ 34.4% - $F^{1)}$ + Bioflor – $F^{2)}$	18.0	135.84	98.90	100.00
6	$AN^{0)}$ 34.4% - $F^{1)}$ + Energy – $F^{2)}$	20.0	150.94	109.89	100.00
7	Slavol – $F^{3)}$	20.7	156.22	113.73	107.81
8	SCD Probiotics –Ema – $F^{3)}$	19.8	149.43	108.79	110.00
9	Bioflor – $F^{3)}$	19.4	146.41	106.59	107.78
10	Energy – $F^{3)}$	18.9	142.64	103.84	94.50

$AN^{0)}$ - Ammonium nitrate

$F^{1)}$- One feeding

$F^{2)}$ – Two feedings

$F^{3)}$ - Three feedings

LSD

5% = 1.17 cm

1% = 1.55 cm

0.1% = 2.01 cm

The length of seedlings without root ranges from 13.25 cm in the check to 18.2 cm in variant 2. So, in this variant, the feeding resulted in 37.35% higher average length of the stalks compared to the check, which means that nitrogen application has a significant effect on growth and development of tobacco plants.

In combined feeding, the length increase in plants without root ranges from 35.84% (variant 5, $AN^{0)}$ + Bioflor) to 50.94% (variant 6, $AN^{0)}$ + Energy), and in variant 2 the increase ranges from 5.49% in variant 3 to 9.89% in variant 6. Only in variant 5 ($AN^{0)}$ + Energy) plants without root showed 1.10% lower length compared to the plants in variant 2.

Compared to the check, feeding only with foliar products increased the length of seedlings from 42.64% in variant 10 (Energy) to 56.22% in variant 7 (Slavol). Compared to variant 2, the increase of seedlings length ranges from 3.84% in variant 10 to 13.73% in variant 7.

The analysis of variance and LSD test show high statistical significance of the values obtained in all investigated variants compared to the check, indicating that differences in length of the above-ground part of plants between the check and fertilized variants are result of the activity of applied products.

Length of root

The aim of feeding is to provide fast and good quality nutrition to tobacco seedling, i.e. to allow normal growth and development both of its above-ground parts and the root system. In our trials (Table 3), the highest average root length of 5.8 cm was obtained in the check variant. This was expected, because the availability of nutrients in the soil affects the development of the root system. In the opposite case, when the amount of nutrients is not sufficient, plants are forced to develop their roots in lower layers of soil in search for food, as is the case with the check (non-fertilized variant).

In variant 2, the average root length is 4.6 cm, which is 1.15 cm (about 20.00%) less than the check variant,.

Table 3. The effect of foliar feeding of seedlings on root length (cm)

No.	Variants		%	%	%
1	Non-fertilized check (Ø)	5.75	100.00	125.0	-
2	AN$^{0)}$ 34.4% - F$^{3)}$	4.6	80.00	100.00	-
3	AN$^{0)}$ 34.4% - F$^{1)}$ + Slavol – F$^{2)}$	4.4	76.52	95.65	100.00
4	AN$^{0)}$ 34.4% - F$^{1)}$ + SCD Probiotics –Ema – F$^{2)}$	5.3	92.17	115.22	100.00
5	AN$^{0)}$ 34.4% - F$^{1)}$ + Bioflor – F$^{2)}$	4.6	80.00	100.00	100.00
6	AN$^{0)}$ 34.4% - F$^{1)}$ + Energy – F$^{2)}$	5.5	95.65	119.56	100.00
7	Slavol – F$^{3)}$	5.6	97.39	121.74	127.27
8	SCD Probiotics –Ema – F$^{3)}$	5.1	88.69	110.87	96.23
9	Bioflor – F$^{3)}$	4.9	85.21	106.52	106.52
10	Energy – F$^{3)}$	4.3	74.78	93.48	78.18

AN$^{0)}$ - Ammonium nitrate

F$^{1)}$- One feeding

F$^{2)}$ – Two feedings

F$^{3)}$ - Three feedings

LSD

1% = 0.68 cm

0.1% = 0.88 cm

The root length in variants with combined fertilization ranged from 4.4 cm in the variant with ammonium nitrate + Slavol, to 5.5 cm in the variant with ammonium nitrate + Energy. Of all variants with combined fertilization, the best results were obtained in variant 6 (AN$^{0)}$ + Energy). The average root length in this variant was 5.5 cm, which is higher than in the other variants (3, 4, 5) where combined fertilization was applied.

In all variants with foliar feeding a decrease of the root length was observed. The lowest decrease compared to the check was estimated in variant 7 (2.61%) and the highest in variant 10 (25.22%). Comparison between variants with foliar feeding and variant 2 shows that the use of the above products, except for variant 10, gave better results and increased the root length from 6:52% in variant 9 to 21.74% in variant 7.

Comparison between the variants with combined feeding and those with foliar application reveals that the best results were obtained in variant 7, where the increase of root length was 27.27%. The decrease of root length in tobacco seedlings as a result of feeding was confirmed through statistical processing of data by the analysis of variance and LSD test. The decrease of root length ranged from 0.1% in variants 2, 3, 5 and 10 to 1% in variant 9.

Seedlings weight

Weight of the seedlings is a parameter which indicates that tobacco plants, under the influence of fertilization, formed a well developed plant mass with adequate supply of nutrients, which promises successful transplanting and acceptance of tobacco in field (Table 1).

The lowest amount of organic matter was formed in the check variant, with an average weight of 5.09 g/plant. Positive impact on formation of organic matter was observed in Variant 2, which had an average weight of 6.04 g/plant, or 18.66% higher than the check.

Higher average weight of seedlings was observed in all variants with combined fertilization. The increase of seedlings weight in relation to the check ranges from 16.30% in variant 5 to 30.45% in variant 3.

Foliar feeding also showed a positive effect

on seedlings weight. Compared to the check, the increase of weight ranged from 16.64% (variant 7) to 25.73% (variant 10).

Table 4. The effect of foliar feeding on seedlings weight (g)

No.	Variants		%	%	%
1	Non-fertilized check (Ø)	5.09	100.00	84.27	-
2	$AN^{0)}$ 34.4% - $F^{3)}$	6.04	118.66	100.00	-
3	$AN^{0)}$ 34.4% - $F^{1)}$ + Slavol – $F^{2)}$	6.64	130.45	109.93	100.00
4	$AN^{0)}$ 34.4% - $F^{1)}$ + SCD Probiotics –Ema – $F^{2)}$	5.98	117.48	99.00	100.00
5	$AN^{0)}$ 34.4% - $F^{1)}$ + Bioflor – $F^{2)}$	5.92	116.30	98.01	100.00
6	$AN^{0)}$ 34.4% - $F^{1)}$ + Energy – $F^{2)}$	6.18	121.41	102.31	100.00
7	Slavol – $F^{3)}$	6.09	116.64	100.82	91.72
8	SCD Probiotics –Ema – $F^{3)}$	6.37	125.14	105.46	106.52
9	Bioflor – $F^{3)}$	5.77	113.35	95.52	97.47
10	Energy – $F^{3)}$	6.40	125.73	105.96	103.56

$AN^{0)}$ - Ammonium nitrate

$F^{1)}$- One feeding

$F^{2)}$ – Two feedings

$F^{3)}$ - Three feedings

LSD

5% = 0.68 cm

1% = 0.73g

0.1% = 0.95g

Comparison between variants 3,4,5 and 6 and variants 7,8,9 and 10 shows that variants 8 and 10 with applied foliar feeding showed better results in the increase of seedlings weight than variants 4 and 6 with combined fertilization, while variants 7 and 9 showed lower effect than variants 3 and 5.

The statistical analysis of data shows a presence of statistical significance, indicating that fertilized plants have higher weight due to the activity of the feeding products.

Leaf number of the seedlings

Important trait in the production of tobacco seedlings is the number of leaves formed on the stalk in the period prior to transplanting. The average number of leaves in the check variant is 6.4, and in variant 2 it is 6.8.

In all variants with combined feeding as well as in those fertilized with foliar product, the average leaf number is 6.8 (in variants 3, 4, 5, 6, 7 and 9) and 6.7 (variants 8 and 10).

The presented data show that the effect of feeding is negligible but, compared to the check, there is still some increase in the number of leaves, ranging from 4.68% to 6.25%.

Table 5. The effect of foliar feeding on leaf number of the seedlings

No.	Variants		%	%	%
1	Non-fertilized check (Ø)	6.4	100.00	94.11	-
2	$AN^{0)}$ 34.4% - $F^{3)}$	6.8	106.25	100.00	-
3	$AN^{0)}$ 34.4% - $F^{1)}$ + Slavol – $F^{2)}$	6.8	106.25	100.00	100.00
4	$AN^{0)}$ 34.4% - $F^{1)}$ + SCD Probiotics –Ema – $F^{2)}$	6.8	106.25	100.00	100.00
5	$AN^{0)}$ 34.4% - $F^{1)}$ + Bioflor – $F^{2)}$	6.8	106.25	100.00	100.00

6	AN[0] 34.4% - F[1] + Energy – F[2]	6.8	106.25	100.00	100.00
7	Slavol – F[3]	6.8	106.25	100.00	100.00
8	SCD Probiotics –Ema – F[3]	6.7	104.68	98.52	98.53
9	Bioflor – F[3]	6.8	106.25	100.00	100.00
10	Energy – F[3]	6.7	104.68	98.52	98.53

AN[0] - Ammonium nitrate
F[1] - One feeding
F[2] – Two feedings
F[3] - Three feedings

LSD
5% = n.s.
1% = 0.73g
0.1% = 0.95g

In addition, it should be noted that leaf number is a distinctive trait of tobacco seedlings which is difficult to change, even with better nutrition of plants.

Number of plants suitable for transplanting

The lowest number of suitable plants was found in the check - 9600 plants/10m^2 (Table 6). In variant fertilized with ammonium nitrate, the average number of suitable plants was 11680/10m^2, which is 21.66% higher than the check.

Table 6. The effect of foliar feeding on the number of plants suitable for transplanting

No.	Variants	10m^2 (1 seedbed)	%	%	%
1	Non-fertilized check (Ø)	9600	100.00	82.19	-
2	AN[0] 34.4% - F[3]	11680	121.66	100.00	-
3	AN[0] 34.4% - F[1] + Slavol – F[2]	11360	118.33	97.26	100.00
4	AN[0] 34.4% - F[1] + SCD Probiotics –Ema – F[2]	11520	120.00	98.63	100.00
5	AN[0] 34.4% - F[1] + Bioflor – F[2]	13280	138.33	113.70	100.00
6	AN[0] 34.4% - F[1] + Energy – F[2]	12800	133.33	109.59	100.00
7	Slavol – F[3]	12000	125.00	102.74	105.63
8	SCD Probiotics –Ema – F[3]	11840	123.33	101.37	102.78
9	Bioflor – F[3]	12480	130.00	106.85	91.76
10	Energy – F[3]	12160	126.66	104.11	95.00

AN[0] - Ammonium nitrate
F[1] - One feeding
F[2] – Two feedings
F[3] - Three feedings

With combined fertilization, the number of plants suitable for transplanting increased from 18:33% (variant 3) to 38.33% (variant 5) compared to the check, while feeding with foliar products increased it from 23.33% to 30.00%.

The increased number of seedlings suitable for transplanting is a result of feeding, either by soil or foliar application, because availability of nutrients allows higher photosynthetic activity and thereby better growth and development of higher number of plants per unit area.

.Length of the period of seedlings production

The length of the period of seedlings production (from sowing the seed to transplanting) is very important for production of a good quality tobacco. In our investigations, the seedlings were ready for transplanting in about 44 days, except for the non-fertilized check which took another 4-6 days to reach the appropriate size for transplanting.

CONCLUSIONS

- Feeding the seedlings with ammonium-nitrate and organic foliar products (separately or in combination) has a significant impact on the increase of seedlings length. The best results for this parameter were obtained in variant 6, fertilized with ammonium nitrate and Energy.
- Feeding of tobacco seedlings also resulted in increase of their weight, which is evident in all the varieties investigated. The best effect on this trait was achieved in variant 3, fertilized with ammonium nitrate and Slavol, which gave 30.45% increase of weight compared to the check.
- Feeding with foliar products had no effect on the increase of root system length. The best results for this trait were obtained in the check variant.
- Feeding of tobacco seedlings has a positive impact on the increase of the number of plants per unit area that are suitable for transplanting. Most of the suitable plants were obtained in variant 5, fertilized with ammonium nitrate and foliar product Bioflor.
- According to the obtained results, the investigated organic foliar products Slavol, Bioflor, SCD Probiotics-EMa and Energy can be used for foliar feeding of tobacco seedlings separately or in combination with easily soluble mineral nitrogen fertilizers such as ammonium nitrate.

REFERENCES

1. Беака Х., 1951. Можности за добивање на ран и здрав тутунски расад. Тутун бр. 2 стр. 33-42. ЈНУ Институт за тутун – Прилеп.
2. Benković F., 1964. Proizvodnja virdžinijskog duhana u Posavini, str.32-38. Sarajevo.
3. Гвероска Б., Смоквоски М., Кочоска К., Ристески И., 2012. Влијание на пробиотикот ProBio Original™ врз развојот на тутунскиот расад.Web - http://tip.edu.mk.
4. Димитров А., Бозуков Х., Николов П., Драчев Д., 2005. Тютюнопроизводство за фармери, стр,46-47, София.
5. Дражиќ С., 1995. Производња дувана. Пољо Књига, стр. 42-44. Београд.
6. Ивановски И., 2012. Фолијарно прихранување со минерални ѓубрива на домати одгледувани во заштитени простори. Магистерски труд. Факултет за земјоделски науки и храна - Скопје.
7. Јекиќ М., Џекова М., 1985. Агрохемија II дел, Скопје.
8. Митрески М., 2012. Компаративни проучувања на поважните производни, технолошки и квалитетни својства кај некои сорти тутун од типот прилеп. Докторска дисертација. Научен институт за тутун - Прилеп.
9. Филипоски К., 2011. Статистички методи во земјоделските истражувања. Одбрани

поглавја. Научен институт за тутун-Прилеп.

10. http://scindeks.ceon.rs/article Efektivnost primene mikrobiološkog đubriva Slavola u biljnoj proizvodnji. 01.09.2013.
11. http://www.agroinfotel.net. Mikrobioloska dzubriva. 1.9.2013.
12. http://www.bioflor.com.mk (21.3.2012).
13. ww.agromarketigor.mk(20.3.2012).