

THE INFLUENCE OF SOME OF THE CHEMICALS TOWARDS TOBACCO SEEDS GERMINATION OF TOBACCO BURLEY VARIETY PELAGONEC

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ABSTRACT

All the research in 2012 were been performed on the seed material from the Burley tobacco variety Pelagonec, produced in year 2011. The seeds were treated with chemicals such as potassium nitrate (KNO₃) with concentration 0.2 and 0.4%, with gibberellic acid (GA₃) with concentration 0.05 and 0.08%, and they were also treated with an universal microbiological preparation Terra Biosa (ProBios) with two concentrations 100 ml and 150 ml diluted in 1l water (also there were two variants).

The research for the influence of the previously mentioned substances towards the germination of the seeds of tobacco variety Pelagonec, were being performed in the Laboratory for seed quality control of agricultural plants-L01. From the research we have established that the treatment with KNO₃ with concentration of 0.2% water solution gave the best results. The lowest seed germination was recorded in variant treated with Terra Biosa (150 ml in 1l water). The results presented here showed that KNO₃ with concentration of 0.2% water solution could be used to shorten the dormancy tobacco seed of the large leaf variety of Pelagonec which means increase germination energy and total germination.

Key words: tobacco seed, Burley-Pelagonec, potassium nitrate, gibberellic acid, Terra Biosa.

ВЛИЈАНИЕ НА НЕКОИ СРЕДСТВА ВРЗ ’РТЛИВОСТА НА ТУТУНСКОТО СЕМЕ ОД БЕРЛЕЈСКАТА СОРТА ПЕЛАГОНЕЦ

Истражувањата се вршеа во 2012 година на семенски материјал од берлејската сорта тутун-пелогонец, произведен во 2011 година. Семето се третираше со хемиските средства калиум нитрат (KNO₃) со концентрации од 0,2 и 0,4% (две варијанти), гиберелинска киселина (GA₃) со концентрации од 0,05 и 0,08% и со универзалното микробиолошко средство Terra Biosa (ProBios), во дози од 100 и 150 ml растворени во 1l вода (исто така две варијанти).

Испитувањата за влијанието на наведените средства врз ’ртливоста на семето од сортата пелогонец се изведоа во Лабораторијата за контрола на квалитетот на семето од земјоделски растенија - L01 при Научниот институт за тутун – Прилеп. Од истражувањата утврдивме дека најдобра варијанта е третманот со KNO₃ во концентрација од 0,2% воден раствор. Најслаба варијанта е третманот со Terra Biosa (150 ml во 1l вода).

Со употребата на KNO₃ во концентрација од 0,2% p-p се скратува (прекинува) периодот на мирување (дормантноста) кај тутунското семе од крупнолисната сорта пелогонец односно се зголемуваат енергијата на ’ртење и вкупната ’ртливост.

Клучни зборови: тутунско семе, берлеј-пелогонец, калиум нитрат, гиберелинска киселина, Terra Biosa.

INTRODUCTION

The agriculture as one of the most important sources for diet of the population is based on the production of seed materials. The seed is a foundation of the agriculture and biodiversity.

In order to have stable and good quality tobacco production, there should be healthy seedling which is related with the usage of high quality tobacco seed.

The tobacco seed as well as all the other plants' seeds is the carrier and transfer of the inherited characteristics of the progeny. That's why the world gives such significance on the type of the seed used during sowing. One part of the seed production chain is the laboratory testing of seed quality. In our country there are used book of regulations, for all the methods used for seed material quality control, which are coordinated with the international standards for seed quality analysis, established by International Testing Association (ISTA).

After the harvest we cannot use the seeds from the large leaves variety types (Burley and Virginia) for sowing, because the germination is on low level, which means that it's on normal level or beyond normal level of usage. This means that the seeds are dormancy i.e. they acquire certain period of inactivity in order to perform the needed physiological processes, after which the seed can germinate on normal or higher level. In this period of "maturing" among the previously mentioned tobacco types' seeds, last for about a year. In order to have improvement in the germination of the seeds so that they can be used next year for sowing after the harvest is over; a seed

treatment is being performed with different physical, chemical and microbiological substances.

Čirkovski (1954), has succeed with gibberellins treating to germinate for 10 days the seed of the wild type *Nicotiana glauca*, which hasn't shown any signs of germination when left in water for 258 days. Dima (2001), has pointed out that the seed germination can also be stimulated by performing ultrasound treatments, during which the vegetation period is being shorted, and the yield has been increased for 11-17%. She has also established that the treatment of the tobacco with indoleacetic acid with concentration of 0.01-0.05% which increases the germination energy up to 5-10% and the total germination for 8-13%. The thiourea of low concentrations has increased the total germination for 4-9%. Also the author emphasizes the fact that the seedling which is taken from the seed treated with these physiologically active substances is healthy and has given a significant increase of the yield.

These types of researches are very rare in our country because there is not enough information about the chemicals-stimulators which can be used for germination increase of the tobacco seeds. The purpose of our researches is to examine the influence of certain chemicals upon the period of dormancy of the seeds from the Burley tobacco variety-Pelagonec, there is improvement in the germination and great possibility of usage of the seed material in the following year after the harvest was performed.

MATERIAL AND METHODS

The research has used the tobacco seed type Burley more precisely the cytoplasmic male sterile variety Pelagonec, which was produced in year 2011, as a plant material. The both seeds from types Pelagonec as

well as Virginia have hard covering and longer period of inactivity, so in the year of production they show lower results when it comes to the energy of germination and total germination.

According to Risteski (2011), the variety Pelagonec (Photo. 1), was patented in year 2010. The stable and good yield (3800 up to 4350 kg/ha), with the typical Burley quality



Photo 1. Burley variety Pelagonec

During our researches we've used the following chemicals and microbiological preparation: potassium nitrate (KNO_3) gibberellic acid (GA_3) and Terra Biosa (ProBios).

- The potassium nitrate is colorless crystalline substance. It melts at temperature of 332 °C and at temperature of 400 °C it decomposes into potassium nitrate and oxygen. In certain concentrations can be used for breaking of the period of dormancy of the seed material.
- The gibberellic acid (GA_3) is used for regulation of the plants growth, and the low concentrations have high significance. Mainly it's used in the dosage between 0.01-10 mg/l. Higher concentrations have opposite effect. The gibberellins were established in 1898 by the Japanese scientists in a fungus, nowadays known as *Gibberella fujikuroi*. Up to now there are known 79 types of different gibberellins. GA_3 stimulates the growth of the stalk and root through fastening the mitotic cell partition in

makes this variety very attractive as well as for the producers and for the manufacturers. The seeds from this variety is very small, 0.085 g. per 1000 seed. (Photo. 2)



Photo 2. Tobacco seed from Pelagonec variety (adopted from Risteski, 2011)

several plants, but also it influences with increase in the seed germination. Also, it can be used in the laboratories and greenhouse for germination stimulation in some of the plants which otherwise would stay in hibernation.

- Terra Biosa (Pro Bios), it's a soil conditioner and a microbiological preparation which production is based on live cultures from probiotic bacteria. USA, Germany and Denmark are the most famous producers of Terra Biosa. During our research we've used the one produced in Germany with a Polish license. Terra Biosa is made by lactic bacteria, yeast, photosynthetic bacteria, and molasses from sugar cane, extracts from two dozen plants and clean not chlorinated water. This substance is used for quality improvement and the health status of all biological systems. Also, it can be used to treating the seed and seedling material for quality properties improvement.

Before we've conducted the researches we've implement the following variations:

1. Untreated control (\emptyset), a standard procedure
2. Variation with KNO₃ (0.2% solution)
3. Variation KNO₃ (0.4% solution)
4. Variation GA₃ (0.05% solution)
5. Variation GA₃ (0.08% solution)
6. Variation Terra Biosa (100 ml/l water)
7. Variation Terra Biosa (150 ml/l water)

All variations were examined in 4 repetitions, the tobacco seed was placed in four Petri dishes containing 100 seeds. The dishes were left to germinate in thermostat-germination type "Sutjeska" with constant temperature of 25 °C. The samples were germinated and analyzed for 16 days since the day when they were left in the thermostat.

The potassium nitrate was moisturizing the filter paper in the Petri dishes where the seeds were put in and from time to time distilled water was being poured.

The gibberellic acid (GA₃), as a tobacco seed germination stimulator, which was used for soaking the seed (2g) in the solution placed in glasses according to the previously established variations (concentrations of GA₃ 0.05-0.08%), with duration of 30 minutes. After which the seeds were placed on clean filter paper so that they could air

dried and then we've placed them in Petri dishes for further testing of the germination. Also we've used the universal microbiological preparation Terra Biosa, we've used it for soaking for 30 minutes in a solution with already mentioned dosage. After the drying process the seeds were placed on filter paper in the Petri dishes, moisturized with distilled water. On Photo 3 we can see the Petri dish with tobacco seed used for germination test.

All the research conducted are according to the Rules on the modus of work, spatial and technical equipment of the authorized laboratories and methods for quality investigations of seed material in plants (Official Gazette of the Republic of Macedonia, No. 61/2007).

The researches were being conducted in 12th of May 2012, in the Laboratory for seed quality control of agricultural plants-L01 at the Scientific Tobacco Institute- Prilep, accredited according MKC EN ISO/IEC 17025:2006.

The given results from germination energy and total germination were being compared with the control and statistically were processed with analysis of variance and Least Significant Difference test (LSD).

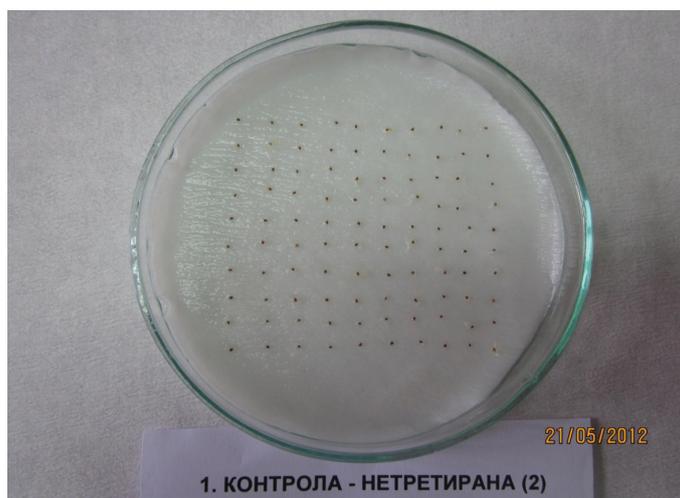


Photo 3. Petri dishes containing seeds for germination

RESULTS AND DISCUSSION

The results from the research are presented in their average values in the tables for easier comparison of all variants and having suitable and objective establishments.

Bogdančeski (1973), emphasizes that the treatment of the tobacco seeds from Prilep varieties Virginia and Burley have three different concentrations of the biological stimulators tryptophan, cortisone and gibberellins which can improve the germination energy and total tobacco seed germination of a certain concentration, while with the concentration increase the germination inhibition can be seen.

Jovičić et al., (2011), has cited Yamauchi, and he says that the previously activated phytochrome has influence on the synthesis of gibberellic acid which has positive influence on seed germination. Due to which the influence of the light towards seeds germination can be replace the treatment with phytochrome-gibberellins.

Dima (2001), has pointed out that the

gibberellins pulling out the seeds from the inactive phase and it stimulates the germination process. The author researches the large leaf variety Baragan 132, and has established that the procaine-hydrochlorate with concentration of 0.05; 0.1 and 0.2%, increases the germination energy from 7 to 14% and the total germination from 9 to 11% when compared with the control. The nicotine acid with concentration of 0.05-0.1% increases the germination energy for 8-10% when compared with the control, when it comes to the concentration which is 0.3% has lower the germination energy for 4% and the total germination energy for 5%. Author also points out that the seedling given by the seeds treated with physiologically active substances is healthy, and has significantly increased the yield.

In Table 1 the average values of the tobacco seed variety Pelagonec germination energy are presented (the seventh day since setting of the germination samples)

Table 1. Average values of tobacco seeds germination energy (%)

Number	Variants	Germination energy %	Variance		Rank
			Absolute	Relative	
1	Untreated Ø	78.25	/	100.00	5
2	KNO ₃ (0.2%)	88.00 ⁺⁺⁺	+ 9.75	112.46	1
3	KNO ₃ (0.4%)	76.25	- 2.00	97.44	6
4	GA ₃ (0.05%)	87.00 ⁺⁺⁺	+ 8.75	111.18	2
5	GA ₃ (0.08%)	78.75	+ 0.50	100.64	4
6	Terra Biosa (100 ml/1 вода)	80.25	+ 2.00	102.56	3
7	Terra Biosa (150 ml/1 вода)	67.25	- 11.00	85.94	7

0.05 = 3.53% +

LSD: 0.01 = 4.85% ++

0.001 = 6.60% +++

We can see that the best option for treating the seeds is treatment with 0.2 % solution of KNO₃, where the average value of energy of germination is 88 %, when compared

with the control (78.25 %), has a positive absolute difference of 9.75 %, while the relative difference showed a value of 12.46 % in preference of this variant.

The variations of GA₃ (0.05%) are with germination energy of 87% and Terra Biosa (100 ml/1 water) with germination energy of 80.25%. The rest of the variant with the highly concentration from the used substances gave low results and two of them are much lower than the control.

The statistical processing of the results has shown the difference of the variations of KNO₃ (0.2%) and GA₃ (0.05%), when it comes to the control they are statistically

signification, i.e. have higher significance because they are beyond the level of probability of 0.001%.

When it comes to the total tobacco seed germination (Table 2), the influence of the chemicals used is proportional with the germination energy, all variants have shown increase of the germinated seeds percentage in the period of total seed germination evaluation (at day 16, after the germination samples are set).

Table 2. Average values for the total tobacco seed germination (%)

Number	Variants	Total germination %	Variance		Rank
			Absolute	Relative	
1	Untreated Ø	82.75	/	100.00	5
2	KNO ₃ (0.2%)	90.00 ⁺⁺⁺	+ 7.25	108.76	1
3	KNO ₃ (0.4%)	81.25	- 1.50	98.19	6
4	GA ₃ (0.05%)	88.75 ⁺⁺	+ 6.00	107.25	2
5	GA ₃ (0.08%)	84.75	+ 2.00	102.42	4
6	Terra Biosa (100 ml/1 water)	88.25 ⁺⁺	+ 5.50	106.65	3
7	Terra Biosa (150 ml/1 water)	75.25	- 7.50	90.94	7

LSD: 0.05 = 3.69%⁺
 0.01 = 5.06%⁺⁺
 0.001 = 6.90%⁺⁺⁺

The treatment with KNO₃ (0.2%) can be seen as the most effective, because the seed has 90% germination, which is a positive absolute difference of 7.25% when compared with the control- untreated variant, which has total germination of 82.75%.

The results statistical processing has shown that: the treatment with KNO₃ (0.2%) is highly significant as well as the ones with GA₃ (0.05%) and Terra Biosa (100 ml/1 water) because the variance between the values on level of probability are 0.001 and 0.01%.

CONCLUSIONS

From the research we've made several conclusions:

- Out of all analyzed variants, the most intensive germination was seen during the fourth and seventh day since the seed samples for analyzes were set and the germination energy was determined.
- The lower concentration variants of chemicals have simulative effect on of the germination energy and total

germination, which means that the period of dormancy, is lower.

- The variants with higher concentrations have shown negative influence, they were inhibitors of the energy and the total tobacco seed germination.
- During the research the best results of several treatments were established with the variations with KNO₃ with concentration of 0.2% (88% germination

- energy and total germination of 90%), the ones with GA₃ with concentration of 0.05% (87% energy and total germination of 88.75%).
- The lowest seed germination was recorded in variant treated with Terra Biosa with dosage of 150 ml/1water (67.25% of which was germination energy and total germination of 72.25%).
 - With usage of KNO₃ (0.2%) and GA₃ (0.05%), the period of dormancy of the Burley variety Pelagonec is shortening and there is a greater possibility to be used in the first year of production.
 - According to us there should be more similar analyzes for the extended effect of the chemicals used during the process of seedling growth and tobacco transplantation in the fields.

REFERENCES

1. Bogdančeski M., 1973. Vlijanje na biostimulatorite vrz procentot na 'rtlivosta I niknenjeto na semeto kaj nekoi sorti tutun, Tutun br. 1-12, str. 25-32, JNU Institut za tutun – Prilep.
2. Dima A., 2001. Vlijanje na fiziološki aktivnite supstancii vrz 'rtlivosta na tutunskoto seme, Tutun br. 3-4, pp. 112-115, JNU Institut za tutun – Prilep.
3. Jovičić D., Nikolić Z., Petrović D., Ignjatov M., Ajduković-Taski K., Tatić M., 2011. Uticaj abiotičkih faktora na klijanje i klijavosti semena, Zbornik referata sa 45 savjetovanja agronoma Srbije, pp. 163-170, 04.02.2011, Zlatibor – Srbija.
4. Risteski I., 2011. Some characteristics of Pelagonec – the newly created variety of Burley tobacco, Тyтyн/Tobacco Vol. 61, No. 1-6, pp. 63-67, Prilep.
5. Čirkovski V. I., 1954. Po pitanju klijavosti duvanskog semena – Tabac br. 1. 1954, Moskva, Prevod: Savezni naučno-istraživački institut za duvan i mahorka, A. I. Mikojana, Beograd.