IMPACT OF MAGNETIC TREATMENT OF TOMATO AND ONION SEEDS ON THEIR PRODUCTIVITY

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ABSTRACT: *To determine the effect of magnetically treated seeds on the productivity of tomatoes and onion in the area of the Sofia field experimental experiments were carried out with variants with magnetically treated seeds and variants without magnetic treatment of the seeds. Irrigation has been dripped in optimum irrigation mode. The yields obtained with the processed tomato seeds in tomatoes are up to 22% higher than those of untreated and onion onions to 28%, respectively.*
KEYWORDS*: MAGNETIC FIELD, TOMATOES, ONION, IRRIGATION REGIME, DRIP IRRIGATION*

Introduction

In many countries with developed agriculture from Europe, Asia and America, studies have been conducted on the impact of magnetic fields on plant objects.

Traditional crop yields have been found to be able to grow through pre-sowing treatment of seeds with electrical (Amaya JM, 2000), magnetic (Carbonell MV, 1996) and electromagnetic (Aladjadjian.A, 2002, ChoE.G ., 1992) fields. The electromagnetic impact to the seeds allows to manipulate to a certain extent their generic qualities (Amaya J.M., 1996, Boe A.A.,). Magnetic field cultivation increases germination and sprout cohesiveness in difficult seed crops and leads to an increase in their biological potential (Aladjadjian, A., 2002) and proves that the magnetic field has the greatest impact on germination and overall simultaneousness of seed germination.

The magnetic field has a positive effect on the pre-sowing treatment of crops' seeds. It was found that in the pre-sowing electromagnetic treatment of sunflower and cotton seeds, resulted in an increase in the yields from 142 to 158% (cotton 12 to 33%) (Palov, Iv. et al 1998, 2008) and electric field treatment of one-year old onion seeds has achieved a 9% increase in seed germination. (Palov., Et al., 1983). The possibility of stimulating effect of the development of vegetable seeds (tomatoes, pepper and cucumbers) has been demonstrated after their pre-sowing treatment in the electrostatic field and in alternating discharge field (Kuzmanov Em., N. Nedyalkov, 2010)

In the laboratory, it has been found that the magnetic field has a positive effect on pre-sowing seed treatment of different crops. As a result of magnetic field treatment, positive results have been obtained, related to increase of germination energy, acceleration of the process and simultaneous germination, formation of good levels of basic substances in some crops.

In order to determine the effect of magnetically processed seeds on agricultural crop yields, field trials were conducted. These tests are necessary to check the results obtained in laboratory conditions.

The aim of the study is to investigate the influence of magnetically treated seeds on the productivity of onion and tomatoes grown in drip irrigation and under optimal irrigation regime.

Materials and methods

The studies for determining the influence of magnetically treated seeds on the on-farm productivity of onion and tomatoes were carried out on the field of Chelopechene at the Institute of Soil Science, Agrotechnology and Plant Protection "N. Pushkarov, Sofia in 2014-2017. The cultivation technology is in line with the current agro-ecological requirements, (Mitova Iv., 2004). The following options have been tested:

- Variation 1 - 100% irrigation rate with magnetically treated seeds
- Variation 2 -100% irrigation rate without magnetic treatment of seeds (pure seeds)

The trials were conducted with block method in four replicates and the irrigation was carried out by a drip irrigation installation. The drip irrigation wings are selected according to the contours of humidification of the chromic luvisols, the distance between the drippers is 0.30 m, with an effluent water of 2 l / h.

Water application rate is calculated with the following formula:

$$m = [10.H\alpha.(\delta_T от ППВ - \delta_T пр.вл.)].K.K_1,$$

Where : m is water application rate amount in mm;

α – the bulk density of the soil in gr/cm^3;

H –active soil layer depth in m (in the experiment H = 0,5 m);

δт from WHC – water holding capacity in % to absolute dry weight of soil;

δт пр. вл – pre irrigation soil humidity in % to absolute dry weight of soil;

K – the coefficient of reduction of the water application rate, taking into account the occupied area of the plants in 1 dka. In the experiment K = 0.52.5, ie. 52.5% of the area is irrigated

The soil is chromic, slightly sandy-loam in the ore layer, formed on the base of an old deluvial cone of dense materials. It is poorly stocked with nitrogen, on average with phosphorus and well with potassium. On average, for the 0 - 0,50 m layer, the soil has the following water - physical properties: WHC 22,1%, wetting point - 12,3% on the weight of the absolutely dry soil, volume weight with WHC - 1,47 g / cm3. For the soil layer 0 - 100 mm, the same indicators have the following values: WHC - 21.8%, fwetting point - 12.3% and volume weight - 1.50 g / cm3. The soil is suitable for cultivation of raspberry.

Magnetic seed treatment is done when placed in a ring by magnets that generate a magnetic field. The seed stay is established by a laboratory method by a team from NIMES - Sofia. The developed device for magnetic processing of agricultural materials ensures the fulfillment of the assigned expositions, changes of the magnetic field poles and simultaneous uniform processing of the material. (Kapashikov., G, N. Nedyalkov et al 2010)

The measurement of the magnetic field values is carried out using a special Gauss-Teslameter type CYHT201, to which there is a probe. In the first stage for generating a magnetic field, a coil with corresponding parameters is used.

Fig. 1 *Laboratory equipment for magnetic seed treatment*

With the additionally incorporated in the circuit autotransformer rheostat type. ATL - 9 "Techenergo" sets different values of the coil supply voltage. The current and voltage values are measured with an ammeter and a multimeter type 8885141.

Results

Meteorological characteristics of the experimental years in the Chelopechene- Sofia region.

Table 1 *Rainfall during the crops' growing season*

Periods	Total rainfall, mm			
	2014	2015	2016	2017
m. IV - IX	630	321	234	231
average multi-annual	365	291	345	343
m. V -VI	148	167	136	129
average multi-annual	156	124	117	-

In the years 2014-2017, the provision of rainfall over the average of the 60-year series in the growing season of the crops (April to September) characterizes three very dry and one wet years. The lowest rainfall fell in 2017 (231 mm), respectively 2016 (245mm), and 2015 (321mm), and most in 2014 (630mm). The rainfall during the vegetation of the crops is unevenly distributed, which led to the realization of irrigations during the growing season of the crops (Table 1). In terms of air temperature, the years are warm.

Sowing tomatoes and onions was done during the first ten-day period of march and the ripening of the fruits of tomatoes occurred on 07.08 and the first harvest was made on 07.09. The harvesting of onions was done in the first ten days of August.

Tomatoes and onions grown with pure seeds (untreated) developed with two weeks delays compared to cultures grown by magnetic seed treatment.

Irrigation regime

The plants need for moisture varies in the process of vegetation. The size and timing of the irrigations depends on the quantity and distribution of rainfall during the growing season. They depend on the water-physical properties of the soil, the crops' needs of water and the dynamics of meteorological factors.

During the growing season of the tomatoes from June to September, 23 pots with water application rate of 19.5 m3 / ha and irrigation rate of 450 mm were made at surface position of the irrigation wings, depending on the parameters of soil humidity. With the onions, the water application rates were implemented during the period March-August, with 6 irrigations with water application rate of 15 mm.

Results obtained for the influence of magnetically treated seeds on growth and susceptibility of tomatoes and onions.

From the conducted experimental results have been obtained for the weight and diameter of onion head. The data show that the highest elevation was achieved by the weight of one onion - 26% (Table 2), and the tomatoes up to 40% (Fig. 1), and the least is the increase of the diameter - 14%. Table 2).

Table 2 *Biometric indicators of onions per year and average for the period 2014-2016*

Year	Magnetic-treated seeds	Unprocessed seeds	Increase over non-magnetic variation in %	Medium Magnetic Seeds	Medium Non-Magnetic	Increase over non-magnetic variation in %
1 average weight of 1 onion bulb in gr						
2014	130	95,0	27	110,7	83	26
2015	91,6	71,1	23			
2016	110,5	83,0	25			
2. average diameter of 1 onion bulb in mm						
2014	79	62	14,0	72,0	62	14
2015	65	56	14,0			
2016	72	68	14,0			
3. average weight of 5 onions gr						
2014	650,0	447	17,0	552	450	18
2015	455	355	17,0			
2016	552	549	17,0			
4. Yields of onion kg/da						
2014	3200	2340	27,0	3040	2193	28
2015	2880	2184	25,0			
2016	3040	2055	27,0			

Table 3 *Yields of tomato and onion*

Variants	**Crops**			
Crops	Tomatoes кg/dka	%	onion кg/dka	%
100 % M pure seeds	4581	100	2193	100
100 % M magnetic treatment	5800	22	3040	28

The yields of the two tested variants change when the seeds are processed with a magnet. The data from (Table 3) show that the highest yields in the soil-meteorological conditions for the Sofia field were obtained in the variants with magnetic treatment of the seeds. An increase of the yield of tomatoes with the magnetic treatment of seeds variant to 22%, with onion to 28% has been achieved.

Fig.2. Magnetic seed treatment

Figure 3. Unprocessed seeds

CONCLUSIONS

From the studies carried out by magnetic treatment of tomato and onion seeds, the following conclusions can be drawn:

1. Magnetic treatment of seeds affects the growth and productivity of crops grown.

2. The highest yields in the soil-meteorological conditions for the Sofia field were obtained in the variants with magnetic treatment of the seeds in both crops irrigated under optimum irrigation regime. An increase of tomato yield to 22% and onion to 28% was achieved.

3. Magnetically processed seeds have also improved the biometric performance of crops. The increase in the average weight of a tomato fruit reaches 13%, on onions to 26%.

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