

Influence of Pre-Sowing Electromagnetic and Chemical Treatment on Sowing Qualities of Maize Seeds

Kiril Sirakov and Miroslav Mihaylov

Department of Electrical Power Engineering, University of Rousse “Angel Kanchev”, 7017 Rousse, Bulgaria, e-mail: csirakov@uniruse.bg

GOAL OF THE STUDY

One of the established methods for increasing yields is the use of artificial fertilizers [1,2]. In many cases it leads to the contamination [3] of soil and produce.

It is known that the pre-sowing treatment of seeds with fungicides is carried out in order to protect them from economically significant pests.

Since the world of animate and inanimate nature exists in the Earth’s electromagnetic field, it is only natural to look for approaches to increase yields through preliminary electrical stimulation of the seeds [4].

The analysis of the non-traditional ways to increase crop yields (such as for triticale [5,6], cotton [7,8], rape seeds [9] and vegetable crops [10,11]) shows that there is a relation between the field of magnetic fields [12,13], electrical and electromagnetic fields [14] is used.

Considering the fact that the pre-sowing electromagnetic, electrical and other types of treatment after the electrical state [15] of the seeds, it is reasonable to expect that wetting the seeds by treating them with fungicide will affect this state.

The purpose of this study was to determine the results of the pre-sowing fungical and electromagnetic treatment of maize seeds at different field levels of the electromagnetic exposure device.

METHODOLOGY OF THE INVESTIGATION

In this study, maize seeds from the French hybrid MAS 47 P were used. It is a mid-late hybrid of FAO group 440.

The control pre-sowing electromagnetic treatment was performed on a specially designed device for pre-sowing electromagnetic treatment of seed material [16].

The adopted electromagnetic impact control factors were: [17] applied voltage U, kV between the device electrodes (electromagnetic field parameters), and duration c, treatment t, s. The control factors values were based on the values obtained in other studies [14,17].

The adopted practice for establishing the impact of the full level in the screw conveyor for electromagnetic treatment [16] was to fill the device with 50% of the maize seeds reaching the middle of the screw shaft, or the seeds reaching “only the tip” of the screw thread, i.e. the full level of the screw conveyor was 10%.

The type of fungicide used was “Pezodor 355®.” This is a systemic insecticide for pre-sowing treatment of seeds. It has a guaranteed effect against wireworms, grey worms and different types of weevils (eg. grey maize weevil).

The experiment planning matrix is shown in Table 1.

Table 1. From Table 1 it can be concluded that in options No.1, No.3 and No.5 the electromagnetic treatment was done on seeds that had been previously disinfected with fungicide. For that reason, the abbreviation designation (d) was used. In the options with numbers 2, 4 and 6, the seeds were not disinfected at the time of applying the electromagnetic treatment – they were marked with the abbreviation designation (n). These seeds were subjected to treatment with fungicide after the electromagnetic treatment.

The seeds were treated in an electromagnetic field on March 25th. In accordance with the established methodology [17], they were sown in the field on April 17th (i.e. 23 days after the electromagnetic treatment) in the land of the company “Safarit” near the village of Borisovo, Ruse district. On the same day, experiments were also performed in laboratory conditions.

MAIN RESULTS FROM THE STUDY

From the laboratory experiments, the length of the germs and roots, the number of roots and the mass of the sprouting plants were determined, as well as their germination power and germination capacity. The described data, expressed as a percentage of the reference specimen (%/n) are shown in Fig. 1 (for seeds pre-treated with fungicide and for seeds untreated with fungicide).

From Fig. 1 it can be concluded that the pre-sowing fungical and chemical treatment of seeds pre-treated with fungicide had a favorable effect on all monitored laboratory parameters – Fig. 1. The explanation for the higher values seen in option No.1 is that a significantly smaller quantity of seeds (only on the “tip of the screw thread”) was exposed to the effect of the same electromagnetic field.

The results in Fig. 1 show that when fungical treatment was applied to the seeds after the pre-sowing electromagnetic treatment, the effect of the latter was suppressed. This can be explained by the fact that the treatment (“wetting”) with moist fungicide increased the electrical conductivity of the electromagnetically pre-treated seeds, and presumably some equalization of the electrical potentials [19], natural and acquired, occurred as a result of the pre-sowing electromagnetic treatment.

In the case shown in Fig. 1, the number of roots grown was the only parameter with values greater than those of the reference specimen – by 20.8%, 83.3% and 21.3% for the options with numbers 2n,4n and 6n, respectively.

During the vegetation of the plants in the field, the characteristics of the maize plant stalks were established. For this purpose, measurements of the plant height reached H0 cm, the number of leaves B, the heights of the first cob H1 cm and the second cob H2 cm, were taken.

After harvest was done, the number of cobs harvested and their length (Fig. 2), the number of rows on the cob and the number of kernels in a row (Fig. 3) were studied, together with the total mass of the cobs with the kernels (Fig. 4).

From the results presented in Fig. 2 it is evident that the pre-sowing electromagnetic treatment had a beneficial impact on the pre-disinfected seeds (options 1d, 3d, 5d) compared to the non-disinfected seed (options 2n, 4n, 6n). It is worth noting that for treatment option No. 3n, both monitored parameters had greater values than those of the reference specimen – the number of cobs was 6.9% higher, and their length – 3.5% higher than those of the reference specimen. The impact factors for treatment option No. 3n were voltage U=1.65 kV, duration of treatment t=10s, and screw conveyor fill level – up to the middle of the shaft (50%).

The increased voltage of U=2.5 kV between the electrodes produced better results in option No. 5d, where the number of cobs was 3.5% higher, and the length – 1.2% higher in comparison with the reference specimen. This shows that the effect of the electric discharge was weaker than the impact of the pre-sowing electromagnetic treatment at a high voltage.

The increased number of harvested cobs in treatment options 2n, 3d and 5d can be considered to be the result of the performed pre-sowing electromagnetic treatment.

The different effects of the control factors during pre-sowing electromagnetic treatment, namely voltage, duration of electromagnetic exposure, screw conveyor fill level, and time of seed disinfection (before or after the electromagnetic treatment), are evident also from Fig. 3.