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OPTIMISATION OF AGROTECHNOLOGY IN THE PRODUCTION OF APPLE ROOTSTOCKS

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Abstract

The study investigated some growth manifestations of root shoots derived from M9 rootstock in stoolbed. The plants were covered with soil without a moisture-absorbing polymer and with soil using a different amount of moisture-absorbing polymer - 1,500 kg/dka and 3,500 kg/dka. Improved values in some of the studied growth indicators are observed among the combinations with soil containing moisture-absorbing polymer, especially the ones with higher content. In respect to the studied vegetative parameters, very good rooting of rootstocks is achieved when applying moisture absorbent in a dose of 3,500 kg/dka.

Key words*: apple, M9 rootstock, moisture absorbent polymer, stoolbe.*

INTRODUCTION

The recently introduced intensification in the field of fruit growing requires the production of high quality apple rootstocks in stoolbed.

The traditional way to produce apple clonal rootstocks is by covering of a vertical shoots getting new extra rooted shoots, originating from adventive root buds. This method has been developed for decades (Trachev et al., 1975; Andreen, 1979; Gryazev, 1979; Mitov et al., 1979; Koval, 1980; Samus, 1983; Verobyov, 1985; Vehov and Retinskaya, 1988; Quamme and Brownlee, 1990; Karpenchuk, 1993; Pepelyankov and Dobrevska, 1995; Dobrevska and Tabakov, 2002; Lipa and Lipicki, 2006; Dobrevska, 2010; Lipa, 2012; Dobrevska, 2013).

Good rooting is considered as an important criterion for the production of high-quality shoots. In addition to the type of planting material, a set of soil indicators also tends to influence shoots' development process. Their optimisation depends on various conditions. Dobrevska et al. (2015a) and Dobrevska et al. (2015b) examine the growth manifestations of M9 and MM106 rootstocks which are developed in soils with different content of organic additions (pine wood chips in two varieties) in stoolbed. Similarly, Popova et al. (2014) examine the effects of the wood chips on some soil characteristics which positively influence the production of first-class quality apple clonal shoots. In addition to the above-mentioned soil additions, which improve the organic content and temporary moisture (in the most important periods of shoots' growth phenophase) of the covering soil layer and lead to a higher productivity level, some unorthodox methods, such as moisture superabsorbent, have been implemented in cultivating different crops in many agriculture sectors (Popova et al., 2014; Dobrevska et al., 2015a; Dobrevska et al., 2015b).

So far, experimental studies on the effect of moisture absorbent on plants in horticulture have been almost never done. Popova et al., (2016) investigate the influence of moisture-absorbing polymer on some soil characteristics in a stoolbed of apple rootstocks and show an improvement in some indicators.

The idea of our experiment is to explore the influence of moisture-absorbing polymer on growth manifestations and quality of root shoots derived from M9 rootstock in stoolbed.

MATERIALS AND METHODS

The experimental stoolbed plant is developed from root shoots derived by somatic organo-genesis of leaf explants (Dobrevska, 2008).

The experiment was conducted by following the block method of Fisher (Zapryanov and

Marinkov, 1978) with four replicates for each combination.

After planting, the plants were cultivated according to the conventional stoolbed technology (Trachev et al., 1975). The method includes, among other things, multiple soil treatments performed with specialised equipment for orchards - fruit disc harrows and cultivators. Universal or specialised tractors were used as energy source (Todorov, 1966; Todorov et al., 1974; Trachev et al., 1975). The most suitable technological solution for stoolbed soil maintenance, which is also the most typical in our country, refers to the so-called black fallow system. As a result, there were 5-7 shallow inter-row soil treatments leading to preservation of its fertility, water and air regime, as well as, destruction of weed vegetation. There was also a deep inter-row autumn soil ploughing at a depth of 18-20 cm. During the vegetation period, three additional soil covering procedures were performed on the basis of the experimental plants, contributing to their better rooting. The moisture-absorbing polymer was introduced in two dozes - 1,500 kg/dka and 3,500 kg/dka - at the beginning of the vegetation period at the base of the root shoots during the initial covering procedure at a plant height of 15-20 cm (Todorov et al., 1974).

With the purpose of determining the effects of the applied mixture component on plants' performance at the end of the vegetative period, their growth manifestations were analysed in three soil types: with no moisture-absorbing polymer and with moisture-absorbing polymer in two dozes - 1,500 kg/dka and 3,500 kg/dka.

The following growth indicators are monitored and reported:

1. Average number of shoots per plant, units;
2. Average length of shoot, cm;
3. Average thickness of shoot, mm;
4. Average number of feathers per shoot, units;
5. Average length of feathers, cm;
6. Average number of roots per shoot, units;
7. Leaf area, cm^2 (Lazarov, 1965) - A = k.1.b, where:

K - coefficient (in the case of apple - 0.69);

L - leaf length;

b - leaf width.

The data from the monitored indicators are statistically processed by following the analysis of variance (ANOVA) method.

RESULTS AND DISCUSSIONS

In respect to average number of shoots per plant and average shoot length, there are no statistically significant differences among the different combinations (Table 1).

Table 1. Growth indicators of root shoots

Soil substrate \ Indicators	Number of shoots per plant	Shoot length, cm	Number of feathers per shoot	Feather length, cm
With 3,500 kg/dka moisture-absorbing polymer	9.81	58.77	4.63	12.15
With 1,500 kg/dka moisture-absorbing polymer	9.47	56.21	4.17	10.24
No moisture-absorbing polymer	8.52	55.78	4.01	8.76
GD - 5%	2.11	25.78	0.43	1.24
GD - 1%	3.21	39.62	0.69	1.93
GD - 0.1%	5.18	64.35	1.16	3.15

Nevertheless, given the range of accessed results, it can be noted that the thickest root shoots are reported in the combination with the highest values of moisture-absorbing polymer, whereas the thinnest ones occur in the combination without moisture absorbent (Table 2).

Feathering of rootstocks at a certain height has a beneficial effect on their overall development. The reported differences in respect to the number and length of feathers are statistically significant in all three combinations.

A higher number and longer feathers are observed in the combinations containing moisture absorbent.

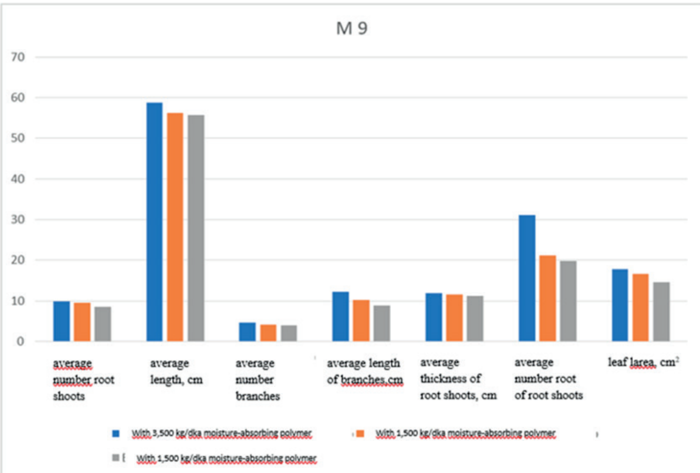
Respectively, the highest growth parameters are achieved in the instances where the maximum content of moisture-absorbing polymer is applied (Table 1).

Table 2. Growth indicators of root shoots

Indicators / Soil substrate	Average thickness of shoots, mm	Average number of roots per shoot	Leaf area, cm^2
With 3,500 kg/dka moisture-absorbing polymer	11.93	31.05	17.82
With 1,500 kg/dka moisture-absorbing polymer	11.45	21.12	16.54
No moisture-absorbing polymer	11.15	19.78	14.57
GD - 5%	0.69	9.75	2.37
GD - 1%	1.13	16.66	2.69
GD - 0.1%	1.90	28.15	4.61

Rooting constitutes a very important indicator of the quality of shoots.
The experiment results unambiguously show that the highest number of root shoots is formed in the combination with the highest content of moisture absorbent, followed by the combination with the reduced amount of moisture absorbent. Finally, the least number of root shoots occurs in the combination without any moisture absorbent (Table 2).

An important factor for effective photosynthetic activity of rootstocks is the good health of their leaf mass and total leaf area. Findings show that the largest and the smallest leaf areas are reported in the combinations with the highest quantity of moisture-absorbing polymer and with no polymer, respectively (Table 2). Figure 1 provides a very good visualization of the above-mentioned interpretation of the presented and statistically processed results.



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CONCLUSIONS

The performed examination of the development of apple clonal rootstocks M9, which are derived from somatic organogenesis in stoolbed with different content of soil moisture absorbent, shows that better values of some of the observed growth parameters occur in the soil combinations where moisture absorbent is present.
This is particularly visible in the case with the highest moisture-absorbent content. The better rooting is one of the most notable expressions when all vegetative growth indicators are taken into consideration.
The use of moisture absorbent is a critically important factor for the production of premium quality orchard trees of apple rootstocks in stoolbed.

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