Scientific Papers. Series B, Horticulture. Vol. LXIV, No. 1, 2020
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

CHANGES IN CONVENTIONAL AGROTECHNOLOGY IN THE GROW OF APPLE ROOTSTOCKS

Galya DOBREVSKA, Manol DALLEV

Agricultural University of Plovdiv, 12 Mendeleev Blvd, Plovdiv, Bulgaria

Corresponding author email: galiasd@abv.bg

Abstract

The growth manifestations of shoots, which are derived from MM106 rootstock in stoolbed, are studied. Plants are covered by soil containing moisture-absorbing polymer in two dozes - 1,500 kg/dka and 3,500 kg/dka. These two combinations are also compared with the performance of plants which are developed in soil without moisture absorbent. Improved values in some growth indicators are monitored among the combinations with moisture-absorbing polymer and, in particular, with the ones with higher polymer content. Among all vegetative indicators, it is important to note the improved feather shoot formation and rooting among rootstocks developed in soil with moisture absorbent doze of 3,500 kg/dka.

Key words: *apple, MM106 rootstock, moisture absorbent polymer, stoolbed.*

INTRODUCTION

The high quality of rootstocks, which are derived in stoolbed, inevitably contributes to the success of the production of apple trees. Apple clonal rootstocks are produced by covering a vertical shoot which leads to the development of additional rooted shoots.
Studying the method of production in stoolbed has been developed for decades (Trachev et al.; 1975; Gryazev, 1979; Mitov et al., 1979; Andreev, 1979; Koval, 1980; Samus, 1983; Verobyev, 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).
Rooting plays an important role in the process of shoot production in stoolbed. The presence of favourable soil indicators has a key role in the process and their optimisation depends on some conditions. Dobrevska et al. (2015a) and Dobrevska et al. (2015b) study the growth manifestations of M9 and MM106 rootstocks developed in a stoolbed with soils which are enriched by organic additions derived from different types of forest wood varieties. Popova et al. (2014) also use a stoolbed. They examine the impact of the same organic additions on some soil indicators influencing the higher production rate of shoots. These additions increase the organic composition and humidity of soil in important phenophase of plant development, as well as, increase plants' quality (Popova et al., 2014; Dobrevska et al., 2015a; Dobrevska et al., 2015b).
Recently, some unconventional products, such as soil mixtures, have been introduced in agriculture. These are some soil moisture superabsorbents which are used in the cultivation of different crops in agriculture. There have been insufficient studies exploring the influence of soil moisture absorbents in horticulture. Popova et al. (2016) study the impact of moisture absorbent on soil characteristics in a stoolbed of apple rootstocks. They find improved values in some soil indicators.
The purpose of the current experiment is to determine the influence of soil moisture absorbent on growth manifestations and quality of apple clonal rootstock MM106 in stoolbed.

MATERIALS AND METHODS

The root shoots of the experimental stoolbed plant are derived by somatic organogenesis of leaf explants (Dobrevska, 2008).
The experiment is structured according to the block method of Fisher (Zapryanov and Marinkov, 1978). It consists of four replicates for each combination.

After planting, the plants were cultivated according to the conventional stoolbed technology with multiple soil treatments (Trachev et al., 1975). Specialised equipment for orchards is used for the soil treatment procedures, such as 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 system for stoolbed soil maintenance 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 when the average plants' height was 15-20 cm (Todorov et al., 1974).

At the end of the vegetative period, shoots' growth manifestations are analysed in soil with no moisture-absorbing polymer, as well as, in soils with two different dozes of moisture-absorbing polymer - 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, 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).

There are no statistical significant differences in respect to average shoot thickness (Table 2). According to these indicators, all studied shoots fit within the established first-quality standard norms (Tables 1 and 2).

Table 1. Growth indicators of root shoots

Indicators/ Soil substrate	Number of shoots per plant	Shoot length, cm	Number of feathers per shoot	Feather length, cm
With 3,500 kg/dka moisture-absorbing polymer	16.00	94.40	7.84	8.65
With 1,500 kg/dka moisture-absorbing polymer	16.00	92.69	7.68	6.72
No moisture-absorbing polymer	15.75	90.10	7.08	6.65
GD - 5% - 1% - 0.1%	 2.14 3.24 5.21	 26.87 40.71 65.44	 0.51 0.77 1.24	 1.33 2.02 3.24

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	8.51	57.24	15.62
With 1,500 kg/dka moisture-absorbing polymer	8.49	41.52	14.29
No moisture-absorbing polymer	8.11	35.35	14.10
GD - 5% - 1% - 0.1%	0.84 1.,28 2.05	12.00 18.91 30.40	2.06 4.14 5.01

It is proven that the combination with the highest content of moisture absorbent leads to the highest number and longest feathers, whereas the combination with no moisture absorbent has the least and the shortest feathers. The combination with a lower moisture absorbent quantity occupies the middle position in terms of feathers' length (Table 1). The formation of rootstock feathers at an appropriate height has a favourable effect on the overall physiological development of shoots. Therefore, the accessed results suggest that the use of soil moisture absorber has a positive effect on the volume of plants' photosynthetic green mass, although there are no statistically significant differences in terms of total leaf mass of the individual combinations (Table 2).

Rooting is a very important factor in the production of high-quality shoots. The results of our analysis show that the highest number of roots is formed in the combination with the highest amount of soil moisture absorbent, followed by the combination with lower soil moisture absorbent. Finally, the least number of root shoots occurs in the combination without any moisture absorbent (Table 2).

The information on Figure 1 provides a very good description of the above-mentioned interpretation of the presented and statistically processed results.

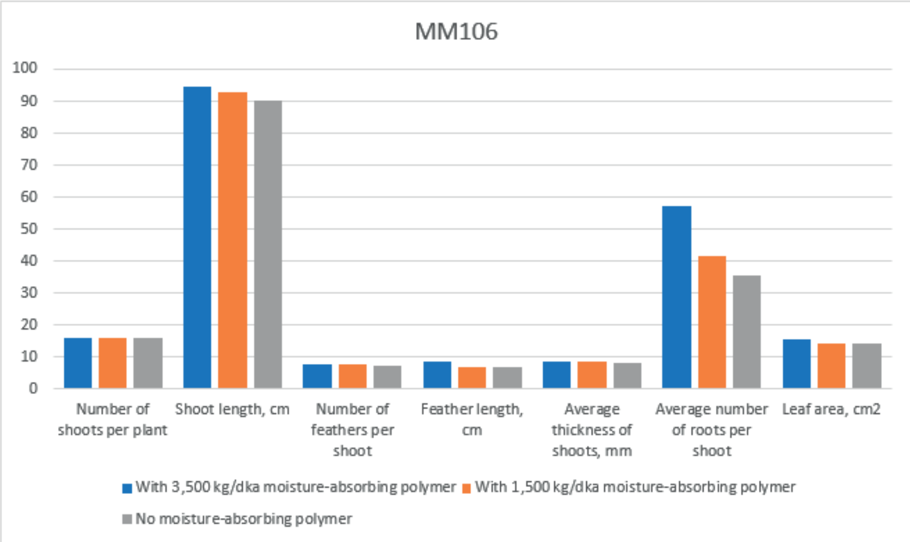

Figure 1. Example text to describe to figure above that should be replaced with your information

CONCLUSIONS

Findings from the examination of apple clonal rootstocks MM106, which are derived from somatic organogenesis of leaf explants in stoolbed with different content of soil moisture absorbent, show that the combinations with moisture absorbent additions in soils demonstrate considerably better values in some of the monitored growth indicators.

These indicators are particularly improved in the cases when higher amounts of additions are present. The increased length and number of feathers, as well as, the better rooting of shoots are among the most indicative growth manifestations. This supports the production of first-class orchard trees material from apple rootstocks when using soil moisture absorbent in stoolbed.

REFERENCES

Andreev, A. (1979). Terms and methods of initial shoot covering in stoolbed of apple and quince clonal rootstocks. *Horticulture and Viticulture Science*, № 2, 16-20.

Dobrevska, G. (2008). Effect of adventive organogenesis on phenotypic and genetic expressions of apple clonal rootstocks M9 and MM106. *Dissertation*. Plovdiv.

Dobrevska, G. (2010). Specifics of some apple clonal rootstocks in the context of production intensification. "*Agriculture science*" journal, Issue 3, pp. 5-10. Agriculture University - Plovdiv.

Dobrevska, G. (2013). Apple clonal rootstocks. Plovdiv.

Dobrevska, G., R. Popova, H. Dzhugalov, 2015a. Manifestations of M9 apple rootstock in stoolbed with different soil substrate and plants with a different origin. "*10th International Symposium on Agriculture*", Zagreb, Croatia (16-20 February, 2015) Zbornik radova, 565-569.

Dobrevska, G., R. Popova, H. Dzhugalov (2015b). Influence of plant origin and soil substrate on the behaviour of the MM106 rootstock in stoolbed. "*10th International Symposium on Agriculture*", Zagreb, Croatia (16-20 February, 2015) Zbornik radova, 570-574.

Dobrevska, G., S. Tabakov (2002). Study of apple clonal rootstocks in rootstocks. *Proceedings - Scientific conference with international participation*, "St. Zagora - 2002", Vol. II, pp. 259-262.

Gryazev, V. A. (1979). Productivity of vegetatively propagated rootstocks in stoolbed under different planting schemes. *Proceedings of scientific works* VNNI Gardening.

Karpenchuk, G., V. Zamorsky, Y. Artemenko (1993). Root distribution of clonal rootstocks of apple rtees in the stoolbed and in the orchard. *Journal of Fruit and Ornamental Plant Research*, v. 1(3), p. 75-8

Koval, A. T. (1980). The productivity of the intensive of stoolbeds clonal rootstocks of apple. *Gardening, viticulture and winemaking of Moldova*, No. 12.

Lipa, T. (2012). Growth, quality and productivity in stool beds of rootstocks M.9 and M.26. *Electronic Journal of Polish Agricultural Universities*, 15(1):87-81.

Lipa, T., Lipicki, J. (2006). Chemical soil properties in apple rootstock stool-beds with special emphasis to the content of copper. *Agronomijas Vestis*, № 9, LLU, 83-86 pp., Latvia.

Mitov, P., A. Atanasov, G. Pepelyankov (1979). Rootstocks of fruit trees in relation to the intensification of fruit growing. *Review*. Sofia.

Pepelyankov, G., G. Dobrevska (1995). Study of apple clonal rootstocks in stoolbed. Scientific session "50 years Higher Agricultural Institute", *Jubilee collection*, Vol. II, book 1, Plovdiv

Popova, R., E. Valtscheva, G. Dobrevska, M. Dallev, D. Atanasov (2016). Influence of the moisture-absorbing polymer (TERAWET) on some soil indicators in a stoolbed of apple rootstocks. *Fourth national conference of BHSS with international participation "Humus substances and their role for climate change mitigation"*, Sofia, 8-10 September, pp. 183-190.

Popova, R., G. Dobrevska, H. Djugalov, A. Matev, L. Dospatliev, A. Stoyanova (2014). Influence of the wooden filings on some soil indicators of an apple plant in a stoolbed. *International Conference with international participation "Innovation and development of agriculture in Bulgaria", Agricultural Science and Technology*, vol. 6, № 3, pp. 304-306, St. Zagora.

Quamme, H. A., R. T. Brownlee (1990). Stool layering ability of thirty-one apple rootstock cultivats. *Fruit Var. J.* 44: 165-169.

Samus, V. A. (1983). The root system of the stoolbeds clonal rootstocks of the apple. *Horticulture*. Minsk, No. 5, 26-30.

Todorov, V. (1966). Application and maintenance of soil surface in orchards. *Review.*

Todorov, V., Belyakov V., Grozdin A., Stamboliiski K., Manov S., Ivanov S., Ivanov V., Petrov A., Vassilev V., Milanov B., Georgiev V., Yoncheva M. (1974). Industrial Technologies in Fruit Growing. "H. G. Danov", Plovdiv.

Trachev, D., M. Yoncheva, S. Ivanov, D. Trifonov (1975). Rootstocks for fruit trees and production of propagation material. Ed. "H. G. Danov", Plovdiv.

Vehov, J., G., N. N. Retinskaya (1988). Study of apple clone rootstocks in stoolbed. *Improvement of assortment and progressive methods of growing fruit and berry crops, Tula*.

Veriobev, V. F. (1985). Study of rootstocks and apples in non-chernozems soils. *Agrotechnics and variety testing of fruit crops, Moscow*.

Zapryanov, Z., E. Marinkov (1978). "Experimental Case with Biometry", Plovdiv.