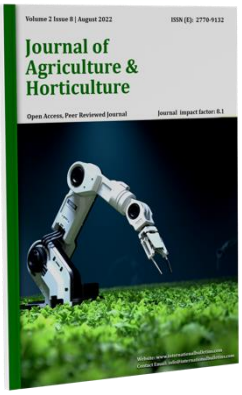

ESTIMATING THE NET PHOTOSYNTHETIC PRODUCTIVITY OF APPLE ROOT STOCKS IN NURSERIES

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Abstract. This article presents the results of an experiment conducted to study the net productivity of photosynthesis with in-depth scientific analysis.

Keywords: root stock, seedling, photosynthetic characteristics, ontogenesis, dwarf and super dwarf root stock.

Introduction

All life processes in plants depend on the photosynthetic activity of leaves. The rate of accumulation of dry matter and the net productivity of photosynthesis reflect the efficiency of both the leaf apparatus and the root system. Net productivity of photosynthesis (NPP) is the accumulation of biomass per unit of leaf area per unit of time. As a rule, it is expressed in grams of dry weight per 1 m^2 per day [1-3].

In apples, FSM varies depending on the variety or rootstock used [4, 7, 9]. At the same time, some scientists also argue that rootstocks do not affect FSM and shoot growth [10].

It has been noted that one-year-old seedlings on the Paradizka Budagovskogo rootstock have a higher FSM than those on the Antonovka obyknovennaya seed rootstock [8].

In our studies, FSM was calculated for the average growth rate and for the average years of the study. The Kidd, West, and Briggs formulas were used in the calculations [6].

Materials and Methods

The experiments were carried out in 2021-2022 at the experimental fields of Hirosaki University in Japan and in 2023-2024 at the Bandikhon Experimental Farm of the Academician Mahmud Mirzayev Research Institute of Horticulture, Viticulture and Winemaking in the following options:

The surface of the leaf surface is Professor V.A. It was determined by the method recommended by Potapov (1976), using a palette and a curvimeter.

To calculate the net productivity of photosynthesis, the formula recommended by Kidd, West and Briggs (Grodzinsky, 1973) was used:

Where: m1 – dry weight of one plant at the beginning of the calculation period (third decade of May), g;

m^2 – dry weight of one plant at the end of the calculation period (third decade of August), g;

S_1 – leaf area of one plant at the beginning of the calculation period (third decade of May), cm;

S_2 - leaf area of one plant at the end of the calculation period (third decade of August), cm;

t - duration of the calculation period, days.

For each option, 4 plants were taken from the replicates.

Research results and discussion

The data obtained show that FSM varied both among rootstocks and among nursery fields.

In the 1st field of the nursery, the FSM increased with the growth force of the root stock. An exception was observed for the MM-104 root stock, where this indicator was lower than that of the MM-102 root stock (3.97 g/cm^2 day and 3.11 g/cm^2·day, respectively). In the 2nd field of the nursery, the differences were less than in the first field. The semi-dwarf (MM-104) and medium-growing (MM-106) root stocks outperformed the super dwarf (M-25) root stock in terms of FSM.

In the 3rd field of the nursery, the highest FSM index was characteristic of the dwarf MM-102 root stock, while the relatively stronger MM-104 and MM-106 root stocks lagged behind it in this indicator. Such a change in FSM in the 1st, 2nd and 3rd year of growth in the nursery may be due to the process of dry matter accumulation of the grafted variety, its hormonal system, redistribution of assimilates, photosynthesis rate, etc.

Table 1

FSM in root stock and Wide David varieties

Root stock	Field 1 of the nursery	Field 2 of the nursery	Field 3 of the nursery
M-25	2,12	6,05	-
MM-102	3,97	5,20	6,86
MM-104	3,11	7,12	2,95
MM-106	8,47	7,14	4,05

At the same time, the high FSM index in the dwarf root stock seedlings in the 3rd field of the nursery may be due to their early entry into fruiting, i.e., as a result of which they accumulate dry matter more rapidly than semi-dwarf and medium-growing forms.

Conclusion

Thus, rootstocks with different growth vigor in the nursery differ from each other in terms of photosynthetic activity indicators. The ratio of dry weight of shoot bark to dry weight of wood can be used to initially assess root stocks for their growth vigor.

References:

1.Gulyaev B.I. Photosynthesis and plant productivity: problems, achievements, research prospects // Physiology and biochemistry of cultivated plants. - 1996. - № 1-2. - P. 15-31.

2.Michurin I.V. Selected works. - M., OGIZ, 1948. - 791 p.

3.Solovieva L.V. Variability of hybrid apple seedlings as a result of grafting them at the juvenile stage of development. Abstract of Cand. Sci. (Biology). - M.: 1968.-25 p.

4.Strelets V.D. Physiological and biochemical characteristics of grafted and own-rooted cherry and plum seedlings // Bulletin of agricultural science, 1978. - № 12. - P. 70-75.

5.Titova N.V. Influence of nodrow on photosynthetic activity of apple tree. Abstract of Cand. Sci. (Biology). Kishinev, 1972. - 19 p.

6.Friedrich G. Photosynthesis // Physiology of fruit plants. - M., 1983. - Ch. 1.- P. 17-38.

7.Shishkanu G.V. Photosynthetic activity of apple tree and possible aspects of its optimization. Diss. Doctor of Biosciences, Kishinev, 1974. - 431 p.
8.Bessho H., Haniuda T. Tsuchiya S. et.al. Selection criteria for dwarfing apple rootstock at the young seedling stage // Bull. Fruit. Tree. Res. Stat. Ser. C Morioka, Iwate. - 1989, - N 16. - P. 1 - 13.
9.Boritzki M., Plieske J., Struss D. Cultivar identification in sweet cherry using AFLP and microsatellite markers // Proceedings of the Eucarpia symposium on fruit breeding and genetics. Acta Hort., 2000. - N 538, vol 2. - P. 505-510.
10.Barden J.A. Ferree D.C. Rootstock does not effect net photosynthesis dark respiration, specific leaf weight and transpiration of apple leaves // J. Amer. Soc. Hart. Sci. 1979.-Vol. 104, N4.-P. 526-528.