**УДК 634.11: 631.8**

# ECOLOGICAL ASPECTS OF LONG-TERM FERTILIZER USE IN APPLE TREES

**YAKOVENKO R.V.** ***Doctor of Agricultural Sciences***
*Uman National University of Horticulture*

In intensive orchards, it is of great importance to use a rational fertilization system to meet the needs of fruit plants for mineral nutrients as fully as possible, and to preserve and improve soil fertility.

In the apple orchard ecosystem, over a long period of cultivation in the same place, it is problematic to regulate soil conditions due to specific changes in soil properties, as well as the age-related state of growth processes and productivity and the needs of fruit trees for mineral nutrients. When new trees are re-grown on the sites of uprooted old trees, the replant disease caused by the previous crop also has a negative impact, which creates unfavorable conditions for root nutrition of subsequent young trees [1-3]. In such circumstances, certain features of fertilizer application in re-grown plantations are necessary [4, 5].

Recently, there has been a trend towards organic gardening to obtain more valuable and environmentally friendly orchard products [6-8].

The research has been conducted in the experimental garden of the Uman National University of Horticulture in a long-term experiment with fertilizer systems according to a four-variant scheme: 1. No fertilizer (control), 2. Manure application 40 t/ha, 3. Manure application 20 t/ha + $Na_{60}$ $P_{60}$ $K_{60}$ 4. $Na_{120}$ $P_{120}$ $K_{120}$. Manure and phosphorus and potassium mineral fertilizers were applied at the indicated rates a year later during autumn plowing in the aisles. Nitrogen fertilizers were applied in half doses annually in the spring for cultivation or disking of the soil kept under clean steam.

Long-term using of the organic fertilization system - application of 40 t/ha of cattle bedding manure in a year ensured the creation of indicators of optimal fertility of dark gray podzolic soil due to an increase in its humus content in the root layer (0-60 cm) by 0.7% and an increase in the content of the main macroelements of mineral nutrition of apple trees: N-$NO_3$ up to 28.6, $P_2O_5$ up to 229, $K_2O$ up to 270 mg/kg of soil, as well as its replenishment with microelements applied with organic fertilizer.

Similar parameters of soil fertility indicators were also observed under the organic-mineral fertilizer system with systematic long-term application of half the norms of organic and mineral fertilizers of manure 20 t/ha together with $Na_{60}P_{60}K_{60}$. And under the mineral system ($Na_{120}P_{120}K_{120}$), the humus content and the content of macronutrients available for plant nutrition increased to a lesser extent.

The created optimal backgrounds of fertility of dark gray podzolized soil by long-term fertilization with organic fertilizer provided an increase in the yield of apple trees of

the varieties Idared and Calville Snow on seed stock and the variety Idared on vegetative M4 rootstock compared to the yield in the control variant without fertilization.

The positive impact of the organic system of long-term fertilization of the orchard on soil fertility and the corresponding increase in fruit tree productivity indicates that such a system should be used in organic horticulture to produce high-quality fruit products without the use of mineral fertilizers.

## Refrences

1. Szczygieł, A., Zepp, A.L. An occurrence and importance of apple replant disease in Polish orchard. Acta Hort. 477. 1998. 99-101.

2. Wang Na, Joost Wolf, Zhang Fu-suo. Towards sustainable intensification of apple production in China —Yield gaps and nutrient use efficiency in apple farming systems. Journal of Integrative Agriculture 2016, 15(4) 716-725

3. Yakovenko R. V. Replant disease and measures to reduce it in apple trees. Bulletin of Uman NUS. 2021. №2. P. 69-72. DOI: 10.31395/2310-0478-2021-2-69-72

4. Kopytko P.G., Yakovenko R.V., Yakovenko O.V., Chepurnyi V.G., Fomenko O.O. Feasibility to Neutralize Replant Disease under the Recultivation of an Apple Orchard. Indian Journal of Agricultural Research, Vol. 56. S. 621-625. DOI: 10.18805/IJARe.AF-695

5. Popova V.P. Biocenotic approach to the development of technologies to optimize the food regime of orchard agrocenoses. Horticulture and Viticulture. 2004. №5. P. 2-5.

6. Veberic R., Trobec M., Herbinger K., Hofer M., Grill D., Stampar F.: Phenolic compounds in some apple (Malus domestica Borkh) cultivars of organic and integrated production. Journal of the Science of Food and Agriculture, 85. 2005: 1687-1694.

7. Kopytko P. G. Yakovenko R. V. Soil conditions and yield of re-grown apple orchard under long-term fertilization. Collection of scientific papers of Uman NUS. 2021. № 98. Part 1. P. 34-47. DOI: 10.31395/2415-8240-2021-98-1-34-4718. Kopytko P. Smart fertilization. Gardening in Ukrainian. №3. 2019. P. 48-50.

8. Mikulic Petkovsek M., Slatnar A., Stampar F., Veberic R. The influence of organic/integrated production on the content of phenolic compounds in apple leaves and fruits in four different varieties over a 2-year period. Journal of the Science of Food and Agriculture, 90. 2010: 2366-2378.