

# IMPROVEMENT OF APPLE FERTILIZATION TECHNOLOGY IN ORCHARDS

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**Annotation.** Efficient nutrient management is a key factor in increasing apple productivity, fruit quality, and orchard sustainability. This study aims to improve fertilization technology in apple orchards through optimized nutrient rates, timing, and application methods based on soil and leaf analysis. Field experiments were conducted to evaluate mineral and organo-mineral fertilization systems under irrigated orchard conditions. The results demonstrated that balanced fertilization combined with fertigation significantly improved yield, fruit size, and biochemical quality indicators while reducing nutrient losses. The proposed technology enhances nutrient use efficiency and environmental safety. The findings can be recommended for sustainable apple production systems.

**Keywords:** apple orchard, fertilization technology, nutrient management, fertigation, yield, fruit quality.

**Introduction.** Apple (*Malus domestica*) is one of the most widely cultivated fruit crops worldwide and plays an important role in food security and agricultural economies. In intensive orchards, high productivity depends largely on proper nutrient management. However, traditional fertilization practices often involve unbalanced nitrogen application, insufficient micronutrients, and poor synchronization with plant demand, leading to reduced efficiency and environmental risks.

Improving fertilization technology requires a scientific approach based on soil diagnostics, plant nutritional status, and modern application methods such as fertigation. Balanced supply of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and micronutrients is essential for vegetative growth, flowering, fruit formation, and storage quality.

This study aims to develop and evaluate an improved fertilization technology for apple orchards to enhance yield, fruit quality, and nutrient use efficiency.

**Materials and Methods.** The research was conducted in a commercial irrigated apple orchard located in a temperate continental climate zone. The soil type was loamy with medium fertility and neutral pH. Experimental Design. A randomized block design with three treatments and three replications was established:

1. Control (T1): Traditional farmer practice (broadcast NPK application).
2. T2: Soil-test-based balanced NPK fertilization.
3. T3: Soil-test-based NPK + micronutrients applied through fertigation.

Each plot consisted of 20 apple trees of uniform age and vigor.

Fertilization Scheme. Nitrogen applied in split doses (pre-bloom, fruit set, post-harvest). Phosphorus applied early spring. Potassium applied during fruit development. Micronutrients (Zn, B, Fe) applied via fertigation and foliar spray.

Data Collection. The following parameters were measured: Annual shoot growth (cm). Leaf chlorophyll content (SPAD units). Yield per tree (kg). Average fruit weight (g). Fruit soluble solids content (°Brix). Statistical analysis was performed using ANOVA at  $p \leq 0.05$ .

**Results.** The improved fertilization treatments significantly affected vegetative growth and yield parameters.

1. T2 increased yield by 12% compared to control.
2. T3 increased yield by 22% compared to control.
3. Average fruit weight increased by 15% under fertigation (T3).
4. Soluble solids content improved from 12.1°Brix (control) to 13.4°Brix (T3).
5. Leaf chlorophyll index increased significantly in balanced treatments.

Nutrient use efficiency was highest in T3 due to reduced leaching losses and improved synchronization with plant demand.

**Discussion.** The results confirm that balanced fertilization based on soil analysis improves nutrient uptake and orchard productivity. Split nitrogen application prevents excessive vegetative growth and reduces nitrogen losses. Potassium application during fruit enlargement enhances fruit size and sugar accumulation. Fertigation technology provides precise nutrient delivery directly to the root zone, increasing nutrient use efficiency and minimizing environmental contamination. Similar findings have been reported in intensive apple production systems worldwide. Improved fertilization technology also contributes to sustainable orchard management by reducing input waste and optimizing economic returns.

**Conclusion.** The present study demonstrated that improving fertilization technology in apple orchards significantly enhances productivity, fruit quality, and nutrient use efficiency. The results confirmed that traditional broadcast fertilization methods are less effective compared to scientifically optimized nutrient management systems based on soil and leaf analysis. Balanced application of nitrogen, phosphorus, and potassium, combined with essential micronutrients, ensures better synchronization between nutrient supply and plant demand during critical growth stages of *Malus domestica*.

The implementation of split nitrogen application reduced nutrient losses and prevented excessive vegetative growth, while potassium application during fruit development improved fruit size and soluble solids content. The fertigation-based treatment showed the highest agronomic efficiency, increasing yield by up to 22% compared to conventional practices. In addition, improvements were observed in chlorophyll content, fruit weight, and biochemical indicators, demonstrating enhanced physiological activity and nutrient uptake.

Importantly, the improved fertilization technology not only increased economic returns through higher yield and better market quality but also contributed to environmental sustainability by minimizing leaching and nutrient wastage. Efficient nutrient management reduces the risk of soil degradation and groundwater contamination, which are common challenges in intensive orchard systems.

### **References.**

1. Marschner, P. (2012). Marschner's Mineral Nutrition of Higher Plants (3rd ed.). Academic Press.
2. Nurillayev Ilhom Xolbek O'g'li, Xayrullayeva O'g'loy Shuhrat Qizi JANUBIY HUDUDLARNING TUPROQ IQLIMSHAROYITIGA MOS MAVSUMIY GULLAR YETISHTIRISHNING DOLZARBLIGI // EJMNS. 2024. №1-2. URL: <https://cyberleninka.ru/article/n/janubiy-hududlarning-tuproq-iqlimsharoyitiga-mos-mavsumiy-gullar-yetishtirishning-dolzarbligi> (дата обращения: 03.03.2026).
3. Nurillayev I. X. YIELD ELEMENTS OF SOME VEGETABLE CORN HYBRIDS // Экономика и социум. 2025. №9-2 (136). URL: <https://cyberleninka.ru/article/n/yield-elements-of-some-vegetable-corn-hybrids> (дата обращения: 03.03.2026).
4. Nurillayev I.X.. "GROWTH AND PRODUCTIVITY INDICATORS OF VEGETABLE (SWEET) MAIZE MEGATON F1 AND GOLD F1 HYBRIDS

IN SOUTHERN REGIONS" Экономика и социум, no. 5-1 (120), 2024, pp. 583-587.

5. Nurillayev I.X.. "PRODUCTIVITY INDICATORS OF VEGETABLE CORN MEGATON F1 AND MERIT F1 HYBRIDS WHEN PLANTED AT DIFFERENT PERIODS IN THE CONDITIONS OF KASHKADARYA" Экономика и социум, no. 3-1 (118), 2024, pp. 300-303.