



Orchard fertilization management has great importance for proper, efficient nourishment of the trees. It is necessary to address the specific species of an orchard, and sometimes the different varieties of fruit trees, fertilization management differ considerably between deciduous trees and evergreen orchards (subtropical, citrus, olive trees, and bananas, etc.).

Fertilization management relates to providing nutrient elements efficiently throughout the season according to the tree's consumption, assuming we know the quantity of nutrient elements necessary for orchard fertilization and taking into consideration the species of plant, its expected yield, and perform soil/leaf analysis.

In Israel, all orchards are irrigated by drip, micro-sprinklers, or micro-jets. This enables fertigation which delivers the nutrient directly to the rooting system.

Fertilizer can be selected with different concentrations and combinations of nitrogen: phosphorus: potassium proportions, including supplemental micro-element and bio-stimulants in variable doses, according to the tree's stages of development along the season.

Determining the nutritional requirements of orchard trees

The process seems to be simple and logical, but in fact, is not easy to execute due to several basic reasons:

1. Information about the uptake of element nutrients in different species of orchard trees is incomplete. Research to estimate plant uptake is complex and expensive. Evaluation of the nutrient content of the trees implies the destruction of sample trees from which laboratory tests are performed to determine the amount/concentration of each nutrient element in the various organs of the tree, during different growth stages and at different ages. Furthermore, studies take several years for each species, so that, worldwide the number of studies is small, dealing with a few species.
2. It is relatively easy to measure the weight of nutrients removed from the orchard. The weight of harvested fruit is known, the fruit's nutrient content can also be analyzed in a laboratory, just as it's possible to estimate the weight of tree pruning removed during the season, also be analyzed in a laboratory for nutrient contents. The multi-year average for quantities of nutrient removed





constitutes a basis for estimating the quantity of fertilizer required by a given orchard. In practice, recommendations for nitrogen, phosphorus, and potassium are twice or more than the amount removed from the plot. Alternate fruit bearings, as well as, non-uniform pruning from year to year, make it difficult to estimate precisely the amount of nutrients required.

3. Very few studies have been performed on the transport of nutrient elements from roots to the consuming organs in the canopy (new branches, leaves, and fruit). There is not adequate information about the tree's reaction time to element nutrients absorbed from soil solutions into the plant roots and transported to the canopy. The rate of absorption and transport of nutrients is very important for determining fertilization management during the different growth stages.
4. In recent years, the number of experiments for control of orchard tree nutrition has increased with the use of the lysimeter. This is an expensive experimental system in which a tree is grown in a container so that it is possible to precisely measure the volume of water for irrigation, the volume of drainage, and the amount of nutrients contained in it. Using such data, it is possible to compute exactly daily and seasonal-nutrient uptake. The lysimeter system does not allow the determination of nutrient transport to the different organs of the tree from the moment they are absorbed by the root.

Consequently, fertilization management is based on a few well-based studies. Recommendations are based primarily on insight gained from experience and observation of orchard fertilization over the years.

The uptake of nutrients by deciduous trees, citrus, and subtropical trees begins at a slow rate from the beginning of root growth in early Spring, with an increasing rate of uptake as the canopy and fruit develop, until the leaf shedding stage. During this period fertilization management must be optimal as to the composition of and quantity of nutrient elements. The remaining questions are, when to start decreasing their rate and when to conclude the fertilization.

Timing fertilizer application for deciduous

For deciduous trees determining optimal fertilization management is complex, and accordingly, there are various professional approaches.





For nitrogen fertilization, it is usual to apply about 50-70% of the seasonal dose of fertilizer up to 2 - 3 weeks before harvest. The remainder nitrogen being applied after harvesting until late autumn. The main problem is in early-ripening varieties in which blossoming and plant growth begin while the root system is not yet active, due to low ground temperatures. Nevertheless, the standard recommendation to begin fertilization early on with "technical irrigation application" for the only purpose is fertigation, even if the orchard's soil is sufficiently wet.

This method is undoubtedly inefficient since root activity is minimal and late spring rains may leach the nitrogen deep into the soil to where the root system is still dormant.

In several studies, carried out fundamentally on apples, it was found that 80% of the nitrogen in the tree's developing parts until the budding stage, and sometimes even later stages (in June), came from stored nitrogen from the previous season, that accumulated primarily in the roots, and only 20% of the nitrogen in the young organs originated from current uptake.

We may conclude from this that nitrogen fertilization is extremely important until the later stage of leaf shedding, to charge the root system with nitrogen for the following season, primarily in early ripening varieties.

Nitrogen fertilization after the harvest indeed encourages more vigorous plant growth that requires more labor for pruning. However, it contributes significantly to charging the roots with nitrogen to be utilized during blossoming at the beginning of the following season.

Phosphorus fertilization of deciduous trees has less influence on the tree's canopy development, contributing to vigorous radicle development at the beginning of the season when being absorbed by the roots. Phosphorus influences the intensity of blossoming and budding but Fall fertilization with phosphorus has no known advantage.

Potassium fertilization of deciduous trees has less influence on tree development.

It is usual to fertilize with potassium according to the annual amount removed. Due to its limited movement in silt and clay soils, it is not immediately available to the root system at the depth at which the most active roots are found. Continuous potassium fertilization throughout the season increases the odds of being





transported to the depth of the soil cross-section. Fall potassium fertilization is recommended as part of the seasonal fertilization management.

Timing fertilizer application for evergreen orchards

In evergreen orchards (subtropical, citrus, and bananas), fertilization management is simple, but there are varying professional approaches.

For nitrogen fertilization, it is customary to give the initial dose of nitrogen at the beginning of spring and onwards, till several weeks before harvest, according to the species. It is not customary to do Fall fertilization, except for mangoes whose harvest during the summer. Suspending fertilization before harvest is recommended to stimulate the change in color and promote earlier ripening of citrus trees, or to prevent surplus nitrogen that shortens the fruit's shelf-life.

For orchards irrigated with wastewater there is no actual break in fertilization, they continues fertilized up to the start of the rainy season, and no essential differences were found at harvest time or in fruit shelf-life,

Even during the winter, the trees continue to develop their canopy and fruit to grow, so that currently there is a tendency is to apply fertilizer to avocado trees and bananas during the winter as well.

The root system has limited activity due to low temperatures, and it is reasonable to assume that the primary supply of nitrogen is from the nitrogen stores in the roots, and a bit from the trunk.

Phosphorus fertilization in **evergreen** orchards, like deciduous orchards, contributes to the vigorous development of radicles at the beginning of the season when being absorbed by the root. Phosphorus influences the vigor of blossoming and budding.

Potassium fertilization in **evergreen** orchards is like the deciduous orchards. Fall potassium fertilization is recommended as part of the seasonal fertilization management.

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