Use of foliar spray method for nutrition of date palm production

Tunis, Tunisia (May 07, 2023) – Foliar spraying is a new process and can be essential in feeding date palm because it helps solve low growth and productivity and environmental issues such as drought, salinity, and high temperatures. Expanding the use of the foliar technic is a modern method for improving date palm culture. Besides, it provides new opportunities for reviving date palm in areas exposed to harsh environmental conditions that hinder date palm cultivation's success.

Can foliar fertilization be used for date palm trees?

Foliar fertilization is one of the crucial ways for continued cultivation of date palm, obtaining the best results of growth and production, in addition to the possibility to reduce damage from abiotic stress. Although subjected date palm to an annual fertilization program, it faces some challenges, including low soil availability for nutrients, dryness of the soil surface, low root activity in the breeding period, soil alkalinity, as well as water scarcity in areas of cultivation, and symptoms of deficiency of some elements.

Foliar fertilization has certain potential benefits; for example, the provision of fertilizers where the use of small amounts of fertilizer is appropriate compared to soil fertilization. Foliar fertilization can overcome the problems of soil factors that lead to the low utilization rate of manure, whether these factors lead to loss of fertilizer in the form of gas, or with irrigation water such as nitrogen, or determine the movement of sediment or fixing, such as phosphorus and microelements. The plant's rapid supply needs for elements during certain stages of growth, such as flowering or the beginning of the development of seeds and fruits, where root absorption of nutrients has often ceased. The earth's elements' interactions make absorption by the roots small, and boron and manganese deficiency symptoms, iron, zinc, copper, and molybdenum will be apparent. While the use of foliar spray quickly compensates for the shortage of these elements. Ground fertilization is limited to roots only and needs time to reach the other organs, while foliar fertilization can get all parts of the plant for ease.

Foliar fertilization is 8–20 times more efficient than ground fertilization. This method of nutrition has a high elasticity in the addition of fertilizers during the different growth stages, thus meeting the tree's nutrient requirements during different growth periods. The addition of nutrients to plants through spray-application ensures the nutrient is inputted directly into the plant and enhances plant tissue metabolism, reducing energy consumption. The foliar technique increases the potential for mixing nutrients with growth regulators and special purpose products, saving much effort and time.

What is the foliar fertilization in generally?

Foliar application of fertilizers and biostimulants (e.g. Sanbio EPSOMIT, TITAN, VITAL) demonstrates a successful technique of absorbing and interacting of various nutrients and active ingredients by date palm cells, similar to other trees.
Palm tree development and enhancement generally rely upon the mix and grouping of mineral supplements accessible in the soil. Three soil properties as most important concerning any plant response-related functions are:

- soil pH - to regulate nutrient availability
- texture - to regulate water transmission properties and fixation and release of nutrients
- organic matter - to realize the cascading effect on the whole range of soil physical as well chemical properties, including the biological properties
- and above all, plant traits as well (nutrient efficient and nutrient responsive both).

Supplement lack can significantly decrease harvest yield or diminished fruit quality.
Indications of supplement inadequacy may incorporate hindered development, the demise of plant tissue, or yellowing of the leaves brought about by a diminished chlorophyll creation, a pigment required for photosynthesis.
The efficacy of nutrients is governed by spray formulation's physicochemical properties such as pH, surface tension, polarity, additives, molecular size, ionic charge, and solubility in spray fluid. Characteristics of the plant and the environment such as humidity, temperature, light, and wind in which the plant is grown affect the rate of foliar uptake.

What are the effects of foliar fertilization on the palm?

Foliar nutrition, which involves the application of nutrients directly to the leaves of plants, can be beneficial for date palm trees. Here are some mechanisms and advantages of foliar nutrition on date palm trees:

1. Efficient nutrient absorption: Date palm trees have a complex root system, and their nutrient uptake can be influenced by soil conditions and root health. Foliar nutrition allows for direct nutrient absorption through the leaves, bypassing any limitations or inefficiencies in the root system. Nutrients applied via foliar sprays are readily absorbed by the leaves and translocated to the rest of the plant.
2. Rapid response: Foliar nutrition provides a quick response to nutrient deficiencies or imbalances. When nutrients are applied directly to the leaves, they are readily available for immediate use by the date palm tree. This can help address nutrient deficiencies in a timely manner, especially during critical growth stages or periods of stress.
3. Targeted nutrient delivery: Foliar sprays allow for precise and targeted nutrient delivery. By applying nutrients directly to the leaves, you can ensure that the specific nutrient(s) needed by the date palm tree are provided in the right quantities. This is particularly useful when there are specific nutrient requirements or when correcting specific deficiencies identified through soil or leaf tissue analysis.
4. Improved nutrient utilization: Foliar nutrition can enhance the efficiency of nutrient utilization in date palm trees. The application of nutrients directly to the leaves bypasses soil-related factors that may affect nutrient availability or uptake. This can result in better nutrient absorption, utilization, and overall plant health.
5. Mitigation of soil-related issues: Date palm trees are often grown in soils with varying nutrient availability and pH levels. Foliar nutrition can be used as a complementary approach to address nutrient deficiencies or imbalances that may be difficult to correct through soil amendments alone. It offers a way to provide necessary nutrients directly to the trees without relying solely on soil conditions.
6. Stress management: Date palm trees may experience various forms of stress, such as drought, high temperatures, or pest and disease pressures. Foliar nutrition can help alleviate stress by supplying essential nutrients directly to the leaves, where they can be readily absorbed and used by the tree. This can promote recovery and maintain overall tree health during challenging periods.

What distinguishes the leaves of the palm tree from those of other plants?

A cross-section of the date palm leaflet shows no difference from a cross-section of other plant leaves. The thickness of the cuticle layer in the date palm leaflet is close to that of other plants that regularly are given foliar fertilization, such as citrus. The epidermis consists of a single row of non-specialized monocytes containing a living protoplast. No chloroplasts, but having other plastids with a few grana. The skin also contains stomata, which consists of thick-walled cells connected to the air chambers. The thickness of the cuticle in date palm ranges from 3–7 μm in various varieties (other plants 2–10 μm, 4–5 μm Citrus). The number of stomata per unit area does not differ from that of other plants (182 stomata per mm2 upper body, 166 stomata per mm2 lower body vs. 188 per mm2 of Citrus limon).

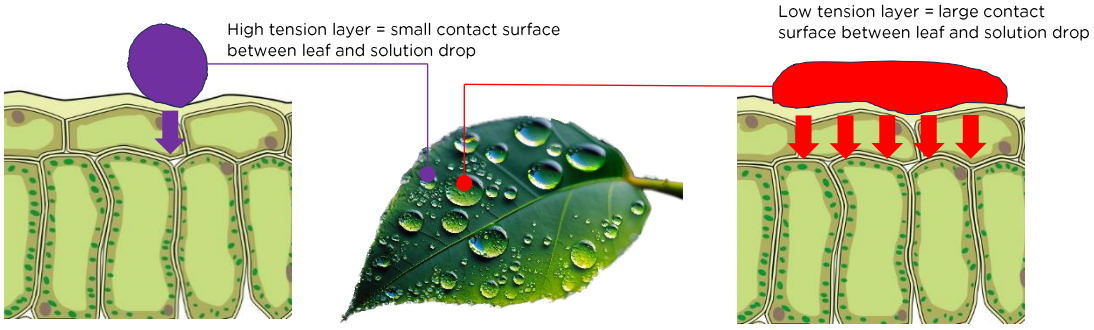
How does the nutrient uptake through the leaves work?

The nutrient absorption process's success through the leaf surface depends on forming a thin layer of solution wetting the leaf surface.
Elements transfer at cell needs the passage of particles through the cuticle layer, which is usually cracked or broken due to the effect of wind on the leaves, allowing the particles to enter the skin that has cytoplasmic channels that help the passage of molecules as well as find spaces between the cells. Also, the presence of stomata, which is the pore, is an important outlet that helps penetrate nutrients into the leaf and the space between the cells. This phenomenon occurs with the property of diffusion.

The foliar absorption mechanism includes:
Surface absorption: The concentration difference is mainly responsible for the penetration of nutrients from the outside into the cell wall in the free spaces and then into the cells.
Negative diffusion: At the time of transpiration, the leaf's central tissue cells lose some water in transpiration, increasing its absorptive strength and withdrawing water from the adjacent cells, which increases the absorption by osmosis and removes moisture from neighboring cells. The stream reaches the vessel's wood absorption by the roots or gaps or skin cells. And then, the leaf's surface and absorption occur through the leaves.
Active uptake by cells: Under the cuticle layer (skin cells), as the thickness of the cuticle does not impede the absorption of nutrient ions because of the occurrence of cracks in the layer of cuticle and the presence of cytoplasmic channels extending from skin cells to the area of the cutin, nutrients can enter into the cellular tissue. The process of nutrient absorption through the vegetative parts is similar to absorption across the roots. The elements move between cells and their outer environment based on the water potential difference (Taiz and Zeiger, 2010). The absorption process begins with the start of the spraying of nutrient solutions. When the leaves are wet, the guard cells' turgor pressure in the leaf increases with the nutrient solutions, leading to the stomata's opening. The permeability of the cuticle increased for nutrients. It penetrates by the pores present inside the cuticle and through small water channels that are also pathways for absorbing the nutrients.

How can I increase the efficiency of foliar fertilization?

Surfactants have a complex hydrophilic and lipophilic structure and can make "spans" between the fluid arrangement and lipophilic waxes at the surface of palm leaves. In this way, surfactants decrease the leaf's surface tension, prompting an expansion in leaf wetting. Surfactants likewise bridge the gap between the air layer and the fluid and leaf surfaces, incrementally infiltrate solutes through the stomata.



SANBOS GmbH provides plant-based and biodegradable surfactants and wettings agents. Due to the improved adhesion and wetting, the effect of fertilizers, biostimulants and pesticides can be optimized.

Chelates are compounds that are mainly used for metallic nutrients (Fe, Mn, Cu, Zn) are used. Here, the nutrient is combined with an organic structure or is coated. This coating prevents the nutrient from forming negative compounds, which results in very good miscibility. In addition, the org.anic structure acts as a transporter into the leaf. A continuous release of nutrients then occurs inside the leaf. This ensures rapid uptake into the leaf even under unfavorable environmental conditions into the leaf is guaranteed. If "overchelation" is used - as with Sanbio VITAL, Sanbio DROPCARE, free chelate is contained in the product, free ions from the spray water are bound. The best way to use chelate to facilitate foliar fertilization is to mix it with the substance to be sprayed on the date palm in a correct proportion.

How date palms response to foliar application of Sanbio fertilizers and biostimulants?

Sanbio fertilizers and biostimulants act on the physiology of the plant through different pathways to improve yields, quality, post-harvest shelf-life/conservation resistance against environmental and biotic stress. The experience from practice showed positive results in using Sanbio fertilizers and biostimulants on date palms and rapid response by plants.

Conclusion

Currently, after years of applying foliar nutrients to date palms, this nutritional technique has proven suitable for date palms not only to fill deficiencies in some elements but to improve plant growth and increase production.

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