Reserves in deciduous fruits and vines

Deciduous species, in their first stages of development during the season, are supported by various reserve nutrients accumulated during the preceding cycle.

All nutrients, including nitrogen, phosphorous, and potassium, are absorbed by plants in various ionic forms. By themselves, the ionic forms play no role within the plant. However, through a number of internal mechanisms, plants succeed in transforming these elements into usable organic forms, some of which are in reserve. Certain very important sources of those reserves are arginine, starch, and in other forms, phosphorous and potassium. The crops where analysis of reserves is most extensively applied are table grapes and grapes for wine production, and, increasingly, walnuts, cherries, and other deciduous species.

Arginine is one of the 20 essential amino acids synthesized in all plant species. It is considered to be the principal source of nitrogen reserves for plants in general, and especially for deciduous plants. Generally, the accumulation of this amino acids tarts in early autumn (when the leaves start to fall), and reaches its peak in the winter months. The principal metabolic sinks are the roots, since they are equipped with specialized structures for storing that amino acid. Normal reference values range between 2.5% and 3.0% (or 25 to 30 mg/g), although variations occur depending upon the zone, the species, and even the variety.

These levels are dependent upon the nutritional level of the orchard, the intensity of the winter cold, and the date when the sample is taken, which should be during the maximum winter repose in cold temperate climates (Chile, Spain, Italy, California, etc.) and subsequent to production pruning in subtropical or tropical climates (for instance, for table grapes in Peru or Ecuador).

Analysis of arginine can be used as an indicator of nutritional reserves or of nitrogen nutrition, but above all as a general metabolic indicator of the plant. In other words, analysis of arginine can provide a notion of the metabolic condition of several deciduous species, especially vines. A vine with high arginine content in its roots should not necessarily be interpreted as a vigorous one. Quite to the contrary, it reflects a condition of equilibrium on the part of the plants. In conclusion, the correct interpretation of this analysis serves to gain an early notion of how one would expect the vine to behave during the season. It should be remembered that in the case of vines and other deciduous species, fertilizations generally commence after the plant starts to bud, and during that entire time, the plant functions with the reserves it has accumulated. Now, if the plant has few reserves, that does not mean it won't grow, but it will surely prioritize its development to the detriment of the development of the rest of the organs; plants also need to develop roots and fruit, however, which could be affected by the shortage of reserves. This will be noted once the season is well underway, at which point there is not much that can be done to overcome a bad start. Other uses of such analysis worth mention are: for taking preventive measures in response spring cold spells in order to prevent risks of spring fever; as an early predictor of bunch-tem necrosis;

for evaluating cold winter quality; for evaluating reserve fertilization quality (post-harvest); and for evaluating post-pruning status, among others.

Carbohydrates such as starch, unlike arginine, start to accumulate early in the season, that is, in late spring and during the summer, and they peak in the heart of the winter repose. This accumulation is much greater in the roots than in the cordons, since the roots have specialized structures for their accumulation.

The greatest use of this reserve starts with budding, while lowest levels are seen in the summer, at which time, in general, the flush of root growth occurs. This translocation runs from the organs of reserve to the new shoots, and it is of vital importance that there be adequate levels for normal development of the plant material. Normal values range between 2.5 and 3% and ought to have a relationship with levels of arginine.

Low levels can be a cause of low vigor. In addition, being able to monitor these levels can provide insights for the recovery of deteriorated vines or for the control of exaggerated vigor.

During the fruit's growth on the vine, up until the harvest, there is a great consumption of carbohydrates by all of the plant's organs. The fruits can use up to 70% of the carbohydrates, on account of which good metabolic function is directly related to the plant's nutritional status. Potassium and phosphorous play fundamental roles in this process. The organs simultaneously compete for carbohydrates and for potassium, and a poor provision of either of them could even affect subsequent floral induction.

Phosphorous in the roots has a behavior similar to that of arginine, accumulating in roots starting in late summer and peaking in late winter, and mobilizing slightly later in the budding process, as flowering approaches. Phosphorous is believed to have a direct incidence in the quantity and quality of the roots in the first flush of root growth, while also providing the energy needed forbudding. That is why caring for the roots and monitoring phosphorous levels both in the leaves and in the roots (in winter) is fundamental. Values between 0.15 and 0.2% are considered sufficient for a good reserve status.

Potassium in the roots is still being debated, given that a specific form of reserve has not been described. Also, a large percentage of potassium is concentrated in the fruits, and potassium demand would be covered by what can be accumulated in the aerial part of the plants, which is accomplished when potassium levels are at normal levels in the aerial part. This is not always achieved, due to the insufficient monitoring of the plants and deficient programs that end early in the cycle. It has also been described that better budding and production have been obtained when the potassium levels in the roots range between 0.35%and 0.45%.

The sampling period for these analyses will depend upon the geographic zone where one is located. In general it is in late winter (for example, February in the North hemisphere, August in the Southern hemisphere). That is when the plant's reserves have been translocated in their entirety to the root. Thus, if the sampling is conducted in spring, values obtained tend to be lower, sincethe reserves start being distributed within the plant, and therefore the samples are not representative.

It is very important to consider that these indicators will always be helpful when the root mass is the correct one, with healthy, abundant roots. Accordingly, preparation of the soil, irrigation, and nutrition play fundamental roles. The quality of the roots, in large measure, is determinant of success in vegetative and reproductive development.

Visit our website to obtain more information about AGQ Labs.