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NITROGEN CONTENT IN ABOVE-GROUND PLANT PARTS AS AN AID TO ESTABLISH MORE ACCURATE FERTILIZER-NITROGEN RECOMMENDATIONS FOR GRAPEVINE

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Nitrogen is the nutrient applied most frequently as fertilizer in annual and perennial crops. In grapevine, nitrogen determines the vigor and yield of vine and several attributes of must quality (Akin et al., 2012; Pérez-Alvaréz et al., 2013). The close relationship between nitrogen application, vine performance and the quality of wine requires the rational use of fertilizer-N. In addition, the excessive use of fertilizer-N may cause environmental damage (Powlson, 1993). The current recommendation systems for vine are usually based on plant analysis complemented by soil testing. These tools are important but insufficient to provide quantified rates of nutrients to apply. To increase the accuracy of the fertilization programs, data on nutrient content and dynamic in plant tissues may be helpful. In this work, nutrient content in different vine parts (leaves, canes, cordons and trunk) and at different dates (from September 14th to November 28th) was determined to understand the fate of the nutrients at the end of the growing season as a mean of increasing precision of the fertilizer recommendation system. In this extended abstract, it will be presented data on nitrogen content and dynamic in those plant tissues and dates.

Materials and Methods

At harvest, on September 14th, the clusters of three vines were cut and separated into rachis, pulp and seeds. Dry matter yield and nitrogen concentration of the different tissues were recorded. The canes were divided into leaves and wood, weighed dry and analyzed for nitrogen concentration. Trunk and cordons were also weighed after dried, and analyzed for nitrogen concentration from sawdust samples and from the outer layer (phloem vessels) of the trunk. The procedure was repeated on October 16th, excluding the clusters that were not present at that time. On November 02nd and 28th the analyses were performed in the woody parts (the leaves had begun to fall). On October 16th, samples of normal (green) and chlorotic leaves taken from a similar position in the canopy were analyzed for nitrogen concentration to infer on nitrogen lost during the senescing process.

Results and Discussion

On September 14th, the leaves were the most nitrogen concentrated tissue (~18 g kg^{-1}), followed by the seeds (~15 g kg^{-1}). The woody vine parts (trunk, cordons and canes) presented low nitrogen concentrations (< 4 g kg^{-1}). Nitrogen concentration in leaves decreased from 18.3 g kg^{-1} on September 16th to 13.3 kg kg^{-1} on October 14th. Nitrogen concentrations in green and chlorotic leaves on October 14th were, respectively, 11.9 and 6.2 g kg^{-1}. Cane nitrogen concentrations increased from September 16th to November 28th. Nitrogen concentration in trunk increased from September until November 02nd. The above-ground parts of a vine contained 84 kg N ha^{-1}, distributed by trunk and cordons, canes, leaves and clusters, respectively in the approx. amounts of 14, 8, 42 and 20 kg N ha^{-1}.

Nitrogen present in the vine at harvest may be lost from the soil/plant system or recycled through remobilization to the perennial structures and taken up from soil in the next season. The schematic view of the process is presented in table 1.

The clusters contained ~20 kg N ha^{-1}, representing 1.4 kg N per ton of fresh fruit. This nitrogen represents an entirely lost from the soil/plant system which should be taken into account in the fertilizer recommendation program. During senescence, nitrogen from leaves may be remobilized to perennial structures or volatilized as NH_3 to the atmosphere. The results here reported indicate that a significant portion is remobilized to woody parts. Nitrogen in fallen leaves undergo mineralization and thereafter nitrogen can be taken up by roots or lost from soil by NH_3 volatilization or NO_3^- leaching and denitrification. The importance of each component may depend on environmental conditions and soil management techniques influencing nitrogen use efficiency. Nitrogen in prunings may be lost from the system or recycled in it depending if prunings are removed and used as firewood or left on the ground as an organic residue. The advisory system should take all those aspects into account in preparing nitrogen recommendations for vineyards.

Table 1. Fate of nitrogen from clusters, leaves and canes at/and thereafter harvest.

Clusters	20 kg N ha^{-1}	Lost from soil plant system
Leaves	42 kg N ha^{-1}	Lost or recycled in soil plant system Remobilized to perennial structure Volatilized from canopy Mineralized in soil Volatilized as NH_3 from soil surface Leaching with autumn winter rains Denitrified in waterlogged conditions Taken up by crop and weeds
Canes prunings	8 kg N ha^{-1}	Lost or recycled in soil plant system Removed and burned (or) Mineralized in soil Volatilized as NH_3 from soil surface Leaching with autumn winter rains Denitrified in waterlogged conditions Taken up by crop and weeds

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