

Post-Spring Frost Canopy Development and Fruit Composition in cv. Barbera Grapevines

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Abstract:

Context and purpose of the study - One of the effects of warming trends is the advance of budburst, increasing the frequency of spring frost-related damage. In April 2021, a severe frost event affected central and northern Italian viticulture. In a cv. Barbera vineyard located in the Colli Piacentini wine district, after such occurrence, vines were tracked and growth of primary bud shoots (PBS), secondary bud shoots (SBS), and suckers (SK) was monitored, as well as their fruitfulness and fruit composition. Vine performances were then compared to those of the previous year, when no post-budburst freezing temperatures occurred. The goal of the study was to evaluate the efficacy of SBS in restoring yield loss due to PBS injuries and analyze respective contribution to fruit composition.

Material and methods – In 2021, survived primary bud shoots (PBS) were tagged after the occurrence of freezing temperatures in spring. Then, developing secondary bud shoots (SBS), and suckers (SK) were also differently tagged. Leaf gas exchange parameters were measured based on shoot type. Contribution of PBS, SBS and SK to vine leaf area and vine yield was determined. At harvest, grapes were separately sampled according to the shoot type, and soluble solids concentration, pH, titratable acidity, total anthocyanins and total phenolics were determined.

Results - The spring frost killed 75% of the developing PBS. At the end of the season, 4 survived PBS, 6 SBS, and 7 SK per vine were counted out of canopies featuring 17 shoots per vine, totally. The number of developed SBS and SK was directly correlated to the number of killed PBS. SBS and SK had a significantly lower fruitfulness than PBS (0.40 and 0.84 inflorescences per shoot, respectively, compared with 1.44 found in PBS), resulting in an average fruitfulness of 0.85 inflorescences/shoot, much lower than the 1.76 inflorescences/shoot recorded in 2020. Vine yield was reduced by 60% as compared with the previous year, and this was due to the decrease in all yield components (bunches/vine, bunch, and berry mass). A direct linear correlation was fitted between the number of PBS per vine and total vine yield. At harvest, no difference was found in grape total soluble solids (TSS) among different shoot types. However, the TSS average was notably higher than that observed in the previous season (27.8°Brix vs. 23.3°Brix in 2020). Interestingly, while in PBS and SK, a direct correlation (linear and quadratic, respectively) existed between the leaf area to yield ratio (LA/Y) and grape TSS or total anthocyanins, this did not occur for SBS.

Data demonstrate that the number of PBS avoiding fatal injuries will drive agronomic results at harvest, since SBS and SK cannot replace yield lost from the killed PBS due to their low fruitfulness. The amount of PBS present in the canopy at harvest is indeed directly correlated to yield, and inversely correlated to LA/Y and, consequently, to grape sugar loading. If the current season crop is pursued, then an altered fruit composition should be expected and harvest time should be carefully planned based on periodical monitoring of ripening kinetics.

Keywords: Spring frost, Vine balance, Compound bud, post-frost management, Fruit composition, budburst.