Marquette Crop Load and Training System Trial for Michigan

Southwest Michigan Research and Education Center, Benton Harbor, MI

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Background and Rationale: Currently there is a lack of data driven information about the potential performance (yield, fruit quality and wine quality) of Marquette grown in Michigan, and also throughout the Midwest. Our research activity in 2014 concentrated on demonstrating the potential yield the variety is capable of under growing conditions of Southwest Michigan, one of the most important grape-growing region of our state.

Treatments: The 2013-2014 winter in the Midwest and Eastern US was impacted by the polar vortex; temperatures plunged into the sub-zero digits and the extended duration of the cold events severely affected the grapevines. Many cultivars in Michigan that normally survive our winters with little to no damage were severely injured by the extreme cold. The extent of the damage depended mainly on cultivar and location. Our experimental trial on Marquette was partially impacted by the winter temperatures. In Michigan almost 90% bud damage was reported on *vinifera* grapes in several locations, with hybrids at 60%, and American grapes at 30%; even cold-hardy grapes were extensively damaged, with Marqutte reporting bud damage at 20% primary bud mortality in our experimental trial. In 2014, the research was conducted at Southwest Michigan Research and Education Center (SWMREC). SWMREC is located in Benton Harbor, in the heart of one of the most important appellation, Lake Michigan Shore. The research focused on the effects of yield per vine on fruit chemical composition from veraison to harvest and canopy growth and development. Three treatments were applied based on the number of clusters counted at the time of fruit set on the vines. All vines within the experimental vineyard were pruned to 100 buds during the dormant period in the previous winter. For this vineyard the vines were trained to High Wire Cordon (HWC) with 691 vines per acre and the training system consisted of a fruiting wire at a height of 1.7m above the vineyard floor.

Crop load Field Experiment

Vines were established in 2008 in the experimental vineyard located at Southwest Michigan Education and Research Center (SWMREC) in Benton Harbor, MI. The vines were planted in a random block design as part of a hybrid variety trial in 2008 (NE1020 project). The vines are planted on a spacing of 2.74 m between rows with 2.13 m between vines at a planting density of 691 vines per acre. After fruit set all of the vines within the research plot were evaluated and assigned to either one of the three treatments being tested (high cropping, medium cropping, and low cropping; HC, MC and LC, respectively). Crop adjustment was made by manually removing fruit in order to achieve the three levels. After adjustment was made weekly measurements were taken to observe canopy growth and development. All sprayings and vineyard management practices were conducted similar to the rest of the experimental vineyard at this location.

At the time of veraison, sampling of fruit started and continued until harvest. The procedure for berry sampling was conducted by selecting 30 randomly selected berries. Care was taken to select berries from different parts of the clusters to insure a representative sample per vine. These berries were then transferred into plastic

collection bags and placed into a -20°C freezer until analysis was performed. The whole process was continued weekly until harvest.

At the time of harvest, each vine used in the experiment was hand harvested. Each vine had the fruit collected from the tagged shoots to be used for chemical analysis in the laboratory. After the fruit was removed, the tagged shoots per vine were also harvested and placed together per vine with care not to damage the shoot or damage any of the leaves on the tagged shoots. These shoots were then placed into coolers and taken to the laboratory for immediate analysis of viticultural parameters like leaf area, number of leaves per shoot, and shoot length. As soon as the tagged shoots were collected, the rest of the vine was harvested with care in order to count and mass the yield per vine. At the time of analysis, previously collected samples were allowed to warm to room temperature before being placed into 50 ml centrifuge tube and homogenized. After the samples were homogenized, approximately 1g ± 0.05g worth of the homogenate was massed out and placed into a 15 ml centrifuge tube to be used for Anthocyanin and total phenolic assay as described by Iland et al., 2004. Readings from this sample of absorbance were gathered using a UV-Vis spectrophotometer (Model UV-1800, Shimadzu Corporation, Kyoto, Japan) at wavelengths of 280nm, 520nm, and 700nm as called for in the procedure. The remaining sample of the homogenate in the 50ml tube was centrifuged for 10 min at 4000 rpm. The surfactant produced in this process was then used as clarified juice for testing of total soluble solids, pH, and titratable acidity.

Results:

The three different levels of yield per vine imposed at fruit set, significantly impacted vine yield at harvest; LC vines had half of the production when compared to HC vines. The reduction in yield was around 50% for LC vines and about 30% for MC vines, when compared to HC vines (Table 1). However, any of the cluster parameters (measured at harvest) were impacted by the different treatments; at harvest cluster weight, berries per cluster and berry weight were similar for all the treatments.

Table 1. Yield components in Crop load Field Experiment from SWMREC in 2013.

Treatment	Yield Tons/acre	Yield Kg/vine	Cluster/ vine	Cluster weight (g)	Berries / cluster	Avg. berry weight (g)
High	4.6 a	6.0 a	62 a	96.0 s	80 a	1.2 a
Medium	3.2 b	4.3 b	45 b	97.5 a	75 a	1.3 a
Low	2.3 b	3.0 b	32 b	98.8 a	76 a	1.3 a

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

Yield per vine had a significant impact on basic fruit chemistry. Sugar concentration of the berry at harvest, indexed as Brix was increased in LC, when compared to HC and MC vines. However, this difference was not reflected in phenols and color compounds concentration (Table 2) that remained unchanged in rrelation to the crop load treatments.

Table 2. Fruit chemical composition at harvest for Crop load Field Experiment from SWMREC in 2013.

Treatment	TSS (^{o}Brix)	pH	TA (g/L)	Phenolics (a.u./g)	Anthocyanin (mol/g)
High	21.0 b	3.5 a	9.8	0.76	1.2
Medium	20.9 b	3.6 a	8.9	0.80	1.1
Low	23.0 a	3.7 a	8.7	0.79	1.1

Treatment means followed by the same letter within a column are not significantly different at the α=0.05 level. Columns where no letters are present indicate a lack of significant differences among treatments.

What the results mean:

- The treatment impacted only the yield per vine at the time of harvest as seen in Table 1.
- The difference between the high cropping treatment and low cropping treatment was nearly 3 kilograms of fruit which is nearly double the yield, obtained doubling the number of clusters.
- The large difference in yield but did not affect the number of berries per cluster, cluster weight, or average berry weight.
- Fruit chemical composition at harvest showed a significant impact only on total soluble solids.
- All other chemical analysis showed no statically difference at the time of harvest but slight differences during the growing season.