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# Cluster Removal on La Crescent and Leaf Removal on Marquette Grapevines

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# Cluster Removal on La Crescent and Leaf Removal on Marquette Grapevines

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## Introduction

As part of the Northern Grapes Project, research has evaluated various cultural practices to aid in understanding the performance of cold-hardy grape vines (*Vitis vinefera*-based hybrids) in cold climates. This multi-state research project has led to increased production of cold-hardy grapevines and consumer acceptance. Some cultural practices often utilized in viticulture throughout various parts of the world could potentially be implemented to increase performance and quality of grapes produced in the Midwest. Two of these cultural practices include leaf removal or canopy thinning, as well as fruit thinning or cluster removal. Both practices are typically aimed at improving fruit quality. Our goal was to determine if these practices can be implemented successfully in cold-hardy grapes grown in Iowa.

## Materials and Methods

In 2015 and 2016, Marquette and La Crescent vines trained to a single curtain bilateral cordon system had treatments administered on either leaf removal (Marquette) or cluster removal (La Crescent) to determine fruit quality impacts at harvest.

La Crescent treatments:

1. Control vines received no treatments and were left to grow unaltered.
2. TRT2 consisted of removing all clusters except the primary cluster.
3. TRT3 consisted of removing only tertiary clusters while leaving primary and secondary clusters.

Marquette treatments:

1. Control vines received no treatments and were left to grow unaltered.
2. TRT2 consisted of removing the leaves adjacent to and below the second cluster.
3. TRT3 consisted of removing the leaves adjacent to the first and second cluster and below the second cluster.

Vines were initially shoot-thinned to retain no more than five shoots per foot of established cordon. Suckers were removed throughout the season. Treatments were applied to three-vine panels and replicated three times for Marquette and four times for La Crescent in a completely randomized design near the start of veraison. Fruits were harvested, weighed, and either a 50-berry subsample in 2015 or a five-cluster subsample in 2016 were collected from each individual vine to analyze fruit quality characteristics (°Brix, pH, and titratable acidity (TA). Number of berries per cluster and berry weight also were calculated in 2016 from the five-cluster sub-samples, but data is not presented. Data for fruit quality and harvest parameters were analyzed using Tukey's honestly significant difference tests ($\alpha = 0.05$).

## Results and Discussion

Yield and yield components (cluster weight) of La Crescent were similar regardless of cluster removal treatment in 2015 (Table 1). In 2016, removal of secondary and tertiary clusters

reduced average cluster weight compared with removing only the tertiary clusters. However, there were no differences between removing clusters and not removing clusters (control vs. TRT2; control vs. TRT3). There were no differences in cluster number or cordon lengths regardless of treatment or year. Leaf removal did not have a significant impact on Marquette yield, yield components (cluster weight), or cordon length regardless of year.

La Crescent fruit quality (°Brix, pH, and TA) was similar among all cluster removal treatments in 2015 (Table 2). However, in 2016, removal of secondary and tertiary clusters on La Crescent vines significantly improved fruit quality (°Brix and TA). Removing all clusters, except the primary cluster (TRT2), resulted in an increase in °Brix compared with the control and TRT3 (removal of only tertiary clusters). In addition, TA was lower in TRT2 compared with TRT3 in 2016. Marquette fruit quality was similar among all treatments regardless of year.

Removal of leaves adjacent to and below the second cluster and removal of leaves adjacent to the first and second cluster and below the second cluster resulted in a significant increase in light penetration into the fruiting zone after initial thinning (Table 3). As the 2016 season progressed, light penetration decreased over time and remained highest for vines where leaves were removed adjacent to the first and second and below the second cluster.

Cluster removal on La Crescent vines exhibited variable fruit quality improvements with no significant differences during the 2015 growing season, although improvements were observed during the 2016 growing season. When comparing the fruit quality results between 2015 and 2016, as well as the yields achieved (2015: 4.0-5.4 kg and 2016: 5.1-9.0 kg), it appears the effects may be greater when a larger fruit load is present. Crop loads were larger in 2016 compared with 2015, suggesting fruit thinning can be a necessary tool to ensure adequate fruit quality as well as balancing the vigor of vines with fruit production capacity. To capitalize on any potential fruit quality improvements from cluster removal, it may be important to remove all the clusters on vines except for primary clusters when large crop loads are expected.

Leaf removal on Marquette may not exhibit direct effects on fruit quality but may have indirect effects related to increased light penetration into the canopy. For instance, if light penetration is increased we can hypothesize that disease pressure may decline as a result of increased air flow through the canopy. Although we did not see any direct effects on fruit quality by removing leaves, leaf removal and/or canopy thinning is a common practice in the viticulture industry to balance the shoot-to-fruit load in aggressive vines and to expose the fruiting zone to allow for better light penetration. Thus, growers in the Midwest should evaluate cultural practices commonly employed in the viticulture industry to determine if the same results can be seen on cold-hardy grapes grown in the Midwest.

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**Table 1. Yield and yield components (cluster weight and cordon length) of La Crescent and Marquette grapevines after cluster or leaf removal during the 2015 and 2016 growing seasons.**

| | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|
| | Yield (no.) | Avg. yield (kg) | Avg. cordon length (m) | Yield (no.) | Avg. yield (kg) | Avg. cordon length (m) |
| | | | Cluster removal La Crescent[z] | | | |
| Control | 83 a[y] | 5.0 a | 2.2 a | 94 a | 8.0 ab | 2.0 a |
| TRT2 | 61 a | 4.0 a | 2.1 a | 68 a | 5.1 b | 2.0 a |
| TRT3 | 92 a | 5.4 a | 2.1 a | 125 a | 9.0 a | 2.2 a |
| | | | Leaf removal Marquette[x] | | | |
| Control | 111 a | 3.3 a | 5.3 a | 83 a | 4.6 a | 1.8 a |
| TRT2 | 89 a | 3.3 a | 5.6 a | 85 a | 4.7 a | 1.8 a |
| TRT3 | 114 a | 3.2 a | 5.3 a | 86 a | 4.1 a | 1.8 a |

[z]Cluster removal: control = no clusters removed; TRT2 = removed all clusters except the primary cluster; TRT3 = removed only the tertiary cluster.
[y]Means (within a column) with the same letters are not statistically different according to Tukey's HSD, α=0.05.
[x]Leaf removal: control = no leaves removed; TRT2 = removed leaves adjacent to and below the second cluster; TRT3 = removed leaves adjacent to the first and second cluster and below the second cluster.

**Table 2. Effect of leaf removal performed on Marquette and cluster removal performed on La Crescent vines on fruit quality during the 2015 and 2016 growing seasons.**

| | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|
| | °Brix | pH | TA[z] | °Brix | pH | TA |
| | | | Cluster removal La Crescent[y] | | | |
| Control | 24.0 a[x] | 3.3 a | 6.2 a | 19.8 b | 3.3 a | 9.1 ab |
| TRT2 | 25.0 a | 3.4 a | 5.8 a | 22.4 a | 3.4 a | 8.5 b |
| TRT3 | 23.6 a | 3.3 a | 6.6 a | 19.1 b | 3.3 a | 9.5 a |
| | | | Leaf removal Marquette[w] | | | |
| Control | 23.2 a[z] | 3.3 a | 5.3 a | 23.3 a | 3.4 a | 8.0 a |
| TRT2 | 24.2 a | 3.3 a | 5.6 a | 23.3 a | 3.4 a | 7.8 a |
| TRT3 | 23.8 a | 3.2 a | 5.3 a | 24.0 a | 3.4 a | 7.8 a |

[z]TA = titratable acidity (g/L).
[y]Cluster removal: control = no clusters removed; TRT2 = removed all clusters except the primary cluster; TRT3 = removed only the tertiary cluster.
[x]Means (within a column) with the same letters are not statistically different according to Tukey's HSD, α=0.05.
[w]Leaf removal: control = no leaves removed; TRT2 = removed leaves adjacent to and below the second cluster; TRT3 = removed leaves adjacent to the first and second cluster and below the second cluster.

**Table 3. Light exposure (μmol·m$^{-2}$·s$^{-1}$) near the fruiting zone of Marquette grapevine after leaf removal, 2016.**

| | July 31 | Aug. 5 | Aug. 31 |
|---|---|---|---|
| Control[z] | 135 b[y] | 68 a | 46 b |
| TRT2 | 343 a | 87 a | 72 b |
| TRT3 | 477 a | 187 a | 147 a |

[z]Leaf removal: control = no leaves removed; TRT2 = removed leaves adjacent to and below the second cluster; TRT3 = removed leaves adjacent to the first and second cluster and below the second cluster.
[y]Means (within a column) with the same letters are not statistically different according to Tukey's HSD, α=0.05.