

FINAL REPORT

Project Number: #001200

Project Title: Adapt viticulture in Ontario to climate change and drought stress

Pillar Number:

Applicant Name: Ontario South Coast Wineries and Growers Association

Interim Report Number: 6

Report Period: October 1, 2016 - March 31, 2017

Date of Submission: April 11, 2017

OGWRI Program Coordinator: Eleanor Hawthorn

1. Executive Summary

- **Summary of activities to date:**

The objectives were to select ten drought resistant genotypes, propagate them for greenhouse drought resistance trials and assess their performance as rootstocks grafted to Pinot Noir. Also make final recommendations about commercial scions and rootstocks from field trials that were in progress

In 2015, 18 rootstocks were selected for the greenhouse drought resistance trials, from a collection of 900 *Vitis riparia* genotypes gathered in 2013 from sandy sites throughout Ontario. After the 2015 greenhouse trials this was reduced to 12 genotypes. The greenhouse trial was repeated in 2016 and 2017, the data collected and will be analysed this fall. As a result of these trials. The 12 genotypes (Simcoe 34, 89, 120, 123, 164, 494, 517, 634, 659, 732, 801 and 802) will be disclosed to the University of Guelph for intellectual property protection. In addition, three genotypes have been identified for their fruit quality. Simcoe 388 and 800 for further breeding as they have high BRIX, low titrable acid and high pH compare with other tested *V. riparia* genotypes, and Simcoe 061 as a potential table grape.

Scions of a commercial grape 'Pinot Noir' were grafted on ten selected genotypes and the commercial rootstock, Glorie de Montpelier. These were planted in 2015 at the Simcoe Research Station and in 2016 at the Burning Kiln Vineyard. Preliminary analyses of the yields ranged from 19.3 to 8.9 Tonnes/ha, with 802 giving the highest yields.

In 2016 The limited supply of Pinot Noir grapes was made available to AWO (Amateur Winemakers of Ontario) winemakers from Kitchener. Five wines were made and then were judged in the following March 2017. All wines were judged as either bronze or silver medal quality. Samples of the wines have been saved for judging after further aging. In 2017, substantial quantities of grapes were available for each new *Riparia* rootstock, the *Riparia gloire* control, and the from the commercial rootstock trials. These grapes were made available to 2 AWO wine clubs in Hamilton and Simcoe areas. The wines will be evaluated first in March 2018, and samples reserved for later judging.

Grapes for winemaking were very limited in 2016. In 2017 wines are bring produced for each rootstock selection. While all grapes were collected for the harvest record, winemakers were instructed to discard unripe fruit and make the best wine possible, given one constraint that they use RC212 yeast. Evaluations in March have be viewed as "preliminary" as the wine can age in bottle to reach a higher quality standard. The Wine Judges of Canada can perform sound assessments of these test wines.

The results from the commercial rootstock x scion trials have indicated through the winters of 2014and 2015 that of the four rootstocks Glorie de Montpelier showed the best winter survival. Preliminary analyses of the yields, based on yield per plant and vine survival, showed significant interactions. The best combinations at Simcoe were Chardonnay on Coudere 3309 (17.1 T/ha) and Reisling on Glorie de Montpellier (14.6 T/ha) The fruit of the 2016 and 2017 harvests have been distributed to the local wine maker groups to determine the suitability of the wines.

Objectives or goals accomplished:

1. To develop viticulture best practices, to support the grape and wine industry in the Ontario South Coast region
2. Identify favorable *riparia* rootstocks through a collection of >900 *riparia* vines at the Simcoe Research Station
3. Rank suitability of commercial scion and rootstock combinations

- **Highlight achievements and reach of project to date:**

Activities	Update on Outcomes or Next Steps Planned to Complete the Activities	Completion Date (Actual or expected)	Degree of Activity Completion (%)
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Activity 1:	Adapt viticulture in Southern Ontario to ...	Eighteen genotypes were selected, and propagated after further evaluation; twelve of them were put into performance trials. Also, three two selections have been made for breeding for fruit quality and a third as a table grape. These will be disclosed to the University.	10/31/2017	100%
Sub Activity 1:	Riparia screening for drought resistance	We have recorded and analyzed many morphological characteristics and selected 18 rootstocks.	03/31/2014	100%
Sub Activity 2:	To assess drought resistance ...	Three greenhouse trials have been completed. Data are summarized for presentation over the winter	10/31/2017	100%
Sub Activity 3:	To assess the performance of grafted vines...	It was started in spring 2015 with 11 selected rootstocks. Grapes were harvested in 2016 and 2017 and sent to local wine maker groups for testing.	10/31/2017	100%
Sub Activity 4:	Cultivar Trials...	We have managed the vineyards and recorded vine performance & conditions. Grapes were harvested in 2016 and 2017 and sent to local wine maker groups for testing.	10/31/2017	100%

2. Detailed description of the Project

a) Objectives and Project Input

- Identify the project objectives

Sub activity 1- Riparia screening for drought resistance (to select 10 out of 900 genotypes based on morphological characteristics).

For the drought experiments (proline assay and field test), we selected 18 favourable genotypes in 2015 [Accessions 34, 89, 97 (Riparia gloire as control), 120, 121, 122, 123, 142, 164, 494, 517, 566, 598, 634, 659, 732, 801, 802]. Later in 2016, we reduced them to 12 genotypes.

Sub activity 2- To assess drought resistance of the selected Riparia genotypes based on proline assay in control environment.

Drought trials and assessment of plant stress were completed in 2015 and 2016 by proline assay is underway in the greenhouse for continued trials. In April 2017, They were replaced replaced with new vines of same genotypes in 2017. Which were grown in the greenhouse with three replicates, and three treatments (drought regimes), under randomized irrigation for the whole summer. Three different irrigation treatments defined by temperature, soil moisture and evapotranspiration will be maintain by a system using a timer, temperature data loggers, soil moisture sensor data logger and atmometer.

Several characteristics were recorded in the greenhouse and leaves were collected from all vines and dried for proline assay.

Sub activity 3- To assess the performance of Pinot Noir vines grafted on Riparia rootstocks under normal vineyard conditions

Based on the milestone, the activity was started in spring 2015. Cuttings from 11 rootstock genotypes [34, 89, 97 (control), 123, 164, 517, 634, 659, 732, 802 and 919 (another control)] were grafted to Pinot Noir at VineTech. Grafted vines were planted in the field in three replicates, three sub-plot and three treatments. The vineyard was established with irrigation tape and trellis system. Some data were measured or recorded in the summer in all the vines (300 vines) such as winter survival, chlorophyll content, no. of trunk and branches, height, trunk diameter, periderm development, leaf fresh and dried weight, leaf area, early veraison, petiole nutrient analysis, phenology, trunk bark damage, pre evaluation of brix, fruit quality, yield. The data were archived and are under analysis. The vines were harvested in 2017

Sub activity 4- Cultivar Trials (four *vinifera* grapes (Chardonnay, Riesling, Pinot Noir and Cabernet Franc) grafted onto four commercial rootstocks (RGM, 3309, 101-14 and 161-49), were continued in order to rank cultivar/rootstock combination in four established fields in the previous CAAP project. The data on plant growth, height and diameter, winter injury and vine survival were recorded at Simcoe Research Station and off-station sites which are located in OSCWGA growers' fields (Blueberry Hill Winery, Burning Kiln Winery, and Villa Nova Winery). In Simcoe Research Station, also, some other characteristics were evaluated such as: Early veraison, periderm development, pre evaluation of brix. We have read temperature data loggers and re-launched them again. Crops were picked, qualified and recorded at Simcoe research station and at Burning Kiln Winery in 2016 and 2017
Proline assay: 297 samples (leaves) which dried by Silica gel (from vines which planted 2016), were ground and are ready for proline testing.

Supplementary activities:

An extra vineyard was also established in 2015 with selected rootstocks to compare the data with the main vineyard (120 vines at the research station).

Also in 2016, we have established an extra vineyard of Pinot Noir with these rootstocks in the Burning Kiln Winery (200 vines). Vinetech nursery have grafted these vines as an in-kind contribution to the project. We have recorded their rate of successes of grafting.

A mother block and collection vineyard from selected genotypes was established in the summer 2016 (160 vines).

Also a new vineyard was established in the summer 2016 (160 vines) with *Riparia* x Riesling hybrids which moved from Vineland research station to Simcoe Research Station.

A pre-experiment was done to evaluate lime tolerance in the *Riparias*. About 3700 seeds from 156 genotypes were extracted and stratified in the cooler. After germination, the seedlings were planted in the plug-trays and later, were transplanted in the ¼ gallon pots with N7 Fafard soil mixed with equal calcium Calcite MisNer (pH=7) and moved them from greenhouse to screen house. They were irrigated with water treated with KOH and NaOH (pH=8 up to 11).

About 50-100 cuttings were taken from each selected riparias (20 selection) and were kept in the cooler and then they planted for rooting evaluation.

Crops from Burning Kiln Winery (20 batches) organized by rootstock, were provided to three wine makers including Herb Taylor, Bob Gibbon and Garry Turner to make Chardonnay, Riesling and Pinot Noir wines. We did not get wines from them yet.

Crops from Simcoe Research Station (6 batches) were given to the Steve Mc. Donald, (Wine club-Kitchener) to make 5 different kinds Pinot Noir wines on different rootstocks (919, 123, 89, 802 and a combination of others (34, 97, 164, 634, 732, 517, 659)). Wine club have made 5 bottles of wine and it is under process for taste evaluation by certified wine judges.



- Identify the project inputs i.e. funding level, staff resources, cash and in-kind and other resources utilized in the project to date

b) Activities / Methodology

- Update on all activities undertaken to reach the project objectives – link these activities to the outlined milestone schedule

- Sub-activity 1
- In last spring and summer we have recorded information such as winter survival, gender, phenology, sensitivity to pesticides, *Phylloxera* infection, early veraison, pubescence on leaves, vigor in all accessions (900 *V. riparia* genotypes) and fruit quality in selected genotypes.
- Sub-activity 2
- Proline assays were done by the Isatin paper assay method that is suitable for analysis of large number of samples. ImageJ software was used to generate quantitative data, by assessment of colour intensity in reference to colour intensity of proline standard concentrations. The results for 2016 were included in the interim report. the 2017 has been completed and the leaves are stored I in a freezer awaiting analysis.
- Sub-activity 3
- The experiment is in progress. The data were archived and are under analysis. Preliminary analyses of the yields ranged from 19.3 to 8.9 Tonnes/ha with 802 giving the highest yields.
- Sub-activity 4
- In 2017, Crops were picked, qualified and recorded at Simcoe research station and at Burning Kiln Winery.

Yield per plant KG - Simcoe

	Coudere 161-49	Coudere 3309	Glorie de Montpellier	MGT 101-14	Mean
Reisling	5.3	6.85	6.08	4.92	5.95
chardonnay	6.13	4.29	4.04	5.11	4.48
Cab Franc	5.96	4.24	4.75	3.26	4.08
Pinot Noir	5.91	5.05	3.64	3.37	4.02

5.83	5.1	4.63	4.17
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Yield at BKW Kg per plant

	Glorie de Montpellier	Coudere 3309	Coudere 161-49	MGT 101-14	Mean
PinotNoir	5.34	4.93	5.24	5.07	5.14
Cab Franc	6.28	4.82	4.92	3.89	4.98
Reisling	4.91	4.82	5.12	4.51	4.84
Chardonnay	4.11	5.37	3.51	4.73	4.43
Mean	5.2	5	4.7	4.6	

- **Outputs created as a result of activities to date (if promotional material is produced, a sample should be included in the report)**

Twelve genotypes (Simcoe 34, 89, 120, 123, 164, 494, 517, 634, 659, 732, 801 and 802) will be disclosed to the University of Guelph for intellectual property protection.

- **Any changes or barriers/issues related to the completion of activities**

All activities planned to be completed by 31 Oct 2017 were completed, so no challenges or issues were encountered

3. Results to Date (short-term)

- **Compare the results to date with the expected results and explain any differences**
- **Are the results to date satisfactory? Explain**

This project will be useful for growers. The rootstock trials should provide growers with better choices of rootstocks to increase the fruitfulness and quality of grapes. The proline assay trials may identify thresholds of moisture availability, and aid in irrigation management. Trials of scion and commercial rootstocks for their yield and fruit quality will be reported and improve the viticulture best practices.

- **Identify the public good/benefit of the project to date**

The selected vines have shown good grafting compatibility and growth in the field. We harvested the first crop from the field. Also the selected vines had good vegetative growth under dry and hot conditions in the greenhouse.

4. Reach and Communications (actual vs. expected)

- **Identify primary target of this project i.e. agricultural producers, processors, rural Ontarians, consumers, youth, farm families**

The Ontario South Coast Wineries and Growers' Association (OSCWGA) will use these results in the development of Ontario's fourth Designated Viticulture Area (DVA). Because the growing conditions are so unique in this area (climate, soils, riparia), this information is critical to the successful initiation, planting, and profitable development of wine grapes within the OSCWGA.

This is the key reason for supporting this research and the good work done by Dr. Ali Rahemi and colleagues. Dr. Rahemi also provided updates of this work to the grower group, which led to further discussion and developments within individual vineyards. The work has also elevated the reputation and scope of the OSCWGA amongst its peer groups and with key influencers for their products. It has also raised the professional awareness of the importance of choosing the correct rootstock, research and development and selecting the correct genotypes for specific climatic and soil conditions.

- **Indicate the total number of people reached by this project to date**

Eleven wineries and sixteen vineyards are located in South Coast.

- **Papers published, seminars or conferences attended**

- Papers and Reports:
- Rahemi, A., A. Dale, H. Fisher, J. Kelly, T. Taghavi, C. Singleton and A. Bonnycastle, 2015, Distribution of pests on Vitis riparia in sandy soils of the South-Western Ontario,. Journal of Plant Studies (JPS), 4(1): 21-26.
- Rahemi, A., A. Dale, H. Fisher, T. Taghavi, A. Bonnycastle, and J. Kelly, 2016, A report on Vitis riparia in Ontario, Canada. Acta Horticulturae. 1136: 33-38.
- Dale, A., and A. Rahemi, 2017, Have enough chilling hours accumulated in Southern Ontario in this year?, The Grower, February, Section 8, Page B14.
- Rahemi, A., M. Mc. Arthur, P. Ryan and A. Kilian, 2016, Breeding cold tolerance grapes, Fruit and Vegetable Magazine, 72 (3): 14-15.
- Presentations:
- Rahemi, A., A. Dale, H. Fisher, T. Taghavi, and J. Kelly, 2015, Research on Vitis riparia to introduce new rootstocks, North American Grape Breeders' Conference, Cornell University, Geneva, poster presentation.
- Taghavi, T., A. Dale, A. Rahemi, D. Galic, B. Hughes, J. Zandstra and J. Kelly, 2015, An introduction to the University of Guelph, berry and nut breeding and development program, (Great Lakes Fruit Workers conference), Geneva, USA, Poster presentation.
- Dale, A. and A. Rahemi, 2015, Grapevines Research, OSCWGA Annual meeting, Oral presentation
- Rahemi, A., A. Dale, H. Fisher, J. Kelly, T. Taghavi, 2016, Dormancy and bud winter injury in two grape cultivars, Great Lakes Fruit Workers (GLFW) meeting in Collingwood, (poster presentation).
- Rahemi, A., 2016, Breeding of grapevine rootstocks for adaptability to the environmental stresses, Key speaker in 3rd National Conference of Grape and Raisin conducted by Research Institute of Grape and Raisin (RIGR), 27-29 September 2016, Malayer University, Malayer, Iran.
- Rahemi, A. A. Rahemi, 2016, Grapevines Research, OSCWGA Annual meeting, Oral presentation
- Rahemi, A. A. Rahemi, 2017, Grapevines Research, OSCWGA Annual meeting, Oral presentation
- Rahemi, A. attended six meetings per year of OSCWGA Directors
 - **Please provide a copy of any communications material developed for this project and indicate number printed/distributed and the target audience**
All documents have sent with previous reports.
 - **Indicate when OGWRI was identified as a supporter throughout the period of the project**
This is a collaboration project. AAC has collaborated with the Ontario Grape and Wine Research Inc. A formal agreement between AAC, UoGuelph and OSCWGA was signed on July 2014, and OGWRI, UoGuelph and OSCWGA agreement was signed on October 2015.

5. Conclusion and Next Steps

All milestones have been completed

This project has provided very valuable information on rootstocks and riparia to the members of the Ontario South Coast Wineries and Growers Association (OSCWGA) and the Ontario Grape & Wine Research Institute (OGWRI). Plans are in place to develop new funding applications through the upcoming Canadian Agricultural Partnerships initiative recently announced by Agriculture & Agri-Food Canada Minister MacAuley. Further, the OGWRI will continue to be engaged with the University of Guelph in its grape and wine research programs. Provision of information through OGWRI to Grape Growers of Ontario, the Ontario Wine Council, the Ontario Fruit and Vegetable Convention, and through The Grower will enhance the opportunity for other grower associations to become involved in this project going forward

- **Degree of project completion (%) to date: 100%**