

IMPORTANT FACTS

ESTATE VINEYARDS

Cave Spring Cellars cultivates three principal vineyards, totaling 72.5 ha (179 ac), located in the Niagara Peninsula's Beamsville Bench and Lincoln Lakeshore sub-appellations.

- **Cave Spring Vineyard** VQA Beamsville Bench 61 ha (151 ac)
- **Myers Vineyard** VQA Lincoln Lakeshore 8.5 ha (21 ac)
- **Tufford Road Vineyard** VQA Lincoln Lakeshore 3 ha (7.5 ac)

Overall, these sites are planted to 30.3 ha (75 ac) of Riesling, 14.6 ha (36 ac) of Chardonnay, 12.3 ha (30.5 ac) of Cabernet Franc, 7.3 ha (18.0 ac) of Pinot Noir and 5.7 ha (14 ac) of Gamay. Remaining plantings include 1.6 ha (4 ac) of Pinot Gris and 0.6 ha (1.5 ac) of Gewürztraminer.

WINE PORTFOLIO

Overall, 85% of Cave Spring's annual production is Estate Grown, with 15% sourced from two long-term growers – one of which is also the winery's vineyard manager – located nearby the winery's estate holdings in the Beamsville Bench and Lincoln Lakeshore. By origin, 80% of production is from the Beamsville Bench and 20% from the Lincoln Lakeshore. Total production is 58,000 cases (9L), with a varietal breakdown as follows:

White Varieties (72%)

- 50% Riesling
- 18% Chardonnay
- 3% Pinot Gris
- 1% Gewürztraminer

Red Varieties (28%)

- 16% Cabernet Franc
- 7% Pinot Noir
- 5% Gamay

The portfolio is organized within the Vintners Quality Alliance of Ontario (VQA) appellation of origin system. At the entry level, the **VQA Niagara Peninsula (NP)** wines originate from Beamsville Bench and Lincoln Lakeshore sites, while the **VQA Niagara Escarpment (NE)** wines are Estate Grown from BB vineyards and de-classified on the label to the broader VQA NE regional appellation. Similarly, the mid-range **Dolomite** wines are Estate Grown exclusively from Cave Spring Vineyard under the NE sub-appellation. The upper tier **VQA Beamsville Bench (BB)** wines are also Estate Grown, originating exclusively from Cave Spring Vineyard, as are the flagship **CSV** wines which originate from the top, old-vine parcels at the estate. All sparkling wines are Estate Grown from Cave Spring Vineyard as BB, while the sweet, late-harvest Rieslings are Estate Grown from Myers Vineyard as VQA Lincoln Lakeshore.

1) Niagara Peninsula & Niagara Escarpment

- Riesling NP | Riesling Dry NP | Pinot Gris NP | Chardonnay NE
- Rosé NP (Cab. Franc)
- Gamay NE | Pinot Noir NE | Cabernet Franc NE

2) Dolomite | Niagara Escarpment

- Riesling Dolomite | Chardonnay Dolomite
- Pinot Noir Dolomite | Cabernet Franc Dolomite

3) Estate | Beamsville Bench

- Riesling Estate | Riesling Adam Steps
- Chardonnay Musqué | Chardonnay Estate
- Gewürztraminer
- Pinot Noir Estate
- Cabernet Franc Estate | La Penna (Cab. Franc)

4) CSV | Beamsville Bench

- Riesling CSV
- Chardonnay CSV

5) Traditional Method Sparkling | Beamsville Bench

- Dolomite Brut NV
- Blanc de Blancs NV Brut
- Blanc de Blancs CSV Vintage Brut

6) Late Harvest & Icewine | Lincoln Lakeshore

- Riesling Indian Summer, Select Late Harvest
- Riesling Icewine

Benchmark wines from the ground up

BACKGROUND

Cave Spring Cellars is a leading grower of premium wines that reflect the distinct terroir of the Niagara Peninsula, one of three Designated Viticulture Areas within Ontario. Founded in 1986 by the Pennachetti family and winemaker Angelo Pavan, Cave Spring's history dates to 1978 when John T. Pennachetti and his son, Leonard (Len), planted some of the first *vinifera* vines in the Niagara Peninsula. These vines, including Riesling sourced from a German nursery that would later have a family connection to the winery, sparked the beginning of Cave Spring's enduring commitment to the cultivation and crafting of the highest-quality wines. This commitment to quality is evident in everything the winery does, including its involvement with the Vintners Quality Alliance (VQA). Len is a co-founder and past Chair of this government-sanctioned organization, which was established in 1988 to regulate and ensure all aspects related to the production of high quality wines in Ontario. The VQA's rigorous standards are among the strictest of all the winegrowing regions in the world.

FAMILY HISTORY

Len's passion for winegrowing started as a young man, working side-by-side with his father, John, and grandfather, Giuseppe, an Italian immigrant who spent his retirement years tending to a hobby vineyard planted on modest-quality site to native *labrusca* grape varieties. As Len's love of the vine continued to grow the family decided to invest in better vineyards, purchasing their first land at Cave Spring in 1973. Named by 18th century European settlers for the limestone caves and mineral springs located throughout the property, and situated on a gently sloping hillside of the Niagara Escarpment known as the Beamsville Bench, the site offered significant potential for quality winegrowing. Recognizing the possibilities, they sought out and planted noble European varieties that they believed would best capture the area's full promise – in particular, Riesling vines purchased from the German nursery, Weis Reben, on the Mosel. In 1978 the Weis family of the acclaimed St. Urbans-Hof winery in the Mosel valley, began exporting its Riesling Clone 21 to Canada and established vineyards in Niagara, where they met the Pennachettis. Although the Weis' decided to sell their Canadian holdings in the early 1990s, the family connection remains to this day. Anne Weis, who had come to Canada to work for her father's business, married Len's brother Thomas (Tom) Pennachetti, Vice-President of Sales and Marketing and a managing partner at Cave Spring Cellars.

VINEYARDS & GRAPE VARIETIES

Cave Spring Vineyard has expanded to more than 60 ha (151 ac), all falling within the coveted Beamsville Bench VQA sub-appellation. The vineyard's unique combination of geology, elevation and proximity to Lake Ontario enables Cave Spring to produce wines of great depth and complexity. The glacial-till limestone, shale and sandstone soils provide a nutrient rich base for the vines, while the estate's steep dolostone cliffs capture temperate lake-effect breezes that extend the growing season. Early pioneers of European viticultural techniques including higher density planting and vertical shoot positioning, the Pennachettis were in the vanguard of grape growers in Niagara who understood how to coax the best possible quality from their land. Planting densities of up to 4,750 vines per hectare increases competition among its vines, forcing the roots deeper into the earth and enhancing flavor development in the berries. They were also among the first growers to install drainage tiles to clear excess rainfall and encourage moisture and root penetration.

In addition, careful trellis management, including leaf removal and cluster thinning during the growing season, help increase ripeness levels at harvest. With growing conditions similar to those in Germany, Alsace and Austria, Cave Spring is very focused on Riesling – the grape variety best suited to the terroir of its vineyards and arguably to that of Niagara as a whole. Other white varieties grown by the winery include Chardonnay, Pinot Gris and Gewürztraminer. In reds, the focus is on Cabernet Franc and Pinot Noir, with smaller parcels of Gamay rounding out the plantings.

In the past decade, the winery has also secured two prime vineyard sites on the shores of Lake Ontario in the Lincoln Lakeshore VQA sub-appellation. Purchased in 2007, the three ha (7.5 ac) Tufford Road Vineyard, is located just 500 m from Lake Ontario and lies on well drained, gravelly clay-loam till that is rich in shale and sandstone. The cooling effect of the Lake makes it an

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ideal terroir for Riesling, and by 2019 the entire property will be entirely converted to this variety. Just a couple of km to the east in the same sub-appellation lays the 8.5 ha (21 ac) Meyers Vineyard, located just 1 km from the Lake in similar, shale-laced clays. Since 1993 the winery has purchased the fruit of this prized Riesling site from the Meyers family, and in 2014, with the retirement of long-time grower Bill Meyers, the winery assumed the property on a long-term lease, controlling all aspects of viticulture. Beginning with the 2017 vintage, wines made from Meyers Vineyard qualify as Estate Grown.

All told, Cave Spring now controls 72.5 ha (179 ac) of prime vineyards within the Beamsville Bench and Lincoln Lakeshore sub-appellations, comprising 85% of the winery's total grape supply. The remaining 15% is purchased on a long-term contract from Andrewes Vineyards, owned and operated by Chris Andrewes, who also serves as vineyard manager for the winery. In addition to his responsibilities at Cave Spring and Myers Vineyards, Chris custom farms three parcels of his own totaling 15 ac for the winery. Planted to Riesling, Chardonnay and Pinot Gris, these blocks lay in very close proximity to Lake Ontario in the Lincoln Lakeshore sub-appellation, just a few km west of the Tufford Road and Myers sites. Overall, 80% of the winery's grape supply originates from the Beamsville Bench, with the remaining 20% coming from the Lincoln Lakeshore.

WINEMAKING

In the cellars – located in an historic winery in Jordan dating back to 1871 – winemaker and co-founding partner Angelo Pavan takes a hands-off approach in his winemaking, aiming to allow the subtleties of the vineyard to be expressed in the finished wine. A firm advocate of the idea that greatness in the bottle requires dedication and precision in the vineyard, Angelo spends endless hours roaming the vineyards to ensure the fullest possible ripening. Angelo likens his approach in the cellars to that of a midwife, respecting the natural integrity of the fruit while minimizing oenological intervention in order to coax out the essence of the vineyard. With this in mind, he has ensured that both the vineyards and cellars at Cave Spring are **Certified Sustainable** by Sustainable Winemaking Ontario (SWO), an externally audited standards program developed by the Wine Council of Ontario (WCO) to assist the Ontario wine industry in implementing environmental best practices.

Angelo and his team use a mix of selected and indigenous yeasts in fermentation, with 40% of total production being fermented using indigenous or ambient yeasts. Throughout vinification, there is a clear emphasis on minimizing the handling and filtration of the wines, and apart from the addition of low levels of sulphur, no adjuncts, enhancements or barrel substitutes are employed. Of note, all Cave Spring wines are vegan-friendly.

Angelo's goal in his barrel program is to enhance the structure, texture and harmony of the wines, while allowing their clarity and transparency to shine through. Accordingly, just five percent of Angelo's barrel inventory is new. Most of the 225L *barriques* and 500L puncheons (*demi-muids*) stock falls between third and sixth fill, while the expanding inventory of large-format 2,500L casks ranges from first to third fill. By format, *barriques* comprise 50% of capacity, followed by puncheons at 40% and 2,500L casks at 10%. By origin, the inventory is 70% French, 15% Hungarian, 10% American and 5% German.

Among the white wines, Riesling, Pinot Gris and Gewürztraminer are fermented mainly in stainless steel, with 2,500L casks increasingly employed in the fermentation and ageing of the top Rieslings. Similarly, Chardonnay is largely fermented in tank, with the top bottlings undergoing fermentation and maturation in French oak *barriques* and puncheons. To further enhance mouthfeel, Angelo ages the white wines extensively on the lees, both in tank and barrel. In the case of the red wines, they are fermented in open top fermenters, with Pinot Noir and Gamay being aged exclusively in French oak *barriques* and puncheons. By contrast, the entry- and mid-level Cabernet Francs mature primarily in French oak *barriques* and puncheons, along with smaller volumes in Hungarian oak of the same formats. The the top-tier Cabernet Francs are aged predominantly in French oak *barriques* and puncheons, with a touch of American oak *barriques* used as well.

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WINE PORTFOLIO

With a well-established domestic and steadily growing international reputation as one of the New World's pre-eminent Riesling producers, it comes as no surprise that Cave Spring's portfolio revolves around this noble grape. Approximately 50% of the winery's production is devoted to Riesling, including nine different iterations. Rounding out the white wines is a range of Chardonnays as well as Pinot Gris and Gewürztraminer, which taken together comprise about 20% of production. Red wines make up the remainder of the portfolio, with Cabernet Franc, Pinot Noir and Gamay accounting for nearly 30% of the winery's annual production.

All wines within the Cave Spring portfolio are designated by grape variety and origin, with the entry level wines bearing the **VQA Niagara Peninsula** and **VQA Niagara Escarpment** appellations. Approximately 80% of the grapes producing these wines are Estate Grown, with the remainder originating from Andrewes Vineyard in the VQA Lincoln Lakeshore (LL) sub-appellation, owned and operated by the winery's vineyard manager, Chris Andrewes. Next up the range are the mid-tier **Dolomite** wines, named for the layers of dolostone – or dolomitic limestone – that form the cap rock of the Niagara Escarpment, these wines are Estate Grown from Cave Spring Vineyard on the Beamsville Bench and bottled under the broader VQA Niagara Escarpment sub-appellation. At the upper end of the range are the **VQA Beamsville Bench** wines, which are Estate Grown from a narrower selection of blocks Cave Spring Vineyard. Included among these are the iconic **CSV** wines. These old-vine bottlings are named after the original plantings of Riesling and Chardonnay at the estate, the oldest of which date back to the 1975, and embody the winery's highest commitment to quality and authenticity.

Cave Spring also produces outstanding Traditional Method **sparkling wines**, all of which are Estate Grown from Cave Spring Vineyard. The Non-Vintage (NV) Blanc de Blancs Brut and Brut Dolomite, both made from Chardonnay, are aged on the lees in bottle for a minimum of 24 and 36 months respectively prior to disgorging. In exceptional years, a small quantity of the vintage-dated Blanc de Blancs CSV is also bottled, originating from old vines and disgorged only after undergoing a minimum of 60 months of bottle age *sur lie*. As well, small quantities of NV Riesling Brut is produced. All sparkling wines are bottled within the winery's VQA Beamsville Bench series.

Top-flight **late harvest wines** produced from Riesling are another area of specialty for Cave Spring. The Riesling Indian Summer (Select Late Harvest) is made from fruit that desiccates on the vine until late-autumn, typically harvested partly frozen in early to mid-December. Vinified from the precious few clusters that endure until they are frozen solid by the first deep frosts of winter, normally in late December, is the renowned Riesling Icewine. Both of these sweet wines are Estate Grown from Myers Vineyard in the VQA Lincoln Lakeshore sub-appellation.

DISTRIBUTION

Cave Spring wines are available throughout Canada and in select international markets. In the USA, distribution covers DC, Illinois, New Jersey, New York, Maryland, Michigan, Pennsylvania and Virginia. Overseas markets in Europe (Belgium, Denmark, France, Germany, Luxembourg, Norway, Sweden) and Asia (Japan, China) round out the winery's exports.

WINERY & VINEYARD HOSPITALITY

Set at the heart of Jordan Village in an historic winery dating back to the 19th century, Cave Spring's **Tasting Room and Wine Cellars** is open to the public, offering private tastings and winery experiences by appointment. Along Jordan's enchanting Main Street, enjoy restaurants featuring regional gastronomy, elegant accommodations, stylish boutiques and artisan galleries.

A few km to the west at Cave Spring Vineyard, enjoy an idyllic stay in wine country with family and friends at the **Cave Spring Estate House**. Set the heart of CSV, this majestic, fully modernized Victorian home – complete with a full kitchen and room for eight people – sits high atop the Beamsville Bench, with breathtaking vistas of Lake Ontario and the Niagara Peninsula. And just a few steps away, we are excited to announce the opening in 2019 of **The Barns at CSV**. This wine tasting, education and event venue will offer a spectacular setting from which to fully experience the wines of Cave Spring at their point of origin.

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VINEYARDS & VITICULTURE

From the Mosel to the Loire Valley and the Oregon Coast, the world's great cool climate winegrowing regions all possess their own unique relationships between wind, water and soil. Situated in the heart of the global wine belt at 43° latitude, the Beamsville Bench area of Ontario's Niagara Escarpment is no exception. Here, rare limestone-rich soils and moderating breezes off Lake Ontario combine to create an exceptional home for the cultivation of noble European cool-climate varieties. First planted almost three decades ago by the Pennachetti family on the site of an abandoned pear orchard, Cave Spring Vineyard has helped set the standard for Canadian winemaking, consistently producing wines with abundant aromatics, brisk acidity, and terroir-infused minerality.

In 1973, realizing the untapped viticultural promise of the region, the Pennachetti family acquired its first 17 ha (42 ac) of land on the Beamsville Bench. More than anything, Cave Spring Vineyard founders, John Pennachetti, Sr. and his son Leonard (Len), were drawn to the site's geographic location and distinctive soil composition. Located along a gently sloping terrace overlooking Lake Ontario, Cave Spring Vineyard benefits from glacial till soils deposited by continental ice drifts over the past 100,000 years. A complex blend of local sedimentary stone and metamorphic rock, these stony clay tills are mainly derived from fragments of limestone, shale and sandstone, and are unique in the winegrowing world.

Primarily of the Oneida and Chinguacousy variety, the vineyard's clay-till soils are relatively low in organic matter, which inhibits excessive vegetation and yield, while promoting deep root penetration. Along with the Escarpment's natural, four to six percent slope, the stony composition of these soils also provide excellent drainage. Above the vineyard, a hardwood forest on the Escarpment brow slowly releases moisture year-round down through layers of limestone and shale into the benchlands below. Numerous groundwater springs, from which the vineyard derives its name, nourish the vines such that none but the newly planted require irrigation even in the driest conditions. By retaining high levels of calcium-laden water during the drier summer months, these clay soils also contribute to the signature minerality of Cave Spring wines.

Just as unique as its soils, the lake-effect macroclimate of the Niagara Escarpment has proven ideal for cool climate grape growing. At Cave Spring Vineyard, air currents from nearby Lake Ontario move inland toward the Escarpment, which rises sharply above the lake along its southern shore. Here, the Escarpment creates a natural buffer containing these moderated lake-effect breezes within a narrow band of the Niagara Peninsula. This constant air circulation provides optimal conditions throughout the year. In summer, the flow of cool air discourages harmful mildews and rot and temper excessive vegetation, while in spring and autumn, warm Lake breezes push cooler air down the hillside, preventing frost and thereby lengthening the growing season. The same effect protects the vines from the cold of winter.

From its initial plantings in 1978 of 5 ha (12 ac) of Riesling Clone 21 from the Mosel and mixed Chardonnay clones from Burgundy, the Pennachetti family has selectively expanded Cave Spring Vineyard to include a total of 61 ha (151 ac) of vines, including 18.6 ha (46 ac) of Riesling, 14.6 ha (36 ac) of Chardonnay, 12 ha (30 ac) of Cabernet Franc and 7.3 ha (18 ac) of Pinot Noir, with the remainder planted to smaller plots of Gamay, Pinot Gris and Gewürztraminer. Planted at a range of elevations above Lake Ontario from 55 to 80 m (180 to 265 ft) in 20 distinct blocks, each offering subtle differences in elevation, soil composition and aspect, today the estate boasts some of the oldest heirloom plantings in Canada. Planted at every phase of expansion with the best available plant material from the top French and German nurseries, Cave Spring Vineyard has been planned and designed to deliver possible ripening from clone and rootstock combinations that we have discovered to be best adapted for the site's unique *terroir*.

To best take advantage of the site's soils and climate, the Cave Spring team adheres to rigorous viticultural practices. Planting densities of 3,586 to 4,782 vines per hectare (1,452 to 1,936 per ac) as well as deep soil tillage promote deep root penetration and mineral uptake by the vines. The vineyard team trains the vines using a single trunk, two-cane vine architecture, utilizing both Pendelbogen (arched cane) and flat cane positioning combined with vertical shoot positioning. Techniques including leaf removal to mitigate disease pressure and green harvesting to reduce yields are applied to enhance flavour concentration in the berries. To maintain a balanced and sustainable relationship with the environment, organic materials are used to the greatest degree possible to control mildew, rot, weeds and insects.

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In 2016, this decades-long commitment to the highest standards of viticulture helped Cave Spring to be recognized as the first Certified Sustainable vineyard and winery by Sustainable Winemaking Ontario (SWO), the externally audited program developed by Ontario Craft Wineries (OCW) to assist wine producers in implementing environmental best practices.

All planting, canopy management and harvesting decisions are made by the Cave Spring team, which includes Len Pennachetti, winemaker Angelo Pavan, oenologist and viticulturalist Gabriel Demarco and vineyard manager Christopher Andrewes. For Cave Spring's top tier VQA Beamsville Bench and CSV wines, additional fruit thinning is applied to reduce yield and increase quality, with selective hand harvesting employed at the ideal moment of ripeness to ensure the fullest possible flavour development. The fruit is then immediately transported six kilometers to the winery in the village of Jordan. Of the production from Cave Spring Vineyard, only the top five percent is designated for use in Cave Spring's top Estate Grown wines from the estate, with 25 percent going to the winery's VQA Beamsville Bench tier of wines and the remainder to the winery's mid-tier Dolomite and entry level VQA Niagara Escarpment and VQA Niagara Peninsula wines.

Over the past dozen years, the winery has also secured two prime vineyard sites on the shores of Lake Ontario in the VQA Lincoln Lakeshore sub-appellation. Purchased in 2007, the three ha (7.5 ac) Tufford Road Vineyard, is located just 500 m from Lake Ontario and lies on well drained, gravelly clay-loam till rich in shale and sandstone. The cooling effect of the Lake makes it an ideal terroir for Riesling, with the entire property dedicated to this variety. Just a couple of km to the east in the same sub-appellation lays the 8.5 ha (21 ac) Meyers Vineyard, located just one km from the Lake in similar, shale-laced clays. Since 1993 the winery has purchased the fruit of this prized Riesling site from the Meyers family, and in 2014, with the retirement of long-time grower Bill Meyers, the winery assumed the property on a long-term lease, controlling all aspects of viticulture at the site. As of 2017, after three years of the winery farming this site, fruit from the site qualify as Estate Grown.

In total, Cave Spring now farms 72.5 ha (179 ac) of estate vineyards, 85% of which is owned and 15% of which is leased, within the Beamsville Bench and Lincoln Lakeshore sub-appellations. These holdings secure 85% of its total grape supply, with the remaining 15% purchased from Andrewes Vineyard under a long-term contract with grower Chris Andrewes, who is very familiar to winemaker Angelo Pavan in his role as the winery's vineyard manager. After a few years of working together, Angelo came to see Chris' deft hand with the vines and, in order to meet growing demand for Cave Spring wines approached him about custom farming for the winery at his eponymous Andrewes Vineyard. Situated in the VQA Lincoln Lakeshore sub-appellation, just a few km west of the winery's own Lincoln Lakeshore holdings at the Myers and Tufford Road sites, Andrewes Vineyard would fit nicely into a growing tapestry of sites that the winery has assembled in a sub-appellation that not only holds tremendous viticultural potential, but was also very familiar to his winemaking team. The result is an assembly of three newly planted parcels at Andrewes Vineyard totaling 20.5 ac (8.3 ha), all located within a few hundred m of the Lake Ontario shoreline. Today, Andrewes Vineyard is producing a level of wine quality that matches that of Cave Spring's own holdings in this under-appreciated and quickly emerging sub-appellation.

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SUSTAINABILITY

At Cave Spring Cellars, our philosophy as winegrowers is to intervene minimally in the vineyard and cellars, allowing nature to take its course as much as possible in the growing of our grapes and the making of our wine. Our goal is to minimize our impact on the environment and preserve the natural world for future generations, while recognizing the long-term need to produce wines that meet the expectations of the marketplace and are economically viable. Stemming from this commitment, in 2016 Cave Spring became Ontario's **first certified sustainable winery and vineyard** in accordance with the standards of Sustainable Winemaking Ontario (SWO), an externally audited program developed by Ontario Craft Wineries (OCW) to assist wine producers in implementing progressive environmental practices.

REGIONAL CLIMATE & WATER USAGE

It is important to understand from the outset that the Niagara Peninsula's cool, continental climate makes for very humid conditions during the growing season. Our region is, in fact, one of the highest-pressure viticultural areas in the world for harmful fungal diseases. These include powdery mildew (oidium), downy mildew (peronospora), as well as botrytis (grey rot) and black rot. In regions such as ours, fully organic grape growing is extremely difficult and can easily compromise the soundness of the fruit at harvest. For example, the fact that there is no known organic treatment to combat black rot which, in combination with other common fungi, can lead to unnecessary and severe reductions in yield and a negative overall effect on wine quality if not treated with sustainable treatments.

The flipside of this, however, is that because our climate provides ample precipitation throughout the year, we do not need to irrigate. Irrigation is commonplace throughout the wine world, yet it is often forgotten that it can place great stress on the environment. Not only does irrigation deplete precious water sources in arid areas, but also it often requires great amounts of energy, as well as elaborate and environmentally invasive infrastructure to distribute water over vast distances. Many organic wines come from dry climates that, while not experiencing high fungal pressure, do require irrigation. In this context, the sustainability of these wines can be called into question.

VINEYARD SITE SELECTION

Nestled against the Niagara Escarpment on a gentle slope of the Beamsville Bench, Cave Spring Vineyard is blessed with a multitude of natural advantages in terms of sustainability. The constant air turbulence at the vineyard caused by the circulation of on-shore breezes from nearby Lake Ontario along the steep Escarpment cliff at the site is very important to our grapes. These winds help to mitigate cold temperatures that may cause frost damage in the winter, spring or fall. One benefit of this is that we do not need the large, fossil fuel-burning fans that vineyards in other areas of Niagara employ to artificially create air movement under frosty conditions. These natural breezes also aid in drying out the soil and grape canopy after rainfall, thereby helping to decrease humidity and lessen fungal disease pressure. Similarly, the gentle slopes and stony soils of our vineyard allow for efficient natural water drainage, which also helps mitigate against fungus and promote overall vine health. Unique to Cave Spring Vineyard is a series of ground water springs that supply highly mineralized ground water. These subterranean flows pass down through layers of sedimentary Escarpment rock above the site to the sub-soils of the vineyards below, helping to provide moisture to the vines during dry periods. In short, the natural attributes of climate and geology at Cave Spring Vineyard provide us with natural frost protection, water drainage, and irrigation, thereby lessening the need for environmentally demanding interventions.

VITICULTURAL PRACTICES

At Cave Spring, we believe that to produce the best wines you must begin with the soundest possible fruit. Above all, this means controlling fungal infections on the vine and of its fruit. In certified organic vineyards, these diseases are controlled mainly

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using the natural elements of sulphur and copper, along with sodium bicarbonate and sodium metabisulphite, all of which we employ extensively. In fact, these materials comprise 30% to 50% of our fungicide regime, depending upon the season. However, it should be noted that if these substances are used to the exclusion of other treatments, toxic accumulations of the heavy metal copper can build up in the soil to the point where they impede the uptake of vital nutrients by the vine's roots, thereby threatening overall vine health and affecting the soil's long-term fertility. Moreover, the frequency of spray application in an organic disease control regime is increased by up to two times that of a balanced, sustainable program. These additional treatments bring with them a significant increase in tractor usage, resulting in greater fossil fuel consumption and soil compaction. The former creates an expanded carbon footprint, while the latter is detrimental to soil structure and microbiology, thus compromising the health of the vine's root system.

Weed proliferation is another threat that can increase fungal disease pressure if left unchecked. On this front, we also employ a mixture of techniques. For example, we sow a mixture of grasses between the rows that impede weed growth, prevent erosion and improve nutrient levels and water availability in the soil. We also hill-up the soil beneath the vine canopy in the fall, partly to protect the vine trunk from winter injury, especially for younger vines. More importantly though, hilling-up helps to control weeds beneath the vines. Come springtime, as the weeds begin to sprout, the hilled-up soil is tilled, thereby preventing weed proliferation. This form of mechanical cultivation is repeated during the growing season and serves not just to stunt weed growth, but also to till and aerate the soil. Most importantly, this technique allows for increased airflow beneath the vines which in turn aids in preventing harmful mildews and molds from developing in the vine's fruiting zone, thereby reducing the frequency of fungicide treatment. While we are continually working to reduce our use of herbicides, we do apply them sparingly to supplement mechanical methods, always selecting materials for their ability to control specific weeds while minimizing their impact on the natural environment of the vineyard floor.

Another threat in the vineyard is insects, which is generally not a major problem in the Niagara Peninsula. Unlike more temperate wine regions, our northern climate has the advantage of cold winters that naturally control insect populations. Where there are threats, however, we use natural methods as much as possible. By maintaining healthy ground cover and soil conditions, we provide an environment that encourages the proliferation of beneficial predatory insects to control pests such as grape berry moth, leafhoppers and mites. Pest populations are measured and scouted parcel by parcel and any intervention using insecticides is highly targeted and absolutely minimized.

As the grape clusters reach *veraison* and continue to ripen through to harvest, certain bird species become an issue in our region. Starlings, for example, can ravage the crop by damaging clusters, which in turn causes the rapid spread of rot. In addition to the use of re-usable netting to protect vulnerable areas of our vineyards, our site also benefits in this regard from its unique environment. The precipitous limestone cliffs of the Niagara Escarpment above Cave Spring Vineyard provide an ideal natural habitat for many species of predatory raptors, including Red-tailed, Broad-winged and Sharp-shinned Hawks as well as Northern Goshawks and Turkey Vultures. We manage the forests surrounding our vineyards to attract these rare and beneficial birds of prey which help to ward off flocks of Starlings and potentially damaging bird species.

Another important aspect of our sustainable vineyard program is soil management. Here we implement completely natural techniques. For example, we make our own compost, which is composed of manure from local farmers and grape pressings (pomace) from our own wine production. This organic mixture is spread throughout our vineyards. As well, we sow a selection of grasses between the rows every year, which helps to squeeze out unwanted weeds and discourage erosion. Once tilled, these grasses also augment organic matter in the soil, thereby helping to maintain healthy soil ecology.

Cave Spring Vineyard is blessed with very balanced soil structure throughout its many parcels. The soils are quite rich and fertile given that they were largely fallow fields and pasture prior to the establishment of the first vines in 1974, meaning that few if any additions are needed to supplement the natural fertility of our soils. However, to ensure a proper balance in the vine canopy, soil and leaf samples are analyzed throughout the growing season. From the analysis of these samples, valuable information is gleaned that aids us in making targeted nutrient amendments of nitrogen, potassium, calcium, magnesium and

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other micronutrients when necessary. As well, foliar applications of kelp and calcium help elongate the clusters and strengthen the berry skins, naturally combatting the onset of fungal diseases.

While many of the practices and controls that we employ in the vineyard are natural and sustainable, if disease undoes the great effort and inputs that go into training the vine from bud break through harvest, resulting in great loss of yield, winemaking quickly becomes economically unsustainable. As such, we find that an integrated approach using natural elements as much as possible combined with minimal, highly targeted interventions with synthetic materials as necessary allows us to optimize soil conservation, vine health, fruit quality and most importantly, concentration and complexity in the finished wine.

WINEMAKING TECHNIQUES

Upon receiving our grapes at the winery our philosophy is to allow the sound, ripe fruit that we harvest to be expressed vividly in the finished wine. Our intention is to capture the unique nature of our vineyard with precision and detail in the glass. This is accomplished by minimizing intervention at every step in the winemaking process. For example, we use a variety of yeasts, including indigenous and selected strains, and avoid the use of enzymes that are used by many vintners to increase juice yield at the press and enhance aromatics. Due to the attention to detail in our vineyards and high quality of our fruit at harvest, we also avoid the use of energy intensive and highly invasive technology such as reverse osmosis. It's also worth noting that after fermentation we absolutely minimize the use of additives with the exceptions of sulphur for preservation (especially in the whites), and, occasionally, natural fining agents for tannin management in the reds. As well, while many vintners utilize ascorbic acid as a preservative in white wines, we completely avoid its use. For the wines that require oak ageing we rely on traditional oak barrels and eschew the use of oak derivatives such as staves and chips. Finally, because we begin with very sound fruit from our vineyards, only minimal additions of sulphur, a naturally occurring preservative in wine, are needed. In sum, from press to bottle, we endeavor to absolutely minimize the use of additives and simplify the winemaking process. By making our wines as naturally as possible, we are able to reduce our energy draw and hence the carbon footprint involved in producing our wines.

WASTEWATER MANAGEMENT

Cave Spring Cellars has also been recognized as a leader in sustainable water practices with the launch of its new BioGill wastewater management system in 2015. This system is not only unique to the food and beverage industry in North America, but is also the first of its kind in the global wine sector.

The BioGill wastewater treatment system reduces the amount of organic matter in process wastewater before it is reintroduced into the municipal water system. Functioning as a closed ecosystem, naturally occurring moulds, fungi and bacteria form on membranes – the 'gills' in the system – consume the organic matter found in the wastewater. This organic matter, or carbon, contained in the alcohol, sugar and acids of the wastewater contribute to an elevated biological oxygen demand (BOD) in the effluent. Wastewater with high BOD levels cannot be safely or legally reintroduced into the environment. The BioGill reduces BOD count of the winery's wastewater to less than two percent, a level at which the regional water authority can manageably treat the effluent before returning it to local waterways.

PRODUCTION AND STORAGE FACILITIES

It is worth noting that Cave Spring Cellars is located in a village setting with access to municipal water supplies. As a result, there is no need for water to be transported to our facility or to tap into local aquifers to supply our needs. We are also leaders in wastewater management, having installed an in-house treatment system called BioGill that uses natural bacteria to treat

Benchmark wines from the ground up

wastewater, reducing the biological contamination of this effluent by as much as 99% prior to its reintroduction to the municipal water trunk. This system is not only the first of its kind in the global wine sector, but it is also unique to the food and beverage processing industry in North America.

Our facility is also located in what was an abandoned winery with underground cellars dating back to 1870. By renovating an existing building, we have preserved a major piece of Ontario's winemaking history, and returned it to its original purpose. As such, we reversed the decay of a useful structure, avoiding the energy-intensive alternative of new construction as well as the wasteful land-use associated with building on prime viticultural land. This choice has also significantly reduced our carbon footprint by virtue of the fact that 80% of our production cellars are located underground, greatly reducing the need for electricity by allowing the movement of our wine during the winemaking process to occur in large part by gravity, and by reducing the amount of power needed to chill or heat these spaces. Furthermore, the temperature control of our storage warehouse is powered entirely by solar panels. In fact, the surplus energy generated by these panels returns enough power to the local grid to offset 25% of our total electricity consumption. Our commitment to diminishing our carbon emissions is further reinforced by the fact that we have converted all lighting fixtures to LED technology, which reduces overall energy usage in our winery and vineyard buildings by an additional 25%.

PACKAGING

In bottling our wines, we use lightweight glass for 75% of our bottled production, greatly reducing greenhouse emissions resulting from the transport of our wines to markets in Canada, the USA and overseas. As well, by choosing cork closures for many of our wines, we utilize an organic material that is entirely renewable. In the printing of our labels we rely upon state-of-the-art technology that is not only among the most energy efficient available, but also eliminates the use of harmful polymers and metals and greatly reduces volatile organic compound emissions as well as landfill waste. We have also streamlined our production and packaging processes at the winery to the point where we divert 95% of our solid waste materials away from landfill and into recycling streams. Among our solid-waste reduction initiatives, in the transport of our wines we have eliminated the use of shrink-wrap film to stabilize shipping pallets – a technique that is nearly ubiquitous throughout the world of transport – thereby greatly reducing the amount of plastic waste directed to landfill sites around the globe. In short, we work to minimize our impact on the environment at every step in the packaging of our wines.

Benchmark wines from the ground up