Vitis cv. Zilga is a vine for the northern temperate climate – Short communication

J. Karvonen

Department of Agricultural Sciences, Faculty of Agriculture and Forestry, University of Helsinki, Helsinki, Finland

Abstract

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Of the grapevines grown in the Nordic countries, cv. Zilga, bred in Latvia, has proven to be very winter resistant and fast-maturing, and produces abundant harvests. In Finland, it is grown as horticultural and agricultural plant unprotected on open land even at 63 degrees latitude. In Southern Finland (60°24'10"N, 25°01'45"E), the growth cycle of cv. Zilga from bud break to harvest lasted 116 days and to leaf fall 125 days. At the beginning of the harvest, the total sugar content was 19°Bx. Tracking the phenology of the growth cycle and the environmental conditions of the growth site shows that cv. Zilga is well placed to make use of the high ambient temperatures and high solar radiation energy of Northern Europe in May, June, July and August.

Keywords: Nordic wine growing; soil temperature; short growing season; cool climate

With global warming, vine growing is spreading to the Baltic Sea region and Northern Europe (Bertin 2009). A number of Baltic and Central European grapevine cultivars have been grown in Denmark, Sweden, and Finland for 20 years. The wine produced from these goes on sale in Denmark, Sweden and Finland (Karvonen 2008; Bentzen, Smith 2009; Mårtensson et al. 2013). According to Rötzer and Chmielewski (2001), Finland and the southern regions of other Nordic countries have a growing season of 180–220 days, so successful growing requires fast-maturing cultivars that can take advantage of the long periods of sunlight and strong solar radiation of the summer months. For this reason, hybrid varieties of *Vitis vinifera* L. containing *Vitis amurensis* or North American *Vitis* species are most likely to succeed in the North. The most successful cultivars are those that have been bred in the Baltic Sea area and that have made adjustments to the cool or temperate climate. The study was set to show how well cv. Zilga, crossbred in Latvia by Paul Sukatniek (Smuglyanka × (pollen mix of Dvietes Zila and Yubileinyi Novgoroda)), has acclimatized to cool Finnish growing conditions, and what is the quantity, quality and sugar content of grapes.

MATERIAL AND METHODS

The phenological development and length of the growth cycle of the cv. Zilga grapevine, the factors affecting growth and climatic conditions at the growing site were monitored in Tuusula, Southern Finland (60°24'10"N, 25°01'45"E) in the summer of 2013. The growing site was located 20 km from the sea at a height of 62 m a.s.l., on even, sunny open land. Soil analysis (April 22, 2013) showed a rich sandy clay soil with a pH of 6.7. The growth cycle was monitored by photography and by comparing

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)  (j) 

Fig. 1. Phenological series of photos from the growth cycle of cv. Zilga in 2013: (a) 21 May, (b) 28 May, (c) 31 May, (d) 8 June, (e) 30 June, (f) 17 July, (g) 27 July, (h) 31 July, (i) 9 August, (j) 18 August

blooming 40 days after budbreak;véraison between July and August; full colour change in middle of August; harvest in September 14;

the phases of the growth cycle with Eichhorn-Lorenz phenological tables (Eichhorn, Lorenz 1977; Coombe 2004). The increasing total sugar content of the grapes (°Bx) was monitored until harvest using a Brix refractometer (HR-180; Optika, Ponteranica, Italy). Air, ground and soil temperatures were monitored at depths of 20 and 40 cm using Thermo Button Temperature data loggers type 22L (Plug and Track by Proges Plus, Willems, France), which recorded temperatures to memory 12 times a day. The measurements were used to calculate a daily average Eichhorn-Lorenz phenological development stage (E-L number) for the days observed.

RESULTS AND DISCUSSION

Several grapevine cultivars were found suitable for growing in Northern Europe over the last 20 years (Stock et al. 2005). In Denmark, 48 grapevine cultivars were approved for growing. Among the most popular are cvs Ortega, Rondo, Leon Milot, Madelaine Angevine, Solaris, and Phoenix (Bentzen, Smith 2009). The same cultivars are also grown in Sweden and Finland. A number of grapevine cultivars bred in the Baltic area and flourishing in cool climates are also grown in the Nordic countries. Among the best known is cv. Zilga, which is the cultivar most certain to produce crop above the latitude of 55 degrees. In Finland, its largest single cultivation areas have been of 0.5 ha, giving a harvest of 2,500 kg (Finnish Broadcasting Company 2012); it has been grown on open land even up to the latitude of 63 degrees (Finnish Broadcasting Company 2013).

The phenological series of photos from the growth cycle of cv. Zilga, Fig. 1 and Table 1 present the fast 116-day growth cycle of the cv. Zilga grapevine in the summer of 2013 following the Eichhorn-Lorenz phenological development stages (Eichhorn, Lorenz 1977; Coombe 2004). These show bud break on May 21, with harvest being reached on September 14. During this period there was no late or early frost in Southern Finland. The last image in the series is for the August 24. Thereafter the appearance and colour of the grapes did not change, but the sugar content increased from 14.2°Bx to an average of 19°Bx at harvest in 50 randomly picked berries. Earlier, in the years 2007–2012, at Lepaa vineyard in Finland (61°N) the sugar content of cv. Zilga reached 11.4–20.2°Bx (Tuovinen 2012), and in 2013 at Sundom vineyard (63°N) that of cv. Rondo 18–19°Bx (Nelimarkka 2014). In Norway at Asker vineyard (60°N) the sugar content of cv. Smuglyanka (mother parent of cv. Zilga) reached 19.4°Bx (Syversen 2013).

Table 1 shows how cv. Zilga could take full advantage of the growing conditions offered by very long northern days during June, July and August, when its growth and the increase in the sugar content of the berries, were rapid (Bergquist et al. 2001). On the 8th and 30th of June, the day length at the growing site was 19 h (Finnish Meteorological Institute 2013), with the average of max-min. air temperatures at 17.0–19.5°C, while soil temperatures were the highest of the summer (Table 1). In May, solar insolation at the growing site amounted to 175 and in June to 170 kWh/m^2/month; these figures are almost as great as in the beginning of summer at Bordeaux, i.e. 177 kWh/m^2 in May, and 184 kWh/m^2 in June (EC 2013).

Table 1. Growth stages of the Zilga vine with the increasing sugar content of the grapes, and temperature changes in the air and in the ground at depths of 0, 20, and 40 cm in summer 2013

Fig. 1	Date	E-L	All stages	°Bx	Air (°C)	0 cm (°C)	20 cm (°C)	40 cm (°C)
a	21 May	4	bud burst		15.5	13.3	13.1	11.9
b	28 May	11	4 leaves separated		21.5	14.8	13.4	12.1
c	31 May	13	6 leaves separated		19.0	15.9	14.3	13.0
d	8 June	17	12 leaves separated		17.0	17.8	15.4	14.5
e	30 June	23	17–20 leaves separated, 50% caps off		19.5	17.5	16.8	16.0
f	17 July	31	berries pea size		15.5	15.7	15.3	15.1
g	27 July	33	berries still hard and green		20.5	16.4	16.0	15.4
h	31 July	34	berries begin to color		18.5	19.5	16.6	15.9
i	9 Aug.	35	berries begin to soften	10.3	20.5	20.6	17.5	16.4
j	24 Aug.	37	berries not quite ripe	14.2	13.0	13.6	14.1	13.5
–	14 Sept	38	berries harvest ripe	19.0	13.0	14.9	13.1	13.0
–	3 Oct.	43	beginning of leaf fall	–	10.0	10.5	8.3	7.8

E-L – Eichhorn-Lorenz (E-L) number for grapevine growth stages, modified from Eichhorn-Lorenz (1977) by Coombe (2004); °Bx – sugar content of an aqueous solution (1°Bx is 1 g of sucrose in 100 g of solution); °C – average temperature of the observation day

In southernmost Finland (Tuusula), during growing seasons of 198 ± 18 days from years 2002–2011, the average of growing degree days (+10°C days) was 794 ± 121, and (+5°C days) 1,608 ± 131 (Finnish Meteorological Institute 2012). In Tuusula, the Huglin-Index in the year 2013 was 1,799. It is relatively high due to the warm summer months (June, July and August), when the average air temperature was 17.3 ± 2.5°C, and comparable to many Northern Central European wine growing sites. This Huglin-Index is sufficient for the growth of cv. Zilga and many other *Vitis vinifera* L. varieties (Huglin 1986).

In Finnish conditions, in winters with heavy snow, cv. Zilga has survived a temperature of –30.7°C outdoors without protection (Karvonen 2013). Growing experience has shown that cv. Zilga is either photoneutral or a long day plant. This may be due to the fact that the 1964 crossbreeding was created from the inbred line of a hybrid grapevine involving two gene pools, Asian and North American. Pedigree selection from the offspring of that crossing involved the individuals best adapted to long days at Latvian latitudes (56–57°N). Descendant selection has given cv. Zilga cold resistance, the ability to take advantage of the benefits of a short growing season and "hybrid power".

Cv. Zilga berries are deep blue, with dark red juice. A single berry weighs 1.5–2 g, and the seeds are large for its size. The large seeds and dark red juice contain a lot of tannins, with antioxidant effects that make young wines produced solely from cv. Zilga bitter and hard. However, two years of storage soften the tannins that make it possible to store and "mature" red wines. Tannins are polyphenols which were also found to protect people from heart and vascular disease (Renaud, de Lorgeril 1992). Research was also done on polyphenols, such as *trans*-resveratrol and *cis*-resveratrol, found in cv. Riesling white wines (Kumsta et al. 2012). Levels of polyphenols such as anthocyanins, flavonols, flavones, and flavanones are exceptionally high in the Northern European berries (e.g. bilberry, chokeberry, and lingonberry) (Rimando et al. 2004; Faria et al. 2005; Mattila et al. 2006). The cool climate and great thermal difference in daily lowest and highest temperatures were found to contribute polyphenols also in grapes, which is currently being studied.

References

Bentzen J., Smith V., 2001. Wineproduction in Denmark. Do the characteristics of the vineyards affect the changes for awards. Working paper. Aarhus, Aarhus University: 1–20.

Bergquist J., Dokoozlian N., Ebisuda N., 2001. Sunlight exposure and temperature effects on berry growth and

composition on Cabernet Sauvignon and Grenache in the Central San Joaquin Valley of California. American Journal of Enology and Viticulture, *52*: 1–3.

Bertin R.I., 2009. Plant phenology and distribution in relation to recent climate change. Journal of the Torrey Botanical Society, *135*: 126–146.

Coombe B.G., 2004. Viticulture. Vol. 1. 2nd Ed. Adelaide, Winetitles: 153.

EC, 2013. Photovoltaic geographical information system – Interactive maps. Available at http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php

Eichhorn K.W., Lorenz D.H., 1977. Phänologische Entwicklung der Rebe. Nachrichtenblatten des Deutschen Pflanzenschutzdienstes, *21*: 119–120.

Faria A., Oliveira J., Neves P., Santos-Puelga G., Mateus N., 2005. Antioxidant properties of prepared blueberry (*Vaccinium myrtillus*) exract. Journal of Agricultural and Food Chemistry, *53*: 6869–6902.

Finnish Broadcasting Company, 2012. Sisukas Suomi-viini kestää sateet ja pakkaset. [Plucky Finnish wine tolerate rains and cold weather.] Available at http://yle.fi/uutiset/kotimaa

Finnish Broadcasting Company, 2013. Vaasa vetää vertoja Keski-Euroopan viinitiloille. [Vaasa is equal to Cetral European vineyards.] Available at http://yle.fi/uutiset/kotimaa

Finnish Meteorological Institute, 2013. Seasons in Finland, winter. Available at www.finnishmeteorologicalinstitute/snowstatistics.fi

Huglin P., 1986. Biologie et écologie de la vigne. Paris, Edition Tec & Doc Lavoisier: 292.

Karvonen J., 2008. Maaperän lämpötila ja viiniköynnöksen kasvu Suomessa. [Soil temperature and grapevine growth in Finland.] [M.Sc. Thesis.] Helsinki, University of Helsinki: 1–67.

Karvonen J., 2013. Effect of snow layer on ground surface temperature in cool wine growing regions. Electronic Journal of Polish Agricultural Universities, *16*: 10. Available at http//ejpau.media.pl/volume16/issue3/art-10.html

Kumsta M., Pavlousek P., Kupsa J., 2012. Phenolic profile in Czech white wines from different terroirs. Food Science and Biotechnology, *21*: 1–9.

Mattila P., Hellström J., Törrönen R., 2006. Phenolic acids in berries, fruits and beverages. Journal of Agricultural and Food Chemistry, *54*: 7193–7199.

Mårtensson A., Karlsson T., Gustafsson J.G., 2013. Swedish vineyards: a utopia? International Journal of Wine Research, *5*: 39–45.

Nelimarkka K., 2014. Sundom Wine. Available at www.sundomwine.fi

Renaud S., De Lorgeril M., 1992. Wine, alcohol, platelets, and the French paradox for coronary heart disease. Lancet, *338*: 1523–1526.

Rimando A.M., Kalt V., Magee J.B., Ballington J.R., Devey J., 2004. Resveratrol, pterosilbene and piceatannol in *Vaccinium* berries. Journal of Agricultural and Food Chemistry, *52*: 4713–4719.

Rötzer T., Chmielewski F.M., 2001. Phenological maps of Europe. Climate Research, *18*: 251–252.

Stock M., Gerstengarbe F.V., Kartchall T., Werner P.C., 2005. Reliability of climate change impact assessments for viticulture. Acta Horticulturae (ISHS), 689: 29–39.

Syversen A., 2013. Testing varieties 60 degrees north, Chateauet i Asker. Available at http://l-bentel.hos.online.no

Tuovinen T., 2012. The effect of winemaking methods on the sensory quality of the 'Zilga' grape wines. [B.Sc. Thesis.] Hämeenlinna, University of Applied Sciences HAMK: 1–51.

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Corresponding author:

Dr. Juha Karvonen, Ratinankatu 7 A 7, 33100 Tampere, Finland
phone: + 358 400 642 378, e-mail: juha.i.karvonen@helsinki.fi