GRAPEVINE GROWING USING TRENCHES IN NORTHEAST SCOTLAND

By Alan Smith, Dalrossach Vineyard

Introduction

Whilst searching for information on the Baltic grape varieties I grow in west Aberdeenshire, I chanced upon an article on grapevine growing using trenches covered with polycarbonate sheet in the Moscow region of Russia by Romanenko (2011). The author used the method for protecting vines from severe winter conditions, and to extend the growing season in order to grow table grape varieties usually only grown much further south in Russia. It occurred to me that here might be a potential solution to the problems of cooler, shorter, growing seasons, with severe frosts at budding time that have characterised the weather in the north of the UK in recent years.

In theory, a trench that can be covered for at least part of the growing season should behave as a temporary pit-greenhouse/solar pit. The concept of the pit greenhouse, whereby a conventional greenhouse design is buried for most of its height into the ground, is to utilise heat from the soil whilst minimising heat loss through exposed surfaces such as walls (e.g. Storey 1980). A test trench was thus constructed in early 2013 to investigate potential applications to grape growing in northeast Scotland, the results from which are reported here.

The Trench Method

Where vines are grown on high trellis systems, the 'vineyard temperature' is the air temperature. Vines grown on such systems may escape damage during mild frosts as night-time temperatures are often lower closer to the ground. By growing vines in trenches the 'vineyard temperature' becomes the near-ground temperature. Covering the trenches, at least during the early season, allows protection from frost whilst utilising the higher near-ground temperatures in the day.

Possible drawbacks of trench growing are flooding, restrictions on the height of the pruned vine, and shading of growth. Most significant is the potential for flooding, which means that trenches can only be used with free-draining soils, and then only as long as consideration is given to soil structure, the presence of impermeable layers and the depth of the water table. Such factors were important on this site, as although the soil is a sandy-loam with good drainage, it is underlain by a less-permeable hardpan. With regard to pruning, several conventional low Guyot methods could be adapted to fit a trench system. Romanenko (2011) suggests that vines benefit from the locally increased temperatures and humidity of the trench environment even though initially in the season there may be a shading factor.

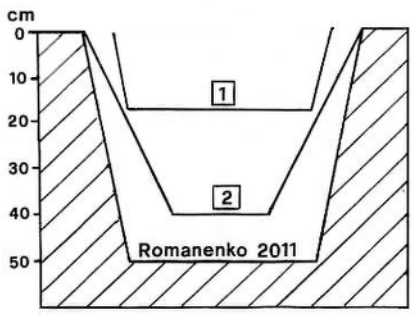

Figure 1. Cross-sections of the trenches tested on this site (1 = test trench, 2 = larger trenches currently being installed) and by Romanenko (2011).

The trenches constructed by Romanenko (2011) were several metres in length, 60 cm wide, and 50 cm deep (Fig. 1). A trench spacing of approximately 1.8m was estimated from the author's photographs. The trench walls were lined with mesh- reinforced concrete. This seems to have been a choice based primarily on longevity of suitable materials. Romanenko (2011) covered the

trenches with polycarbonate sheet in Winter and Spring, and in Summer utilised the polycarbonate as part of a cloche construct over the trenches.

First Test Trench

The principal interest in using trenches on this site was the frost protection aspect as winter temperatures in the north of the UK are not a concern for the Baltic vine varieties grown here. A comparison of budding records of vines grown under glass and in the open indicated, particularly in 2011 and 2012, the latter were being set back by late season frosts such that the time from first budswell to leaf development in open grown vines was up to 70 days (Fig. 2a,b). Frost protection had been attempted by placing sealed tree-protection guards around the rods of bush-pruned vines, but the tubes were found to offer only minimal protection as the temperature in the tubes soon equilibrated with the surrounding air temperature. The site is near the floor of a river valley and thus susceptible to radiation frosts, but by far the principal problem over the last few years has been advection frosts from the introduction of Arctic air masses. It was therefore hoped that growing vines in trenches which could be covered in the Spring would reduce the time from first bud-swell to leaf development, thereby allowing the vines to complete their growth cycle before the end of the growing season in late September.

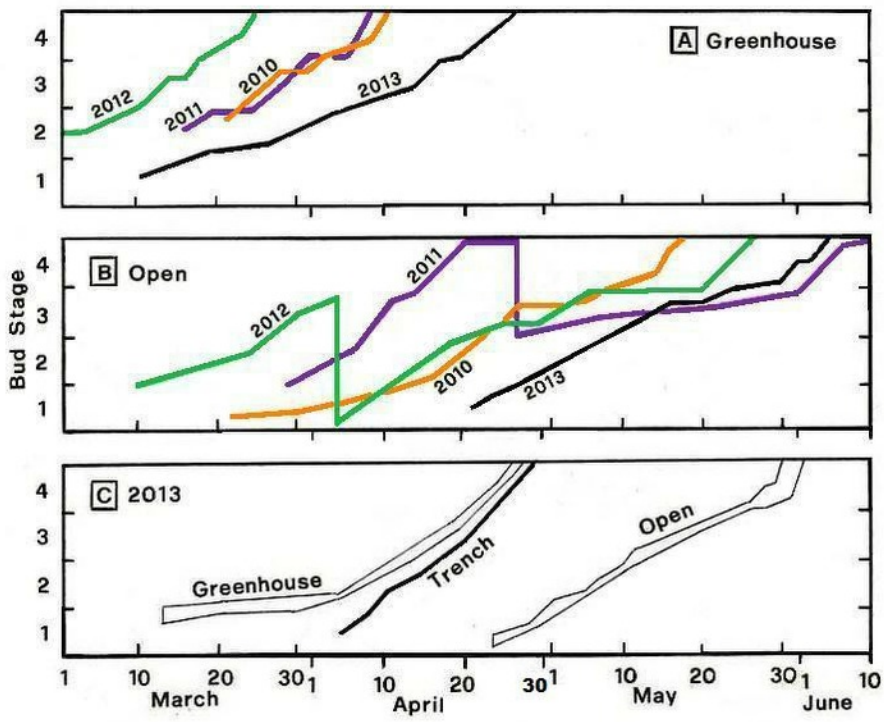

Figure 2. Budding record for: (A) the Latvian variety Zilga under glass at this site. Bud development stages: 1 = budswell, 2 = woolly bud, 3 = green tip, 4 = rosette of first leaves. (B) Zilga grown as low-bush vines under open condition. The protracted leaf development is due to loss of the more advanced buds as a result of frost. Note severe setbacks to the vines in 2011 and 2012 due to –4C and –7C frosts, respectively. (C) Jublienka Novgoroda vines under greenhouse, open, and trench conditions in 2013. Jublienka Novgoroda is a parent of Zilga and behaves similarly to the vines shown in (A) and (B).

Figure 3. The test trench with 1-year old vines and various temperature sensors in early May 2013. The rocks at the side are for weighting down the polycarbonate cover.

The test trench was constructed in February 2013 and was quite shallow (100 x 45 x 17 cm, length x width x depth; Figs. 1, 3), being based on materials available at the time. The trench was covered with a 120 x 60 cm sheet of 4 mm twin-wall polycarbonate, with the sheet ends closed by Duct tape. The polycarbonate was placed directly on the ground and weighted down with stones for wind protection. The trench was aligned NNW-SSE so that the length of the trench would be illuminated by the sun at mid-day. The site slopes with a 15% gradient to the south, which also helps with drainage. The trench walls were lined with wooden board. The trench was planted with 1-year old vines of Jublienka Novgoroda and Vino Nordica in March 2013, and was covered on 8th April. At this time the vines were still in the early stages of budswell (Fig. 2c). The timing of cover deployment was based on a perceived change to milder, more Spring-like weather conditions.

The late start to the 2013 growing season meant this was the first year since vines were planted at the site, that there was no severe frost during budding. However, tests performed during low temperature events in February 2013 showed the potential for frost protection by trenches, as although temperatures reached almost –7^{0}C in the open, they did not drop below -1.1^{0}C in the test trench (Fig. 4). The moderation of temperatures by warming from the soil would have been sufficient, even at this time of year, to allow survival of buds at most stages of development. Bud development progressed rapidly after covering of the trench and by 30th April had reached the same stage as for vines under glass (Fig. 2c). In contrast, vines of Jublienka Novgoroda in exposed conditions did not come into leaf until after 30th May. Correspondingly, the late-budding variety Vino Nordica had leaves in the trench and under glass by 3rd May, but not until mid June in the open. Trench covers were removed on 19th May after frost risk passed.

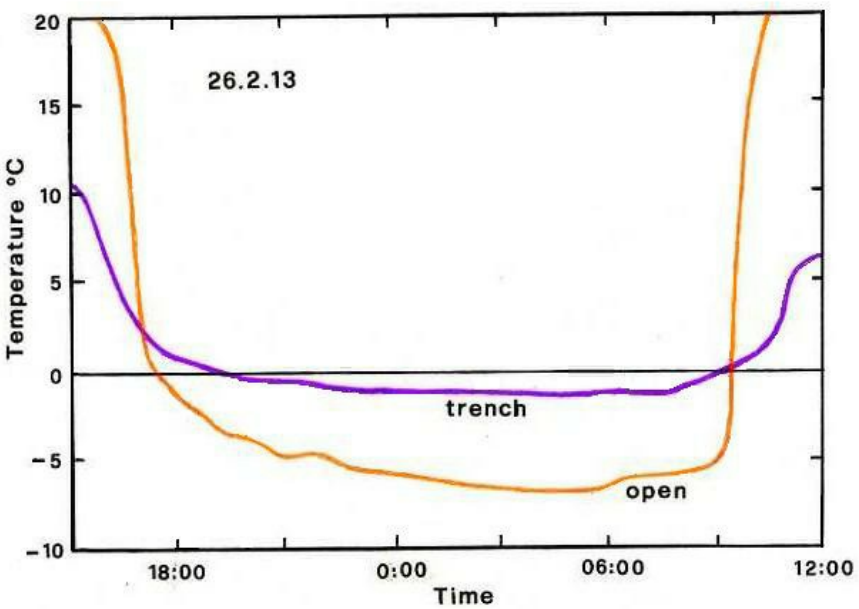

Figure 4. Temperature record for open growing (30 cm from the ground, equivalent to the height of bush-pruned vines) and covered trench conditions on the night of 26th February 2013. Although there was a severe (-6.9^{0}C) frost, temperatures in the trench did not fall below –1.1^{0}C.

CURRENT STATUS

Larger trenches, 230 cm long by 60 cm wide, with a V-shaped profile 40 cm deep, and lined with 20mm-thick garden timber to 2/3 the depth of the trench, are now being installed (Figs. 1, 5). The inclined walls, compared to the trenches used by Romanenko (2011), are designed to simplify construction (building time takes less than an hour) and maximise light and heat input (at the latitude of 57^0N here, the optimum angle for solar heating of the trench walls in April/May is 40-50^0).

Figure 5. A larger trench with vines of Jublienka Novgoroda in early July 2013. Border Collie for scale.

The trench covers are 250 x 80 cm sheets of 4 mm polycarbonate, attached to a wooden frame made from 30 x 20 mm lengths. Silicone is used to seal the polycarbonate ends and the join between the cover-sheet and frame. The trenches are spaced 1.5m apart, with each trench containing 3 vines. The intention is to test a variety of pruning methods including growing as low bushes and single-Guyot systems with wire-supporting posts positioned at the ends of the trenches.

CONCLUSIONS

Grapevine growing in trenches has several potential advantages for northern vineyards, principally:

1. Frost Protection: It has been generally thought that the way to beat a severe frost while vines are budding is to spray with water such that the buds become covered with a protective layer of ice. Growing in trenches presents a further method. Moreover, trench covers can be left in place during budding and early shoot growth without any need to predict and react to the threat of frost on a daily basis.
2. A longer growing season: Covering of the trenches advances vine growth early in the year. Tests using the early-budding variety Jublienka Novgoroda suggest more than 31 days growing time can be gained. Trench-grown vines reach the leaf stage around the same time as vines grown under glass, which even at 57^0 N, allows an average further 170 days growing time based on recent years' records.
3. Utilisation of warmer, near-ground growing conditions during the growing season: Pruning systems need to be tailored to the dimensions of the trench; however, if budding canes/spurs are pruned at around half the height of the trench, shading effects from the trench wall should be minimal during the early stages of shoot growth. New growth can be conventionally trained along low wires just above the top of the trench, or the vines grown as low bushes.

Providing a site has a well-drained soil, these advantages increase the reliability of grape growing under marginal conditions, thereby offsetting the effort required to construct the trenches. Lastly, the trenches may also provide an answer to the problem of moles, which on this site seem to enjoy using the uncovered soil around vines as preferred sites for molehill building. The root systems of

several vines have thus been destroyed, but hopefully now they will run into the boards and be prevented from disturbing the vine roots.

REFERENCES

Romanenko, A. 2011 Technology for growing large-fruited table grapes in Moscow in the open field on sandy soil. http://vinograd7.ru/docs/statjii/opit_romanenko.htm (in Russian) [accessed February 2013, translated with Google]

Stone, G. 1980 Building a Solar-Heated Pit Greenhouse. Storey's Country Wisdom Bulletin A-37, Garden Way Publishing, Vermont, USA, p 32

RABBITS OF KINGFISHERS' POOL – banned! Liz is in serious trouble with her publisher having not finished a large chapter that she should have submitted six months ago. The rabbits have therefore been banned from writing their regular feature – much to their utter indignation.

Instead they will spend their time creating mayhem and chaos in the vineyard and munching their way through the parts of the garden that are not covered in a blanket of weeds.

Oh, yes, perhaps a few interludes of rabbit romance when Dad Rabbit is not looking!