



GUIDELINES FOR

PINOTAGE

VINEYARDS



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VITICULTURAL GUIDELINES FOR PINOTAGE

INTRODUCTION

Pinotage is a uniquely South African grape varietal that came into being in 1925 through the crossing of Pinot noir and Cinsaut, then locally known as Hermitage. International recognition for Pinotage came through the dedicated efforts of a few South African winemakers who were committed to produce a wine that could hold its own against any varietal from any wine-growing region of the world.

Pinotage has the inherent adaptability and capacity to produce high grape yields under ideal cultivation conditions. Since there is now a considerable bank of knowledge about how to grow Pinotage vines successfully, the Pinotage producer is in the fortunate position that he has various options when having to decide on alternate cultivation practices and yield control measures that will ensure an optimal crop.

It is often said that the quality of the wine is determined in the vineyard. With these guidelines the Pinotage Association would like to make grape growers aware of the total series of factors that have to be taken into consideration to cultivate Pinotage grapes with the right characteristics that are required for the production of quality Pinotage wines.

PROPERTIES OF PINOTAGE

Although variations may occur from locality to locality, the following characteristics are typical of Pinotage grapes:

- **Budding:** Early mid-season, from early September after Chardonnay and before or together with Merlot.
- **Flowering:** From end October until early November.
- **Veriason:** From end December until early January.
- **Ripening:** Early mid-season, from end January to early March. Bud burst to harvesting takes approximately 160 - 180 days. The ripening of grapes on virus-infected vines takes approximately 10 to 21 days longer, i.e. from end February until middle March.
- **Vigour:** Moderate to ideal. Due to differences in cultivation conditions, the following variations in shoot length occur quite regularly:

Weak	(30 - 50 cm)
Moderate	(60 - 80 cm)
Ideal	(90 - 120 cm)
Lush	(>120 cm)

The vigour of old bush vines usually range from weak to moderate, while that of young trellised vines usually varies from moderate to lush.

- **Production potential:** This is primarily determined by the age of the vines, the potential of the soil, planting width, rootstock, the application of supplementary irrigation, the wine objective and other vineyard management practices.

Low (old bush vines)	2 - 8 ton/ha
Moderate	9 - 15 ton/ha
High (trellised vines)	16 - 20 ton/ha
Very high	>20 ton/ha

Predominantly moderate vigour of bush vines.



LONG TERM CULTIVATION PRACTICES

● Choice of terrain

Pinotage is well-acclimatized in both cooler regions with average February temperatures lower than 22°C, as well as warmer regions with average February temperatures higher than 23°C.

Most of the vineyards in the Stellenbosch area of which grapes were used for the production of winning wines of the Absa Top 10 Pinotage competition have the following properties in common:

- (a) Old bush vines (30 - 40 years) that grow under dryland conditions.
- (b) Medium-deep hilly slopes with soil having a good water retention capacity.
- (c) A cooler south-east or south-west aspect or a warmer north or north-east aspect.

Wines from cooler locations often have a fruity cherry or blackberry character while a dominant plum and banana character distinguishes wines from warmer regions. Wines with a combination of flavours can be acquired from grapes that originate from vineyards on different slopes on the same farm.

● Soil types

Low-lying medium to high potential alluvial soil with high production potential, such as Oakleaf, Tukulu and Dundee, should rather not be used for Pinotage, especially not in irrigated areas. These soils are distinguished by their dark brown/black colour, high organic material content and natural nitrogen-supplying capacity.

Deep poor coarse sandy soils such as Fernwood and Westleigh, with a poor water retention capacity ability, not only require more regular irrigation, but usually produce fruity wines with limited complexity that have to be drunk at an early stage.

Poor to medium potential sloping hillsides with a medium to good water retention capacity usually enhance moderate growth and a natural low crop that ripen easily. These are of the best soils for the growing of quality Pinotage grapes.

● Direction of rows

It is generally accepted that a south-east/north-west row direction is conducive to—

- (a) protect grapes from direct sunlight in warm ripening conditions;
- (b) let the ripening process take place under cooler conditions; and
- (c) more uniform ripening of the grapes.

Pinotage vineyards on the hilly slopes at Kanonkop.





In cooler areas rows in a north/south direction will stimulate the ripening process since a larger portion of the trellis, and therefore also of the grapes, is exposed to direct sunlight.

Prevailing winds during the ripening phase also play an important part in the selection of row direction. Winds along the row direction will cause the leaves and bunches to dry sooner, which will reduce the possibility of fungal infection. In the case of sea-wind conditions it will also have a cooling effect.

In the case of sloping hillsides rows should be established along the contour to facilitate the movement of implements and to combat soil erosion.

Significant differences were found in the analysis results of the grapes that grow on the south-eastern (shady) side and the north-western (sunny) side of north/south rows in trellised vineyards. (Table 1)

TABLE 1: Grape analyses in north/south trellised vineyards (Rawsonville)

ANALYSIS	SHADY SIDE (SOUTH-EAST)	SUNNY SIDE (NORTH-WEST)
Sugar	25,3°B	28,7°B
Total acid	5,08 g/l	4,92 g/l
Malic acid	2,34 g/l	2,41 g/l
pH	3,67	3,86

¹ According to unpublished work by S R du Toit, 2003.

● Soil preparation

The purpose of soil preparation is to create a well-branched root system for sufficient shoot growth so that grapes can be ripened under dry land and/or additional irrigation conditions with optimum results.

A comprehensive soil investigation should form an integral part of the planning process when the establishing of a new vineyard is considered. At least two to four profile holes per hectare are required for a thorough profile study. The GPS positions of these profile holes should for future reference be recorded on the map of the relevant block or farm. The samples of different soil profiles and that of the topsoil and subsoil must be kept and analysed separately.

Sufficient lime should be applied since low pH soils tend to re-acidify over time and it is difficult and costly to place lime in the deeper substrata in established vineyards, especially in high rainfall areas. Saline, brackish and wet soil conditions limit the development of the vine root network.

Under cooler climatic conditions, dry land conditions and low production conditions an effective soil preparation depth of 800 - 1000 mm is normally adequate. The deeper the soil is effectively prepared, the better the resulting increased soil water buffer capacity enables the vine to handle warmer and drier ripening years.

Even in irrigated areas deep soil preparation will limit the frequency and total volume of water needed to ripen the crop.

● Plant material

Only certified plant material should be used. At this stage the following three clones are available to the industry:

- PI 45, certified in 1981 (SFW)
- PI 48, certified in 1966 (Slaley selection)
- PI 50, certified in 1976 (Meerendal selection)

The first Pinotage was grafted in 1935 and planted on Welgevallen Experimental Farm at Stellenbosch. It is highly likely that all three these clones evolved from the original Elsenburg/ Welgevallen selection

– different clone numbers were most probably given to the same material that performed well on different farms.

All three are described as typically berry-ish with moderate vigour and medium production potential. Under similar cultivation conditions there doesn't seem to be much difference amongst the three clones.

New Pinotage selections from Kanonkop and Warwick plant material are currently being prepared for the industry via the plant improvement process.

● Choice of rootstock

As far as is known, Pinotage has no affinity problems with any of the well-known rootstock varieties. The choice of rootstock variety will therefore mainly be dependant on the soil type and the availability of water. Rootstock varieties that induce moderate balanced vigour under supplementary irrigation or dry land conditions should enjoy preference.

Rootstock varieties that induce lush growth, e.g. Ramsey, should be avoided.

Under dry land conditions preference should be given to R99, R110, Paulsen 1103, 8-7USVIT and 140 Ruggeri. Under supplementary irrigation conditions rootstock varieties such as R110, 101-14Mgt and 8-7USVIT can be considered.

● Plant spacing

The spacing of vines depends on the soil type, slope, climatic conditions, rootstock selection, cultivation practices, choice of implements, expected vigour, wine target, etc. The objective should be balanced growth.

Tractor row width normally varies between 2,2 and 3,0 metres.

Along slopes a minimum tractor row width of 2,7 to 3.0 metres is usually recommended.

Since bush vines normally fall slightly open during the ripening period, a minimum tractor row width of 2,7 metres is recommended so that shoots will not be damaged during normal cultivation practises.

Inter-vine spacing in rows can vary between 0,75 and 1,50 metres. If medium to lush growth is expected, spacing in rows can vary from 1,2 to 1,5 metres, and between 0,75 and 1,2 metres if poor to medium growth is expected.

Practical experience has shown that inter-vine spacing of less than 1,2 metres in rows will result in too few bearer shoots for normal Pinotage vigour. For medium potential soil an inter-vine spacing of 1,25 metres in rows is recommended.

● Trellising system

In the past old bush vines often produced the best wines. The fact that more wines from younger trellised vineyards have in the recent past been designated as winning wines of the Absa Top 10 Pinotage competition can be ascribed to better vineyard management practices and the utilisation of new technology.

New vineyards are generally trellised to facilitate mechanization. Under ideal growth conditions dense foliage with large leaves, compact bunches and big berries can be obtained. This usually results in a larger than normal crop with poor wine quality.

Lush growth conditions can through the judicious choice of rootstock and planting width as well as the use of adapted irrigation, fertilization and foliage management practices be manipulated to obtain more balanced growth.

A trellis system must be capable of handling the balanced growth in a 1,0 to 1,2 metre vertical foliage space. Direct sunlight on grapes in environmental temperatures of higher than 30°C should be avoided. Because of its oval form and dark colour the temperature of a black grape berry is approximately 6 - 10°C higher than the ambient temperature. If the grape berry's temperature rises above 35 - 38°C, the anthocyanins can be broken down. In such cases it was observed that the outer berries turn pink.



Sunburn in a trellised vineyard.

In cooler cultivation conditions some degree of diffused light and/or moderate sunlight penetration in the bunch zone will be beneficial for colour development.

The grapes on the western (sunny) side of north/south rows in trellised vineyards have higher sugar levels but a lower colour intensity, and more or less the same ratio of brown to red colour pigment, as the grapes on the eastern side of such rows. (Tables 2 and 3)

TABLE 2: Sugar content and colour intensity of grapes in trellised vineyards¹

ANALYSIS	SHADE	SUN
Sugar	25,3°B	28,7°B
Brown pigment (420 nm)	567	346
Red pigment (520 nm)	992	659
Colour intensity (brown + red pigment)	156	101
Colour intensity (red pigment)	64%	65%

¹ According to unpublished work by S R du Toit, 2003.

TABLE 3: Sugar content and colour intensity of grapes in bush vine vineyards¹

ANALYSIS	SHADE	SUN
Sugar	24,8°B	27,7°B
Brown pigment (420 nm)	852	786
Red pigment (520 nm)	729	646
Colour intensity (brown + red pigment)	158	143
Colour intensity (red pigment)	46%	45%

¹ According to unpublished work by S R du Toit, 2003.

Narrow, dense hedge systems contribute to large variations in ripening in a vertical grape trellis, while sun damage also occurs more readily therein. If some shoots are allowed to fall open, foliage conditions are created that would be nearer to that of bush vines.

If a Pinotage vineyard is to be trellised, a lengthened Perold trellis system with moveable foliage wires and a minimum pole length of 1,8 to 2,1 metres is recommended.

● Vine frame development

A balanced vine framework is important for the uniform ripening of grapes. Trellised vines that are planted closer than 1,0 metres to each other should be developed in one direction only, namely downwind. If trellised vines are planted further than 1,0 metres apart, the cordon arms should for better shoot

growth balance and greater sturdiness be developed equally in strength and length in both directions. In the case of bush vines the apical dominance of strong spurs can be lessened by developing the spurs on more or less the same height.

A uniform spreading of bearers will promote sunlight utilization and ventilation. In the case of bush vines 4 to 6 bearers are recommended and in the case of trellised vines one bearer every 12 to 15 cm. Because of Pinotage’s inherent capacity to deliver high grape yields, bearers should not be spaced closer than 12 cm apart.

SHORT TERM CULTIVATION PRACTICES

● Fertilization

A soil analysis should, in the case of sandy soils, be done every third year, in the case for clay soils, be done every fifth year. The fertilization programme for a vineyard should, in the case of P and K, be adjusted on the basis of the results of the soil analysis.

Nitrogen fertilization (N) should be adjusted as follows in accordance with the vigour and yield of the vines (P and K) and the vitality and yield levels of the vineyard:

Poor growth (shoots < 50 cm):	50 - 60 kg/ha/year
Medium growth (shoots 60 - 80 cm):	30 - 40 kg/ha/year
Ideal growth (shoots 90 - 120 cm):	10 - 20 kg/ha/year
Lush growth (shoots > 120 cm):	0 kg/ha/year

The first 40 kg N/ha should be applied post harvest, and the rest by the end of October, approximately four weeks after budding when the roots begin to grow actively.

Soils with high organic content usually have better nitrogen releasing potential. Balanced vineyards on such soils usually don’t need additional nitrogen fertilization.

For the purposes of the application of nitrogen fertilization

10 kg N (nitrogen)/ha	=	36 kg KAN (28) /ha
	=	22 kg Uream (46) /ha
	=	53 kg AN (19) /ha
	=	25 kg Nitro-S (40) /ha.

The norm for phosphate and potassium depends on the texture classification of the soil:

	SANDY SOIL	CLAY SOIL
Phosphate	20 ppm	30 ppm
Potassium	30 ppm	80 ppm

The absorption of most of the trace elements through the root system of the vine is dependent on the pH status of the soil. Since the application of lime or gypsum will influence the pH status of the soil and therefore also the availability of trace elements, the trace element nutrient status of soil cannot be determined very accurately through soil analyses. It is, however, reflected more accurately through leaf analysis during the growing season.

● Irrigation

Most old bush vine vineyards are cultivated successfully under dryland conditions or receive supplementary irrigation only. During the dry summer months supplementary irrigation is usually more critical during veraison than during flowering. During flowering most soils in the areas with a rainfall of more than 500 mm per year have sufficient soil moisture.



Young trellised vines are inclined to produce relatively higher yields. The vegetative growth and berry size of trellised vineyards under irrigation can be regulated by means of judicious moisture stress control. During the cell division/enlargement stage after flowering (mid November) until approximately the veraison stage (middle to end December) judicious moisture stress control will limit the size of the berries and therefore also of the crop.

During this period vegetative growth will have to be regulated by means of vineyard management practices since it is difficult to control berry size in actively growing vineyards. Judicious irrigation practices should strive for moderate vegetative growth, i.e. shoots with a length of 80 to 120 cm. Active growth of shoots during the veraison stage until ripening should be restricted so that the vine can focus on the ripening of the bunches.

Vineyards with moderate growth generally have thinner shoots than vigorous vineyards. The internodes of thinner shoots are spaced closer together (less than 4 to 6 cm), resulting in more small to medium-sized leaves per metre shoot length. The smaller berries and bunches result in vineyards with lower yields. Vigorous vineyards are characterized by thicker shoots that normally produce bunches with large berries.

The outer berries of a closely packed Pinotage bunch with large berries will colour easier than those on the inside of the bunch. Since judicious moisture stress control will result in slightly smaller and looser bunches, the more diffuse light environment around the inner berries will contribute to their easier colouring.

● Winter Pruning

● Trellised vineyards

Since Pinotage is fairly fertile, trellised vines can be pruned successfully to one- or two-bud spurs. A minimum spur spacing of 12 to 15 cm is, however, recommended. If the production level of a specific block is too high, the crop can be decreased by more drastic pruning, with one-bud spurs, or by spacing bearers further apart (more than 15 cm)..



Trellised vine with the right bearer spacing.

● Bush vines

Bush vines should be pruned so as to have four to six bearers that are evenly spaced in a crown formation. It is desirable to keep the bearers on more or less the same horizontal level so as to restrict apical ascendancy of dominant bearers.

Drastic reduction of old spurs is not recommended as large pruning wounds are easily infected with eutypa die-back and/or other wood-rotting fungi. If large pruning wounds are unavoidable, they should be treated with a wound sealant and/or biological control agent.

● Canopy management

The ideal foliage should be approximately 1,0 metre high and be well-balanced and uniform so that all bunches are protected from direct sunlight by one or two layers of leaves. Diffused light in the bunch zone is advisable to lengthen the effectiveness of especially older leaves and to promote colour development.



Yellow inner leaves are indicative of shading.

At the commencement of the ripening phase active vegetative growth should terminate or decrease in favour of reproductive development in the bunches.

Because of Pinotage's fertility, all bearers should be suckered to a maximum of two short bud spurs. The ideal norm is 16 - 20 shoots per metre cordon. Crop loads should be adapted according to shoot length so that bunches and shoots can be ripened sufficiently. Shoots that are shorter than 40 cm should not bear any grapes, while shoots between 40 and 80 cm should not bear more than one bunch of grapes.

Grapes on poor, short, sucker shoots ripen later and can contribute to green tannins in the wine if it is pressed together with other riper grapes. (Table 4)

TABLE 4: Grape analysis of bunches in trellised Pinotage vines¹

ANALYSIS	AN OUTER SIDE OF FOLIAGE	ON INNER SIDE OF FOLIAGE	ON WEAK SHOOTS
Sugar	25,4°B	23,2°B	21,5°B
Total acid	6,35 g/l	7,76 g/l	7,84 g/l
Malic acid	2,69 g/l	4,58 g/l	4,58 g/l
PH	3,34	3,19	3,13

¹ According to unpublished work by S R du Toit, 2003.

The suckering of vineyards holds several advantages, the most important of which probably is the more even ripening of bunches.

The tips of more lush growing shoots should be tipped and topped on a regular basis to obtain more evenness in shoot length and quality. Tipping and topping which is required at a late stage (after veraison) would be indicative of undesirable late shoot growth and/or an insufficient trellis system.

It is most undesirable to prune a vineyard drastically before harvest as the sudden exposure of soft unprotected grapes to direct sunlight could cause sunburn damage that could destroy colourants and flavourants.

Defoliation is normally only necessary in cool wet years when there is a possibility of *Botrytis cinerea* fungus infection. Good spacing of bearers and severe suckering will also reduce the possibility of fungus infection.

● Pest and disease management

The fungus management programme for Pinotage grapes should focus on the prevention of powdery mildew and downy mildew. It should not only be in accordance with the principles of IPW (Integrated Production of Wine), but should also take the disease forecasts of automatic weather stations into consideration. It is furthermore important to apply a strategy that will prevent fungus resistance to chemical sprays.



The pest management programme for Pinotage grapes should focus on the effective control of mealybug and ants so as to limit the infection and spreading of leaf-roll virus.

Pests and diseases should be combated chemically only if they can cause economical damage in terms of quality and quantity. Remedies should be applied in such a way that it will have the least possible detrimental effect on the environment and will not be injurious to human health.

● Harvest control

Shoots that are shorter than 40 cm should usually not be allowed to bear any grapes. Shoots between 40 and 80 cm should bear only one bunch.

Shoots between 80 and 120 cm should be able to ripen two bunches. Although particularly high production levels of more than 20 ton/ha can be obtained from evenly balanced rather lush vineyards, this is undesirable from a quality viewpoint.

In trellised vineyards a maximum of 20 bunches per metre cordon length (less than 15 ton/ha) is recommended for the production of quality wines.

During veraison, i.e. at about 80% bunch colouration, all bunches should be removed that have not coloured well.

An estimated production forecast for Pinotage vineyards according to bunch mass, bearer spacing and number of bunches is shown in Table 5 (trellised vineyards) and Table 6 (bush vine vineyards).

TABLE 5: Production Forecast for Trellised Pinotage vineyards¹

(Row width: 2,5 m; Cordon length: 4,000 m/ha; 2 shoots per bearer)

Spacing between spurs	Average mass per bunch	Production @ 1 bunch/shoot	Production @ 1,5 bunches/shoot	Production @ 2 bunches/shoot
10 cm	230 g	18,4 ton/ha	27,6 ton/ha	36,8 ton/ha
10 cm	170 g	13,6 ton/ha	20,4 ton/ha	27,2 ton/ha
10 cm	100 g	8,0 ton/ha	12,0 ton/ha	16,0 ton/ha
12 cm	230 g	15,3 ton/ha	23,0 ton/ha	30,7 ton/ha
12 cm	170 g	11,3 ton/ha	17,0 ton/ha	22,7 ton/ha
12 cm	100 g	6,6 ton/ha	10,0 ton/ha	13,4 ton/ha
15 cm	230 g	12,3 ton/ha	18,4 ton/ha	24,5 ton/ha
15 cm	170 g	9,1 ton/ha	13,6 ton/ha	18,1 ton/ha
15 cm	100 g	5,4 ton/ha	8,0 ton/ha	10,6 ton/ha

¹ According to unpublished work by S R du Toit, 2003.

TABLE 6: Production Forecast for Bush Vine Pinotage vineyards¹

(Row width: 3 m; Inter-vine spacing: 1,5 m; 2,222 vines/ha; 2 shoots/spur)

Number of spurs	Average mass per bunch	Production @ 1 bunch/shoot	Production @ 1,5 bunches/shoot	Production @ 2 bunches/shoot
4	230 g	4,1 ton/ha	6,1 ton/ha	8,2 ton/ha
4	170 g	3,1 ton/ha	4,5 ton/ha	6,0 ton/ha
4	100 g	1,8 ton/ha	2,7 ton/ha	3,6 ton/ha
6	230 g	6,1 ton/ha	9,2 ton/ha	12,3 ton/ha
6	170 g	4,6 ton/ha	6,8 ton/ha	9,1 ton/ha
6	100 g	2,7 ton/ha	4,0 ton/ha	5,3 ton/ha
8	230 g	8,2 ton/ha	12,3 ton/ha	16,4 ton/ha
8	170 g	6,2 ton/ha	9,1 ton/ha	12,1 ton/ha
8	100 g	3,6 ton/ha	5,3 ton/ha	7,1 ton/ha

¹ According to unpublished work by S R du Toit, 2003.

DETERMINING OPTIMUM RIPENESS

It would appear from discussions with successful Pinotage producers that sufficient sugar ripeness generally occurs before tannin ripeness. Experienced Pinotage producers rely heavily on the tasting of grapes to determine the ideal harvest date.

The following indicators are regarded as signs of optimum tannin ripeness in Pinotage grapes:

- The skin and pedicel become dark red.
- The portion of the skin at the joint with the pedicel is coloured red all around.
- The pedicel is dark red, slightly thinner and is easily detachable from the rest of the berry.
- The skin is soft, breaks easily when it is chewed and tastes slightly sweet but not raisiny.
- Green unripe grape flavours are normally absent from ripe skins.
- When the broken skin is rubbed on the palm of one's hand, it leaves a red stain.
- Most of the seeds have become brown.



Broken skin of ripe grapes colour.

Overripe and sunburned berries taste somewhat bitter and jammy. If the skin has a bitter taste, it can be an indication of unripeness, or that the berries were exposed to too much direct sunlight.

Current grape analyses show that almost half the total titratable acid of Pinotage consists of malic acid, but that it can vary from as low as 30% to as high as 60%. The malic acid content in grapes that are exposed to direct sunlight tend to be lower than that of grapes in the same block which are protected against direct sunlight. This inevitably requires judicious acid adjustments in the wine making process to control the pH and to make provision for the malo-lactic acid fermentation (MLF).

INDEMNITY

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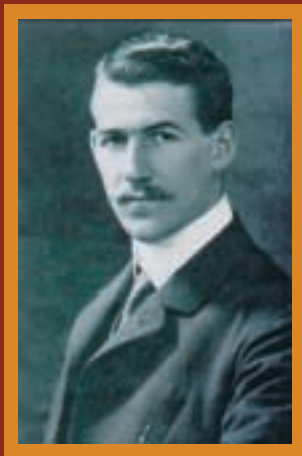
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Professor Abraham Izak Perold (1880 - 1941),
the "father" of Pinotage.



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