Practical hints for the control of weeds in vineyards

J.C. FOURIE & L. VAN HUYSSTEEN

Viticultural and Oenological Research Institute, Stellenbosch

During the growing season of a vineyard, from the beginning of September to approximately the end of March, growing weeds and/or cover crops compete with the vine for moisture and nutrients. Van Huyssteen & Weber (1980b) found that the competition of a short-clipped but growing weed stand decreases crops by 65% on average over a period of seven years, measured against conventional clean tillage.

For a wine farmer with an average yield of 10 tons per hectare this can mean a loss of up to R2 000 per hectare. In addition, weeds create favourable conditions for certain vineyard pests and a dense stand of weeds hampers light penetration into the vineyard, which may favour diseases.

From the above it is clear that effective weed control is of major importance to the grower. As a result of the ever-increasing operational costs it is therefore also necessary to obtain effective weed control with the lowest possible expense.

1 VARIOUS METHODS OF WEED CONTROL

There are mainly three methods of weed control, namely mechanical, chemical and biological weed control. Each of the said control methods discussed below has several advantages and disadvantages.

Mechanical weed control gives acceptable results, provided the right implement is used at the right time. Weed competition is immediately eliminated and on sandy soils and soils with a high pH, where pre-emergence control with the aid of a chemical agent holds a safety risk for the vineyard, it remains an acceptable and practical method.

However, despite these advantages, mechanical weed control damages the soil structure, because the pressure and smearing action of the implements result in a ploughsole (Fig 1). Regular disc harrow and cultivator tillage also loosen the surface soil too much and make it too fine, which results in the so-called sieve effect (Van Huyssteen & Weber, 1980a). It also contributes to the formation of a ploughsole, as well as the puddling of the surface soil layer under irrigation conditions. These soil physical restrictions prevent the development of vine roots in the surface soil, with the result that this fertile soil layer is not optimally utilised.

Another disadvantage is the fact that weed control is only temporary and has to be repeated during the season. In addition, each movement of the tractor and implements through the vineyard contributes to compaction. Tillage promotes the distribution of problem weeds like *Tribulus terrestris* (ostrich thorn) and *Cyperus* species (nutgrass) and also stimulates the growth of these weeds by creating an ideal seedbed for the seeds and root tubers of the various plants.

Chemical weed control, on the other hand, has particular advantages because one or two sprayings with the right combination of agents can keep the vineyard free of weeds from bud break until after harvesting. The main advantage of this method is that it does not disturb the soil, with all the accompanying advantages.

Praktiese wenke vir die beheer van onkruide in wingerd

J.C. FOURIE & L. VAN HUYSSTEEN

Navorsingsinstituut vir Wingerdbou en Wynkunde, Stellenbosch

Tydens die groeiseisoen van 'n wingerd, wat strek vanaf begin September tot ongeveer einde Maart, kompeteer groeiende onkruide en/of dekgewasse met die wingerdstok vir vog en voedingselemente. Van Huyssteen & Weber (1980b) het gevind dat die kompetisie van 'n platgesnyde, maar groeiende, onkruidstand oeste met gemiddeld 65% oor 'n periode van sewe jaar verlaag, gemeet teen konvensionele skoonbewerking.

Vir 'n wynboer met 'n gemiddelde oesopbrengs van 10 ton per hektaar kan dit 'n verlies van tot R2 000 per ha beteken. Onkruide skep boonop gunstige toestande vir sommige wingerdplae en 'n digte stand onkruide verswak die deurligting van die wingerd, wat siektevoorkoms mag bevoordeel.

Uit bogenoemde feite is dit duidelik dat effektiewe onkruidbeheer van groot belang vir die boer is. Weens die steeds stygende bedryfskoste is dit dan ook nodig om doeltreffende onkruidbeheer met die laagste moontlike uitgawes te verkry.

1 VERSKILLENDE METODES VAN ONKRUIDBEHEER

Daar bestaan hoofsaaklik drie metodes van onkruidbeheer, nl meganiese, chemiese en biologiese onkruidbeheer. Daar is verskeie voor- en nadele verbonde aan elk van die genoemde beheermetodes wat hieronder bespreek word.

Meganiese onkruidbeheer gee aanvaarbare resultate indien die regte implement op die regte tyd gebruik word. Die uitskakeling van onkruidkompetisie geskied onmiddellik en op sandgronde en gronde met 'n hoë pH, waar vooropkomsbeheer met behulp van 'n chemiese middel 'n veiligheidsrisiko vir die wingerd is, bly dit steeds 'n aanvaarbare en praktiese metode.

Ten spyte van dié voordele, is meganiese onkruidbeheer egter skadelik vir die grondstruktuur, aangesien die druk- en smeeraksie van die implemente aanleiding gee tot die vorming van 'n ploegsool (Fig 1). Gereelde skotteleg- en ghropbewerking maak ook die bogrond te los en fyn, wat aanleiding gee tot die sogenaamde sifeffek (Van Huyssteen & Weber, 1980a). Dit dra verder by tot die vorming van 'n ploegsool en ook die toeslaan van die boonste grondlagie onder besproeiingstoestande. Hierdie grondfisiesebeperkings verhoed die ontwikkeling van wingerdwortels in die bogrond en veroorsaak dat dié vrugbare grondlaag nie optimaal benut word nie.

'n Verdere nadeel is die feit dat onkruidbeheer net tydelik is en deur die seisoen herhaal moet word. Daarbenewens dra elke beweging van die trekker en implemente deur die wingerd by tot verdigting. Bewerking bevorder die verspreiding van probleemonkruide soos *Tribulus terrestris* (volstruisdubbeltjie) en *Cyperus* spesies (uintjies) en stimuleer ook die groei van hierdie onkruide deurdat dit 'n ideale saadbed vir die sade en wortelknolle van die onderskeie plante skep.

Chemiese onkruidbeheer hou daarenteen besondere voordele in deurdat een of twee bespuitings met die regte kombinasie van middels, die wingerd van bot tot na oes onkruidvry kan hou. Die groot voordeel van hierdie metode is dat dit die grond onversteurd laat met al die voordele wat daarmee gepaard gaan.

Fig 1 The ploughridge (or ploughsole), formed as a result of regular clean tillage, is clearly visible. Vine roots are absent in the surface soil layer and a few root ends are encircled in white for identification purposes.
Fig 1 *Die ploegbank (of ploogsool) wat as gevolg van gereelde skoonbewerking gevorm het, kan duidelik gesien word. Wingerdwortels is afwesig in die boonste grondlaag en enkele wortelpunte is wit omkring vir identifikasiedoeleindes.*

Fig 2 Effective weed control with the aid of a mulch cover, obtained through the successful cultivation of a cover crop.
Fig 2 *Effektiewe onkruidbeheer met behulp van 'n goeie deklaag, wat verkry is deur die suksesvolle verbouing van 'n dekgewas.*

However, under irrigation conditions full-surface chemical control holds the disadvantage that a bare soil surface results in poor water infiltration. This is due to the lack of both organic material on the soil surface and sufficient pores in the surface soil layer.

Biological weed control is based on the principle that a carpet of dead plant rests is left on the soil surface to suppress the emergence of seed of summer weeds through smothering (Fig 2). This method of weed control eliminates tillage and herbicide sprayings during the growing season and therefore decreases tractor traffic.

Research has proven that the use of a cover crop is a very effective method to maintain and even improve the structure of a soil (Van Huyssteen & Weber, 1980a; Saayman & Van Huyssteen, 1983). Van Huyssteen, Van Zyl & Koen (1984) found that soil moisture is retained much better, particularly in the top 0-150 mm of soil surface, if a mulch cover is used. Mulching also improves the water infiltration (Van Huyssteen, 1981) and in summer results in lower soil temperatures (Van Huyssteen, 1977), which is favourable for root activity, for example the absorption of nutrients and water (Varadan & Rao, 1983). A cover crop with a dry matter production of 5-8 tons per ha is sufficient to control summer weeds effectively (Van Huyssteen *et al*, 1984).

These days the above methods of weed control are not applied independently of one another and in most cases control programmes are used that combine more than one technique. As example the various options open to the producer will be discussed, as well as the cost attached to each. All of the following calculations were done for a 3-m row spacing. The herbicide prices in the calculations are the 1987 co-operative prices. The examples were developed with herbicides that are in general use in the industry, but other agents can be used if necessitated by circumstances or justified by price. (See section 2.) Tractor cost was calculated with a medium-power 35-kilowatt tractor as norm. The various control methods look as follows:

Onder besproeiingstoestande het voloppervlakte- chemiese beheer egter dié nadeel dat 'n kaal grondoppervlakte swak waterinfiltrasie tot gevolg het. Dit is te wyte aan die afwesigheid van beide organiese materiaal op die grondoppervlakte en genoegsame porieë in die boonste grondlaag.

Biologiese onkruidbeheer berus op die beginsel dat 'n mat van dooie plantreste op die grondoppervlakte gelaat word om die opkoms van saad van someronkruide deur versmoring te onderdruk (Fig 2). Dié metode van onkruidbeheer skakel bewerking en onkruiddoderbespuitings gedurende die groeiseisoen uit en verminder dus trekkerverkeer.

Navorsing het bewys dat die gebruik van 'n dekgewas 'n baie effektiewe metode is om 'n grond se struktuur te behou en selfs te verbeter (Van Huyssteen & Weber, 1980a; Saayman & Van Huyssteen, 1983). Van Huyssteen, Van Zyl & Koen (1984) het gevind dat beter grondvogbewaring verkry word, veral in die boonste 0 – 150 mm grondlaag, indien 'n deklaag gebruik is. 'n Deklaag verbeter ook die waterinfiltrasie (Van Huyssteen, 1981) en het in die somer laer grondtemperature tot gevolg (Van Huyssteen, 1977) wat gunstig is vir wortelaktiwiteit soos bv die absorpsie van voedingstowwe en water (Varadan & Rao, 1983). 'n Dekgewas met 'n droëmateriaalproduksie van 5 – 8 ton per ha is voldoende om someronkruide effektief te beheer (Van Huyssteen *et al*, 1984).

Bogenoemde metodes van onkruidbeheer word deesdae nie onafhanklik van mekaar beoefen nie en in die meeste gevalle word beheerprogramme aangewend wat meer as een tegniek kombineer. As voorbeeld sal die verskillende opsies wat vir die produsent oop is, bespreek word asook die koste daaraan verbonde. Al die onderstaande berekenings is gedoen vir 'n 3-m-ryspasiëring. Die onkruiddoderpryse in die berekenings is die 1987-koöperasieprys. Die voorbeelde is uitgewerk met middels wat algemeen in die bedryf gebruik word, maar ander middels kan ook gebruik word waar omstandighede dit noodsaak of pryse dit regverdig. (Kyk afdeling 2.) Trekkerkoste is bereken met 'n mediumkrag-35-kilowatt-trekker as norm. Die verskillende beheermetodes sien soos volg daar uit:

1.1 Low-cost programme for the control of annual weeds in dryland vineyards

1.1.1 Chemical control under the rows ('bankies') and mechanical control in the work rows

2 litres simazine @ R7,78/litre (Aug or Sept)	R15,56
1 litre paraquat @ R10,63/litre (Aug)	R10,63
1 litre diquat @ R12,54/litre (Aug)	R12,54
Application cost @ R21,50/hour and an application time of ½ hour/ha	R10,75
Disc harrow tillage in work rows @ R16,40/hour, 1 hour/ha, twice	R32,80
Cultivator tillage in work rows @ R14,93/hour 1 hour/ha, three times	R44,79
Total expense per hectare per season	R127,07

If the application of the contact and pre-emergence agent is separated, an extra application cost of R10,75 must be added. The more resistant weeds will have to be controlled with a systemic post-emergence herbicide (See Table 2a), which means an additional expense of R3,11. If a cover crop is sown in the work row the cost will increase with an additional R90,69 (see biological control). The cost of this control method therefore varies between R127,07 and R231,62.

1.1.2 Full-surface chemical control

6 litres simazine @ R7,78/litre (Aug or Sept)	R46,68
2,5 litres paraquat @ R10,63/litre (Aug)	R26,58
2,5 litres diquat @ R12,54/litre (Aug)	R31,35
Application cost @ R21,50/hour and an application time of ¾ hour/ha	R16,13
Total expense per hectare per season	R120,74

Where the application of the pre-emergence herbicide and the contact herbicide is separated, the application cost increases with R16,13 and if a systemic post-emergence herbicide is applied, it means an additional cost of R7,77. The cost of this control method varies between R120,74 and R144,64.

1.1.3 Biological control

Rye seed @ R0,58/kg, 70 kg/ha	R40,60
Establishment cost:	
Disc harrow tillage @ R16,40/hour, 1 hour/ha (seedbed preparation)	R16,40
LAN @ R0,38/kg, 50 kg/ha	R19,40
Cultivator tillage @ R14,93/hour, 1 hour/ha (covering of seed)	R14,93
Killing with 5 litres of systemic agent @ R13,18/litre	R65,90
Application cost @ R21,50/hour and an application time of ¾ hour/ha	R16,13
Total expense per hectare per season	R172,96

After four years of mulch cover cultivation a topdressing of 50 kg LAN/ha must still be applied for the cover crop, but the 50 kg LAN/ha can be subtracted from the vineyard fertilisation programme, because the rotting plant material supplies the equivalent amount of nitrogen at that stage. This will decrease the total cost of this tillage technique with R19,00. The cost of this control method therefore varies in effect between R153,96 and R172,96.

1.1 Lae-kosteprogram vir die beheer van eenjarige onkruide in droëlandwingerde

1.1.1 Chemiese beheer op die bankies en meganiese beheer in die werksrye

2 liter simasien @ R7,78/liter (Aug of Sep)	R15,56
1 liter parakwat @ R10,63/liter (Aug)	R10,63
1 liter dikwat @ R12,54/liter (Aug)	R12,54
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ½ uur/ha	R10,75
Skottelegbewerkings in werksrye @ R16,40/uur, 1 uur/ha, twee keer	R32,80
Ghropbewerkings in werksrye @ R14,93/uur, 1 uur/ha, drie keer	R44,79
Totale uitgawe per hektaar per seisoen	R127,07

Indien die toediening van die kontak- en vooropkomsmiddel geskei word, moet 'n ekstra R10,75 toedieningskoste bygetel word. Die meer weerstandbiedende onkruide sal met 'n sistemiese na-opkomsmiddel beheer moet word (Kyk Tabel 2a), wat 'n addisionele uitgawe van R3,11 beteken. Indien 'n dekgewas in die werksry gesaai word, sal die koste 'n addisionele R90,69 beloop (kyk biologiese beheer). Die koste van die beheermetode wissel dus tussen R127,07 en R231,62.

1.1.2 Voloppervlakte- chemiese beheer

6 liter simasien @ R7,78/liter (Aug of Sep)	R46,68
2,5 liter parakwat @ R10,63/liter (Aug)	R26,58
2,5 liter dikwat @ R12,54/liter (Aug)	R31,35
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ¾ uur/ha	R16,13
Totale uitgawe per hektaar per seisoen	R120,74

Waar die toediening van die vooropkomsmiddel en kontakmiddel geskei word, verhoog die toedieningskoste met R16,13 en indien 'n sistemiese na-opkomsmiddel toegedien word, moet 'n addisionele koste van R7,77 aangegaan word. Die koste van die beheermetode wissel tussen R120,74 en R144,64.

1.1.3 Biologiese beheer

Rogsaad @ R0,58/kg, 70 kg/ha	R40,60
Vestigingskoste:	
Skottelegbewerking @ R16,40/uur, 1 uur/ha (saadbedvoorbereiding)	R16,40
KAN @ R0,38/kg, 50 kg/ha	R19,00
Ghropbewerking @ R14,93/uur, 1 uur/ha (toewerk van saad)	R14,93
Doodspuit met 5 liter sistemiese middel @ R13,18/liter	R65,90
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ¾ uur/ha	R16,13
Totale uitgawe per hektaar per seisoen	R172,96

Na vier jaar van deklaagbewerking moet nog steeds 'n kopbemesting van 50 kg KAN/ha vir die dekgewas toegedien word, maar die wingerdbemestingsprogram kan met 50 kg KAN/ha verminder word, aangesien die verwerende plantmateriaal in daardie stadium die ekwivalente hoeveelheid stikstof voorsien. Dit sal die totale koste van wingerdverbouing met R19,00 verminder. Die koste van die beheermetode wissel dus in effek tussen R153,96 en R172,96.

1.2 Low-cost programme for the control of annual weeds under irrigation conditions

1.2.1 Chemical control under the rows ('bankies') and mechanical control in the work rows

Alternative 1 (In the case of bush vines where the "bankies" can be sprayed only once)

2 litres simazine @ R7,78/litre (Aug or Sept)	R15,56
1 litre paraquat @ R10,63/litre (Aug)	R10,63
1 litre diquat @ R12,54/litre (Aug)	R12,54
Application cost @ R21,50/hour and an application time of ½ hour/ha	R10,75
Cultivator tillage in work rows @ R14,93/hour, 1 hour/ha, seven times	R104,51
Total expense per hectare per season	R153,99

If the application of the pre-emergence herbicide and contact herbicide is separated, the cost increases by R10,75. Where a systemic post-emergence agent is imperative, it will mean an additional cost of R3,11. If a cover crop is sown in the work row the additional cost will amount to R90,69. The cost of this method varies between R153,99 and R258,54.

Alternative 2 (For trellised vines where the "bankies" can again be sprayed later in the season)

1 litre simazine (Aug) + 1 litre (Nov) @ R7,78/litre	R15,56
2 litres paraquat (Aug) + 1 litre (Nov) @ R10,63/litre	R21,26
1 litre diquat (Aug) @ R12,54/litre	R12,54
Application cost @ R21,50/hour and an application time of ¾ hour/ha, twice	R32,25
Cultivator tillage in work rows @ R14,93/hour, 1 hour/ha, seven times	R104,51
Total expense per hectare per season	R186,12

If it is imperative that a systemic herbicide be used, the cost will increase by R3,11/ha. If a winter cover crop is sown, the cost will increase by R90,69. This control measure's expenses vary between R186,12 and R279,92.

1.2.2 Full-surface chemical control

Alternative 1 (In the case of bush vines)

6 litres simazine @ R7,78/litre (Aug or Sept)	R46,68
2,5 litres paraquat @ R10,63/litre (Aug)	R26,58
2,5 litres diquat @ R12,54/litre (Aug)	R31,35
Application cost @ R21,50/hour and an application time of ¾ hour/ha	R16,13
Total expense per hectare per season	R120,74

An application of the pre-emergence herbicide in September as well as the use of a systemic agent for post-emergence control, will increase the cost by R16,13 and R7,77 respectively. The cost of this control method varies between R120,74 and R144,64.

Alternative 2 (For trellised vines)

3 litres simazine (Aug) + 3 litres (Nov) @ R7,78/litre	R46,68
2 litres paraquat (Aug) + 1 litre (Nov) @ R10,63/litre	R31,89
2 litres diquat (Aug) @ R12,54/litre	R25,08
Application cost @ R21,50/hour and an application time of ¾ hour/ha, twice	R32,25
Total expense per hectare per season	R135,90

1.2 Lae-kosteprogram vir die beheer van eenjarige onkruide onder besproeiingstoestande

1.2.1 Chemiese beheer op die bankies en meganiese beheer in die werksrye

Alternatief 1 (In die geval van bosstokwingerd waar die bankies net een keer gespuit kan word)

2 liter simasien @ R7,78/liter (Aug of Sep)	R15,56
1 liter parakwat @ R10,63/liter (Aug)	R10,63
1 liter dikwat @ R12,54/liter (Aug)	R12,54
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ½ uur/ha	R10,75
Ghropbewerkings in werksrye @ R14,93/uur, 1 uur/ha, sewe keer	R104,51
Totale uitgawe per hektaar per seisoen	R153,99

Indien die toediening van die vooropkomsmiddel en kontakmiddel geskei word, verhoog die koste met R10,75. Waar 'n sistemiese na-opkomsmiddel noodsaaklik is, sal 'n addisionele uitgawe van R3,11 gemaak moet word. Indien 'n dekgewas in die werksry gesaai word, sal die koste 'n addisionele R90,69 beloop. Die koste van die metode wissel tussen R153,99 en R258,54.

Alternatief 2 (Vir opgeleide wingerd waar die bankies later in die seisoen weer gespuit kan word)

1 liter simasien (Aug) + 1 liter (Nov) @ R7,78/liter	R15,56
2 liter parakwat (Aug) + 1 liter (Nov) @ R10,63/liter	R21,26
1 liter dikwat (Aug) @ R12,54/liter	R12,54
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ¾ uur/ha, twee keer	R32,25
Ghropbewerkings in werksrye @ R14,93/uur, 1 uur/ha, sewe keer	R104,51
Totale uitgawe per hektaar per seisoen	R186,12

Indien dit noodsaaklik is om 'n sistemiese middel te gebruik, sal die uitgawes met R3,11/ha verhoog. Indien 'n winterdekgewas gesaai is, styg die koste met R90,69. Die beheermetode se uitgawes beloop tussen R186,12 en R279,92.

1.2.2 Voloppervlakte- chemiese beheer

Alternatief 1 (In die geval van bosstokwingerd)

6 liter simasien @ R7,78/liter (Aug of Sep)	R46,68
2,5 liter parakwat @ R10,63/liter (Aug)	R26,58
2,5 liter dikwat @ R12,54/liter (Aug)	R31,35
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ¾ uur/ha	R16,13
Totale uitgawe per hektaar per seisoen	R120,74

'n Toediening van die vooropkomsmiddel in September asook die gebruik van 'n sistemiese middel vir na-opkomsbeheer, sal die koste met R16,13 en R7,77 onderskeidelik laat styg. Hierdie beheermetode se koste wissel tussen R120,74 en R144,64.

Alternatief 2 (Vir opgeleide wingerd)

3 liter simasien (Aug) + 3 liter (Nov) @ R7,78/liter	R46,68
2 liter parakwat (Aug) + 1 liter (Nov) @ R10,63/liter	R31,89
2 liter dikwat (Aug) @ R12,54/liter	R25,08
Toedieningskoste @ R21,50/uur en 'n toedieningstyd van ¾ uur/ha, twee keer	R32,25
Totale uitgawe per hektaar per seisoen	R135,90

The use of a systemic herbicide in August to control resistant weeds will increase the cost by R7,77. The cost of this method will therefore vary between R135,90 and R143,67.

1.2.3 Biological control

Biological control under irrigation conditions will cost the same as in the case of dryland vineyards, in other words the cost will vary between R153,96 and R173,22 per hectare per season.

From the above cost calculations it is clear that under dryland conditions there is sometimes very little difference in cost between chemical control under the rows plus mechanical control in the work rows (127,07 to R232,12), full-surface chemical control (R120,74 to R144,64) and biological control (R154,46 to R173,22).

Despite the slightly higher cost of biological control as against the cheaper alternatives with the other methods of control, it still remains the preferred method to use because of its long-term advantages for the grower. Van Huyssteen & Weber (1980b), for example, found that a dryland vineyard under mulch cover cultivation for seven years yielded 3,14 tons/ha more grapes on average than under mechanical cultivation. This means an additional income of R937,60 per hectare per annum in the case of wine grapes. Apart from the financial advantage, a mulch cover also improves the structure and moisture retention ability of the soil.

Under irrigation circumstances the costs of the various methods involved are again approximately the same. Biological control will also be recommended under these circumstances, because recent research in Oudtshoorn and Upington showed that a mulch cover as against mechanical cultivation resulted in an increase in yield of respectively 7 ton/ha and 4 ton/ha in the two areas (J.L. van Zyl, 1987 – personal communication).

In addition to this great advantage, a thick layer of plant material also prevents the puddling of silty soils or other heavy soils after an irrigation. This ensures that the soil will still take up enough water with sequential irrigations. The system is also suitable for controlling troublesome weeds like thorns and burweed. It is particularly useful on sandy soils, because it restricts extremes in day temperatures as well as wind-blown sand.

2 CHARACTERISTICS OF THE HERBICIDES AVAILABLE IN THE VINE-INDUSTRY

2.1 Pre-emergence herbicides

Over the past number of years herbicides like dichlobenil and diuron became obsolete as a result of the damage caused to vineyards by these two herbicides. Nitralin, on the other hand, is a safe pre-emergence herbicide which can even be applied in vine-nurseries, but as a result of the unavailability of the agent it has also become obsolete. Meanwhile two new pre-emergence herbicides were registered for use in vineyards, namely fluorochloridone (Racer) and oryzalin (Surflan). A characteristic of the new herbicides is that both are soil residually safer than simazine. For an exposition of the recommended dosage rates and weed species controlled by available pre-emergence herbicides, see Table 1.

Trifluralin

This herbicide must be worked into the soil mechanically to give effective weed control, because the herbicide is broken down by sunlight. As a result of this restriction the herbicide is therefore mainly applied prior to or during establishment of a vineyard to thus give effective control of susceptible weeds over a period of two seasons. An advantage of this herbicide is that shallow cultivation can be done on treated soils during the season for the control of resistant weeds.

Die gebruik van 'n sistemiese middel in Augustus om weerstandbiedende onkruide te beheer, sal die koste met R7,77 laat toeneem. Die betrokke metode se koste sal dus wissel tussen R135,90 en R143,67.

1.2.3 Biologiese beheer

Biologiese beheer onder besproeiingstoestande sal dieselfde kos as in die geval van droëlandwingerde, die koste sal dus wissel tussen R153,96 en R173,22 per hektaar per seisoen.

Uit die voorafgaande kostebepalings is dit duidelik dat daar onder droëlandtoestande soms min kosteverskil is tussen chemiese beheer op die bankies en meganiese beheer in die werksrye (R127,07 tot R232,12), voloppervlakte- chemiese beheer (R120,74 tot R144,64) en biologiese beheer (R154,46 tot R173,22).

Ten spyte van die effens hoër koste verbonde aan biologiese beheer teenoor die goedkoper alternatiewe by die ander beheermetodes, bly dit steeds die aangewese metode om te gebruik aangesien dit oor die lang termyn voordele inhou. Van Huyssteen & Weber (1980b) het byvoorbeeld gevind dat 'n droëlandwingerd oor 'n tydperk van sewe jaar onder deklaagbewerking, gemiddeld 3,14 ton/ha meer druiwe gelewer het as onder meganiese bewerking. Dit beteken 'n addisionele inkomste van R937,60 per hektaar per jaar in die geval van wyndruiwe. Bo en behalwe die finansiële voordeel, verbeter deklaagbewerking die struktuur asook vogbewaringsvermoë van 'n grond.

Onder besproeiingstoestande is die koste verbonde aan die onderskeie beheermetodes weer eens min of meer dieselfde. Biologiese beheer sal ook onder die toestande aanbeveel word, aangesien onlangse navorsing in wingerde te Oudtshoorn en Upington getoon het dat deklaagbewerking teenoor meganiese bewerking 'n toename in oesmassas van onderskeidelik 7 ton/ha en 4 ton/ha in die twee gebiede tot gevolg gehad het (J.L. van Zyl, 1987 persoonlike mededeling).

Buiten dié groot voordeel, voorkom 'n digte laag plantmateriaal dat slikgronde of ander swaar gronde na 'n besproeiing toeslaan. Dit verseker dat die grond met opvolgende besproeiings steeds goed sal water vat. Die stelsel is ook geskik om lastige onkruide soos dubbeltjies en klitsgras te beheer. Dit is veral bruikbaar op sanderige gronde, aangesien dit uiterstes in dagtemperature asook waaisand beperk.

2 EIENSKAPPE VAN DIE ONKRUIDDODERS BESKIKBAAR IN DIE WINGERDBEDRYF

2.1 Vooropkomsonkruiddoders

Gedurende die afgelope paar jaar het middels soos dichlobenil en diuron in onbruik geraak as gevolg van skade wat deur dié twee middels in wingerde veroorsaak is. Nitralin is daarenteen 'n veilige vooropkomsmiddel wat selfs in wingerdkwekerye aangewend kan word, maar weens die onverkrygbaarheid daarvan het dit in onbruik geraak. Twee nuwe middels is intussen vir gebruik in wingerd geregistreer, nl fluoorchloridoon (Racer) en orisalin (Surflan). 'n Kenmerk van die nuwe onkruiddoders is dat albei grondresidueel veiliger as simasien is. Vir 'n uiteensetting van die aanbevole dosisse en onkruidspesies wat deur beskikbare vooropkomsmiddels beheer word, kyk Tabel 1.

Trifluralin

Dié onkruiddoder moet meganies in die grond ingewerk word om effektiewe onkruidbeheer te gee, aangesien die middel deur sonlig afgebreek word. As gevolg van hierdie beperking word dit hoofsaaklik voor of tydens die vestiging van 'n wingerd toegedien om oor 'n periode van twee seisoene effektiewe beheer van die gevoelige onkruide te gee. 'n Voordeel van die middel is dat vlakbewerking deur die seisoen op behandelde gronde gedoen kan word vir die beheer van weerstandbiedende onkruide.

Table 1 Pre-emergence herbicides available
Tabel 1 *Vooropkomsonkruiddoders beskikbaar*

Technical name *Tegniese naam*	Trade name *Handelsnaam*	Formulation *Formulasie*	Recommended dosage rate *Aanbevole dosis*		Weeds controlled by the agent *Onkruide wat deur die middel beheer word*
			Lighter soil *Ligter grond*	Heavier soil *Swaarder grond*	
trifluralin	Treflan Trif 480	48% EC	8 litre/ha	8 litre/ha	Controls all summer grass, as well as rescue grass, ostrich thorn, **Amaranthus** species, goosefoot and prostrate knotweed.
trifluralin	*Treflan* *Trif 480*	*48% EK*	*8 liter/ha*	*8 liter/ha*	*Beheer alle somergras, asook reddingsgras, volstruisdubbeltjie, **Amaranthus** spesies, hondebossie en voëlduisendknoop.*
simazine	Simazine SC Simaflo Gesatop	50% SC	3 litre/ha	6 litre/ha	Controls all annual weeds except crab finger grass and bur-weed. The herbicide does not control the perennial weeds.
simasien	*Simazine SK* *Simaflo* *Gesatop*	*50% SK*	*3 liter/ha*	*6 liter/ha*	*Beheer alle eenjarige onkruide behalwe kruisgras en klitsgras. Die middel beheer nie die meerjarige onkruide nie.*
oxadiazon	Ronstar	24% EC	5–6 litre/ha	5–6 litre/ha	Wild radish, spiny emex, musk heron bill, crab finger grass, goose grass, **Amaranthus** species, goosefoot, prostrate knotweed and dock.
oksadiasoon	*Ronstar*	*24% EK*	*5–6 liter/ha*	*5–6 liter/ha*	*Ramenas, Emex dubbeltjie, turknael, kruisgras, osgras, **Amaranthus** spesies, hondebossie, voëlduisendknoop en tongblaar.*
oryzalin	Surflan	75% WP	2,5 kg/ha	3,0 kg/ha	Crab finger grass, goose grass, goosefoot, prostrate knotweed and **Amaranthus** species.
Orisalin	*Surflan*	*75% BP*	*2,5 kg/ha*	*3,0 kg/ha*	*Kruisgras, osgras, hondebossie, voëlduisendknoop en **Amaranthus** spesies.*
fluorochloridone	Racer	25% EC	4–5 litre/ha	4–5 litre/ha	Controls annual broadleaf weeds except musk heron bill, bur-clover, **Bidens** species, tall khaki weed and purple echium. The herbicide also controls dock and darnel grass.
fluoorchloridoon	*Racer*	*25% EK*	*4–5 liter/ha*	*4–5 liter/ha*	*Beheer eenjarige breëblaaronkruide behalwe turknael, klitsklawer, **Bidens** spesies, langkakiebos en pers Echium. Die middel beheer verder ook tongblaar en drabokgras.*

Abbreviations: EC – emulsifiable concentrate; SC – suspension concentrate; WP – wettable powder
Afkortings: *EK – emulgeerbare konsentraat*; *SK – suspensie konsentraat*; *BP – benatbare poeier*

Simazine
This agent should only be used on vines older than three years due to the danger of uptake by the shallow roots of the young vineyard. To ensure effectivity the herbicide must be washed into the soil by rain or irrigation within 14 days of application. The herbicide can cause damage to the vines through leaching into sandy soils and soils with a high pH.

Oxadiazon
This agent can be used in young vineyards. Oxadiazon must be applied on a bare soil just prior to the commencement of the summer irrigation. To ensure effectivity the soil must be kept moist and not be disturbed. As a result of these restrictions the herbicide can only be recommended under irrigation conditions and it tends to be more effective on heavier soils.

Oryzalin
Oryzalin must be washed into the soil with a light irrigation within 10 days of application. Light cultivation can be applied thereafter without impairing the effectivity of the herbicide. This herbicide is safer on light soils than simazine.

Fluorochloridone
This herbicide can be used on lighter soils as well as vineyards younger than three years. Directly after application the herbicide must be washed in with approximately 15 mm of rain or an irrigation to ensure optimum effectivity, after which the surface may not be disturbed. The herbicide must be applied prior to bud break in a vineyard and the spray must not be applied over young vines. It is important that all spraying apparatus be thoroughly washed with a suitable cleanser immediately

Simasien
Dié middel moet slegs op wingerde ouer as drie jaar gebruik word weens die gevaar van opname deur die vlak geleë wortels van jong wingerd. Om effektiwiteit te verseker, moet die onkruiddoder binne 14 dae na toediening in die grond ingewas word deur reën of besproeiing. Die onkruiddoder kan logingskade gee op sanderige gronde en gronde met 'n hoë pH.

Oksadiasoon
Hierdie middel kan in jong wingerd gebruik word. Oksadiasoon moet net voor die aanvang van die somerbesproeiing op 'n kaal grond toegedien word. Om effektiwiteit te verseker, moet die grond nat gehou en geensins versteur word nie. As gevolg van laasgenoemde beperkings kan die middel slegs onder besproeiingstoestande aanbeveël word en neig dit om meer effektief op swaarder gronde te wees.

Orisalin
Orisalin moet binne 10 dae na toediening met 'n ligte besproeiing in die grond ingewas word. Ligte bewerkings kan daarna gedoen word sonder om die middel se effektiwiteit te benadeel. Die onkruiddoder is veiliger as simasien op ligte gronde.

Fluoorchloridoon
Die middel kan op ligte gronde en ook op wingerd jonger as drie jaar gebruik word. Direk na toediening moet die onkruiddoder met ongeveer 15 mm reën of 'n besproeiing ingewas word om optimum effektiwiteit te verseker, waarna die oppervlakte nie versteur mag word nie. Die middel moet voor bot in 'n wingerd toegedien word en die bespuiting moet nie bo-oor jong stokkies plaasvind nie. Dit is belangrik dat alle spuittoebehore

after use.

The farmer must be selective in his use of pre-emergence herbicides and take note of the following factors before he makes his selection:

- The soil characteristics of the vineyard: If it is a sandy soil or soil with a high pH, a herbicide like simazine can damage the vineyard.
- Age of the youngest vines in the vineyard: There is, for example, a high risk of leaching damage if simazine is used in vineyards younger than three years, because most of the roots are still shallow.
- Weed spectrum: Select the herbicide that will be the most effective and cheapest in the particular situation.

2.2 Post-emergence herbicides

The herbicide proprop (Basfapon) became obsolete as a result of the availability of safer herbicides for vineyards. Amitrole (Weedazol) is still available and still sometimes used, but as a result of two new herbicides, namely amitrole/simazine (Spectrum SC) and amitrole/diuron (Di-weed SC), which control a wider spectrum of weeds, the former agent has become obsolete. For an exposition of the recommended dosage rates and weed species controlled by available post-emergence herbicides, see Table 2.

Amitrole/simazine and amitrole/diuron

Application of the two systemic herbicides must take place after leaf drop and not later than July. The herbicides should also not be sprayed over vineyards that have just been pruned. Where amitrole/simazine (Spectrum SC) and simazine are used as a post-emergence and pre-emergence control combination, it must be taken into account that the post-emergence herbicide already contains simazine as active ingredient, otherwise an over-dosage of simazine will be obtained for the season, with accompanying leaching damage.

Glyphosate

This systemic herbicide must not be sprayed on any green parts of the vine and care must be taken that it is only applied ten days after pruning. This product must therefore be applied prior to bud break. If the producer applies his pre-emergence and post-emergence herbicide as a tank mixture, he must take into account that only simazine can be mixed with glyphosate and then only in the case of the Sting formulation. Any other pre-emergence herbicide might impair the effectivity of glyphosate.

Paraquat and diquat

These two contact herbicides can control a wider spectrum of weeds if they are applied in a one-to-one tank mixture. Directed sprayings can also be applied in trained vineyards during the growing season to thus obtain improved control and even control for the whole season.

Fluazifop-butyl

This selective grass-killer can be used in the vineyard during the season without a phytotoxicity danger, particularly to control annual grasses. In the case of fine quickgrass and bluegrass the rhizomes (grass shoots) must be broken with an implement to obtain effective control. It is important to remember that a safety period of 40 days prior to harvest be observed for this herbicide.

MCPA

This agent should only be used in a vineyard prior to bud break.

onmiddellik na gebruik deeglik gewas moet word met 'n gepaste skoonmaakmiddel.

Die boer moet selektief wees by die gebruik van vooropkomsonkruiddoders en op die volgende faktore let voordat hy sy keuse maak:

- Die grondgeaardheid in die wingerd: Indien dit 'n sandgrond of grond met 'n hoë pH is, kan 'n middel soos simasien die wingerd beskadig.
- Ouderdom van die jongste stokke in die wingerd: Daar bestaan bv 'n hoë risiko vir logingskade met simasien by wingerde jonger as drie jaar, aangesien meeste van die wortels nog vlak in die grond geleë is.
- Onkruidspektrum: Kies die middel wat die mees effektiewe en goedkoopste in die betrokke situasie sal wees.

2.2 Na-opkomsonkruiddoders

Die middel proprop (Basfapon) het in onbruik geraak weens die beskikbaarheid van veiliger onkruiddoders vir wingerd. Amitrool (Weedazol) is nog steeds beskikbaar en word soms nog gebruik, maar weens twee nuwe middels, nl amitrool/simasien (Spektrum SK) en amitrool/diuron (Di-weed SK) wat 'n breër spektrum van onkruide beheer, het eersgenoemde middel in onbruik geraak. Vir 'n uiteensetting van die aanbevole dosisse en onkruidspesies wat deur beskikbare na-opkomsmiddels beheer word, kyk Tabel 2.

Amitrool/simasien en amitrool/diuron

Toediening van die twee sistemiese middels moet na blaarval plaasvind en nie later as Julie nie. Die middels moet ook nie oor pasgesnoeide wingerd gespuit word nie. Waar amitrool/simasien (Spektrum SK) en simasien as 'n na-opkoms- en vooropkomsbeheerkombinasie gebruik word, moet daarop gelet word dat die na-opkomsmiddel reeds simasien as aktiewe bestanddeel bevat, anders mag 'n oordosering van simasien vir die seisoen verkry word met gepaardgaande logingskade.

Glifosaat

Hierdie sistemiese onkruiddoder moet nie op enige groen dele van wingerd gespuit word nie en sorg moet gedra word dat dit eers tien dae na snoei in 'n wingerd toegedien word. Die middel moet dan ook voor bot in 'n wingerd toegedien word. Indien die produsent sy vooropkoms- en na-opkomsmiddel as 'n tenkmengsel toedien, moet hy daarop ag slaan dat slegs simasien met glifosaat vermeng kan word en dan ook slegs in die geval van die Sting-formulasie. Enige ander vooropkomsmiddel mag die effektiwiteit van glifosaat benadeel.

Parakwat en dikwat

Dié twee kontakmiddels kan 'n breër spektrum onkruide beheer indien dit in 'n een-tot-een tenkmengsel toegedien word. Gerigte bespuiting kan ook in opgeleide wingerde gedurende die groeiseisoen gedoen word om sodoende beter en selfs seisoenlange beheer te verkry.

Fluasifopbutiel

Hierdie selektiewe grasdoder kan sonder 'n fitotoksisiteitsgevaar gedurende die seisoen in 'n wingerd gebruik word om veral eenjarige gras te beheer. In die geval van fynkweek en bloukweek moet die risome (kweeklote) met 'n implement gebreek word om effektiewe beheer te verkry. Dit is belangrik om te onthou dat 'n veiligheidsperiode van 40 dae voor oes vir hierdie middel gehandhaaf moet word.

MCPA

Dié middel moet slegs voor bot in 'n wingerd gebruik word.

Table 2 Post-emergence herbicides available
Tabel 2 *Na-opkomsonkruiddoders beskikbaar*

Technical name *Tegniese naam*	Trade name *Handelsnaam*	Formulation *Formulasie*	Recommended dosage rate *Aanbevole dosis*		Weeds controlled by the agent *Onkruide wat deur die middel beheer word*
			Light weed stand *Ligte onkruidstand*	Heavy weed stand *Digte onkruidstand*	
a. Systemic agents					
amitrole/simazine	Spectrum SC	41%/15% SC	3 litres	5 litres	Controls all annual broadleaf weeds except ostrich thorn, tall khaki weed and tall fleabone. The agent also controls darnel grass, **Bromus** species, dock, sheep sorrel and small mallow.
a. Sistemiese middels					
amitrool/simasien	*Spectrum SK*	*41%/15% SK*	*3 liter*	*5 liter*	*Beheer alle eenjarige breëblaaronkruide behalwe volstruisdubbeltjie, langkakiebos en armoedskruid. Verder beheer die middel drabokgras, **Bromus** spesies, tongblaar, steenboksuring en kiesieblaar.*
amitrole/diuron	Di-weed SC	42,5%/16% SC	4 litres	6 litres	Cape marigold, common blackjack, musk heron bill, small mallow, bur-clover and dock are controlled.
amitrool/diuron	*Di-weed SK*	*42,5%/16% SK*	*4 liter*	*6 liter*	*Soetgousblom, gewone knapsekêrel, turknael, kiesieblaar, klitsklawer en tongblaar word beheer*
glyphosate	Sting	18% SOLN	4 litres	6 litres	Controls all annual broadleaf weeds except bur-clover, **Bidens** species, evening primrose and tall fleabone. The agent also controls all annual winter grasses and goose grass. **Bromus** species, dock and small mallow are also controlled.
glifosaat	*Sting*	*18% OPL*	*4 liter*	*6 liter*	*Beheer alle eenjarige breëblaaronkruide behalwe klitsklawer, **Bidens** spesies, nagblom en armoedskruid. Die middel beheer ook alle eenjarige wintergrasse asook osgras. Verder word **Bromus** spesies, tongblaar en kiesieblaar beheer.*
glyphosate	Roundup	41% SOLN	6 litres	8 litres	Controls all weeds at suitable dosage rates.
glifosaat	*Roundup*	*41% OPL*	*6 liter*	*8 liter*	*Beheer alle onkruide teen geskikte dosisse.*
MCPA	MCPA-400 MCPA	40% SOLN	3 litres	5 litres	Controls wild radish, ostrich thorn, **Bidens** species, tall khaki weed, **Amaranthus** *species, goosefoot and prostrate knotweed.*
MCPA	*MCPA-400 MCPA*	*40% OPL*	*3 liter*	*5 liter*	*Beheer ramenas, volstruisdubbeltjie, **Bidens** spesies, Lang kakiebos, **Amaranthus** spesies, hondebossie en voëlduisendknoop.*
fluazifopbutyl	Fusilade Super	12,5% EC	2 litres	4 litres	Controls all annual grasses as well as common paspalum, fine quickgrass and bluegrass.
fluasifopbutiel	*Fusilade Super*	*12,5% EK*	*2 liter*	*4 liter*	*Beheer alle eenjarige grasse asook polpaspalum, fyn kweek en bloukweek.*
b. Contact agents					
diquat	Reglone	20% SOLN	2,5 litres	5 litres	Controls all annual broadleaf weeds.
b. Kontak-middels					
dikwat	*Reglone*	*20% OPL*	*2,5 liter*	*5 liter*	*Beheer alle eenjarige breëblaaronkruide.*
paraquat	Gramoxone	20% SOLN	2,5 litres	5 litres	Controls all annual grasses and annual broadleaf weeds except Cape marigold goosefoot and prostrate knotweed.
parakwat	*Gramoxone*	*20% OPl*	*2,5 liter*	*5 liter*	*Beheer alle eenjarige grasse en eenjarige breëblare behalwe soetgousblom, hondebossie en voëlduisendknoop.*

Abbreviations: EC – emulsifiable concentrate; SOLN – solution; SC – suspension concentrate
Afkortings: EK – emulgeerbare konsentraat; OPL – oplossing; SK – suspensie konsentraat

3 SUCCESSFUL APPLICATION OF CHEMICAL HERBICIDES

After having decided on a method of weed control and chemical herbicides with which good control of the weed spectrum can be obtained, the grower must ensure that the herbicide(s) be correctly applied. Know-how, accuracy and thoroughness are required to effectively apply a herbicide. The following must be done to prepare and calibrate a tractor sprayer:

3.1

Rinse the tank, boom, nozzles and the whole spraying system with clean water. It is important that brackish or dirty water be avoided as far as possible, because it impairs the effectiveness of the herbicide to a considerable degree. This action will prevent the herbicide being contaminated with other herbicides

3 SUKSESVOLLE TOEDIENING VAN CHEMIESE ONKRUIDDODERS

Nadat besluit is op 'n metode van onkruidbeheer en chemiese middels waarmee goeie beheer van die onkruidspektrum verkry kan word, moet die boer self seker maak dat die middel(s) korrek toegedien word. Om 'n onkruiddoder effektief toe te dien verg kundigheid, noukeurigheid en deeglikheid. Om 'n trekkerspuit vir toediening voor te berei en te kalibreer, moet soos volg te werk gegaan word:

3.1

Spoel die spuittenk, spuitbalk, spuitkoppe en die hele pompstelsel met skoon water uit. Dit is belangrik om sover moontlik brak- of vuil water te vermy, aangesien dit die effektiwiteit van 'n middel sterk benadeel. Dié aksie sal voorkom dat die

during spraying, which can decrease the effectiveness of the herbicide. If necessary, the tank can even be washed with a soap/ammonia solution.

3.2
Replace all defective parts, eg broken sieves as well as worn nozzles. Too much herbicide is applied with worn nozzles, which firstly results in a waste of expensive herbicide and secondly in over-dosage. When new nozzles are bought, they must be suitable for a specific spray volume. The herbicides diquat and paraquat give better control with high spray volumes (750-1 000 litre/ha), while the systemic herbicides give better control with lower spray volumes (200-500 litre/ha). If pre-emergence herbicides are applied separately, approximately 500 litre/ha spray volume is recommended.

3.3
Fill the tank with clean water and operate the sprayer at a convenient engine speed (1 200-1 600 rpm) with the tractor in a stationary position. Set the pressure between 150 and 200 kPa (1,5 and 2 Bar), with the stopcocks in the open position. Check the nozzles to ensure that each gives the desired spraying pattern and make sure that there are no leakages or clogging. If two or more nozzles are used, set the nozzles at a slight angle so that they don't spray directly into one another, but do overlap. Set the height of the boom to obtain the desired spraying width, eg 3 metres.

3.4
Measure a convenient distance, say 100 metres, preferably in a vineyard to be sprayed and select the gear ratio which will give a speed of approximately 3,5 km/hour at the selected engine speed – a convenient walking speed. Drive the tractor over this distance and determine the exact time. Note that the tractor should already move at the selected speed at the starting point of the measured distance. Repeat this action a few times, in the opposite direction as well, and calculate the average time needed to cover the distance, say 78 seconds. Measure the amount of water discharged by the nozzles in the set time by collecting the water of each nozzle and then determining the total volume, say eg 7,5 litres. Now the application volume of the tractor sprayer per hectare can be calculated as follows:

Surface sprayed during calibration = 3 metres (spray width) x 100 metres (distance covered) = 300 m^2.

therefore application volume = $\frac{10\ 000\ m^2 \times 7{,}5\ \text{litres}}{300\ m^2}$

(water discharged in 78 seconds)

= 250 litres per hectare

3.5
After the calibration of the tractor sprayer has been completed, the tank can be half-filled with clean water. The correct amount of herbicide must now be added, stirring the mixture thoroughly. It is very important to study the label on the container carefully. If the herbicide tank can take 750 litres of water, three times the recommended dosage rate of herbicide will be added in the above case, which will be sufficient for 3 ha (dosage rate X 750/250). If the pH of the water is too high, it can be rectified by adding an acid or suitable commercial buffer solution. The desired pH is between 4,5 and 5,5.

3.6
Effective application can be ensured by heeding environmental conditions, namely dew on the weeds, possible rain after spraying and wind speed during application. Contact herbicides can be applied if the plants are not heavily covered with

onkruiddoder tydens bespuiting met ander stowwe gekontamineer word, wat sodoende die middel se effektiwiteit kan verlaag. Indien nodig kan die tenk selfs met 'n seep/ammoniakoplossing gewas word.

3.2
Vervang alle onklaar dele, bv stukkende siffies asook verslete spuitkoppe. Verslete spuitkoppies dien te veel onkruiddoder toe wat eerstens 'n vermorsing van duur onkruiddoder tot gevolg het en tweedens oordosering tot gevolg kan hê. Wanneer nuwe spuitkoppies aangekoop word, moet dit vir 'n spesifieke spuitvolume geskik wees. Die kontakmiddels dikwat en parakwat gee beter beheer met hoë spuitvolumes (750 – 1 000 liter/ha), terwyl die sistemiese middels beter beheer gee met laer spuitvolumes (200 – 500 liter/ha). Indien vooropkomsmiddels afsonderlik toegedien word, word ongeveer 500 liter/ha spuitvolume aanbeveel.

3.3
Vul die tenk met skoon water en laat die pomp teen 'n gerieflike enjinspoed (1 200 – 1 600 opm) loop met die trekker in 'n stilstaande posisie. Stel die druk tussen 150 en 200 kPa (1,5 en 2 Bar) met die afsluitkrane in die oop posisie. Gaan die spuitkoppe na sodat elkeen die gewenste spuitpatroon gee en maak seker dat geen lekkasie of verstoppings voorkom nie. Waar twee of meer spuitkoppe gebruik word, stel dit effens skuins sodat die spuitkoppe nie in mekaar vasspuit nie, maar nogtans oorvleuel. Stel die hoogte van die balk om die verlangde spuitwydte te kry, bv 3 meter.

3.4
Meet 'n gerieflike afstand af, sê 100 meter, verkieslik in 'n wingerd waar gespuit gaan word en selekteer 'n ratverhouding wat by die gekose enjinspoed 'n snelheid van ongeveer 3,5 km/uur sal gee – 'n gerieflike stapsnelheid. Laat die trekker oor die afstand ry en bepaal die presiese tyd. Let daarop dat die trekker by die beginpunt van die afgemete afstand alreeds die gekose snelheid moet handhaaf. Herhaal die aksie 'n paar keer, ook in die teenoorgestelde rigting en bereken die gemiddelde tyd om die afstand af te lê, sê 78 sekondes. Meet die hoeveelheid water wat die spuitkoppe in die bepaalde tyd lewer deur elke spuitkop se water op te vang en dan die gesamentlike volume te bepaal, sê bv 7,5 liter. Nou kan die trekkerspuit se toedieningsvolume per hektaar soos volg bereken word:

Oppervlakte gespuit tydens kalibrasie = 3 meter (spuitwydte) x 100 meter (afstand afgelê) = 300 m^2.

d.w.s. toedieningsvolume = $\frac{10\ 000\ m^2 \times 7{,}5\ \text{liter}}{300\ m^2}$

(water gelewer in 78 sekondes)

= 250 liter per hektaar

3.5
Nadat die kalibrasie van die trekkerspuit voltooi is, kan die tenk halfvol skoon water getap word. Die korrekte hoeveelheid onkruiddoder moet nou bygevoeg word, terwyl die mengsel goed geroer word. Hier is dit belangrik om die etiket op die houer noukeurig te bestudeer. Indien die onkruiddodertenk 750 liter water kan hou, sal in bogenoemde geval 3 keer die aanbevole dosis onkruiddoder bygevoeg word wat dan genoeg vir 3 ha sal wees (dosis X 750/250). Indien die water se pH te hoog is, kan dit reggestel word deur die byvoeging van 'n suur of geskikte kommersiële bufferoplossing. Die gewenste pH is tussen 4,5 en 5,5.

3.6
Effektiewe toediening kan verseker word deur te let op die omgewingstoestande, nl dou op die onkruide, moontlike reën na

dew, because the dew can assist in improved wetting. On the other hand dew impairs the effectiveness of systemic herbicides as a result of its thinning effect. Contact herbicides will not wash away with rain after they have dried, but rain within approximately eight hours of application impairs the effectiveness of systemic agents to a considerable extent. On the other hand, rain assists in washing the pre-emergence herbicides in the surface soil layer. Care must be taken that the wind speed does not exceed 15 km/hour during spraying.

3.7
Physical contact with a herbicide as well as inhaling the herbicide vapours must be avoided at all times. It is therefore important that the necessary protective clothing be worn when working with the herbicides.

bespuiting en windsnelheid tydens bespuiting. Kontakmiddels kan toegedien word as die plante nie te swaar natgedou is nie, aangesien die dou kan meehelp tot beter benatting. Dou is andersyds nadelig vir die doeltreffendheid van sistemiese middels as gevolg van die verdunningseffek wat dit tot gevolg het. Kontakmiddels sal nie afreën nadat dit droog geword het nie, maar reën binne ongeveer agt uur na toediening sal die effektiwiteit van sistemiese middels erg benadeel. Daarenteen is reën 'n hulpmiddel om vooropkomsdoders in die boonste grondlaag in te was. Daar moet ook sorg gedra word dat die windsnelheid tydens bespuiting nie 15 km/uur oorskry nie.

3.7
Fisiese kontak met 'n onkruiddoder asook die inasem van onkruiddoderdampe moet te alle tye vermy word. Dit is dus belangrik om die nodige veiligheidstoerusting te dra wanneer met die middels gewerk word.

SLEGS SENTRAOES DRA JOU PREMIE-KORTING-BALANSE OOR VAN EEN SEISOEN NA 'N ANDER.

SENTRAOES
JY PLANT DIE OES.
ONS DRA DIE RISIKO.

Gesels met ons verteenwoordiger by jou plaaslike koöperasie.

DIE AGENTSKAP 3775/a/1

VERWYSINGS/REFERENCES

SAAYMAN, D. & VAN HUYSSTEEN, L., 1983. Preliminary studies on the effect of a permanent cover crop and root pruning on an irrigated Colombar vineyard. *S. Afr. J. Enol. Vitic.* 4, 7-12.

VAN HUYSSTEEN, L., 1977. 'n Vergelykende ondersoek na die effektiwiteit van verskillende konvensionele- en minimum grondbewerkingspraktyke in die wingerdbou ten opsigte van grondbewaring en ander fisiese eienskappe. M.Sc (Landbou)-tesis, Univ. Stellenbosch, Nov. 1977.

VAN HUYSSTEEN, L., 1981. Bewerking. In: J. Burger en J. Deist (Reds.) Wingerdbou in Suid-Afrika. N.I.W.W., Privaatsak X5026, 7600 Stellenbosch, pp 283-307.

VAN HUYSSTEEN, L., VAN ZYL, J.L. & KOEN, A.P., 1984. The effect of cover crop management on soil conditions and weed control in a Colombar vineyard in Oudtshoorn. *S. Afr. J. Enol. Vitic.* 5, 7-17.

VAN HUYSSTEEN, L. & WEBER, H.W., 1980a. The effect of conventional and minimum tillage practices on some soil properties in a dryland vineyard. *S. Afr. J. Enol. Vitic.* 1, 35-45.

VAN HUYSSTEEN, L. & WEBER, H.W., 1980b. The effect of selected minimum and conventional tillage practices in vineyard cultivation on vine performance. *S. Afr. J. Enol. Vitic.* 1, 77-83.

VARADAN, K.M. & RAO, A.S., 1983. Effect of mulch on soil temperature in humid tropical Latosols under coconut (*Cocos nucifera* Linn.) and banana (*Musa paradisiaca*). *Agric. Meteor.* 28, 375-386.

Deciduous Fruit Grower Subscription form

Rates are for one year, payable in advance

R15,94 for South African subscribers
R19,80 Surface mail abroad
R52,80 Airmail abroad

*Overseas subscribers can pay by means of a bank draft drawn on the Standard Bank of South Africa Limited, Cape Town. The draft must be submitted together with this order form.

To The Circulation Manager
Deciduous Fruit Grower
PO Box 1801
Bellville 7535

Included is my subscription fee for one year.

Name .....

.....

Address .....

.....

Date ..... Signed .....