



Macspred Australia, Industrial Newsletter – Nov/Dec 2005.

Short and Long-Term Total Weed Control.

What are Your Choices?

To begin with, let's look at some of the desirable characteristics of a good residual, non-selective industrial herbicide for use by various Council and Government departments.

1. Generally speaking, the product must stay where its put, i.e., no leaching or sideways movement.
2. It should control a broad spectrum of weeds with few if any escapes (low maintenance).
3. In most cases it should not pose a danger to desirable trees and shrubs.
4. Compatibility with Glyphosate products or other suitable knockdown herbicides is generally required.
5. Because it would be used in areas accessed by the public, it should be of low to nil mammalian toxicity.
6. When it may be desirable to use near waterways, it should be safe to aquatic organisms.
7. The product used should control weeds for a specified time and then break down rapidly so that the area could be used to establish parks or gardens.
8. UV stability is desirable so that applications can be made during dry sunny weather.

If you think that you can get hold of such a product from the range currently registered in Australia, then dream on.

Of course there are many herbicides registered for specifically selective pre-emergent weed control. These products are used in agriculture, horticulture and silviculture for weed control in crops (cereals, vegetables, flowers etc), orchards, turf and plantations. None of these products will control a broad range of susceptible weeds and are designed to last only long enough to get the crop established. Some of this type of herbicide may be used by councils in their horticulture sections around trees and shrubs or in gardens. These will be dealt with later.

Industrial weed control essentially needs to be robust and of low maintenance. Once an area is treated for total weed control, it is generally desirable not to have to return and retreat weed escapes. This result usually relies on the operator:

- a) selecting the right product for the job,
- b) choosing the correct rate for the species present and the soil type involved, and
- c) ensuring accurate and complete coverage of the area being treated.

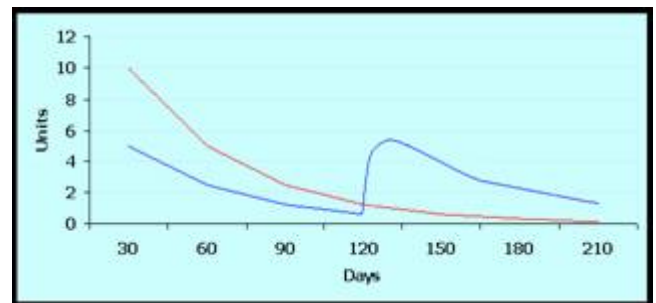
Some factors such as rainfall and soil disturbance after application are beyond the control of the operator and need to be taken into account when assessing results.

How long will my product give effective control?

All herbicides have a "Half Life" in soil and water. This time span has to be determined before a product can even get as far as pre-registration field trials. This is a safeguard for the protection

of the environment. The half life of a product has nothing to do with the length of effective weed control from any single application of herbicide. It simply means that half of the product applied disappears in that particular period. What the half life will tell you is that according to the rate applied, what length of control you could reasonably expect to obtain. The higher the rate applied, the longer the control; and usually the wider the spectrum of susceptible species. Knowing the half life can help you to determine the rate you need to use for any specific job. It can also assist with planning a maintenance program and even lead to financial savings. See figure 1.

Figure 1. Simple half life graph.



This graph shows that of 10 units of product applied (red line), half of the amount has degraded in 40 days, and half of the remaining in another 40 days, and so on until the graph flattens right out. The blue line shows that two applications strategically timed, will afford a longer term of control than one single application. For this reason, many industrial herbicides will have an initial application rate and a maintenance rate on their label. New technology such as controlled release activity in granular herbicides gives the same advantage and cuts out the cost of one application.

Use this example to find out the length of control of herbicides X and Y. The half life of the product is 18 days for X and 28 days for Y, the minimum activity level is 10 grams for both and the rate applied is 600 grams.

Table 1. Comparison of half lives

Product X		Product Y	
Half life 18 days		Half life 28 days	
No. of Days	Product remaining	No. of Days	Product remaining
At Application	600	At Application	600
18	300	28	300
36	150	56	150
54	75	84	75
72	37.5	112	37.5
90	18.75	140	18.75
108	9.375	168	9.375

The period of effective weed control is generally rate related.

This shows that for herbicide X, an expected control length could be around 4 months and for herbicide Y, around 6 months. In each case this will depend on a number of environmental factors such as pH, rainfall, organic matter, temperature and soil type. While desirable characteristic number 7 (above) is an ideal, we can see that if we want a product to break down quickly after it has provided the desired length of control, you have to select not only the correct herbicide to do the job, but also the right rate and preferably one with a short half life. While this may be desirable in many situations, there may well be a case where long term residual activity is required. This is the case in some industrial and even forestry situations where Velpar® is used. Velpar has a half life in sandy loam soils of from 4-5 months.

Off Target (Site) Movement

This problem is always a worry with soil applied herbicides. Unless the herbicide is physically mixed into the surface layer of the soil, there is always the potential for off site movement, especially if the soil is dry at time of application or a heavy rainfall event occurs soon after application.

Desirable characteristic (1) required that the product must stay where its put, i.e., no leaching or sideways movement. However by necessity, most soil applied herbicides have to be water soluble so that they can move into the soil with moisture and disperse in the soil to the control zone for the target plants. The control zone will vary with the type of herbicide. Some products are absorbed through the roots of the plant as it feeds on the nutrients in the soil water while others are absorbed through the growing point or coleoptile of emerging seedlings. Already we can see another reason to determine the target species and application timing before selecting a product to use. Where there are existing deep rooted plants, a product that will move deeper into the soil profile is desirable, if the target is germinating seedlings or small shallow rooted plants, a less soluble product or one which clings to clay particles will be the product of choice. The best of both worlds is a combination of the two, for example Macspred's Kromac or Dymac G herbicides. These products contain bromacil (Dymac also contains hexazinone) which moves into the soil to control deep rooted plants, as well as diuron, which clings to clay colloids and stays closer to the surface to control germinating seedlings and shallow rooted species.

Because of the solubility of the products used, there will always be potential for the movement of herbicide from the site of application. This potential is overcome by best management practice in application timing and product selection for site specific purposes. The first priority in a residual application is to get the product to move into the surface of the soil as soon as possible.

To achieve this there are a few simple rules to follow;

1. Always apply the product to moist soil if possible. The active is taken into the soil moisture and distributed relatively evenly through the top 5-10 cm of soil. Once in the surface layers, most products will not move sideways unless the soil is eroded or mechanically moved.
2. Avoid application during seasons where heavy rain or storm activity is anticipated. If a high and sudden rainfall event occurs immediately after application, surface flow of rainwater will take the freshly applied product with it and deposit it in off target positions causing severe damage to desirable species.
3. Do not apply herbicides to waterlogged soil or shallow porous soils such as sandy granite soils with impervious layers beneath.
4. Do not apply herbicides within the root zone of desirable species; this is usually 2 times the height of the tree, depending on species and other conditions.

Generally application in late autumn or early winter will give good control of winter germinating annuals, or in late winter early spring for summer growing species. Both of these timings should avoid the summer storm syndrome, however careful consideration of prevailing conditions and your local rainfall pattern is advisable.

Plate 1. Herbicide Damage through Movement by Heavy Rain



Spectrum of Activity and Tree Safety

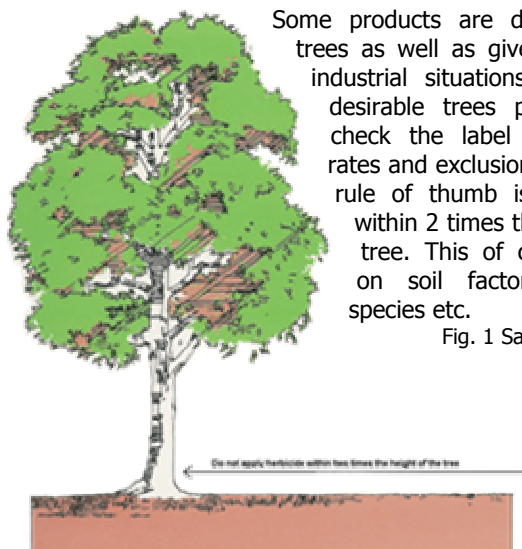
Generally speaking, herbicides for total weed control will do just that. However there are some actives which by rate can become selective herbicides and be used to control weeds within crops or ornamental plantings. Such an active is Sulfometuron Methyl which is the active ingredient in Oust® (a total weed control product) and one of the actives in EucMix PrePlant® (a product used prior to planting in Eucalypt plantations). Other products are simply rate selective; most labels will give you this information in the rate of use table.

Label Panel Example- Total Weed Control

Crop / Situation	Weeds Controlled	Rate kg/ha	Critical Comments
Commercial and industrial areas; around agricultural buildings, rights-of-way including road sides, around guide posts, railways, power lines and telephone lines	Easy-to-kill Annual Weeds Grasses -	7.5 or 15	For roadside applications confine treatment between the edge of the bitumen and the roadside shoulder. For weeds advanced beyond the 4-leaf stage, or when knockdown of existing growth is required, apply in conjunction with a Glyphosate based herbicide, used in accordance with its label directions.
	Broadleaves - Easy-to-kill Perennials Broadleaves		Use the higher rate for dense weed infestations and where weeds are greater than 15cm in height or diameter. Use the higher rate for long term residual control. *Always use the lower rate on sandy, granite or highly erosive soils.
	Hard-to-kill Annual Weeds Grasses - Broadleaves		
	Hard-to-kill Perennial Weeds Grasses -	15 or 30	Use the higher rate for dense weed infestations and where weeds are greater than 15cm in height or diameter. *Always use the lower rate on sandy, granite or highly erosive soils.

Some products are designed to kill trees as well as give bare earth in industrial situations. If there are desirable trees present, always check the label for application rates and exclusion zones. A good rule of thumb is not to apply within 2 times the height of the tree. This of course depends on soil factors, slope and species etc.

Fig. 1 Safety Zone.



Compatibility with Knockdown Herbicides

To obtain the maximum benefit from your residual herbicide, it may be necessary to pre-treat the site with a knockdown herbicide or add such herbicides to the tank mix. The reason for this can be threefold;

1. Some products may "tie up" on organic matter and become unavailable to enter the soil.
2. Heavy weed infestations may prevent the operator from obtaining an even coverage of the site.
3. If you rely on the residual product to kill existing weeds, some or much of the residual activity will be lost through plant uptake.

If the weed cover is dense or large deep rooted weeds exist, it is advisable to add a knockdown to the tank mix.

Always check the label for compatibility because some products may be antagonistic and need compatibility agents such as ammonium sulphate to be added, others may contain clay as part of the carrier and neutralise knockdowns such as glyphosate or the bipyridilium herbicides.

Safety to Humans and the Environment

Most herbicides are of relatively low toxicity to mammals, however there are some exceptions. Whilst the poison schedule is a guide, label precautions should always be followed and the Material Safety Data Sheet consulted.

Generally, herbicides are designed to act on enzymes and other systems such as photosynthesis which are only found in plants and are therefore relatively safe to humans and other mammals. Herbicides which are applied to soil as a residual are also usually safe to soil fauna such as earthworms; again you should always follow the precautions listed above.

Table 2. Comparison of Some Products, Active Ingredients and LD50's

Trade Name	Poison Schedule	Components	LD50
KROMAC	0	Bromacil (400g/kg) + diuron (400g/kg)	5200 3400
HYVAR X	0	Bromacil I(800g/kg)	*2000
CASORON G	0	Dichlobenil (67.5g/kg)	4250
DIURON LIQUID	5	Diuron (500g/L)	>3000
KARMEX DF	0	Diuron (900g/kg)	2500
DYMAC G	5	Hexazinone (100g/kg) + bromacil (50g/kg) + diuron (50g/kg)	1690 5200 3400
VELPAR DF	6	hexazinone(750g/kg)	1310
VELPAR L	5	hexazinone(250g/L)	1200
ARSENAL XPRESS	5	imazapyr as ipa (150g/L) + glyphosate as ipa (150g/L)	>5000 4050
RONSTAR G	6	Oxadiazon (20g/kg)	>5000
SIMAZINE 500SC	0	Simazine (500g/L)	>5000
GESATOP 600 SC (FLOWABLE)	0	Simazine (600g/L)	7080
GESATOP 900 WDG	0	Simazine (900g/kg)	>10000
ENVIROMAC G	5	Sulfometuron-methyl (20g/kg)	>5000
OUST	5	Sulfometuron-methyl (750g/kg)	>5000
TRIMAC	5	Terbacil (880g/kg) + Sulfometuron-methyl (40g/kg)	1255 >5000

* For technical grade bromacil, formulated product similar to Kromac.

Photodegradation and Application Timing

Some products which contain triazines or diuron are susceptible to degradation by ultra violet light. This means that should the product remain on the surface of the soil for any great length of time before incorporation by rainfall or absorption into soil moisture, there will be some loss of efficacy. For example, even when applied to moist soil, diuron needs sufficient rainfall soon after application to move the product into the root zones of the target species. This is one of the critical comments contained in the product label. Also for the triazines such as simazine, some label statements insist on sufficient rainfall or irrigation to the equivalent of 10mm rain within 10 days of application or mechanical incorporation into the soil within 7 days. Oust on the other hand does not have these requirements as it is relatively

UV stable. From the labels it can be determined what the best timing is for the application of each product. Even though rainfall is required by all products to move them into the soil, the timing is not as critical for some as compared to those mentioned above. In all cases, soil active/residual herbicides will produce better results when applied to a moist, but not saturated, soil surface. Read the label, especially the critical comments and restrictions for use, before using any product.

Advantages of Residual Weed Control

In my opinion, not enough use is made of the available range of residual herbicides. There are many situations where repeated applications of knockdown herbicides are used, or areas such as roadsides which are slashed on a regular basis. The cost of labour and fuel in this age is becoming quite restrictive and may well lead to cutbacks in areas where they can be least afforded. The growth of tall species on roadsides for example can reduce visibility and create dangerous situations. Plate 2 shows how grass can almost hide the presence of guide rails from oncoming motorists, also weeds growing in close proximity to roadside furniture can lead to undue damage from slashers and wasted time in manoeuvring during slashing operations.

Plate 2. Comparison of Treated and Untreated Guard Rails.



Often times the most difficult areas to slash are those on corners. There are essentially more guide posts and less visibility for oncoming traffic which poses danger to both motorist and slasher operator, even with sufficient signage. It's even worse when employees are sent out with whipper-snippers to these areas. See Plate 3 at right

Plate 3.



The following is an extract from a paper presented by G. Keech, Macspred Pty Ltd. at the 10th Biennial Noxious Weeds Conference at Ballina in 1999.

"Manipulating roadside vegetation by slashing, or with Roundup® by chemical mowing (Monsanto, 1994), is an operation needing repeated applications, especially during warm moist weather. The total cost of these operations for the season needs to be looked at i.e., labour, plant and chemical for several applications vs. a single pass utilising a soil active herbicide (Roundup® may or may not be needed). An example of cost comparisons is shown in Table 3".

(Since this paper was presented, chemical costs have fallen with Roundup Biactive now costing around \$6.00 per litre and Oust about \$280.00 per Kilogram [exclusive of GST]. It may be useful

to do a cost comparison with your current labour and plant costs.)

Table 3. Cost Comparisons between Slashing and Residual Herbicides.

Slashing Costs		Spraying Costs	
Slasher / hr	\$22.00	Spray Contractor	\$7.00 / km
Operator / hr	\$24.00	Roundup cost	\$7.50 / L X 30L / 50 km (approx. 3L/Ha) = \$4.50 / km
Contract Slashing / hr (*alternative to Council)	\$59.00	Oust cost	\$440.00 / kg X 3 kg / 50 km (approx. 300 gm/Ha.) = \$26.40 / km
Km treated / 8 hr day	6 average	Km treated / 8 hr day	80
Number of treatments	3	Number of treatments	1
Cost to treat 80 km (one treatment)	\$4906.50 to \$6280.00	Cost to treat 80 km	\$3032.00
Cost per kilometre per year (3 treatments)	\$184.00 to \$235.50	Cost per kilometre per year (1 treatment)	\$37.90

Based on average cost for Kempsey Shire Council, 1998.

Plate 4.

While spot application over roadside furniture can be a cost saving for slashing operations as less time is taken negotiating guide posts and signs and less damage is caused to assets because of the weed free areas provided around them; the same can apply to amenity maintenance in urban areas where weed free conditions can significantly reduce the time taken during programmed maintenance. This oval fence in plate 4 shows a difficult situation avoided by preventing the kikuyu from growing through the fence. Many cemetery operators are also finding that by maintaining weed free conditions immediately around headstones and graves, their maintenance costs have been reduced and the neat tidy ambience of the cemetery is much nicer for those visiting the area.



Other Areas to Consider for Total Weed Control

Every town, city or even rural property has sites that require weed free conditions for protection of assets, safety, fire and vermin management, ease of access and scenic value.

Some examples of sites requiring long term weed control are: Sheds, machinery yards, electric fences, outdoor storage areas such as pole yards, steel storage etc, fuel depots, car parks, under asphalt, firebreaks, airports, industrial sites, sewerage lines, railway lines, fire hydrants, manhole covers, pipelines, electrical installations, guide posts and guard rails and any area which requires weed free access for the protection of private property or public assets.

Weeds can be a particular problem in any outdoor open space and in particular under asphalt, pavers and in joins in concrete, especially where traffic is light. Weed propagules such as rhizomes and seeds can be found in almost any imported sub-grade and will readily grow, particularly under newly laid asphalt where warmth and moisture conditions are ideal. Experience has shown weed damage to newly laid asphalt in as little as a week (see right). Even in older surfaces, weed seeds become deposited in cracks and roots encroach from adjacent vegetation, and as they grow cause more damage by lifting the asphalt. This produces unsafe conditions for pedestrians and allows the entry of water which accelerates the deterioration of the surface. Herbicide treatment of all sub-grades is good insurance



and can save much unnecessary expenditure by extending the life of the surface in question. Tree roots are often the cause of early deterioration of outdoor surfaces including concrete. The invasion of roots under new surfaces can be reduced by treating the area with a herbicide before sealing. The roots of existing species should be pruned and a suitable buffer zone included in the treatment plan. As always care should be taken when applying any herbicide near existing and desirable trees and shrubs.

Which Product Should I Use?

The best advice here is to consult an industry specialist in weed management. The reason is that there are many things to consider and risk assessments to carry out as seen above. You will need to know the length of weed free conditions required on the site and available resources to put a program into place. As an example, one airport currently being treated with long term product is achieving from 1 to 2 years control, depending on rainfall. The average is about 15-18 months. This allows a budget to be done for treatment every 18 months with enough product in reserve to patch out any escapes or areas of soil disturbance occurring through general maintenance.

Having said this, the table below (4) may assist you in your decision making process.

Table 4. Some Products Registered for Residual Weed Control.

Trade Name	Components	Label claims	Control Length*
KROMAC	Bromacil (400g/kg) + Diuron (400g/kg)	Non agricultural areas such as: railways, pipelines, petroleum storage depots, timber yards, storage areas, industrial plant sites, fence lines, road sides, bridge abutments & powerlines.	M/L
HYVAR X	Bromacil (800g/kg)	Commercial & industrial areas, rights of way, around agricultural buildings	L
SIERRARON G	Dichlobenil (67.5g/kg)	Established shrubs and trees, nursery stock, commercial and industrial areas, aquatic areas.	M
DIURON 900 WDG	Diuron (900g/kg)	Rights of way, commercial and industrial areas, irrigation channels, drainage ditches.	S/M
DYMAC G	Hexazinone (100g/kg) + Bromacil (50g/kg) + Diuron (50g/kg)	Commercial and Industrial areas; rights of way, agricultural buildings	L
VELMAC G	Hexazinone (200 g/kg)	Commercial and Industrial areas; rights of way; around Agricultural buildings.	L
VELPAR DF	Hexazinone (750g/kg)	Commercial and industrial areas, rights of way, around agricultural buildings.	L
ARSENAL XPRESS	Imazapyr as ipa (150g/L) + Glyphosate as ipa (150g/L)	Commercial, industrial and public service areas, rights of way and waste land, away from non-target vegetation.	S
RONSTAR G	Oxadiazon (20g/kg)	Container grown woody ornamental shrubs, trees & vines, Field grown ornamental crops, recreational turf.	S
SIMAZINE 900	Simazine (900g/kg)	Non-Crop Uses, Commercial and Industrial areas; Rights of way; Public utility areas, Road shoulders, Drains, Headlands, Driveways, Railway tracks, Aerodromes, Gutters, Footpaths.	S
ENVIROMAC G	Sulfometuron-methyl (20g/kg)	Commercial & industrial areas, around agricultural buildings, rights of way including roadsides, around guide posts, railways, power lines and telephone lines.	M
OUST	Sulfometuron-methyl (750g/kg)	Commercial & industrial areas, around agricultural buildings, rights of way including roadsides, around guide posts, railways, power lines and telephone lines.	M
TRIMAC	Terbacil (880g/kg) + Sulfometuron-methyl (40g/kg)	Commercial and Industrial areas, around building lines, rights of way, roadsides, guideposts, powerlines and substations, aerodromes, public utilities	M
There may be other products available with the same active ingredients; this table is a guide only. The length of control achieved will relate to the rate applied, soil conditions and pH, rainfall and temperature and type and volume of weeds present.			*GUIDE ONLY

*S = Short, M = Medium, L = Long. This is a guide only to length of control, actual time may vary.

Selective Pre-emergent Herbicides

Amenity and roadside plantings of shrubs and trees have long posed a problem to those involved in this activity. The biggest problem arises from a lack of registered herbicides for use with the plethora of species planted. Generally an APVMA permit may be required before many products known to be safe through trial work could be used, especially in multiple species plantings. For example, EucMix Pre-Plant is registered for use in a range of Eucalypt species in plantation forestry but will cause damage to Acacias and other shallow rooted species. The following table

lists some of the more commonly used products for pre-emergent residual weed control in ornamental species and amenity plantings. This list does not include many of the products registered and trialled in plantation Eucalypt and pine forestry.

Table 5. Some Commonly Used Selective Pre-emergent Herbicides.

Components	Trade Name
chlorthal-dimethyl(900g/kg)	DACTHAL 900 WG
diuron(500g/L)	DIURON LIQUID
isoxaben(750g/kg)	GALLERY 750
oryzalin(500g/L)	SURFLAN 500
oxadiazon(20g/kg)	RONSTAR GRANULES
oxyfluorfen(240g/L)	GOAL
pendimethalin(330g/L)	STOMP 330EC
simazine(600g/L)	GESATOP 600 SC (FLOWABLE)

Of these products, the most comprehensive registration belongs to the oryzalin products, they include the Trade Names: Prolan, Oryzalin 500 (various manufacturers), Cameo 500 and Surflan 500. It should be noted that oryzalin products need to be applied to fine seed beds and incorporated by at least 12.5 mm of rainfall or irrigation within 21 days to be effective.

Oryzalin may also be mixed with simazine and/or oxyfluorfen to enhance the spectrum of weeds controlled and even reduce costs. However any tank mixing needs to be checked out thoroughly before use on a large scale, as some species may not be tolerant to some of the admixtures or combinations of actives. There is also the problem of registrations and APVMA permits may be necessary.

Rehabilitation or revegetation areas such as roadsides often pose a problem. Most denuded areas are highly disturbed and may have had topsoil imported to provide a growing medium for the revegetation species. As this soil is loose and generally not properly compacted, or left exposed on steep slopes, it is highly susceptible to erosion. To combat this problem, road building contractors plant a fast growing annual species to stabilise the soil. In combination with weed seeds, this provides the ultimate in competition for young seedling shrubs and trees trying to establish. Over the years I have witnessed the demise of many such plantings due to weed competition. There is a simple law in tree planting; you cannot successfully grow trees and weeds together if moisture or nutrients are lacking. I have seen this in herbicide trials in plantation forestry (see photographs below).

Trees planted in this untreated plot had a very low survival rate even though there was sufficient moisture and each tree was individually fertilised.



In contrast, these trees in the same trial showed vigorous growth because of the weed free conditions provided by pre-emergent herbicides.

In all cases, once the desired species or mix of species has been selected, the operator should consult the respective labels for plant safety and planting intervals before embarking on any spraying operation. If a suitable product or mix of products is not available, there is always the option of using knockdown herbicides such as glyphosate or glufosinate or selective post emergent herbicides to control weeds close to the transplants. The big danger with knockdowns is accidental over-sprays and droplet drift onto the desirable species. This may find a place for discussion in a subsequent newsletter. In the meantime remember.....

Residuals Make Mowing Easier!



In Town

Or

Out of Town



Footnote

Where the label states that the product needs to be incorporated into the soil by rainfall, it is impossible to apply a high enough volume of water through a handgun or boom spray to achieve a satisfactory result. The water application rate to achieve 10mm of rainfall is 100,000 litres per hectare.

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