SOUTH AFRICAN SUGARCANE
RESEARCH INSTITUTE

HERBICIDE GUIDE

JUNE 2014

South African Sugarcane Research Institute is a division of the South African Sugar Association SASA

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INTRODUCTION

Users of this booklet should appreciate that it is only a guide and information should be used in conjunction with the herbicide label instructions. Full herbicide programmes have been omitted and growers are encouraged to use the selected treatments as a basis to plan herbicide schedules. A simplified herbicide chart has been included to show which products control each weed group.

After selecting a treatment, refer to the
Chemical Information
section for more details on each product.

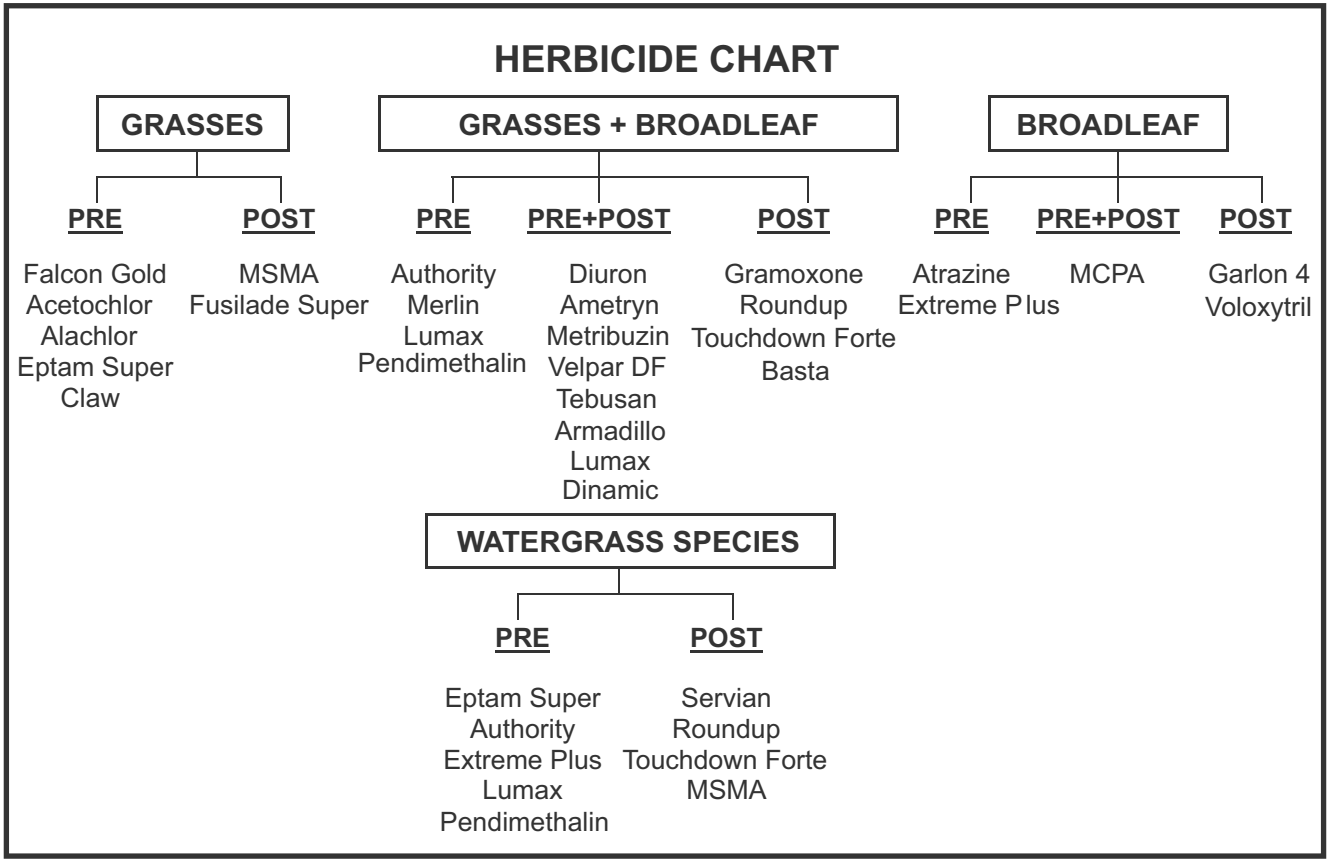
Also refer to: *A Guide to the Use of Herbicides,* obtainable from:

The Department of Agriculture, Forestry & Fisheries
Directorate: Communication,
Private Bag X250
Pretoria 0001

Disclaimer:

- This guide is not a complete list of registered herbicides; only those herbicides and combinations recommended by SASRI have been listed.
- Application rates are derived from registered rates as indicated on herbicide labels.
- All information has been provided by agrochemical companies and SASRI cannot be held responsible for any loss or damage arising from the use of these products or product combinations.
- The use of proprietary names in this publication should not be construed as an endorsement for their use.

HERBICIDE CHART



NOTE: Refer to pages 17-19 for a list of registered generic herbicide trade names and their active ingredients.

Also refer to SASRI Information Sheet 10.6 *Understanding the Label on Herbicide Containers*

NOTES ON TANK MIXTURES WITH GENERICS

Caution: Read the label of <u>all</u> ingredients in tank mixtures to match the registered generics.

There are many generic herbicides registered for use in sugarcane. When using generics in tank mixtures, the preferred recommendation is to refer to the **Registration 'L' Number** on every label of products **registered** to be mixed, and to read the information under the heading **'Compatibility (Mixing and Application)'**. Here, the label will inform you which formulated products are **registered** as being compatible for the required tank mixture.

This is important as efficacy and phytotoxicity trials have been done only on the specified **registered** formulations of product partners. There is no guarantee that mixing non-registered generic formulations together will be synergistic in their efficacy, i.e. they might not be effective in controlling the weeds listed on the labels. An example is given below:

HERBICIDE TRADE NAME

Registration No. L3200 Act/Wet 36/1947

COMPATIBILITY (MIXING AND APPLICATION)

"DIURON 800 SC (L3200) can be mixed with MCPA 400 SL (L3616), MSMA 720 SL (L3754), GRAMOXONE (L1174) ……."

EXPLANATION OF TERMS USED IN THE TABLES

Abbreviations

B/L = broadleaf weeds
G = grasses
WG(Y) = yellow watergrass
WG(P) = purple watergrass

Weed spectrum Refers to a weed category (e.g. B/L). In mixed stands of weeds, grasses are the most important, followed by watergrass species and then broadleaf species. Chemicals should be selected to deal with them in this order.

Timing The terms *pre-, early-post, post* and *late post-emergence* refer to the growth stage of the weeds. The following table describes each growth stage.

Stage	Watergrass	Grasses	Broadleaf
Pre-emergence	No emergence	No emergence	No emergence
Early post-emergence	1 to 4 leaves	1 to 2 leaves	0 to 30 mm
Post-emergence	Pre- to early flowering	2 to 4 leaves, pre-tillering	<100 mm or pre-flowering
Late post-emergence	Flowered Most tubers have germinated	Tillered	>100 mm or post-flowering

Length of control: Herbicide effectiveness is **short-term** (4 to 6 weeks) or **long-term** (8 to 14 weeks).

THREE STEPS TO TREATMENT SELECTION

1: Identify the most common weed spectrum
Also refer to tables on Suggested Control for
Other Problem Weeds (page 14) and Problem Creeping Grasses (page 15).

↓

2: Decide the timing of application required (pre-, post, etc.)

↓

3: Decide on the length of control required (long or short-term)

↓

From the key below, use the above to select a Table number

2: Time of application	3: Length of control	1: Weed spectrum			
		B/L	G	WG (Y)	WG (P)
Pre-emerge (non-incorporated)	Short-term	1			
Pre-emerge (non-incorporated)	Long-term	2	2	2	2
Pre-emerge (incorporated)	Long-term		3	3	3
Pre- to early post-emergence	Long-term	4	4	4	4
Post-emergence	Long-term	5	5	5	
	Short-term	6	6	6	6
Late post-emergence	Short-term	7	7	7	7

TREATMENT SELECTION TABLES

TABLE 1. PRE-EMERGENCE (SHORT-TERM)

(This chemical requires moist soil conditions)

	WEED SPECTRUM				B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple				
Clay %	B/L	G	Water Grass		TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
			Y	P					
All	●				MCPA 400 SL	(a)	7	5	70

TABLE 2. PRE-EMERGENCE (LONG-TERM)

(These tank mixtures require moist soil conditions)

	WEED SPECTRUM										
Clay %	B\L	Grass	**Babe	**Sorg	**Rott	Water grass Y	Water grass P	TREATMENT	Code	Rate (L or kg/ha)	Length of control (Weeks)	Cost R/ha/ week
All	●	●	●	●		●		Alachlor + MCPA 400 SL	(a)	(5-6) + 4	8	74
All	●	●	●	●		●		Alachlor + atrazine	(b)	(5-6) + (2-3)	8	67
All	●	●	●	●		●		Alachlor + ametryn	(c)	(5-6) + (2-3)	8	67
All	●	●	●	●		●		Alachlor + diuron	(d)	(5-6) + 2.5	8	76
All	●	●	●	●		●		Falcon Gold + ametryn	(e)	(1-1,6) + (2-3)	9	38
All	●	●	●	●		●		Acetochlor 900 + ametryn	(f)	(1,8-3) + (2-3)	9	31
All	●	●	●	●		●		Acetochlor 900 + diuron	(g)	(1,8-3) + (2,5-3)	9	42
All	●	●	●	●		●		Acetochlor 900 + atrazine	(h)	(1,8-3) + (2-6)	9	41
>10	●	●				●		Claw 500 SC + Diuron 800 SC	(i)	(1,5-2) + 3	9	81
5	●	●	●			●		Velpar DF (ratoon)	(q)	0,5-1,0	12	23
>10	●	●	●	●				Merlin + diuron (ratoon)	(s)	(0,1-0,25) + (2-2,5)	14	37
>10	●	●	●					Merlin + ametryn (ratoon)	(t)	(0,1-0,25) + (3-4)	14	36
> 7	●					●	●	Extreme Plus	(u)	0,8-1,2	12	33
All	●	●				●		Lumax	(v)	4-5	10	62
>20	●	●	●		●	●		Pendimethalin + diuron	(w)	4 + 2.5	12	55
>20	●	●	●		●	●	●	Parabat + Extreme plus	(x)	3,5+1,2	12	77
>15	●	●				●	●	Authority 480 SC	(y)	1.2-1.9	12	106
>10	●	●	●					Merlin + Velpar DF (ratoon)	(z)	(0,1-0.25) + (0,5-1)	14	42
>15	●	●	●			●	●	Authority 480 SC + ametryn	(aa)	1.25 + 3	12	84
>15	●	●	●			●	●	Authority 480 SC + acetochlor 900	(ab)	1.25 + 2	12	80
>15	●	●	●			●	●	Authority 480 SC + diuron 800 SC	(ac)	1.25 + 2.5	12	88
> 5	●	●	●			●		Falcon Gold + Velpar DF (ratoon)	(ad)	(1-1.6) + (0,6-0,8)	12	45
>10	●	●				●		Dinamic + Acetochlor 900 (ratoon) *	(ae)	2 + 3	14	76
>10	●	●				●		Dinamic + Hexazinone 750 (ratoon) *	(af)	1,5 + 1	14	69

* Consult Farmers' Agricare for proposed new rates.

** Suggested treatments for problem grasses:
Panicum maximum (Ubabe/barbi), *Sorghum bicolor* (Umqombothi/ gangepoort) and *Rottboellia* (tarentaalgras/guinea-fowl grass)

TABLE 3. PRE-EMERGENCE (INCORPORATED)

(Dry soil at incorporation before planting followed by moist conditions are ideal)

B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple

Clay %	WEED SPECTRUM				TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
	B/L	G	Water grass						
			Y	P					
All		●	●	●	Eptam Super (plant cane)	(a)	3-7	8	74

NOTE: The treatment is applicable to easily worked soils that are not prone to erosion. Incorporation must be immediate due to the volatility of the product.

TABLE 4. PRE- TO EARLY POST-EMERGENCE (LONG-TERM)

(These chemicals are more effective when applied to a moist soil)

B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple

Clay %	WEED SPECTRUM							TREATMENT	Code	Rate (L or kg/ha)	Length of Control (weeks)	Cost R/ha/ week
	B/L	Grass	*Babe	*Sorg	*Rott	Water grass						
						Y	P					
All	●	●	●	●		●		Alachlor + atrazine + Gramoxone	(a)	6 + (2-3) + (1-2)	8	85
All	●	●	●	●		●		Alachlor + ametryn + Gramoxone	(b)	6 + (3-5) + 1,5	8	95
All	●	●	●	●		●		Alachlor + diuron + Gramoxone	(c)	6 + 2,5 + 1,5	9	84
All	●	●				●		Alachlor + ametryn + S	(d)	6 + 6 + S	8	98
All	●	●				●		Falcon Gold+ametryn+MCPA 400 SL+S	(e)	(1-1,6)+(4-5)+3,5	9	73
All	●	●	●	●		●		Falcon Gold + ametryn + Gramoxone	(f)	(1-1,6)+(2-3)+1,5	9	50
All	●	●				●		Falcon Gold +ametryn + S	(g)	(1-1,6) + 6 +S	9	62
All	●	●	●	●		●		Falcon Gold + diuron + Gramoxone	(h)	(1-1,6)+(2-2,5)+1,5	8	64
All	●	●	●	●		●		Acetochlor 900 + ametryn + Gramoxone	(i)	(1,8-3)+4+(1-1,5)	9	50
All	●	●	●	●		●		Acetochlor 900 + diuron + Gramoxone	(j)	(1,8-3)+(2,5-3)+1,5	9	55
All	●	●	●	●		●		Acetochlor 900 + atrazine + Gramoxone	(k)	(1,8-3)+(2-6)+(1-1,5)	9	51
All	●	●				●		Acetochlor 900 + ametryn + S	(l)	(1,8-3)+6+S	9	55
>10	●	●				●		Claw 500 SC + Ametryn 500 SC (Plant and ratoon)	(al)	(1,5-2) + (3-6)	9	80
>10	●	●				●		Claw 500 SC + Ametryn 500 SC + Paraquat 200 SL (Plant)	(m)	(1,5-2) + (3-4) + 1	9	81
>10	●	●				●		Claw 500 SC + Diuron 800 SC + Paraquat 200 SL (Plant)	(n)	(1,5-2) + 3+ 1,5	9	92
6-35	●	●				●		Metribuzin + diuron	(o)	3 + 2	12	62
6-35	●	●	●	●		●		Metribuzin + diuron + Gramoxone	(p)	3 + 2 + 1	12	68

S = Surfactant

Continued...

The cost (R/ha/week) includes a common surfactant applied at a typical rate.

* = Suggested treatments for problem grasses: *Panicum maximum* (Ubabe/barbi*), Sorghum bicolor* (Umqombothi/gangepoort) and *Rottboellia* (tarentaalgras/guinea-fowl grass)

TABLE 4. (Continued)

(These chemicals are more effective when applied to a moist soil)

B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple

Clay %	WEED SPECTRUM							TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
	B/L	Grass	**Babe	**Sorg	**Rott	Water grass						
						Y	P					
>5	●	●	●			●		Hexazinone 240 + diuron (ratoon only)	(q)	(1-3) + (1-2)	12	25
>5	●	●	●			●		Velpar DF + diuron (ratoon only)	(q)	(0,5-1) + (1-2)	12	34
8-50	●	●						Tebusan + diuron + S	(v)	(2-2,5) + 2,5 + S	12	57
8-50	●	●						Tebusan + ametryn SC + S	(w)	(2-2,5) + 4 + S	12	58
>5	●	●				●		Velpar DF + acetochlor 900 (ratoon only)	(x)	(0,5-1) + (1,8-3)	12	35
>5	●	●				●		Hexazinone 240 + acetochlor 900 (ratoon only)	(x)	(1-3) + (1.8-3)	12	26
>10	●	●	●					Merlin + Gramoxone (ratoon only)	(aa)	(0,1-0,25) + 1	14	28
6-35	●	●				●		Metrad	(ab)	4	12	60
All	●	●	●			●		Lumax + Gramoxone + S	(ac)	(4-5) + 0.5 + S	10	68
8-50	●	●				●		Tebusan + Relay Super 900 EC	(ad)	(2-2.5)+(1.75-3)	12	57
>5	●	●	●			●		Hexazinone 240 + ametryn (ratoon only)	(ae)	(1-3) + (3-4)	12	31
>5	●	●	●			●		Velpar DF + ametryn (ratoon only)	(ae)	(0.5-1) + (3-4)	12	39
>15	●	●	●	●		●	●	Authority 480 SC + MCPA 400 SL	(af)	1.25 + 4	12	86
>15	●	●	●	●		●	●	Authority 480 SC + ametryn 500 SC	(ag)	1.25 + 3	12	84
>15	●	●	●	●		●	●	Authority 480 SC + Gramoxone	(ah)	1.25 + 0.5	12	73
All	●	●						Armadillo	(ai)	1.6 – 3.6	8	47
>10	●	●	●			●		Dinamic + Acetochlor 900 + Paraquat (ratoon) *	(aj)	2,0+3,0+1,5	14	81
>10	●	●	●			●		Dinamic + Hexazinone 750 + Paraquat (ratoon)*	(ak)	1,5+1,0+1,5	14	73

S = Surfactant

The cost (R/ha/week) includes a common surfactant applied at a typical rate.

* = Suggested treatments for problem grasses: *Panicum maximum* (Ubabe/barbi*), Sorghum bicolor* (Umqombothi/gangepoort) and *Rottboellia* (tarentaalgras/guinea-fowl grass)

TABLE 5. POST-EMERGENCE (LONG-TERM)

(These chemicals are more effective when applied to a moist soil)

B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple

Clay %	WEED SPECTRUM B/L	G	Water grass Y	Water grass P	TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
All	●	●	●		Voloxytril + acetochlor 900 + diuron	(a)	1,25 + 3 + 2,5	9	105
All	●	●	●		Voloxytril + alachlor + diuron	(b)	1,25 + 6 + 2,5	8	150
6-35	●	●	●		Metribuzin + diuron	(d)	3 + 2	12	62
6-35	●	●	●		Metribuzin + ametryn	(f)	(2 - 2.9) + (3 - 4)	12	46
6-35	●	●	●		Metribuzin + ametryn + Gramoxone	(g)	3 + 3 + 1	12	67
>5	●	●	●		Velpar DF + diuron (ratoon only)	(h)	(0,5-1) + (1-2)	12	34
>5	●	●	●		Velpar DF + ametryn (ratoon only)	(i)	(0,5-1) + (3-4)	12	39
6-35	●	●	●		Falcon Gold + metribuzin + Gramoxone	(j)	(1-1,6) + 2 + 1,5	12	58
>5	●	●	●		Voloxytril + Velpar DF + diuron (ratoon only)	(l)	1,25+(0,5-1)+2,5	12	87
6-35	●	●	●		Voloxytril + metribuzin + diuron	(p)	1,25 + 2,9 + 2,5	12	110
All	●	●	●		Voloxytril + Tolla + diuron	(q)	1,25 + 2 + 2,5	8-10	107
>10	●	●	●		Dinamic + MCPA 700 WSG + S (ratoon)	(r)	1,5 + 2,0 + S	12	63
>10	●	●	●		Dinamic + Ametryn 750 + S (ratoon) *	(s)	1,5 + 2,67 + S	12	66
>10	●	●	●		Dinamic + MCPA 700 WSG + Ametryn 750+ S (ratoon) *	(t)	1,5 + 1,14 + 1,33 + S	12	65

S = Surfactant

The cost (R/ha/wk) includes a common surfactant applied at a typical rate.

* = Consult Farmers' Agricare for proposed new rates.

TABLE 6. POST-EMERGENCE (SHORT-TERM)

(Moist soil conditions are preferable)

	WEED SPECTRUM				B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple				
Clay %	B/L	G	Water grass		TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
			Y	P					
All	●	●			Ametryn + S #	(a)	8 + S	6	78
All	●	●	●		Ametryn + MCPA 400 SL + S	(b)	(4-5) + 3,5 + S	6	75
All	●	●	●		Voloxytril + ametryn	(c)	(1-1,25) + (4-5)	5	149
All	●	●	●		Voloxytril + MCPA + ametryn	(d)	0,5 + 3 + (4-5)	6	103
All	●				MCPA 400 SL + S	(e)	(6,25-8,75) + S	5	79
All		●	●	●	MSMA	(f)	6	6	60
All	●	●	●		Diuron + MCPA 400 SL + S	(g)	2,5 + 4 +S	6	74
All	●	●	●		Voloxytril + diuron	(h)	(1-1,25) + 2,5	5	142
All	●	●	●		Voloxytril + MCPA + diuron	(i)	0,5 + 3 + 2,5	5	117
All			●	●	Servian + Complement Super	(k)	0,05 + 0,1	6	46
All	●				Voloxytril	(l)	1.5	5	132
>15			●		Authority 480 SC + S	(n)	0,55 + S	6	66
>15	●	●	●		Authority 480 SC + MCPA 400 SL	(o)	0,55 + 3	6	91
All	●	●	●	●	Diuron + Gramoxone	(p)	2,5 + (1,5-3)	5	76
All	●	●	●	●	Gramoxone + S	(q)	(2 – 3) + S	4	52
All	●	●	●	●	Basta ◆	(r)	5 - 7,5	-	Supplier

S = Surfactant

The cost (R/ha/wk) includes a common surfactant applied at a typical rate.

◆ = Knock-down control - Use treatment marked # in dry conditions

TABLE 7. LATE POST-EMERGENCE (SHORT-TERM)

(Treatments effective under both dry and moist conditions)

	WEED SPECTRUM							B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple				
Clay %	B/L	Grass	**Babe	**Sorg	**Rott	Water grass		TREATMENT	Code	Rate (L or kg/ha)	Length of control (weeks)	Cost R/ha/ week
						Y	P					
All	●	●				●	●	Gramoxone + S	(a)	(1,5 - 3)+ S	5	85
All		●	●			●	●	MSMA	(b)	6	4	91
All	●	●	●	●	●	●	●	Ametryn + MSMA	(c)	(3-4) + 4	5	87
All	●	●				●	●	Diuron + Gramoxone	(d)	2,5 + (1,5-3)	5	76
All	●	●	●	●		●	●	Diuron + MSMA	(e)	3 + 4	5	100
All						●	●	Servian + Complement Super	(f)	0,05 + 0,1	6	46
All	●	●	●			●	●	Basta ◆	(g)	7,5	-	Supplier

S = Surfactant

◆ = Knockdown control

** = Suggested treatments for problem grasses: *Panicum maximum* (Ubabe/barbi*), Sorghum bicolor* (Umqombothi/gangepoort) and *Rottboellia* (tarentaalgras/guinea-fowl grass)

TABLE 8. TREATMENTS FOR SPECIAL PROBLEMS

(Treatments other than (g) should be applied with extreme caution)

❖ (Treatment (h) only for control of creeping grasses growing on verges or in fallow fields: Consult your supplier for advice before using this treatment.)

	WEED SPECTRUM							B/L = Broadleaf; G = Some annual grasses; Y = Yellow; P = Purple		
Clay %	B/L	Grass	**Babe	**Sorg	**Rott	Water grass Y	Water grass P	TREATMENT	Code	Rate (L or kg/ha)
All	●	●				●	●	Roundup	(a)	6-8
All	●	●				●	●	Roundup	(b) x	8-10
All		●						Fusilade Forte	(c) x	5
All		●						Volley	(c) x	6
All	●	●				●	●	Touchdown Forte	(e) ■	1.32-3.96
All	●	●				●	●	Touchdown Forte	(f) x	5.28-6.6
All	●	●						Garlon 4	(g)	0,5% mixture
All	●	●				●	●	Arsenal GEN 2	(h) ❖	4 – 5,22
All						●	●	Servian + Complement Super	(l)	0,05 + 0,1
All	●	●	●			●	●	Basta	(m) ◆	5 – 7,5

x = rates for cane eradication

◆ = knockdown control

** Suggested treatment for *Panicum maximum* (Ubabe/barbi)

Refer to: x SASRI Information Sheet 4.2 *Cane stool eradication.*

x SASRI Information Sheet 4.4 *Chemicals for cane eradication.*

■ Touchdown Forte label for recommended rates.

SUGGESTED CONTROL OF OTHER PROBLEM WEEDS IN SUGARCANE

Common name	Botanical name	Pre-emergence	Early post-emergence	Post-emergence	Late post-emergence
Sticky gooseberry	*Physalis viscosa*	-	-	Table 8 (g) or hand weed[1]	Table 8 (g) or hand weed[1]
Madeira vine	*Anredera baselloides*	-	-	Table 8 (g) or hand weed[1]	Table 8 (g) or hand weed[1]
Purple watergrass	*Cyperus rotundus*[6]	Table 3[3] Table 2 (u, x, y, aa, ab, ac)	Table 4 (af, ag, ah)	Table 8 (a, e) repeat[2] or Table 6 (f, k)[5] or Table 7 (c, e)[4] or Table 8 (l)	Table 8 (a, e) repeat[2] or Table 6 (f, k)[5] or Table 7 (c, e)[4] or Table 8 (l) or Table 8 (m)[6]
Morning glory	Ipomoea species	Table 2 (ae, af)			
Tall Paspalum	*Paspalum urvillei*			Table 8 (a, e)[2] or hand weed[1]	Table 8 (a, e)[2] or hand weed[1]
Common Paspalum	*Paspalum dilatatum*			Table 8 (a, e)[2] or hand weed[1]	Table 8 (a, e)[2] or hand weed[1] or Table 8 (m)[7]

NOTES

1 Removal by hand/hoeing should be considered for these weeds where infestations are not heavy. Weeds should always be removed from the field.

2 When using glyphosate, wiper type applicators or shields should be used where there is a danger of cane leaf contact. This product is more effective when applied later into summer (i.e. from December onwards). Repeated applications are necessary if regrowth occurs.

3 This treatment should only be used at planting in easily worked soils that are not prone to erosion.

4 MSMA applications should be repeated within two weeks of first spraying.

5 Servian treatment should be repeated when enough regrowth has occurred. Refer to SASRI Information Sheet 10.1 Watergrass control.

6 Multiple sprays at the higher rate is required. Re-spray at 50% or more leaf area.

7 If regrowth appears, repeat application at the lower rate.

SUGGESTED CONTROL OF PROBLEM CREEPING GRASSES IN SUGARCANE

Common name	Botanical name	Pre-emergence	Early post-emergence	Post-emergence	Late post-emergence
Kweek	*Cynodon dactylon*	-	-	Table 8 (a, e)[2] or Table 8 (h)[3] or Table 8 (m)[4] or Table 7(d) repeated	Table 8 (a, e)[2] or Table 8 (h)[3] or Table 8 (m)[4] or Table 7(d) repeated
Giant stargrass	*Cynodon nlemfuensis*	-	-	Table 8 (a, e)[2] or hand weed[1] or Table 8 (m)[4]	Table 8 (a, e)[2] or hand weed[1] or Table 8 (m)[4]
Couch paspalum	*Paspalum paspaloides*	-	-	Table 8 (a, f)[2] or hand weed[1]	Table 8 (a, f)[2] or hand weed[1]
Creeping Digitaria	*Digitaria abyssinica*	-	-	Table 8 (a, e)[2] or hand weed[1] or Table 8 (m)[4]	Table 8 (a, e)[2] or hand weed[1] or Table 8 (m)[4]
Wild rice grass	*Leersia hexandra*	-	-	Table 8 (a, e)[2] or hand weed[1]	Table 8 (a, e)[2] or hand weed[1]

NOTES

1 Removal by hand or hoeing should be considered for these weeds where infestations are not heavy. Weeds should always be removed from the field.

2 When using glyphosate, wiper type applicators or shields should be used where there is a danger of cane leaf contact. These products are generally more effective when applied later into summer (i.e. from December onwards). Repeated applications are necessary if regrowth occurs.

3 Only for control of *Cynodon* growing on verges or in fallow fields. Consult the supplier for use restrictions and refer to pages 37 and 70 for more information.

4 Multiple sprays at the higher rate are required.

ACTIVE INGREDIENT PRICE LIST

Active ingredient	Formulation		List price R/L or kg	Active ingredient	Formulation		List price R/L or kg
Acetochlor	700 g/litre	EC	89.48	Hexazinone & diuron	250+533 g/kg	WDG	189.55
Acetochlor	900 g/litre	EC	59.21	Imazapyr	100 g/kg	EC	149.25
Acetochlor	960 g/litre	EC	66.60	Imazapyr	240 g/litre	SL	376.63
Alachlor	384 g/litre	EC	71.64	Ioxynil + bromoxynil	200 + 200 g/litre	EC	440.30
Ametryn	500 g/litre	SC	55.20	Isoxaflutole	750 g/litre	WDG	1805.78
Ametryn	750 g/kg	WDG	88.00	MCPA	400 g/litre	SL	50.00
Amicarbazone	700 g/kg	WDG	440.30	MCPA WSG	700 g/litre	WSG	83.00
Atrazine	500 g/kg	SC	56.72	Mesotrione + S-metolachlor + terbuthylazine	37.5+375+125g/litre	SE	137.61
Diuron	800 g/kg	WDG	92.11	Metazachlor	500 g/litre	SC	267.91
Diuron	800 g/litre	EC	86.84	Metolachlor	960 g/litre	EC	97.01
EPTC	720 g/litre	EC	117.84	S-Metolachlor	960 g/litre	EC	156.72
Fluazifop-P-butyl	125 g/litre	EC	216.42	Metribuzin	480 g/litre	SC	190.30
Fluazifop-P-butyl	150 g/litre	EC	320.90	Metribuzin + Chlorimuron ethyl	643+107 g/litre	WDG	395.52
Glufosinate ammonium	200 g/litre	SL	321.54	Metribuzin + diuron	360+400 g/kg	WDG	207.46
Glyphosate	360 g/litre	SL	63.43	MSMA	720 g/litre	SL	60.46
Glyphosate	450 g/litre	SL	87.31	Paraquat	200 g/litre	SL	73.13
Glyphosate	480 g/litre	SL	85.28	Paraquat + diuron	100+300 g/litre	SL	126.87
Glyphosate	500 g/litre	SC	117.91	Paraquat + diuron	50+450 g/litre	SL	78.92
Glyphosate	500 g/kg	WSG	69.07	Pendimethalin	500 g/litre	EC	111.94
Glyphosate	510 g/litre	SL	74.93	Sulcotrione + atrazine	120 + 300 g/litre	SL	145.00
Glyphosate	700 g/litre	WSG	97.70	Sulfentrazone	480 g/kg	SC	669.62
Halosulfuron	750 g/kg	WDG	4851.30	Tebuthiuron	500 g/litre	SC	198.13
Hexazinone	240 g/litre	SL	115.60	Tebuthiuron	800 g/kg	WDG	283.43
Hexazinone	750 g/kg	WSG	365.67	Triclopyr	480 g/litre	EC	196.27

Adjuvants List price R/L or kg								
	Actipron Super	49.33	Complement Super	361.81	Summit Super	52.24	Wet-All	85.07
	Aqua-Right 5	44.55	LI 700	99.20	Tronic	54.84		
	Bladbuff 12	56.95	Mist Control	97.51	Velocity-Glifo	11.94		
	Break-thru	Supplier	Power-up	Supplier	Villa 51	109.85		

List of herbicide trade names and their active ingredients

Note: The herbicide trade names below have their active ingredient(s) in the second column. For more herbicide information refer to pages 22-54.

Trade name	Active ingredient	Trade name	Active ingredient
Acetamet 700	Acetochlor + ametryn	Arysta MSMA	MSMA
Acetak EC	Acetochlor	Arysta Paraquat	Paraquat
Acetochlor 700	Acetochlor	Arysta Velpar K2.0	Hexazinone + diuron
Acetochlor 900 EC	Acetochlor	Arysta Velpar K2.4	Hexazinone + diuron
Agrizine 500 SC	Atrazine	Arysta Velpar K3	Hexazinone + diuron
Agroquat 200	Paraquat	Atraflo 500 SC	Atrazine
Alachlor EC	Alachlor	Atrazine SC	Atrazine
Alachlor	Alachlor	Atrazine 900 WG	Atrazine
Amazon 480 SC	Metribuzin	Authority 480 SC	Sulfentrazone
Ametrex 500	Ametryn	Aventis Diuron Flo	Diuron
Ametryn 500 SC	Ametryn	Basta	Glufosinate ammonium
Anaconda	Ametryn	Bound	Glufosinate ammonium
Annihilate	Glyphosate	Bounty	Glyphosate
Armadillo	Sulcotrione + atrazine	Brigadier 750 WG	Halosulfuron
Arsenal GEN 2	Imazapyr	Cention 800 SC	Diuron
Arysta Acetochlor	Acetochlor	Claw 500 SC	Metazachlor
Arysta Alachlor	Alachlor	Clearout 180	Glyphosate
Arysta Ametryn	Ametryn	Clearout 500 WG	Glyphosate
Arysta Ametryn 750 WDG	Ametryn	Crown	Halosulfuron
Arysta Atrazine 500	Atrazine	Chopper	Imazapyr
Arysta Atrazine 900 WDG	Atrazine	Cyprex	Halosufuron
Arysta Diuron	Diuron	Develop	Diuron
Arysta Hexazinone	Hexazinone	Diablo	Diuron SC
Arysta Hexazinone 750 WSG	Hexazinone	Dinamic	Amicarbazone
Arysta Lava	Tebuthiuron	Diron 800 WG	Diuron
Arysta MCPA WSG	MCPA	Diurex 800 SC	Diuron
Arysta Metribuzin 480	Metribuzin	Diuron 800 SC	Diuron

...Continued

Trade name	Active ingredient	Trade name	Active ingredient
Eptam Plus	EPTC	Gramuron	Paraquat + diuron
Eptam Super	EPTC	Guardian S	Acetochlor
EPTC Plus	EPTC	Guillotine 750 WG	Isoxaflutole
EPTC S EC	EPTC	Halo	Halosulfuron
EPTC Super 720 EC	EPTC	Harpoon 200 SL	Paraquat
Erase 360	Glyphosate	Hatchet	Imazapyr
Erase 500	Glyphosate	Hexazimax 240 SL	Hexazinone
Esculentus 720	EPTC	Hexazinone 480 SL	Hexazinone
Extend 800 WDG	Diuron	Hexazinone 750 WG	Hexazinone
Extreme Plus	Metribuzin + chlorimuron-ethyl	Hexazinone 480 SL	Hexazinone
Falcon Gold	S-metolachlor	Hexazinone 750 WG	Hexazinone
Farmag Diuron 800 WG	Diuron WG	Hexsan 420	Hexazinone
Fluzie	Fluazifop-butyl	Kalach 510 SL	Glyphosate
Format	Imazapyr	Kalach 700 WSG	Glyphosate
Fusilade Forte	Fluazifop-butyl	Karmex	Diuron
GAP Acetochlor 900	Acetochlor	Kestrel 960	Acetochlor
GAP Alachlor	Alachlor	Lasso EC	Alachlor
GAP Ametryn 500 SC	Ametryn	Lava 800 WDG	Tebuthiuron
GAP Atrazine 500	Atrazine	Leap 840	Acetochlor
GAP Diuron 800 SC	Diuron	Locate 538	Mesotrione + S-metolachlor + terbuthylazine
GAP Alachlor	Alachlor	Lumax	Mesotrione + S-metolachlor + terbuthylazine
GAP MCPA	MCPA	Mamba	Glyphosate
GAP Metribuzin	Metribuzin	Mamba DMA	Glyphosate salt
GAP MSMA	MSMA	Mamba Max	Glyphosate
GAP Paraquat	Paraquat	MCPA 400 SL	MCPA SL
Garlon 4	Triclopyr	Merlin	Isoxaflutole
Glygran 710	Glyphosate	Metolochlor 960 EC	Metolochlor

...Continued

Trade name	Active ingredient	Trade name	Active ingredient
Metrad	Metribuzin + diuron	Slash 360 SL	Glyphosate
Metribuzin 480 SC	Metribuzin	Slash Turbo 450	Glyphosate
Metricane 700 WDG	Metribuzin	Slash 710 SG	Glyphosate
MSMA	MSMA	Springbok	Glyphosate
MSMA SL	MSMA	Squash EC	Acetochlor + Ametryn
Palladium 960	S-Metolachlor	Tebusan 500 SC	Tebuthiuron
Panga 360	Glyphosate	Tolla 960	Metolachlor
Parabat 500EC	Pendimethalin	Tornado 400 SL	MCPA
Paragone SL	Paraquat	Tornado 700 WG	MCPA
Paraquat 200 SL	Paraquat	Touchdown Forte Hitech	Glyphosate
Paraquat SL	Paraquat	Tremor	Acetochlor
Pendimethalin 500 EC	Pendimethalin	Tumbleweed	Glyphosate
Persuador	Glyphosate	UAP Hexazinone	Hexazinone
Piranha	Glyphosate	UAP Metribuzin	Metribuzin
Premium 840	Acetochlor	Universal MCPA	MCPA
Premium 900	Acetochlor	Unizone 750 WDG	Hexazinone
Ransom 240 SL	Hexazinone	Villex 750	Hexazinone
Relay Super 900 EC	Acetochlor	Volley	Fluazifop-butyl
Rescue 400 SL	MCPA	V-Zone 750	Hexazinone
Roundup	Glyphosate	X-Tinct SC	Paraquat + diuron
Roundup Turbo	Glyphosate	Zinon 750 WG	Hexazinone
Scat 360 SL	Glyphosate		
Senator Xtra	Glyphosate		
Sentak SC	Metribuzin		
Servian	Halosulfuron		
Skoffel 145 SL	Paraquat		
Skoffel 200 Super	Paraquat		

CHEMICAL INFORMATION

Pages 22-54 contain information on when and how to apply the chemicals that are currently available for use in sugarcane. It is, however, important that you read all product labels carefully before use.

ABBREVIATIONS USED IN THIS SECTION

AL	liquid to be applied undiluted
CS	capsule suspension
DF	dry flowable
EC	emulsifiable concentrate
S	surfactant
SC	suspension concentrate
SE	suspo-emulsion
SL	solution
WDG	water dispersible granules
WP	wettable powder
WSG	water soluble granule

Some practical tips for mixing order (rule of thumb)

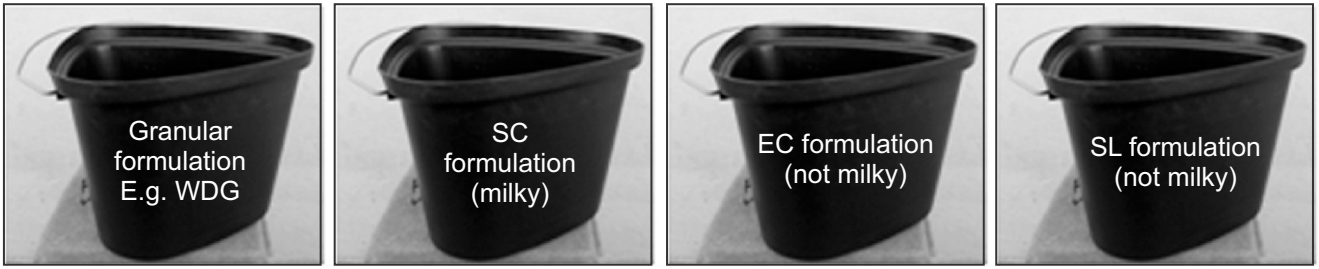
(Refer to page 20 for abbreviations and the top of pages 22-54 for information on product formulations)

It is an advantage to dilute herbicides before adding to spraytanks. This ensures that there are no chemical incompatabilities.

NB. Always follow label recommendations. As a general rule of thumb, the following directions apply:

A) Add half of the water to the knapsack sprayer.

B) Premix/dilute in buckets in the following order:



C) Add surfactant to knapsack if needed - (refer to the herbicide and surfactant label for mixing order).

D) Top up the knapsack to the required volume.

ACETOCHLOR

FORMULATION		TRADE NAMES
700 g/litre (EC)	:	Wenner, Acetochlor 700 EC
840 g/litre (EC)	:	Guardian S, Leap 840 EC, Premium 840 EC
900 g/litre (EC)	:	Relay Super, Arysta Acetochlor, GAP Acetochlor 900, Acetak EC, Premium 900 EC, Acetochlor 900 EC
960 g/litre (EC)	:	Tremor, Kestrel

Weeds controlled : Annual grasses and certain broadleaf weeds
Variable control : Yellow watergrass
Expected period of control : 8 to 10 weeks
Site of absorption : Mainly by germinating seeds of grasses
Application timing : Pre-emergence
Adsorption and leaching : -
Climatic requirements : Best results are obtained when rainfall moves the herbicide into the root zone after application.

COMMENTS

Weed control

Acetochlor controls grasses and a few broadleaf weeds when applied before germination of the weeds. Under suitable conditions some control of yellow watergrass may be achieved. The addition of paraquat or other post-emergence chemicals provides good early post-emergence weed control and is useful when application has been delayed in plant cane.

Effects on cane

Pre-emergence (of sugarcane) applications are unlikely to have any effect on sugarcane, while mixtures with post-emergence chemicals will show the effects associated with these chemicals.

Variety sensitivity : Not tested on a range of varieties.
Plant/ratoon cane : Both.
Application : Ground.
Precautions : See label - no special precautions.
Spray rate of water : Minimum 200 L/ha.

ACETOCHLOR + AMETRYN

FORMULATION	TRADE NAMES
350 + 200 g/litre (EC)	Squash EC
450 + 250 g/litre (SC)	Acetamet 700 SC

Weeds controlled : Annual grasses and certain broadleaf weeds
Variable control : Yellow watergrass
Expected period of control : 9 weeks
Site of absorption : Mainly by germinating seeds of grasses
Application timing : Pre-emergence
Adsorption and leaching : -
Climatic requirements : Best results are obtained when rainfall moves the herbicide into the root zone after application.

COMMENTS

Weed control

Squash controls grasses and a few broadleaf weeds when applied before germination of the weeds. Apply as a full cover spray pre-emergence of weeds and after cutting cane, up to the 2-leaf stage of cane.

Effects on cane

Pre-emergence up to the 2-leaf stage of sugarcane applications are unlikely to have any effect on sugarcane.

Variety sensitivity : Not tested on a range of varieties
Plant/ratoon cane : Ratoon
Application : Ground
Precautions : Ratoon cane only
Spray rate of water : 250 -350 L/ha

ALACHLOR

FORMULATION **TRADE NAMES**

384 g/litre (EC) : Lasso EC, Arysta Alachlor, Alachlor, GAP Alachlor, Alachlor EC

Weeds controlled	:	Annual grasses, certain broadleaf weeds and yellow watergrass
Expected period of control	:	8 to 10 weeks
Site of absorption	:	Mainly by germinating seeds of grasses and roots of broadleaf weeds
Application timing	:	Pre-emergence
Adsorption and leaching	:	Adsorbed by clay, and not readily leached.
Climatic requirements	:	For best results, 10 to 15 mm of rain is required within 7 to 10 days after application to take the chemicals into the soil.

COMMENTS

Weed control

A wider spectrum of broadleaf weeds can be controlled pre-emergence by adding:

- MCPA or atrazine. Atrazine persists for longer than MCPA.
- Adding paraquat is useful to control small weeds when treatment has been delayed.

Effects on cane

Alachlor is very safe to use in plant and ratoon cane, and only mixtures with post-emergence herbicides are likely to damage foliage if contacted by chemicals.

Variety sensitivity	:	None.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial.
Precautions	:	Requires careful mixing (see label). Must not stand overnight.
Spray rate of water	:	100-300 litres/ha.

AMETRYN

FORMULATION		TRADE NAMES
500 g/litre (SC)	:	Ametryn 500 SC, Arysta Ametryn, GAP Ametryn , Anaconda, Ametrex 500 SC
750 g/kg (WDG)	:	Arysta Ametryn 750 WDG

Weeds controlled	:	Broadleaf weeds and grasses
Variable control	:	Yellow watergrass
Expected period of control	:	6 to 8 weeks
Site of absorption	:	Roots and foliage
Application timing	:	Pre- and post-emergence; use a surfactant
Adsorption and leaching	:	Adsorbed in soils with high clay and organic matter contents; not readily leached.
Climatic requirements	:	Effective post-emergence weed control can be obtained under relatively dry conditions. For pre-emergence control, soil must be moist and conditions must favour rapid growth.

COMMENTS

Weed control

Ametryn provides pre- and post-emergence control of grasses and broadleaf weeds, and is therefore particularly suitable in mixtures with other herbicides. Additions of:

- Falcon Gold or acetochlor increases the spectrum and the period for which grasses can be controlled pre-emergence.
- MCPA provides better control of emerged yellow and purple watergrass.

Effects on cane

Ametryn scorches cane foliage and should be directed away from leaves. Mixtures will increase likelihood of damage.

Application	:	Ground and aerial.
Precautions	:	Follow instructions on label.
Spray rate of water	:	250-500 litres/ha, depending on the density and size of the weeds.

AMICARBAZONE

FORMULATION	TRADE NAME
700g/kg (WDG)	: Dinamic 700 WG
Weeds controlled	: Broadleaf weeds (including creepers), *Cyperus esculentus* (yellow watergrass) and certain grasses.
Expected period of control	: 12 – 14 weeks
Site of absorbtion	: Foliar and root absorbed. Photosystem II inhibitor.
Application timing	: Pre- or post-emergence (with suitable partner)
Adsorption and leaching	: High leaching index
Climatic requirements	: Can be applied to dry soil when partnered with hexazinone. Stable under dry conditions and activated by rainfall or irrigation.

COMMENTS

Weed control

- Exceptionally effective on broadleaf weeds including creepers (pre-emerge from seed) and *Cyperus esculentus* (Yellow watergrass).
- For pre-emergence weed control, Dinamic 700 WG must be used in mixtures with Arysta Acetochlor 900 EC or Arysta Hexazinone 750 WSG or Arysta Velpar DF.
- For post-emergence weed control, Dinamic 700 WG must be used in mixtures with Arysta MCPA 700 WSG or Arysta Ametryn 750 WDG or with both Arysta MCPA 700 WSG + Arysta Ametryn 750 WDG. All post-emerge Dinamic 700 WG treatments should include the adjuvant Wet-All.
- Dinamic 700 WG is not registered for use on its own.

Effects on cane

Can be damaging to cane if label directions are not closely followed. Post-emergence applications should be directed away from cane foliage. Contact your supplier for more details.

Variety sensitivity	: Not tested on specific varieties.
Plant/ratoon cane	: Ratoon cane only.
Application	: Ground (registration for incorporation in irrigation water pending).
Precautions	: Follow mixing instructions carefully.
Spray rate of water	: 200 – 300L/ha.

ATRAZINE

FORMULATION		TRADE NAMES
500 g/litre (SC)	:	Atrazine SC, Atraflo 500 SC, Arysta Atrazine 500, GAP Atrazine, Agrizine 500 SC
900 g/kg WDG	:	Arysta Atrazine 900 WDG, Atrazine 900 WG

Weeds controlled	:	Mainly annual broadleaf weeds and some grasses
Expected period of control	:	8 weeks
Site of absorption	:	Mainly roots
Application timing	:	Pre-emergence
Adsorption and leaching	:	Adsorbed by clay and organic matter.
Climatic requirements	:	Active growing conditions and soil must be moist. Best results obtained when rainfall moves the herbicide into the root zone soon after application.

COMMENTS

Weed control

Additions of acetochlor, metolachlor, Falcon Gold or alachlor provide good pre-emergence control of grasses, and paraquat controls small emerged weeds if application is delayed in plant cane.

Effects on cane

Atrazine is safe, and only mixtures with paraquat damage cane.

Variety sensitivity	:	None.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	Repeated or prolonged use can lead to bio-accumulation in water courses.
Spray rate of water	:	Minimum 200 litres/ha.

DIURON

FORMULATION		TRADE NAMES
800 g/litre (SC)	:	Diuron 800 SC, Aventis Diuron Flo, Arysta Diuron, GAP Diuron, Diablo, Cention, Diurex 800 SC
800 g/kg (WDG)	:	Karmex, Farmag Diuron 800, Diron 800 WG, Develop 800 WDG, Extend 800 WDG

Weeds controlled	:	Mainly annual broadleaf weeds and grasses
Variable control	:	Yellow watergrass
Expected period of control	:	5 to 6 weeks
Site of absorption	:	Mainly through roots, but also through foliage
Application timing	:	Pre- or post-emergence; use a surfactant
Adsorption and leaching	:	Adsorbed by soils with high clay and organic matter content.
Climatic requirements	:	Active growing conditions. Best results are obtained in moist soil when rainfall/irrigation moves the herbicide into the soil soon after application.

COMMENTS

Weed control

Diuron is ideal for use with a variety of other chemicals as it is relatively cheap and it controls a range of weeds. Yellow watergrass may be well controlled post-emergence.

Effects on cane

High rates of diuron can affect cane growth, particularly in mixtures with hormones or paraquat or MSMA, when cane foliage is sprayed.

Variety sensitivity	:	Excessive doses affect most cane varieties, especially N14 and N25.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial.
Precautions	:	No special precautions.
Spray rate of water	:	200-400 litres/ha. Use the higher rate where severe weed infestations are anticipated or where longer residual activity is required on heavier soils.

EPTC

FORMULATION **TRADE NAME**

720 g/litre (EC) : EPTC Plus, Eptam Super, Eptam Plus, EPTC Super 720 EC, Esculentus 720 EC, EPTC S EC

Weeds controlled	:	Mainly grasses, and yellow and purple watergrass
Expected period of control	:	6 to 12 weeks
Site of absorption	:	Roots
Application timing	:	Pre-emergence **incorporated**
Adsorption and leaching	:	Adsorbed into particles of dry soil. Adsorption increases as clay and organic matter contents increase.
Climatic requirements	:	Soil should be moist for activation of the chemical.

COMMENTS

Weed control

Provides good control of purple and yellow watergrass if adequately incorporated into the soil, and if furrows are not drawn deeper than the depth of incorporation (200 mm). Must be incorporated into the soil within two minutes as the product is volatile.

Effects on cane

In sandy soils, high rates may retard germination and growth of variety N14, but these effects are likely to disappear in time with no adverse effect on yield.

Variety sensitivity	:	N14.
Plant/ratoon cane	:	Plant cane only.
Application	:	Ground and incorporated.
Precautions	:	Ensure adequate incorporation - read the label.
Spray rate of water	:	200-450 litres/ha.

FLUAZIFOP-BUTYL

FORMULATION		TRADE NAME
125 g/litre (EC)	:	Volley 125, Fluzie
150 g/litre (EC)	:	Fusilade Forte

Weeds controlled	:	Grasses, including sugarcane
Expected period of control	:	Kills existing grasses but has some residual action
Site of absorption	:	Through foliage and then translocated
Application timing	:	Post-emergence
Adsorption and leaching	:	Only slightly mobile in soil.
Climatic requirements	:	Apply under warm, humid conditions when the target plants are growing vigorously. Irrigation or rainfall within one hour will necessitate re-spraying.

COMMENTS

Weed control

Not recommended for use in cane fields with growing cane. Controls both perennial and annual grasses.

Cane eradication

Apply 5 litres/ha of Fusilade Forte to actively growing sugarcane after temperatures have risen. Follow-up crops after eradication with Fusilade Forte should be restricted to variety NCo376. Note from the label that the spray to replant period is important.

Effects on cane

Sugarcane foliage turns yellow/brown and then straw coloured with black margins, which leads to death. Leaves may become yellow and contorted with tattered, blackened edges at low rates (e.g. from drift).

Variety sensitivity	:	-
Application	:	Ensure adequate coverage of every shoot.
Precautions	:	This product is volatile, so avoid treating lands adjacent to young cane.
Spray rate of water	:	200-300 litres/ha.

GLUFOSINATE AMMONIUM

FORMULATION	TRADE NAME
200g/litre (SL)	: Basta, Bound, Brass
Weeds controlled	**:** Broadleaf weeds, certain annual grasses, sedges, common reed.
Multiple sprays	: *Cynodon dactylon* (Cynodon), *Panicum maximum* (barbi grass), and watergrass require multiple sprays at the higher rate (except for *Panicum maximum*) and when grass is actively growing.
Application timing	: Post-emergence
Adsorption and leaching	: Normally stays in the top 15 cm of soil.
Climatic requirements	: Conditions promoting active growth of weed leaf area e.g. humid, warm, after rain. Wait 6 hours before irrigation. Do not apply if more than 5 mm rainfall is expected within 6 hours.

COMMENTS

Weed control

Ensure that sugarcane foliage is not exposed to any spray drift as the cane will be damaged. DO NOT spray stressed weeds or weeds with wet foliage or weeds covered with a heavy layer of dust. Spray grasses before seed sets. Spray when adequate leaf area is present for uptake but before grass forms a recumbent mat. For tall weeds, increase the volume of water to 800 L/hectare and use the higher application rate (follow label directions).

Effects on cane

Ensure sugarcane leaves and stems are not exposed to any spray drift as the cane will be damaged.

Variety sensitivity	: Apply as a directed post-emergence spray.
Plant/ratoon cane	: Both.
Application	: Ground.
Precautions	: Where Basta has been in contact with water, do not use for domestic purposes for at least 24 hours after spraying.
Spray rate of water	: 300 to 800 L/ha. Ensure thorough wetting of foliage.

GLYPHOSATE

FORMULATION	TRADE NAMES
180 g a.e./litre (SL)	Clearout 180
360 g a.e./litre (SL)	Roundup, Mamba, Springbok, Senator Xtra, Clearout 360, Erase 360, Persuador, Annihilate, Piranha 360 (SL), Panga 360 Scat 360 SL, Slash 360 SL, Bounty SL
450 g a.e./litre (SL)	Roundup Turbo, Slash Turbo 450 SL
480 g a.e./litre (SL)	Mamba Max, Mamba DMA
500 g a.e./litre (SC)	Touchdown Forte Hitech
500 g a.e./kg (WSG)	Erase 500, Clearout 500
510 g a.e./litre (SL)	Kalach 510 (SL)
700 g a.e./kg (WSG)	Kalach 700 (WSG)
710 g a.e./kg (WSG)	Glygran 710 SG, Slash 710 SG

Weeds controlled : Sugarcane and most annual and perennial weeds - non-selective
Expected period of control : Kills existing weeds only
Site of absorption : Foliage (green plant material)
Application timing : Post-emergence
Adsorption and leaching : Strongly adsorbed in soil.
Climatic requirements : Good growing conditions for cane eradication. No rain for 6-8 hours after application. Target plants should not be suffering from moisture stress (drought or waterlogging).

COMMENTS

Weed control

Not recommended for use in fields with growing cane. See label for recommendations in non-crop area. Fallow cane fields with problem weeds can be treated. Glyphosate is useful for control of Cyperus rotundus, Cyperus esculentus and grasses such as Paspalum urvillei and Cynodon dactylon. Repeat spot sprays usually necessary for complete control.

Sugarcane eradication

Apply 8-10 litres/ha in 100-400 litres water/ha to actively growing sugarcane. Surfactant may be added. Cane should have all buds emerged and tillered at time of spray. Only apply in summer (October to April).

Effects on cane

Foliage turns yellow and then brown, and eventually the cane dies. Effects may take some time to become visible (5-15 days). It is essential to remove all regrowth shoots.

Variety sensitivity : N27 might be more tolerant - use the higher rate for this variety.
Application : Ensure adequate coverage of every shoot.
Precautions : Use clean water only.
Spray rate of water : 200-600 litres/ha.

HALOSULFURON

FORMULATION TRADE NAME
750 g/kg (WDG) : Servian, Cyprex, Brigadier 750 WG, Crown, Halo

Weeds controlled	:	*Cyperus rotundus* (purple watergrass) *Cyperus esculentus* (yellow watergrass)
Expected period of control	:	6 weeks
Site of absorption	:	Root and shoot uptake (shoot uptake improves with penetrator).
Application timing	:	90% of watergrass must have germinated prior to flowering.
Adsorption and leaching	:	High leaching index - no clay restrictions.
Climatic requirements	:	Good, moist growing conditions.

COMMENTS
Weed control

- Watergrass must be actively growing without any stress.
- Waiting period after application, before irrigation/rainfall between 4 and 6 hours.
- Must be sprayed as a post-emergence treatment at 90% germination of watergrass.
- Add Complement Super or Break-thru adjuvants.

Variety sensitivity	:	Safe on all cane varieties tested.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	No special precautions.
Spray rate of water	:	200-400 litres/ha.

HEXAZINONE

FORMULATION		TRADE NAMES
240 g/litre (SL)	:	Arysta Hexazinone, UAP Hexazinone, Ransom 240 SL, HexaziMax, Hexsan 240
480 g/litre (SL)	:	Hexazinone 480 SL
750 g/kg (WSG)	:	Velpar DF, Zinon WG
750 g/kg (WDG)	:	Villex 750 WDG, V-Zone 750 DF, Unizone 750 DWG

Weeds controlled	:	Grasses and broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	10 to 14 weeks
Site of absorption	:	Roots and foliage
Application timing	:	Pre- and post-emergence
Adsorption and leaching	:	Moderately adsorbed by clay
Climatic requirements	:	Moist soil and warm humid conditions for active weed growth. Best results are obtained when rainfall moves herbicide into root zone after application.

COMMENTS

Weed control

Velpar DF controls a broad spectrum of grasses at the 2-4 leaf, pre-tillering stage, and broadleaf weeds when they are less than 100 mm high. Yellow watergrass is adequately controlled post-emergence. Mixtures with diuron or ametryn increase the spectrum of weeds that can be controlled and the range over which conditions are suitable. Ametryn is preferred for drier conditions, and diuron for moist conditions.

Effects on cane

Velpar DF is also used as an industrial weedkiller, and high rates if applied over cane foliage can severely damage its growth. However, standard rates applied correctly are not likely to have any detrimental effects. Sprays should be directed away from cane foliage.

Variety sensitivity	:	N13, N14, N18, N25, N31.
Plant/ratoon cane	:	Ratoon cane only.
Application	:	Ground.
Precautions	:	Follow mixing instructions carefully.
Spray rate of water	:	150-400 litres/ha.

HEXAZINONE + DIURON

FORMULATION		TRADE NAMES
250 g/kg hexazinone + 533 g/kg diuron (WDG)	:	Arysta Velpar K2.4
250 g/kg hexazinone + 533 g/kg diuron (WDG)	:	Arysta Velpar K3
375 g/kg hexazinone + 400 g/kg diuron (WDG)	:	Arysta Velpar K2.0

Weeds controlled	:	Grasses and broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	10 to 14 weeks
Site of absorption	:	Roots and foliage
Application timing	:	Pre- and post-emergence
Adsorption and leaching	:	Moderately adsorbed by clay
Climatic requirements	:	Moist soil and warm humid conditions for active weed growth. Best results are obtained when rainfall moves herbicide into root zone after application.

COMMENTS

Weed control

Velpar controls a broad spectrum of grasses at the 2-4 leaf, pre-tillering stage, and broadleaf weeds when they are less than 100 mm high. Yellow watergrass is adequately controlled post-emergence.

Effects on cane

High rates of hexazinone if applied over cane foliage can severely damage its growth. However, standard rates applied correctly are not likely to have any detrimental effects. Sprays should be directed away from cane foliage.

Variety sensitivity	:	N13, N14, N18, N25, N31.
Plant/ratoon cane	:	Ratoon cane only.
Application	:	Ground.
Precautions	:	Follow mixing instructions carefully.
Spray rate of water	:	150-400 L/ha.

IMAZAPYR

FORMULATION		TRADE NAMES	FORMULATION		TRADE NAMES
100 g a.i./litre (EC)	:	Chopper, Hatchet	240 g a.i./litre (EC)	:	Arsenal GEN 2

Weeds controlled : 240 g a.i./litre Sugarcane and other grasses - non-selective
100 g a.i./litre Alien plant control (refer to SASRI Information Sheets 10.3 and 10.7)
Variable control : Some grasses and broadleaf weeds, unless in registered tank mixtures.
Expected period of control : Up to 44 weeks for creeping grasses like *Cynodon dactylon.*
Site of absorption : Foliage (green plant material) and roots.
Application timing : Post-emergence
Adsorption and leaching : Leaching risk can be high. Refer to page 70 to minimise this risk.
Climatic requirements : Good growing conditions for target plants. Target plants should not be stressed (drought or waterlogging). No rain for 2 hours after application.

COMMENTS

Weed control - Arsenal GEN 2® is persistent in soil. Four important points to note:

- Verges: Apply Arsenal GEN 2® only adjacent to tall cane. Avoid drift and application to bare soil.
- Ratoon cane and spot sprays: Arsenal GEN 2® is NOT registered for application in fields with growing cane.
- Fallow fields and cane stool eradication: Arsenal GEN 2® is recommended for control of creeping grasses and cane stool eradication in fallow fields provided there has been at least 600 mm rain **and** 4 months between spray application and planting the new crop. Planting cane too soon after application will cause yield losses.
- Prevent soil erosion: Where required, put into place measures to prevent soil erosion where imazapyr or glyphosate are sprayed.

NB: Should you wish to use Arsenal GEN 2® you must contact your chemical supplier.

Effects on cane : Imazapyr kills growing cane.
Application : Ensure adequate coverage of actively growing grass.
Precautions : Use clean water only. Avoid drift and runoff. Do not spot spray in-field.
Spray rate of water : 250-300 litres/ha. Ensure good coverage of target weeds.

IOXYNIL + BROMOXYNIL

FORMULATION		TRADE NAME
200 + 200 g/litre (EC)	:	Voloxytril
Weeds controlled	:	Broadleaf weeds
Expected period of control	:	4 to 6 weeks
Site of absorption	:	Foliage only
Application timing	:	Post-emergence
Adsorption and leaching	:	-
Climatic requirements	:	Active growing conditions, no rain for 4-6 hours after spraying.

COMMENTS

Weed control

Voloxytril controls a range of broadleaf weeds when applied post-emergence. In combination with diuron or ametryn, good knockdown is achieved of *Cyperus esculentus* and fair control provided of seedling grasses.

Effects on cane

Effects are no worse than hormone herbicides. Allow 80 days between last application and harvesting.

Variety sensitivity	:	Not tested on a range of varieties.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	See label.
Spray rate of water	:	300-400 litres/ha.

ISOXAFLUTOLE

FORMULATION		TRADE NAME
750 g/kg (WDG)	:	Merlin, Guillotine 750 WG
Weeds controlled	:	Grasses and broadleaf weeds
Expected period of control	:	12-16 weeks
Site of absorption	:	Seeds, roots and shoots
Application timing	:	Pre-emergence to spiking
Adsorption and leaching	:	Low to moderate leaching, less than most acetanilides.
Climatic requirements	:	Can be applied to dry soil when temperatures become suitable for weed germination. Stable under dry conditions (no photodegradation). Activated by rainfall.

COMMENTS

Weed control

When tank-mixed with diuron or ametryn, Merlin controls at least 29 broadleaf and nine grass weed species, including difficult to control species such as *Panicum maximum*. Does not control *Cyperus* spp. or perennial weeds with established root systems. When tank-mixed with Velpar DF or Gramoxone under dryland conditions, refer to Velpar DF and Gramoxone labels for full particulars of weed spectrum controlled. There is no known herbicide resistance.

Effects on cane

Can cause some transitory bleaching/chlorosis under certain conditions (see label), but yield will not be affected if label directions are adhered to.

Variety sensitivity	:	No varietal sensitivity observed in trials on N12, N13, N14, N16, N17, N19, N22, N25, NCo376.
Plant/ratoon cane	:	Ratoon only.
Application	:	Ground. No need to incorporate.
Precautions	:	Not for use on plant cane. Can be used on dryland cane and on cane under scheduled irrigation. Not for use on soils of less than 10% clay. Not for use on dry crop residue (trash) that may be blown by wind. Ensure application of correct dosage. Do not allow overlap of spray swaths. See also label precautions.
Spray rate of water	:	100-400 litres/ha.

MCPA

FORMULATION		TRADE NAMES
400 g/litre (SL)	:	MCPA 400 SL, Universal MCPA, GAP MCPA, Rescue 400 SL, Tornado 400 SL
700 g/kg (WSG)	:	Arysta MCPA 700 WSG, Tornado 700 WG

Weeds controlled	:	Annual broadleaf weeds and certain annual grasses
Variable control	:	Purple watergrass
Expected period of control	:	4-5 weeks
Site of absorption	:	Foliage and roots
Application timing	:	Pre- and post-emergence - use a surfactant
Adsorption and leaching	:	Readily leached from soil; longer residual in dry soil.
Climatic requirements	:	No rain for 4-6 hours after post-emergence application. Moist soil and favourable growing conditions.

COMMENTS

Weed control

Suitable as pre-emergence treatment in plant or ratoon cane. Mixtures with diuron or ametryn will control a broad spectrum of weeds and suppress purple watergrass. The addition of Falcon Gold or Lasso improves the pre-emergence control of grasses, and paraquat will control newly emerged weeds.

Effects on cane

MCPA is relatively safe when applied before the leaves develop in plant or ratoon cane. High rates alone, but particularly with mixtures, will cause stunting if in contact with foliage when cane is taller than 400 mm.

Variety sensitivity	:	-
Plant/ratoon cane	:	Both.
Application	:	Ground only.
Precautions	:	Do not use near other crops such as bananas and tomatoes. Prevent drift by adhering to spraying procedures.
Spray rate of water	:	300-400 litres/ha. Rate depends on required length of control. The lower dosage is used on lighter type soils.

MESOTRIONE + S-METOLACHLOR + TERBUTHYLAZINE

FORMULATION		TRADE NAME
37.5 g/litre + 375 g/litre + 125 g/litre (SE)	:	Lumax, Locate 538 SC
Weeds controlled	:	Annual grasses and some broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	10 to 12 weeks
Site of absorption	:	Mainly through germinating shoots of grasses and roots of broadleaf weeds
Application timing	:	Pre-emergence to early post-emergence
Adsorption and leaching	:	Adsorbed in soils with high clay and organic matter contents. Extent of leaching depends on organic matter.
Climatic requirements	:	For best results 10-15 mm of rain is required within 7-10 days after application, to take the chemical into the soil. For pre-emergence control of watergrass, chemical should be in the soil before tubers begin to germinate.

COMMENTS

Weed control

Gramoxone **must** be added for post-emergence control, especially where there is *Panicum maximum* and *Cyperus esculentus*. Add Complement Super adjuvant.

Effects on cane

Post-emergence applications of Lumax plus paraquat may cause foliar scorch and stunting if the cane has more than 2-3 leaves per shoot.

Variety sensitivity	:	No particularly sensitive varieties.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial, centre pivot irrigation system with an injector system.
Precautions	:	Avoid overlapping swaths. Follow instructions on label.
Spray rate of water	:	Minimum 200-300 litres/ha.

METAZACHLOR

FORMULATION		TRADE NAMES
500 g/litre (SC)	:	Claw

Weeds controlled	:	Annual grasses and a range of broadleaf weeds;
Variable control	:	Yellow watergrass
Expected period of control	:	8 to 10 weeks
Site of absorption	:	Mainly germinating seeds of grasses
Application timing	:	Pre-emergence
Adsorption and leaching	:	High leaching potential.
Climatic requirements	:	Best results are obtained when rainfall moves the herbicide into the root zone after application.

COMMENTS

Weed control

Metazachlor controls grasses and some broadleaf weeds when applied before germination of those weeds. Under suitable conditions very good pre-emergence control of yellow watergrass is also achieved. The addition of paraquat or other post-emergence chemicals provides good early post-emergence weed control and is useful when application has been delayed in plant cane.

Effects on cane

Pre-emergence (of sugarcane) applications are unlikely to have any effects on sugarcane, whereas mixtures with post-emergence chemicals will show the effects associated with those chemicals.

Variety sensitivity	:	Not tested on a range of varieties
Plant/ratoon cane	:	Both
Application	:	Ground
Precautions	:	No special precautions – see label
Spray rate of water	:	Minimum 200 L/ha

METOLACHLOR

FORMULATION	TRADE NAMES
960 g/litre (EC)	: Tolla 960, Metolochlor 960 EC

Weeds controlled	:	Annual grasses and some broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	8 to 10 weeks
Site of absorption	:	Mainly through germinating shoots of grasses and roots of broadleaf weeds
Application timing	:	Pre-emergence
Adsorption and leaching	:	Adsorbed in soils with high clay and organic matter contents. Extent of leaching depends on organic matter.
Climatic requirements	:	For best results 10-15 mm of rain is required within 7-10 days after application, to take the chemical into the soil. For pre-emergence control of watergrass, chemical should be in the soil before tubers begin to germinate.

COMMENTS

Weed control

Metolachlor controls germinating grasses mainly, and adding ametryn improves the control of broadleaf weeds. Use higher rates where *Panicum maximum* is a problem and/or for improved control of yellow watergrass. Pre- to early post-emergence herbicides such as ametryn + paraquat may be added (as indicated in Table 4 on page 8) to kill all emerged weeds.

Effects on cane

Metolachlor is very safe to use before cane emerges. Post-emergence applications of metolachlor mixed with other herbicides (particularly paraquat) may cause foliar scorch and stunting if the cane has more than 2-3 leaves per shoot.

Variety sensitivity	:	No particularly sensitive varieties.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial.
Precautions	:	Add metolachlor last in tank mixtures and mix thoroughly. Follow instructions on label.
Spray rate of water	:	Minimum 200 litres/ha.

S-METOLACHLOR

FORMULATION		TRADE NAMES
960 g/litre (EC)	:	Falcon Gold, Palladium 960
Weeds controlled	:	Annual grasses and some broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	8 to 10 weeks
Site of absorption	:	Mainly through germinating shoots of grasses and roots of broadleaf weeds
Application timing	:	Pre-emergence
Adsorption and leaching	:	Adsorbed in soils with high clay and organic matter contents. Extent of leaching depends on organic matter.
Climatic requirements	:	For best results 10-15 mm of rain is required within 7-10 days after application, to take the chemical into the soil. For pre-emergence control of watergrass, chemical should be in the soil before tubers begin to germinate.

COMMENTS

Weed control

Falcon Gold controls germinating grasses mainly, and adding ametryn improves the control of broadleaf weeds. Use higher rates where *Panicum maximum* is a problem and/or for improved control of yellow watergrass. Pre- to early post-emergence herbicides such as ametryn + paraquat may be added (as indicated in Table 4 on page 8 and 9) to kill all emerged weeds. S-Metolachlor has more biological activity than metolachlor, resulting in lower application rates. The registered rate of s-metolachlor is 35% lower than the registered rate of metolachlor (based on the active ingredient).

Effects on cane

Falcon Gold is very safe to use before cane emerges. Post-emergence applications of Falcon Gold mixed with other herbicides (particularly paraquat) may cause foliar scorch and stunting if the cane has more than 2-3 leaves per shoot.

Variety sensitivity	:	No particularly sensitive varieties.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial.
Precautions	:	Add Falcon Gold last in tank mixtures and mix thoroughly. Follow instructions on label.
Spray rate of water	:	Minimum 200 litres/ha.

METRIBUZIN

FORMULATION		TRADE NAMES
480 g/litre (SC)	:	Metribuzin 480 SC, Arysta Metribuzin 480, GAP Metribuzin, Sentak, Amazon 480 SC
700 g/kg (WDG)	:	Metricane 700 WDG

Weeds controlled	:	Annual grasses and broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	10-14 weeks
Site of absorption	:	Mainly through roots but also through foliage
Application timing	:	Pre- or post-emergence
Adsorption and leaching	:	Moderately adsorbed in soils with high clay and organic matter contents. Adsorption decreases as pH increases. Readily leached in sandy soils with low organic matter.
Climatic requirements	:	Good growing conditions. Best results obtained when rainfall moves the herbicide into the root zone soon after application.

COMMENTS

Weed control

To reduce costs and improve the spectrum and control of grasses, particularly *Panicum maximum* and yellow watergrass, mixtures are preferred. The mixtures are particularly suitable for long-term control in plant or ratoon cane. Replacing diuron with ametryn may improve the control of grass which has started to tiller. Complete control of grass at this stage cannot be expected.

Effects on cane

Generally, metribuzin has very little effect on plant or ratoon cane growth, and the mixture with diuron is also safe. However, metribuzin mixtures are not recommended on soils with less than 5% clay, because it is likely that nematicides will be used and interactions can occur.

Variety sensitivity	:	Untested.
Plant/ratoon cane	:	Both.
Application	:	Ground or aerial.
Precautions	:	No special precautions.
Spray rate of water	:	200-300 litres/ha.

METRIBUZIN + CHLORIMURON-ETHYL

FORMULATION		TRADE NAME
643 + 107 g/kg (WDG)	:	Extreme Plus

Weeds controlled	:	Sedges, broadleaf weeds and some grasses
Expected period of control	:	12 weeks
Site of absorption	:	Via roots and foliage
Application timing	:	Pre-emergence
Climatic requirements	:	This herbicide is very water-dependent, and best results are obtained when application is made just prior to, or even during rain or irrigation.

COMMENTS

Weed control

Effective on *Cyperus* spp. and broadleaf weeds. Disturb soil before spraying, e.g. cultivate interrows of ratoons and disc or rotavate before planting. This breaks up *C. rotundus* tuber chains, prevents apical dominance and results in uniform growth that is more susceptible to control by herbicides, thereby increasing weed control efficacy. Only a few grasses are controlled by this product.

Effects on cane

It can be phytotoxic to sugarcane and therefore should be applied as soon after planting or harvesting as possible.

Variety sensitivity	:	Not tested.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	Do not apply Extreme Plus to soils withexceptionally high clay or organic matter percentages. The product usually works better in sandy soils, but some interaction may occur with nematicides.
Spray rate of water	:	200-400 litres/ha.

METRIBUZIN + DIURON

FORMULATION		TRADE NAMES
360 + 400 g/kg (WDG)	:	Metrad

Weeds controlled	:	Annual grasses and broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	12 weeks
Site of absorption	:	Mainly through roots but also through foliage
Application timing	:	Pre- or post-emergence
Adsorption and leaching	:	Moderately adsorbed in soils with high clay and organic matter contents. Adsorption decreases as pH increases. Metribuzin is readily leached in sandy soils with low organic matter and where heavy rains follow application.
Climatic requirements	:	Good growing conditions. Best results obtained when rainfall moves the herbicide into the root zone soon after application.

COMMENTS

Weed control

The mixture is particularly suitable for long-term control in plant or ratoon cane. Optimal results are achieved where spraying is done pre-emergence on to moist soils. For early post-emergence application, broadleaf weeds must be less than 3 cm in height and grass species not beyond the two leaf stage of development. Crop residue (trash) may reduce efficacy of the product.

Effects on cane

Generally, the metribuzin + diuron mixture is relatively safe on plant or ratoon cane. However, it is recommended to apply a directed spray to the interrow. Metrad is not recommended on soils where nematicides are used.

Variety sensitivity	:	N14, N25 and N31 are more sensitive than other varieties to diuron.
Plant/ratoon cane	:	Both.
Application	:	Ground or aerial.
Precautions	:	No special precautions.
Spray rate of water	:	200-400 litres/ha. Use the higher rate where severe weed infestations are anticipated or where longer residual activity is required on heavier soils.

MSMA (MONOSODIUM METHANEARSENATE)

FORMULATION		TRADE NAMES
720 g/litre (SL)	:	MSMA SL, Arysta MSMA, MSMA, Agromate, GAP MSMA

Weeds controlled	:	Grasses (including *Panicum maximum* and *Rottboellia conchinchinensis)*
Variable control	:	Purple watergrass
Expected period of control	:	Kills existing weeds only - no residual control
Site of absorption	:	Foliage
Application timing	:	Late post-emergence
Adsorption and leaching	:	Almost completely inactivated by adsorption in the soil.
Climatic requirements	:	Hot and humid conditions.

COMMENTS

Weed control

MSMA controls fairly large tillered grasses at the following growth stages:

- *Rottboellia conchinchinensis* 100-500 mm in height
- *Digitaria* species 100-300 mm in height
- Yellow watergrass pre-flowering
- *Panicum maximum* 100-300 mm in height
- *Panicum schinzii* 100-300 mm in height

Perennial stools of *Panicum* species may not be completely killed. The growth of *Sorghum bicolor* (100-300 mm), *Eleusine indica* sub-spp. (100-300 mm) and purple watergrass is severely retarded or suppressed. Mixtures with diuron or ametryn improve the control of grasses.

Effects on cane

MSMA scorches contacted cane foliage severely and retards sugarcane growth. Severe cases may result in some yield loss, but if consequent growing conditions are favourable the effects will disappear before the crop is harvested. Spray should always be directed away from cane foliage as far as possible.

Variety sensitivity	:	N16 and J59/3 are most sensitive.
Plant/ratoon cane	:	Both, but young plant cane appears to be more sensitive than older cane.
Application	:	Ground only.
Precautions	:	No special precautions.
Spray rate of water	:	300-500 litres/ha.

PARAQUAT

CAUTION: Highly toxic to humans and livestock

FORMULATION		TRADE NAME
145 g/litre (SL)	:	Skoffel 145 SL
200 g/litre (SL)	:	Gramoxone, Paraquat SL, Skoffel 200 Super, Arysta Paraquat, GAP Paraquat, Paragone SL, Harpoon 200 SL, Paraquat 200 SL, Agroquat 200

Weeds controlled	:	Annual grasses and broadleaf weeds
Variable control	:	Yellow and purple watergrass
Expected period of control	:	No persistence in soil - kills existing weeds only
Site of absorption	:	Foliage only; contact chemical, translocation limited
Application timing	:	Post-emergence only
Adsorption and leaching	:	Inactivated by soil binding
Climatic requirements	:	No rain during spraying

COMMENTS

Weed control

Paraquat is a non-selective contact chemical and will kill most young annual grasses and broadleaf weeds. It will knock down yellow or purple watergrass, but its control is short-lived. Adding diuron improves its effect, particularly on grasses, and the mixture is useful for weeds which are too big for other chemical treatments, i.e. grasses beyond the 2-4 leaf stage and after tillering, and for broadleaf weeds taller than 100 mm.

Effects on cane

Paraquat causes severe scorching to cane foliage. When cane has more than three unfurled leaves per shoot at the time of spraying, growth will be set back by applications over the cane. Thus paraquat and mixtures containing paraquat should be directed away from foliage in ratoon cane and should preferably be applied no later than the spike stage of growth in plant cane.

Variety sensitivity	:	All varieties are sensitive.
Plant/ratoon cane	:	Paraquat can be used in plant cane before the cane develops, and in ratoon cane as a directed spray, or preferably for spot spraying.
Application	:	Ground only.
Precautions	:	Paraquat is very poisonous (Group 2) and produces very small droplets when sprayed. **Do not inhale spray mist! Do not spill concentrate on the skin!** Use clean water only.
Spray rate of water	:	The dosage depends on weed size and density.

PARAQUAT + DIURON

CAUTION: Highly toxic to humans and livestock

FORMULATION		TRADE NAME
100/300 g/litre (SL)	:	Volmuron, Gramuron
450/50 g/litre (SC)	:	X-Tinct
Weeds controlled	:	Annual grasses and broadleaf weeds
Variable control	:	Yellow and purple watergrass
Expected period of control	:	5-6 weeks
Site of absorption	:	Foliage and roots
Application timing	:	Early to late post emergence
Adsorption and leaching	:	Adsorbed by soils with high clay and organic matter content.
Climatic requirements	:	No rain during spraying. Active growing conditions. Best results obtained in moist soil when rainfall moves the herbicide into the soil soon after application.

COMMENTS

Weed control

Paraquat is a non-selective contact chemical and will kill most young annual grasses and broadleaf weeds. It will knock down yellow or purple watergrass, but its control is short-lived. Adding diuron improves its effect, particularly on grasses, and the mixture is useful for weeds which are too big for other chemical treatments, i.e. grasses beyond the 2-4 leaf stage and after tillering, and for broadleaf weeds taller than 100 mm.

Effects on cane

Paraquat causes severe scorching to cane foliage. When cane has more than three unfurled leaves per shoot at the time of spraying, growth will be set back by applications over the cane. Thus mixtures containing paraquat should be directed away from foliage in ratoon cane and should preferably be applied no later than the spike stage of growth in plant cane.

Variety sensitivity	:	All varieties are sensitive.
Plant/ratoon cane	:	Used in plant cane before the cane develops, and in ratoon cane as a directed spray, or preferably for spot spraying.
Application	:	Ground.
Precautions	:	Paraquat is very poisonous (Group 2) and produces very small droplets when sprayed. **Do not inhale spray mist! Do not spill concentrate on the skin!** Use clean water only.
Spray rate of water	:	200-400 litres/ha. Use the higher rate where severe weed infestations are anticipated or where longer residual activity is required on heavier soils.

PENDIMETHALIN

FORMULATION		TRADE NAME
500 g/litre (EC)	:	Pendimethalin 500 EC, Parabat 500 EC

Weeds controlled	:	Seeding grasses and annual broadleaf weeds
Variable control	:	Yellow watergrass
Expected period of control	:	12 weeks
Site of absorption	:	Roots
Application timing	:	Pre-emergence
Adsorption and leaching	:	Adsorbed by clay and organic matter.
Climatic requirements	:	For good control of Rottboellia, it is **critical** that incorporation by 20 to 50 mm sprinkler irrigation must be carried out as soon as possible after application (definitely within 3 days of application). In rainfed conditions soils **must** be moist with rainfall occurring within three days of spraying to ensure that the herbicides move into the soil profile and reach the root zone of germinating weeds.

COMMENTS

Weed control

Very good pre-emergence control of difficult seeding grasses like *Rottboellia* and *Panicum maximum*. Mixtures with diuron increase the spectrum of weeds that can be controlled.

Effects on cane

Relatively safe on cane.

Variety sensitivity	:	Safe on NCo376, N25 and N27. Not tested on other varieties.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	Avoid inhalation.
Spray rate of water	:	200-300 litres/ha.

SULCOTRIONE + ATRAZINE

FORMULATION		TRADE NAMES
125 + 300 g a.i./litre (SL)	:	Armadillo

Weeds controlled	:	Annual grasses and broadleaf weeds
Variable control	:	Suppresses yellow watergrass
Expected period of control	:	8 weeks
Site of absorption	:	Mainly foliage, some root uptake
Application timing	:	Pre-early post-emergence at the 2-4 leaf stage
Adsorption and leaching	:	Adsorbed by clay and organic matter.
Climatic requirements	:	Moist soil with actively growing weeds. Continuous wet, rainy conditions after a post-emergence application may reduce the efficacy of the product.

COMMENTS

Weed control

Caballo is a systemic chemical that will control some annual grasses and many broadleaf weeds e.g. pigweed, commelina, and at higher rates, e.g. morning glory. It will suppress yellow watergrass. Refer to label before planting cover crops.

Effects on cane

Safe on cane.

Variety sensitivity	:	None expected.
Application	:	Ground or aerial.
Precautions	:	**Do not enter the treated area within one day after application. Do not add additional Atrazine.**
Spray rate of water	:	200-300 litres/ha.

SULFENTRAZONE

FORMULATION		TRADE NAME
480 g/litre (SC)	:	Authority 480 SC
Weeds controlled	:	Range of broadleaf weeds, grasses and *Cyperus* species
Variable control	:	Certain grass species, depending on growth stage
Expected period of control	:	12 to 14 weeks
Site of absorption	:	Roots (primary) and foliage
Application timing	:	Pre-emergence (primary) to early post-emergence in mixtures. A late post-emergence application for *Cyperus esculentus* as a rescue treatment.
Adsorption and leaching	:	Sulfentrazone is not strongly adsorbed by clay or organic matter. This chemical is moderately mobile in the soil.
Climatic requirements	:	Sulfentrazone is relatively persistent in the soil. It is not susceptible to photo-decomposition or volatility and therefore can be applied early in the season to provide weed control later on when conditions for growth improve.

COMMENTS

Weed control

Plants emerging from soil treated with sulfentrazone turn necrotic and die after exposure to light. Effects can take some time to manifest and species such as *Cyperus rotundus* will show varying degrees of exposure and can die many weeks after emergence.

Effect on cane

Sulfentrazone can cause a temporary red scorching to sugarcane leaves that have been contacted by spray deposit. This disappears after a short time and effects on yield are minimal.

Variety sensitivity	:	Safe on N19, N27, N31, NCo376 and N43. N36 and especially N41 showed herbicide damage.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	No special precautions.
Spray rate of water	:	200-400 litres/ha.

TEBUTHIURON

FORMULATION		TRADE NAME
500 g/litre (SC)	:	Tebusan 500 SC, Arysta Lava
800 g/kg (WDG)	:	Lava 800 WDG
Weeds controlled	:	Grasses and broadleaf weeds
Expected period of control	:	12 weeks
Site of absorption	:	Mainly roots, but also foliage
Application timing	:	Pre- to early post-emergence
Adsorption and leaching	:	Little leaching can be expected, as this product is bound to clay and organic matter.
Climatic requirements	:	Apply when conditions favour active growth.

COMMENTS

Weed control

Effective on grasses, broadleaf and woody weeds.

Effects on cane

Does not appear to cause severe phytotoxicity.

Variety sensitivity	:	Not tested.
Plant/ratoon cane	:	Both.
Application	:	Ground and aerial.
Precautions	:	Do not apply near trees.
Spray rate of water	:	200-300 litres/ha.

TRICLOPYR

FORMULATION		TRADE NAME
480 g/litre (EC)	:	Garlon 4

Weeds controlled	:	Woody plants and broadleaf weeds
Expected period of control	:	Only kills existing weeds
Site of absorption	:	Roots and foliage, then translocated
Application timing	:	Post-emergence
Adsorption and leaching	:	-
Climatic requirements	:	Best results are obtained when soil moisture is adequate for normal growth.

COMMENTS

Weed control

Very effective on broadleaf weeds and certain woody plants.

Effects on cane

Safe to use on cane. NB: Do not add surfactant when used in cane.

Variety sensitivity	:	Not tested.
Plant/ratoon cane	:	Both.
Application	:	Ground.
Precautions	:	Should have a rain-free period of 4 hours after application.
Spray rate of water	:	300-400 litres/ha.

ADDITIONAL WEED CONTROL INFORMATION

The pages that follow contain important issues that need to be considered for improved weed management on your farm:

PREVENTIVE WEED CONTROL IN SUGARCANE

There is an economic benefit to preventing the weeds in a field from developing into a 'crisis management' situation. When a field is full of tall weeds, it becomes expensive to control, it can reduce yield and often the herbicides required to control this situation are harmful to cane. It is better to avoid this situation by adopting the following strategies:

1. **Correct timing of application, according to weed growth stage**
   Aim to apply herbicides soon after harvest, or within two weeks of planting, when weeds are still emerging and are very small. Thus use Table 2 (pre-emergence) and Table 4 (pre- to early post-emergence control) of this Guide. Control of large weeds is costly, so avoid using Table 7 (late post-emergence control). Prioritise your fields for weed control.

   High priority fields are:
   - those just harvested or planted, or
   - those with small weeds, or
   - those that have small patches of weeds.

   Low priority fields have:
   - no weeds, or
   - canopied cane not requiring weed control, or
   - cane in marginal areas with a low yield, or
   - tall weeds that have already set the cane back severely.

2. **Consider winter spraying (after some rain) during April to July, with**
   - Velpar + diuron, or
   - MCPA + ametryn, or
   - Merlin with diuron or ametryn.

   The major benefit of winter spraying is to prevent falling behind with the spray programme during spring.

3. **Spot-spray application**
   Treat small weed patches before they expand. Use a knapsack operator dedicated to clearing small patches. This is an insurance to prevent the patches expanding to cause loss in yield. The operator costs are comfortably covered by increased yield. If this is neglected, you will need to replant sooner.

   Where there is *Cynodon dactylon* in the field, mark the patches with flags for rapid and accurate spot spray application each growing season.

4. **Practise field hygiene**
   - Mechanical operations such as harrowing will spread creeping grass runners, and muddy tractor tyres will spread seed. Clean vehicles and implements to prevent spread within and between fields.
   - Do not handweed grass verges and throw the grass into the field as this spreads weeds.
   - Cattle grazing on *Cynodon* will pass viable seeds. Do not spread kraal manure on your cane fields if your cattle have grazed on *Cynodon, Digitaria* and *Paspalum* species.

5. **Crop residue (trash) blanketing**
   A crop residue (trash) blanket spread evenly over the field suppresses weeds by preventing their germination. Less frequent herbicide spraying is required and control costs are reduced.

6. **Field edges**
   - Keep field edges/verges, fencelines, roadsides, waterways and irrigation channels free from weeds to prevent the spread of weed seeds (e.g. *Panicum maximum*), runners (e.g. *Cynodon dactylon*) and tubers (e.g. *Cyperus rotundus*) to fields.
   - Plant a line of cane along the field edge to prevent drift and encroachment of *Cynodon* runners into the field.

HERBICIDE RESISTANCE

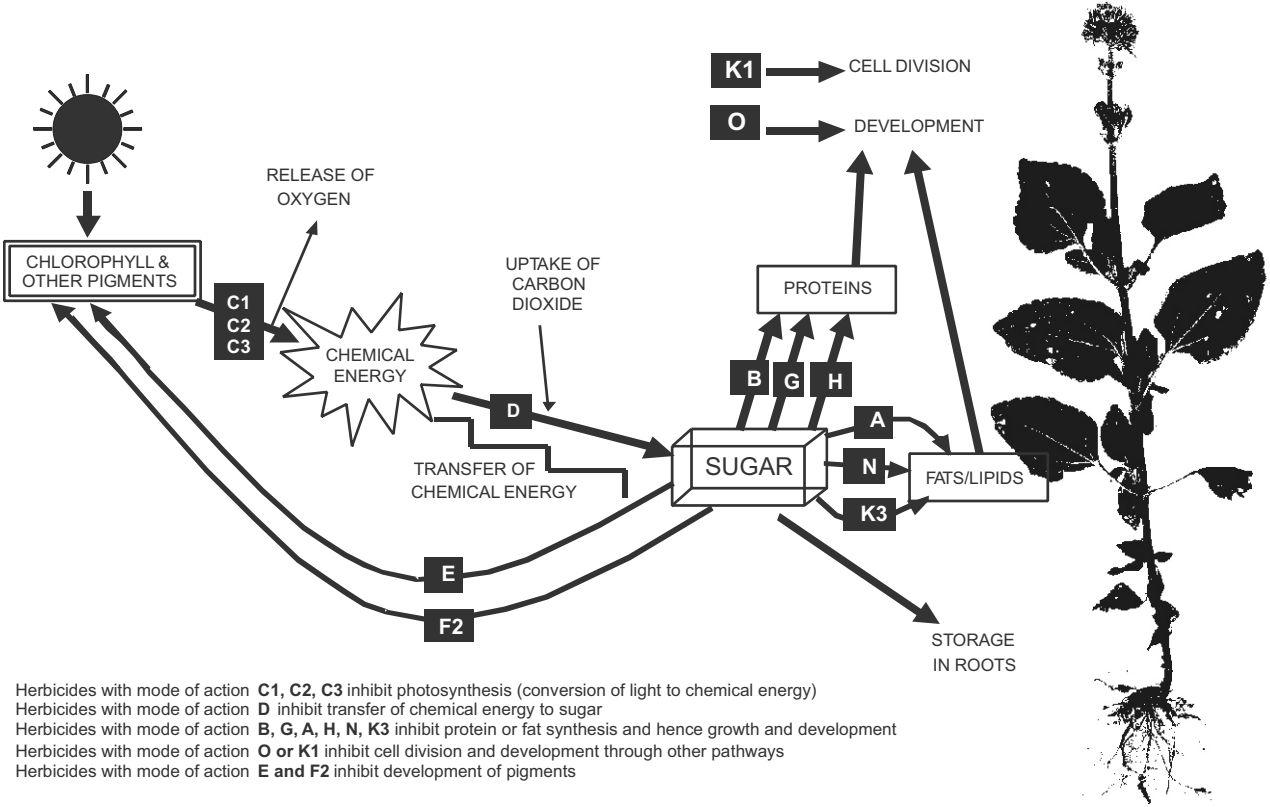
Any weed population may contain individuals naturally resistant to herbicide. Resistance develops after repeated applications of a single herbicide or herbicides with the same mode of action. Individual plants may eventually dominate the weed population if a herbicide is used repeatedly and exclusively in control programmes. To prevent or delay herbicide resistance, use a range of herbicides with different modes of action (Refer to page 60 for guidelines).

New herbicide labels now provide information on the mode of action of the formulation. For example, Lumax has three ingredients in its formulation that belong to different mode of action groups: C1, F2 and K3 (see table below). This product will inhibit photosynthesis (C1), development of pigments (F2) and fat synthesis (K3), and hence growth and development of target species.

Classification of herbicides registered for use in sugarcane according to mode of action

Herbicide	Mode of action	Herbicide	Mode of action	Herbicide	Mode of action
Fusilade Forte	A	Authority	E	Claw	K3
Servian	B	Merlin	F2	Eptam Super	N
Imazapyr	B	Glyphosate	G	Garlon 4	O
Ametryn	C1	Touchdown Plus	G	MCPA SL	O
Metribuzin	C1	Basta	H	MSMA	Z (unknown)
Velpar (hexazinone)	C1	Pendimethalin	K1	Extreme Plus	C1 + B
Dinamic	C1	Falcon Gold	K3	Lumax	C1 + F2 + K3
Diuron	C2	Metolachlor	K3	Parabat Extra	K1 + C1 + B
Tebusan SC	C2	Acetochlor	K3	Armadillo	F2 + C1
Gramoxone (paraquat)	D	Alachlor	K3	Squash	K3 + C1

Figure showing mode of action of different herbicides in a weed



Herbicides with mode of action **C1, C2, C3** inhibit photosynthesis (conversion of light to chemical energy)
Herbicides with mode of action **D** inhibit transfer of chemical energy to sugar
Herbicides with mode of action **B, G, A, H, N, K3** inhibit protein or fat synthesis and hence growth and development
Herbicides with mode of action **O or K1** inhibit cell division and development through other pathways
Herbicides with mode of action **E and F2** inhibit development of pigments

Guidelines to prevent or delay herbicide resistance:

1. Keep accurate spraying records for each field, give reasons for poor efficacy.

2. Apply herbicides according to label recommendations (correct rates and stages of weed growth). Ensure that equipment is properly calibrated. Do not reduce the recommended rates or experiment with your own 'cocktails'.

3. Rotate herbicides or use tank mixtures which contain products that have different modes of action.

   For example - Velpar (hexazinone) + diuron, or metribuzin + diuron, are both C1 + C2 tank mixtures. Repeated use of these tank mixtures for many years will increase the chances of weeds becoming resistant. These products can be rotated according to the weed spectrum and spraying conditions, e.g. with Falcon Gold + ametryn + MCPA (K3 + C1 + O) or acetochlor + ametryn + Gramoxone (K3 + C1 + D) or Lumax + Gramoxone (C1 + F2 + K3 + D).

4. To prevent the seed of resistant plants returning to the soil seed bank, apply herbicide to small weeds before they produce seed.

5. Integrate other control methods (chemical, cultural, biological) into weed control programmes.

6. For specific information on resistance management contact the registration holder or the SASRI weed control specialist.

HERBICIDE TOXICITY

Risk of herbicides to human health and the environment

There is increasing concern over the environmental impact of herbicides used in agriculture. Growers should become more familiar with the risk to their workforce and to the environment when using these herbicides. The label states the toxicity class of the herbicide as a colour band. Refer to the left hand side of the following page for more information, and page 63 for a list of herbicides registered for use in sugarcane and their corresponding label colours.

The Groundwater Ubiquity Score (GUS) was developed to classify herbicides for their water contamination potential. Refer to the right hand side of the following page. GUS is based on the soil/water partitioning coefficient (Koc) and the soil half-life (DT50) of each herbicide***. The basis of the model is that pesticides that are weakly adsorbed, and have prolonged soil persistence will have a greater potential to contaminate ground water. GUS scores are given for herbicides applied to a sandy soil and a clay soil.

Where the GUS index exceeds 2.8, a high pollution potential exists (score = 4).

Where the GUS index falls below 1.8, a low pollution potential exists (score 1 or 2).

CAUTION - Leaching properties of herbicides are not currently measured in a standardised way. There are at least two other leaching classification systems.

It must be noted that the potential of a pesticide to contaminate groundwater is also influenced by many other factors, including soil conditions, application methods, and irrigation practices.

Environmental risk***

Some labels state a restriction in use of the herbicide near water bodies and root zones of desirable plants. Refer to the right hand side of the following page for definitions, and to page 63 for the list of herbicides registered for use in sugarcane and their toxicity. Definitions and scores are given for the environmental risk of herbicides to terrestrial (mammals, birds and honey bees) and aquatic animals (*Daphnia* (a freshwater crustacean), and fish). Refer to page 64 for ways to minimise leaching of herbicides into groundwater.

Score 4 is very high toxicity to the animal, score 1 is low toxicity.

***Vencill, WK (Ed) (2002). *Herbicide Handbook* 8th Edition, Weed Science Society of America; Dow Agrosciences; Syngenta; Bayer Crop Science.

DEFINITIONS OF RISK TO HUMAN HEALTH (LABEL BAND COLOUR) AND SCORES FOR ENVIRONMENTAL RISK (LEACHING POTENTIAL AND EFFECT ON ANIMALS)

Risk to humans	Environmental risk		
	Category	Score	Definition
Toxicity to humans is in three ways: 1) by mouth (oral), 2) through the skin (dermal) or 3) through the nose (inhalation)		**1**	Low leaching potential. GUS = -0.6-0.5
		2	Medium leaching potential. GUS = 1.0-1.8
		3	High leaching potential. GUS = 1.9-2.8
		4	Very high leaching potential. GUS = 2.8-10.0
			**Water bodies** - the label states a use restriction of the herbicide within a certain distance of dams, rivers, boreholes.
Herbicides are classified according to their toxicity: **Class 1 - red band** = highly toxic, requiring extreme caution		**1**	Low toxicity to mammals (ORAL LD50 2000-8000 mg/kg)
		2	Medium toxicity to mammals (ORAL LD50 1000-2000 mg/kg)
		3	High toxicity to mammals (ORAL LD50 280-1000 mg/kg)
		4	Very high toxicity to mammals (ORAL LD50 48-160 mg/kg)
Class 2 - yellow band = toxic and described as harmful		**1**	Low toxicity to birds (LD50 2000-20000 mg/kg)
		2	Medium toxicity to birds (LD50 900-2000 mg/kg)
Class 3 - blue band = toxic with caution required		**3**	High toxicity to birds (LD50 200-900 mg/kg)
Class 4 - green band = relatively safe herbicide		**4**	Very high toxicity to birds (LD50 75-200 mg/kg)
		**1**	Low or no toxicity to bees (LD50 1000 ug/BEE - NON TOXIC)
		2	Medium high toxicity to bees (LD50 70-1000 ug/BEE)
Refer to the Table on page 65 for colour banding of the herbicides		**3**	High toxicity to bees (LD50 50-70 ug/BEE)
		4	Very high toxicity to bees (LD50 11-50 ug/BEE)
Remember that all herbicides are toxic even if they belong to class 4, and must be used according to the precautions stated on the label.		**1**	Low toxicity to fish (LC50 1800 mg/L - NON TOXIC)
		2	Medium toxicity to fish (LC50 50-300 mg/L)
		3	High toxicity to fish (LC50 1-20 mg/L)
Each grower should be familiar with the herbicides used and remedies for accidental intake by operators.		**4**	Very high toxicity to fish (LC50 0.023-1.0 mg/L)
		**1**	Low toxicity to daphnia (LC50 900 mg/L - NON TOXIC)
		2	Medium toxicity to daphnia (LC50 45-300 mg/L)
In case of accidents, contact the poison control centre at:		**3**	High toxicity to daphnia (LC50 4-25 mg/L)
		4	Very high toxicity to daphnia (LC50 0.11-4.0 mg/L)
082 911 (Netcare) **St Augustine's Hospital Poison Centre 0800 333 444**			**Avoid roots** - the label stipulates that the herbicide should be used away from root zones of neighbouring plants.

- Human toxicity is based on LD50 values. LD50 = the dose lethal to 50% of the test animals, usually rats.
- Animal toxicity is based on LD50 or LC50 values = the concentration of herbicide in the air, water or diet that will kill 50% of the test animals.

LIST OF HERBICIDES REGISTERED FOR USE IN SUGARCANE AND THEIR LABEL IN COLOURS

Herbicide		Human risk	Environmental risk								
			Leaching potential			Toxicity to terrestrial and aquatic environments					
Trade name	Active ingredients	Label colour band									
Acetochlor	acetochlor	Blue		1			1	2	1	3	3
Alachlor	alachlor	Yellow	4	3			1	1	2	2	4
Ametryn	ametryn	Yellow	4	2			1	1	2	4	3
Armadillo	sulcotrione + atrazine	Yellow	4	3			1	1	1	3	2
Arsenal GEN 2	imazapyr	Blue	4	4	x	x	1	1	2	2	2
Atrazine	atrazine	Yellow	4	3	x		2	2	1	3	2
Authority	sulfentrazone	Blue	3				1	1		2	2
Basta	glufosinate ammonium	Yellow	2	2			2	1	1	2	
Claw	metazachlor	Blue	4	4			1	1	1	3	
Dinamic	amicarbazone	Blue	4				2	1	2	2	2
Diuron	diuron	Green	3	3		x	1	2	1	3	3
Eptam Super	EPTC	Yellow	2	1			2	1	4	3	
Extreme Plus	chlorimuron-ethyl + metribuzin	Blue	4			x	2	4		2	3
Falcon Gold	S-metolachlor	Yellow	4				1	1	2	3	3
Fusilade Forte	fluazifop-butyl	Yellow	1	1	x		1	1	2	3	3
Garlon 4	triclopyr	Yellow	3	2			2	2	2	2	2
Glyphosate	glyphosate	Green-blue	1	1			1	1	1	3	3
Gramoxone	paraquat	Yellow	1	1			3	3		3	3
Lumax	mesotrione+S-metol.+terbuthyl	Yellow	4				1	2	1	3	2
MCPA	MCPA	Yellow	2	1			3	3	1		2
Merlin	isoxaflutole	Green	4	1		x	1	1	2	2	3
Metribuzin	metribuzin	Yellow	4	1			2	3	2	2	3
MSMA	MSMA	Yellow	4	1			3	2	2	1	2
Parabat + Extreme Plus	pendimethalin+metribuzin+ chlorimuron-ethyl	Yellow	4			x	2	4	2	4	4
Pendimethalin 500 EC	pendimethalin	Yellow	1	1			2	2	2	3	4
Servian	halosufuron	Green	4				1	1	2	2	2
Tebusan	tebuthiuron	Yellow	4		x	x	3	2	1	2	2
Velpar	hexazinone	Yellow	4		x	x	3	1	1	2	2
Voloxytril	ioxynil+bromoxynil	Yellow		1			4	4	2	4	4

Ways to minimise leaching of herbicides into groundwater:

1. In a tank mixture, consider the ingredient with the most serious environmental impact.

2. Irrigation increases mobility of herbicides. Do not over-irrigate or apply herbicide when heavy rains are expected.

3. Correct drainage problems.

4. Minimise runoff. Prevent erosion.

5. As organic matter increases, mobility decreases. Try to increase organic matter in all soils, especially where there is a high water table.

6. Increase in clay decreases mobility. Use the recommended application rates for the soil type. Do not use herbicide on sandy soils if there is a soil use restriction.

7. Do not use herbicide more than once in a season if there is a use restriction. This will prevent accumulative effects that might be present.

Management of creeping grasses

A) **A few "rules of thumb"**
The biggest problem with creeping grass control is one of scale. It is fairly easy to manage 1 hectare but more difficult if the extent of infestations covers 10 hectares or 100 hectares of your farm. A few general rules to improve management are as follows:

1) **Be realistic:** You cannot *eradicate* all creeping grass infestations on your farm but you can manage them.

2) **Be consistent in your control efforts:** Aim to reduce the extent (area covered) by the infestations.

3) **Repeated sprays:** Do not start to control new infestations until the areas already treated have been resprayed and contained.

4) **Small in-field patches:** Mark small in-field creeping grass patches with flags for rapid and accurate spot spray application each growing season. Fields with light infestations are high priority for control, requiring immediate attention before the area covered by the grass increases. Be vigilant, as repeated spraying is usually required to control slow-emerging runners.

5) **Practise field hygiene:** Ensure that mechanical operations such as ploughing, harrowing, ridging and even mechanical loading do not spread runners in the fields. Clean vehicles and implements to prevent spread within and between fields. Ensure that imported material such as manure or compost comes from a good source and is free of grass seed.

6) **Vigorous growth:** The grass **MUST** be growing vigorously and with a substantial amount of foliage to get the best results. This is stimulated by conditions of warmer temperatures, high humidity and good rainfall prior to application. **DO NOT** spray stressed grass. Actively growing grass absorbs more herbicide.

Results generally are better where application is after mid-summer.

B) **Current chemical control recommendations for creeping grasses**

1) **Small cane:** Repeated applications of 1.5-3L/ha Gramoxone + 2.5L/ha diuron OR Basta® are effective for knockdown control of Cynodon for 3-5 weeks. These must be applied as a directed inter-row spray in small cane, sometimes with shields to protect contact with cane leaves. This will affect the cane moderately to severely, depending on the height of the cane, but will suppress the creeping grasses sufficiently to allow the cane to grow.

2) **Tall cane:** Glyphosate is highly toxic to cane and is therefore used only as an under-canopy spray where the cane is tall with dead leaves on the lower portions of stalks. However, control is only temporary, as runners from the surviving grass in the rows will spread back to interrows.

3) **Field verges/edges:**

- Prevent encroachment into fields from the verges and cane breaks by chemical mowing with 8-10L/ha glyphosate 360, 5L/ha Fusilade Forte Hitech or 5.22 L/ha Arsenal GEN 2 near tall cane. 1.5-3L/ha Gramoxone + 2.5L/ha diuron is used near short cane.
- DO NOT USE only one active ingredient, as this might increase the risk of herbicide resistance. Keep verge control records, and ROTATE herbicides to avoid and reduce the risk of resistance to any one mode of action.
- Integrate other control methods into the verge weed control program, e.g. mechanical mowing, use of Melinis as a hedge to push cynodon out or planting a line of cane along the field edge to prevent drift and encroachment of runners into the field.
- DO NOT throw discarded creeping grass runners into fields during handweeding operations.

4) **Cynodon in rows:**

In small cane, control heavy infestations of cynodon by the “cut-back method” **.

This method can be adapted for small fields, with two spray operations:

a) Spray cynodon in the interrows using 8-10L/ha glyphosate 360.

b) The following day, slash the cane down to ground level, AVOID cutting the grass.

c) Rake the leaves into the treated interrows, away from the rows.

d) Spray the cynodon in the rows 24 hours after cutting the small cane.

e) Repeated follow-up spot spraying will be needed.

** For the conventional cut-back method, refer to SASRI Information Sheet 10.2 Creeping perennial grass weed control.

5) **Long fallow and minimum tillage:** The best opportunity to control creeping grasses is in fallow fields or when old sugarcane stools are to be eradicated prior to replanting. Glyphosate and Arsenal GEN 2 are registered to kill cane and at the same time will control the grass. Use a surfactant with glyphosate to help the herbicide action. Delay planting and apply repeat spot-sprays to any surviving grass as it emerges. This reduces the amount of live runners becoming buried during ridging and other mechanical planting operations. Do not plough out fields heavily infested with *Cynodon dactylon* as this buries some runners too deeply, with delayed emergence that allows escape from non-residual agrochemicals such as glyphosate. Refer to page 68 for more information regarding application of Arsenal GEN 2.

6) **Water quality:** Treat the water for spraying if it is of poor quality. Any water source e.g. from boreholes, dams, rivers and municipal water, must be clean and low in salt content. Water with a high salt content, especially calcium, magnesium and sodium, but also iron, potassium and bicarbonate in large amounts can reduce the activity of glyphosate and other herbicides. Test the water and speak to your local distributor about the registered adjuvants available to overcome any salt antagonism.

   NB: Follow the label specifications for each particular herbicide.
   NB: Never use fertiliser grade ammonium sulphate as an adjuvant, always ask for good quality products.

7) **Application rates:** Consider increasing the application rate of glyphosate to 8 L/ha for *Cynodon dactylon* and 10 L/ha for other creeping grasses, as the registered rates sometimes been inconsistent in the field under unfavourable spraying conditions. However, the best results are obtained when grass is actively growing.

Two new herbicides for creeping grass control:

Arsenal GEN 2®:

Arsenal GEN2® is now registered for control of creeping grass and old cane stools in **fallow fields.** Good agricultural practices are essential for applying this product as it is residual and kills growing cane.
Follow a 4-step approach:

Step 1: November/December: Harvest last ratoon.

Step 2: Mid-February to March: Apply Arsenal GEN2® for Cynodon control **and** cane stool eradication. The results are generally better where application is after mid-summer.

Step 3: Allow a fallow period of at least 4 months **AND** 600 mm rain before planting the new sugarcane crop. If liming is required, timing of application is critical – consult your supplier.

Step 4: If required, during the fallow period, apply glyphosate to control any missed Cynodon patches.

Minimise risk of crop damage: Persistence in soil is high, especially in soils with low pH. Incorrect use leads to crop damage. To avoid the risk of damage to cane, there must be more than 600 mm rain and 4 months fallow prior to planting. **Careful management is essential for timing of a) application, b) liming and c) planting the new crop.** Consult the supplier for instructions.

Minimise risk of environmental impact: Arsenal GEN 2® is generally safe on aquatic and terrestrial organisms. Leaching risk is high, especially in soils with a high pH and weak soil texture. The risk can be minimised by: **only** applying in fallow fields, **not** spot-spraying, **avoiding** surface runoff, **appropriate and careful timing** of lime application. Arsenal GEN 2® is broken down by microbes in soil and in 2-5 days by sunlight in surface water e.g. dams, rivers and does not bio-accumulate in aquatic organisms.

Basta®:

Basta® is a new chemistry for post and late post-emergence knockdown control of weeds, including *Cynodon dactylon* (Cynodon). It is environmentally friendly (to aquatic and terrestrial organisms, pages 62-63). Although the leaching risk is high, it is not residual, is broken down rapidly by microbes, and stays in the top 15 cm of soil. It is used as a directed spray between cane rows to minimise crop damage. Repeated directed applications of 7,5 L/ha are required for knockdown control of Cynodon.

Water quality and herbicide performance

Water is the most common liquid used to dilute herbicides and deliver them to the target weeds that they are intended to control. Poor quality water can seriously affect herbicide performance. Water quality depends on the source of the water (municipal, dam, river, borehole) and the season (e.g. heavy rain, drought).

The risks and consequences of neglecting to correct poor quality water, depending on the herbicides used, include:

a) Reduced effectiveness of weed control,
b) higher application rates required, with increased costs,
c) damage to the crop (this seldom happens), and
d) increased risk of herbicide resistance.

Three water quality variables that can impact the activity of many herbicides are:

1) Suspended soil particles (dirty water/water turbidity),
2) acidity and alkalinity, and
3) dissolved salts.

Note: Even though water quality might not be important to the performance of some herbicides, tank mixtures might include sensitive and insensitive products.

For more information about the collection and analyses of water samples, contact: SASRI Fertiliser Advisory Service (FAS) (Tel: 031-508 7000) or SASRI soil scientist (Tel: 031-508 7466).

For best performance:

- Take a water sample and get it tested for pH and dissolved salts. Test for calcium, magnesium, sodium and potassium (or at least an EC measurement).
- Check labels for use restrictions of water quality and the correct order of mixing chemicals in the spray tank to avoid incompatibility.
- Check labels for treatment of water.
- Obtain advice from the agrochemical company.

1) Suspended Soil Particles/dirt

a) **Turbid and dirty water:** Contains suspended solids, soil, or organic matter and can reduce effectiveness of post-emergence herbicides. Sensitive herbicides will bind to soil and organic matter particles suspended in water and will not be available for absorption into weed foliage.

b) **Note:** Dirt can also block nozzles, lines and filters and reduce the lifespan of the sprayer and its overall performance. Always choose a water source that is clean and clear (free of dirt, grit, and organic matter) for all herbicide applications.

c) **Note:** The same kind of inactivation can occur when these products are applied to plant surfaces that are covered with a layer of dust. Dust kicked up during the spraying operation may also result in reduced control, especially directly behind the sprayer.

d) **Strongly sensitive products:** Include Gramoxone (paraquat) and Roundup (glyphosate). These herbicides will bind to soil and organic matter particles suspended in water and will not be available for absorption into weed foliage.

2) Acidity and Alkalinity

a) Generally, spray water pH should be slightly acidic **(pH 4.5 to 6.0)** for most herbicides, with exceptions like sulfonylureas (e.g. Servian, Extreme Plus, Parabat Extra), and MCPA. Make sure to follow label directions of the herbicides you intend to use.

b) Only acidify or buffer a spray solution when specified on the label. **Do not over-acidify.**

c) Follow label directions on the amount of product and sequence of mixing to optimise compatibility over a wide range of conditions.

d) Herbicides sensitive to highly acidic spray water include EPTC (must be above pH 2), MCPA (must not be less than pH 7), Fusilade Forte and sulfonylureas. MCPA at low pH is insoluble and could result in physical incompatibility in the sprayer tank. Sulfonylureas are "less soluble" and often less effective at low pH.

e) Most herbicides are sensitive to highly alkaline spray water (pH 9 to 14).

Where the soil is acidic:

- Apply lime according to SASRI FAS recommendations to enhance crop growth.
- DO NOT USE pre-emergence herbicides on newly limed soil (follow label use restrictions).
- Select non-sensitive herbicides for pre-emergence application.
- Post-emergence application is effective provided the spray water of sensitive herbicides is treated according to label directions.

Where the soil is alkaline:

- Select non-sensitive herbicides for pre-emergence application.
- Post-emergence application is effective provided the spray water is acidified according to label directions.

3) Dissolved Salts:

a) **Poor quality water:** Can have a high percentage of dissolved positively charged salts (cations) like calcium, magnesium, sodium and potassium that antagonise herbicides. Negatively charged salts (anions) like carbonates, bicarbonates, chlorides and sulphates are normally not antagonistic, but are also found in the water that contains the above cations. Cations can cause some chemicals to precipitate, affect the balance of the surfactant system, affect properties like wetting and dispersion, and cause sensitive herbicides to become inactive by limiting their absorption by weed foliage. This can severely impact herbicidal efficacy.

b) **Herbicides and dissolved salts:** Some herbicides require or benefit from treatment of dissolved cations like calcium, magnesium, sodium and potassium salts with adjuvants that contain high grade ammonium sulphate. Such herbicides include some glyphosate products, Servian and MCPA.
Note: ammonium sulphate is not registered to be used with MCPA in South Africa.

Other products state that NO adjuvants should be added e.g. Fusilade Forte Hitech, Merlin, Terbo and certain glyphosate formulations. Treat water according to label directions and get advice from the agrochemical company.

c) **Fertiliser and herbicide timing:** Fertilisers can affect pre-emergence herbicide performance. To avoid this, follow the recommendations below:

- **For plant cane:** Apply fertiliser with cane in furrows at planting. Apply herbicide to moist soil after first rain.
- **For ratoon cane:** Apply herbicide after first rain. Apply fertiliser to actively growing cane, up to knee height.

d) **Lime and herbicide timing:** Herbicide efficacy can be reduced on newly limed soil in ratoon cane, especially for pre-emergence application, e.g. for Merlin. Where lime has been applied, post-emergence herbicides should be used.

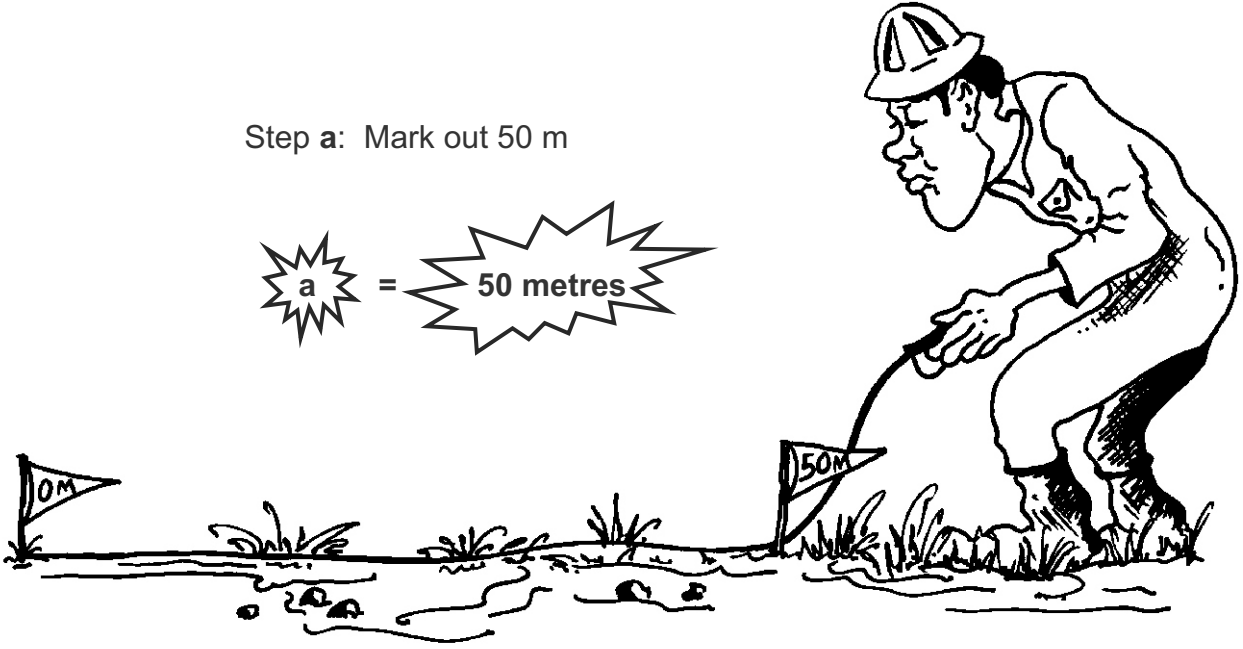
Practical Solutions if Water Quality is a Concern

- Test spray water and assess for suitability for spraying herbicides. **Contact SASRI FAS 031-508 7000**.
- Always start with a compatibility test before using spray water.
- Never add concentrated products to water. Rather, dilute with water before adding to a half filled spray tank. Top up the spray tank with water to the desired level.
- Reduce the water volume to the minimum required for good coverage and performance. Check the label for water volume specifications.
- Use herbicides that are least affected by water quality.
- Seek an alternative water source.
- Spray as soon as possible after adding the herbicide to the sprayer tank. DO NOT leave in tank overnight.
- Where water quality is a concern and there are concentrations of more than 150 ppm cations (e.g. calcium + magnesium + sodium + potassium), treat the spray water if stated on the label. High grade ammonium sulphate adjuvants, for example, will overcome the antagonistic effects of magnesium, calcium, sodium and potassium in the spray water.
- Do not use water where iron is shown to occur. When iron that is dissolved in groundwater is exposed to the air, it can oxidize and produce an orange precipitate that can plug screens and nozzles.

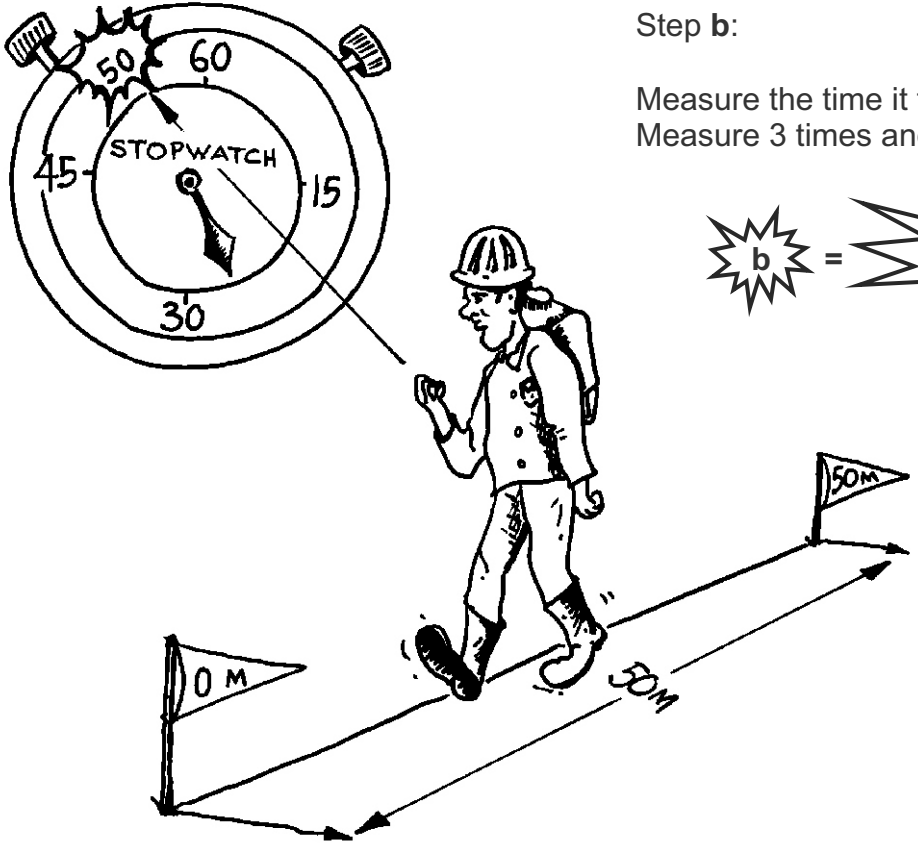
Special thanks are due to Dr Brian de Villiers for his technical input and review of this section 'Water quality and herbicide performance'.

CALIBRATION OF A KNAPSACK SPRAYER

Step **a**: Mark out 50 m



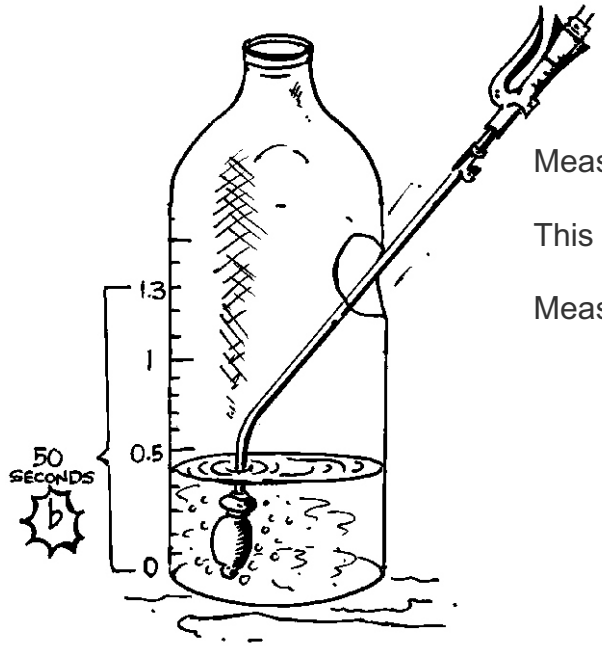
Cartoons copied from AE Loxton (1983): *Weed Control in Forestry*.



Step **b**:

Measure the time it takes to walk 50 m.
Measure 3 times and take an average.

b = 50 seconds



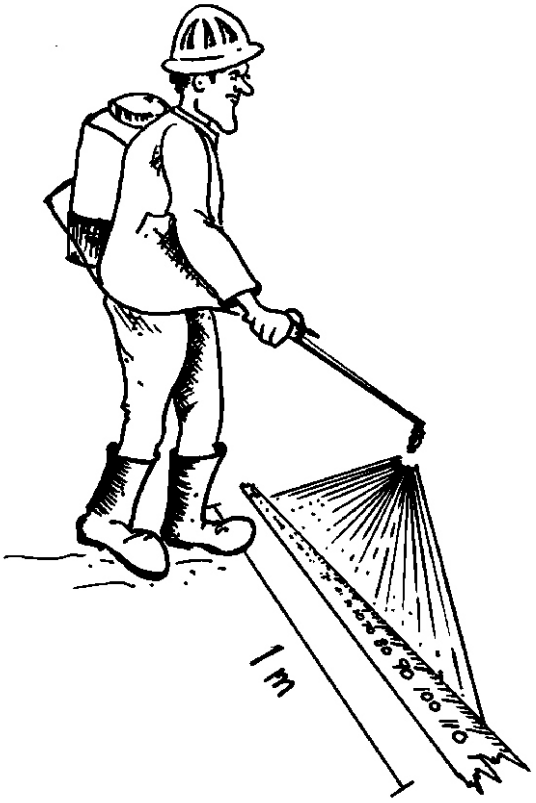
Step **c**:

Measure the volume sprayed for 50 seconds.

This was the time taken to walk 50 m (Step b).

Measure 3 times and take an average.

c = **1,3 litres**



Step **d**:

Take the sprayer to a level, clean surface and measure the swath/spray width.

d = 1 metre

STEP e : CALCULATIONS

Work out the spray volume of water for the size of the field.
Example: field size = 1 hectare = 10 000 m^2

$$c \times \frac{10\,000\ m^2}{a \times d} = 1{,}3 \text{ litres} \times \frac{10\,000\ m^2}{50\ m \times 1{,}0\ m} = \underline{\textbf{260 L/ha}}\ e$$

Now work out the volume of herbicide to be added to a 15 L knapsack where the herbicide is recommended at 4 L/ha

$$\frac{4 \text{ L recommended} \times 15 \text{ L knapsack} \times 1\,000}{\textbf{e}} = \frac{4 \text{ L} \times 15 \text{ L} \times 1\,000}{260 \text{ L/ha}}$$

= **230 ml** herbicide must go into the knapsack

How many metres of row can you spray with a 15 L knapsack?

$$\frac{15 \text{ L} \times \textbf{a}}{\textbf{c}} = \frac{15 \text{ L} \times 50 \text{ m}}{1{,}3 \text{ L}} = \textbf{577 m}$$

How many 15 L knapsacks do you need for a one hectare field?

$$\frac{\textbf{e}}{15 \text{ L}} = \frac{260 \text{ L/ha}}{15 \text{ L}} = \textbf{17,3 knapsacks}$$

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