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Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control—1998

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The tables herein summarize herbicide trials for the control of pasture, range, and non-cropland weeds conducted by the College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa; the Hawaii Department of Agriculture; the Division of Forestry and Wildlife of the Hawaii Department of Land and Natural Resources; and other cooperators. These preliminary data are published to assist applicators experimenting with herbicides for weed control. The herbicide applicator is cautioned to confirm that any herbicide use, rate, or method of application conforms to the product label.

Rating weed response to herbicides

Weed response to treatment is evaluated by different methods. Plant injury may be scored on a 0–100 scale in which the score is a subjective evaluation of the severity of injury:

0	No symptoms
10–30	Insignificant to poor weed control; little or no defoliation
40–60	Inadequate weed control; moderately severe symptoms; less than 70% defoliated
70	Adequate weed control; severe symptoms; all leaves chlorotic or more than 70% defoliated
80	Good weed control; very severe symptoms; 80% defoliated
90	Excellent weed control; very severe symptoms; 90% defoliation
100	Complete control; no sign of life

In addition to the scale described above, efficacy of treatments may be determined by estimation of defoliation or its opposite, remaining weed cover. The method used depends on the growth habit of the weed. Response may also be measured by counting the number of surviving plants or stems, by measuring weed height, or a combination of these.

Methods of herbicide application

Foliar

See: Motooka, Philip, Guy Nagai, and Lincoln Ching. 1982. Weed and brush control in pastures and ranges of Hawaii: I. Foliar application of herbicides. HITAHR Brief 16. CTAHR. 6 p.

Basal bark and basal stump

See: Motooka, Philip, Guy Nagai, and Lincoln Ching. 1982. Weed and brush control in pastures and ranges of Hawaii: II. Basal bark method of herbicide application. HITAHR Brief 17. CTAHR. 3 p.

Cut-surface

See: Motooka, Philip, Guy Nagai, and Lincoln Ching. 1982. Weed and brush control in pastures and ranges of Hawaii: III. The notching method of herbicide application. HITAHR Brief 18. CTAHR. 4 p.

Soil application

See: Motooka, Philip, Guy Nagai, and Lincoln Ching. 1982. Weed and brush control in pastures and ranges of Hawaii: IV. Soil application of herbicides. HITAHR Brief 19. CTAHR. 3 p.

Drizzle application

See: Motooka, P., G. Nagai, and L. Ching. 1983. The "magic wand" method of herbicide application. Proc. Ninth Asian Pacific Weed Sci Soc. Conf. Suppl. Vol. p. 550–553.

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Herbicides tested

Chemical	Trade name and manufacturer
2,4-D	Amine salt formulation, various brands Ester formulation, various brands
Dicamba	Banvel (Sandoz)
Glyphosate	Rodeo (Monsanto) Roundup (Monsanto)
Imazapyc	Plateau (American Cyanamid)
Metsulfuron	Escort (DuPont)
Triclopyr	Garlon 4 (DowElanco) Remedy (DowElanco) Redeem (DowElanco) Pathfinder II (Dow Elanco)

Weeds

Albizia	*Albizia lebbeck* (L.) Benth.
Bahiagrass	*Paspalum notatum* Flugge
Bermudagrass, manienie	*Cynadon dactylon* L.
Catsclaw	*Caesalpinia decapetala* (Roth) Alston
Downy rosemyrtle	*Rhodomyrtus tomentosa* (Aiton) Hassk.
Gorse	*Ulex europaeus* L.
Ivy gourd	*Coccinea grandis* (L.) Voigt
Jobs tears	*Coix lachryma-jobi* L.
Kahili ginger	*Hedychium gardnerianum* Ker-Gawl.
Lantana	*Lantana camara* L.
Madagascar fireweed	*Senecio madagascariensis* Poir.
Melastoma	*Melastoma candidum* D. Don.
Pangolagrass	*Digitaria pentzii* Stent (Syn. *D. decumbens*).
Paragrass, californiagrass	*Brachiaria mutica* (Forssk.) Stapf.
Strawberry guava	*Psidium cattleianum* Sabine
Smutgrass	*Sporobolus indicus* (L.) R. Br.
Uluhe, false staghorn fern	*Dicranopteris linearis* (Burm.) Underw.
Water hyacinth	*Eichhornia crassipes* (Mart.) Solms
Wild olive	*Olea europaea* L.

Observations

Several trials in 1998 involved the very-low-volume (VLV) drizzle application method developed by Shigeo Uyeda of Kauai. Because the method employs very low volumes (1.5 gal/A), it is very labor-efficient (1998, Proc. West. Soc. Seed Sci., p. 124–127). In foliar applications with water as the carrier, triclopyr at 0.25 to 2 lb/A was effective on catsclaw (Tables 2, 3). Although there was eventual resprouting, that appeared to be because of a shadow effect, as most of the resprouting was on the side of the plant opposite the direction of application. Thus a repeat application or split applications from opposite directions would probably provide almost complete control of catsclaw at relatively low rates of application. Glyphosate was effective on lantana (Table 10). Where plants are tolerant of herbicides in water carrier, non-phytotoxic crop oil may increase efficacy by promoting uptake of oil-soluble herbicides. Gorse, tolerant of triclopyr in water, was susceptible to triclopyr in crop oil (Table 7). Triclopyr in crop oil was also effective as a VLV basal bark application on albizia and strawberry guava (Table 1, 16). Melastoma and Formosan koa were somewhat tolerant of VLV basal bark applications (Table 1, 5) but may be susceptible to applications from opposite sides of the plants and repeat applications, as was downy rosemyrtle (Table 4).

In conventional herbicide applications, crop oil was effective as an adjuvant in the control of gorse (Table 6). A new herbicide, imazapyc, was evaluated for selectively controlling bunch grasses in non-crop situations. Imazapyc severely injured guineagrass (Table 8). The symptoms included chlorosis, necrosis, and stunting. Imazapyc was less effective on guineagrass in a roadside environment (Table 9), but that area suffered a drought after application. Imazapyc suppressed smutgrass without injury to bahiagrass, but pangolagrass was eliminated from all treated plots (Table 15). The rapidly spreading Madagascar fireweed was not as susceptible to 2,4-D and triclopyr as in previous trials, but the fireweed in this trial was very rank (Table 12). Wild olive saplings were susceptible to conventional basal bark applications of triclopyr but less so to 2,4-D (Table 13). Large olive trees were sensitive to notching applications of triclopyr, glyphosate, and 2,4-D but somewhat less susceptible to dicamba (Table 14).

In a non-herbicide study, the viability of ivy gourd seed (Table 10) remained high when stored under dry

conditions at ambient temperatures or refrigerated for one year but demonstrated no dormancy in soil exposed to the weather. This suggests that ivy gourd can be eradicated from small areas with a diligent control program.

Table 1. Response of albizia, melastoma, and strawberry guava to very-low-volume basal bark applications of triclopyr (G97-1-3).
Date installed: 04/10/97; Date rated: various; Location: Wailua, Kauai; Investigators: G. Kawakami, G. Nagai, L. Ching, P. Motooka; Notes: Ready-to-use Pathfinder II (DowElanco) used.

Species	Defoliation (%) on date: 04/10	01/28
Albizia[1]	84	79
Melastoma[2]	43	63
Strawberry guava[3]	88	93

[1]Very susceptible; trees 8 inches dbh survived but were severely injured; smaller plants killed; six replicates.
[2]Sprouted multiple roots at nodes; four replicates.
[3]Ten replicates.

Table 2. Catsclaw response to drizzle application of triclopyr ester in a crop oil carrier (K98-2).
Date installed: 06/09/98; Date evaluated: various; Location: Captain Cook; Cooperator: Kealakekua Development Corp.; Investigator: P. Motooka; Notes: Spray volume rate (SVR) 1.5 gal/A, 1 lb a.e./A triclopyr.

Adjuvant	Defoliation (%) on date: 07/10	09/16	12/14
No treatment check	0	0	0
Bivert (4%)	96	76	35
Silwet L-77, 0.25%	95	81	56
Forest Crop Oil (10%)	98	97	75
Forest Crop Oil (50%)	97	93	68
Forest Crop Oil (100)	96	84	60

Table 3. Catsclaw response to drizzle applications of low rates of triclopyr (98-8).
Date installed: 10/06/98 Date rated: 12/14/98; Location: Kealakekua; Investigator: P. Motooka; Cooperator: Kealakekua Development Corp.; Notes: Branches on lee side of the application were less injured.

Rate (kg/ha)	Defoliation (%) on 12/14
Check	0
0.25	66
0.5	62
2	94

Table 4. Clearing downy rosemyrtle on trails by very-low-volume basal bark applications of triclopyr (G97-27).
Date installed: 10/30/97; Location: Wailua, Kauai; Investigators: G. Kawakami, L. Ching, G. Nagai, P. Motooka; Notes: 20% triclopyr ester in crop oil. Reapplied 05/21/98. Two-pass treatment applied from opposite directions.

Treatment	Defoliation (%) on date: 1/28/98	04/27	08/12
Check	11	22	5
One pass	35	18	40
Two passes	54	25	84

Table 5. Control of Formosan koa by very-low-volume basal bark applications of triclopyr (G97-23).
Date installed: 10/30/97; Date rated: 04/27/98; Location: Wailua; Investigators: L. Ching, G. Nagai, G. Kawakami, P. Motooka; Cooperator: J. Sanchez; Notes: Check = no treatment, Conv = Conventional application of 4% triclopyr product in diesel, Die = very-low volume basal bark application of 20% triclopyr product in diesel, Hbi = 20% triclopyr product in Herbimax, Path = Pathfinder II.

Treatment	Defoliation (%)
Check	11
Die	15
Hbi	18
Path	58
Conv	100

Table 6. Gorse response to triclopyr ester with crop oil adjuvant (K98-4).
Date installed: 06/30/98; Date rated: varies; Location: Humuula; Investigators: A. Kawabata, M. DuPonte, P. Motooka; Cooperator: Parker Ranch; Notes: Triclopyr applied at 1 lb a.e./A, SVR 34 gpa. L-77 = Silwet L-77, FCO = Forest Crop Oil.

	Defoliation (%) on date:	
Adjuvant	08/04	09/30
Check	0	0
L-77 0.25%	76	86
FCO 1.5%	83	91
FCO 3%	82	91
FCO 6%	84	89

Table 7. Gorse response to drizzle applications of triclopyr ester with crop oil (K98-4).
Date installed: 06/30/98; Date rated: various; Location: Humuula; Investigators: M. DuPonte, A. Kawabata, P. Motooka; Cooperator: Parker Ranch.

Triclopyr rate (lb a.e./A)	Crop oil conc. (%)	Defoliation (%) on date: 08/04	09/30
0	0	0	0
1	50	41	80
1	100	45	80
2	50	58	91
2	100	66	90

Table 8. Guineagrass response to imazapyc (G98-10).
Date installed: 08/24/98; Location: Lawai; Investigators: G. Nagai, L. Ching, P. Motooka; Cooperators: G. Uyenten; Notes: Guineagrass mowed, treated when regrowth at knee high. Same treatments reapplied to respective plots on 11/23/98.

Rate	Injury rating		Height (inches)
(kg/ha)	09/22*	10/20**	on 11/18***
0	0	0	60
0.28	49	66	26
0.56	69	79	20
0.84	72	81	26

*Stunting, chlorosis. ** Stunting, chlorosis, necrosis.
*** No visible symptoms except height.

Table 9. Control of guineagrass on roadsides with imazapyc (G98-8).
Date installed: 08/24/98; Date rated: 12/08/98; Location: Hanamaulu; Investigators: L. Ching, G. Nagai, P. Motooka; Cooperators: Hawaii DOT; Notes: Grass kept mowed throughout trial. Drought after application until shortly before evaluation. Burmudagrass survived treatment.

Rate (kg/ha)	Guineagrass cover (%)
0	89
0.28	79
0.56	65
0.84	41

Table 10. Viability of ivy gourd seed. (K97-3)
Date installed: 08/01/97; Date rated: 08/10/98; Investigator: P.Motooka; Notes: *Coccinea grandis* fruit collected in Kona, seed extracted, washed and dried. Buried seed placed in nylon bag and buried in pots under 10 cm of soil and pots placed on open bench in Kailua-Kona.

	Germination (%) at Incubation period (mo)			
Treatment	0	3	6	12
Room temperature	94	88	67	85
Refrigerated (15°C)		91	93	90
Buried		10	2	2

Table 11. Lantana response to drizzle application of glyphosate (G97-13).
Date installed: 05/29/97; Date rated: various; Location: Kokee; Investigators: G. Kawakami, G. Nagai, L. Ching, P. Motooka; Notes: Drizzle application at 1.5 gal/A SVR.

Rate	Defoliation (%) on date:			
(lb/A)	10/28	01/27/98	04/29	10/20
0	0	10	4	0
0.5	88	95	72	70
1.0	98	98	97	90

Table 12. Madagascar fireweed response to 2,4-D and triclopyr (K98-1).
Date installed: 04/30/98; Date rated: various; Location: Kamuela; Investigators: A. Kawabata, P. Motooka; Cooperator: A. Lindsey.

Herbicide	Rate (lb/A)	Fireweed cover /mo (%) 1	4
Check	0	55	38
2,4-D amine	0.25	12	18
	5.5	17	37
	1.0	8	25
2,4-D ester	0.25	13	20
Triclopyr amine	0.25	16	35

Table 13. Control of large olive trees by notching (G-97-21).
Date installed: 10/28/97; Date rated: 10/21/ 98; Location: Kokee; Investigators: G. Kawakami, G. Nagai, L. Ching, P. Motooka; Notes: Notches at base of trunks made with a machete every 4 inches around circumference. 1 ml of herbicide applied to each wound.

Herbicide	Defoliation (%)	Kill (%)
Check	4	0
2,4-D	74	0
Dicamba	56	0
Glyphosate	80	20
Triclopyr	92	30

Table 14. Contol of olive saplings by basal bark applications of 2,4-D and triclopyr (G-97-22).
Date installed: 10/28/97; Date rated: 04/29/98; Location: Kokee; Investigators: G. Kawakami, G. Nagai, L. Ching, P. Motooka; Notes: Application of 4% of commericial product in diesel oil.

Herbicide	Defoliaton (%)
Check	8
2,4-D	49
Triclopyr	90

Table 15. Smutgrass response to imazapyc (G98-6).
Date installed: 08/23/98; Date rated: 11/23/98; Location: Wailua, Kauai; Investigators: L. Ching, G. Nagai, P. Motooka; Notes: Pangolagrass, initially present in all plots, eliminated by imazapyc. Bahiagrass, present in a few plots, was tolerant.

Rate (lb/A)	Injury rating
0	4
0.56	55
0.84	68

Table 16. Response of strawberry guava to very-low volume basal bark applications of triclopyr (G97-15).
Date installed: 05/29/97; Date rated: 05/19/98; Location: Kokee; Investigators: G. Kawakami, L. Ching, G. Nagai, P. Motooka; Notes: Streaks = number of streaks made across stems. Triclopyr ester diluted to 20% of product in Herbimax oil adjuvant.

Streaks	Volume/stem (ml)	Defoliation (%)
0	0	8
4	2.7	69
6	4.0	91
8	5.4	87

Continued, over

Table 17. Unreplicated or unrandomized demonstrations.

Weed	Herbicide*	Rate*/Conc.	Method	Injury	Reps	Duration (mo)	Site
Jobs tears	Glyphosate	2 lb /A	drizzle	100%	1	1	Kauai
Kahili ginger	Metsulfuron	0.4 oz/A	foliar spray	90%	1	3	Kona
Kahili ginger	Triclopyr	1 lb /A	drizzle	40%	1	3	Kona
Kahili ginger	Triclopyr	2 lb/A	drizzle	65%	1	3	Kona
Paragrass	Glyphosate	0.5 lb/A	drizzle	100%	1	1	Kauai
Uluhe	Triclopyr	2 lb/A	drizzle	75%	1	3	Wailua
Uluhe	Glyphosate	0.5 lb/A	drizzle	70%	1	3	Wailua
Water hyacin	Glyphosate	0.5 lb/A	drizzle	100%	1	1	Kauai

* Active.