CONTROL OF ANNUAL GRASS WEEDS WITH HALOXYFOP, IN NORTHERN N.S.W. AND QUEENSLAND

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Summary. From 1982-86 haloxyfop was evaluated for control of annual grass weeds. Haloxyfop at 78 g a.i./ha gave excellant control of wild oats, *Avena ludoviciana*, and paradoxa grass, *Phalaris paradoxa*. Summer grasses including liverseed grass, *Urochloa panicoides*, barnyard grass, *Echinochloa* spp., crowsfoot grass, *Eleusine indica*, Australian millet, *Panicum decompositum* and volunteer sorghum, *Sorghum bicolor* were controlled with haloxyfop applied at 104 g/ha. Activity of haloxyfop was similar to fluazifop-P and two to three times that of glyphosate on these annual grasses. Optimum control with haloxyfop was achieved when applied to actively growing grasses between the 3-leaf and early tillering stages. Haloxyfop was compatible with bentazone and acifluorfen-sodium when applied in tank mixture for grass and broad-leaved weed control. Both haloxyfop and fluazifop-P were rainfast within one hour of application under field conditions.

INTRODUCTION

Haloxyfop (Verdict® 104) is one of several new aryloxyphenoxy propionate herbicides being developed for the control of grass weeds in broad-leaved crops. The post-emergence activity of the methyl ester and ethoxyethyl ester formulations of haloxyfop on annual and perennial grasses and selectivity to broad-leaved crops has been documented (1, 6, 11, 18). Results indicate that haloxyfop is most effective when applied to actively growing grasses between the 3-leaf and early tillering stages of growth. Haloxyfop is rainfast within one hour of application (3, 15). This paper reports the results of field trials with haloxyfop conducted between 1982-86 in Queensland and Northern N.S.W. to determine:

1. activity on a range of annual grasses,
2. compatability with bentazone and acifluorfen, and
3. rainfastness.

METHODS

Trials were carried out with the ethoxyethyl ester formulation containing 104 g/L haloxyfop acid. An adequate level of non-ionic surfactant was present in the formulation for normal broadacre spraying. Additional surfactant or crop oil (D-C-Tron®, Ulvapron®, Tregspray miscible summer oil®) was investigated in some experiments.

Sites were selected to include the major soil types and grass species. The stage of growth of the grasses at application ranged from ZGS 12 to 18/27.

A randomized complete block design with three or four replicates was used in most experiments although at some sites logarithmic screening was used to observe dose responses. Treatments were applied with a propane sprayer delivering 100 L/ha (in some experiments haloxyfop was applied in other volumes).

Visual assessments of weed control were made four to six weeks after application using a 0-100 rating scale. Wherever possible plant counts were taken from either randomly placed quadrats or along a line transect. These data were also expressed as a percentage of controls. The data from several seasons trials were bulked for each herbicide treatment and are presented as a mean figure in Table 1.

In the rainfastness trials simulated rainfall was evenly applied 30 and 60 minutes after application of herbicides with a Spraying Systems 43HR handgun with D8 orifice. Rainfall levels equivalent to 1.5 to 2.5 mm for annual summer grasses and 8 mm for annual winter grasses were applied over a 15 minute period and checked by placing raingauges throughout the plots.

RESULTS AND DISCUSSION

Haloxyfop applied at 78 g/ha gave commercially acceptable (85%) control of wild oats and paradoxa grass (Table 1). Increasing the rate to 104 g/ha improved the level of control and reduced the variability between sites. The activity of haloxyfop was similar to fluazifop on wild oats and twice that of glyphosate. For consistent control of the two dominant annual summer grasses, liverseed grass and barnyard grass, 104 g/ha of haloxyfop was required. Fluazifop applied at 106 g/ha gave similar control but with more variability. These data show haloxyfop to be two to three times as active as glyphosate. Results show haloxyfop also provided acceptable control of crowsfoot grass, Australian millet, and volunteer sorghum, at a dosage of 104 g/ha and summer grass, *Digitaria sanguinalis* at 156 g/ha.

Haloxyfop was more effective under optimal growing conditions. Environmental conditions such as moisture stress, which limit the activity of related post-emergence herbicides or the stage of growth at application (grasses should be younger than Zadoks 15, 25) also reduced the activity of haloxyfop. Haloxyfop applied at up to 240 g/ha did not induce any phytotoxicity in a range of broadleaf crops including soybean, cotton, peanuts and sunflower.

Many studies have been conducted to examine the interaction between broad-leaved herbicides and haloxyfop. The work to date suggests that most broad-leaved herbicides antagonise haloxyfop with the greatest antagonism being caused by the phenoxy herbicides (e.g. MCPA, 2,4-D etc.) and the least with pyridine compounds (picloram, clopyralid and fluroxypr), dicamba and the sulfonyl ureas. Bentazon, acifluorfen, cyanazine, atrazine, ioxynil and bromoxynil fall between the two extremes (2, 7, 8, 10, 14, 19, 20). The mechanism of antagonism appears to be primarily associated with reduction in leaf penetration caused by the broad-leaved herbicides (6) and to a lesser extent reduction in translocation within the plant (22).

Results of trials which tested the compatibility of tank-mixes of haloxyfop and bentazone or acifluorfen under Australian conditions are presented in Table 2.

Some antagonism (reduction in grass control) was observed in the tank-mix treatments containing the label rates of haloxyfop (104-156 g/ha) and the maximum label rates of bentazone (960 g/ha) or acifluorfen (448 g/ha) but the level of grass control was usually acceptable when the treated grasses had no more than five leaves. Results were variable if grasses were treated after this growth stage, and when the tank-mixes were applied under sub-optimal growing conditions (dry).

Results were also variable when tank-mixes were applied to species known to be difficult to control e.g. *Digitaria* spp. and rhizome Johnson grass, *Sorghum halepense*. Similar findings have been reported in the U.S.A. (9, 21).

Table 1. Annual grass control (%) four to six weeks after post-emergence application of haloxyfop in northern Australia 1982-86[a]

Herbicide	Rate (g/ha)	Wild oats	Paradoxa grass	Liverseed grass	Barnyard grass	Crowsfoot grass	Aust. millet	Volunteer sorghum
Haloxyfop	52-60	82 (24%) [9]	63 (47%) [5]	77 (31%) [17]	72(26%) [13]			
Haloxyfop	78	90 (12%) [14]	85 (22%) [5]	86 (17%) [10]	77 (27%) [13]	58 [3]		82 [2]
Haloxyfop	104	97 (4%) [9]		85 (18%) [16]	85 (11%) [17]	90 [4]	93 [4]	89 [4]
Haloxyfop	156			100 [3]	97 [4]			
Fluazifop	106	98 (3%) [4]			73 (42%) [5]			73 [3]
Glyphosate	180	89 (9%) [7]		67 [3]	75 [3]			

[a] Fluazifop was applied with 0.25% (v/v) non-ionic surfactant
[] Indicates the number of trials
() Indicates coefficient of variation c.v.

Table 2. Compatability of haloxyfop with bentazone and acifluorfen for annual grass control (% control 4 to 6 weeks after application) in northern Australia[a]

Grass	Rate	Summer grass		Mossman River grass		Barnyard grass				
ZGS	(g/ha)	15/25	18/27	12	17/23	12 to 15	15/22	16/25	15/22	15/24
Haloxyfop	104	-	80	90	80	100	80	43	100	83
Haloxyfop	156	62	90	90	-	-	83	73	100	85
Haloxyfop+bentazone	104+960	-	70	96	57	93	80	33	99	70
Haloxyfop+bentazone	156+960	40	80	-	-	-	90	35	-	-
Haloxyfop+acifluorfen	104+448	-	60	85	58	76	70	45	91	95
Haloxyfop+acifluorfen	156+448	0	45	-	-	-	90	36	-	-

[a] All treatments applied with the addition of 1% (v/v) petroleum crop oil (Tregspray miscible summer oil) at 1% of spray volume

The addition of petroleum crop oil did not overcome the antagonism in these instances. Acifluorfen was generally more antagonistic to haloxyfop than bentazone (21), and had to be applied to smaller grasses or under optimal growing conditions to achieve acceptable grass control. Acifluorfen and haloxyfop tank-mixes were also more phytotoxic to soybean than bentazone/haloxyfop tank-mixes.

Haloxyfop did not reduce the broad-leaved weed activity of either bentazone or acifluorfen.

Haloxyfop, fluazifop and glyphosate applied at recommended rates gave excellent control of wild oats, liverseed grass, barnyard grass and sorghum in the absence of simulated rainfall. In all cases the activity of glyphosate was reduced by simulated rainfall. Both haloxyfop and fluazifop-P were rainfast 60 minutes after application. Trial design precluded the use of statistical analysis on these data but results were supported by previous work (3, 15). Both haloxyfop and fluazifop have been shown to be readily absorbed by plant foliage (4, 13), and this work carried out in the field confirms the rapid uptake of these products.

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