IOXYNIL AND BROMOXYNIL — FIELD TRIALS IN CEREALS

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Summary

Three trials in cereals were conducted with the halogenated benzonitrile herbicides, ioxynil and bromoxynil. Some weeds normally resistant to MCPA and 2,4-D were controlled, though for the widest spectrum of control it is suggested that mixtures with MCPA or mecoprop should be used. The rapid herbicidal action and the wide range of crop tolerance are major advantages for the two herbicides.

INTRODUCTION

THE HERBICIDAL ACTIVITY of the 3,5-dihalogeno-4-hydroxybenzonitriles was first reported simultaneously by Carpenter and Haywood (1963) and Wain (1963). Their papers described ioxynil and bromoxynil as being active against annual weeds at low rates of application. Terry and Wilson (1964) showed that both materials are well tolerated by cereals and that they controlled most of the important weeds of cereals including some normally resistant to the phenoxyalkanoic acid herbicides. Formulation of the materials is important, the amount of wetter, for instance, markedly affecting the control of fathen (*Chenopodium album*). Extensive field trials reported by Carpenter *et al.* (1964) demonstrated the effectiveness of mixtures of ioxynil with MCPA and with mecoprop. Ball *et al.* (1964) showed that bromoxynil is safer than ioxynil on lucerne and red and white clover and that the clovers are more sensitive than lucerne to both compounds.

The cereal trials described in this paper were designed to assess the herbicidal activity of ioxynil and bromoxynil under New Zealand conditions. All rates are in ounces active ingredient per acre.

METHODS AND MATERIALS

The following compounds were used in the trials.

Common Name (and Formulation Code No.)	*Formulation*
Ioxynil (NPH/1250)	Aqueous solution of sodium salt equivalent to 40% w/v of ioxynil with added wetter.
Bromoxynil (NPH/1320)	Emulsifiable concentrate of the octanoyl ester equivalent to 25% w/v bromoxynil.
2,4-D	Aqueous solution of dimethylamine salt containing 4 lb a.i. per gallon.

Trial Sites

211. Marton: Mengarvi wheat 3- to 4-leaf 8 to 10 in.
212. Sanson: Gemenya wheat 8 to 10 in. tillering.
214. Masterton: Carlsberg barley 8 to 10 in. tillering.

Plot Size

30 ft × 6 ft. There were two replications of each treatment.

Treatments

Treatments	*Rate*
1. NPH/1250	4 oz
2. NPH/1250	8 oz
3. NPH/1250	12 oz
4. NPH/1320	3 oz
5. NPH/1320	6 oz
6. NPH/1320	9 oz
7. Amine 2,4-D:	
Sites 211, 212	16 oz
Site 214	12 oz
8. Control	

All treatments were applied with an experimental sprayer in 14.5 gal of water per acre through 730154 Teejets at 30 lb/sq. in. and 3 m.p.h.

ASSESSMENTS

Weed Control

Weed counts were made in 2 × ½ sq. yd quadrats per plot on the day of spraying or the day before, 3 weeks after spraying and 6 to 7 weeks after spraying.

Crop Tolerance

Assessments were made of leaf scorch one week and three weeks after spraying.

RESULTS

Weed Control

The percentage reduction in weed numbers from the various treatments is summarized in Table 1.

The rapid action of ioxynil and bromoxynil is shown clearly by the near-maximum control that was achieved after three weeks. (The later improvements in results on shepherd's purse (*Capsella bursa-pastoris*) and spurrey (*Spergula arvensis*) were probably due to the very dry conditions of site 214.) The control with 2,4-D took five to six weeks to be fully manifest. Ioxynil and bromoxynil were superior to 2,4-D against redshank (*Polygonum persicaria*), the superiority being very marked. Even at the lowest rates both materials gave excellent control of this weed when it was treated at the 2- to 4-leaf stage. Plants at the 6- to 8-leaf stage required 8 oz ioxynil and 6 oz bromoxynil per acre for a similar level of control. Ioxynil gave some control of mouse-eared chickweed (*Cerastium glomeratum*). Scarlet pimpernel (*Anagallis arvensis*) was better controlled by ioxynil and 2,4-D than by bromoxynil.

TABLE 1: PERCENTAGE REDUCTION IN WEED NUMBERS

Species	Site	Growth Stage when Sprayed	Weeks after Spraying	Application rates (oz) Ioxynil 4	Ioxynil 8	Ioxynil 12	Bromoxynil 3	Bromoxynil 6	Bromoxynil 9	Amine 2,4-D 16	Control
Brassica campestris (Wild turnip)	211	2 to 5-leaf	3	62	96	98	96	100	100	60	6
			6	80	100	100	98	100	100	100	39
Polygonum persicaria (Redshank)	211	2- to 4-leaf	3	90	96	100	96	100	100	12	0
	211	2- to 4-leaf	6	86	96	100	94	100	100	24	0
	212	6- to 8-leaf	3	66	93	96	50	90	95	4	0
	212	6- to 8-leaf	6	74	93	95	49	91	95	9	0
Cerastium glomeratum (Mouse-eared chickweed)	211	4-leaf	3	28	39	26	0	0	0	0	0
			6	31	33	19	0	0	0	0	0
Anagallis arvensis (Scarlet pimpernel)	211	4-leaf	3	80	90	95	0	38	35	24	27
			6	77	86	95	0	65	48	85	22
	212	4-leaf	3	68	77	86	49	20	71	54	21
			6	64	75	87	60	26	72	90	39
	214	4-leaf	3	83	94	92	43	59	48	92*	41
			6	92	99	94	76	72	93	99	85
Solanum nigrum (Black nightshade)	212	2- to 4-leaf	3	85	95	93	93	92	91	98	77
			6	100	99	00	100	100	100	100	93
	214	2- to 4-leaf	3	92	100	92	100	97	100	91*	30
			6	92	100	92	100	100	100	91	48
Chenopodium album (Fathen)	212	½ to 3 in.	3	100	100	100	100	100	100	55	7
			6	100	100	100	100	100	100	100	0
	214	½ to 3 in.	3	87	98	98	100	91	100	35*	0
			6	87	100	98	100	94	100	100	0
Capsella bursa-pastoris (Shepherd's purse)	214	4- to 6-leaf	3	4	29	24	56	8	52	59*	0
			6	6	29	44	100	42	92	100	3
Spergula arvensis (Spurrey)	214	1 to 2 in.	3	11	12	23	21	15	24	35*	36
			6	64	52	77	62	64	83	60	48
Cirsium lanceolatum (Scotch thistle)	214	2- to 3-leaf	3	69	80	100	82	88	75	72*	0
			6	82	82	100	86	88	75	100*	0

* 12 oz 2,4-D.

TABLE 2: LEAF SCORCH ON CROP

0=Nil 1=Slight 2=Moderate 3=Severe

Site	Crop	Stage of Growth	Days after Spraying	Treatment (oz) Ioxynil 4	Ioxynil 8	Ioxynil 12	Bromoxynil 3	Bromoxynil 6	Bromoxynil 9	Amine 2,4-D 16	Control
211	Wheat	3- to 4-leaf 8 to 10 in.	7	0.5	1	1	0	0.5	1.5	2	0
212	Wheat	8 to 10 in. Tillering	6	0	1	1.25	0	0.5	0.5	2	0
214	Barley	8 to 10 in. Tillering	5	0	1	1.75	0.5	1	2	0*	0

* 12 oz 2,4-D.

2,4-D and bromoxynil gave better control than ioxynil of shepherd's purse. 2,4-D was slightly better than the other two materials against Scotch thistle (*Cirsium lanceolatum*). All three materials gave similar good control of wild turnip (*Brassica campestris*), black nightshade (*Solanum nigrum*) and fathen but were unsatisfactory for control of spurrey.

Crop Tolerance

Some leaf scorch was recorded a week after spraying (see Table 2). This was confined to the upper leaves which were bent over and lying nearly horizontal at the time of spraying. Three weeks after spraying there was no sign of leaf scorch.

DISCUSSION

Ioxynil and bromoxynil show promise for the control of prevalent broadleaved annual weeds in cereal crops. Their spectrum of activity against these weeds is different from that of the phenoxyacetic acids. For example, their superiority over 2,4-D in the control of redshank is marked and for this reason alone they should find a place in New Zealand.

The comparatively rapid herbicidal action of ioxynil and bromoxynil and the wide range of crop tolerance are also major advantages for this group of herbicides.

There are indications in these tests that there are some differences in the activities of these two compounds and this has been confirmed in overseas experiments — *e.g.*, bromoxynil was found to be particularly effective against cornbind (*Polygonum convolvulus*) in Canada and against knotweed (*Polygonum aviculare*) in England. Ioxynil is usually rather more effective against cruciferous species. The differences in activity between these herbicides and the phenoxyacetic acids suggest that mixtures between the two groups could be of value — *e.g.*, a mixture of ioxynil/MCPA would probably have given better control of Scotch thistle and shepherd's purse in these trials. In England, an ioxynil/MCPA mixture gives satisfactory control of Californian thistle (*Cirsium arvense*) in cereals. Mixtures with mecoprop are also of considerable interest — *e.g.*, for the control of spurrey.

REFERENCES

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