FLUMETSULAM - A NEW POST-EMERGENCE HERBICIDE FOR BROADLEAVED WEED CONTROL IN UNDERSOWN WHEAT AND IN MEDIC, SUB-CLOVER AND LUCERNE SEED CROPS AND PASTURES

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Summary. Flumetsulam is a new sulfonanilide herbicide being developed for post-emergence broadleaved weed control in undersown wheat and certain legume crops and pastures. Indian Hedge mustard (*Sisymbrium orientale*), wild turnip (*Brassica tournefortii*), ball mustard (*Neslia paniculata*), wild radish (*Raphanus raphanistrum*), threehorn bedstraw (*Galium tricornutum*), and yellow burrweed (*Amsinckia calycina*) are controlled by flumetsulam at 16-20 g ai/ha. Crop tolerance studies show wheat from zadoks 12 to 31, medic and clover pre-emergence and post-emergence from two trifoliate leaf onwards and lucerne post-emergence from two trifoliate up to six trifoliate leaf are tolerant to flumetsulam at up to 40 g/ha. Plant back studies have shown that susceptible rotational crops including lupins, faba beans and canola can be safely planted six to thirteen months after an in-crop application of up to 30 g/ha flumetsulam.

INTRODUCTION

Flumetsulam, N-[2,6-difluorophenyl]-5-methyl (1,2,4) triazolo-[1,5a]-pyrimidine-2-sulfonamide, is being developed by DowElanco Australia Limited for broad-leaved weed control in undersown wheat crops and medic, sub-clover and lucerne pastures and seed crops.

Flumetsulam is a member of the sulfonanilide family. It is absorbed by both the roots and foliage of plants and translocated to the growing points where it acts by inhibiting the enzyme acetolactate synthase (ALS) which is essential for amino acid synthesis.

The relative susceptibility of plants to flumetsulam is a function of the time required for absorption and translocation and the rate of metabolism within the plant.

This paper summarises the spectrum of weeds controlled by flumetsulam, its selectivity to a range of crops and its safety to rotational crops. It briefly discusses the potential of flumetsulam for more effective legume pasture establishment in the cereal/pasture ley rotations practised in southern Australia.

METHODS

Formulation and adjuvants. Flumetsulam is formulated as a water dispersible granule containing 800 g/kg (BROADSTRIKE* herbicide). All applications were made with either a non-ionic surfactant (e.g. Agral® 600 or polyglycol 26-2 at 0.1% v/v) or with UPTAKE*, an emulsifiable crop oil, at 0.5% v/v.

Efficacy trials. Efficacy trials, laid in a randomised complete block design, were replicated three or four times, often with split timings of application. Treatments were applied using a gas-powered AZO small-plot sprayer with hand held boom fitted with flat fan nozzles at 50 cm centres, or with 4WD motorbike sprayers, applying 50-100 L/ha water volumes.

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Weed free crop tolerance. Weed free crop tolerance screens were established in representative agronomic areas covering at least two seasons and using major commercial crop cultivars.

Plantback trials. Plantback trials were conducted over two years in which flumetsulam at over two times the label rate was applied to bare soil and rotational crops sown into the plots.

RESULTS AND DISCUSSION

Weed control (biomass reduction) was assessed visually at 2, 4 and 6 weeks post-treatment and final ratings are presented in Table 1.

Table 1. Weeds up to 5 cm diameter. Mean visual percent weed control (biomass reduction by flumetsulam of Indian hedge mustard (IHM), wild turnip (WT), ball mustard (BM), wild radish (WR), bedstraw (B), turnip weed (TW) and yellow burrweed (YB). Mean of two to nine sites per species. (Standard deviation underneath in brackets)

	Rate g/ha	IHM	WT	BM	WR	B	TW
Flumetsulam~	16	83.7	-	-	79.5	75.0	-
		(4.7)			(16.6)	-	
	20	94.7	91.7	88.1	87.0	91.7	97.0
		(4.1)	(11.8)	(9.7)	(10.7)	(10.3)	(5.1)
	32	-	-	-	94.9	-	-
					(7.6)		
Flumetsulam#	16	91.7	-	-	77.4	82.0	97.5
		(5.7)			(19.9)		(3.5)
	20	96.7	97.5	97.2	83.4	92.7	97.5
		(4.4)	(3.5)	(2.5)	(18.1)	(6.7)	(3.9)
	32	-	-	-	98.2	-	-
					(19.6)		
Diflufenican	100	93.9	-	-	82.6	-	-
		(2.7)			(12.2)		
MCPA sodium	175	79.3	75.9	53.9	65.6	-	83.3
		(6.6)	(8.3)	(39.3)	(15.8)	-	

~ Plus Agral 600 at 0.1% v/v
\# Plus Uptake (surfactant/oil) at 0.5% v/v

Flumetsulam at 16-20 g/ha gave commercially acceptable control of Indian hedge mustard (*Sisymbrium orientale*), wild turnip (*Brassica tournefortii*), ball mustard (*Neslia paniculata*), wild radish (*Raphanus raphanistrum*), threehorn bedstraw (*Galium tricornutum*) and yellow burrweed (*Amsinckia calycina*).

Flumetsulam was generally more effective as an early post-emergence application (weeds up to 5 cm diameter Table 1) than at a later application to larger weeds (5-10 cm diameter Table 2).

This was most marked with Indian hedge mustard and wild turnip, with bedstraw being the exception such that better control resulted from later applications.

On Indian hedge mustard, wild turnip and ball mustard, flumetsulam was more effective when applied with UPTAKE at 0.5% v/v than when applied with AGRAL 600 at 0.1% v/v. On wild radish, bedstraw and turnip weed, flumetsulam gave comparable levels of control irrespective of adjuvant.

Table 2. Weeds 5 cm to 10 cm diameter. Mean visual percent weed control (biomass reduction by flumetsulam of Indian hedge mustard (IHM), wild turnip (WT), ball mustard (BM), wild radish (WR), bedstraw (B), turnip weed (TW) and yellow burrweed (YB). Mean of two to nine sites per species. (Standard deviation underneath in brackets)

	Rate g/ha	IHM	WT	WR	B	TW	YB
Flumetsulam~	16	74.3	-	75.0	83.2	-	66.5
		(6.3)		(14.9)	(7.3)		(19.1)
	20	81.7	73.9	79.2	92.2	90.4	85.5
		(11.1)	(23.3)	(18.9)	(5.5)	(8.1)	(15.0)
	32	-	76.5	96.1	-	95.3	
			(19.1)	(5.5)		(4.7)	
Flumetsulam#	16	82.2	95.0	76.8	90.2	-	75.0
		(8.5)	-	(13.9)	(2.6)		(7.0)
	20	85.1	88.2	83.0	93.7	90.5	76.7
		(10.9)	(13.8)	(13.3)	(5.0)	(7.7)	(16.0)
	32	-	89.0	96.7	-	94.6	-
			(8.5)	(4.4)		(4.8)	
Diflufenican	100	83.7	85.0	78.1	-	-	-
		(13.6)	-	(11.7)			
MCPA sodium	175	65.2	64.0	56.9	-	85.4	-
		(26.6)	(31.4)	(20.5)		(2.9)	

~ Plus Agral 600 at 0.1% v/v
# Plus Uptake (surfactant/oil) at 0.5% v/v

Flumetsulam has shown poor activity on capeweed (*Arctotheca calendula*), soursob (*Oxalis pes-caprae*), fumitory (*Fumaria densiflora*) and moderate activity on white iron weed (*Lithospermum arvensis*).

Wheat tolerance. In seven multi-variety weed free crop tolerance screens conducted in 1991 and 1992, flumetsulam was safe to all varieties of wheat tested. (Table 3) Treatments were applied at zadoks 12-13, 14-15/21, 22 and 30-31, at 16 or 20 g/ha and also at 32 or 40 g/ha with either non-ionic surfactant at 0.1% v/v or a Uptake at 0.5% v/v. Flumetsulam shows a high margin of selectivity up to 40 g/ha irrespective of adjuvant.

Medic, Sub-clover and Lucerne Crop Tolerance. In 1991, flumetsulam was included in a medic and lucerne crop tolerance screen at the Victorian Institute for Dryland Agriculture (1).

Parabinga, Parragio *(M. truncultata)*, Circle Valley and Santiago *(M. Polymonpha)* medics as well as CUF 101 lucerne *(M. sativa)* were included and flumetsulam was applied at 20 g/ha. Flumetsulam did not significantly reduce medic burr production (relative to hand weeded controls) in any variety except Parabinga where the yield was comparable with that of the unsprayed control. Lucerne persistence as measured in February (plants/m^2) showed that flumetsulam was one of the most selective herbicides.

Table 3. Wheat grain yield expressed as a percent of untreated control from seven weed free multi-variety crop tolerance screens in 1991 and 1992 (Standard deviation in brackets, where more than one screen)

	Rate g/ha	Crop growth stage at treatment		
		Zadoks 12-13	Zadoks 14-15/21-22	Zadoks 30-31
Flumetsulam⁻	16	99.8 (6.4)	-	-
	20	99.0	95.9 (6.4)	100.4 (2.3)
	32	97.6 (6.9)		
	40	95.9	89.8	98.5 (4.0)
Flumetsulam#	16	98.8 (4.1)		99.1 (5.2)
	20			
	32	97.5 (3.5)		101.0 (3.8)
	40			
No of varieties tested		18	12	18

⁻ Plus non-ionic surfactant at 0.1% v/v
\# Plus Uptake (surfactant/oil) at 0.5% v/v

In 1991 and 1992, flumetsulam was included in a medic, sub-clover and grain legume screen at Hart in South Australia (2). Pre and post-emergence applications of flumetsulam at 20 and 40 g/ha were selective to the cultivars screened.

In 1992, flumetsulam was applied pre and post-emergence to lucerne (Aurora) in Northern New South Wales. Flumetsulam at 20 g/ha applied pre-emergence was unacceptably damaging, but post-emergence application (with UPTAKE at 0.5% v/v) at the two and 6 leaf growth stages showed good selectivity as measured by fresh weight cuts.

Soil Persistence and Rotational Crop Restrictions. Flumetsulam is metabolized by soil microorganisms. Herbicide half life has ranged from less than one month up to two months under varying conditions. Availability in soil is primarily dependent upon soil pH and organic matter and herbicidal activity increases as pH increases and organic matter decreases.

Flumetsulam was applied to a red-brown earth in southern New South Wales in 1990 at rates of up to 75 g/ha, more than twice the proposed maximum use rate in winter crops (32 g/ha).

Susceptible crops (lupins, faba beans and canola) sown into these treatments six months later were unaffected.

At two sites in South Australia, flumetsulam was applied at 10, 20 and 30 g/ha. Rotational crops including vetch, sub-clover, medic, barley, wheat, canola and lupins were sown thirteen months later in 1991. No damage was observed in any crop at any rate.

In 1991 at two sites in South Australia, flumetsulam was applied at 10, 20 and 40 g/ha and rotational crops sown two to three months later.

At 20 g/ha at the Moonta site there was no damage to any crop, but the 40 g/ha rate caused slight damage to canola.

At the Clare site, 20 g/ha caused slight damage to vetch but moderate damage to canola.

Conclusion. Flumetsulam shows particular promise for weed control both in undersown wheat crops and in medic, sub-clover and lucerne based pastures and seed crops. Trial results indicate that early post-emergence use in cereals or pasture will not pose a threat to rotational crops grown nine to ten months later.

Taking into account the drive towards sustainable systems, there is now much more focus on establishing high quality legume dominant pastures as part of the cereal/pasture ley rotation. Successful legume pasture establishment relies on use of herbicides that provide effective weed control for the final cereal crop but are not damaging to the undersown pasture component. The wheat, medic, sub-clover and lucerne selectivity shown by flumetsulam will allow grain growers the option of better pasture establishment following the final wheat crop in a rotation.

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