Florasulam + MCPA for broad spectrum broadleaf weed control in winter cereals in southern Australia

Peter Nott
Dow AgroSciences Australia Ltd., PO Box 58, Strathdale, Victoria 3550, Australia
Email: nott@dow.com

Summary Conclude Herbicide™ is a formulation containing florasulam + MCPA-2-ethylhexyl ester. The submission for registration in Australia is currently being reviewed by the APVMA. The proposed application rate will apply 5 g a.i. ha^{-1} of florasulam + 250 g a.e. ha^{-1} of MCPA-2-ethylhexyl ester.

Conclude will provide broad-spectrum broadleaf weed control in winter cereals, with rotational flexibility regardless of soil pH.

Keywords Florasulam, MCPA, efficacy, broadleaf weeds, winter cereals.

INTRODUCTION

Florasulam is a member of the triazolopyrimidine family of chemistry, which includes flumetsulam and metosulam. Florasulam inhibits the enzyme acetolactate synthase and is classified as Group B for resistance management labelling in Australia.

Florasulam possesses both soil and foliar activity, but has a very short-half life in soil (2–18 days compared to 14–180 days for metsulfuron methyl). Florasulam is broken down microbially in soil, with the rate of degradation influenced by soil moisture, temperature and organic matter content and is not significantly influenced by soil pH. (Wilson 1999).

Florasulam was first registered in Israel in 1998 and is currently widely registered overseas for use in winter cereals. Florasulam is registered in Australia as a formulation with clopyralid and is sold in Canada formulated with MCPA. The Canadian use rate of florasulam is the same as for Australia, but the MCPA rate is higher (350 g a.e. ha^{-1}). The weeds listed on the Canadian label include a range of brassica weeds, cleavers (*Galium aparine* L.), prickly lettuce (*Lactuca serriola* L.), lamb's quarters (fat hen in Australia, *Chenopodium album* L.) and wild buckwheat (*Polygonum convolvulus* L.) (Anon. 2004).

Florasulam has been formulated with MCPA to give a broad spectrum broadleaf herbicide, with excellent cereal selectivity, a short rainfast period and no plantback or export residue concerns.

MATERIALS AND METHODS

Formulations and adjuvants A range of florasulam formulations were used in the studies reported. Field trials prior to the 2007 season used GF-1390, containing 5 g L^{-1} florasulam + 250 g a.e. L^{-1} MCPA-2-ethyl hexyl ester, formulated as a suspension emulsion. A range of florasulam formulations were also used either alone, tank mixed with MCPA iso-octyl ester (IOE) or in some cases formulated with clopyralid. Florasulam treatments were always applied with Uptake Spraying Oil™.

Efficacy trials Efficacy studies were conducted over a number of years in a variety of locations, mostly across southern Australia. Field trials were generally conducted in commercial winter cereal crops that contained the appropriate target weeds. However, some pulse and canola (*Brassica napus* L.) data are included from screens where these crops were planted. Trials were usually randomised complete block in design, with 3 or 4 replicates and a plot size of 3 × 10 m or similar. Applications were made via a gas propelled, backpack mounted, precision plot sprayer fitted with a 3 m boom. Spray volume was 80–125 L ha^{-1}. Treatments were assessed for percent weed control, taken by subjective visual assessment (where 100 = complete control) at approximately 28 and 56 days after application.

Results for individual weed species were summarised across locations, with similar treatments grouped together. Tank mixes and formulated products that applied the same rate of active ingredient per ha were grouped together. Clopyralid was applied with florasulam + MCPA in some of the studies included in the wild radish (*Raphanus raphanistrum* L.), bedstraw (*Galium tricornutum* Dandy) and canola (*Brassica napus* L.) data as clopyralid has no activity on these weeds and is registered for use in canola. The standard treatment, diflufenican + MCPA was also generally applied with clopyralid at 30 g a.e. ha^{-1}. However clopyralid is only listed with this treatment in the case of lentils (*Lens esculenta* Moench) and capeweed (*Arctotheca calendula* L.) as these are the only weeds on which it has activity.

Selectivity trials Crop injury assessments were made in most efficacy studies. In addition, weed free cereal selectivity herbicide tolerance trials containing

multiple varieties of oats and barley were treated with florasulam + MCPA and a standard herbicide treatment. Assessments were generally made for percent crop injury, taken by subjective visual assessment (where 100 = complete crop loss) at approximately 7, 14 and 28 days after application.

Plantback trials Florasulam applied alone at 5 and 10 g a.i. ha^{-1} was included in a series of six plantback field studies compared to florasulam + clopyralid and a standard such as metsulfuron or chlorsulfuron. Herbicide treatments were applied to winter cereals late in the growing season and sensitive crops such as pulses and canola were sown the following season. Percent crop injury taken by subjective visual (where 100 = complete crop loss) assessments were made at various intervals throughout the growing season. Grain yields were not taken in most trials.

RESULTS

Efficacy trials Results from efficacy studies are presented in Tables 1–4 below. Application rates were 5 g a.i. ha^{-1} of florasulam + 250 g a.e. ha^{-1} of MCPA-2-ethylhexyl ester and 18.8 g a.i. ha^{-1} of diflufenican + 188 g a.i. ha^{-1} MCPA (+ 30 g a.e. ha^{-1} clopyralid). These results show excellent control of wild radish, bedstraw, canola, lentil and capeweed, which was similar to the commercial standard.

Selectivity trials Crop injury was generally transitory, very minor and well within 'commercial acceptability' of less than 15% injury (by subjective visual assessment). These data are not presented.

Plantback trials No significant injury was observed in a range of susceptible rotational crops following application of 5 g a.i. ha^{-1} of florasulam the previous season. The only exception was injury to field peas in two replicates of one study in which 10 g a.i. ha^{-1} of florasulam was selective.

Florasulam has a short soil half life and at the proposed use rates and application timings should not restrict rotational flexibility in southern Australia. These data are not presented.

DISCUSSION

Florasulam is a new (to Australia) ALS inhibitor herbicide from a different chemical class to the sulfonylurea's and imidazolinones. This molecule has a short soil half life and is among the most selective herbicides that act on this target site. Conclude Herbicide™, (florasulam + MCPA), provides broad spectrum broadleaf weed control in winter cereals in southern Australia, with rotational flexibility, regardless of soil pH. It is

Table 1. Average percent control of wild radish (*Raphanus raphanistrum* L.) (Growth stage 1–8 leaf, 2–25 cm diameter).

Active ingredient	Mean[A]	n[B]	min[C]	max[D]
Florasulam +MCPA	98	30	85	100
Diflufenican +MCPA	99	20	93	100

[A] mean control across all replicates and sites.
[B] number of observations (i.e. replicates).
[C] minimum %control value across all replicates and sites.
[D] maximum %control value across all replicates and sites.

Table 2. Average percent control of threehorn bedstraw (*Galium tricornutum* Dandy) (Growth stage 2-whorl to 5-branch and flowering).

Active ingredient	Mean	n	min	max
Florasulam + MCPA	92	38	75	100
Flumetsulam + bromoxynil + MCPA[A]	99	20	93	100

[A] 20 g ha^{-1} flumetsulam + 100 g ha^{-1} bromoxynil + 100 g ha^{-1} MCPA IOE.

Table 3. Average percent control of volunteer canola (*Brassica napus* L.) (Growth stage 2–8 leaf, 3–20 cm diameter).

Active ingredient	Mean	n	min	max
Florasulam + MCPA	99	24	95	100
Diflufenican + MCPA	94	12	95	100

Table 4. Average percent control of volunteer lentils (*Lens esculenta* Moench) (Growth stage 4–10 leaf, 5–10 cm diameter).

Active ingredient	Mean	n	min	max
Florasulam + MCPA	96	20	95	100
Diflufenican + MCPA + clopyralid	99	8	95	100

Table 5. Average percent control of capeweed (*Arctotheca calendula* L.) (Growth stage 2–9 leaf, 2–20 cm diameter).

Active ingredient	Mean	n	min	max
Florasulam + MCPA	87	19	75	99
Diflufenican + MCPA + clopyralid	88	25	60	100

also potentially useful in exported cereal crops where the use of certain herbicide actives such as clopyralid are not permitted. Dow AgroSciences is continuing research with tank mixes containing other broadleaf herbicides in order to further broaden the spectrum of weeds controlled.

ACKNOWLEDGMENTS

The author would like to acknowledge Dow AgroSciences research department and various contract researchers for conducting the field trials.

REFERENCE

Wilson, C. (1999). Florasulam technology transfer resource guide, Level 1 active ingredient module. Dow AgroSciences technical product reference guide, Indianapolis, United States of America.