Sulfonylurea chemistry on *Emex australis* (doublegee)

Stephen Addenbrooke, DuPont (Australia) Ltd., 7 Sleat Road, Applecross, Western Australia 6153, Australia.

Abstract
Trials showing the degree of *Emex australis* (doublegee) control with the sulfonylurea herbicides, Glean® (chlorsulfuron), Ally® (metsulfuron methyl) and Muster® (ethametsulfuron methyl) are described.

Glean® (chlorsulfuron)
Glean was first trialed in Australia from 1979 with commercial release in 1982. The active herbicide chlorsulfuron inhibits the 'ALS' target site in susceptible plants. For *Emex australis*, the herbicide is taken up primarily via root uptake (soil residual) at weed emergence in winter cereal crops, e.g. wheat. Post-emergent control with chlorsulfuron is weak unless mixed with a companion product(s).

Glean is compatible with the pre-emergent knockdown herbicides glyphosate, glyphosate trimesium; paraquat/diquat and post-emergent herbicides bromoxynil + MCPA, phenoxy herbicides (2,4-D, MCPA etc.), diflufenican + MCPA and diflufenican + bromoxynil.

Factors effecting efficacy
Chlorsulfuron is more readily degraded in acid soils, and leaches more readily in sandy soils. The amount of soil moisture at application and subsequent rainfall can affect activity – moist conditions favour weed control. Most Glean is applied before seeding and incorporated by the sowing process. Doublegee control is usually good when used this way (Table 1). Evenness of incorporation into the soil profile is important in determining the level of control achieved as poor incorporation can lead to stripping of the herbicide.

The addition of a knockdown is required when used pre-emergent to actively growing weeds. For post-emergent application, Glean activity is enhanced if used with products containing either bromoxynil or a phenoxy herbicide. Glean application rates for doublegee are usually in the order of 15–20 g ha^{-1}.

Note: Triasulfuron (Logran®) is consistently less efficacious in controlling doublegee.

Ally® (metsulfuron methyl)
Ally was first trialed in Australia from 1983 and commercial use started in 1987. The active herbicide metsulfuron methyl inhibits the 'ALS' target site in susceptible plants. Ally controls actively growing doublegee primarily by foliar uptake either alone or with a compatible product(s) for use in winter cereals, i.e. wheat, barley (Table 2). It can be applied either pre-seeding of crop with knockdown herbicides or post-emergent to actively growing doublegee. Ally is more active on doublegee in Western Australia (WA) than in South Australia (SA)/Victoria. The addition of a non-ionic wetting agent is required. The addition of phenoxy products such as MCPA, 2,4-D may sometimes reduce the effectiveness of Ally in controlling doublegee (MCPA – 15%, 2,4-D amine – up to 13%), but may at the same time improve crop safety (Table 3).

Factors effecting weed efficacy
Metsulfuron methyl is readily degraded in most soils but some persistence is expected on alkaline soils. It leaches more readily in sandy soils. The amount of soil moisture at application and subsequent rainfall can affect activity – moist conditions favour weed control, while water or temperature stressed doublegee are more difficult to control. Frost after application of Ally will slow the speed of kill on doublegee. Ally gives good control of doublegee over a wide range of plant sizes and plant densities and this makes it one of the preferred options for doublegee control.

Ally is compatible with the knockdown herbicides glyphosate, glyphosate-trimesium, and the post-emergent herbicides bromoxynil + MCPA, bromoxynil + diflufenican, diuron + MCPA, MCPA, MCPA + diflufenican, and some other less widely used herbicides. Application by either ground sprayer or by aerial application are equally effective, but uniformity is generally better with the ground sprayer. Ally application rates in WA are 5 g ha^{-1} while in SA and Victoria 5–7 g ha^{-1} are used.

Muster® (ethametsulfuron methyl)
Muster was first trialed in Australia from 1983 in WA. The first experiments for the control of doublegee in lupins and canola were in 1992. The active herbicide ethametsulfuron inhibits the 'ALS' target site in susceptible plants. Muster controls actively growing doublegee primarily by foliar uptake either alone or with a compatible product(s) (Tables 4 and 5).

Muster is compatible with the post-emergent products diflufenican, metosulam, metribuzin, and clopyralid.

Table 1. Control of doublegee in wheat (Kulin) with Glean® and Logran incorporated at seeding.

Treatment (per ha)	% doublegee control
Glean 15 g	90
Glean 20 g	93
Logran 30 g	58
Logran 35 g	58
Glean 5 g + Logran 20 g	85
Untreated	0

Table 2. Control of doublegee with Ally and mixtures with Ally (post-emergence). Doublegee plants were at the 3-8 true leaf stage

Treatment (per hectare)	% doublegee control Trial A	Trial B
Ally – 5 g + 0.1% BS1000	98	99
MCPA amine – 0.7 L	0	8
MCPA amine – 1.0 L	0	13
Ally + MCPA – 5 g + 0.7 L	95	97
Ally + MCPA – 5 g + 1.0 L	93	98
Terbutryn + MCPA – 0.55 + 0.6 L	0	30
Ally + Terbutryn + MCPA – 5 g + 0.55 + 0.6 L	99	100
Tigrex® – 1.0 L	0	23
Ally + Tigrex – 5 g + 1.0 L	95	100
Bromoxynil MCPA – 1.0 L	0	60

Table 3. Control of doublegee with Ally and mixtures of Ally with phenoxy herbicides. Doublegee plants were at the 2–4 true leaf stage.

Treatment (per hectare)	% doublegee control
Ally® 5 g[A]	99
Ally® + 2,4-D amine, 5 g + 0.5 L[A]	89
Ally® + 2,4-D amine, 5 g + 0.7 L[A]	89
Ally® + 2,4-D amine, 5 g + 1.0 L[A]	86
Ally® + MCPA amine, 5 g + 1.0 L[A]	95

[A] + 0.1% BS1000.

Table 4. Doublegee control in lupins (Gungurru) with Muster. Doublegee were at the 5–7 true leaf stage and 10 plants m^{-2}.

Treatment (per hectare)	% Crop phytotoxicity at 38 days	% doublegee control
Muster 30 g[A]	0	80
Muster 60 g[A]	0	90
Muster 90 g[A]	0	90
Muster + Brodal®, 30 g + 100 mL[A]	0	85
Eclipse 10 g	5	65

[A] 0.2% BS1000 added.

Table 5. Doublegee control in wheat (Kulin) with Muster. Doublegee were at the 1–2 true leaf stage and 37 plants m^{-2}.

Treatment (per hectare)	% Crop phytotoxicity at 38 days	% doublegee control
Muster 30 g[A]	25	100
Muster 60 g[A]	25	100
Muster 90 g[A]	60	100
Ally 5 g	0	100

[A] 0.2% BS1000 added.

Proposed Muster application rates are 30–40 g ha^{-1}, plus a nonionic wetting agent.

Note: Muster patent in Australia lapsed in 1995, thus is highly unlikely to be granted registration as a stand alone product by the National Registration Authority, but may be possible in a mixture.

Possible factors in effecting weed efficacy

Muster gives good control of growing doublegee over a wide range of plant sizes and plant densities and this makes it one of the preferred options for doublegee control in lupins and canola. The effectiveness of Muster in the broad leaf crops may be reduced by the canopy effect of the crop leaves. Early application for these crops is likely to be critical.

Emex australis: resistance to sulfonylurea chemistry

Glean, Ally and Muster are highly efficacious on doublegee. Repeated exposure to Glean, Ally and Muster alone could lead to doublegee resistance to sulfonylurea chemistry. More competitive pricing of sulfonylurea chemistry will increase their exposure to doublegee. Other factors which could effect control measures are the biology of doublegee, habitat, seed longevity, and depth of seed in the soil profile.