ANGEL

Patent pending

Strand Medic

KEY ATTRIBUTES

- Only medic available with tolerance to sulfonylurea (SU) herbicide soil residues
- Early flowering cultivar that produces large quantities of highly nutritious herbage
- Good insect resistance to Blue Green Aphid and Spotted Alfalfa Aphid
- Hardseeded, suited to crop/pasture rotations
- Ideal replacement for Herald and Harbinger
- Performs particularly well on low – medium rainfall neutral-to-alkaline soils

KEY BENEFITS

- ✔ Greater flexibility in crop rotations, Angel can be sown the year following cereal crops that have had SU herbicide use.
- ✔ Crop rotations can be more productive and potentially shorter as growers no longer have to wait a year to get pasture established.
- ✔ Angel has the ability to take advantage of the residual weed control of SU herbicides in the establishment year resulting in legume dominant pasture with fewer weeds.
- ✔ Angel will become a significant tool in the management of Branched Broomrape and Bladder Campion as growers can establish Angel SU into treated paddocks.

ADAPTATION

Angel is adapted to a large area of Australia's farming zone. It is best suited to loamy sand through to loam soils that are slightly acidic to alkaline and receive more than 275mm of annual rainfall in southern enviroments. The same soil requirements and annual rainfall of 375mm is required in northern Australia. Angel will grow well in any area currently growing Herald or Harbinger.

BREEDING OF ANGEL MEDIC

Angel was bred by John Heap and Chris Preston (CRC for Weed Management Systems, University of Adelaide) and further developed by Jake Howie and Craig Bell (SARDI Pastures) with support from GRDC. It will be released through the Australian Pasture Alliance (APA). The APA is a joint venture of SARDI and Seedmark which is focusing on providing pasture options that deliver real benefits to Australian farmers. Angel is evidence of this commitment.

Angel with its world first annual SU tolerance technolgy is patent pending (Australian Patent Application Number 2007200148). It was conventionally bred and is a mutant derivitive of the popular strand medic Herald.

Angel is a new strand medic (Medicago littoralis) bred from the variety Herald, which has demonstrated excellent tolerance to soil residues of various sulfonylurea herbicides.

Sulfonylurea (SU) herbicides such as triasulfuron, chlorsulfuron and metsulfuron-methyl are used extensively in the cereal-livestock zones of temperate Australia. This is because they are cost effective, safe-to-apply and provide useful levels of residual activity. Unfortunately, in low rainfall alkaline conditions, residual activity can persist beyond a single cropping cycle, as breakdown by biological activity and chemical hydrolysis is significantly reduced under these conditions.

SARDI

Government of South Australia

GRDC Grains Research & Development Corporation

THE UNIVERSITY OF ADELAIDE AUSTRALIA

seedmark

APA Australian Pasture Alliance

PlantTech Bringing seed technology to life

The Worlds First SU Tolerant Medic

Regenerating pasture legumes, typically used in Australian ley farming systems, are highly intolerant of even very low residues of SU herbicides resulting in severe stunting, reduced dry matter production, lower seed yields, poor persistence and decreased N fixation.

TOLERANCE TO LONGER TERM SU SOIL RESIDUES (>10 MONTHS)

Trials have been conducted in South Australia, Queensland, New South Wales and Victoria to compare the relative effect of SU herbicide residues applied the previous year, on Angel and Herald.

These have all confirmed Angel's ability to tolerate SU residues (ie. *Triasulfuron, Chlorsulfuron* and *Metsulfuron-methyl*) from a range of application rates. Table 1 provides the results from one trial at Waikerie, SA on a mallee sandy loam, average annual rainfall of 275mm, pH 8.3$_{(water)}$ (See figures 2 and 3).

TOLERANCE TO SHORTER TERM SU SOIL RESIDUES (4-6 MONTHS)

SU herbicides are commonly used to control summer germinating weeds, such as lincoln weed, caltrop and skeleton weed, before a paddock regenerates or is sown to pasture. Angel was found to be tolerant to recent residues of SU herbicides, from applications for summer weed control (Figure 1).

The ability of Angel to tolerate these short term SU residues will enable it to survive and to take advantage of the residual moisture and nutrient benefits gained from summer weed control, whether regenerating or being established for the first time.

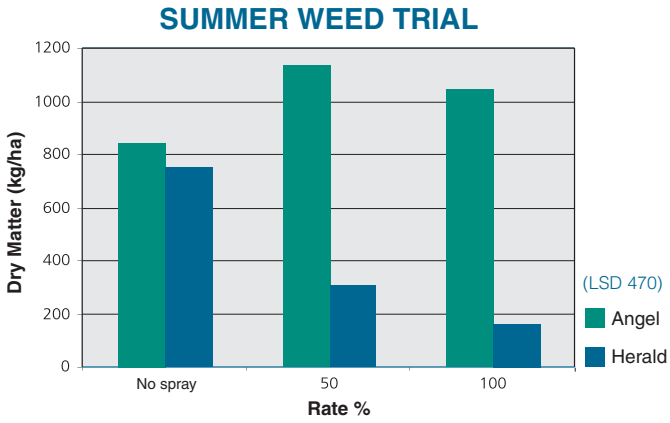

Figure 1. Effect of SU herbicide applied in January and February at No spray, 50 & 100% of suggested rates, (metsulfuron methyl - 3.5 & 7 g/ha, triasulfuron – 9 & 18 g/ha. Results were the same for both products) on the dry matter production of Angel and Herald sown four months later at a low rainfall alkaline soil site at Wirrulla on Eyre Peninsula.

WEED CONTROL IN ANGEL

Apart from its additional tolerance to SU herbicide residues and some other Group B herbicides, Angel's herbicide tolerance is the same as for other annual medics. Therefore, the options for controlling weeds in the pasture phase for Angel are essentially the same as for other medics.

To maximise seed set in the year of establishment, weed competition needs to be reduced as much as possible.

Early removal of grasses with grass selective herbicides results in improved pasture growth and reduced carry-over of cereal root diseases (eg Take-all, Pratylenchus and CCN). Less selective means of weed control, such as spray-grazing, winter-cleaning and spray-topping can be used to control weeds after the initial year, when medic density and soil seed reserves have been built-up.

TABLE 1. Shoot dry weight and seed yield (2003) and regeneration (2004) of Angel and Herald medic in soil treated with triasulfuron (2002) at Waikerie, SA

Triasulfuron (applied 2002)	Shoot dry weight (kg/ha, 2003)		Seed yield (kg/ha, 2003)		Regeneration (p/m^2, 2004)	
(g.a.i./ha)	Herald	Angel	Herald	Angel	Herald	Angel
0	3422	3022	652	678	1532	1472
7.5	2314	2868	564	690	1323	1488
13	2442	3192	511	690	945	1543
26	1618	2863	290	790	728	1549
LSD 5%	799		177		439	

(Sandy loam, pH 8.3 (water) average annual rainfall 275 mm, Angel and Herald sown into wheat stubble containing SU herbicide residues in May 2003)

CONTROLLING ANGEL IN THE CROPPING PHASE

Trials confirm that although Angel has excellent tolerance to soil residues of SU herbicides, ***this tolerance does not extend to the foliar application of post-emergent SU herbicides*** or other herbicide groups typically used to control medic in cropping situations.

The knockdown herbicides glyphosate and paraquat/diquat are equally as effective on Angel as for Herald.

Post-emergent herbicides such as 2,4-D amine, MCPA, bromoxynil, clopyralid and dicamba can still be used to control Angel in the cereal phase.

Post emergent SU herbicide options for control of Angel in the cereal phase include metsulfuron-methyl and iodosulfuron-methyl sodium at label rates. *NB Chlorsulfuron and sulfosulfuron were also effective in trials but are not registered for control of medic in-crop.*

Triasulfuron applied alone has not provided adequate control of Angel strand medic in-crop. *NB Within annual medics, triasulfuron used alone is only registered for the pre-emergent control of burr medic.*

For more information on in-crop medic control, contact your agronomist or herbicide reseller.

HERBICIDE RESISTANCE

The risk of developing herbicide resistance is dependent on the number of applications of herbicides from the same group and the size of the weed population being treated. SU herbicides are in Group B, a group known to develop resistance quickly. Resistance has been recorded after four to six applications for some weeds such as ryegrass and wild radish.

For the first time, Angel provides growers with a pasture legume option for use in farming systems reliant on SU herbicides for weed control. With poor herbicide management this could allow a greater frequency of use of SU (Group B) herbicides leading to an increased risk of herbicide resistance. However, rotating herbicide groups and using non-chemical weed control are key methods of slowing the speed of development of herbicide resistance.

A well managed pasture phase can be an integral tool in preventing herbicide resistance by providing additional weed control options such as grazing, hay making, green manuring, spray-topping.

Growers are encouraged to record herbicide details for each paddock and have a herbicide rotation plan as part of their production plans.

Figure 2. Angel (top) and Herald (below) eight weeks after sowing into residues of chlorsulfuron applied in the previous year crop at 20 g/ha of product.

Figure 3. Angel (left) showed good tolerance of triasulfuron residues at all rates, maintaining stable yields for all parameters measured. However, increasing rates of triasulfuron residues reduced Herald (right) shoot dry weight, seed yield and seedling regeneration by > 50%.

PADDOCK SELECTION & ESTABLISHMENT

Choose a paddock with adequate soil nutrient status, especially phosphorus, and a good history of broadleaf weed control. Ideally, select one with recent but not less than three months SU herbicide use to take advantage of any residual herbicide weed control. Angel establishes well if sown dry (from mid-April onwards) into standing cereal stubbles free of broadleaf weeds and with good weed control the previous year. If inoculating, ideally sow into a moist and weed free seedbed as soon as possible after the break of the season.

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SEEDING RATE & SOWING

Sow at 7 to 10kg/ha. Higher seeding rates result in greater plant density improved competition against weeds and allow for earlier grazing in the first year. Target 250 plants/m^2 in the first year.

NB If SU residues are believed to be an issue with ongoing pasture productivity, then sowing Angel (SU tolerant) at lower rates in mixtures of intolerant varieties is likely to be counter productive.

Aim for a sowing depth of 1-2cm and ensure good seed-soil contact by the use of press wheels or covering devices such as harrows or prickle chains.

INOCULATION

Inoculate seed with fresh Group AL rhizobium (not AM) or use ***Agristrike*** treated seed to ensure that Angel is nodulated with the best rhizobial strain currently available, especially if the soil $pH_{(water)}$ is under 7.0. Good nodulation is essential to maximise nitrogen fixation for the benefit of the following crop.

NUTRITION

Good phosphorus (P) and zinc (Zn) nutrition is crucial for maximum medic growth and nitrogen fixation. Experiments at 15 low rainfall alkaline sites in SA and Victoria found that the addition of P and Zn increased medic dry matter production by an average of 25%. Other nutrient deficiencies to watch for include sulphur and copper.

PEST CONTROL

Closely monitor for redlegged earth mite and lucerne flea damage, both at the seedling and flowering stage and spray as necessary, especially in the year of establishment but also in regenerating years.

Rhizoctonia damage is exacerbated under conditions which cause slow medic root growth, eg poor soil fertility, low temperatures, late sowing, early over-grazing.

Phoma black-stem fungus occasionally attacks medic stands which have become too rank, especially in wet seasons or have been in pasture for some years.

Angel is susceptible to powdery mildew, particularly as temperatures climb coming out of winter. Seedgrowers may find it economic to apply fungicide in early spring.

GRAZING

Establishment

Defer grazing after sowing until plants are well established and then only graze lightly until flowering.

Remove stock until the stand has finished flowering and producing pods, to maximise seed set. Carefully monitor summer grazing, especially in the first year, as over-grazing of pods will reduce future pasture regeneration.

Regeneration

Initially defer grazing at the break of the season to maximise plant establishment. Then apply grazing pressure to control upright grasses and to encourage prostrate growth until ground cover is complete.

Increase grazing pressure as necessary to prevent overly bulky pastures that are more susceptible to moisture stress and foliar fungal disease.

Ensure a good seed-set at least one year in four, to maintain adequate soil-seed reserves for maximum persistence, regeneration and production.

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