

Herbicide tolerance of canola

Dr Harmohinder Dhammu and Mark Seymour, DPIRD

Key messages

- ATR Bonito may be sensitive to propyzamide, ATR Snapper to s-metolachlor and ATR Mako to clopyralid + haloxyfop at label rates and timings on sandy soils.
- ATR Bonito had narrow crop safety margin for s-metolachlor, ATR Mako for metazachlor (Butisan[®]), Sturt (TT) for propyzamide, Hyola[®] 404RR and Pioneer[®] 45Y88CL for butoxydim at the label rates and timings.
- Triazine Tolerant and Roundup Ready[®] (TT+RR) varieties Hyola[®] 525RT[®] and Bayer 3000TR tolerated a sequential application of glyphosate (621g a.i./ha) followed by two-way tank mix of glyphosate with atrazine, butoxydim, clethodim, clopyralid, haloxyfop and terbuthylazine at the label rates quite well.
- When growing canola after wheat or other cereals where soil active and residual herbicides like isoxaben and terbuthylazine were used during cereal phase, pay careful attention to the label recommended replanting intervals for canola. Gallery[®] (isoxaben) used as pre-emergent (at 70-140g/ha), or early post-emergent (at 70-100g/ha) in wheat and barley has a plant back period of 22 months with more than 300mm rainfall (over two seasons) for canola. However, Nuseed GT-50 showed sensitivity to terbuthylazine residues on a sandy loam soil even after satisfying the plant back period of 6 months with 175mm rainfall.

Background

Weeds are one of the major production problems in canola. Herbicides are still the main method of weed management in canola in Western Australia. Herbicides can cause grain yield losses in canola. A small reduction in yield due to herbicide damage may be acceptable if weeds are competing strongly with the crop. However, yield reductions greater than 10% due to herbicides may be as significant as weeds in limiting yield.

New canola varieties have been bred or modified to be tolerant to specific herbicides in Australia, for example, triazines (TT), imadazolinones (IT/CL), glyphosate (RR) and triazine + glyphosate (TT+RR). However, there is a range of herbicides (apart from these specific herbicides) which are registered on all canola types. Moreover, canola varieties have been reported to differ in their tolerance to these general herbicides worldwide. The differences in tolerance may be due to any combinations of morphological and physiological characters among canola varieties. Environmental conditions under which

a crop grows (before, at or after herbicide application) also strongly influence the level of crop safety of most herbicides.

As canola is grown as a break crop in rotation with cereals, the soil residual herbicides applied to wheat or other cereals may affect plant establishment, growth and development, and grain yield of subsequent canola in rotation. Different herbicides have different residual lives in soil. Herbicides are broken down mainly via chemical or microbial degradation and additionally both processes are enhanced by heat and moisture.

A total of eight field trials under weed free conditions were conducted from 2014-2017 at Mullewa (1), Mingenew (3) and Katanning (4) using criss-cross design to determine:

- Tolerance of new canola varieties to herbicides common to all canola production systems, that is, conventional (CC), Triazine Tolerant (TT), Roundup Ready[®] (RR), Triazine Tolerant and Roundup Ready[®] (TT+RR) and Clearfield[®] (CL).

- Tolerance of TT+RR canola varieties to glyphosate mixes with other herbicides to reduce selection pressure on glyphosate.
- Residual effect of herbicides applied to wheat on a range of canola varieties grown in rotation.

Herbicide tolerance of canola varieties

A total of three canola herbicide tolerance trials were conducted, two at Mingenew on sandy soils (pH CaCl₂ 4.9-5.5) during 2014 and 2015 and one at Katanning on loamy sand soil (pH CaCl₂ 5.1) during 2017. A range of pre and post-emergent herbicides (registered on all canola types) were tested at label rates and timing against ATR Bonito, ATR Mako, ATR Snapper, ATR Stingray, Hyola[®] 404RR, Hyola[®] 450TT, Hyola[®] 525RT[®], Nuseed GT-53(RR), Pioneer[®] 43Y23RR, Pioneer 45Y88CL, Sturt (TT) and Yetna. All herbicide x variety combinations were not tested across all the three years. The key findings were:

- Trifluralin (for example, TriflurX[®]), clethodim (for example, Select[®]) and clopyralid (for example, Lontrel[®]) + clethodim at label rates and timing were tolerated well by all the varieties.
- S-metolachlor (for example, Dual Gold[®]) applied before seeding at 240g a.i./ha (label rate) reduced grain yield of ATR

Snapper significantly whereas its crop safety margin was narrow for ATR Bonito. S-metolachlor (Group K) at 240g/ha rate provides control of Toad Rush (*Juncus bufonius* L.) in canola.

- Propyzamide (for example, Edge[®]/Rustler[®]) applied before seeding at 500g a.i./ha (label rate) caused significant grain yield loss in ATR Bonito and its crop safety margin was narrow for Sturt (TT). Propyzamide (Group D) at 500g/ha provides control of annual ryegrass and other grass weeds in canola.
- Metazachlor (for example, Butisan[®]) incorporated by sowing (IBS) at 900g a.i./ha was tolerated well by all varieties. Its crop safety margin was narrow for ATR Mako. Metazachlor (Group K) is a new registration for control of ryegrass, wild oats and wire weed in canola.
- Clopyralid (for example, Lontrel[®]) at 90g a.i./ha + haloxyfop (for example, Verdict[™]) at 52g a.i./ha applied at the 2 leaf crop stage caused significant yield loss in ATR Mako. All the other varieties tolerated this mixture.
- Butroxydim (for example, Factor[®]) at 20g a.i./ha applied at the 4 leaf crop stage was tolerated by all varieties. Its crop safety margin was narrow for Hyola[®] 404RR and Pioneer 45Y88CL. According to the label, butroxydim is registered only for conventional, TT and CL canola varieties.



Dr Harmohinder Dhammu (far left) presenting canola trial to farmers and consultants at Mullewa Dryland Farmers Initiative Inc. field day during 2015

Tolerance of canola varieties to glyphosate mixtures

To investigate the effect of glyphosate mixtures with other herbicides on canola variety Hyola[®] 525RT[®], a total of three trials were conducted, one at Mingenew on sandy soil (pH CaCl₂ 5.5) during 2015 and two trials at Katanning on loamy sand - sandy loam soil (pH CaCl₂ 4.9 - 5.1) during 2016 and 2017. The trial during 2017 also included canola variety Bayer 3000TR.

- Glyphosate 621g a.i./ha applied mixed with atrazine or clethodim or clopyralid at the label rates at the 3-4 leaf crop stage or sequential application of glyphosate at 621g a.i./ha at the 1-2 leaf crop stage followed by glyphosate at label rate alone or in two-way tank mixes with atrazine, butoxydim, clethodim, clopyralid, haloxyfop or terbuthylazine (for example, Terbyne[®] Xtreme[®]) at the label rates applied at the 4-5 leaf crop stage were tolerated by Hyola[®] 525RT[®] and Bayer 3000TR.
- Pre-emergent propyzamide or simazine at label rates followed by glyphosate at 621g a.i./ha mixed either with atrazine or atrazine + terbuthylazine at the label rates applied at the 1-2 leaf crop stage and then followed by another application of glyphosate at 621g a.i./ha at the 4-5 leaf crop stage was safe to both Hyola[®] 525RT[®] and Bayer 3000TR.
- Glyphosate at 621g a.i./ha in mixture with non-registered or off label canola herbicides reduced grain yield of Hyola[®] 525RT[®] significantly during 2015. Agricultural chemicals can only be applied according to their label registrations.

Residual effect of wheat herbicides on canola

The residual effect of a range of herbicides/ herbicide mixtures applied to six wheat varieties at Mullewa during 2014 and at Katanning during 2015 was assessed on six canola varieties grown in sequence/rotation during 2015 and 2016, respectively.

- Isoxaben (for example, Gallery[®]) at higher than label rate (experimental rate) applied to wheat at 3-4 leaf stage on a red loam soil (pH CaCl₂ 5.8) at Mullewa during 2014 season, inhibited almost completely the emergence of all the six canola varieties tested during 2015 season (ATR Bonito, Hyola[®] 404RR, Hyola[®] 450TT, Hyola[®] 525RT,

Hyola[®] 577CL and Yetna). The total rainfall within a period of 10 months from isoxaben application in wheat during 2014 to seeding of canola during 2015 was 202mm. Pre-emergent and early post-emergent isoxaben at 53-105g a.i./ha (Gallery[®] 70-140g/ha) is registered on wheat, barley and triticale for control of wild radish. Isoxaben is also one of the components in X-Pand[®] herbicide (100g a.i./ha) that is registered as an early post-emergent on wheat, barley and triticale. According to the label, if you use pre or post-emergent isoxaben at 53-105g a.i./ha in cereals, then the plant back period for canola is 22 months along with more than 300mm rainfall in total (first and second seasons).

- Terbuthylazine (for example, Terbyne[®] Xtreme[®]) at 1.05kg a.i./ha and at higher than the label rate applied pre-emergent to wheat on a sandy loam soil (pH CaCl₂ 5.1) at Katanning during 2015 reduced grain yield of Nuseed GT-50 canola significantly (12-15%) during 2016 season. It did not have similar negative effect on grain yield of other canola varieties ATR Bonito, Hyola[®] 404RR, Hyola[®] 525RT[®], Hyola[®] 559TT and Pioneer[®] 43Y23RR included in the trial. The total rainfall at Katanning from application of terbuthylazine on wheat during 2015 to seeding of canola after 11.5 months was 435mm. According to the label, plant back period for canola after terbuthylazine application is six months with 175mm rainfall.

Crop safety margins: Higher than label rates of some herbicides were included in the trials to determine the crop safety margin of the herbicides at the maximum label rates.

Good crop safety margin means that a herbicide at its maximum label rate and at the higher rate(s) was tolerated well by a crop variety.

Narrow crop safety margin means a variety tolerated a herbicide well at the maximum label rate, but at higher than the label rate(s) there was statistically significant yield loss. A narrow crop safety margin implies that when spraying under less than optimal conditions, herbicide damage and yield loss may occur even at the label rate.