Phenoxy herbicide timing – its effect on wheat

The aim of this replicated trial was to identify safe options for using phenoxy herbicides on wheat displaying different maturity (short-, medium- and long-season).

Summary
Phenoxy herbicide rates and application times are generally based on crop leaf number. This however, does not take into account the fact that varieties with different maturity lengths will differ in leaf number ie. shorter season wheats generally produce less leaves than long season wheats.

Critical head development to ensure crop safety with spraying a phenoxy herbicide was reached in Silverstar at 4 leaves, Yitpi at 4.5 leaves and Lorikeet 5.5 leaves. Although the visible leaf number at critical head development stages differed between varieties – fewer leaves for shorter season varieties – it did not consistently influence the effect of LVE MCPA applications based on leaf number between varieties.

The timing of the LVE MCPA application did have a significant effect on yield for all three varieties tested (Silverstar, Yitpi and Lorikeet). The later the application the greater the impact on yield. Consistently, applying LVE MCPA at the 4-6-leaf stage gave the highest yields.

The rate of LVE MCPA, either 0.4 L/ha or 1 L/ha had no significant effect on crop yield when applied at the 4-leaf stage. The label recommendation is to use lower rates when the crop is at the 3-5-leaf stage.

Background
Phenoxy herbicides mimic plant growth hormones and applying them at the incorrect stage may result in significant yield penalties. The critical stages are the commencement of head development (critical for early applications) and pollen formation (critical for late applications). Phenoxy herbicide rates and application times are generally based on leaf number but this does not take into account the fact that varieties with different maturity lengths will differ in leaf number ie. shorter season wheats generally produce fewer leaves than long season wheats. Therefore short season wheats such as Silverstar will have fewer leaves visible at the double ridge stage (the point at which the growing point stops producing leaves and starts producing the head) than Lorikeet (long season Rosella replacement).

Methods
This trial was conducted using a fully replicated randomised block design.

The trial was dry sown on 11 May with three wheat varieties of different maturity types at 200 plants per square metre – Silverstar 79 kg/ha (short season), Yitpi 100 kg/ha (mid season) and Lorikeet 83 kg/ha (long season).

The wheat was sown into a canola stubble that had been cultivated once during a pre-drilling operation when 60 kg/ha Urea was applied. All seed was sown with 80 kg/ha Mallee Mix 1.

Twelve days before sowing the site was treated with 0.8L/ha Triflur 480. 20 g/ha Affinity + 75mL/ha LVE MCPA was applied across all treatments on 31 August to remove the volunteer canola population from the control and late timing treatments.

At each time of spraying 10 plants were collected from each variety for assessment of Zadok growth stage and head development stage.

Prior to harvest head deformities were assessed and counted in the field. After harvest 1000-grain weights were conducted for each treatment.

Results

Silverstar (1.32 t/ha) yielded significantly higher than Yitpi (1.23 t/ha) and Lorikeet (1.25 t/ha) (LSD 5% = 0.04).

The shorter the maturity length the fewer leaves produced (Table 1). The growing point of the plant changed from producing leaves to producing the head at 4, 4.5 and 5.5 leaves for Silverstar, Yitpi and Lorikeet respectively.

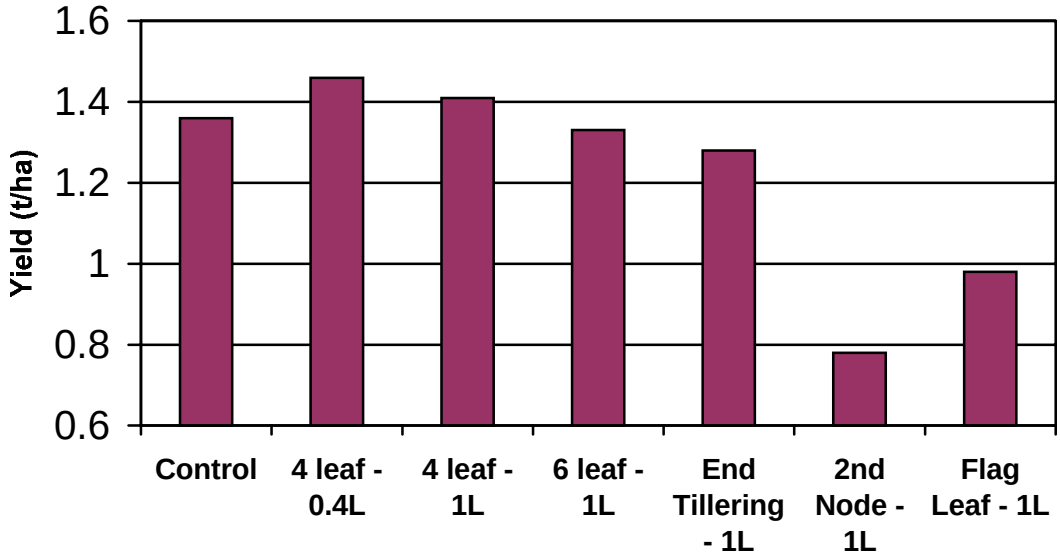
Table 1: The number of leaves that were extended when the growing point reached critical stages in head development for Silverstar, Yitpi and Lorikeet wheat.

Head development	**Number of leaves**		
	Silverstar	**Yitpi**	**Lorikeet**
Head not formed yet?	< 4	< 4.5	< 5.5
Head starting to form	4	4.5	5.5
Flowers forming	5	5.5	6.5
Head finished forming	6	8	7
Pollen forming	7	8.5	7.5
Pollen almost mature	8	8.5	9

Application timing of LVE MCPA had a significant effect on grain yield in Yitpi wheat (Refer Figure 1). The highest yielding treatment, which was significantly higher than all other treatments was LVE MCPA at 0.4 L/ha applied at the 4-leaf stage (yield 1.5 t/ha). The later the LVE MCPA application was made the greater the impact on yield – 6-leaf (1.3 t/ha), end of tillering (1.3 t/ha), 2nd node stage (0.8 t/ha). The exception to this was the application made when the flag leaf was emerging was significantly higher yielding than at the 2nd node stage – 1.0 t/ha and 0.8 t/ha respectively.

The effect of LVE MCPA on Yitpi yield was the same for the varieties Silverstar and Lorikeet (data not presented).

Figure 1: Yitpi wheat grain yield when LVE MCPA is applied at six different times (P <0.001, LSD 5% = 0.06)



At the earliest spraying treatment, 4 leaf, there was no difference in yield between the 0.4 and 1.0L LVE treatments in any of the three varieties.

Timing of LVE MCPA application had no significant effect on head distortion for any of the varieties tested in this trial – all varieties had less than 1% .

Interpretation

Although the visible leaf number at critical head development stages differed between varieties – with fewer leaves for shorter season varieties – it did not consistently influence the effect of LVE MCPA applications based on leaf number between varieties.

The timing of the LVE MCPA application did have a significant effect on yield for all three varieties tested (Silverstar, Yitpi and Lorikeet). The later the application, the greater the impact on yield. Consistently, applying LVE MCPA at the 4-6-leaf stage gave the highest yields. In a wetter season with higher yield potential the penalties seen in this trial may not be so severe.

The rate of LVE MCPA applied at the 4-leaf stage could possibly influence potential yield. In our trial work there was little difference between 0.4 and 1.0L/ha but the label recommendation is to use lower rates when the crop is at the 3-5-leaf stage.

Commercial Practice
Spraying outside the recommended application window with phenoxy herbicides can cause yield penalties. Label recommendations based on crop growth stage should be adhered to.

The recommended application times for phenoxy herbicides are:

- MCPA Amine (MCPA 500) and LVE MCPA up to **500 mL/ha from 3 leaf to flag leaf emergence**

- MCPA Amine (MCPA 500) and LVE MCPA **500mL/ha – 2L/ha from 5 leaf to flag leaf emergence**

- 2,4-D Amine (Amicide 500), 2,4-D LV Ester 60 and 2,4-D Ester 80 (estercide 80) **from 5 leaf to flag leaf emergence**

In the trial work undertaken in 2001 (a dry season with low yield potential) the later applications of MCPA LVE all resulted in a yield penalty.

Definition of Zadok's Growth Scale

The Zadok's scale is a decimal scale that describes the principle growth stages of cereal crops. The scale is label 0 –9:

0 – Germination
1 – Seedling growth
2 – Tillering
3 – Stem elongation
4 - Booting
5 – Ear emergence
6 – Flowering
7 – Milk development
8 – Dough development
9 - Ripening

1 Seedling Growth
10 first leaf through coleoptile
11 first leaf emerged
12 two leaves emerged
13 three leaves emerged
14 four leaves emerged
15 five leaves emerged
16 six leaves emerged
17 seven leaves emerged
18 eight leaves emerged
19 nine or more leaves emerged

2 Tillering
21 main shot only
21 main shot and one tiller
22 main shot and two tillers
23 main shot and three tillers
24 main shot and four tillers
25 main shot and five tillers
26 main shot and six tillers
27 main shot and seven tillers
28 main shot and eight tillers
29 main shot and nine tillers

3 Stem Elongation
30 leaf sheath erection
31 first node detectable
32 second node detectable
33 third node detectable
34 fourth node detectable
35 fifth node detectable
36 sixth node detectable
37flag leaf just visible
38 -
39 flag leaf ligule just visible

4 Booting
40 -
41 flag leaf sheath extending
42 -
43 Boots just visible
44 -
45 Boots swollen
46 -
47 flag leaf sheath openning
48 -
49 first awns visible

More Critical Growth Stages
65 50% of spikes are flowering (mid-flowering)
70 kernels watery, ripe clear liquid
75 mid milk, contents mostly milky liquid
79 very late milk, half solids half clear
81 early dough, mostly solids when kernel is crushed
85 soft dough, kernels firm but fingernail impression not held
85 soft dough, kernels firm but fingernail impression not held
87 hard dough fingernail impression held
92 harvest ripe, kernels can not be dented by thumb nail