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Arable Extra

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Chemical control of grass grub

Introduction

Currently the use of both fast acting e.g. Diazinon, or persistent e.g. suSCon Green®, insecticides is seen as the best/most economic method for protecting seedlings from grass grub attack.

Grass grub can be damaging to autumn established crops, particularly cereals, carrots, ryegrass and white clover seed crops. Grass grub generally prefer light, free draining soils. They commonly have one generation per year where the larvae hatch from December to March, feed in the soil until July to September and then pupate. Some grass grub however have a two year life-cycle. These larvae stop feeding in their first winter and resume feeding in the spring or early summer period rather than pupating. This life-cycle of grass grub can therefore cause damage to late spring planted crops.

This update reports on field work investigating insecticides in the neonicotinoid and organophosphate (OP) groups for protection of winter wheat seedlings.

Key points

- Trials investigated the efficacy of neonicotinoid and organophosphate (OP) insecticides for protection of winter wheat seedlings against grass grub.
- All treatments investigated showed a loss of plants following emergence when 144 - 240 grass grub larvae were present.
- Protection from grass grub feeding can be provided by Poncho® if feeding stops soon after planting.
- The addition of Diazinon or suSCon Green® to Poncho is required if grass grub larvae are likely to feed beyond 60 - 80 days following planting (when planting occurs in late April).
- In both seasons, protection against grass grub damage was required for approximately 60 - 80 days following planting. However larvae were well fed on white clover and attack could be prolonged if the autumn and winter feed supply is limited.

Field experiments

Two field experiments were established near Southbridge in 2012 and 2013. Both followed second year white clover seed crops, a rotation which is prone to high grass grub pressure. The experiments were direct sown (no cultivation) in April with cultivar 'Oakley' winter wheat at a target plant population of 150 or 175 plants/m^2 and a targeted sowing depth of 4 cm. Plots were 1.65 x 11 m in length (~18 m^2). The site was located on a Templeton moderately deep silt loam with an available water holding capacity of ~116 mm in the 0-100 cm depths.

At the end of March, prior to establishment, the grass grub larvae population was determined within the proposed areas in eight spade squares. In 2012/13, 250 grass grub larvae were present compared with 140 in 2013/14. In both trials larvae showed good fat deposits and were in the third instar phase. Larvae were predominantly located in the top 7 cm of the soil profile.

Plant counts, where between 100 and 120 cm of planted row were tagged and assessed, were completed at regular intervals following germination and emergence. Plants were considered alive if they had green leaf tissue. Wheat head numbers were assessed using the same methodology four weeks prior to harvest. All treatments received Raxil® fungicide seed treatments while all insecticides were applied at planting. Plots were machine harvested during February using a small plot combine.

Figure 1. Grass grub larvae collected 21 April 2012 from the experimental site seven days prior to sowing, note the white colouration indicates good fat deposits.

Results

Grain yield

Grain yield was increased in both seasons by treatments which contained either Poncho® and/or an organophosphate insecticide (applied as either Diazinon or suSCon Green) (Table 1). In year one grain yield was increased from 7.49 to 13.6 t/ha (mean of treatments in the top statistical group), an 81% increase. There was no advantage to adding a granular insecticide to Poncho alone. In year two, Poncho increased ($P<0.01$) grain yield above the untreated control and the addition of a suSCon Green further increased grain yield by an additional ~ 1.35 t/ha.

Table 1. Grain yields of wheat, cv. 'Oakley' following treatment with seven pesticide treatments in the presence of 250 (2012/13) or 144 (2013/14) grass grub larvae/m² when grown near Southbridge in the 2012/13 and 2013/14 growing seasons.

Trt #	Seed treatment	At sowing	Grain yield (t/ha)		Mean	Relative mean (%)
			2013	2014		
1	-	-	7.50	7.00	7.25	100
2	Poncho	-	13.40	8.95	11.20	154
3	Poncho	10 kg/ha suSCon Green	13.40	10.30	11.90	164
4	Poncho	15 kg/ha suSCon Green	13.70	10.30	12.00	165
5	Poncho	5.5 kg/ha Diazinon	13.10	9.75	11.40	158
6	Poncho	5.5 kg/ha Diazinon + 10 kg/ha suSCon Green	14.20	10.40	12.30	169
7	Poncho	-	13.60	N/A		
		Mean	12.70	9.50		
		LSD 0.05	1.83	1.01		

Final plant population

Final plant population was affected by insecticide treatment in both seasons. Most treatments containing either Poncho or an organophosphate insecticide protected seedling adequately to ensure 100 plants/m² were maintained compared with approximately 50 plants/m² in the untreated control (Table 2).

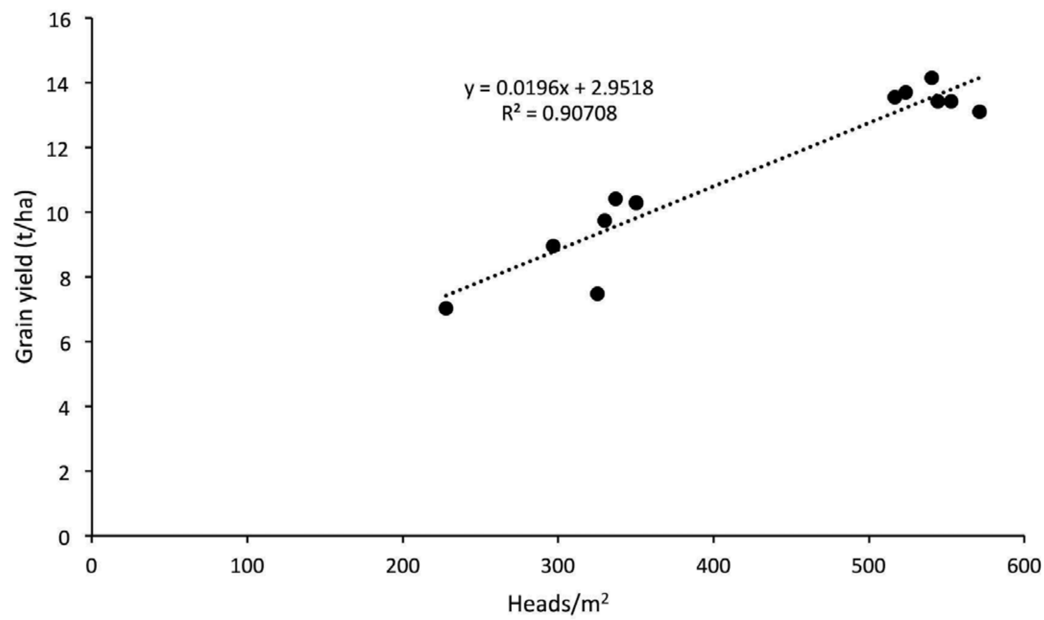
Table 2. Final number of wheat plants/m², cv. 'Oakley' following treatment with seven pesticide treatments in the presence of 250 (2013) or 144 (2014) grass grub larvae/m² when grown near Southbridge in the 2012/13 and 2013/14 growing seasons.

Trt #	Seed treatment	At sowing	Final plant population (plants/m²)		Mean	Relative mean (%)
			2013	2014		
1	-	-	38.8	56.0	47.4	100
2	Poncho	-	111.0	101.0	106.0	224
3	Poncho	10 kg/ha suSCon Green	116.0	107.0	111.5	235
4	Poncho	15 kg/ha suSCon Green	86.0	121.0	103.6	218
5	Poncho	5.5 kg/ha Diazinon (with seed)	122.0	115.0	118.5	250
6	Poncho	5.5 kg/ha Diazinon + 10 kg/ha suSCon Green	125.0	104.0	114.5	242
7	Poncho	-	108.0	N/A		
		Mean	108.0	101.0		
		LSD 0.05	36.1	38.2		

Pattern of plant loss and head numbers

All treatments experienced a period plant loss during establishment, regardless of chemical input. The untreated plots lost approximately 2 plants/m^2 per day compared with 0.3 plants/m^2 per day for the better insecticide treatments (Figure 1). In both seasons, protection against grass grub damage was required for approximately 80 days following planting. Insecticide treatment influenced when plant decline started, ranging from 22 days after sowing (DAS) in the untreated, compared with 29-40 DAS for treatments where Poncho was applied. In year two, the addition of suSCon Green increased head numbers compared with Poncho alone, thus while plant numbers were similar, increased plant tillering with suSCon Green increased grain yields. Final head number was strongly correlated to grain yield (Figure 1).

Figure 1. Relationship between number of wheat heads and grain yield of winter wheat cv 'Oakley' following various insecticide treatments for the control of grass grub larvae. Data combined from 2012/13 and 2013/14.



Discussion

High grain yields in wheat are determined by producing a large number of grains/m^2. The main yield component in setting a baseline yield is the number of heads/m^2. It is generally accepted that high yielding wheat crops require between 400 – 600 heads/m^2 (Poole, et al., 2013). The number of heads produced is a function of the number of plants present and their ability to tiller and utilize space. In these experiments, the highest yields were achieved when greater than 500 heads/m^2 were produced, these head densities were achieved from between 75 and 125 plants/m^2.

For plant population to be maintained, treatments must have provided either deterrent or lethal protection from below ground grass grub feeding. At establishment, larvae were large third instars with good fat deposits, indicating that they were well fed and that further feeding may be limited compared with larvae with less fat deposits. In these experiments it appears larvae had stopped feeding by mid-July, as plant numbers plateaued following these assessment.

It is generally accepted that Poncho will provide protection for seedlings until approximately GS 21 when the active ingredient becomes diluted within plant mass to a level where control is not achieved. If larvae have stopped feeding and begun pupation at, or prior to, GS 21 then Poncho may provide adequate protection, as per year one. In year two Poncho alone gave protection until 29 days after sowing, not enough to fully protect plants from grass grub feeding which occurred for approximately 80 days.

The addition of an OP insecticide to Poncho showed small, non-significant, increases in plant population. Head numbers and subsequent grain yield were also higher where an OP insecticide was added to Poncho. This result supported by other research where the longevity of neonicotinoids is too short to provide protection when damage occurs through until late August or September (McCloy and O'Hara, 2009).

The period of feeding depends on feed supply during autumn and winter. White clover provides an excellent feeding source for grass grub larvae, thus in situations where the autumn populations are high and the feed source is limited e.g. fallow paddocks or paddocks with no actively growing roots, feeding damage can be expected to extend into early spring. Under this situation the addition of suSCon Green would be advantageous.

Photo 1. Feeding damage captured on 19th July 2013 from 144 grass grub larvae/m^2 on Oakley winter wheat, untreated (L), Poncho (C), and Poncho + 10 kg/ha suSCon Green (R), sown 24 April near Southbridge.

References

McCloy, B. and O'Hara, M. 2009. Grass grub control trial. Report to the Foundation for Arable Research.

Poole, N.F., M.E. Arnaudin and R. Craigie. 2013. Increasing wheat productivity through the use of early sowing and new generation fungicides. Agronomy New Zealand In press.

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