POTENTIAL FOR SITE SPECIFIC MANAGEMENT OF *Lolium rigidum* (annual ryegrass) IN SOUTHERN AUSTRALIA

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Contents

Abstract

Weed spatial distribution is typically patchy and *Lolium rigidum* (annual ryegrass) distribution is no exception. The potential for site specific management of annual ryegrass was assessed to increase farmers' financial returns through reduced herbicide costs while maintaining weed control in commercial paddocks near Bute and Tarlee, SA. Commercially available sensors N-Sensor, Greenseeker, Crop Circle and digital RGB camera were assessed for their ability to detect annual ryegrass patches in growing lentil, pea, canola and wheat crops at various growth stages. The best platform for annual ryegrass detection was the digital camera with an Excess Red – Excess Green algorithm applied to the image to delineate plant matter from background soil. The best relationship for this system was an R^2 of 0.85 and 0.86 in Ronnies and Stones North paddock respectively when the lentils and peas were at the 10-12 node stage and the annual ryegrass was at early-mid tillering.

The N-Sensor was used to map annual ryegrass in lentil, pea and canola crops with R^2 values from 0.15 to 0.88. Poor correlations were related to misclassification due to the presence of other weed species or variability in crop growth. When these effects were accounted for, the correlations improved with R^2 from 0.27 to 0.86.

Four paddocks were monitored in three seasons between 2006 and 2009 to determine stability of annual ryegrass populations at fixed locations. Annual ryegrass populations were relatively stable with high density locations typically staying high between seasons and low density locations typically staying low. The

relationships between seasons ranged from R^2 0.53 to 0.94. Of the locations that changed ranking from being relatively low density to relatively high between seasons many could be explained by their proximity to the patch boundary.

Herbicide efficacy dependence on population density was assessed by counting a wide range of annual ryegrass densities and recounting the surviving plants after the application of herbicide. It was found that efficacy of clethodim, imazapic and imazapyr was independent of annual ryegrass density between zero and 1600, 2000 and 6000 annual ryegrass plants m^{-2} in three respective paddocks. However, there were more plants surviving at the high density locations, due to the higher initial population. This greater number of survivors is likely important for patch persistence.

Small plot herbicide trials were targeted at high and low density annual ryegrass sites in lentils and wheat to assess the potential for variable applications of clethodim in lentils and pre-emergence herbicides in wheat. Economic returns from variable rate applications over a uniform application cannot exceed the cost of the herbicide used uniformly at the maximum rate unless it causes yield loss due to phytotoxic crop effects. The maximum herbicide saving that could be achieved with clethodim in lentils was \$5.42 ha^{-1} and this declined as high density patch area increased. The value of applying pre-emergence herbicides site specifically was much greater, reducing herbicide costs by \$14.60 and \$15.30 ha^{-1} in two paddocks where high density weed infestations affected 30 and 35% of the paddock respectively. This is including additional application costs of \$7.50 ha^{-1} for variable rate applications. Savings increased as high density patch area decreased. Targeting patches reduces the risk of return from high cost treatments and makes it economic to treat smaller patches, as low as an infestation level of 5.6% of the paddock. Where cheaper herbicides or nil treatments were applied to low density sites there were no significant differences in annual ryegrass densities in the year of application or the following year.

Site specific management of annual ryegrass has merit with pre-emergence herbicides. The patches are able to be mapped in crop and patch stability means the map can be used in subsequent seasons to target pre-emergence herbicides.

Declaration

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