COMPATIBILITY AND SAFETY OF MIXING AZOXYSTROBIN AND STARTER FERTILIZERS FOR CONTROLLING *R. SOLANI* IN SUGARBEET

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INTRODUCTION

Rhizoctonia crown and root rot (RCRR) is one of the most severe production problems for growers in Minnesota and North Dakota. RCRR is caused by the fungus *Rhizoctonia solani*. The main anastomosis group that affects sugarbeet in Minnesota and North Dakota is AG 2-2 with the intraspecific groups (ISGs) being AG 2-2 IVB and AG 2-2 IIIB (Brantner and Windels, 2008); the latter is considered more aggressive and damaging (Bolton et al., 2010). The fungus is present in all soils but becomes problematic in fields where the pathogen population is high due to frequent use of Rhizoctonia susceptible host crops in rotation. Root rot infections are favored by warm temperatures of between 21.1° C and 26.7° C, and moisture levels of 75 to 100% (Bolton et al., 2010). Rhizoctonia root and crown rot may significantly reduce yield (Khan and Bradley, 2010). In 2009, Rhizoctonia root rot was named as one of the most serious production problems affecting sugarbeet growers in North Dakota and Minnesota (Stachler et al., 2009). Fungicide application prior to infection by *R. solani* can be used to obtain good control against the pathogen. Several studies have been done to confirm azoxystrobin as the best fungicide for controlling RCRR disease when applied before infection takes place (Brantner and Windels, 2002; 2010; Khan and Bradley, 2010). Application of starter fertilizers at planting is a common practice for sugarbeet growers in this region. The combination application of azoxystrobin and starter fertilizers as a mixture will save time as well as reduce cost of application. There is no report on this issue as whether they will be safe to combine and their effect on controlling sugarbeet crown and root rot caused by *R. solani.* Syngenta, the manufacturer of azoxystrobin does not support the mixture of azoxystrobin with liquid starter fertilizers due to possible stand reduction. It will be useful to have information on combining azoxystrobin and liquid starter fertilizers and their effect on controlling RCRR.

OBJECTIVES

The objective of this study was to evaluate the safety and efficacy of control of *R. solani* by azoxystrobin applied in mixtures with starter fertilizers.

MATERIALS AND METHODS

An experimental trial was done in the new greenhouse of the Agricultural Experimental Station located at North Dakota State University, Fargo, North Dakota. Sugarbeet cultivar Crystal 539RR was used as a *Rhizoctonia* susceptible variety. Sunshine Mix 1 peat soil (Sun Gro Horticulture) was filled in the small tray and 10 seeds/tray were planted in the furrow. *R. solani* AG 2-2 IIIB infested barley grain was used as inoculum. Fungicide used for this experiment was azoxystrobin at 9.2 fl oz and three kinds of starter fertilizer (10-34-0, 6-24-6 and Redline) at 3 gpa were used. Fungicide and fertilizer applications were done using a spraying system calibrated to deliver the fungicides and fertilizers at 20 psi with a speed of 2.7 revolutions per minute using a single flat fan nozzle (4001E). Azoxystrobin 9.2 fl oz was applied as an in-furrow application singly as well as mixed with three different starter fertilizers: 10-34-0, 6-24-6 and Redline at 3 gpa. Three kinds of starter fertilizer 10-34-0, 6-24-6 and Redline at 3 gpa were applied singly without any fertilizer mixture to compare with the azoxystrobin and starter fertilizers mixure. Also, 10-34-0, 6-24-6 and Redline 3 gpa were applied in inoculated soil without any azoxystrobin mixture. During formulation azoxystrobin was mixed with water prior to mixing with starter fertilizers to have better compatibility. Inoculated and non-inoculated controls were set as well where no fungicide or fertilizer mixture was applied. Data collection was done 21 days after spraying. Only the numbers of plants that were healthy and alive were counted. Along with stand count sugarbeet roots were also washed carefully to confirm whether any root rot symptoms remained. Since inoculated control showed completely dead roots and fungicide and fertilizer mixture as well as single fertilizer application without inoculation yields complete healthy roots similar to the non-inoculated control, only survived plants were counted. The experimental design was a RCBD with 3 replicates, repeated twice.

Folded F-test showed homogeneous variances for both experiments. Data were combined and analyzed with the Proc GLM procedure of SAS (version 9.3, SAS Institute Inc., Cary, NC).

RESULTS AND DISCUSSION

In treatments where a fertilizer was used alone with no inoculation, there was about 85 to 88% emergence and survival of healthy plants similar to where no treatments (fungicides, starter fertilizer and no inoculum) were used. As expected, the inoculum was effective and killed most of the plants in the inoculated control and where only starter fertilizers were used. The use of azoxystrobin alone and when combined with starter fertilizers (10-34-0, 6-24-6 and Redline) provided effective disease control similar to the non-inoculated control, which was significantly better than the inoculated control. There was no significant difference in emergence and survival of plants between the non-treated control and any of the non-inoculated treatments where fertilizer was used, suggesting that the fertilizers, used at 3 gpa did not impact plant stand. Similar results were obtained for the inoculated treatments where azoxystrobin was used alone or with starter fertilizers, indicating that emergence and survivability were not adversely affected under the testing conditions. No phytotoxicity was observed on sugarbeet plants or roots when azoxystrobin was applied alone or in mixtures with starter fertilizers. This study suggests that the combination of starter fertilizers and azoxystrobin will be safe for sugarbeet; however field research should be done to confirm these results since this experiment was done in the greenhouse where controlled environmental conditions, including adequate watering and warm temperature (22±2º C) was maintained.

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Table 1. Effect of mixing azoxystrobin and starter fertilizer on controlling *R. solani* in sugarbeet

Treatments	**Method of application**	**Mean number of surviving plants**
Non-Inoculated control	No application	8.8a
Inoculated control	No application	0.2b
10-34-0 at 3 gpa - non-inoculated	In-furrow	8.5a
10-34-0 at 3 gpa + inoculated	In-furrow	0.8b
6-24-6 at 3 gpa - non-inoculated	In-furrow	8.8a
6-24-6 at 3 gpa + inoculated	In-furrow	1.0b
Redline at 3 gpa - non-inoculated	In-furrow	8.8a
Redline at 3 gpa + Inoculated	In-furrow	0.2b
Azoxystrobin 9.2 fl oz + Inoculated	In-furrow	8.8a
Azoxystrobin 9.2 fl oz + 10-34-0 at 3 gpa + Inoculated	In-furrow	8.3a
Azoxystrobin 9.2 fl oz + 6-24-6 at 3 gpa + Inoculated	In-furrow	8.2a
Azoxystrobin 9.2 fl oz + Redline at 3 gpa + Inoculated	In-furrow	8.8a
LSD (0.05)		1.07