PRELIMINARY EVALUATION OF *LAETISARIA ARVALIS* AS CHEMICAL SEED TREATMENT ALTERNATIVE IN SUGARBEET

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Abstract:

As with several other crops, application of protective fungicides as seed treatment is a common and effective practice to manage seedling diseases of sugar beet. Sugarbeet seeds from commercial sources are pretreated with one or more of the available fungicides. Occasionally, some of the fungicides are combined to pretreat sugarbeet seed to enhance the spectrum of activity against targeted pathogens. Chemicals used to pretreat sugarbeet seeds include hymexazol, metalaxyl and tetramethylthiuram disulfide; (TMTD). In the Lower Yellowstone River Valley sugarbeet growing region (Eastern Montana and Western North Dakota), a combination of metalaxyl and TMTD is commonly offered as seed treatment to commercial sugarbeet growers. We present in this paper the result of a preliminary evaluation of *Laetisaria arvalis* as a biological alternate to commercial fungicide treatment of sugarbeet seed. Ground dried culture of *L. arvalis* was applied to sugarbeet seed using methyl cellulose. In other treatments, *L. arvalis* was cultured in substrates and incorporated in soil prior to planting of untreated seed. Controls consisted of untreated or commercially treated seeds. After planting, the crops were maintained under controlled environment and subsequently assessed for emergence and growth over a period of six weeks. Emergence and growth of all the *L. arvalis* treatments were comparable to the chemical treatment. The *Laetisaria* cultures on substrates enhanced growth of the sugarbeet seedlings. Our results support the need for expanded investigation of *L. arvalis* as an alternate to chemical seed treatment of sugarbeet seed.

Introduction:

Figure 1. Sugarbeet at Lower Yellowstone River Valley

Application of protective fungicides is a common and effective practice to manage sugarbeet seedling diseases. For that purpose, sugarbeet seeds from commercial sources are pretreated with one or more of the available labeled fungicides. Occasionally, some of the fungicides are combined to pretreat sugarbeet seeds to enhance the spectrum of activity against target pathogens. Chemicals used to pretreat sugarbeet seeds include hymexazol, metalaxyl and Tetramethylthiuram disulfide (TMTD). In the

Lower Yellowstone River Valley sugarbeet growing region (Eastern Montana and Western North Dakota) **Figure 1**, a combination of Metalaxyl and TMTD is commonly offered as seed treatment to commercial sugarbeet growers.

Laetisaria arvalis Burdsall is a soil inhabiting Basidiomycete. According to Papavizas *et al*. (1983), *L. arvalis* was first isolated from sugarbeet residues in the soil by Boosalis in western Nebraska and was initially referred to as *Corticium sensu lato*. It was later placed in the genus *Laetisaria* by Burdsall *et al*. (1980). *L. arvalis* has in the past been shown to control a variety of soil-borne pathogens in several crops (Lartey *et al.* 1994; Lartey *et al.* 1991). Lewis and Papavizas (1980) added *L. arvalis* to soil in the form of mycelia and sclerotia and obtained a decrease in the severity of cucumber fruit rot caused by *Rhizoctonia solani*. Odvody *et al*. (1980) observed reduction of damping-off in beans, soybeans and sugar beets when seeds were coated with dried mycelium of the fungus before planting in *R. solani* infested soil. The objective of this study was to investigate *L. arvalis* pre-planting treatment as an environmentally friendly alternative to chemical seed-treatments to protect sugarbeet seedlings.

Material and Methods:

The treatments were 1) *L. arvalis* as seed treatment, 2 & 3) soil incorporation of substrate grown *L. arvalis* at two levels, 4) formulated labeled chemical treated seeds and 5) untreated control. For seed treatment *Laetisaria arvalis* was cultured in 50 ml potato dextrose broth in 250 ml Erlenmeyer flasks at 21EC for 1 week. Mycelia with sclerotia were harvested, air-dried under a hood, ground and tested for viability before application. For the seed treatment, 1.0 g of ground *L. arvalis* culture was mixed with 1.0 ml of 0.5% methyl cellulose solution in a test tube. One hundred sugarbeet seeds (ACH 927) were mixed and rolled in the suspension and air dried for 24 hrs.

For substrate incorporated applications, *L. arvalis* was first cultured in CSYE broth in Erlenmeyer flasks. Cultures were incubated for 1 week at 27EC on a shaker at 130 rpm. Three hundred ml of the culture was then transferred to 500 g sterile ground pearled barley in a substrate bag, heat sealed and incubated for 1 week at 21EC. Cultures were then air-dried under a hood. For soil incorporation treatments, the dried cultures were incorporated at 100 mg or 1.0 g per 1 kg per natural field soil. Other treatment was commercial metalaxyl and TMTD formulated treated seed and control untreated sugarbeet seed.

Tests were carried out in nonsterilized sugarbeet field soil. One sugarbeet seed was planted in 1 kg soil per pot (11.5 x 15.25 cm). There were 12 replicate pots per treatment. Pots were completely randomized and maintained under 12 hr photoperiod in a greenhouse for six weeks at 25EC day and 21EC night temperatures. Emergence was determined after 2 weeks for each pot. After 6 weeks, the plants were evaluated for seeding emergence and biomass (total growth and root growth). Growth was based on total fresh weight and leaf area. Plants were photographed and subjected to analysis with ASSESS 2.0 Image Analysis Software (APS Press, St Paul MN). Root growth was based on fresh and dry weights determined after final harvest. Results were analyzed by comparing differences between treatment means using Tukey test.

Results and Discussions:

Results of our investigations of *L. arvalis* as a seed protectant alternative to chemical applications are presented in Figures 3 to 6. Percent emergence was based on the total number observed plants after 2 weeks, with 100 % emergence for all treatments.

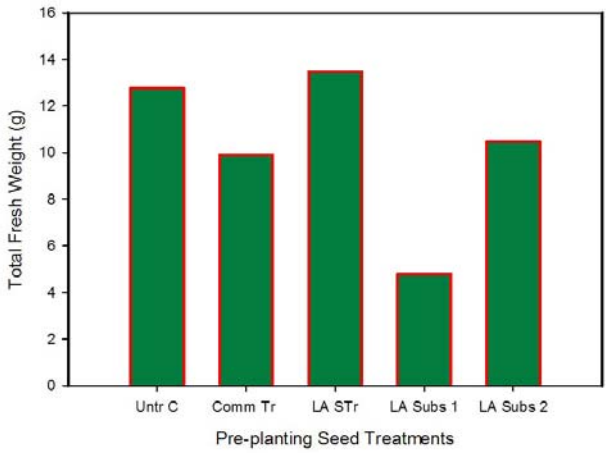

Figure 2. Total fresh weight of sugarbeet seedlings. Plants were harvested after 6 weeks after which individual plant weight was determined. Bars represent mans for 12 replicate plants. Untr C = Untreated control (12.76 g); Comm Tr = Commercial fungicide seed treatment (9.90 g); LA STr = *L. arvalis* seed treatment (13.48 g). LA Subs1 = *L. arvalis* at 100 mg/kg soil treatment (4.80 g); LA Subs2 = *L. arvalis* at 1 g/kg soil treatment (10.48 g).

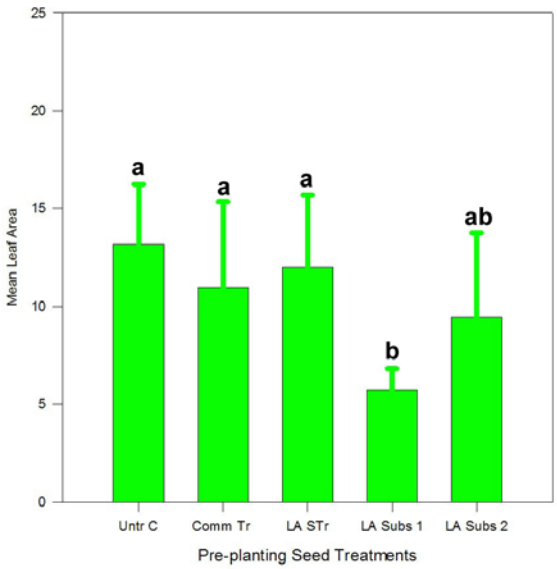

Figure 3. Mean leaf area of sugarbeet seedlings. Individual plants were photographed after 6 weeks at 72 dots per inch (dpi). For leaf area, images were transferred and analyzed with ACCESS Image Analysis Software. The bars are mean % area covered by plant leaves. The % ware converted from the figures in the following: Untr C = Untreated control (516.06 cm^2); Comm Tr = Commercial fungicide seed treatment (429.5 cm^2); LA STr = *L. arvalis* seed

treatment (469.83 cm^2); LA Subs1 = *L. arvalis* at 100 mg/kg soil treatment (224.34 cm^2); LA Subs2 = *L. arvalis* at 1 g/kg soil treatment (369.99 cm^2). Bars with the same letter are not significantly different, Tukeys HDS test, $P<0.05$.

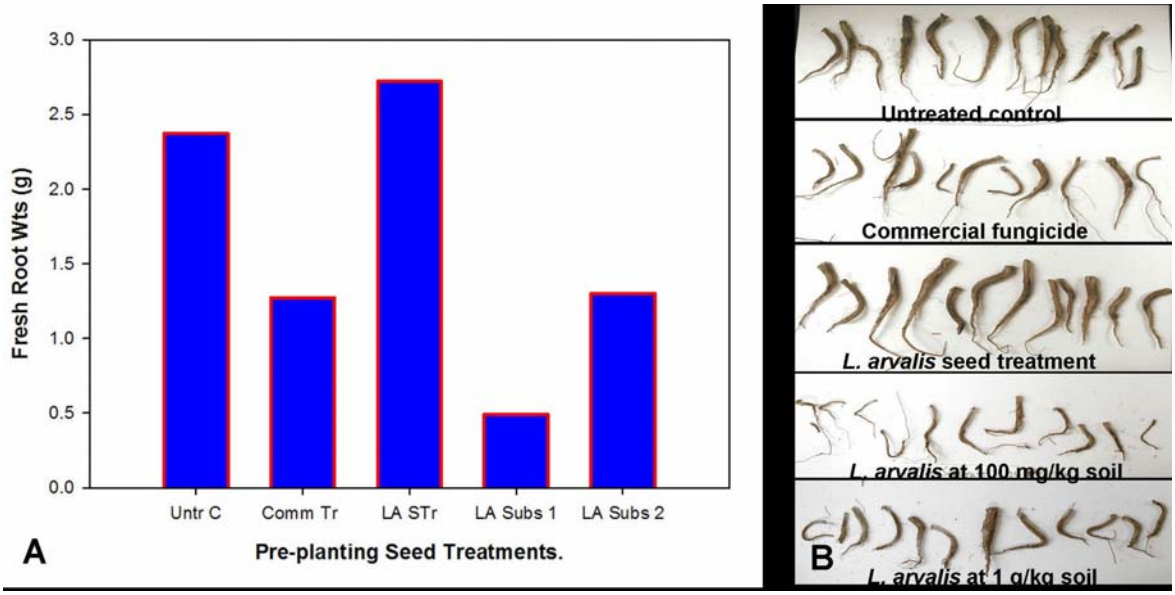

Figure 4. A. Mean fresh roots weight of sugarbeet seedlings. Roots were excised from plants after 6 weeks after which fresh weights were determined. The following are means from the twelve replicate plants. Untr C = Untreated control **(**2.37 g); Comm Tr = Commercial fungicide seed treatment **(**1.27 g); LA STr = *L. arvalis* seed treatment **(**2.72 g); LA Subs1 = *L. arvalis* at 100 mg/kg soil treatment **(**0.49 g); LA Subs2 = *L. arvalis* at 1 g/kg soil treatment **(**1.3 g). **B.** Images of sugarbeet roots after harvest Images of roots from the treatments: Untreated control, Commercial fungicide, *L. arvalis* seed treatment, *L. arvalis* at 100 mg/kg soil treatment; LA Subs2 = *L. arvalis* at 1 g/kg soil treatment.

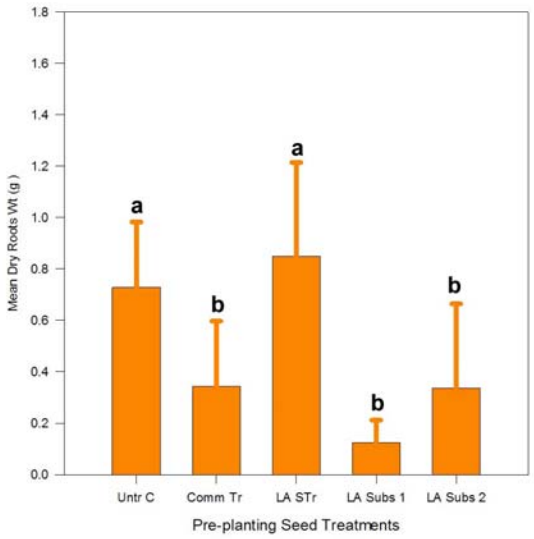

Figure 5. Mean dry root weight of sugarbeet seedlings. The excised roots were dried at 37°C for 72 hr in an oven after which the dry weight of individual root was determined and subjected to statistical analysis. The bars mean for twelve replicate plants. Untr C = Untreated control; Comm Tr = Commercial fungicide seed treatment; LA STr = *L. arvalis* seed treatment. LA Subs1 = *L. arvalis* at 100 mg/kg soil treatment; LA Subs2 = *L. arvalis* at 1 g/kg soil treatment. Bars with the same letter are not significantly different Tukeys HDS test, P<0.05.

Conclusions:

In this preliminary evaluation, sugarbeet seedling growth after *L. arvalis* seed treatments was comparable to or even better than the commercial fungicide seed protectant treatment. Soil incorporation of *L. arvalis* at high rate also appeared to have had an effect that is comparable to commercial fungicide treatment. However, the *Laetisaria* seed treatment appeared to have enhanced growth of the sugarbeet seedlings. Our results support the need for expanded investigation of *L. arvalis* as an alternate to chemical seed treatment of sugarbeet.

Literature Cited:

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