Evaluating *Poa supina* as an alternative species for overseeding in pesticide free athletic fields

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Executive Summary:

Sports fields have weak turfgrass stands in the centre of their fields, based upon the amount of play they receive during the playing season. Weak stands of turf leave openings for undesirable weeds that can cause disruption in play or injury. To reduce the influence of weak stands on fields, an evaluation of supina bluegrass (*Poa supina* Schard.) as an overseeding option was performed. Companion overseeding with perennial ryegrass (*Lolium perenne*) is being performed at varying rates, frequencies and mowing heights. Species composition counts are performed monthly to determine the amount of desirable species, and are being compared to areas receiving no overseeding at all. Frequency has an important influence on percent turfgrass coverage, data thus far shows that at the same overseeding rates, the plots receiving the same total amount of seed over three applications have greater turfgrass coverage than the plots that receive the all the seed in one application; while both treatments have greater coverage than the control. Demonstration fields have been set up both on the Guelph Turfgrass Institute property and in the cities of Guelph and Hamilton. As the results of overseeding take time to come to fruition, thus far the fields at the GTI have shown that there has been some success in establishing supina bluegrass into in-use fields when seeded with only supina bluegrass. An investigation into the overall effects of overseeding on the soil seedbank is currently still underway, however the first year's sampling has shown that overseeding does influence the population of the seedbank, and may be increasing the probability of turfgrass seeds germinating over weed seeds when a disturbance occurs.

OTRF Grant Objectives (Milestones):

1. **To evaluate P. supina as a potential candidate for pesticide free home lawns and athletic fields (March 2012):** Through a more extensive literature review and also due to the expensive cost of the seed, it was determined that the evaluation of supina bluegrass in home lawn environments was currently not warranted. The growth habit of supina bluegrass would required a home owner to have a very intensive cultural program to avoid the lawn from becoming too thatchy and to maintain a high quality uniform lawn. The focus of supina research has been changed to look at solely athletic fields, and the effects of overseeding on the soil seedbank. This has allowed the researcher to start a novel strain of research in the turfgrass field. The research thus far is showing that supina bluegrass is an excellent choice for southern Ontario athletic fields within a companion overseeding program with perennial ryegrass. Further evaluation of the

demonstration fields will determine if overseeding with supina bluegrass alone is functional.

2. **Determine if *P. supina* can be seeded with a high percentage of perennial ryegrass (March 2011):** The companion overseeding program on the worn research plots at the GTI have proven to be successful. The combination of the fast germinating, moderately wear tolerant perennial ryegrass with the slower germinating, higher wear tolerant, persistent seed of supina bluegrass have shown to have better turf coverage under heavily worn conditions. The seedbank research has shown that there are no adverse effects of seeding both perennial ryegrass and supina bluegrass together.
3. **Determine of the effectiveness of overseeding *P. supina* into existing turfgrass stands under high traffic and low traffic conditions (March 2012):** The companion overseeding program on the worn research plots at the GTI have proven to be successful. The combination of the fast germinating, moderately wear tolerant perennial ryegrass with the slower germinating, higher wear tolerant, persistent seed of supina bluegrass have shown to have better turf coverage under heavily worn conditions. While the research is still underway the first replication in time is showing the effectiveness of companion overseeding with supina bluegrass and perennial ryegrass. The long-term effects of overseeding take time to come about, however the demonstration fields that have received three overseeding events have begun to show the positive effects of overseeding with supina bluegrass.
4. **Create a series of demonstration fields throughout the region that can be used for educational and research purposes (September 2010):** Currently there are 7 demonstration fields in southern Ontario. The Guelph Turfgrass Institute's in use youth soccer fields, 2 irrigated and 1 non-irrigated have received overseeding 3 times with the 4th seeding event occurring spring 2012. The 4 city fields began their overseeding program May 2011, with a second overseeding in September 2011. There are 2 in-use play fields at the Howden Crescent park in Guelph ON. The 2 fields are non-irrigated fields maintained by the city of Guelph, however they have extensive (over-use) use by the neighbouring school, so the fields are under tremendous amount of wear particularly in the spring and fall seasons. The final 2 fields are in the city of Hamilton at Billy Sherring park. One field is irrigated and had extensive fall use for the neighbouring high school's Lacrosse team, while the high school's field hockey team used the non-irrigated field. The expectation by the researcher is that the 4 city fields will begin to show more differences in spring 2012 because the 3 fields that have received an extra overseeding event at the GTI now have established sections of supina bluegrass in them. The fields have been shown to members of the turfgrass industry on three separate occasions.

Extension and Outreach:
The following is a list to date of how the supina research is being transferred to members of the turfgrass industry:

- Guelph Turfgrass Institute Field Day 2010.
- Ontario Turfgrass Symposium. 2011. Turf Seeds vs. Weed Seeds: The ultimate competition for space and nutrients on a trafficked field.
- Dodson K.L, K. Jordan, F.J. Tardif, E. Lyons. 2011. An examination of the question: "Is Overseeding with Supina bluegrass a viable option?" Sports Turf Manager. Spring. 24(1): p. 1, 12-13, 15.
- June 2011. Walked a group of approximately 25 industry workers through the plots and fields for Jay Kivel as part of ORFA educational program.
- August 2011. City of Mississauga staff. Gave tour to approximately 35 people that work for the city of Mississauga.

Introduction:

Athletic fields are under an intense amount of stress during the playing season, which in southern Ontario is the length of the entire growing season. The large amount of play during the spring and fall puts greater stress on turfgrasses when they are either breaking or entering dormancy, resulting in bare patches or thin stands in the most trafficked areas of the field. Weak turfgrass stands leave openings for opportunistic weeds to enter into the field. Traditionally, Kentucky bluegrass (KBG) is used on athletic fields due to its ability to withstand traffic and its rhizomatous growth habit. Previous studies have examined the use of perennial ryegrass (PR) for overseeding into pre-existing fields (Elford et al., 2008 and Rossi, 2004). Both Elford (2008) and Rossi (2004) found that frequent overseeding with high rates of PR could result in a more uniform stand, with fewer bare ground patches and weeds. This practice may lead to reduce winter survival rates of the fields, since PR is susceptible to winter kill, which leaves merit into investigations of other turfgrass species that could perform well under trafficked conditions.

Supina bluegrass (*Poa supina* (Schrad)) is native to the European Alps, and has been bred and used as a turfgrass in Germany since the 1930s (Stier, 1998). The German name Lägerrispe, translates in English to " where the cows lay" reflects the ability of the turfgrass plants to withstand tremendous traffic pressures and still thrive (Sorochan and Rogers, 1998). *P. supina* is a turfgrass that has come out of favor in North America with the use of high inputs. Its lime green color, and dark numerous seed heads in the spring, do not fit into the dark green expectations that North Americans tend to migrate to when evaluating new cultivars. The National Turfgrass Evaluation Program (NTEP) rates a genetic color of dark green as a 9, while lighter shades would be rated lower (National Turfgrass Evaluation Program, 2010).

Now, with the changing attitudes of turf management, *P. supina* is an ideal candidate for high trafficked and shaded turf areas. Supina bluegrass' growth strategy is a competitive-ruderal, that is, it tends to grow laterally with a good canopy, while also producing seed heads, which enter into the soil seedbank, and

colonize in other disturbed areas of the field (Sorochan and Rogers, 1998). Its aggressive and stoloniferous growth habits, relatively late fall dormancy and early spring-up make it an ideal candidate for low-input athletic fields. Previous supina research on athletic fields has been on establishing fields, and has shown that with as little as 10% of supina seed in a KBG mix will result in a predominately supina bluegrass field within a few years (Sorochan and Rogers, 1998). Considering the aggressive nature of supina bluegrass an examination of overseeding with supina bluegrass in in-use fields is required.

Three projects were implemented to determine the effect of overseeding on weed infestation on athletic fields. The first project is to determine the ideal mowing height in combination with seeding rate and frequency of *Poa supina* within an overseeding mixture to effectively reduce weed pressure. The second project is to determine which species supina bluegrass or perennial ryegrass can more effectively reduce weed pressure on in-use athletic fields. The third project will evaluate the quantity and viability of existing and incoming weed seed as a result of overseeding in an established turfgrass system.

Project 1: Overseeding Rate Trial

The purpose of this project was to determine the optimum seeding rate and frequency of supina bluegrass within an overseeding mixture. The seeding rate study was also combined with an examination of an appropriate mowing height, and how all three of these factors will affect overall turfgrass quality and seed population levels in an established athletic field.

The experimental design of the overseeding rate trial is a randomized complete block design with 4 replications repeated over 2 years. There are a total of 22 treatments [(5x3x2)+2controls], with the factors being seeding rate (5), seeding frequency (2) and mowing height (2). The seeding rates are summarized in Table 1. All plots with the exception of the two non-seeded controls were seeded with 6 kg/ 100m^2 perennial ryegrass seed, while other plots were also seeded with supina bluegrass. Using an overseeding mix will ensure a more cost effective method of introducing supina bluegrass into a playing field. Plots were either seeded all in one

treatment or the plot would receive the total amount of seed over three (1/3 rate) applications throughout the playing season. Plots were maintained either at 3" (7.6cm) or 1.5" (3.8cm), in order to determine the optimum mowing height for a field containing supina bluegrass.

The overseeding rate trial was heavily worn for two weeks prior to the first seeding with the Sisis wear machine, to emulate an in-use athletic field. Throughout the playing season the plots were worn multiple times per week to emulate 6 football games a week. Pre-seeding counts were performed on June 30th, 2010, and June 3rd 2011. The first overseeding treatment occurred July 1st 2010 and June 7th 2011. The second seeding event occurred on August 16th 2010 and August 8th 2011, and the third occurred on September 15th 2010 and September 14th 2011. Wear was reduced in mid-September to 6 times per week, approximately 3 games per week. The mowing frequency for the 1.5" height of cut was also reduced to once a week on September 15th 2010.

Table 1: Seeding Rates for the Companion overseeding program. Overseeding is occurring on heavily worn Kentucky bluegrass dominant research plots at the Guelph Turfgrass Institute during the growing seasons of 2010, 2011 and will continue through to the end of 2012. All 6 seeding rates are applied either all at once in the spring or one third of the seed is applied 3 times throughout the growing season. Perennial ryegrass is the standard species choice for overseeding athletic fields because of its fast germination and low seed cost. Supina bluegrass is being added to the perennial ryegrass overseeding program to determine the ideal seeding rate and frequency of overseeding. All overseeding treatments are being compared to a no overseeding control (No OS).

Seeding Rate	Perennial ryegrass	Supina bluegrass
SR0	6kg/100m^2	0kg/100m^2
SR1/2	6kg/100m^2	0.5kg/100m^2
SR1	6kg/100m^2	1kg/100m^2
SR2	6kg/100m^2	2kg/100m^2
SR4	6kg/100m^2	4kg/100m^2
No OS	0kg/100m^2	0kg/100m^2

Species composition counts were performed monthly to determine the amount of desirable species in each plot. In general overseeding produced higher quality turfgrass coverage than the non-overseed control over time (Fig. 1). However what is interesting to note is the frequency of overseeding appears to play an important role in maintaining uniformity of the playing surface. Assuming equivalent seed amount, seeding 3 times per annum produces a more uniform playing surface (Fig. 2). This confirms previously OTRF-funded research question

proposed by Elford et al. (2008) on whether frequency of overseeding plays a more important role than overseeding all at one time. The quality data thus far indicates that more frequent overseeding provides a more uniform and consistent playing surface.

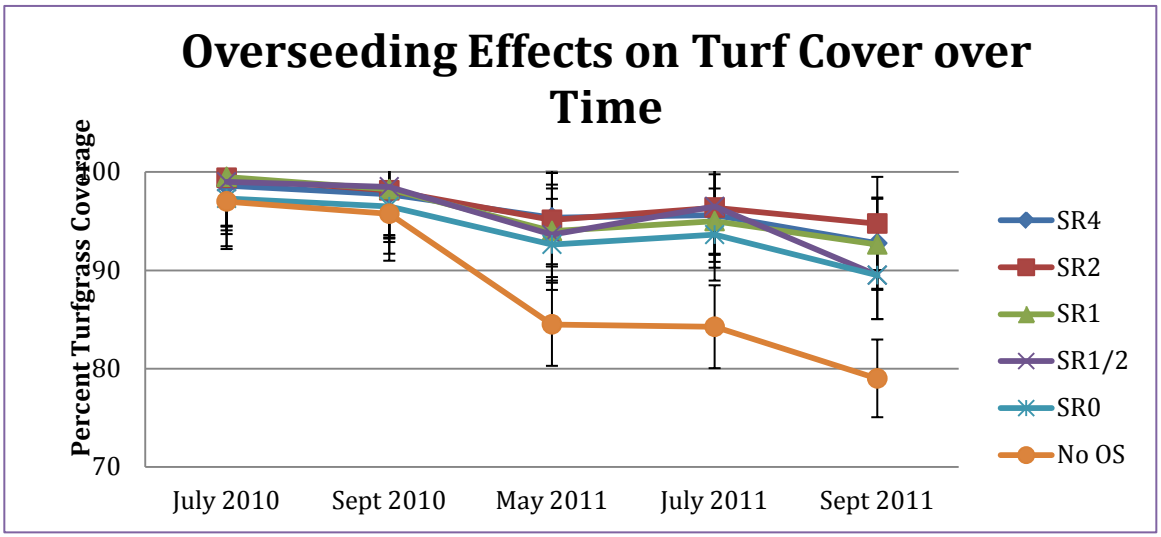

Figure 1: Turfgrass coverage over time on irrigated, heavily worn Kentucky bluegrass dominant research plots at the Guelph Turfgrass Institute, Guelph, ON. The 5 different seeding rates correspond to the rates listed in Table 1, where SR1/2 represents an overseeding mixture of 6kg/100m^2 perennial ryegrass combined with 0.5 kg/100m^2 supina bluegrass. No OS represents the control plots that received no overseeding. The points on the graph represent the mean of four replicates, and the error bars are indicative of the standard deviation for each point in the series. All plots started at approximately 95% turfgrass coverage. Over the 2 growing seasons it is apparent that without any overseeding the amount of turfgrass coverage is steadily declining, while there is no differences between the seeding rates with amounts 1kg/100m^2 supina bluegrass or higher.

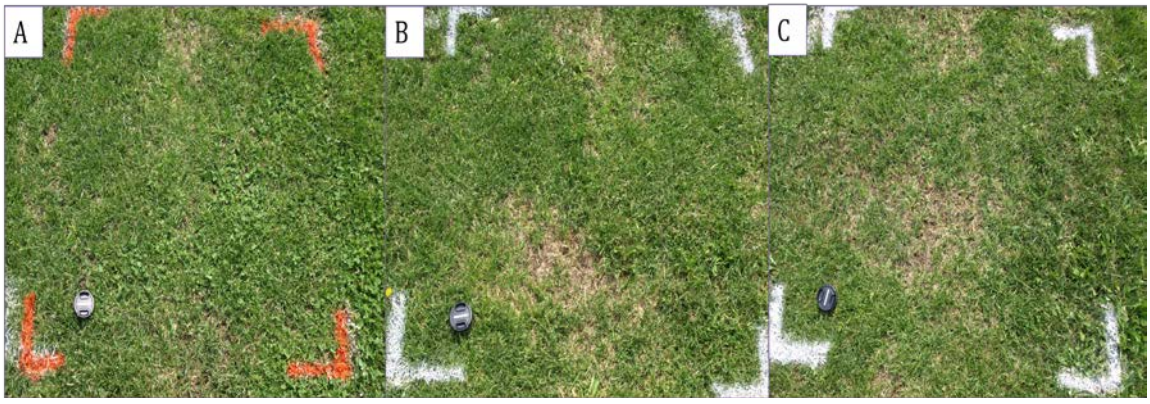

Figure 1: Overview of 4kg/100m^2 supina bluegrass + 6KG/100m^2 perennial ryegrass (A & B) compared to a no overseeding control (C) one year after the first seeding. Picture A received the same amount of seed as B, but over 3 intervals vs. all the seed applied once late spring (picture B).

Project Two: Demonstration Fields

The purpose of this demonstration project is to examine the effects of overseeding with supina bluegrass vs. overseeding with perennial ryegrass. Both irrigated and non-irrigated athletic fields in Guelph and Hamilton are currently part of the demonstration project.

Fields were divided in half and each half received either PR at a rate of 3 kg/100m^2 or with SB at a rate of 0.5 kg/100m^2. The 3 fields at the GTI (2 irrigated and one non-irrigated) were seeded September 24th 2010, May 5th and September 27th 2011. The city of Guelph and Hamilton fields (4 fields total) were overseeded May 10th and September 27th 2011. One month after the first overseeding treatment the halves that were overseeded with PR had greater turfgrass coverage. So far the data is showing no differences between the treatments, however the GTI fields that had been overseeded two times have established SB stands around the edges of the goalmouths. Also an interesting point to note so far is that the non-irrigated field at the GTI had severe drought conditions, and the half that was overseeded with SB now has a large population of SB in the stand, and fewer weeds than the PR half (Figures 3 – 7).

In personal communications with an athletic field manager in the US, he found that overseeding with SB appeared to not be aiding in the turf quality of his field, however spring 2011, after 2 years of adding SB in his OS mixture he is now seeing seedheads, and realized that his SB overseeding is aiding in maintaining turf quality on his fields. As this is an ongoing project I expect to seed more conclusive results from my overseeding program on the demonstration fields during the playing season of 2012.

Figure 3: Photo of the mid-field of the non-irrigated youth soccer field at the Guelph Turfgrass Institute, Guelph ON, on July 19th 2011. The hot dry conditions of mid-summer have caused the turfgrass to go dormant.

Figure 2: Photo of the mid-field of the non-irrigated youth soccer field at the Guelph Turfgrass Institute, Guelph ON, on August 23rd 2011. As the dry season is ending and precipitation has returned some turf is beginning to enter back into the stand, however there is approximately 15% bare soil now.

Figure 3: Close-up of supina side of midfield in the non-irrigated field at the Guelph turfgrass Institute, Guelph ON, on September 27th 2011. Note the lighter green colour, and how the drought has allowed supina to become the dominant turf on the side of the field where supina bluegrass overseeding occurred.

Figure 6: Overview of the non-irrigated field at the Guelph turfgrass Institute, Guelph ON, on September 27th 2011. Field has been marked with flags in preparation for the third overseeding treatment of the demonstration field (yellow and pink flag in the distance). The foreground is the supina bluegrass treated side, while the background was overseeded with perennial ryegrass. Supina bluegrass regrowth is very evident (light green turf) in the foreground.

Figure 4: Overview of the non-irrigated field at the Guelph turfgrass Institute, Guelph ON, on September 27th 2011. The line where the turf goes from being a more solid stand to patchy turf displays the centre of the field where overseeding is occurring compared to where no overseeding is occurring on the outer third of the field.

Project 3: Seedbank Analysis

Project three was implemented to examine the hypothesis that overseeding will decrease the percentage of weed species in the soil seedbank, when compared with the overseeded species. This study occurred in the same location as the project 1, therefore the same overseeding treatments were used. There were 22 treatments

[(5x2x2)+2 controls], with five seeding rates, two seeding frequencies, two mowing heights, and two controls (one at each mowing height).

Soil samples were collected using a soil probe on Nov. 30th 2010, May 4th 2011, and Dec. 2nd 2011 (Fig. 8). A second spring soil sampling will occur May 2012, for a total of two sampling events for each season. The rationale for two sampling events is to determine when the optimal time to take seedbank samples in turfgrass systems that will be representative of the potential incoming species for the following season. The top 5 cm of each soil core was cut, screened and mixed according to methods described by Pareja et al. (1985). Following the seedling emergence method (Ter Heerdt et al. 1996), 60 cc of the prepared soil was placed on top of potting mix in a 7.6 x 7.6 cm pot. Pots were watered daily to ensure the sampled remained moist for 4 weeks before being harvested. Pots were then dried down before remixing and rewetting. For the sample taken late fall 2010 the dry down and rewetting procedure was repeated for a total of 9 months before the seedbank was extinguished in all pots. The spring 2011 pots are still continuing to be harvested and rewetted, but it appears they are now in their last month.

Figure 8: Plot picture of the soil probe taking soil sample of the seedbank of the irrigated heavily worn research plots at the Guelph Turfgrass Institute, Guelph ON, on Nov. 30th, 2010.

An analysis of the fall 2010 seedbank data revealed that increased seeding rates of supina bluegrass resulted in more desired turf seed in the seedbank (Fig. 9). The seedbank population was categorized by turfgrass species type, and the weed species present were subdivided into annual weeds, which are typically only a problem in no-mow conditions, and turf weeds, which are typically perennial weeds

that have evolved mechanisms to tolerate mowing and moderate amounts of wear (Fig.9). Mowing height had no significant effects on the seedbank composition. Supina bluegrass seed appears to have some persistent seed characteristics, which resulted in supina bluegrass seed becoming the dominant species in the seedbank. An analysis of the seedbank after 2 full years of overseeding will confirm if supina bluegrass seed is persistent or transient in the seedbank.

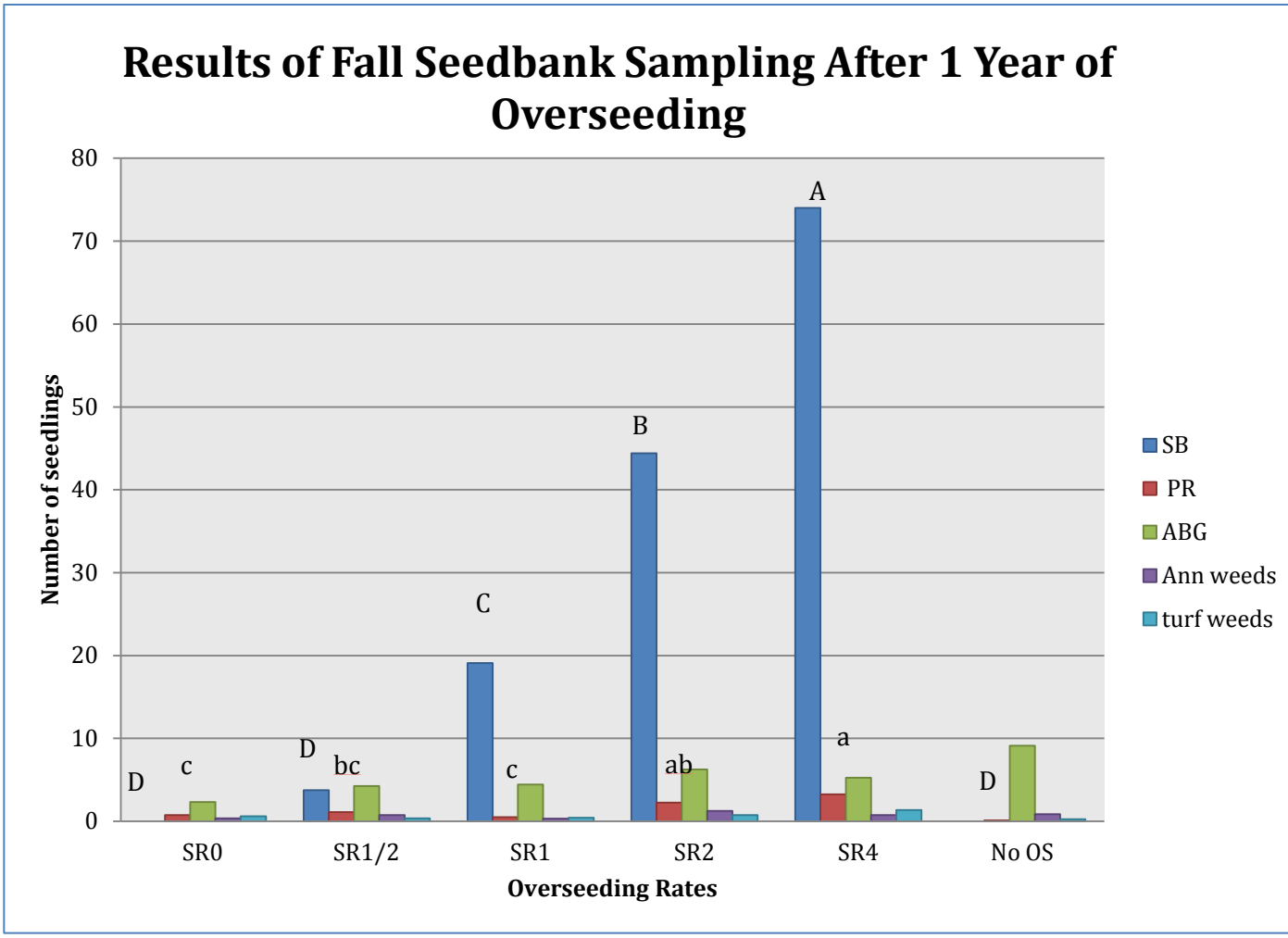

Figure 9: Seedbank analysis results after one year of companion overseeding on irrigated, heavily worn Kentucky bluegrass dominant research plots at the Guelph Turfgrass Institute, Guelph, ON. The 5 different seeding rates correspond to the rates listed in Table 1, where SR1/2 represents an overseeding mixture of 6kg/100m^2 perennial ryegrass combined with 0.5 kg/100m^2 supina bluegrass. No OS represents the control plots that received no overseeding. LS means calculated using ANOVA. Treatments with different letters are shown to be different at P=0.05. As overseeding rates of supina bluegrass increased there was an increase in the amount of desirable turfgrass seed in the seedbank.

Conclusions:

Overseeding with supina bluegrass has displayed it's ability to withstand high amounts of traffic and can persist in the soil seedbank of athletic fields in southern Ontario. The companion overseeding program with SB and PR together results in the fast fill-in of bare areas by PR, while the SB seed is slowly establishing in the sward. Overseeding smaller amounts more frequently allows a turfgrass manager a cost effective measure to maintain turf coverage throughout the playing season more effectively than overseeding once per season. Maintaining a lower height of cut in conjunction with overseeding appears to be producing a more uniform playing surface. As this is an ongoing overseeding program the third growing season will supply more concrete conclusions.

References:

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