

## **Evaluation of the Herbicide Velocity for Selective Removal of Annual Bluegrass from Creeping Bentgrass**

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### **Summary**

The herbicide Velocity SP was tested for its effects on annual bluegrass removal from a Penn A-4 creeping bentgrass putting green maintained at a height of 3.2mm (0.125"). Weekly applications were made beginning July 17. Four applications were made for the two higher rates, while six applications were made for the two lower rates. At the 1.0x rate (0.31 g/100m<sup>2</sup>), almost complete eradication of the annual bluegrass was obtained one week after the third application of product. As well, control of annual bluegrass was almost complete with the 0.75x rate (0.23g/100m<sup>2</sup>). However, removal was more gradual and it was six weeks after the fourth application before almost complete eradication was achieved. Removal rates were even more gradual for the 0.5x (0.15g/100m<sup>2</sup>) and the 0.25x (0.07g/100m<sup>2</sup>) rates. A 90% reduction was obtained three weeks after the final application, while a 70% reduction was obtained with the lowest rate. Discolouration of the turf was evident for all rates of application. However, recovery was complete for all rates three weeks after the final application of product. Cold hardiness levels were unaffected by the product when sampled prior to the onset of winter.

### **Background**

The herbicide, Velocity SP (active ingredient Bispyribac 76.1%), has been licensed for use in Canada to remove annual bluegrass (*Poa annua*) from creeping bentgrass that is mowed higher than 9mm. Unfortunately, the majority of bentgrass grown in western Canada is for use on golf course putting greens which is typically mowed at 3-5mm in height.

This study was developed in order to test the effectiveness of the herbicide Velocity SP for reduction of annual bluegrass in creeping bentgrass when mowed at putting green height. In addition, discolouration of the creeping bentgrass and the product's effect on the cold hardiness levels were determined. Research has shown that plants that are under stress may not reach full levels of cold hardiness.

### **Methodology**

During the summer of 2009 a test was conducted at the Carstairs Community Golf Course (Carstairs, Alberta) to determine the effectiveness of Velocity SP Herbicide on a Penn A-4 creeping bentgrass putting green mowed at height of 3.2mm (0.125"). The trial was conducted on the clean-up pass of the green and showed a moderate level of plant stress. Plot sizes were 0.5 X 0.5 meters and were replicated four times in a randomized complete block design. Weekly applications were made for six weeks beginning on July 17 with a compressed air sprayer equipped with Teejet 8002 nozzles that were calibrated to spray 8L/100m<sup>2</sup>. Rates of product application were equivalent to 0, 0.25 (0.07g/100m<sup>2</sup>), 0.5 (0.15g/100m<sup>2</sup>), 0.75 (0.23g/100m<sup>2</sup>) and 1.0 times the recommended application rate (0.31 g/100m<sup>2</sup> or 31g/ha) for gradual removal of annual bluegrass. The letter 'x' is used to designate times the recommended application rate when referenced further. Following the fourth application treatments were stopped on both the 0.75x and 1.0x rate due to concerns for injury to the creeping bentgrass turf.

In order to determine the product effect on reduction of annual bluegrass, the percent of area infested was determined through a visual evaluation. Annual bluegrass has a bunch type growth habit and therefore, infestations are circular in appearance and are relatively easy to distinguish from creeping bentgrass.

Discolouration of the creeping bentgrass, which is an indication of toxicity to the plant from the herbicide, was determined using a 0-5 scale (Table 1).

Table 1 - Rating scale for discolouration of bentgrass following product applications.

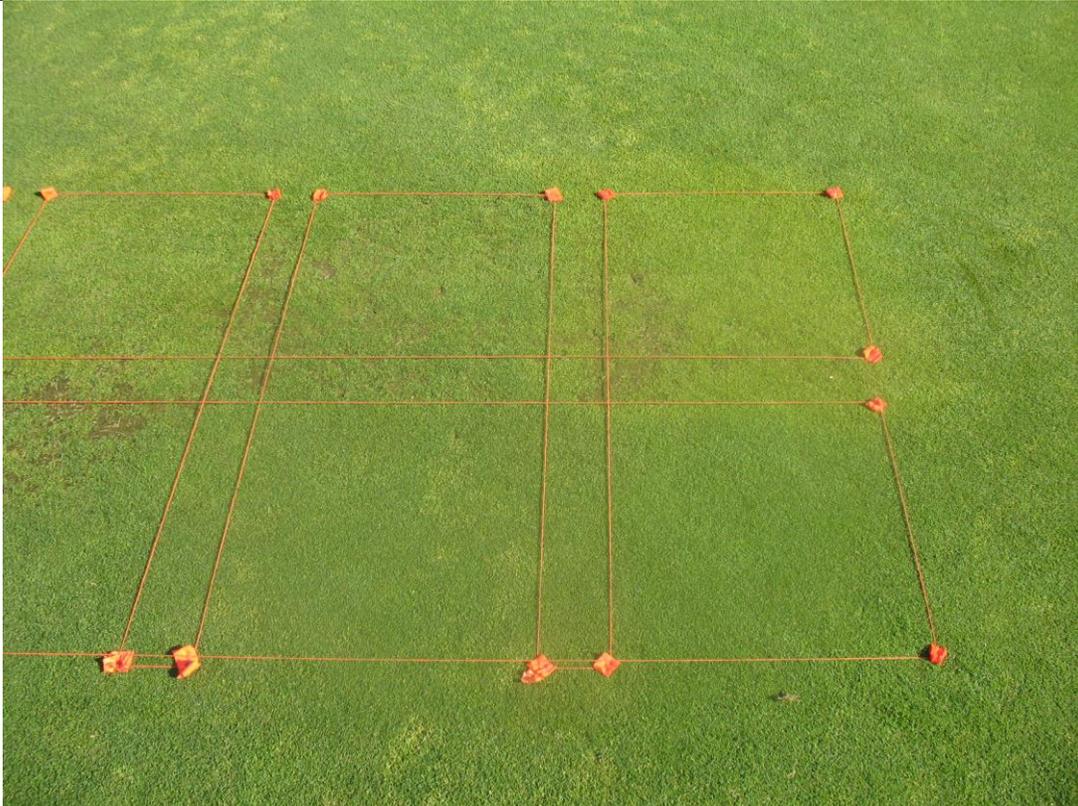
Value	Visible signs observed
0	No turf discolouration evident.
1	Negligible discoloration, distortion and/or stunted growth not evident.
2	Slight discoloration, distortion and/or stunted growth clearly evident.
3	Moderate discoloration and damage, marked distortion and/or stunted growth, recovery expected.
4	Substantial discoloration and damage, substantial distortion and/or stunted growth, some damage irreversible.
5	Majority of plants discoloured and damaged, considerable distortion and/or stunted growth, some plant mortality (<40%).

The relative cold hardiness of the treated bentgrass was determined using a laboratory freeze test. On October 30, ten turf plugs were collected from each of the plots. The plugs were arranged into trays and placed in an incubator (Revco Freezer/incubator BOD 30A) at 4°C for an additional 3 days prior to the commencement of the freeze test. A low temperature programmable freezer (Forma Model 8270/759M Freezer with a Watlow 982 programmable controller) was used for the freeze test. In order to prepare the individual plugs for the freeze test, a piece of moist paper towel was placed beneath each plug to act as a nucleator. Plugs were then allowed to acclimatize in the freezer for 12 hours at -2°C. Following acclimatization, the temperature of the freezer was decreased in a step-wise fashion by 2°C/hour. When the temperature was in the selected range, the predetermined turf plugs were removed. The temperature was further decreased by 2°C and the next series of turf plugs were removed. This process continued until all the test temperatures were reached. Following the freeze test, the turf plugs were thawed for 24 hours at 4°C in the incubator prior to being transplanted in segmented plastic trays containing an artificial potting media. The plug trays were then transferred to a growth chamber for four weeks at 18°C/10°C day/night temperatures with supplemental lighting. After four weeks, plant re-growth was rated for survival in order to establish the relative cold hardiness (LT<sub>50</sub> values) of the bentgrass.

## Results

At the 1.0x rate ( $0.31\text{g}/100\text{m}^2$ ) almost complete eradication of the annual bluegrass was evident one week after the second application (Table 2). One week after the third application, eradication was more than 95% complete and the population of annual bluegrass remained low for the remainder of the trial period. This would indicate that either two or three applications at this rate were sufficient to almost completely eradicate the annual bluegrass. Obvious voids (bare patches) in the turf were evident soon after the second application; however, area cover was not specifically rated in this study.

A 70% reduction in annual bluegrass population was also noted for the 0.75x rate ( $0.23\text{g}/100\text{m}^2$ ) one week after the third application of product. However, it was six weeks after the fourth application before eradication was equal to the 1.0x rate (95%). This would indicate a more gradual reduction in annual bluegrass from the creeping bentgrass with this rate of application.



Plots with bare patches where annual bluegrass was removed following applications of Velocity. High rates remove annual bluegrass within three weeks.

The rate of reduction for the 0.5x rate ( $0.15\text{g}/100\text{m}^2$ ), which was applied six times, was even more gradual. A 90% reduction of annual bluegrass was recorded three weeks after the final application of product, some nine weeks after the initiation of the study. The voids in the turf were not as evident as they were at the higher rates of application.

The lowest rate of application, the 0.25x rate (0.07g/100m<sup>2</sup>), showed the slowest rate of eradication of annual bluegrass. Ten weeks after initiation of the study there was almost a 70% reduction and the voids were never readily apparent.

Table 2 – Percent of area covered by annual bluegrass in plots.

Application Rate	Prior to Treatment	1 week	2 weeks	3 weeks	4 weeks	5 weeks
		%				
Untreated	25a	26a	22ab	26a	26a	26a
0.25x (0.07g/100m <sup>2</sup> )	35a	30a	28a	27a	25a	21a
0.5x (0.15g/100m <sup>2</sup> )	22a	23a	16abc	13b	12b	10b
0.75x (0.23g/100m <sup>2</sup> )	30a	32a	9bc	8bc	8bc	7bc
1.0x (0.31g/100m <sup>2</sup> )	36a	36a	3c	1c	1c	1c
LSD <sub>0.05</sub> =	n/s	n/s	14	9	8	8

\* Values that have the same letter as a suffix are not significant from each other.

Application Rate	6 weeks	7 weeks	8 weeks	9 weeks	10 weeks
	%				
Untreated	28a	27a	30a	31a	26a
0.25x (0.07g/100m <sup>2</sup> )	15b	11b	8b	10b	8b
0.5x (0.15g/100m <sup>2</sup> )	5c	5b	3bc	4bc	5c
0.75x (0.23g/100m <sup>2</sup> )	3c	3b	2bc	1c	1d
1.0x (0.31g/100m <sup>2</sup> )	1c	1b	1c	1c	1d
LSD <sub>0.05</sub> =	7	10	6	6	3

\* Values that have the same letter as a suffix are not significant from each other.

Discolouration of the creeping bentgrass was most evident after the fourth application of product and the two highest application rates produced the greatest discolouration. The discolouration was great enough that there was concern for mortality on the creeping bentgrass and treatments were discontinued for the high rates. However, three weeks after the final application, creeping bentgrass that had been treated with the high rates of application showed no discolouration and had completely recovered.



Individual plots showing discolouration of creeping bentgrass following four applications of velocity. Plots with no discolouration were untreated. As rate increases so does discolouration.

The two lower rate applications showed significantly less discolouration than the high rate for weeks two through six. However, the two lower rates took about the same length of time as the higher application rates to completely recover their colour.

Table 4 – Discolouration of bentgrass following application using a 0-5 rating scale.

Application Rate	Prior to Treatment	1 week	2 weeks	3 weeks	4 weeks	5 weeks
0 – 5 scale						
Untreated	0.a	0.0a	0.0d	0.0c	0.0c	0.0c
0.25x (0.07g/100m <sup>2</sup> )	0a	1.0a	1.0c	1.5b	1.5b	2.0b
0.5x (0.15g/100m <sup>2</sup> )	0a	1.2a	2.2b	2.0b	2.2b	2.0b
0.75x (0.23g/100m <sup>2</sup> )	0a	1.7a	3.0a	3.7a	4.1a	3.4a
1.0x (0.31g/100m <sup>2</sup> )	0a	2.0a	3.0a	4.2a	4.5a	3.6a
LSD <sub>0.05</sub> =	n/s	n/s	0.6	1.1	0.9	1.0

\* Values that have the same letter as a suffix are not significant from each other.

Application Rate	6 weeks	7 weeks	8 weeks	9 weeks	10 weeks
	0 – 5 scale				
Untreated	0.0b	0.0b	0.0a	0.0a	0.0a
0.25x (0.07g/100m <sup>2</sup> )	2.0a	1.0a	0.0a	0.0a	0.0a
0.5x (0.15g/100m <sup>2</sup> )	2.0a	1.5a	1.0a	0.0a	0.0a
0.75x (0.23g/100m <sup>2</sup> )	2.0a	0.0b	0.0a	0.0a	0.0a
1.0x (0.31g/100m <sup>2</sup> )	2.0a	0.0b	0.0a	0.0a	0.0a
LSD <sub>0.05</sub> =	0.8	0.6	n/s	n/s	n/s

\* Values that have the same letter as a suffix are not significant from each other.

When relative hardiness levels were tested just prior to the onset of winter, there were no differences between treatments.

Table 5 - Relative cold hardiness of creeping bentgrass as measured by freeze test.

Application Rate	LT <sub>50</sub> value °C
Untreated	-22.5a
0.25x (0.07g/100m <sup>2</sup> )	-21.0a
0.5x (0.15g/100m <sup>2</sup> )	-22.0a
0.75x (0.23g/100m <sup>2</sup> )	-21.0a
1.0x (0.31g/100m <sup>2</sup> )	-22.0a
LSD <sub>0.05</sub> =	n/s

\* Values that have the same letter as a suffix are not significant from each other.

## Discussion

This trial was conducted on a creeping bentgrass green that appeared to have a moderate level of plant stress. Typically, greens that are mowed with a triplex (three unit riding mower) require a single pass around the outside ring of the green to clean-up clippings and complete the mowing process. Tires of the mower exert pressure in the same area each time the green is mowed and the turf quality is negatively impacted.

The fact that the turf was somewhat stressed may have improved the effectiveness of the product and higher rates may be required on turf that is stress free. However, the fact that there was complete recovery from the discolouration three weeks after the final applications would indicate that there is some level of safety with this product when applied to creeping bentgrass that is mowed at putting green height.

In addition, it would also appear that the negative effects of the product are short lived as plants attained normal levels of cold hardiness soon after the completion of this trial. Previous research has shown that plants that are under stress may not achieve their full potential for cold hardiness. The fact that the untreated control attained a similar level of cold hardiness to the treated plots would indicate that there was a full recovery from the negative effects of the applications of the product, if there was ever a negative effect at all.

Results from this trial would indicate that the 1.0x rate of application may cause unacceptable bare patches when populations of annual bluegrass are higher than 25%. A more gradual reduction was shown to be possible with the lower rates of application where bare patches were not evident. Application rates of 0.75x or 0.5x may be more appropriate for gradual removal.

Further testing will concentrate on a strategy to remove annual bluegrass without creating significant bare patches when higher populations exist.