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Short title: Dichlobenil and Hair Fescue

Effect of Application Method on Dichlobenil Efficacy of Hair Fescue (*Festuca filiformis*) in Lowbush Blueberry

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Abstract

This study assessed dichlobenil's potential to manage hair fescue in lowbush blueberry when targeted or broadcast-applied (7000 g ai ha⁻¹) as justification for developing a precision-targeted applicator. A randomized complete block design was used to assess both application methods, and results were compared with industry-standard pronamide (2240 g ai ha⁻¹). Targeted and broadcast-applied dichlobenil in fall 2020 significantly reduced average total tuft density in the non-bearing year (2021) by 75% and 67%, respectively, and in the bearing year (2022) by 61% and 59%, respectively. Broadcast pronamide applications in fall 2020 significantly reduced total tuft density by 84% in the non-bearing year (2021) and 81% in the bearing year (2022). These reductions in total tuft density resulted in average lowbush blueberry yields of 416, 557, 573, and 617 g m⁻² for each control, pronamide, targeted, and broadcast-applied dichlobenil, respectively. Increases in yield were not significant, though the large variation within the sample is the likely cause. The similarities between targeted and broadcast-applied treatments demonstrate the potential of targeted dichlobenil. Given the high product cost of dichlobenil at \$1,873 ha⁻¹, hair fescue's non-uniform distribution in lowbush blueberry fields and the lowbush blueberry industry's overreliance on pronamide, targeted application of dichlobenil has significant potential. This work justifies developing a mechanized precision targeted applicator for use in the lowbush blueberry cropping system.

Nomenclature: Dichlobenil; pronamide; hair fescue, *Festuca filiformis*; lowbush blueberry, *Vaccinium angustifolium* Ait.

Keywords: casoron, fescue, herbicide, kerb, targeted application

Introduction

Lowbush blueberries are a perennial woody fruit crop and are among eastern Canada's most economically important crops, with a farm gate value of \$181 million in 2022 (Statistics Canada 2024). The first year of lowbush blueberry growth is purely vegetative, where stems grow from underground rhizomes from spring through late July. The plant dedicates energy to developing flower buds from the end of July. The plant overwinters, and in the following spring, flowers open, are pollinated, and form fruit. Throughout the summer, fruit transition from green to red and finally to blue, softening as they mature (MacEachern et al. 2021). Ripe berries are harvested from mid-August through mid-September. In late fall, the remaining stems are mowed back to ground level, and the cycle is repeated. Several critical management decisions must be made throughout the two-year production cycle, with perennial weed management at the forefront.

The perennial weed of greatest concern to the lowbush blueberry industry is hair fescue, with the Wild Blueberry Producers Association of Nova Scotia identifying its management as their number one industry priority since 2019 (Wild Blueberry Producer's Association of Nova Scotia 2019, 2022). Hair fescue is a densely tufted perennial grass which, when left unmanaged, tends to form dense sods within lowbush blueberry fields (White 2022; White and Kumar 2017). Further, hair fescue tends to outcompete lowbush blueberries and has been shown to reduce yields by over 50% (White 2019; Zhang 2017; Zhang et al. 2018). In 2001, hair fescue was observed in only 7% of sampled Nova Scotian lowbush blueberry fields, and by 2019, it was observed in 75% of fields (Lyu et al. 2021). Mature hair fescue tufts can produce up to 3,000 seeds, which readily break from the panicle, lack primary dormancy (Amen 1966; White 2018, 2020; White and Kumar 2017), and are a common contaminant on agricultural equipment such as harvesters (Boyd and White 2009). Hair fescue also complicates the harvest process, which can be slowed by significant weed presence and cause reduced harvested berry quality. The industry's shift towards flail mowing and away from burn pruning has worsened the problem as hair fescue seeds can be killed by heat, but are no longer destroyed as part of the pruning process (White and Boyd 2016).

Preemergence applications of terbacil (Weed Science Society of America (WSSA) group 5 herbicide) and hexazinone (WSSA group 5 herbicide) have traditionally been used to manage hair fescue. Recent research demonstrates terbacil efficacy to be highly variable in Nova Scotia

(White 2019; White and Zhang 2021) while hexazinone resistance was shown to be 6.1 times higher in hair fescue biotypes within lowbush blueberry fields than biotypes from roadside hair fescue populations (Laforest et al. 2022). Postemergence applications of foramsulfuron (WSSA Group 2 herbicide) and flazasulfuron (WSSA group 2 herbicide) can likewise aid in suppression (White and Zhang 2020; Zhang et al. 2018) however, their similar modes of action are concerning for herbicide resistance management. Pronamide is a WSSA group 3 herbicide and is the current industry standard providing >90% control of hair fescue (White 2019, 2022; White and Zhang 2020, 2021) at a typical application cost of \$435 ha⁻¹ (Truro Agromart 2023). Given its prominence and lack of employed alternatives, there is concern over the use of pronamide and its potential selection for herbicide resistance. Dichlobenil is a granular WSSA group 29 herbicide which has shown success at controlling hair fescue (MacEachern et al. 2023; White and Zhang 2020) however it has seen little deployment due to its elevated cost of \$1,873 ha⁻¹ (Truro Agromart 2023). Both dichlobenil and pronamide are used as fall-applied preemergence herbicides in lowbush blueberry. Granular products in lowbush blueberry are typically applied using a spinner spreader or air boom applicator. With improved application methods targeted at reducing this cost, dichlobenil has significant potential to address herbicide resistance concerns while providing similar hair fescue control to pronamide.

Given hair fescue's tendency to clump and form patches, targeted applications have significant potential for managing hair fescue in lowbush blueberry fields. Targeted applications have had considerable success across many cropping systems by reducing the total agrochemical usage without sacrificing treatment quality. Giles and Slaughter (1997) found that targeted spraying in orchard crops reduced application volume by 66% to 80% over traditional methods. Esau et al. (2018) demonstrated a 79% agrochemical savings when targeted spraying moss in lowbush blueberry. Oebel and Gerhards (2005) looked at the effect of targeted spraying weeds in cereals, maize, sugar beet, and rapeseed and found up to a 60% herbicide savings for grass weed species and up to a 77% savings for broadleaf weed species. Finally, a review by Gerhards et al. (2022) looked at targeted spraying in various cropping systems and noted at least a 50% reduction in application costs without incurring detriment in future seasons when compared with traditional methods. Considering that average hair fescue coverage in lowbush blueberry fields is only 37% (Lyu et al. 2021), there is the potential for significant cost reduction by using targeted

application. Further, targeted application has significant temporal benefits as stoppages for refilling product can be reduced considerably.

Comparing broadcast and spot applications of dichlobenil is essential for effective weed management in lowbush blueberry fields. First, spot application may not be as effective on weeds that have not yet germinated in untreated areas, especially given the two-year cycle of lowbush blueberries and the data which has demonstrated significant hair fescue regrowth in the bearing-year for plots treated with dichlobenil and pronamide (MacEachern et al. 2023). Environmental herbicide redistribution effects are likely more pronounced in spot treatments, potentially leading to uneven herbicide distribution and inconsistent weed control (Williams and Mortensen 2000). Finally, the manual nature of spot application introduces human error, as individuals must accurately identify and treat each weed while ensuring label applications are maintained. This task becomes particularly challenging in dense hair fescue sods, where distinguishing individual plants can be difficult. Therefore, understanding these differences is crucial for optimizing herbicide application methods and ensuring effective long-term weed control.

Given the potential selection for pronamide-resistant hair fescue biotypes, dichlobenil's potential to provide an alternative mode of action for managing hair fescue in lowbush blueberry, dichlobenil's high cost of \$1,873 ha⁻¹, and the lack of research comparing targeted and broadcast-applied dichlobenil, the objective of this study is to compare the efficacy of broadcast and targeted-applied dichlobenil on hair fescue.

Materials and Methods

Plot Setup

The experiment was designed to compare both targeted and broadcast-applied dichlobenil (Casoron[®] G4, OHP) applications to industry standard pronamide (Kerb[™] SC, Corteva Agriscience) applications. Four treatments were arranged as a randomized complete block design with 5 blocks. Plot size was 4 m x 4 m and a 1 m buffer was left between adjacent plots. Treatments consisted of a nontreated control, pronamide at 2,240 g ai ha⁻¹, targeted-applied dichlobenil at 7,000 g ai ha⁻¹, and broadcast-applied dichlobenil at 7,000 g ai ha⁻¹. Experiments were carried out in three commercially managed lowbush blueberry fields. Site 1 was a 5.45 ha field located in North River, Nova Scotia (45°27'49"N, -63°12'45"W), Site 2 was a 2.21 ha field

located in Lornevale, Nova Scotia (45°28'20"N, -63°37'47"W) and Site 3 was a 6.23 ha field located in Camden, Nova Scotia (45°17'59"N, -63°11'01"W). The soil composition at all three sites was loamy sand (Table 1). Soil texture was estimated using the jar test in triplicate and averaging across the samples (Jeffers 2023).

Table 1. Soil texture, pH, and organic matter in each of the three sites located in North River, Lornevale, and Camden, Nova Scotia, Canada.

Site	Sand	Silt	Clay	pH	Organic matter
	-----%-----			pH	%
Site 1	86	10	5	4.5	12
Site 2	84	10	7	4.7	13
Site 3	82	9	9	4.6	10

Average absolute plot slopes in North River, Lornevale, and Camden were 9%, 7%, and 5%, respectively. Pronamide solution was applied at all sites on November 17, 2020, while granular dichlobenil was applied at all sites on November 18, 2020. Pronamide was applied with a CO₂-pressurized research grade sprayer outfitted with four Hypro 12002 ULD nozzles calibrated to deliver 300 L ha⁻¹ at 276 kPa. Targeted and broadcast dichlobenil applications were made with a Fertil™ Backpack Dispenser (Simeoni Tecnogreen, Sacile, Italy) and Scotts® Wizz™ Year-Round Spreader (ScottsMiracle-Gro, Marysville, United States), respectively. The Wizz™ is a portable spinner-spreader powered by AA batteries, featuring adjustable application rate and width. The application width remained constant throughout the experiment at 1 m, while the rate was set to 17.5 g m⁻². Consequently, four passes were conducted per plot for the plot measuring 4 m in width. To guarantee precision, all product dispensed using the Wizz™ underwent pre-weighing, ensuring the exact amount was applied to each plot. The Fertil™ was likewise pre-calibrated in lab prior to use to ensure the correct amount of product was dispersed on each press of the applicators opening mechanism.

Data Collection

Hair fescue total tuft density data were collected at the time of herbicide applications (Fall 2020). Vegetative and flowering tuft density (combined to give total tuft density) were collected in June of the non-bearing (2021) and bearing year (2022), and the tuft inflorescence number was collected in July of the non-bearing year. Densities were determined by counting all

tufts within nine 0.25 m² quadrats per plot. Tuft inflorescence number was determined on 10 flowering tufts per plot selected using the line transect method described in White and Kumar (2017).

Lowbush blueberry data included stem density collected in July of the non-bearing year, flower bud number per stem collected in October of the non-bearing year, and fruit yield collected in August of the bearing year. Stem density was determined by counting all stems within nine 0.023 m² quadrats per plot. The flower bud number was determined by counting the total number of flower buds on 30 stems in each plot. Stems were selected using the line transect method described by White and Kumar, 2017. Yield was determined by harvesting and weighing all berries within four 1 m² quadrats per plot. All data pertaining to hair fescue and lowbush blueberry were collected in-situ.

Herbicide Savings

The total amount of herbicide savings through spot application was calculated using the following assumptions. Herbicide application rate for both the broadcast and spot applied treatments was maintained at 17.5 g m⁻², the cost of dichlobenil was \$1,873 ha⁻¹, and the average tuft size was 0.0074 m². This value was based off a random sample of 30 hair fescue tufts at each of the three sampled sites selected using the line transect method. Herbicide savings at each field were then calculated based on the average number of tufts in each of the spot applied treatments and compared with broadcast application.

Statistical Analysis

Data analysis for all metrics was done using ANOVA in Minitab 21.2 (Minitab LLC, State College, United States). The site, treatment, and the site-by-treatment interaction were modeled as fixed effects with significance determined at $\alpha = 0.05$. Dependent on the interaction significance, data were either pooled or analyzed by site. The pencil test (Montgomery 2013) supported by the Anderson-Darling test for normality, which was used to determine the normality of the data. Constant variance was assured by plotting the residuals versus the fitted values and checking for the impression of an even band centered on 0. Multiple means comparisons were performed using Fisher's least significant difference at $\alpha = 0.05$.

Results and Discussion

Hair Fescue

Hair fescue tuft density at the time of herbicide applications did not vary across treatments at any site ($p > 0.05$) and averaged 49, 65, and 37 tufts m^{-2} for Sites 1, 2, and 3, respectively. There was a significant site-by-treatment interaction effect on non-bearing year total tuft density and tuft inflorescence number data ($p < 0.001$), and these data were analyzed separately for each site. There was, however, no significant site-by-treatment interaction ($p = 0.678$) effect on non-bearing year flower tuft density, and these data were therefore pooled across sites for analysis.

Eight months post application, pronamide-treated plots had lower total tuft density, flowering tuft density, and tuft inflorescence number than the untreated control across all study sites (**Error! Reference source not found.**). Targeted and broadcast-applied dichlobenil plots demonstrated total tuft densities which were lower by 75% and 67%, respectively, while pronamide plots demonstrated tuft densities which were lower by 84% when averaged across all sites. Both dichlobenil treatments had lower total tuft density at all sites, though only the broadcast treatment at Site 1 and the targeted treatment at Site 2 resulted in similar reductions to pronamide. All three herbicide treatments resulted in similar reductions in flower tuft density across sites with average reductions of 98%, 91%, and 91% in the pronamide, targeted dichlobenil, and broadcast dichlobenil treatments, respectively. Similarly, pronamide, targeted dichlobenil, and broadcast dichlobenil resulted in reduced tuft inflorescence number by an average of 99%, 86%, and 87%, respectively. The only significant difference between targeted and broadcast-applied dichlobenil across any of the variables was total tuft density at Site 2 where targeted application had greater density reductions than broadcast applications (Table 2). Further, for most sites and variables, dichlobenil applications were not significantly different from pronamide applications. This makes dichlobenil an excellent option to aid in resistance management for a crop with few options available for managing hair fescue.

For the bearing year, there was a significant site by treatment interaction on total tuft density and flowering tuft density ($p < 0.001$) therefore, these data were analyzed separately for each site (**Error! Reference source not found.**).

Twenty months post application, pronamide had lower hair fescue tuft and flowering tuft density at all sites (**Error! Reference source not found.**). Pronamide-targeted dichlobenil and broadcast dichlobenil had lower total tuft density by 81%, 61%, and 59%, respectively, during the bearing year. Notably, both targeted and broadcast applications of dichlobenil produced comparable reductions in total tuft density at Site 1. At Site 2, total tuft density was lower in areas treated with targeted applications of dichlobenil compared with broadcast application, while at Site 3, total tuft density was lower in areas treated with broadcast applications of dichlobenil when compared with targeted application. Reductions in flowering tuft density, however, were consistent across all herbicide treatments at each site and were reduced by 100%, 85%, and 85% in the pronamide, targeted dichlobenil, and broadcast dichlobenil treatments, respectively. These results demonstrate that control of hair fescue with dichlobenil extends into the bearing year. In contrast, hair fescue tends to recover in the bearing year following non-bearing year applications of herbicides such as terbacil, foramsulfuron, glufosinate (WSSA Group 10 herbicide), and flazasulfuron (White 2019; White and Graham 2021; White and Zhang 2021), making dichlobenil one of the most important alternatives to pronamide for long-term hair fescue control in lowbush blueberry fields.

In comparing the bearing and non-bearing year data, targeted-applied plots had greater total tuft density increases than broadcast-applied plots. On average, broadcast-applied plots had an increase of 19% while targeted-applied plots had an increase of 35%. This result does make sense, as no application buffer was used when the target applied dichlobenil, meaning that non-infested areas did not receive any herbicide and thus provided opportunities for seedling recruitment. Given dichlobenil's persistence in soils (Miller et al. 1966; Sheets et al. 1968), it is understandable that broadcast treatments will result in lower increases in total tufts over targeted treatments. Future work with targeted dichlobenil applications should consider using a larger buffer around applied tufts to account for dispersed seeds from plants not killed by the herbicides.

In comparing the effects of broadcast and targeted-applied dichlobenil, there were only marginal differences observed across both the bearing and non-bearing year. The results demonstrate the considerable potential of targeted-applied dichlobenil not only to reduce application costs, but to improve resistance management with respect to pronamide. As

pronamide is currently the only widely employed herbicide for managing hair fescue in Nova Scotia, dichlobenil can help by providing an alternative product with a differing mode of action. As for targeted application, future work should consider mechanized approaches for applying dichlobenil as the over \$1,800 ha⁻¹ cost will not be achievable for most growers. Alternatively, hand applications of dichlobenil may be viable for smaller operations with limited hair fescue presence however, as field size and hair fescue uniformity increase, it is likely that the feasibility of this approach will reduce.

Lowbush Blueberry

There was no significant site by treatment interaction effect on lowbush blueberry stem density, flower buds per stem or yield ($p = 0.246$, $p = 0.580$ and $p = 0.883$, respectively). Data were therefore pooled across sites for analysis.

Pronamide and the broadcast application of dichlobenil had the most substantial increase in lowbush blueberry stem density, although all treatments yielded comparable increases in the number of flower buds per stem (**Error! Reference source not found.**). Targeted applications of dichlobenil led to relatively lower increases in stem density, possibly due to uncontrolled tufts with this application method. Despite the improvements in stem density and the number of flower buds per stem, the overall lowbush blueberry yield remained consistent across all treatments, averaging 540 g m⁻². While there were no significant differences among the lowbush blueberry yield data, it should be noted that it is not unusual to encounter lack of yield response to weed control in small plot trials demonstrated by initial studies with hexazinone and other preemergence herbicides in commercial lowbush blueberry fields (Boyd et al. 2014; Boyd and White 2010; Kennedy et al. 2010; White and Kumar 2017). Further, it is well established that increases in stem density, flower buds per stem, and yield will increase with subsequent effective herbicide applications though not necessarily in each application cycle (Eaton 1994). For this reason, it is encouraging that stem density and flower bud per stem increased with each herbicide treatment as it demonstrates that the removal of competing weeds had a positive effect on lowbush blueberry development. It is likely that with similar management, subsequent years will also see improvements to the yield. Finally, targeted applications are likely to be more effective

at low weed densities which would have less of an impact on yield than more established weed populations.

Herbicide Savings

Herbicide savings through spot application at each of the three sites are shown in **Error!**
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The calculated herbicide savings at each of the three sites resulted in a reduction in total herbicide application and product cost of 63%, 48%, and 73% for each of Sites 1, 2, and 3 respectively. While a fully mechanized solution for spot applying dichlobenil would need to consider additional economic factors, there exists considerable potential to reduce the application cost of dichlobenil through spot application. If you extrapolate the calculated values across the entire fields for Sites 1, 2, and 3, the total savings are \$6,423, \$1,955, and \$8,543, respectively, for each of the fields. Determination of whether the product savings justify the use of dichlobenil would have to be made on a case-by-case basis, with hair fescue tuft uniformity likely being the driving factor in that determination.

Practical Implications

The findings from this study have significant practical implications for management of hair fescue in lowbush blueberry fields. The data confirm that targeted applications of dichlobenil is effective, offering a viable alternative to current herbicide practices. Despite the minimal differences observed between pronamide, targeted-applied, and broadcast-applied dichlobenil, pronamide remains the most cost-effective option for growers due to its lower cost of \$435 ha⁻¹ compared to \$1,873 ha⁻¹ for dichlobenil (Truro Agromart 2023). However, the reliance on pronamide raises concerns about potential herbicide resistance. To mitigate this risk and extend the efficacy of pronamide, it is crucial to incorporate alternative herbicides into weed management programs. This research supports the feasibility of targeted application as a cost-effective strategy for using dichlobenil, making it a practical consideration for field practitioners aiming to diversify their herbicide use. That said, future research should explore the efficacy of alternating both targeted and broadcast applied pronamide and dichlobenil over several growing seasons to assess the potential impacts on resistances.

Currently, the absence of commercially available targeted applicators for granular agrochemicals limits the implementation of this approach on a large scale. The study underscores the need for

the development of such technology, which would enable precise application, reduce herbicide use, and lower costs. As such, the research highlights an important direction for future technological advancements in the form of a granular targeted applicator.

In summary, this work provides a strong foundation for integrating targeted-applied dichlobenil into hair fescue management. Field practitioners can leverage these findings to optimize herbicide use, manage costs, and address the growing concern of herbicide resistance. This study not only validates the effectiveness of targeted application but also advocates for the development of necessary tools to support its widespread adoption.

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Competing Interests: The authors declare none.

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Table 2. Effect of pronamide and two dichlobenil application methods on hair fescue total tuft density, flowering tuft density, and tuft inflorescence number at three non-bearing year lowbush blueberry fields located in North River, Lornevale, and Camden, Nova Scotia, Canada.^a

	Rate	Total tuft density			Flowering tuft density		Tuft inflorescence number		
		Sit e 1	Sit e 2	Sit e 3	All Sites		Sit e 1	Sit e 2	Sit e 3
	g ai ha ⁻¹	-----tufts m ⁻² -----			flowering m ⁻²	tufts	-----number tuft ⁻¹ -----		
Nontreated control	0	67.0 (4.3)	72.4 (4.3)	44.6 (2.8)	41.1 (2.1)	a	44.0 (6.7)	9.1 (1.0)	15.0 (2.6)
Pronamide	2240	12.8 (2.2)	9.9 (1.4)	2.1 (0.7)	0.8 (0.1)	b	0.3 (0.2)	0.0 (0.0)	0.0 (0.0)
Targeted dichlobenil	7000	21.4 (3.2)	9.1 (1.6)	7.9 (1.1)	3.8 (1.4)	b	6.4 (2.0)	2.2 (0.6)	1.2 (0.3)
Broadcast dichlobenil	7000	18.7 (2.0)	23.6 (2.9)	7.9 (0.8)	3.7 (1.2)	b	6.7 (1.8)	1.0 (0.4)	1.1 (0.6)

^a Standard errors are in parentheses. Means within a column followed by the same letter are not significantly different according to Fisher's LSD (P≤0.05). Herbicide was applied in late fall 2020 and data was collected in spring 2021

Table 3: Effect of pronamide and two dichlobenil application methods on hair fescue total tuft density, flowering tuft density, and tuft inflorescence number at three bearing year lowbush blueberry fields located in North River, Lornevale and Camden, Nova Scotia, Canada. ^a

	Rate	Total tuft density						Flowering tuft density					
		Site 1		Site 2		Site 3		Site 1		Site 2		Site 3	
	g ai ha ⁻¹	-----tufts m ⁻² -----						-----flowering tufts m ⁻² -----					
Nontreated control	0	73.2 (5.6)	a	87.2 (5.1)	a	60.7 (3.7)	a	41.7 (4.4)	a	36.9 (3.0)	a	18.9 (2.4)	a
Pronamide	2240	11.6 (2.5)	b	14.8 (2.0)	c	2.2 (0.5)	d	0.0 (0.0)	b	0.0 (0.0)	b	0.0 (0.0)	b
Targeted dichlobenil	7000	18.3 (2.8)	b	20.4 (2.0)	c	20.5 (2.4)	b	2.9 (0.8)	b	6.6 (0.3)	b	5.2 (0.3)	b
Broadcast dichlobenil	7000	16.9 (2.4)	b	32.5 (3.2)	b	12.8 (2.2)	c	2.8 (1.2)	b	6.6 (0.2)	b	5.2 (0.3)	b

^aStandard errors are in parentheses. Means within a column followed by the same letter are not significantly different according to Fisher's LSD ($P \leq 0.05$). Herbicide was applied in late fall 2020 and data was collected in spring 2022

Table 4: Effect of pronamide and two dichlobenil application methods on lowbush blueberry stem density, flower buds per stem and yield at three fields in North River, Lornevale and Camden Nova Scotia in late fall 2021 (non-bearing year).

Treatment	Rate g ai ha ⁻¹	Stem density		Flower bud count		Yield	
		stems m ⁻²		buds stem ⁻¹		g m ⁻²	
Nontreated control	0	970 (49.0)	c	3 (0.09)	b	416 (68)	a
Pronamide	2240	1413 (48)	a	4 (0.13)	a	557 (100)	a
Targeted dichlobenil	7000	1273 (44)	b	4 (0.14)	a	573 (68)	a
Broadcast dichlobenil	7000	1348 (42)	ab	4 (0.15)	a	617 (86)	a

Table 5: Calculated herbicide cost achieved through targeted application of dichlobenil at three fields in North River, Lornevale and Camden Nova Scotia

Site	Applied herbicide	Cost
	kg ha ⁻¹	\$ ha ⁻¹
1	64.88	694.4
2	92.33	988.2
3	46.88	501.7