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Trialing DeerPro Winter™ and Deer Free Winter Armor™ Repellants to Control White-tailed Deer Depredation of Arborvitae and Yew

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Figure 1: White-tailed deer standing nearest untreated control shrubs that show signs of browsing in "Field" block shortly after planting

Introduction

Northern white-cedar, a.k.a. eastern arborvitae (*Thuja occidentalis*), is an evergreen coniferous tree in the cypress family that is native to the Northeastern United States and widely cultivated as an ornamental plant. Yew (*Taxus × media*) is a broadly adapted ornamental conifer created by the hybridization of yew species *Taxus baccata* and *Taxus cuspidata*. Arborvitae and yew are attractive to white-tailed deer and can experience significant defoliation in areas of high deer density. Depredation of coniferous ornamental shrubs by deer typically peaks in winter when other more nutritious food sources are less abundant and accessible.

One of the most common and effective winter damage control methods deployed by homeowners is physical exclusion. This can be achieved by covering foliage that is accessible to deer with plastic or burlap, or by fencing deer out of areas where shrubs are growing. Other control methods include scare tactics like dogs, motion activated sprinklers, scarecrows and even radios. However, success of scare tactics can diminish over time as deer become used to them, especially in cases of high deer pressure (Hillock et al., 1991). Lethal control is another effective method, but is rarely permitted in residential areas. Traditional control options may not be practical in many situations where aesthetics, cost, public perception, and safety must be considered. Chemical repellants are gaining popularity for deer control in urban residential settings due to their non-lethal and passive nature.

Deer repellants vary greatly in their composition and effectiveness. Repellant products can be classified into two different groups, area repellants and contact repellants. Area repellants are applied around the plants desired to be protected, using odors to repel deer. Examples of area repellants considered effective for white-tailed deer are ammonia soaps of higher fatty acids, predator urine, blood or meat meal, human hair, and bar soap. Effectiveness of these products is variable, typically ranging from 15-43% effective (Hillock et al., 1991).

Contact repellants are applied directly on the plants to be protected, using undesirable odors, taste, or both odor and taste to repel deer. Common active ingredients in contact deer repellants include putrescent egg solids, benzyldiethyl ammonium saccharide, thiram, and capsaisin. Research has shown that contact repellants tend to be more effective than area repellants. However, efficacy of contact repellents is still highly variable, especially across differences in deer pressure and according to the baseline palatability of plant material protected (Hillock et al., 1991).

DeerPro Winter is a contact repellent product from Great Oak Inc. including the active ingredient thiram (25.8%). Thiram is a fungicide, mostly for seed treatment, that has also been used as a conditioned aversion deer repellant. Repellant products containing thiram were shown to be 78% effective in protecting yews in one study (Ward and Williams, 2010) and 68% effective in protecting arborvitae in another (Nolte, 1998). Thiram is thought to be more effective in field than pen studies, which brings into question its potential efficacy in an urban or residential setting. MSU Extension conducted a field study during the winter of 2017-18 to compare the ability of DeerPro Winter to control depredation of arborvitae and yew versus a

competitor's product, Deer Free Winter Armor including white pepper (19.4%) and 2-Phenethyl propionate (15.1%) as active ingredients.

Methods

Twelve 2.24 gallon size arborvitae (*Thuja occidentalis* 'Smaragd') and twelve 2.24 gallon yews (*Taxus X media* 'Densiformis') were purchased from a local garden center. Plants were individually numbered and four plants of each species were randomly assigned treatments DeerPro Winter, Deer Free Winter Armor and Untreated Control. Repellant products were all applied the day before planting according to manufacturer's recommendations using a small hand pump sprayer. Treated plants were allowed to dry before planting and exposure to deer the following day.

A private property in Moltke Township, Presque Isle County, Michigan was selected for the study based on a history of heavy use by white-tailed deer causing damage to ornamental plants. Shrubs were planted in four separate blocks across the property on October 21st, 2017. Block locations were selected to represent different cover/habitat types. One block was located along a trail under scotch pines, another in an open grassy area, a third at the edge of an open and fallow agricultural field, and a fourth under a large maple tree surrounded by other hardwoods. However, all four blocks were within 1,000 feet of one another and exposed to similar deer pressure (Figure 2). Each block consisted of three arborvitae and three yews planted in pairs of one arborvitae and one yew by treatment, separated from one another by 5 feet, and from other treatment pairs in the block by approximately 20 feet (Figure 3).

Before planting, shrub green area was measured using the Canopeo app and a one meter-squared frame. At the time of planting, shrub height and width at the widest point were recorded. These baseline measurements were used to detect any decrease in shrub size and density caused by deer browsing. Shrub green area, height and width were then recorded bi-weekly in the field October 21st, 2017 through May 5th, 2018. In addition to shrub measurements, daily snow depth and daily average temperature were collected from the nearest NOAA weather station to identify any possible correlations between weather, deer browsing and repellent performance. Shrubs were dug and removed from the field for a final round of imaging on May 5th, 2018 to replicate the method used for imaging before planting.

Results and Discussion

Both arborvitae and yews were browsed by deer during our study. Browsing began soon after the shrubs were planted, and continued throughout the study period. This was confirmed by the presence of deer browse patterns, deer tracks and trail camera footage (Figure 1). Arborvitae were browsed preferentially over yews, damaged earlier and had more inches of tissue removed. Yews appeared to sustain abiotic injury as winter set in, more so than arborvitae, resulting in yews with significant amounts of intact, dead tissue at the end of the study.

Arborvitae treated with DeerPro Winter lost significantly less green area (F=7.22, P=0.016) and width (F=6.67, P=0.019) than arborvitae treated with Deer Free Winter Armor and the untreated arborvitae. The DeerPro Winter treated arborvitae also lost less height than the other treatments on a numeric basis, but statistical significance could not be established due to variability in the data set (Table 1). Arborvitae treated with Deer Free Winter Armor avoided significant damage for 1-2 months after planting, but the white pepper based repellant quickly failed as winter set in (Figure 4).

Yews treated with either DeerPro Winter or Deer Free Winter Armor lost significantly less green area (F=14.38, P=0.003) and height (F=7.75, P=0.01) than the untreated yews. Yews treated with DeerPro Winter also lost less width than the controls (F=3.00, P=0.10), while yews treated with Deer Free were intermediate in width, and not significantly different from the untreated yews (Table 2).

In summary, we observed that both repellents significantly reduced deer browse in yews, while only DeerPro Winter was able to protect arborvitae (Figure 7). We suspect that this observed difference in Deer Free performance across plant species was due to a baseline difference in palatability between the two shrubs, arborvitae being preferred by deer in this case.

The timing of deer damage and plant condition seemed to align with seasonal changes in temperature and snow depth. Damage increased as temperatures decreased in the fall. Damage appeared to spike 2-3 times during the winter when snow cover temporarily receded (Figures 4, 5 & 6). Measurements of shrub green area using Canopeo were notably influenced by in-situ placement of the shrubs in the field and snow cover, rebounding markedly in the spring during our post-harvest measurements (Figure 4). This was despite our use of mobile backdrops for imaging of plants in the field. We confirmed that this was an artifact of the way Canopeo measures green area, rather than an effect of new growth, and only the final measurements collected after digging the shrubs were used in our analysis. The green colorant in DeerPro Winter may have masked dead tissue and improved green area numbers on both species. However, DeerPro Winter also performed well based on limited change in plant height and width, suggesting that our findings regarding plant green area are also valid. The authors wish to thank Great Oak Inc. for funding this study, and Katherine and Zach Wilbur for hosting the trial.

References

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Nolte, D. L. 1998. Efficacy of selected repellents to deter deer browsing on conifer seedlings. International Biodeterioration and Biodegradation 42:101–107.

Ward, J. and Williams, S. 2010. Effectiveness of deer repellents in Connecticut. Human–Wildlife Interactions 4(1):56–66, Spring 2010.

Figure 2: Study design on a private property in Moltke Township, Presque Isle County, Michigan

Figure 3: Example of plot layout in “Field” block showing pairs of arborvitae and yews arranged by treatment.

Treatment	Δ Green Area (% of 1 M^2)	Δ Height (in.)	Δ Width (in.)	East Trail	Field	Tall Grass	Maple
DeerPro Winter	0.43 a	-0.63 a	0.38 a				
Deer Free Winter Armor	-16.31 b	-2.25 a	-5.94 c				
Untreated Control	-20.18 b	-4.44 a	-2.94 b				

Table 1: Mean change in green area, height and width of arborvitae by treatment from beginning to end of the study. Different letters indicate significant differences at the P< 0.10 level.

Treatment	Δ Green Area (% of 1 M^2)	Δ Height (in.)	Δ Width (in.)	East Trail	Field	Tall Grass	Maple
DeerPro Winter	-3.17 a	-0.31 a	0.94 a				
Deer Free Winter Armor	-2.53 a	0.25 a	-1.94 b				
Untreated Control	-6.77 b	-2.38 b	-3.88 b				

Table 2: Mean change in green area, height and width of yews by treatment from beginning to end of the study. Different letters indicate significant differences at the P< 0.10 level.

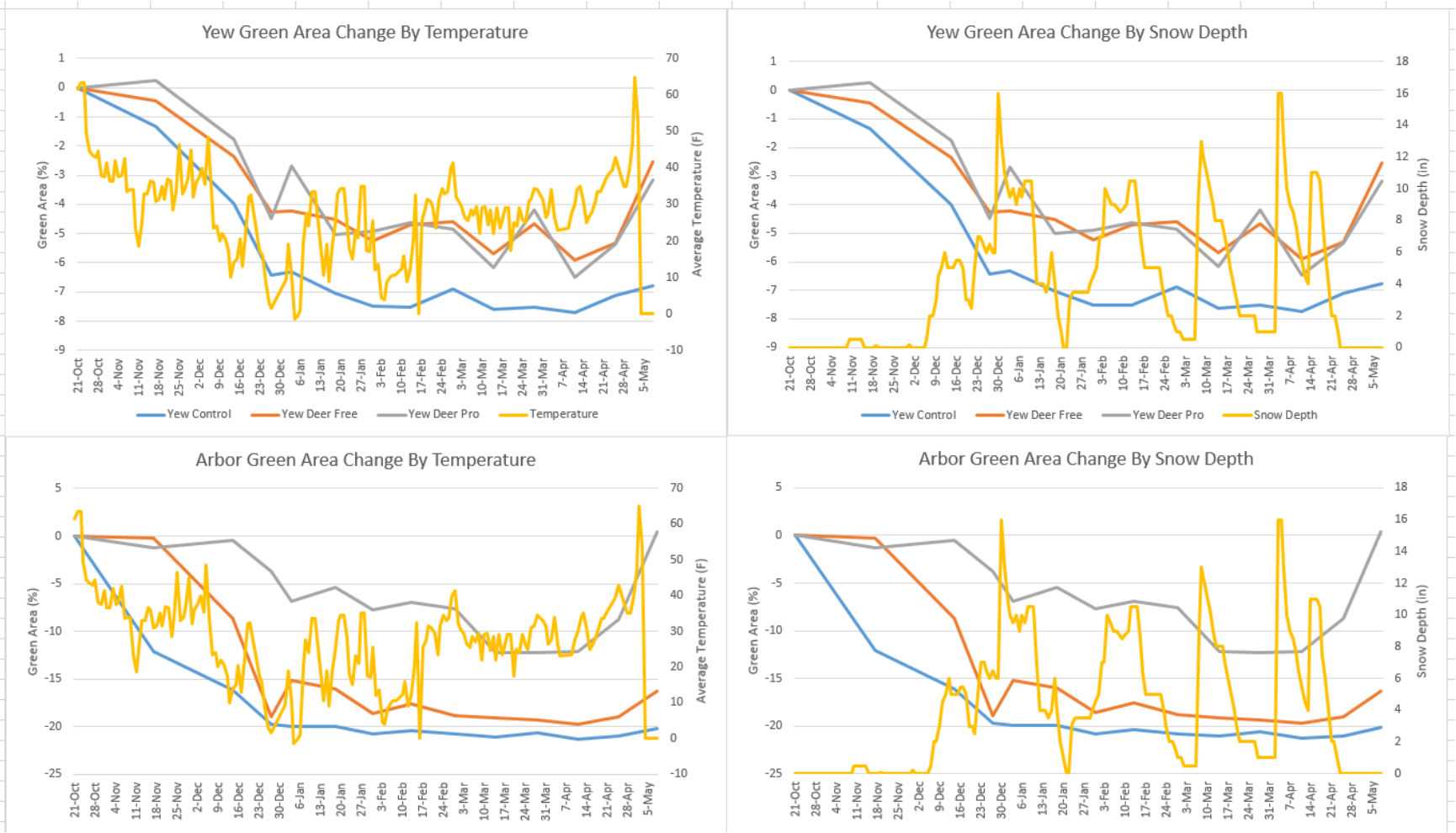

Figure 4: Change in green area by species and treatment across seasonal trends in temperature and snow depth. Note Deer Free failure in arborvitae coincided with decline in average temperature. Note also higher numbers in periods of reduced snow cover and marked increase in final measurements taken after digging due to Canopeo imaging method.

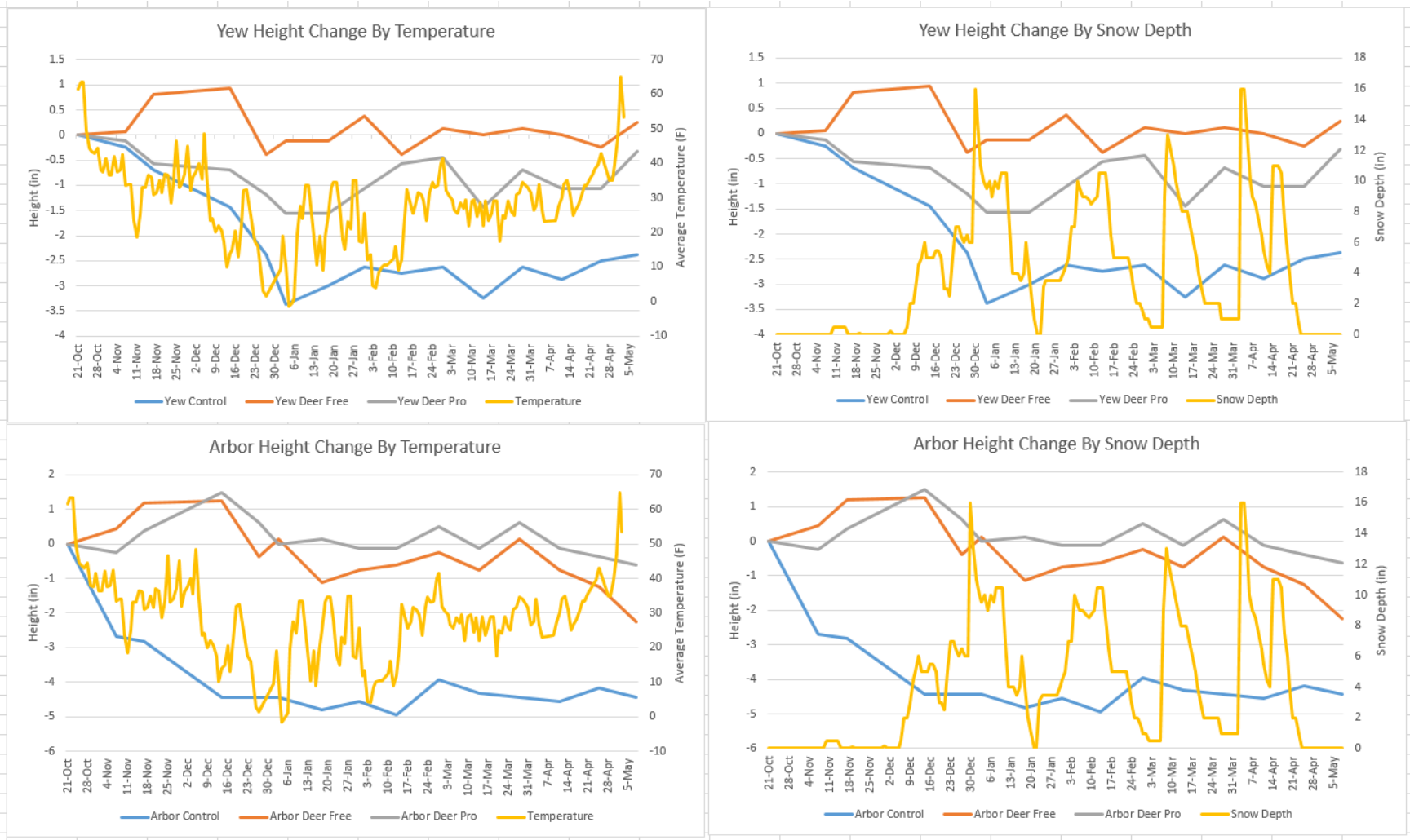

Figure 5: Change in height by species and treatment across seasonal trends in temperature and snow depth

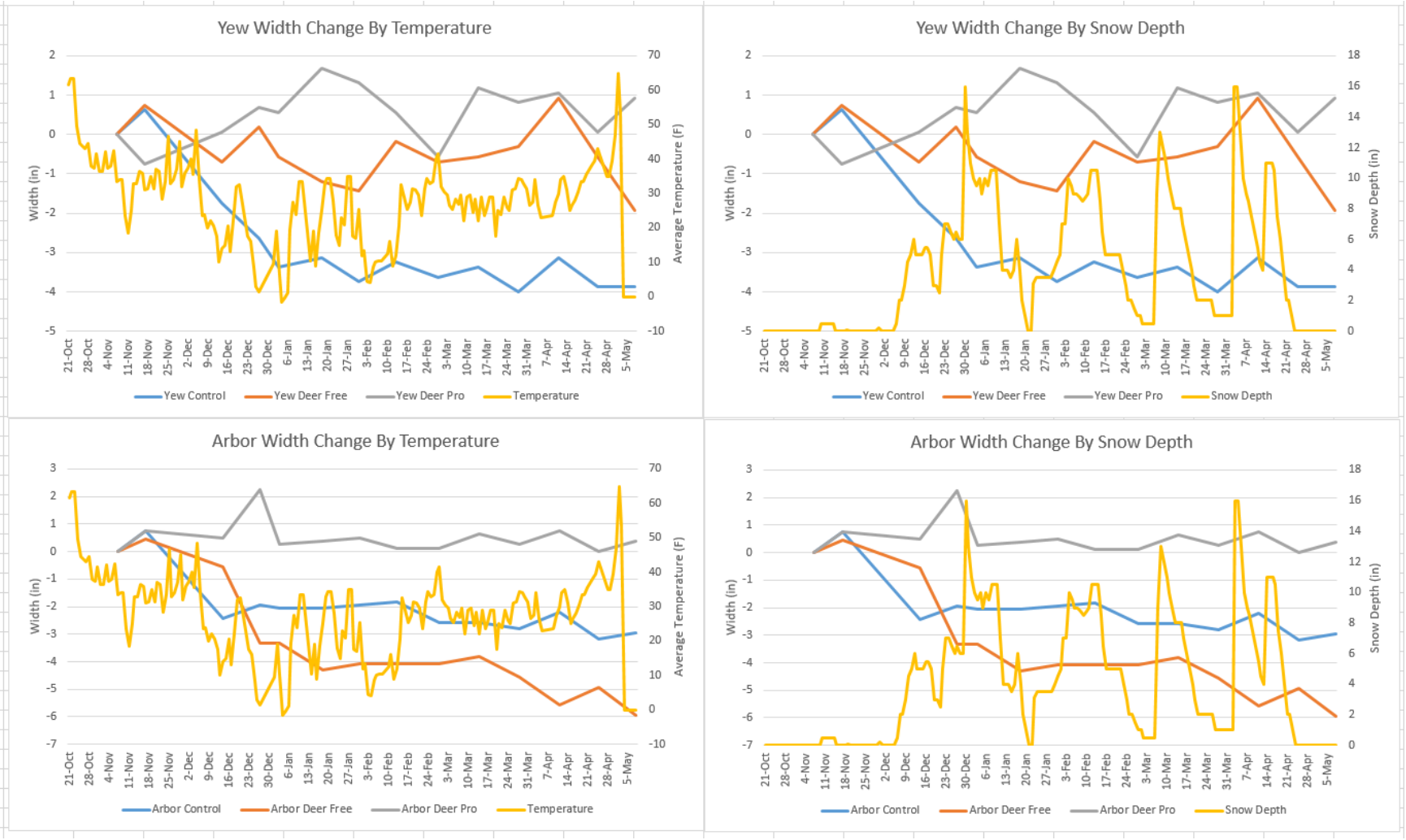

Figure 6: Change in width by species and treatment across seasonal trends in temperature and snow depth

Figure 7: Exemplary before (left, taken Nov. 7th, 2017) and after (right, taken April 26th, 2018) photos of untreated vs. DeerPro treated arborvitae. Note that top-right photo is flipped horizontally to match shrub orientation in the top-left photo.