Tree Shelters Fail to Enhance Height Growth of Northern Red Oak in the Upper Peninsula of Michigan.[1]

Douglas O. Lantagne,
Associate Professor,
MSU Department of Forestry

and

Raymond Miller,
Resident Forester,
Upper Peninsula Tree Improvement Center

[1] In: Pallardy-SG (ed.); Cecich-RA (ed.); Garrett-HG (ed.); Johnson-PS. Proceedings, 11th Central Hardwood Conference. Columbia, MO, March 23-26, 1997. USDA Forest Service North Central Forest Experiment Station, St. Paul, MN GTR NC-188, 401 pp. (Abstract)

Abstract

Deer browsing in some areas of the Upper Peninsula of Michigan make hardwood establishment difficult, if not impossible. Tree shelters have been found to be effective in other locations with animal browsing problems. In the spring of 1990, 2-0 bare-root northern red oak seedlings were machine-planted in an old field in Delta County, Michigan. Four replications of four treatments were initially established: control (no shelter or weed control), weed control only, I.2m plastic tree shelters only, and plastic tree shelters and weed control. At the start of the third growing season, weed control was initiated on all seedlings and rigid mesh tubes were installed on previously unsheltered trees. After six years, survival was 74% for all treatments and there were no significant differences between the total heights of plastic or mesh sheltered seedlings. Initial height gains with plastic sheltered seedlings were lost due to repeated dieback of new growth in the fifth and sixth growing seasons. Use of plastic shelters has not been successful for the establishment of northern red oak on this site.

Introduction

High deer numbers in some counties in the Upper Peninsula of Michigan make it difficult to establish hardwoods due to heavy browsing. Tree shelters have been found to be effective in the establishment of several hardwoods, including northern red oak (Lantagne 1996, Schuler and Miller 1996, Potter 1991).

There are also reports of tree shelters aiding in the general establishment of plants on marginal or extreme sites (Bainbridge and MacAller 1996). Experience has also shown that tree shelters can add to the stress of sheltered northern red oak seedlings, leading to poor survival and growth on some sites (Lantagne, unpublished data). Dieback has been documented for black walnut within tree shelters associated with exit time and seasonal temperature changes (Miller 1996).

The objective of this study was to test the effectiveness of using tree shelters for the establishment of northern red oak in old fields in the central Upper Peninsula of Michigan.

Materials and Methods

Location: Upper Peninsula Tree Improvement Center in the Upper Peninsula of Michigan.

Soil: Predominately fine sandy loam (Alfisol)

Site: Old field

Planted: Spring1990 with 784 2-0 red oak seedlings. Seedlings were not undercut or top clipped after planting.

Exp. Design (Phase 1): A 2X2 factorial, four replications.

Treatments: Randomly applied to four 49-tree plots within each replication. These treatments were in effect the first two growing seasons. (1990-1991)

- Control (no weed control or shelters) (CO)
- Weed control only (herbicides) (WC)
- 1.2 m plastic shelter only (PS)
- 1.2 m plastic shelter & weed control (WC & PS)

Exp. Design (Phase 2): Two treatments, four replications.

Plastic mesh protectors were added at beginning of third growing season to unsheltered trees due to heavy deer browsing and weed control was applied to all trees annually in third, fourth and sixth growing seasons.

Treatments: (1992-1995)

- Weed control and mesh protectors (WC & MS)
- 1.2 m plastic shelters & weed control (WC & PS)

Data collection:
Seedling heights measured fall of 1990, 1991, 1993,1995.

Results

- Seedling survival was 97% or better over the first two years of the study. (Phase I)
- Seedling survival declined to 79% for unsheltered seedlings, significantly less than the 95% survival for sheltered seedlings at the end of the fourth growing season. (Phase 2)
- Seedling survival for sheltered seedlings with weed control declined to 74%, the same as weed control and mesh protected seedlings at

Experimental Design: Phase 1

Replications				
R1	Weed Control (WC)	Control (CO)	WC & PS	Plastic Shelter (PS)
R2	Plastic Shelter (PS)	Weed Control (WC)	WC & PS	Control (CO)
R3	WC & PS	Control (CO)	Plastic Shelter (PS)	Weed Control (WC)
R4	Control (CO)	WC & PS	Plastic Shelter (PS)	Weed Control (WC)
		Treatments		

- Four replications
- Four treatments
- Number of treatments was reduced at the beginning of the third growing season.

Experimental Design: Phase 2

Replications				
R1	WC & Mesh	WC & Mesh	PS & WC	PS & WC
R2	PS & WC	WC & Mesh	PS & WC	WC & Mesh
R3	PS & WC	WC & Mesh	PS & WC	WC & Mesh
R4	WC & Mesh	PS & WC	PS & WC	WC & Mesh
		Treatments		

With the addition of mesh protectors to unsheltered seedlings and weed control to all seedlings, four treatments became two treatments in Phase 2 of the study.

- Weed control and Plastic Shelter (WC & PS)
- Weed control and Mesh Protector (WC & Mesh)

the end of the sixth growing season. (Phase 2)

- Total seedling height was significantly enhanced by use of tree shelters over the first two growing seasons. (Phase 1)
- At the end of the second growing season, sheltered trees averaged 3.76 times taller than unsheltered seedlings. (Phase I)
- Growth of sheltered trees averaged 38 cm during the second growing season compared to less than 1cm for unsheltered trees. (Phase I)
- Height gain from the end of the second growing season to the end of the fourth growing season totaled only 7cm for sheltered trees with weed control.
- Height gain for this same period for weed control and mesh protected trees totaled only 3 cm.
- The average total heights of seedlings within shelters with weed control declined from a high of 85 cm after the fourth growing season to less than 44 cm at the end of the fourth growing season. (Phase 2)
- The average total heights of sheltered seedlings with weed control are not significantly different from weed control and mesh protected trees after six growing seasons. (Phase 2)

Conclusions

- An unknown factor or factors affected the survival and growth of seedlings in plastic tree shelters in this study. The repeated dieback of seedling growth is noted in the pictures.
- Use of mesh protectors, in combination with weed control, was at least as effective as using plastic tree shelters and weed control by the end of the sixth growing season.
- The widespread and inexperienced use of tree shelters could result in large and expensive planting failures over time.
- Success of any planting program is based upon appropriate site and tree species selection.

Literature Cited

Bainbrigde, D.A. and R. MacAller. 1996. Tree shelters improve desert planting success. pp. 57-59. In: J.C. Brissette, ed. Proceedings of the Tree Shelter Conference; 1995 June 20-22; Harrisburg, PA. USDA Forest Service Gen. Tech. Rep. NE-221. 80p.

Lantagne, D.O. 1996. Effect of tree shelters on planted red oaks in Michigan. pp. 24-28. In: J.C. Brissette, ed. Proceedings of the Tree Shelter Conference; 1995 June 20-22; Harrisburg, PA. USDA Forest Service Gen. Tech. Rep. NE-221. 80p.

Miller, L.K. 1996. Plastic tubes and tree improvement: Eight years experience with tree shelters on grafted black walnut and northern red oak (Abstract). p. 71. In: J.C. Brissette, ed. Proceedings of the Tree Shelter Conference; 1995 June 20-22; Harrisburg, PA. USDA Forest Service Gen. Tech. Rep. NE-221. 80p.

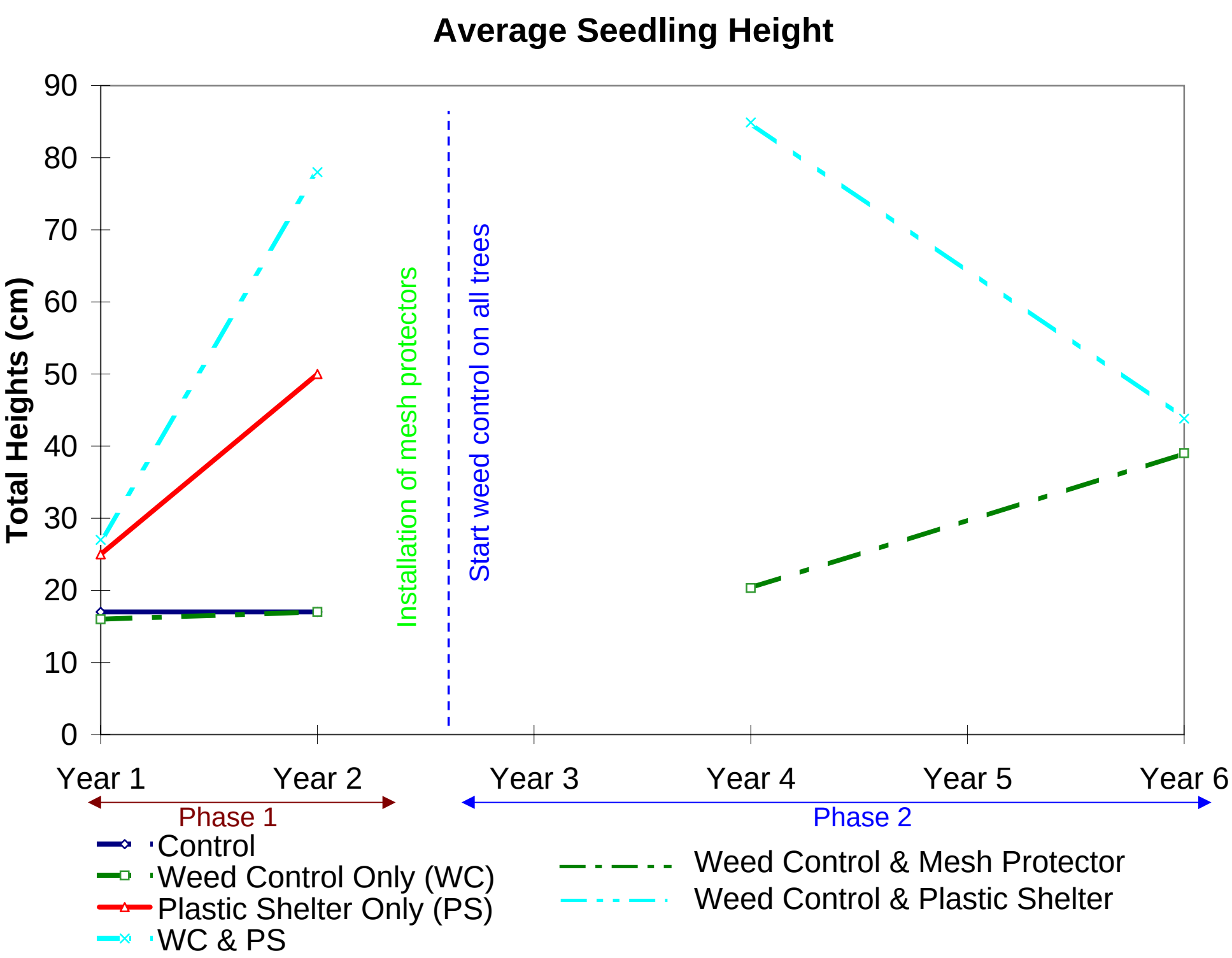
Potter, M.J. 1991. Treeshelters, Forestry Commission, Handbook No. 7. HMSO Publications Center. London, England. 48p.

Schuler, T.M. and G.W. Miller. 1996. Guidelines for

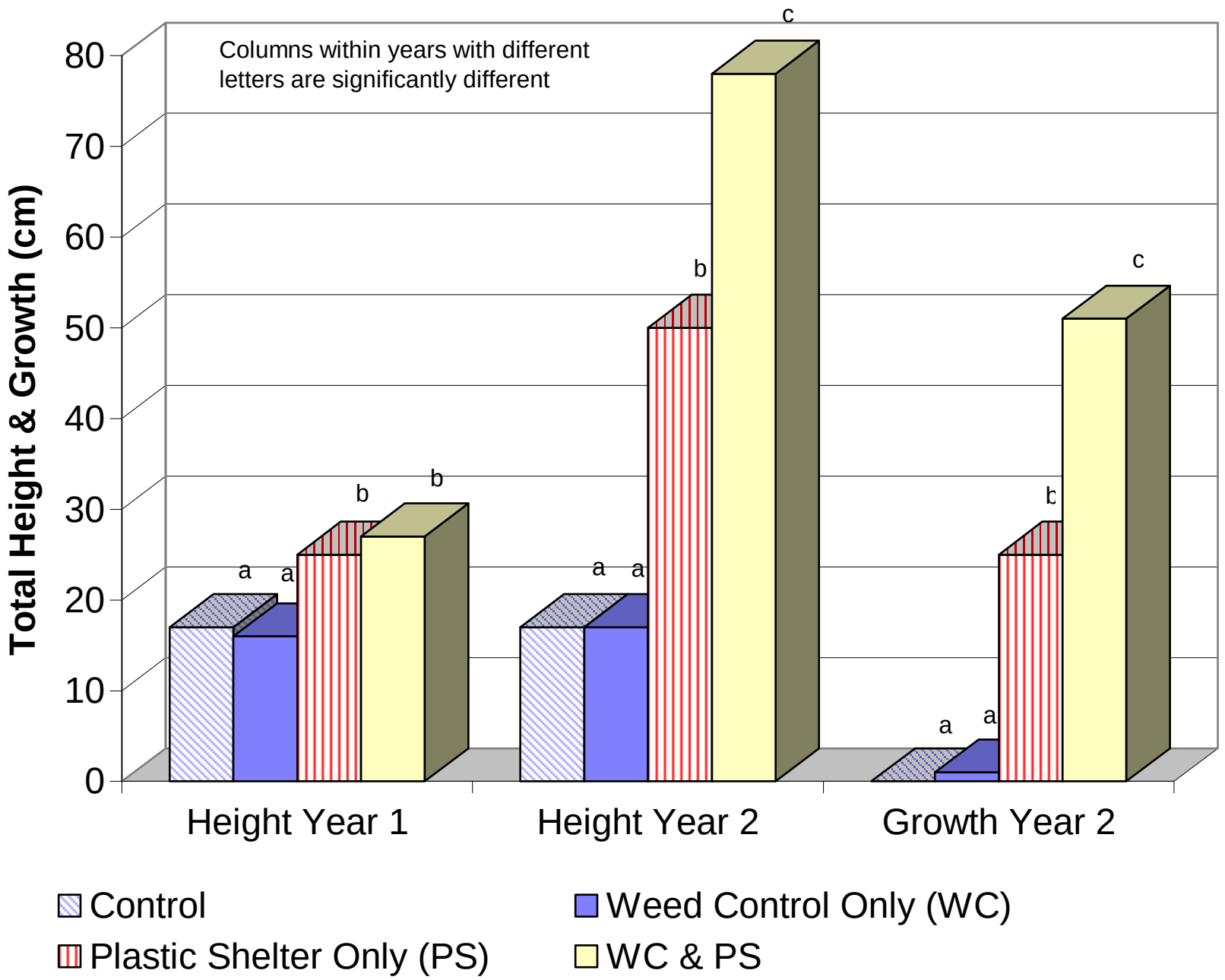
Four examples of six-year old northern red oak showing dieback occurring in plastic shelters.

Example of a six-year old planted northern red oak showing top-dieback within a tree shelter.

Planting site showing mesh protectors in the foreground and plastic shelters in the background.

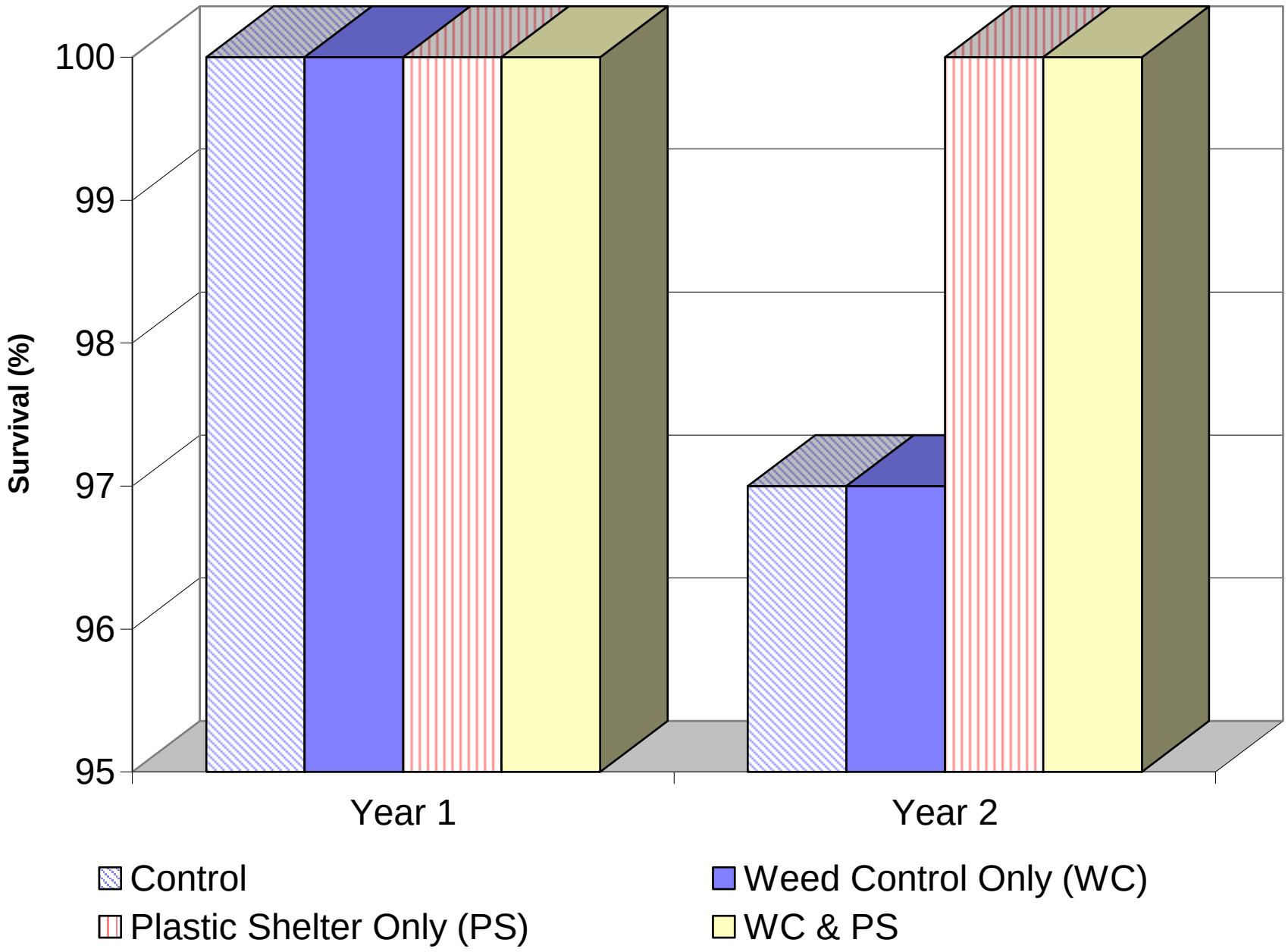

Average Seedling Height
Total Heights (cm)
90
80
70
60
50
40
30
20
10
0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Installation of mesh protectors
Start weed control on all trees
Phase 1
Phase 2
Control
Weed Control Only (WC)
Plastic Shelter Only (PS)
WC & PS
Weed Control & Mesh Protector
Weed Control & Plastic Shelter

Height and Growth: Phase 1

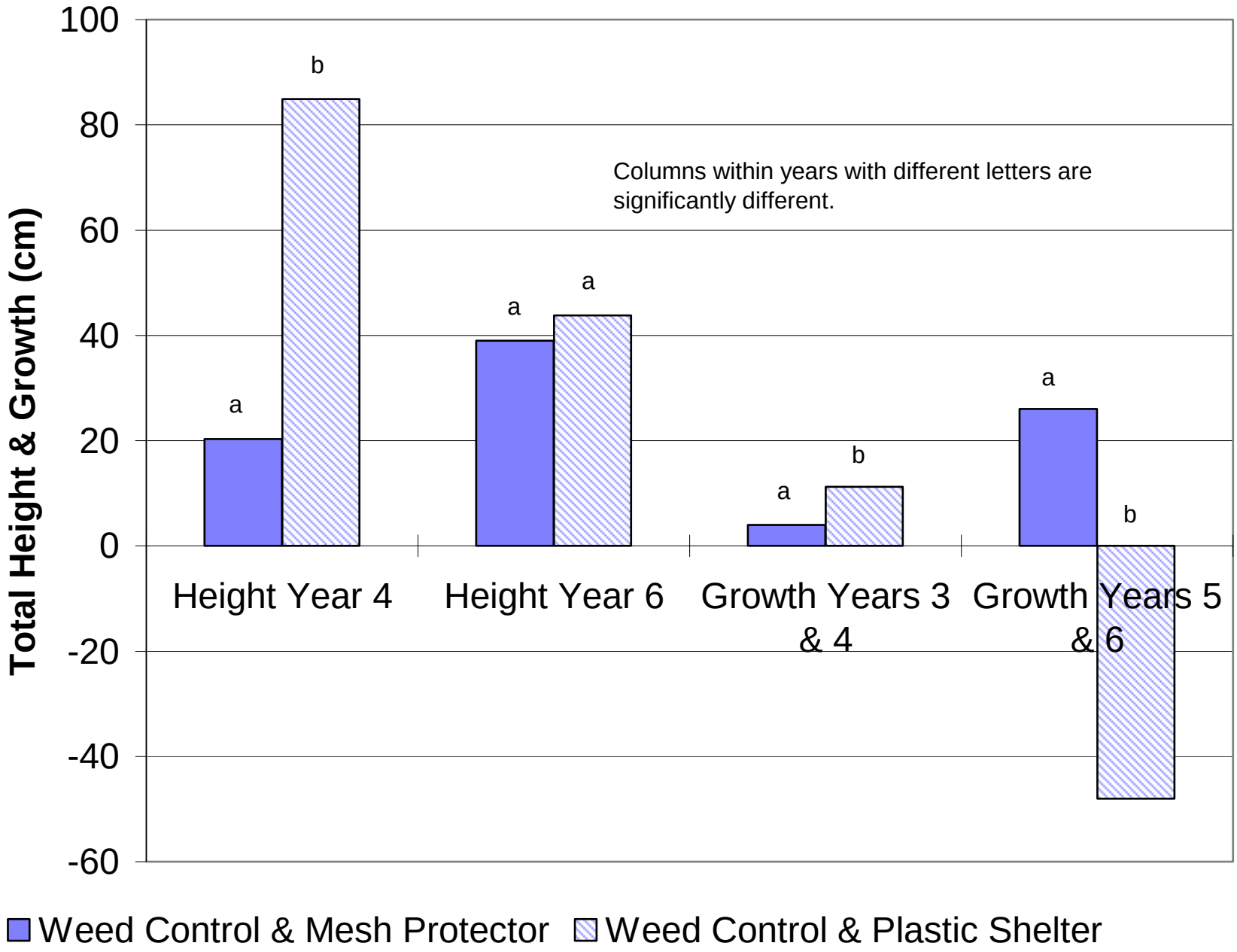


Columns within years with different letters are significantly different.

Seedling Survival: Phase 1



Height and Growth: Phase 2



Columns within years with different letters are significantly different.

Seedling Survival: Phase 2