1-MCP Ethylene Inhibitor: Storage and Survival

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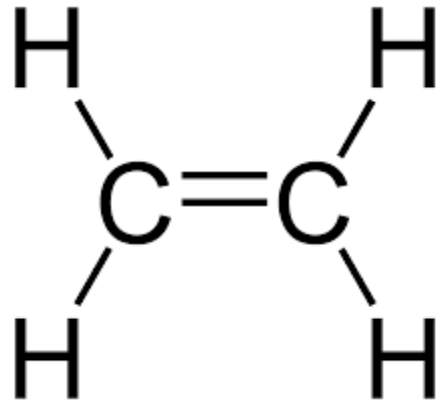
Introduction

- The hormone Ethylene
- The gas ethylene (C_2H_4) is synthesized from methionine
- Sites of biosynthesis is in most tissue in response to stress, especially in tissues undergoing senescence or ripening
- Effects fruit ripening, leaf and flower senescence, leaf and fruit abscission.
- Ethylene promotes abscission, or shedding of leaves, flowers and fruits in a variety of plant species. In leaves, ethylene triggers the enzymes that cause the cell wall dissolution associated with abscission.



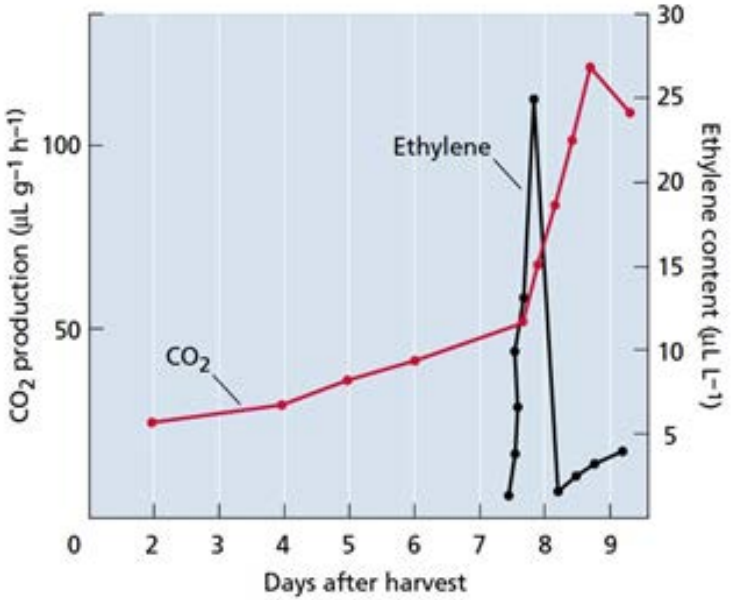
Introduction

- Ancient history of commercial impact of ethylene in fruit production
  - "Gashing "figs stimulated ripening
  - Managing storage temperatures kept fruit fresher
  - Many fruits need air circulation during storage

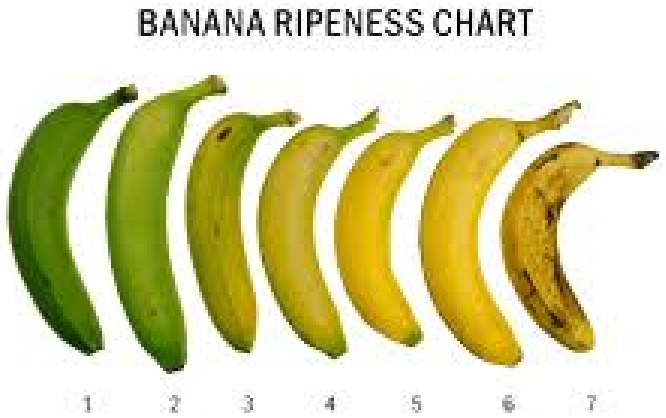
- When fleshy fruits ripen they undergo a series of characteristic changes mediated by ethylene
- Ethylene is used commercially to promote fruit loosening in cherries, blackberries, grapes and blueberries, thus making chemical harvesting possible.
- Used as a fruit-thinning agent in commercial orchards of prunes and peaches

Introduction

- In the min 1990's a number of compounds that inhibit ethylene production were discovered
- 1-MCP (1-methylcyclopropene) was found to be the most active.
- This recent discovery has added new technologies for ethylene management in fruit production and storage.



(Raven Biology of Plants (2013))



Introduction

- Benefits for blocking ethylene action:
  - Improve storage life
  - Increase vase life and reduce transportation losses
  - Improves yield potential by reducing crop responses to stress

Effect of ethephon combined with 1-MCP on color change of harvested banana fruit (25 ± 1 °C).

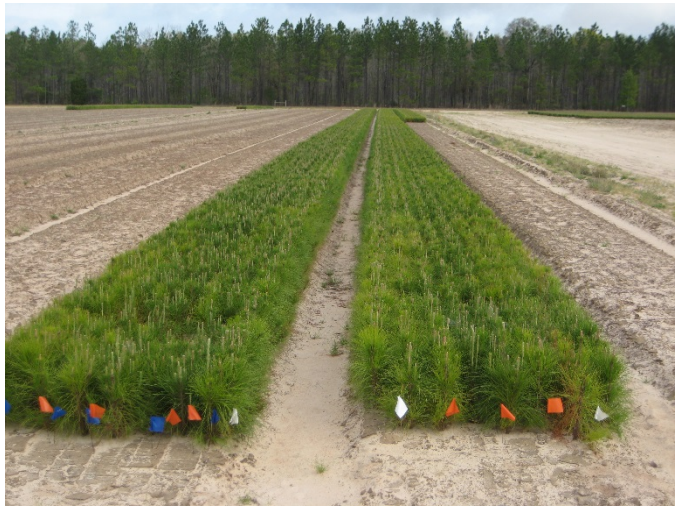
Objective

- To determine whether 1-MCP will effect pine seedling storability and increase seedling survival and growth after outplanting

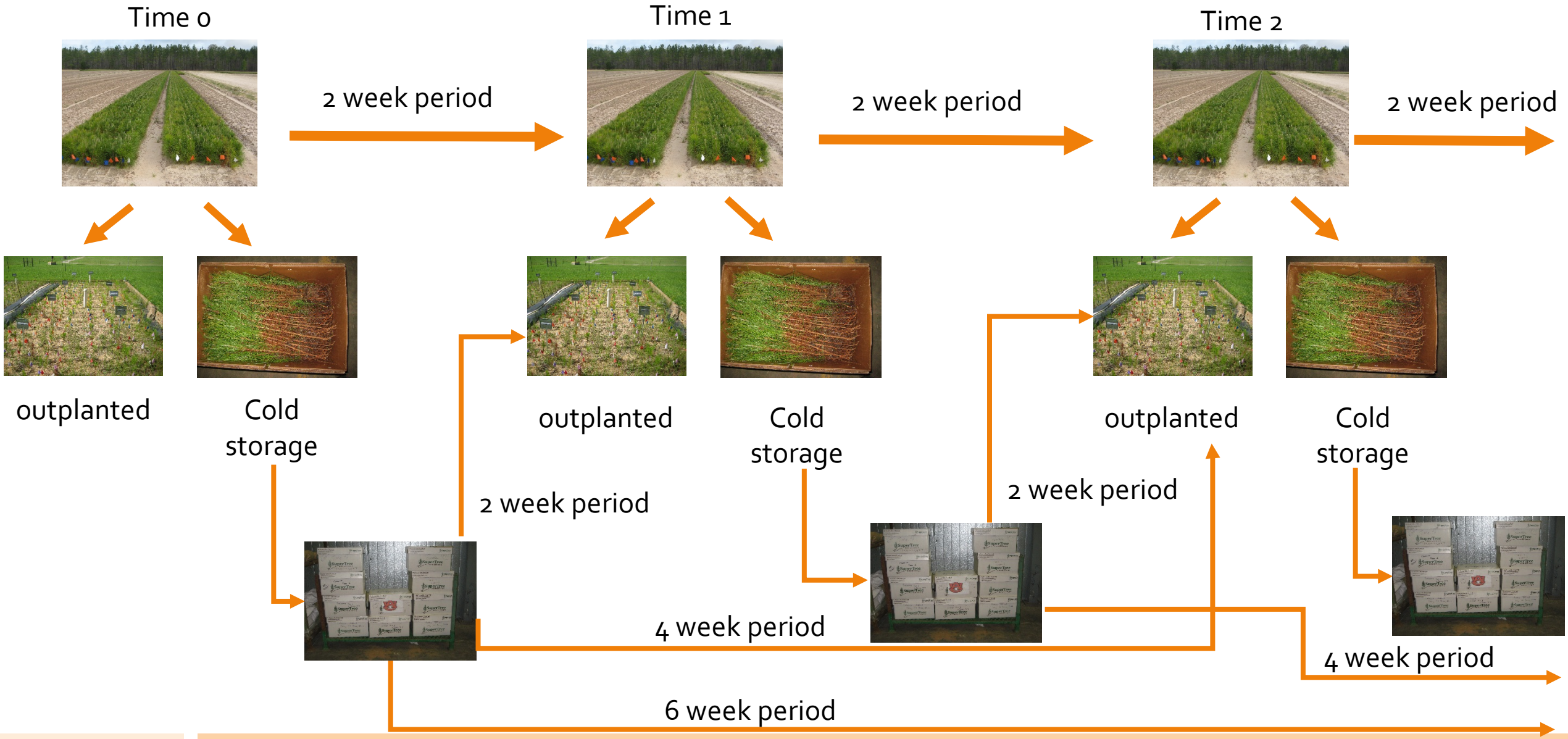
- Potential benefits:
  - May allow nurseries to increase storage times after lifting
  - Despite longer storage , 1-MCP may increase both the survival and growth of pine seedlings after outplanting

Study design

- Slash seedlings grown from a single seedlot were used for this study.
- At trial initiation 1000 seedlings were pulled from the nursery for each treatment (control and treated) and placed in a cooler.
- 15 seedlings were kept aside for measurement and outplanting.
- Remaining seedlings were placed in boxes and placed in the refrigerator for storage (temperature as set by nursery).
- At two week intervals (for a 14 week period), 15 seedlings were removed from the stored seedlings for measurement and outplanting

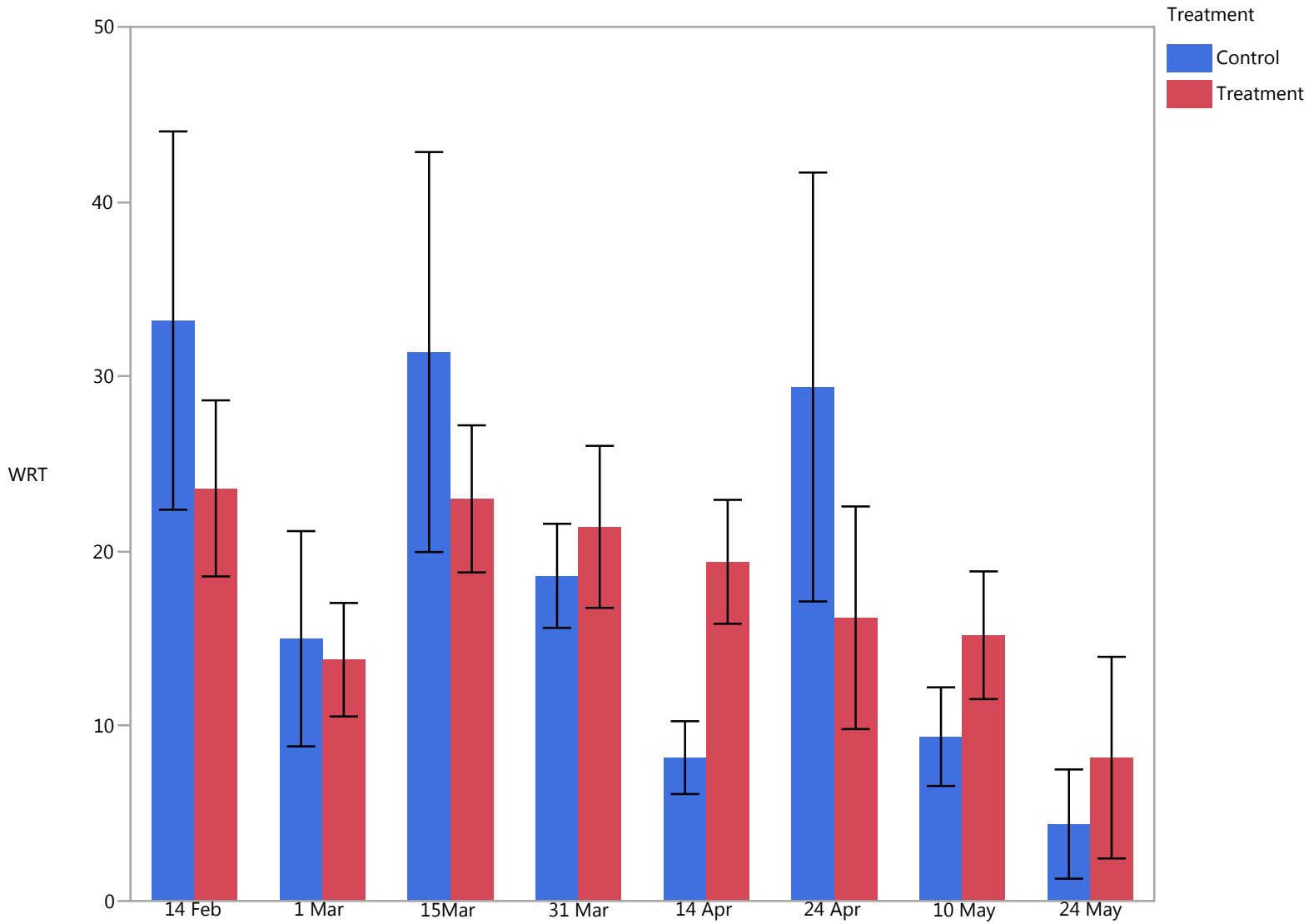


Methodology overview

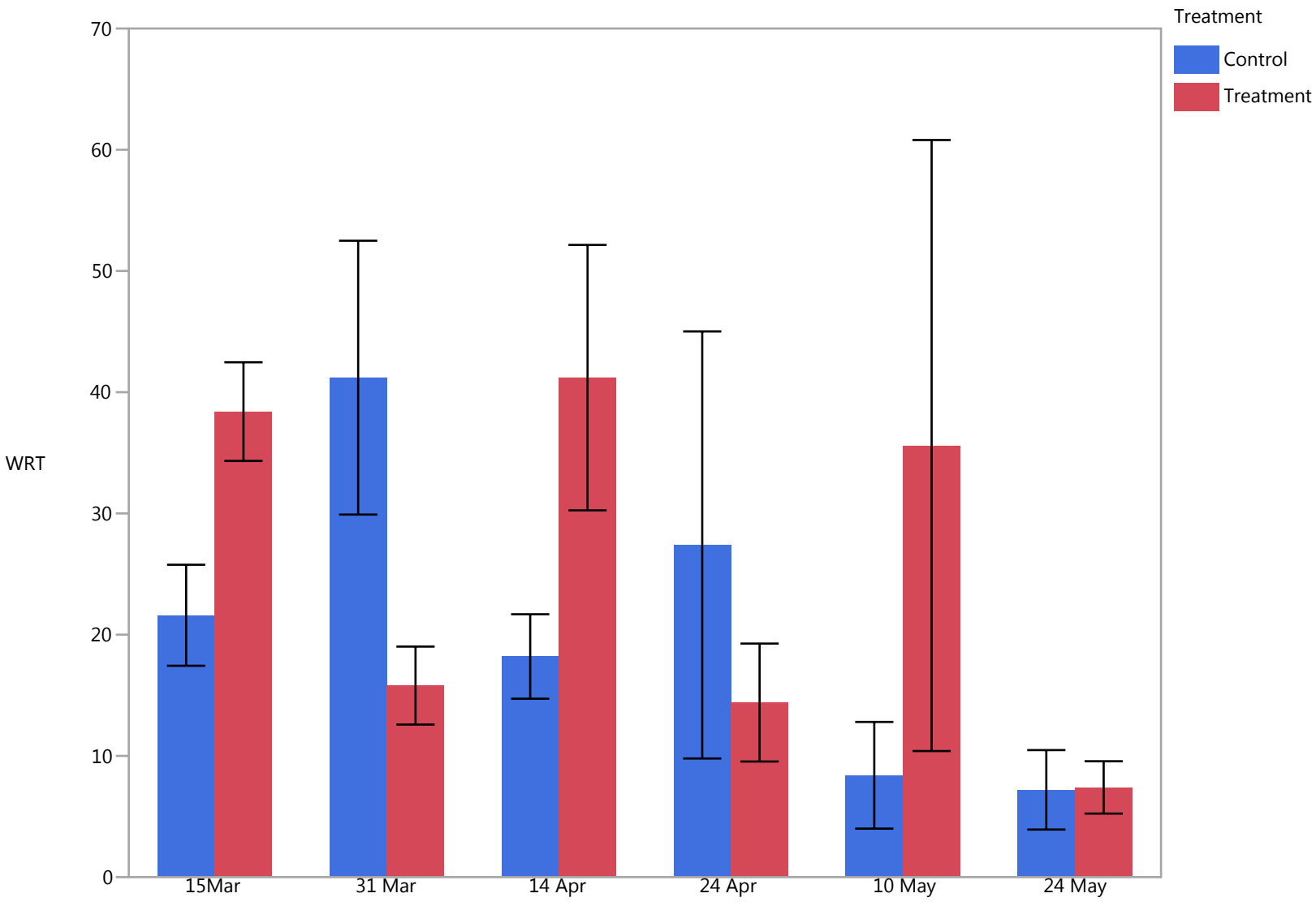


White root growth potential over time (RGP)

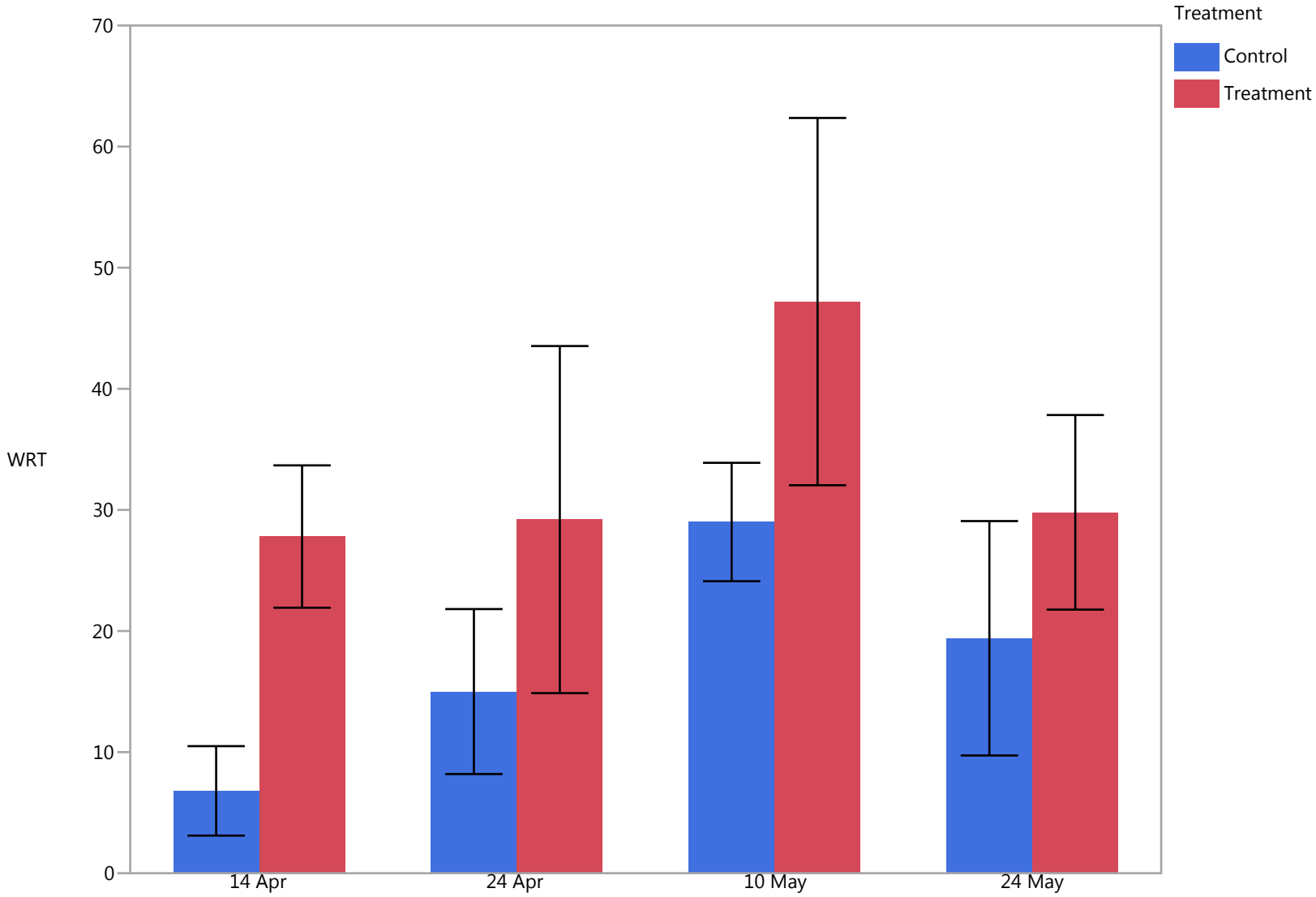
RGP Time o


Treatment
Control
Treatment
WRT
50
40
30
20
10
0
14 Feb
1 Mar
15Mar
31 Mar
14 Apr
24 Apr
10 May
24 May

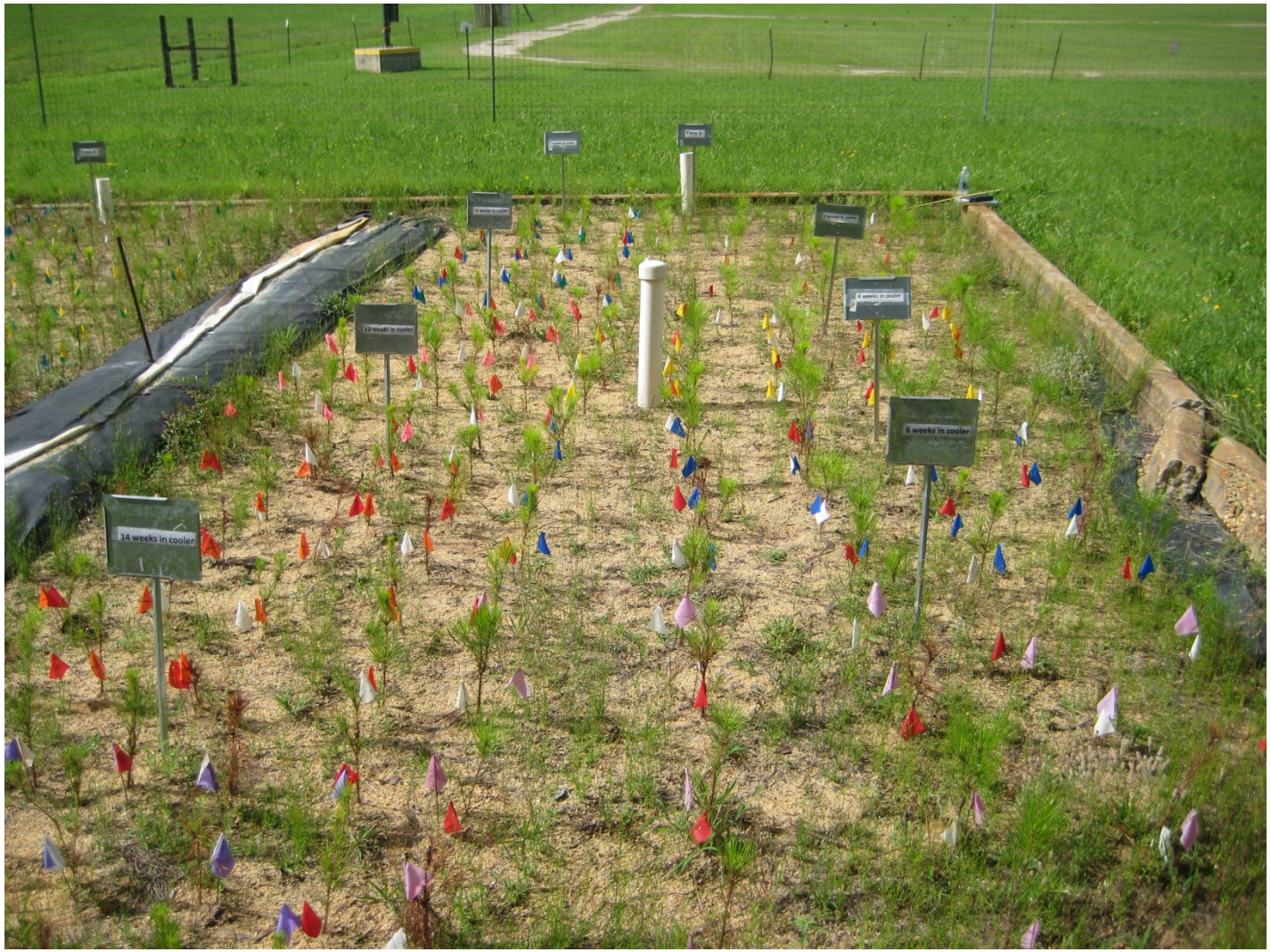
RGP Time 2


Treatment
Control
Treatment
WRT
70
60
50
40
30
20
10
0
15Mar
31 Mar
14 Apr
24 Apr
10 May
24 May

RGP Time 4


Treatment
Control
Treatment
WRT
70
60
50
40
30
20
10
0
14 Apr
24 Apr
10 May
24 May

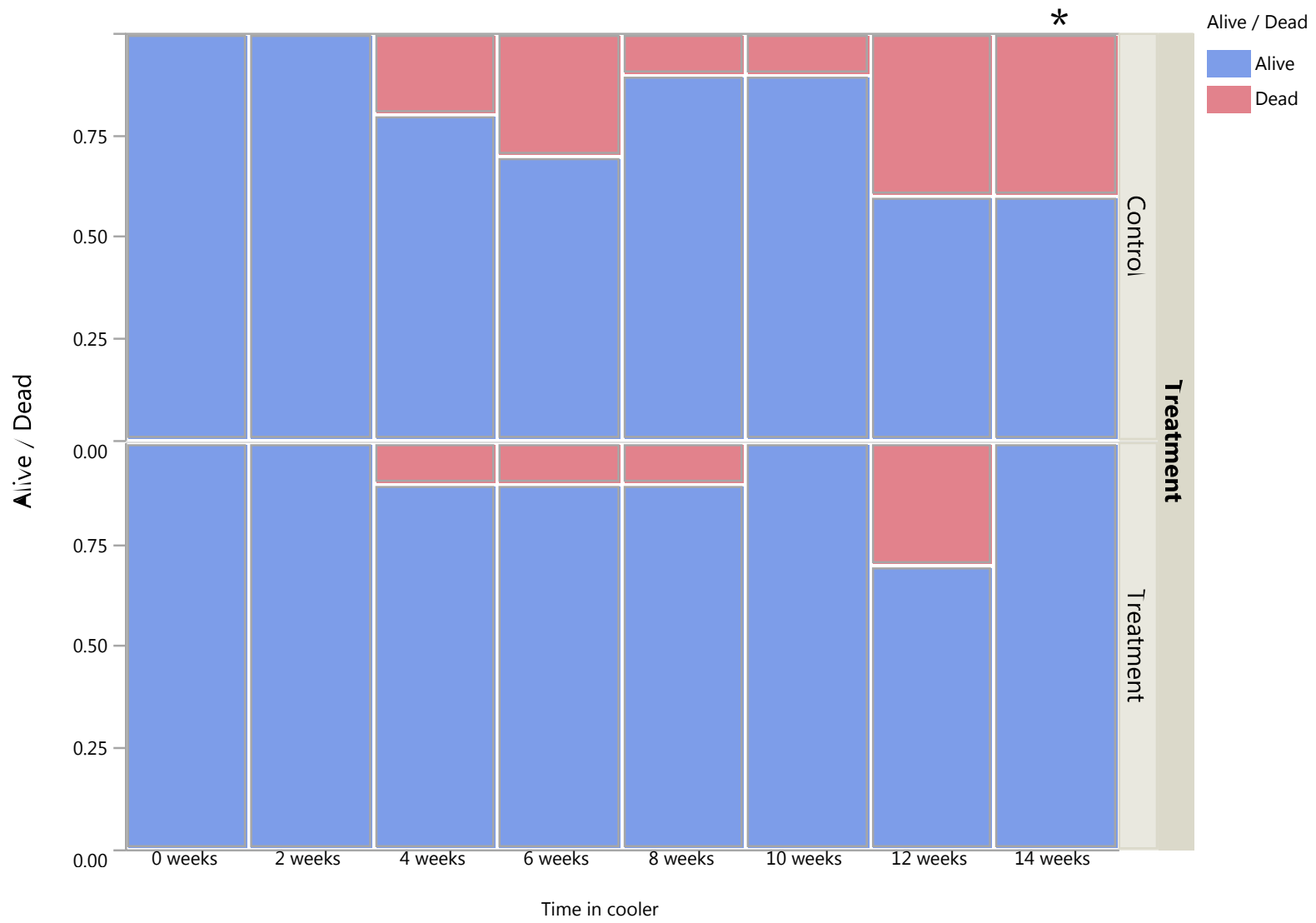
Outplanting



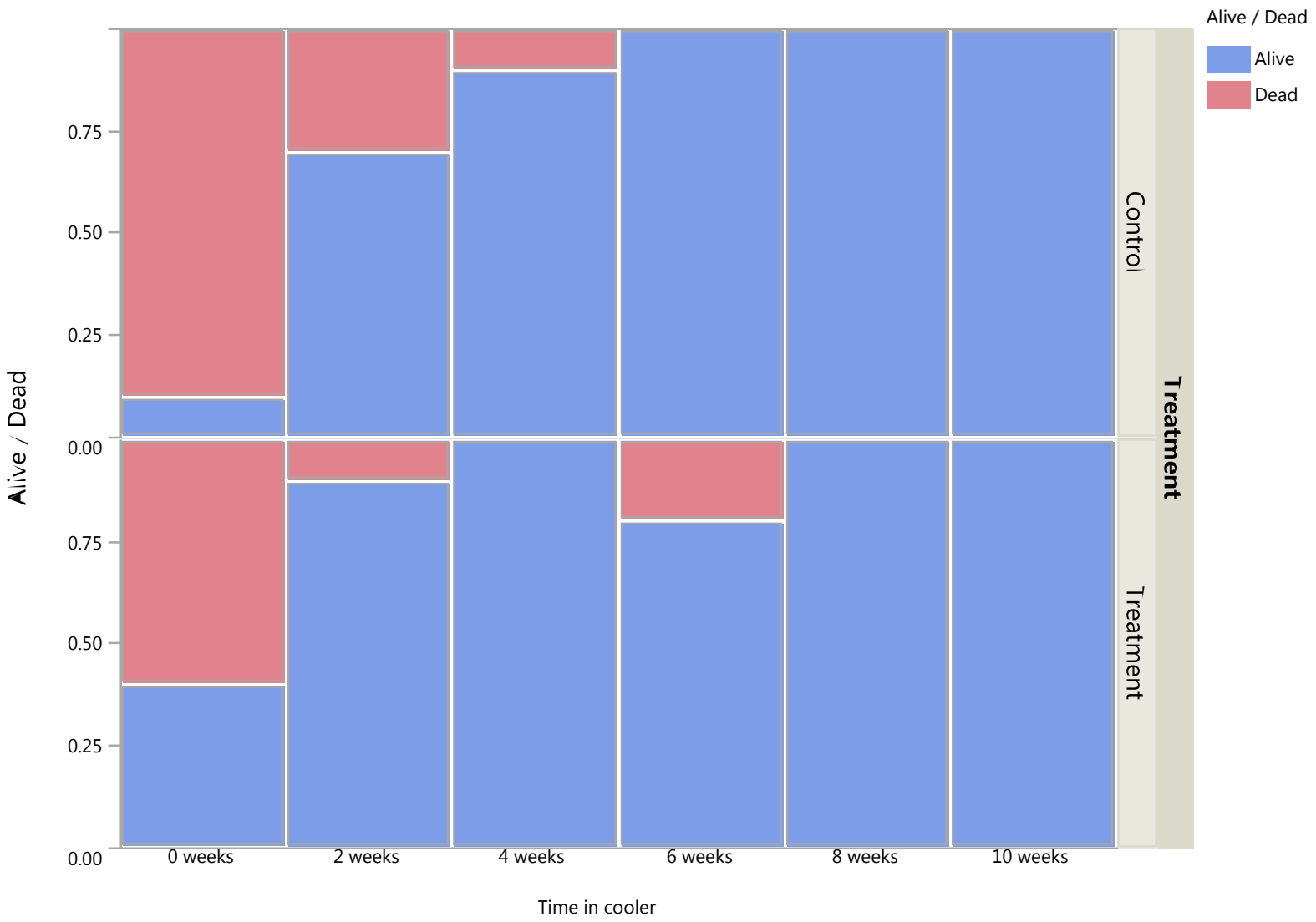
Trial layout

BED 1B	BED 1A	BED 2 B	BED 2 A	BED 3 B	BED 3 A	BED 4 B	BED 4 A	BED 5 A	BED 6 A
	Time 3		Time 2		Time 1		Time 0	Time 5	Time 4
8 WEEKS IN COOLER		8 WEEKS IN COOLER		8 WEEKS IN COOLER		8 WEEKS IN COOLER			
T C T C	T T C T	C T C T	C C T T	C T C T	T C T C	C T C C	T T C C	T T C T	T C C T
C C T T	C C T C	T C T C	T C T C	T C T T	C C T C	T T C T	C C T T	T C T C	T T C C
C T T C	T T C C	C C T T	T T C T	C T T C	T T C T	T T C C	C T C T	C T C T	C T T C
C T C T	C T C T	T T C C	C T C C	T T C C	C C T T	T C C T	C T T C	C T C C	T C T T
T C T C	C C T T	T C T C	C T T C	C C C T	T T C C	C T T C	T C C T	T C T C	C C C T
	2 WEEKS IN COOLER	10 WEEKS IN COOLER	2 WEEKS IN COOLER	10 WEEKS IN COOLER	2 WEEKS IN COOLER	10 WEEKS IN COOLER	2 WEEKS IN COOLER	2 WEEKS IN COOLER	2 WEEKS IN COOLER
	C T T C	C T C T	T T C T	C T C T	C T C T	T C C T	C T C T C	C T C T	T C T C
	C T C C	C T T C	C C T T	C C T T	C C T T	C C T T	T T C T T	T C T C	C C T T
	T C T C	T T C T	C C T C	T C T C	T C T T	T T C C	C C T C T	C C T T	T T C C
	C C T T	C T C C	T T C T	T T C C	C T T C	C T C T	C T C T C	T T C C	C T T C
	T T T C	C T C T	C C T C	C T C T	T C C T	T C T C	C T C T C	C T C T	T C C T
	4 WEEKS IN COOLER		4 WEEKS IN COOLER	12 WEEKS IN COOLER	4 WEEKS IN COOLER	12 WEEKS IN COOLER	4 WEEKS IN COOLER	4 WEEKS IN COOLER	4 WEEKS IN COOLER
	T C C T		T C T C	T C C T T	T T T C	T C T C	T C T T C	T C T C	C C T T
	C T T C		C C T T	T C T C C	C C T T	C C T T	C T C C T	C C T T	T C T C
	C T C T		C T C T	C T C T C	T C T T	T T C C	C T C T C	T C C T	C T C T
	T C T C		T T T C	T C T C T	C T C C	T C C T	T C T C T	T C T C	T T C C
	C T T C		C C C T		C T T C	C T T C		T C C T	C C T T
	6 WEEKS IN COOLER		6 WEEKS IN COOLER		6 WEEKS IN COOLER	14 WEEKS IN COOLER	6 WEEKS IN COOLER		6 WEEKS IN COOLER
									T C T C
	C T C T		T T C C		T C T C	T C T C T	T C C T C		C C T T
	T C T C		C T T C		C T C T	T T C C T	C T T C T		C T T C
	T C C T		T C C T		T C T T	T C C T C	T T C C T		T C C T
	T T C C		C T T C		C T C C	C C T T C	C C T T C		T T C C
	C T T C		T C C T		T C T C				

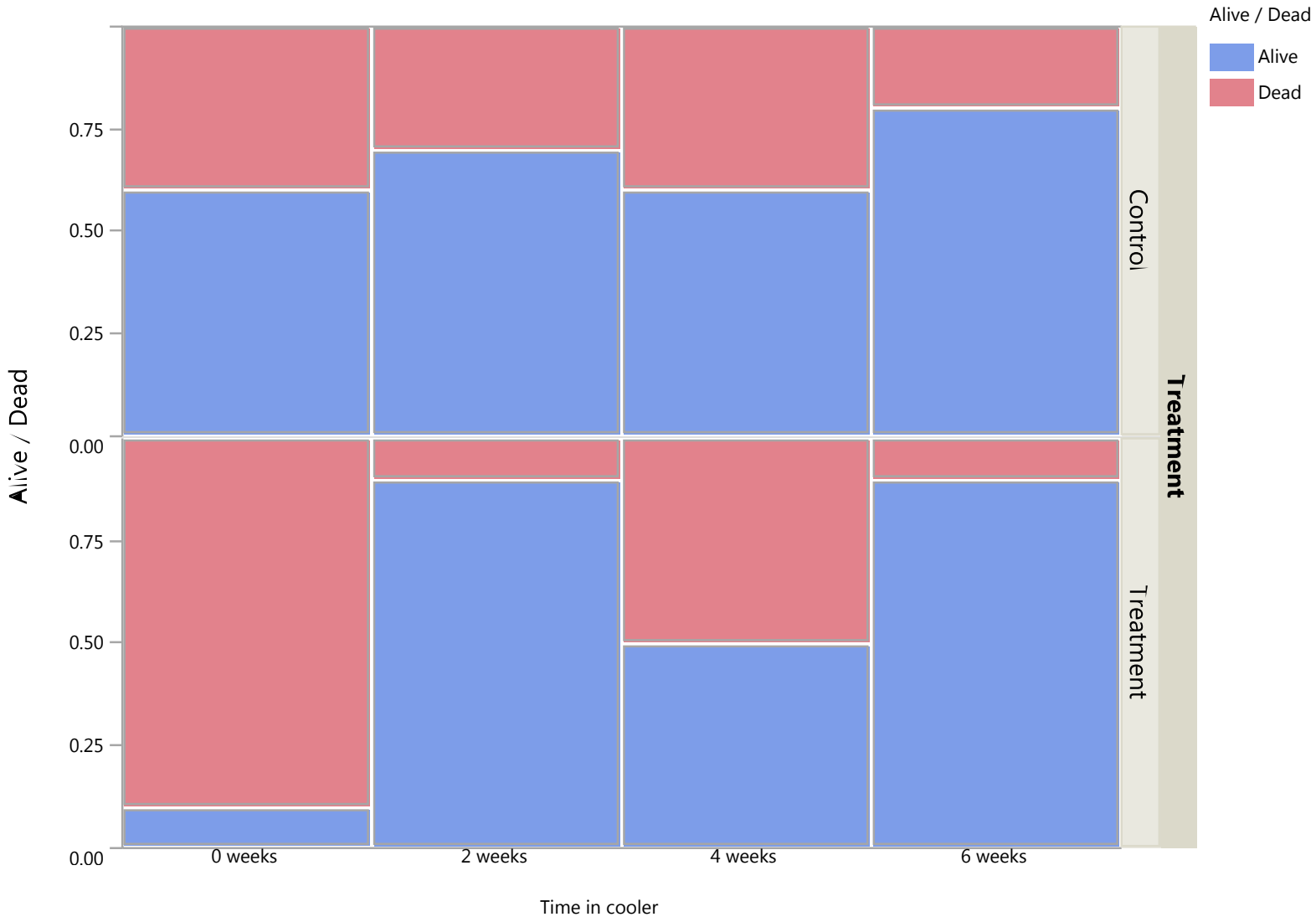
Time o survival



Time 2 survival



Time 4 survival



Summary

- Provisional results indicate that the root growth potential of seedlings decreased with storage time.
- Outplanting survival decreased with increasing storage time.
- Provisional results indicate that significantly fewer treated seedlings died compared to those of the untreated controls.
- Results indicate that seedlings harvested later in the lifting season resulted in decreased survival.
- Further studies on the use of 1-MCP are recommended to determine the reproducibility of the results over a "normal" lifting season.