4.1 Vegetation Management for Long-Term Productivity and Environmental Sustainability, and Enhancing Ecosystem Services in Canadian Semi-Arid Vineyards

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Canada

BRITISH COLUMBIA WINE GRAPE COUNCIL

Canadian Grapevine Certification Network
CGCN · RCCV
Réseau canadien de certification de la vigne

Cover Crop Goals for Vineyards

Category 1: Productivity and fruit quality	
1	**Yield**
2	**Fruit quality**
Category 2: Soil chemical and biological	
3	Improve soil health
4	Carbon sequestration
5	**Improve soil fertility**
6	**Biological Nitrogen Fixation**
7	Reduce nutrient losses (Nutrients scavenging)
Category 3: Soil physical	
8	Reduce compaction
9	Reduce erosion and dust
10	Regulate soil moisture and temperature

Category 4: Visual and ecological	
11	Enhance aesthetics
9	Enhanced biodiversity
Category 5: Biological control and water regulation	
12	Reduce pest and diseases pressure
13	Bio fumigation (reduce soil born diseases and pest)
14	**Suppress weeds/ Weed control**
15	Regulate vine growth/ reduce vigour
Category 6: Revenue generation	
16	Potential revenue generation

Cover Cropping in Irrigated Vineyards

- Cover crops can improve soil health, particularly soil carbon and nitrogen dynamics.
- In irrigated vineyards, a key concern is potential competition between cover crops and grapevines for water and nutrients.
- The absence of significant differences in yield and yield quality between control and cover crop treatments is a positive outcome.
- These results suggest that cover crops can support sustainable soil management without negatively affecting vine performance.

Objectives

- Objective 1: Quantify existing vegetation and predictors and mechanisms of plant community assembly
- **Objective 2: Screen drought tolerant cover crops species for Canadian vineyards**
- **Objective 3: Quantify influence on wine grape productivity, physiology, and fruit quality**
- Objective 4: Quantifying influence on above- and below-ground co-benefits and costs
  - 4.1 Quantification of pest and beneficial insect abundance and impact
  - 4.2 Soil borne pests (e.g. nematodes) and pathogens
  - 4.3 Soil health
- Objective 5: Knowledge and technology transfer

Obj. 2 and 3. Participating Vineyards

Waldhof Family Estate Winery -Est. 2024-

Spring CC

Little Straw Vineyards

Phased out in 2025

Le Vieux Pin

Spring CC

Osoyoos Larose

New (2026)

Peller Estates

Winter CC

G™

Mission Hill Family Estate

Winter CC

Gray Monk™ Estate Winery

New (2026)

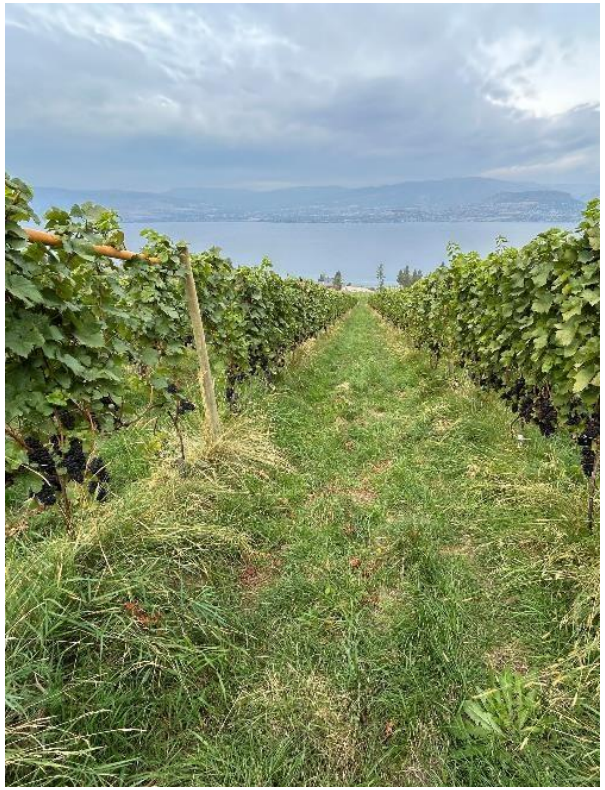
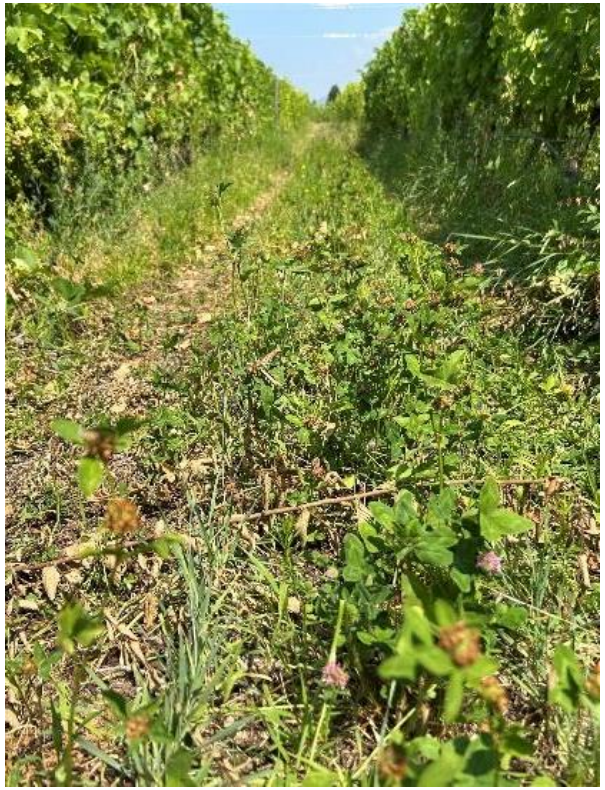
Experimental Vineyards and Treatments

	Zone	Spring 2025	Fall 2025
Sebastian Farm-33	Alley	**Fall Rye + Slender Wheatgrass**	Fall rye + winter Peas
Standard/Reduced Irrigation		**Fall Rye + Italian Ryegrass**	Fall rye + winter Peas
		Fall Rye + Red Clover + Dutch White Clover	Fall rye + winter Peas
		Spontaneous vegetation (Control)	Spontaneous vegetation (Control)
Diamondback			
Standard/Reduced Irrigation	Alley	**Sainfoin + Lentils**	Fall rye + winter Peas
		Italian Ryegrass	Fall rye + winter Peas
		Field Peas	Fall rye + winter Peas
		Spontaneous vegetation (Control)	Spontaneous vegetation (Control)
Le Vieux Pin			
Standard/Reduced Irrigation			
	Alley	**Fall Rye + Kirk Crested Wheatgrass**	
		Fall Rye+ Red clover + Dutch White clover	
		Spontaneous vegetation (Control)	
Little Straw			
Standard/Reduced Irrigation	Alley	**Daikon Radish + Lentils**	
		Daikon Radish + Field Peas	
		Spontaneous vegetation (Control)	
Waldhof			
Standard/Reduced Irrigation	Alley	**Fall Rye + Slender Wheatgrass**	
		Fall Rye + Italian Ryegrass	
		Fall Rye + Red clover + Dutch White clover	
		Spontaneous vegetation (Control)	
	Row	**Lentils**	
		Microclover	
		English Thyme	
		Control	

Cover Crop Species - 2026

Zone	Plant type	Species	Growth rate	Drought tolerance	Cold tolerance
Alley	Grass				
		Italian ryegrass	Medium	M	H
	Legume				
		White clover	Medium	M	M
		Red clover	Medium	M	M
		Winter peas	Fast	M	M
		Field/Forage peas	Fast	M	M
		Sainfoin	Slow	H	H
	Nurse crop				
		Fall rye	Fast	H	H
		Triticale	Fast	H	H
Row	Legume	Dutch white clover			
	Legume	Microclover	Slow	M	M
	Legume	Crimson clover	Slow	H	M
	Legume	Lentils	Fast	H	L
	Grass	Italian ryegrass	Medium	M	H

2025 Season


Fall Activities

Winter Cover Crops – Feb 2026 (Sebastian Farm -33)

Winter Cover Crops – Feb 2026
(Diamondback Vineyards)

Obj. 2 and 3. Trista Algar (MSc project; Drs. Mehdi Sharifi, David Ensing and Ben-Min Change) Measurements

Yield and fruit quality parameters

Soil measurements: Nitrate and Ammonium, Total C and N, Active C and N fractions

Petiole and leaf blade N

SPAD measurements

Physiological measurements: photosynthetic rate and stem water potential

Canopy temperature sensors (iButton sensors)

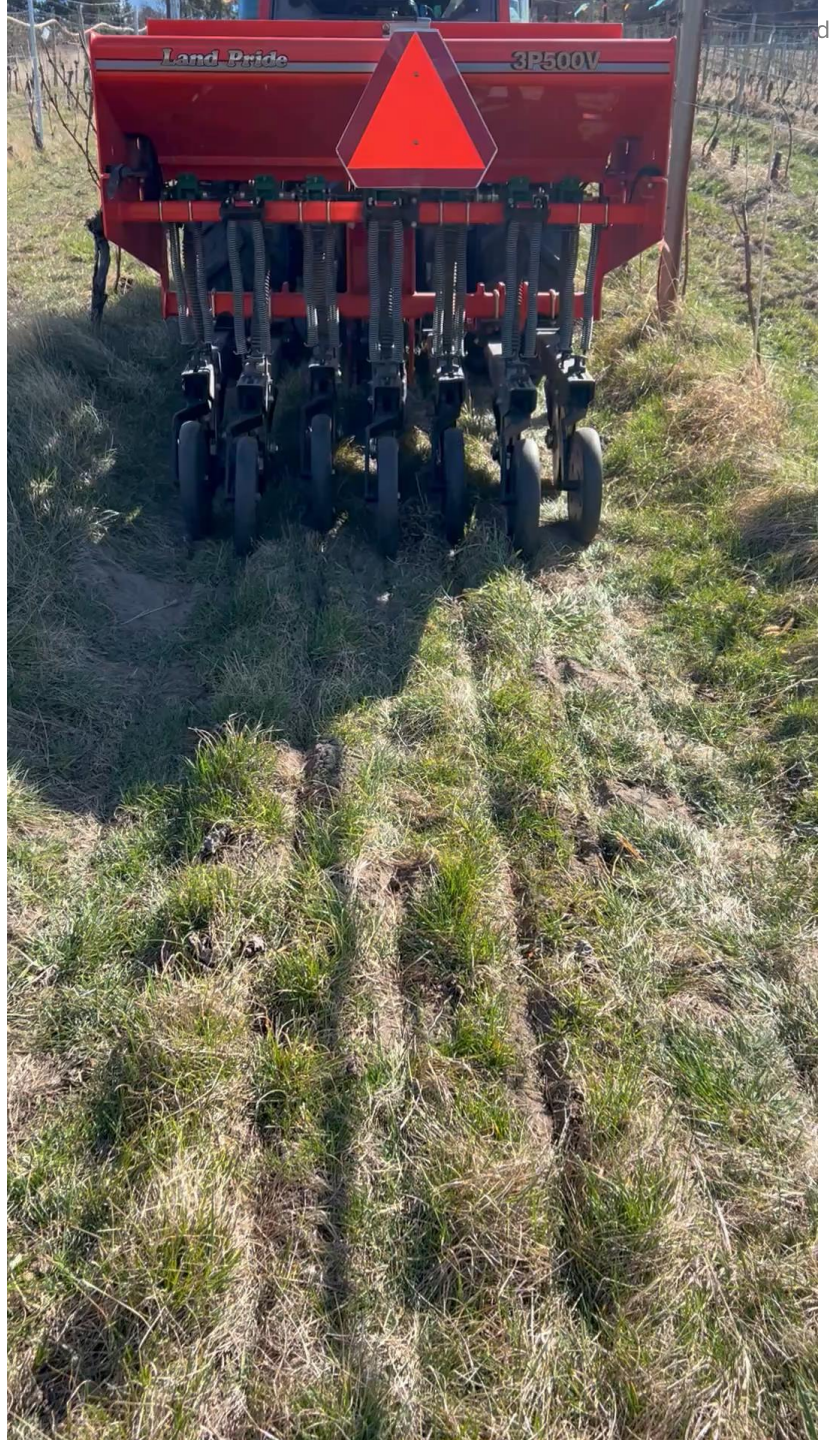
Ground radiation sensors

Soil moisture and temperature sensors

Rodent activity

Soil compaction

Spring cover crop seeding

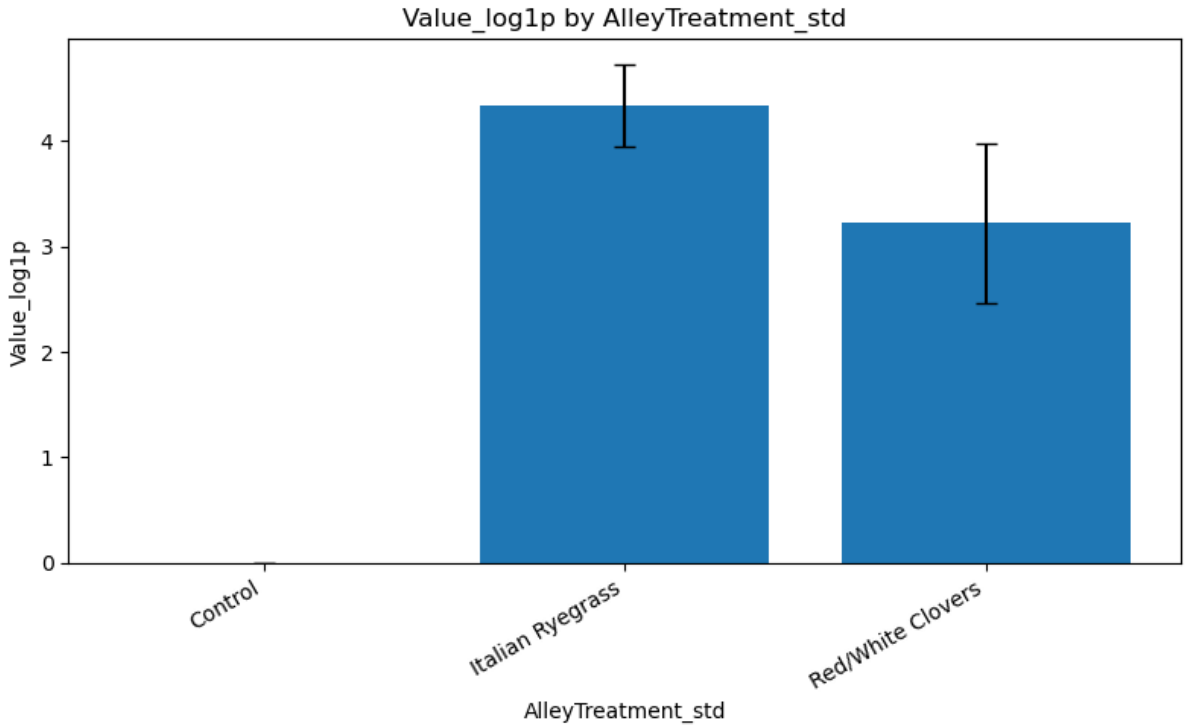


Waldhof Vineyards – Ovehead Irrigation

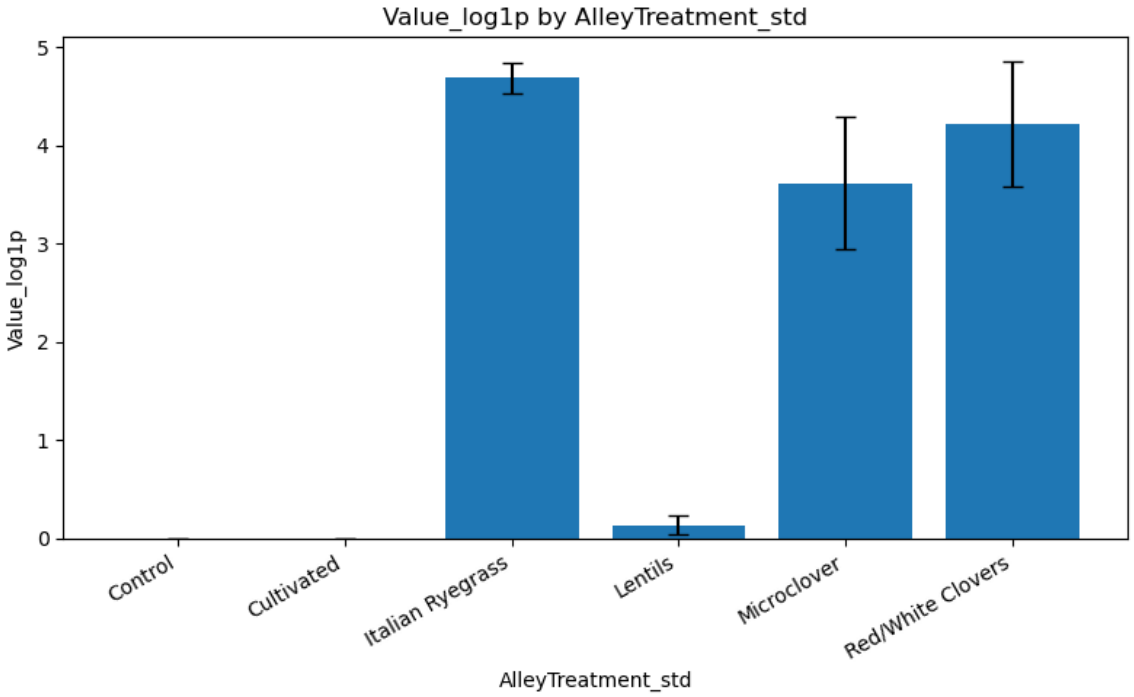
2025

WV-Cover crops dry biomass *

Reduced Irrigation



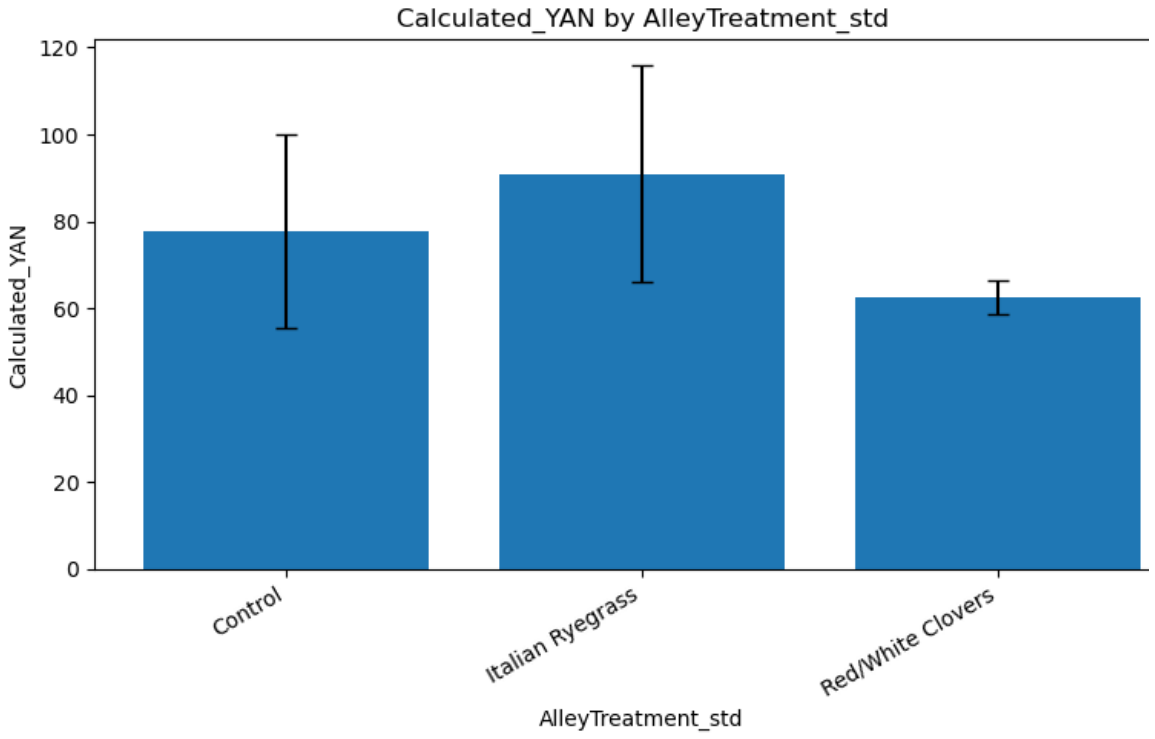
Standard Irrigation*



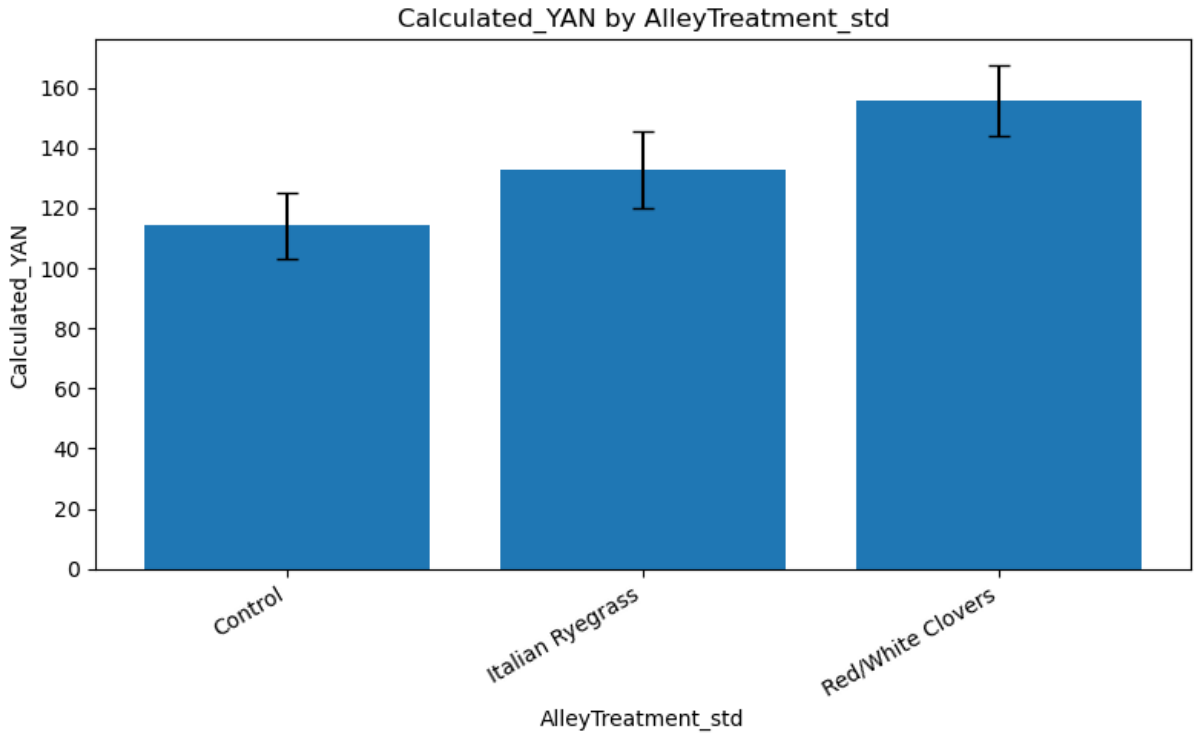
Cover crops established well under both reduced and standard irrigation, except for wheatgrass and English thyme, which were excluded from the analysis.

WV- YAN- Alley cover crops

Reduced Irrigation

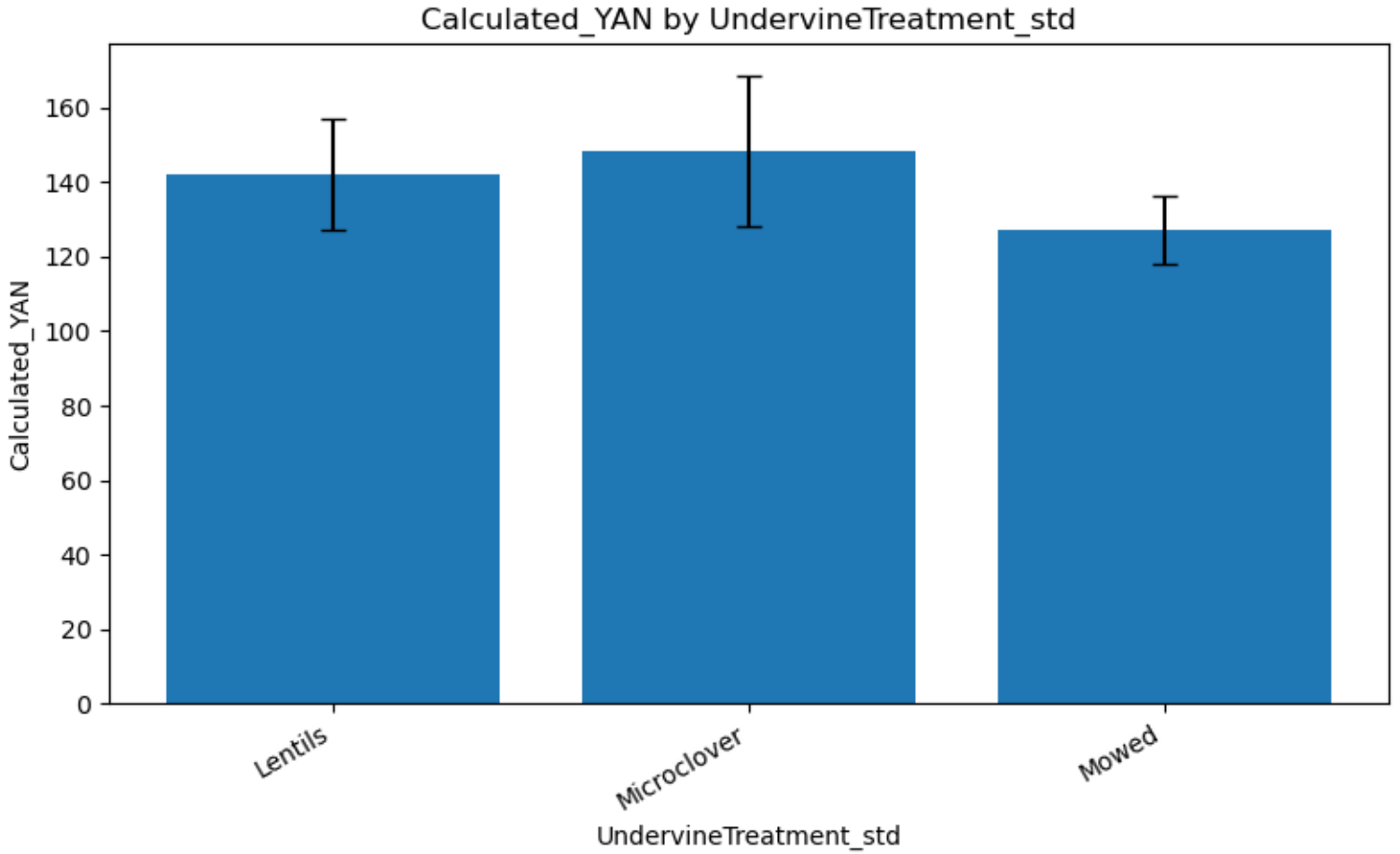


Standard Irrigation*



The effect of alley cover crops on YAN was not significant; however, a trend toward higher YAN was observed in legume-based cover crops under standard irrigation.

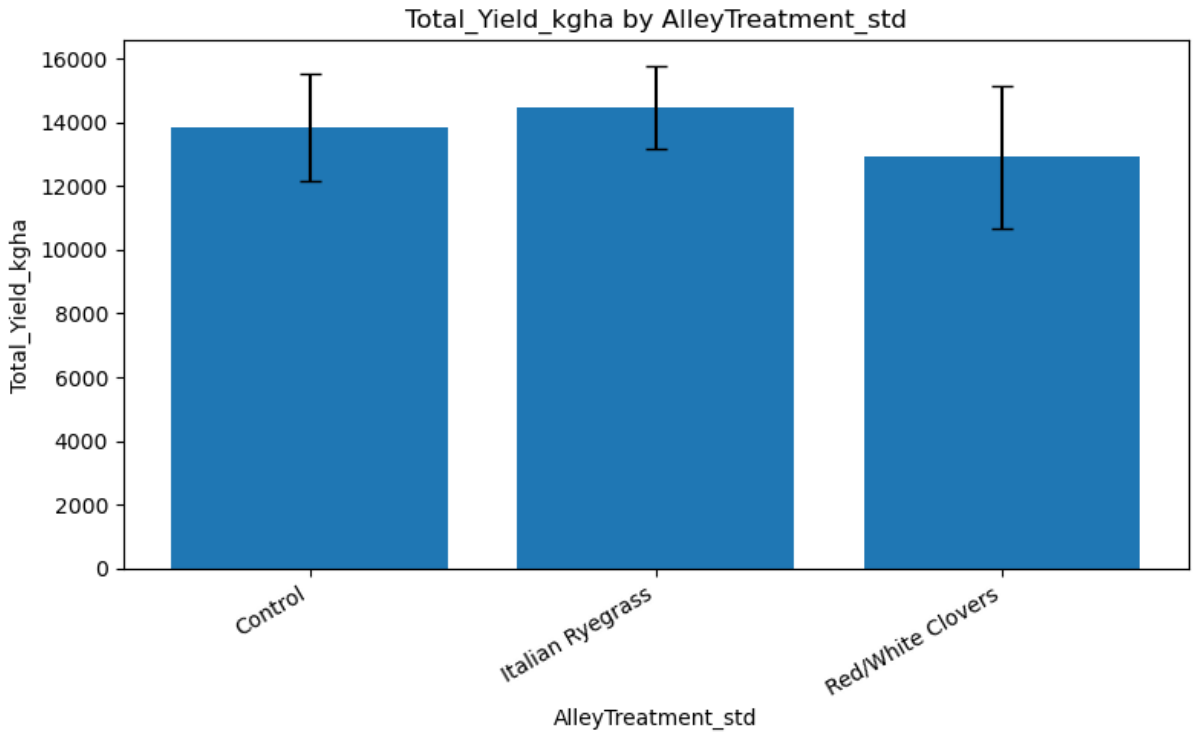
WV- YAN- Undervine cover crops



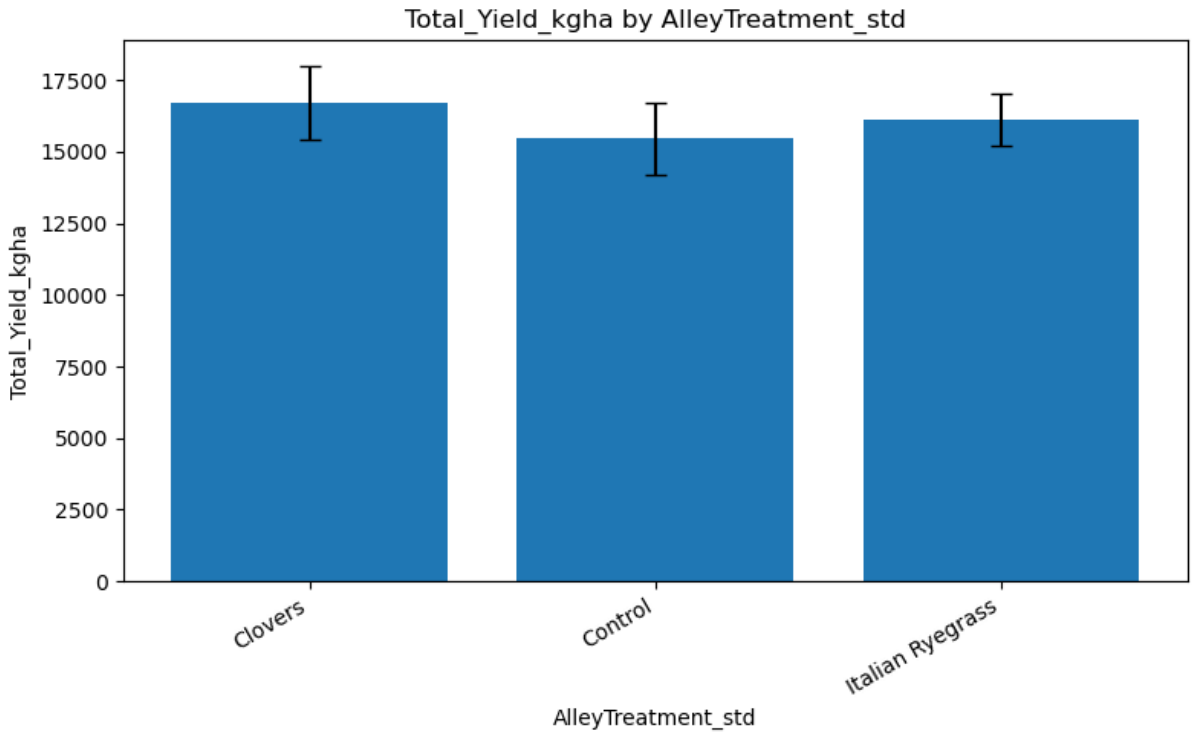
The effect of undervine cover crops on YAN was not significant; however, a trend toward higher YAN was observed in legume cover crops under standard irrigation.

WV- Yield- Alley cover crops

Reduced Irrigation

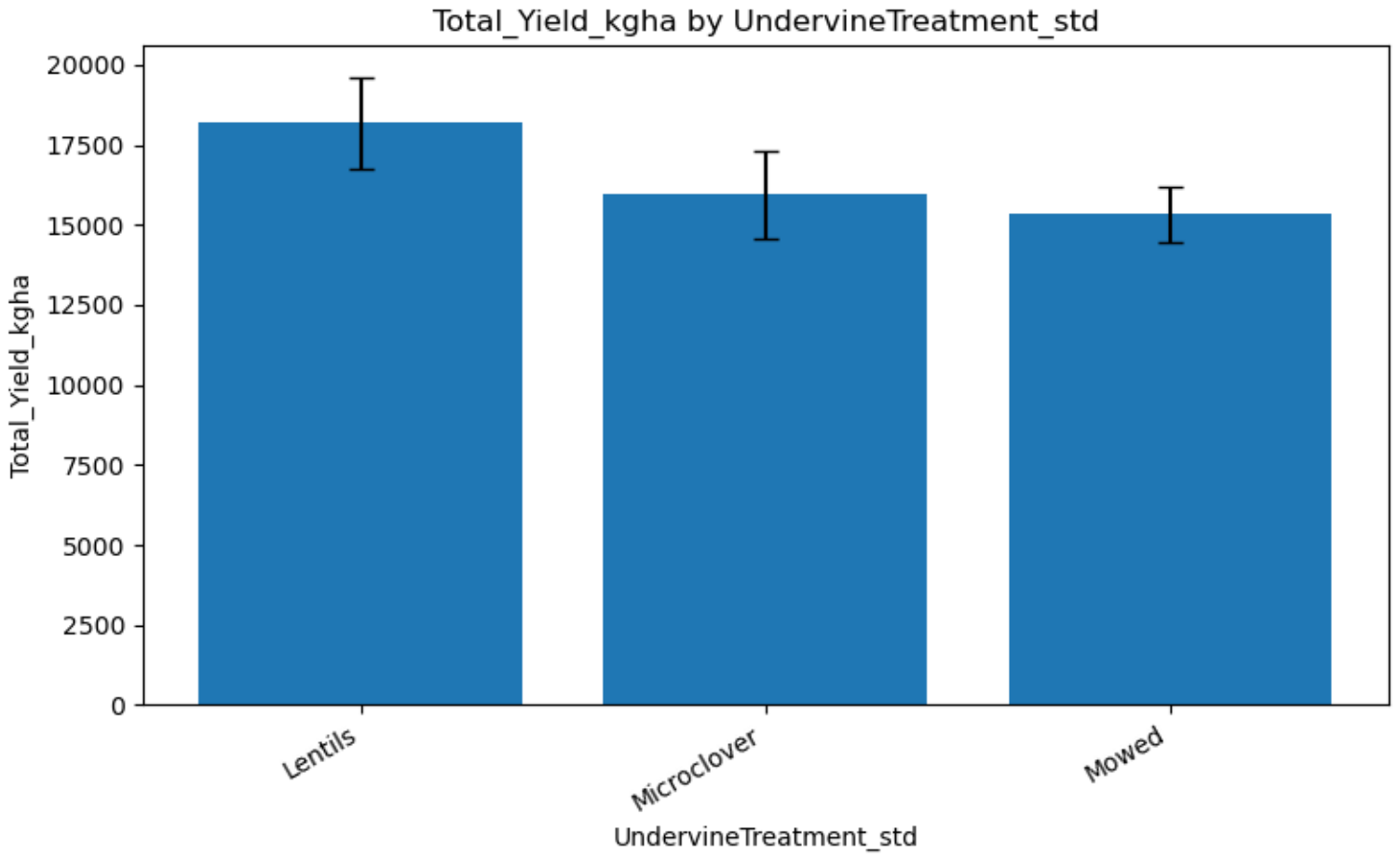


Standard Irrigation*



The effect of alley cover crops on YIELD was not significant; however, a trend toward higher YIELD was observed in legume cover crop under standard irrigation.

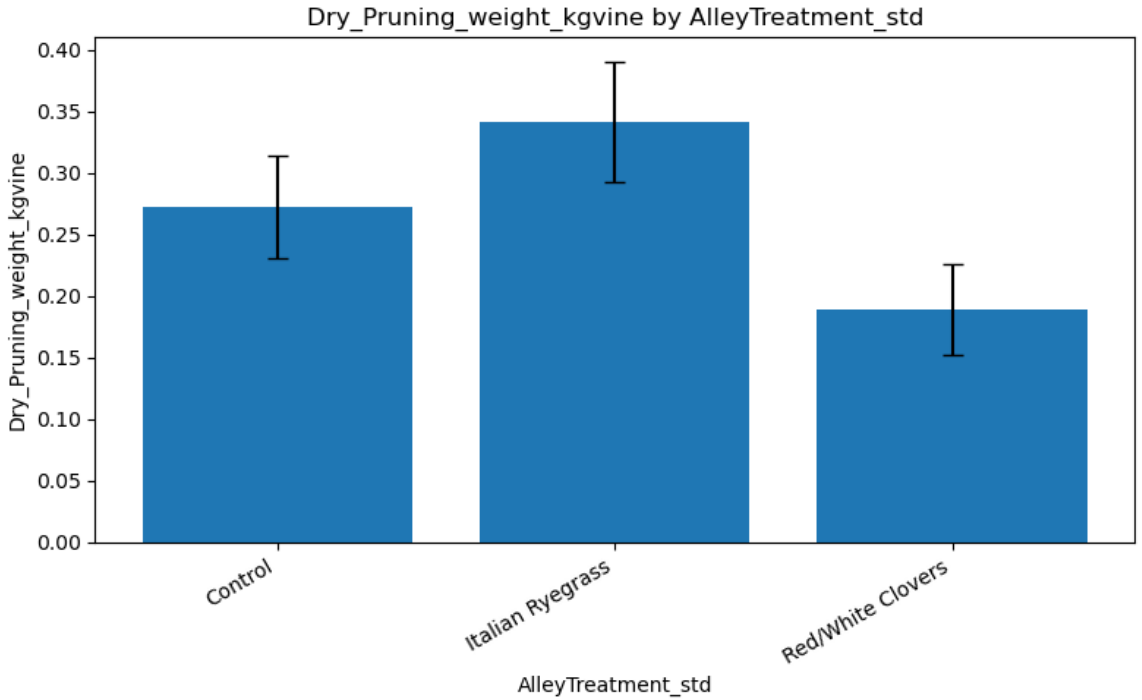
WV-Yield- Undervine cover crop



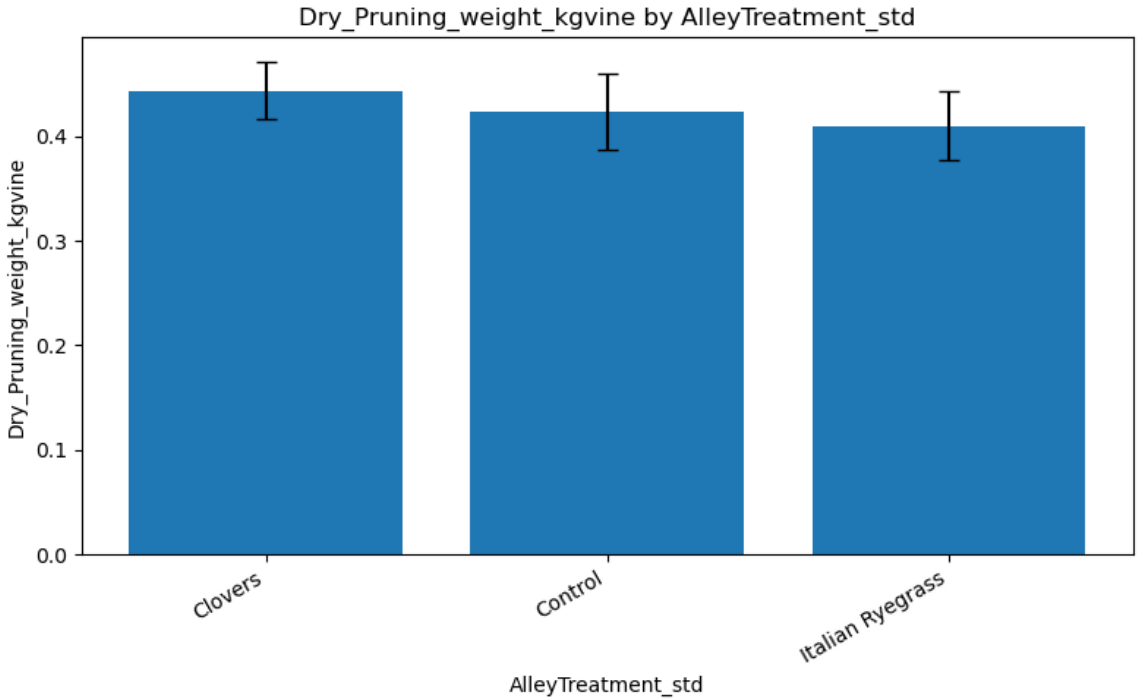
The effect of undervine cover crops on YIELD was not significant; however, a trend toward higher YIELD was observed in lentils under standard irrigation.

WV-Yield- Alley cover crop

Reduced Irrigation

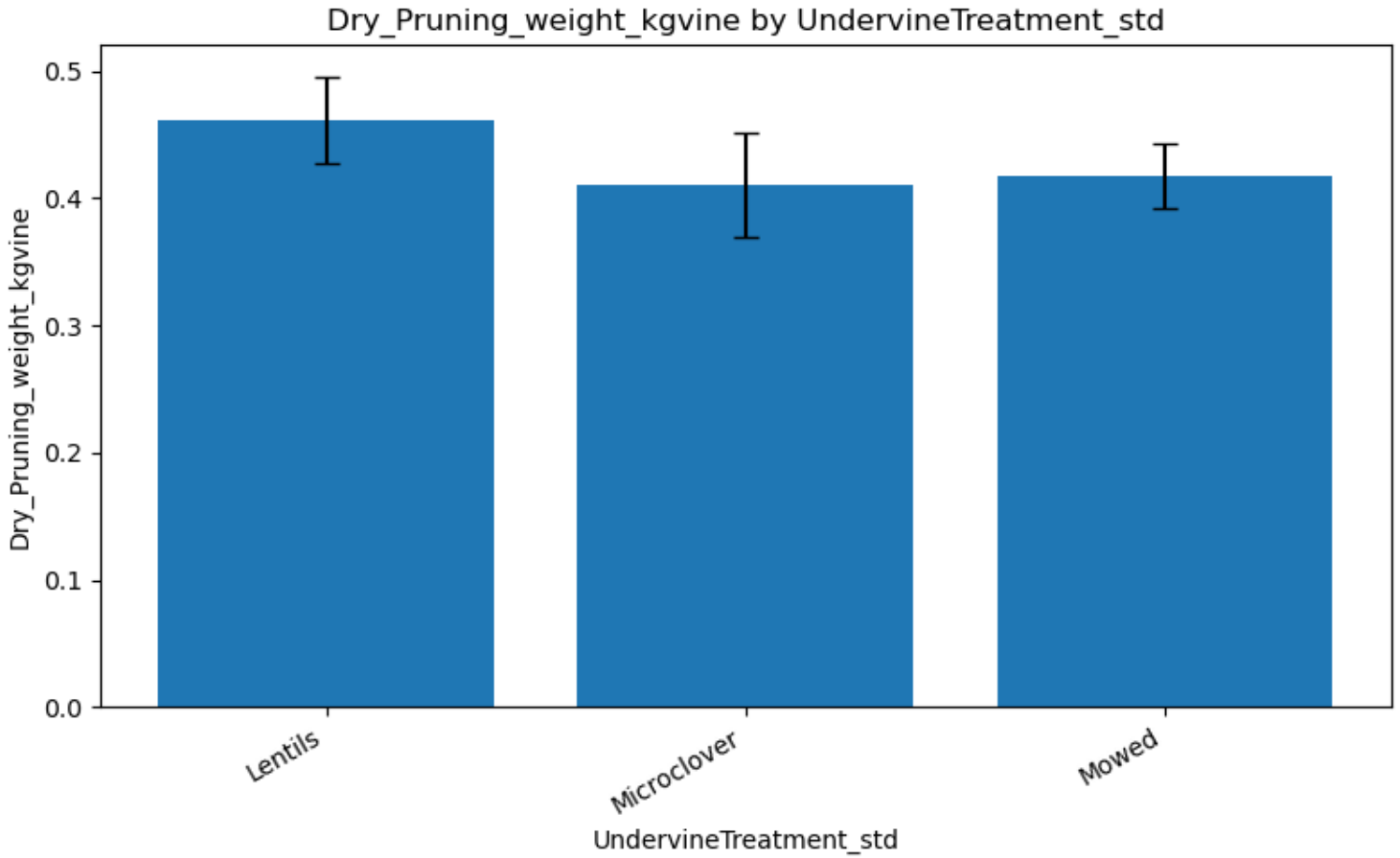


Standard Irrigation*



The effect of alley cover crops on PRUNING weight was significant in reduced irrigation; however, lower PRUNING weights were measured in legume cover crop compared to others.

WV-Pruning weight- Undervine cover crop



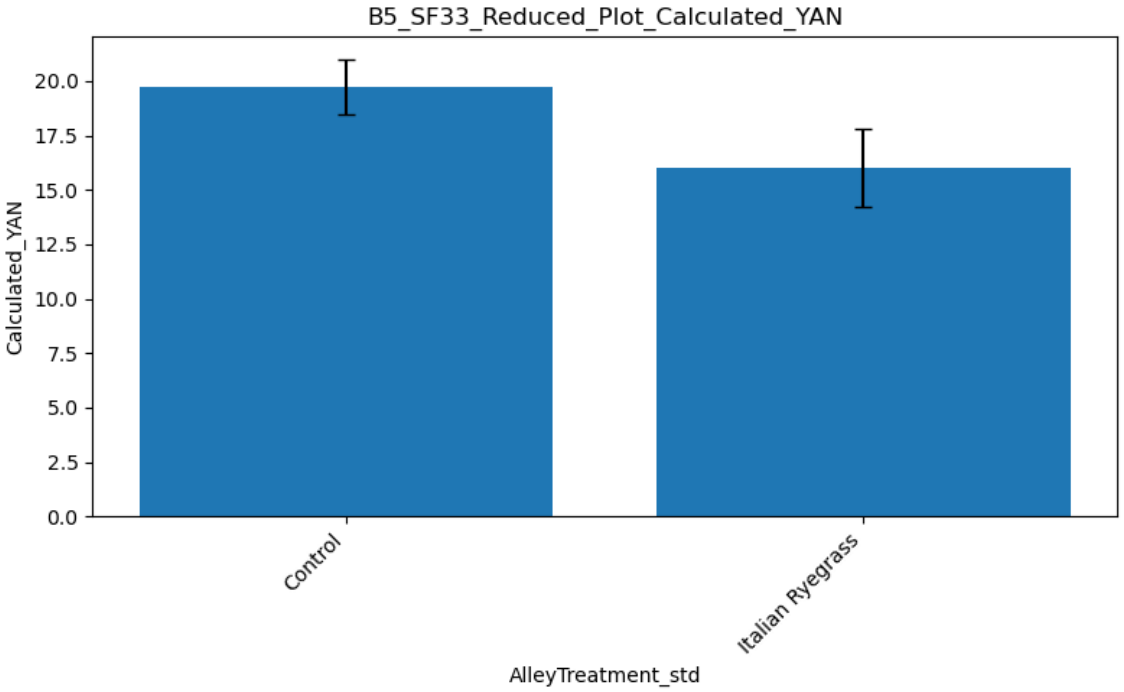
The effect of undervine cover crops on Pruning weight was not significant.

Sebastian Farms 33 – Dual Irrigation

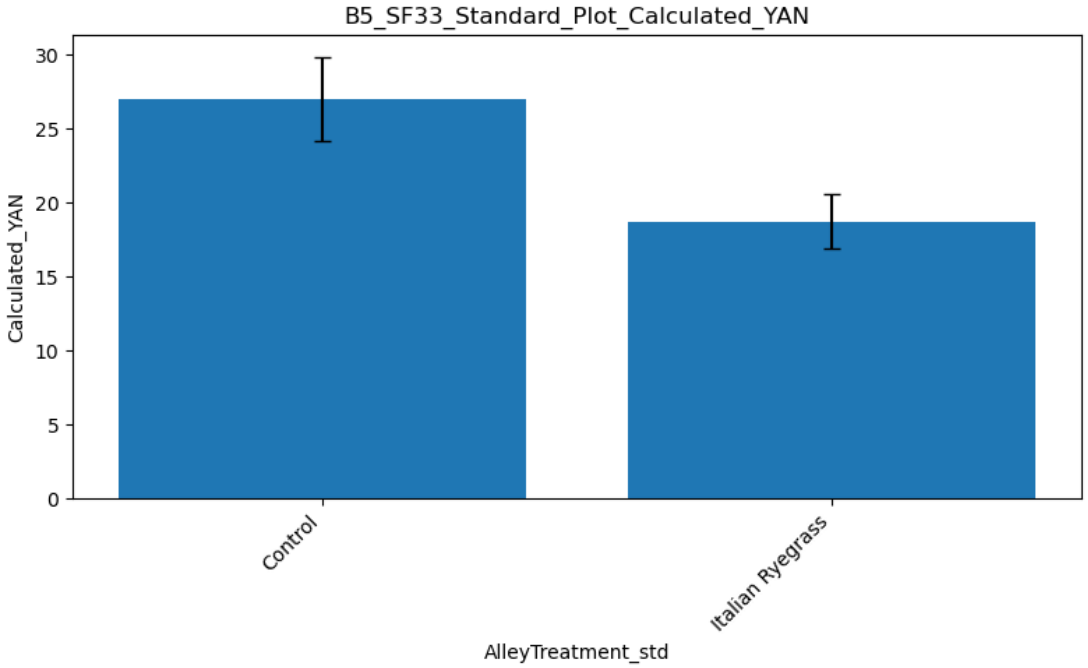
2025

SF- YAN- Alley cover crops

Reduced Irrigation



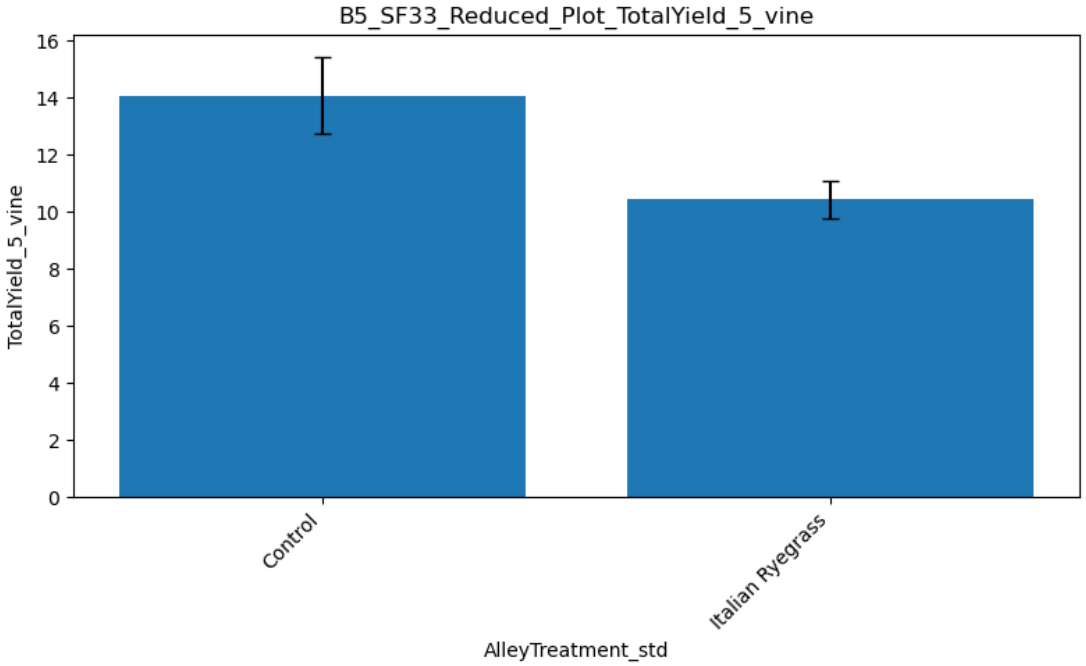
Standard Irrigation*



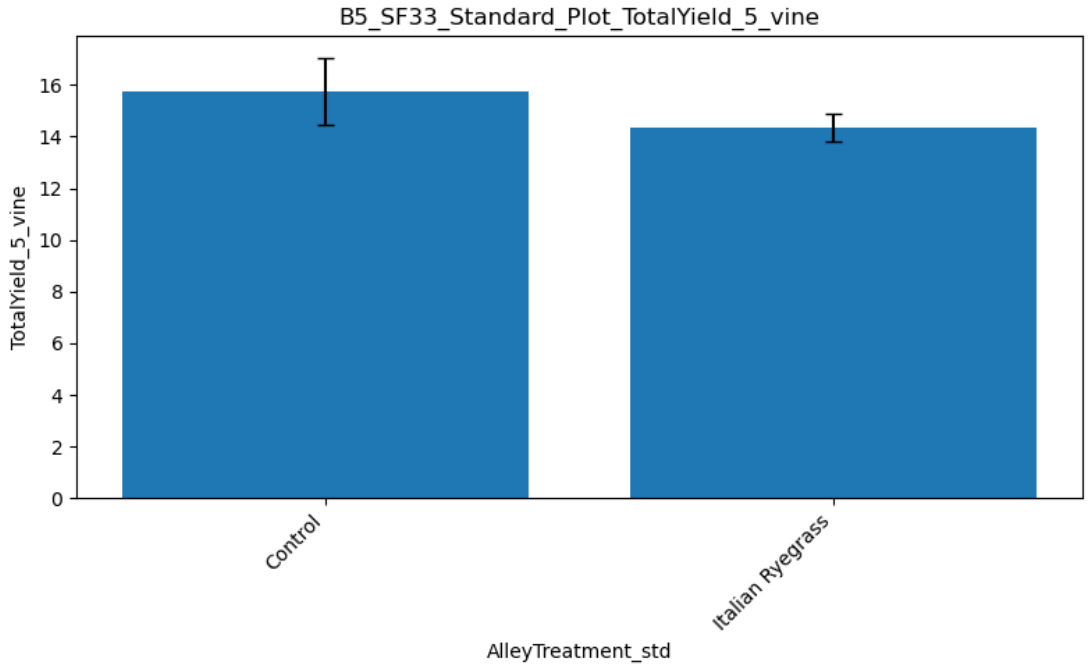
The effect of alley cover crops on YAN was not significant; however, a trend toward lower YAN was observed in grass-based cover crops under both irrigations.

SF- Yield- Alley cover crops

Reduced Irrigation



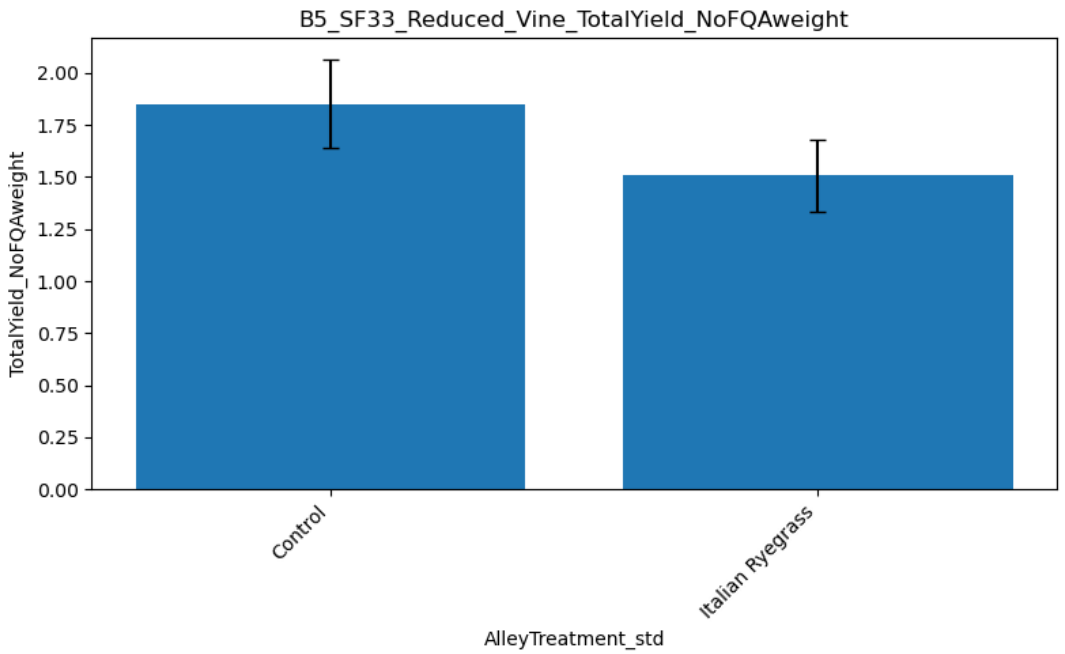
Standard Irrigation*



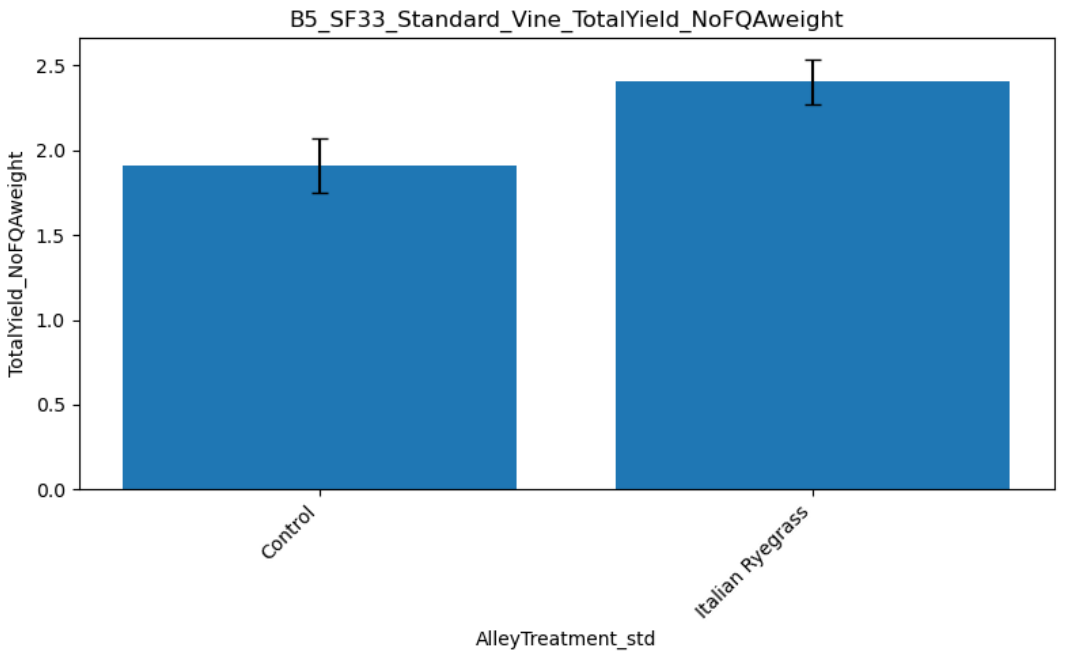
The effect of alley cover crops on YIELD was not significant; however, a trend toward lower YIELD was observed in grass cover crop under reduced irrigation.

SF- Yield- Alley cover crops

Reduced Irrigation



Standard Irrigation*



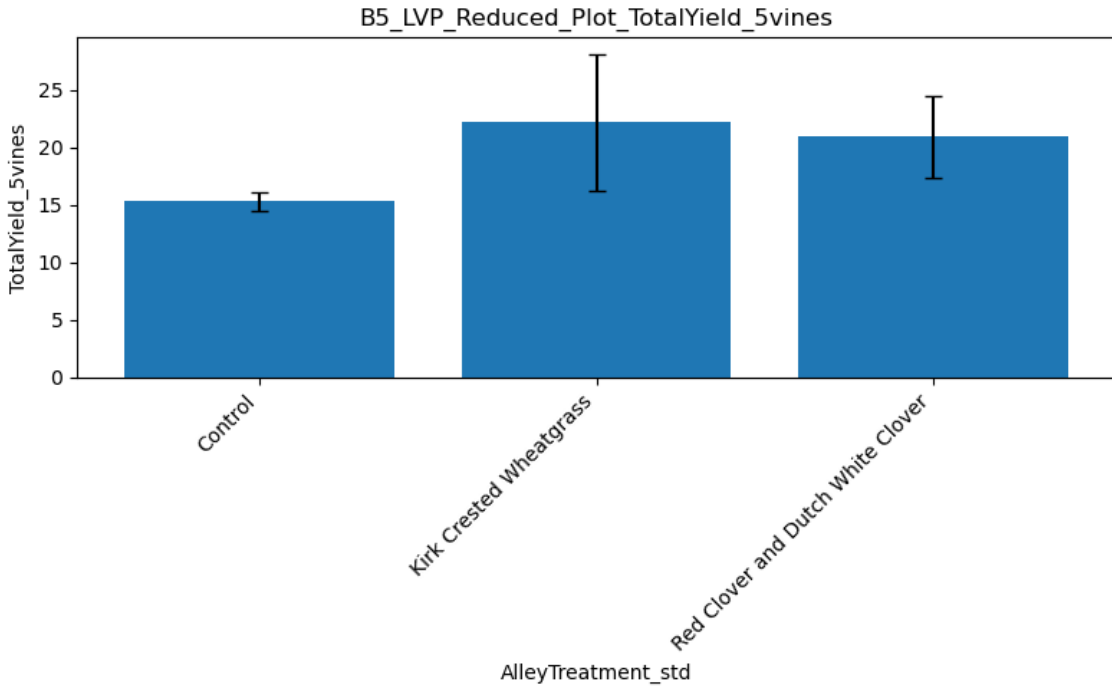
The effect of alley cover crops on YIELD was significant in standard Irrigation; where, greater YIELD was observed in grass cover crop.

Le Vieux Pin Vineyards – Dual Irrigation

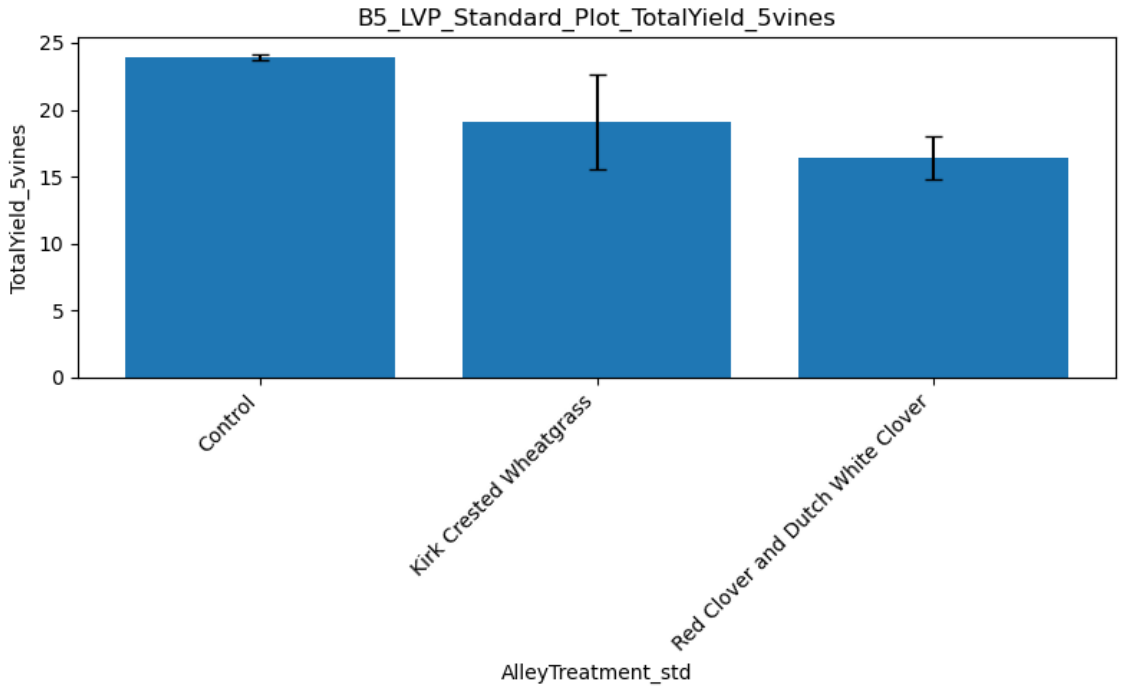
2025

LVP-Reduced and Standard NS.

Reduced Irrigation



Standard Irrigation

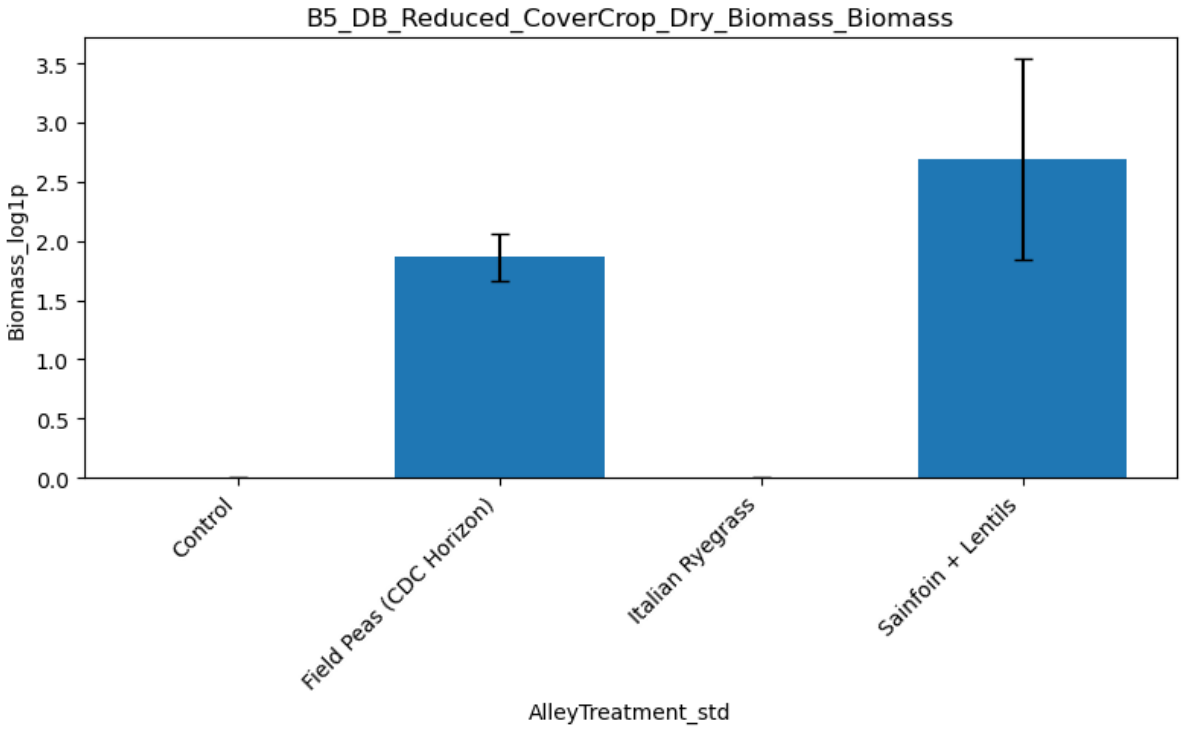


Diamondback Vineyards – Dual Irrigation

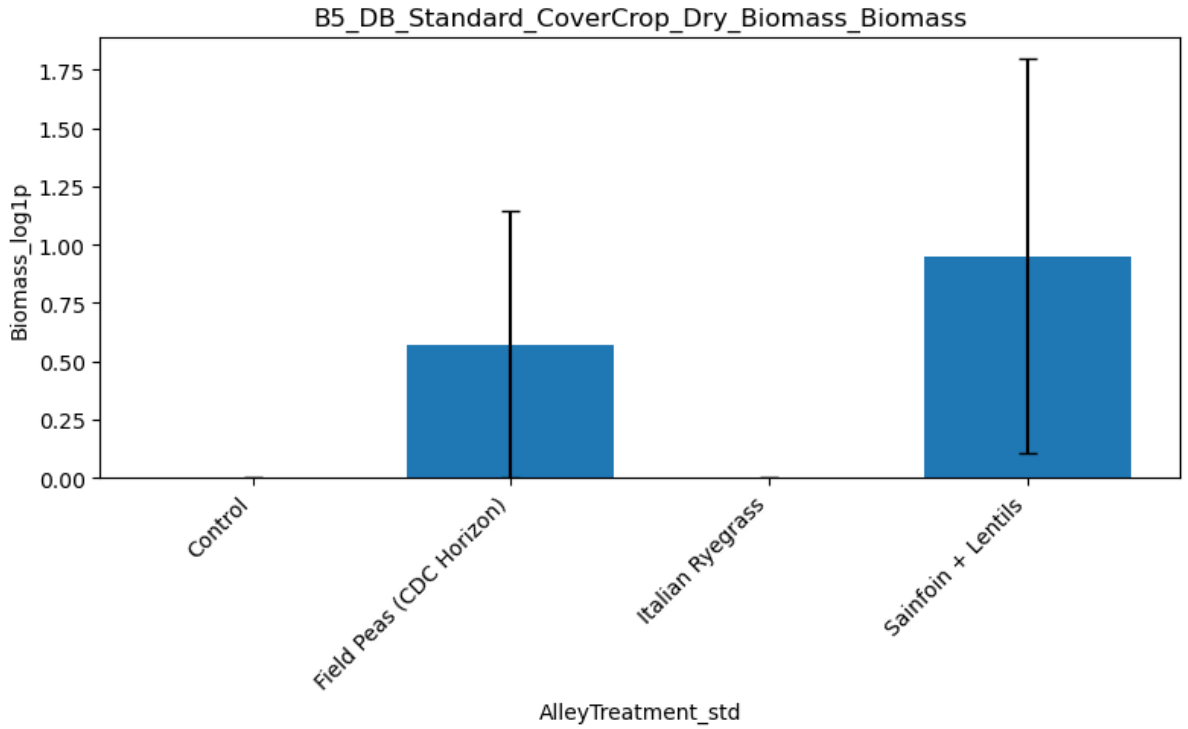
2025

DB-Reduced and Standard NS.

Reduced Irrigation

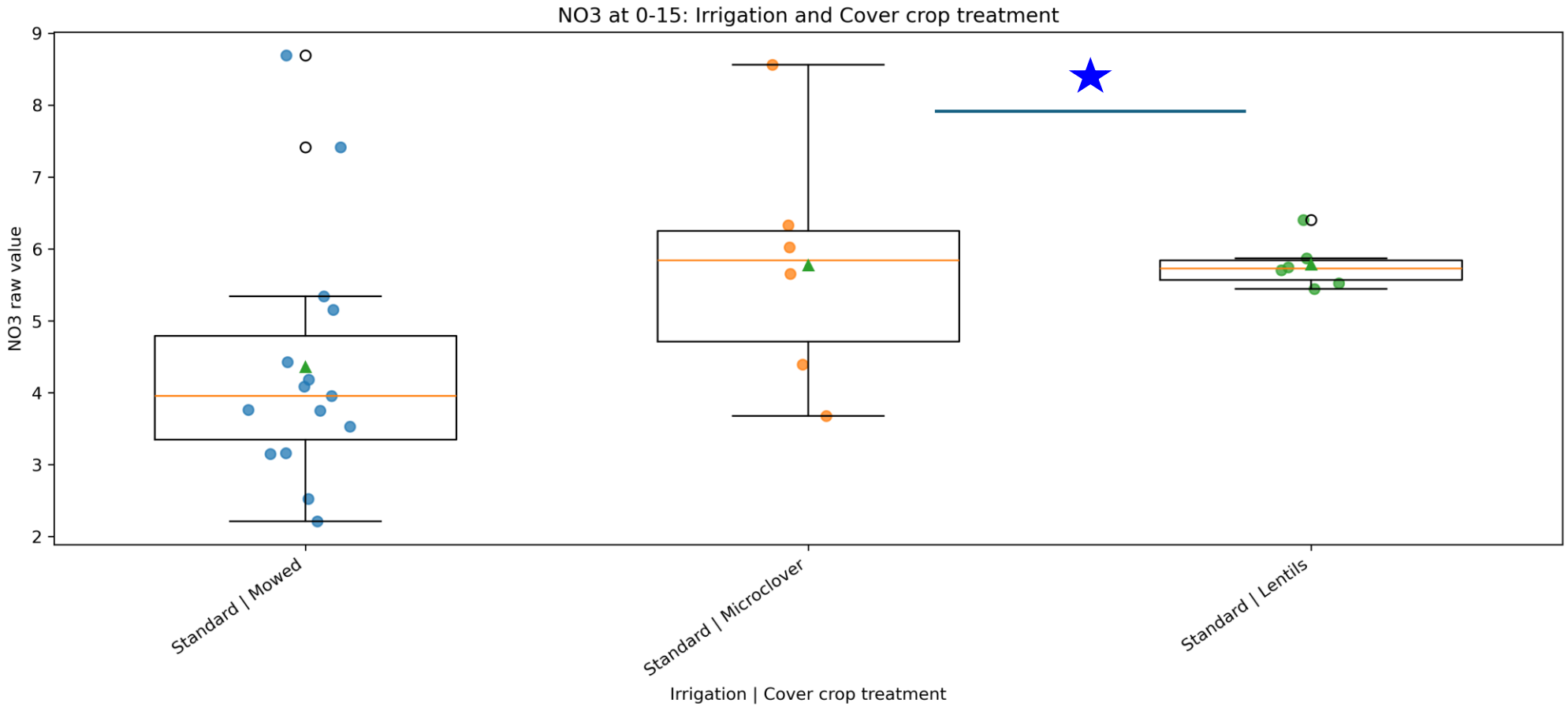


Standard Irrigation

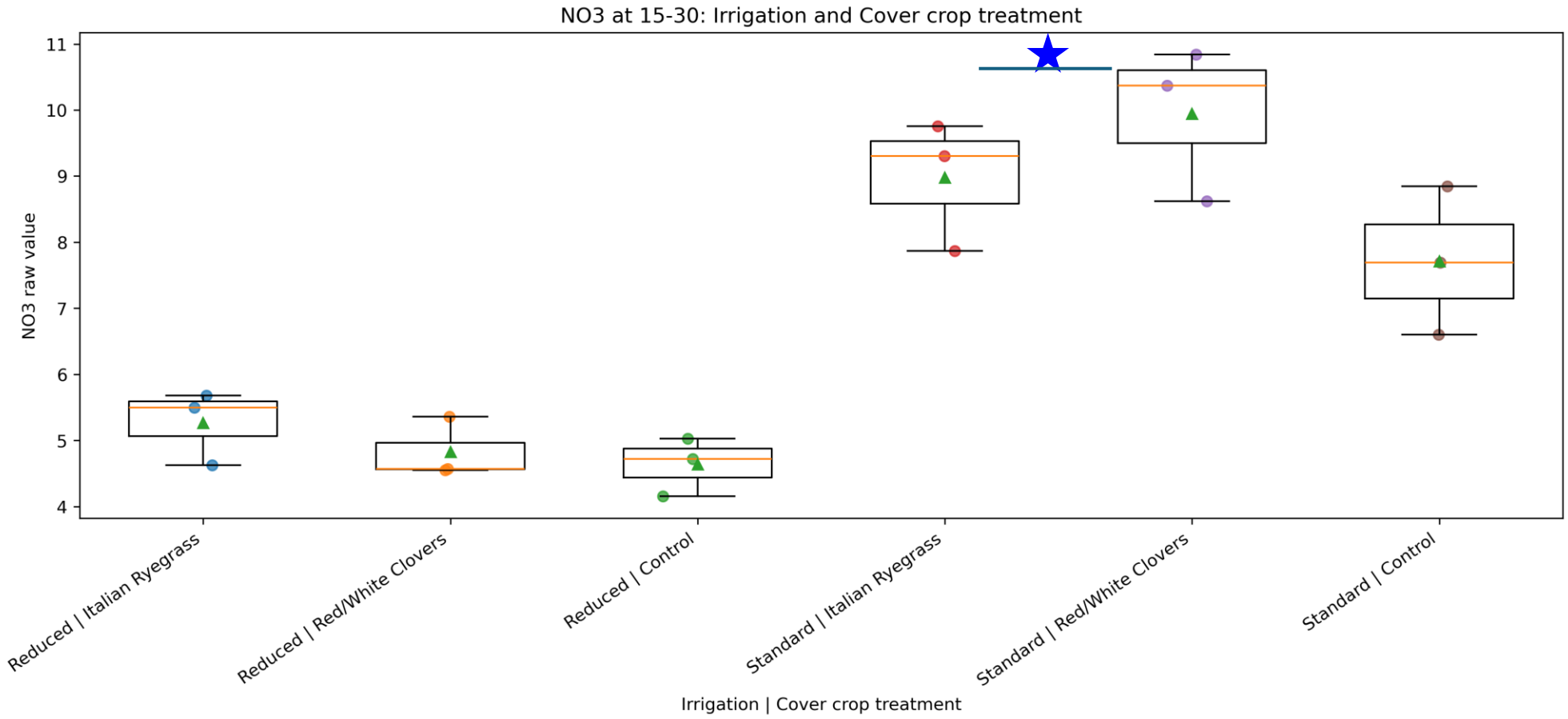


Soil available N at harvest

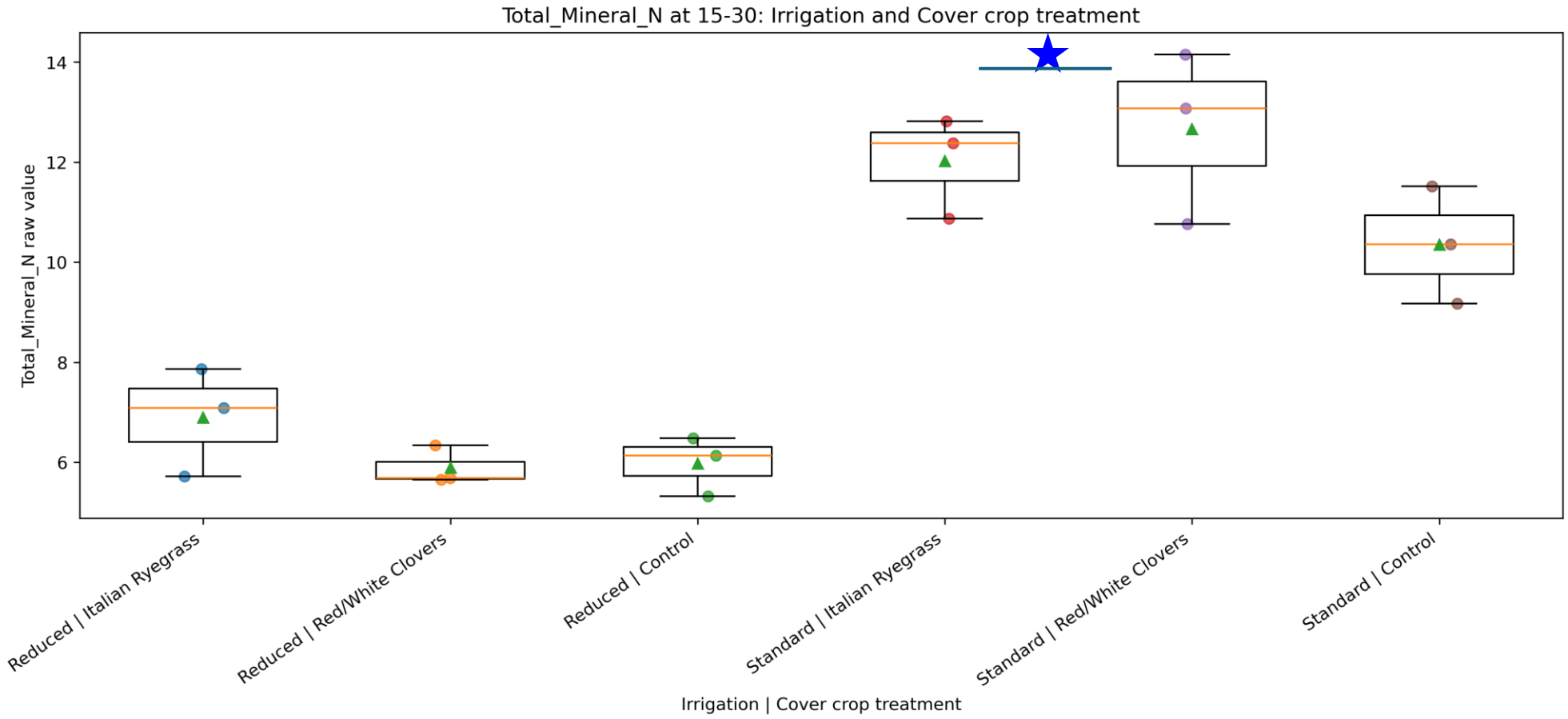
Waldhof Vineyards- Row Cover Crops – Soil Nitrate (0-15 cm) at Harvest



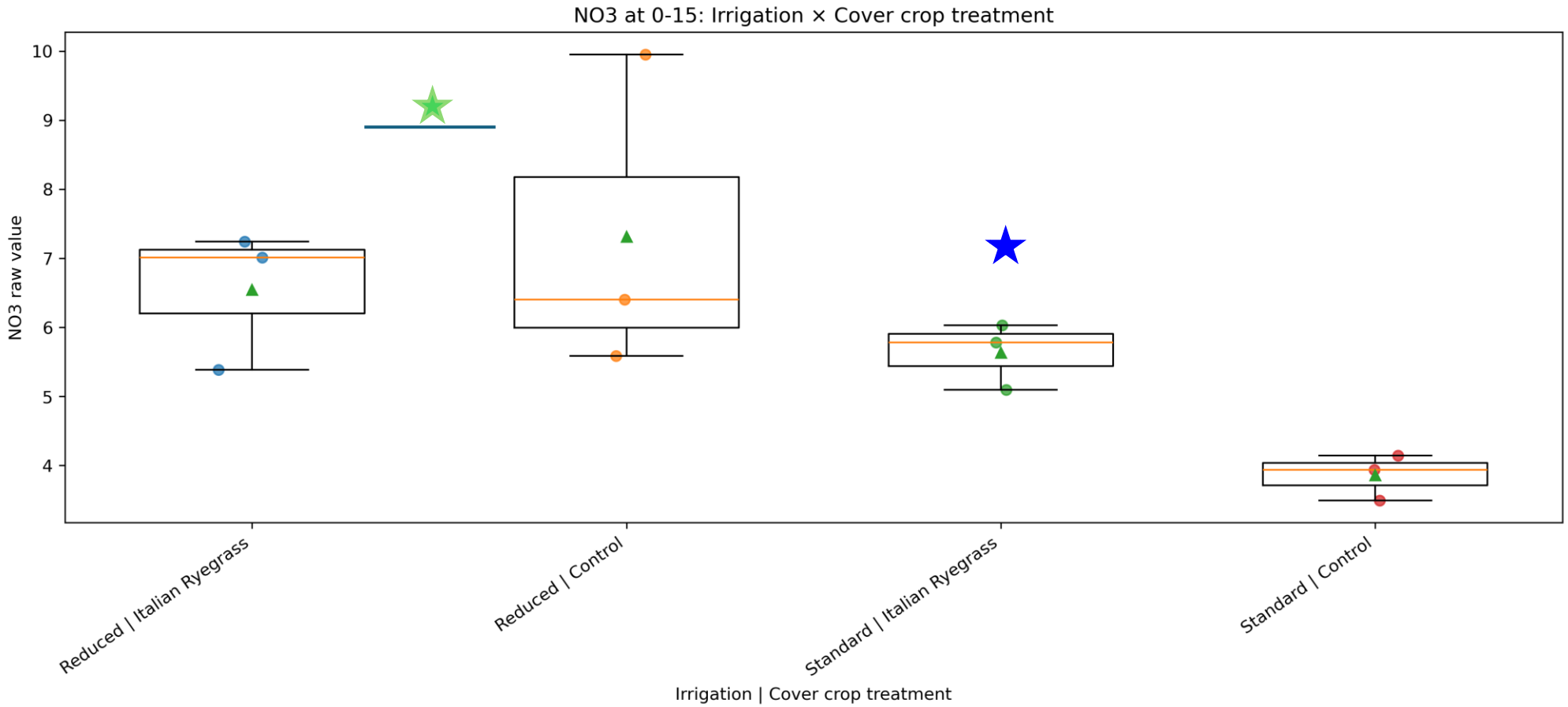
Waldhof Vineyards- Alley Cover Crops X Irrigation – Soil Nitrate (15-30 cm) at Harvest



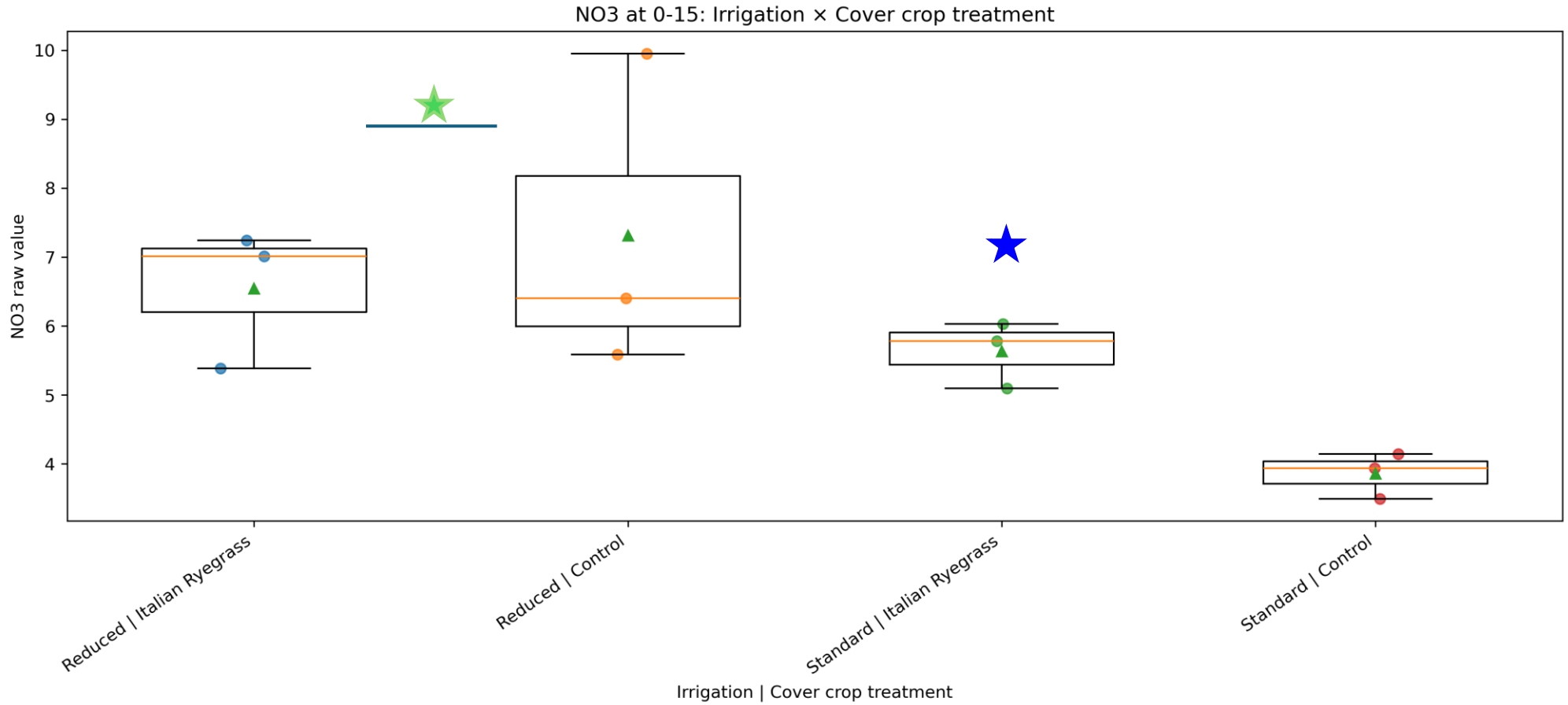
Waldhof Vineyards- Alley Cover Crops X Irrigation – Available Soil Nitrogen (15-30 cm) at Harvest

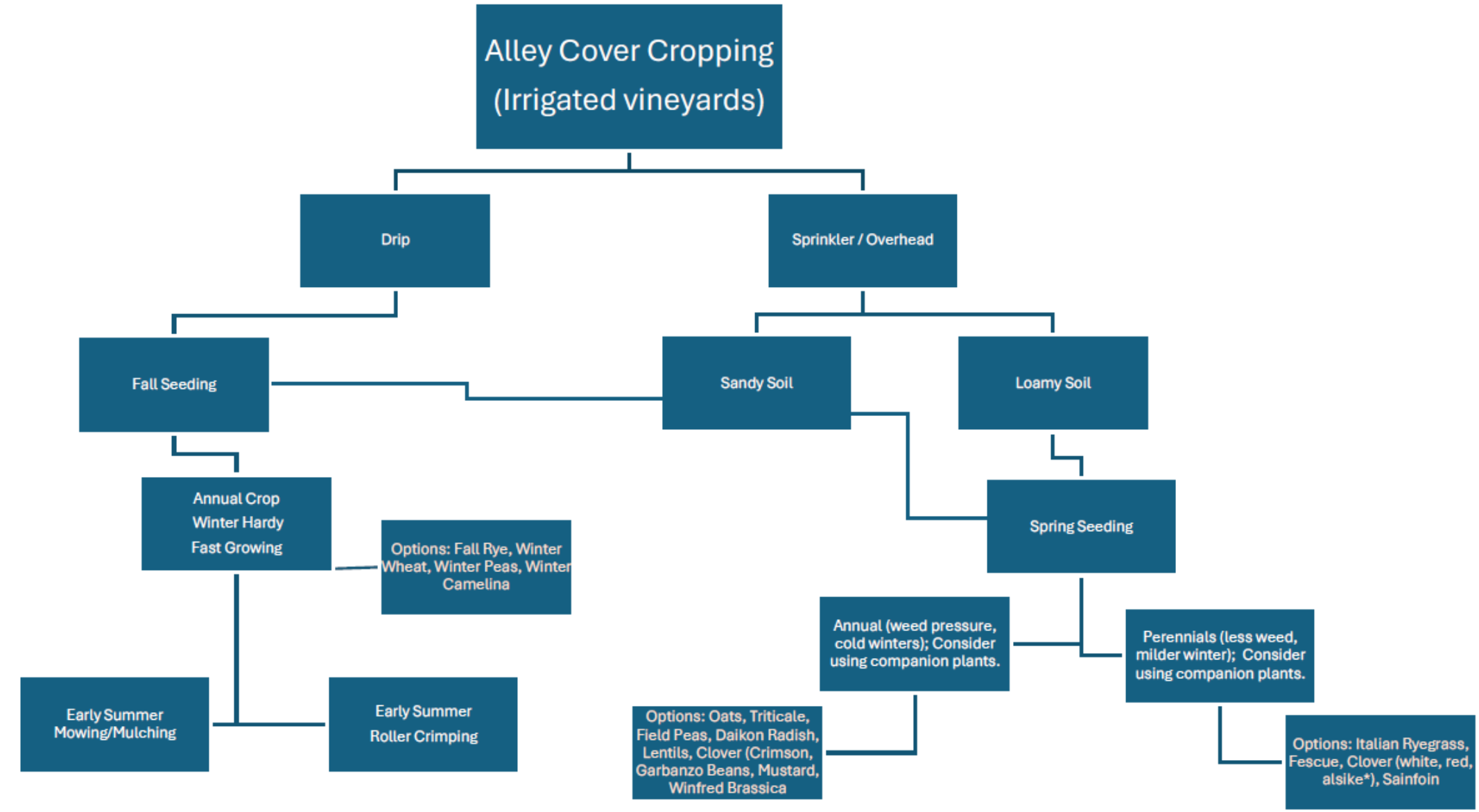


Sebastian Farms Vineyards- Alley Cover Crops X Irrigation –Soil Nitrate (0-15 cm) at Harvest

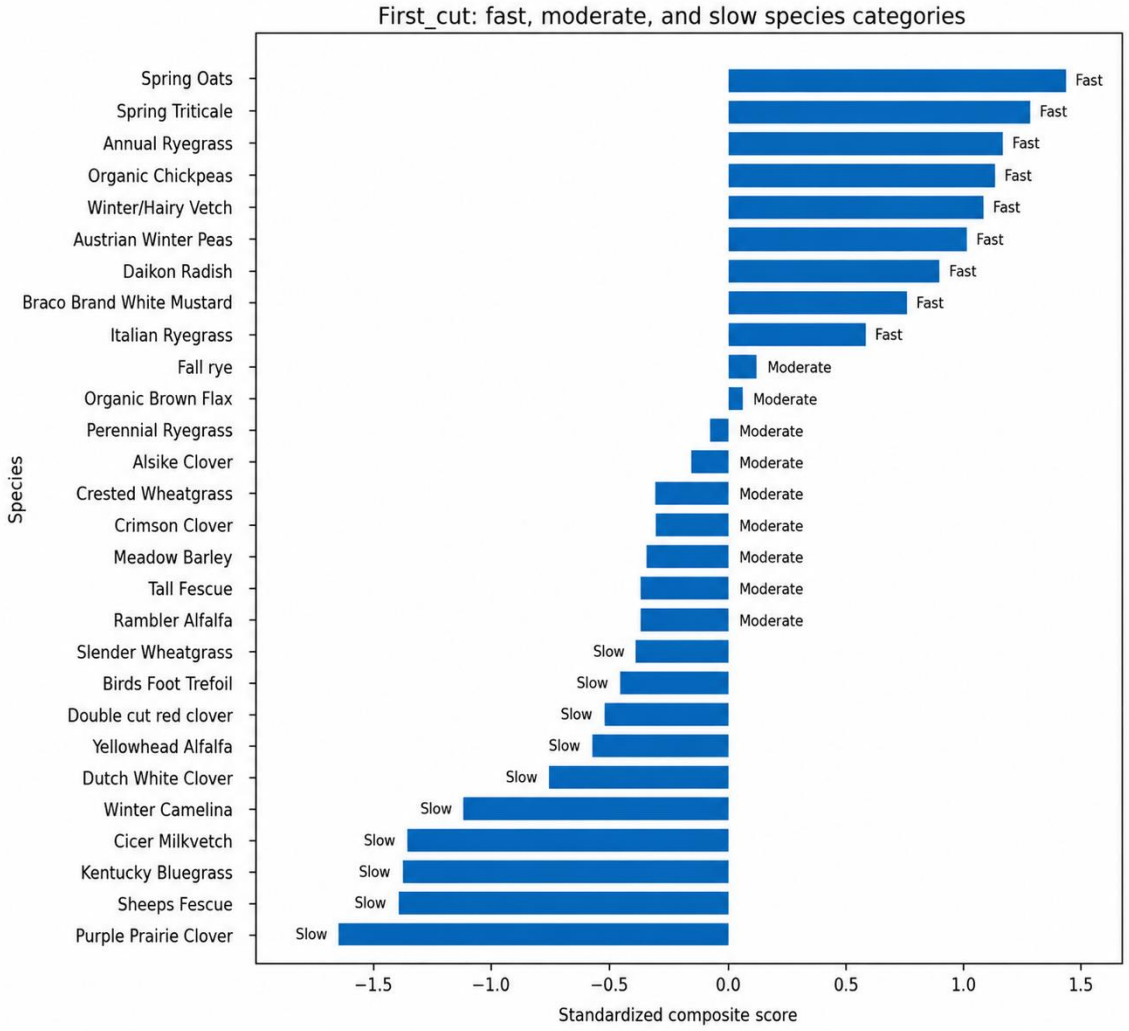


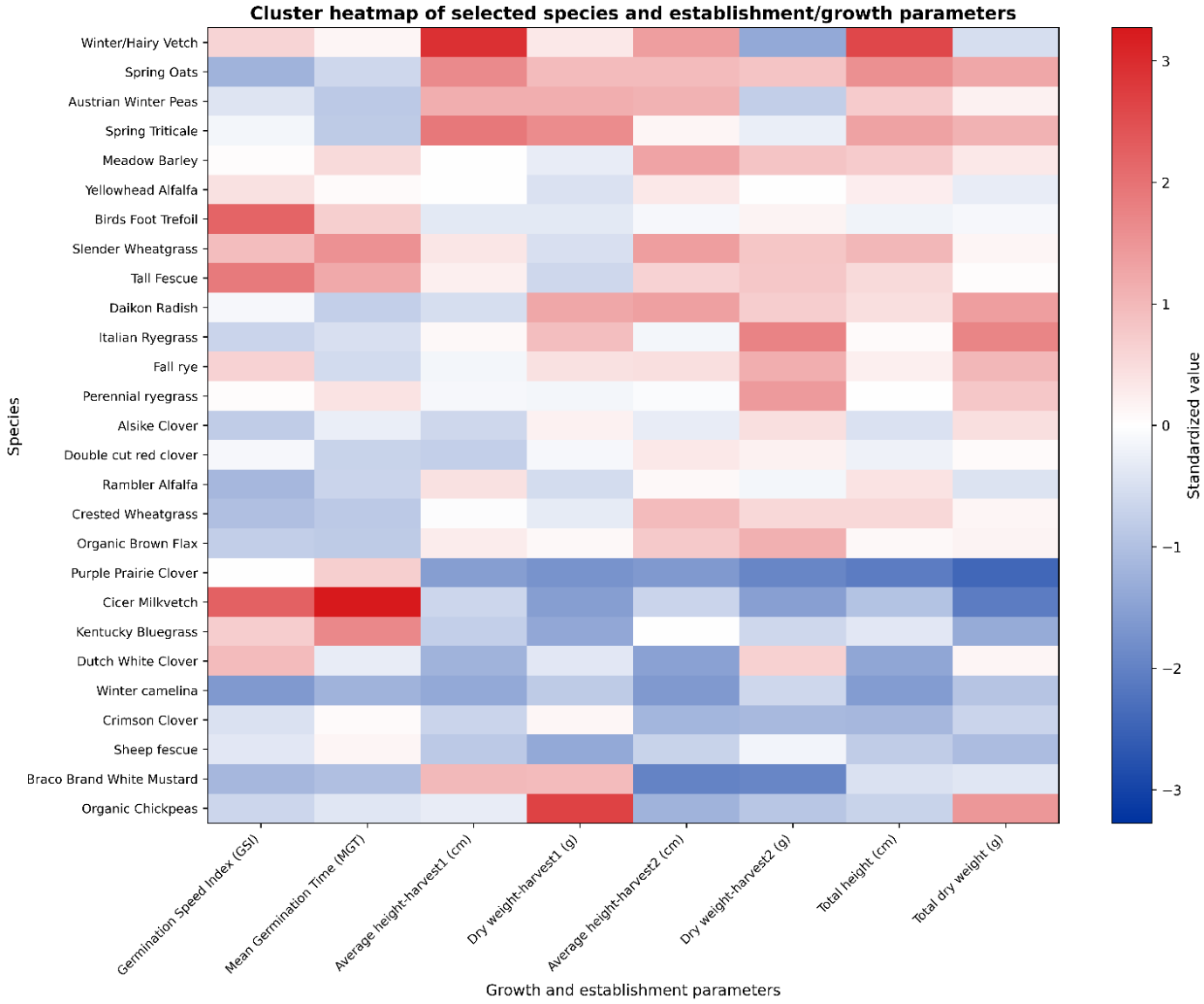
Sebastian Farms Vineyards- Alley Cover Crops X Irrigation –Available Soil Nitrogen (0-15 cm) at Harvest





* Alsike clover can be toxic to animals, especially horses, and sometimes cattle.


First_cut: fast, moderate, and slow species categories
Species
Spring Oats
Spring Triticale
Annual Ryegrass
Organic Chickpeas
Winter/Hairy Vetch
Austrian Winter Peas
Daikon Radish
Braco Brand White Mustard
Italian Ryegrass
Fall rye
Organic Brown Flax
Perennial Ryegrass
Alsike Clover
Crested Wheatgrass
Crimson Clover
Meadow Barley
Tall Fescue
Rambler Alfalfa
Slender Wheatgrass
Birds Foot Trefoil
Double cut red clover
Yellowhead Alfalfa
Dutch White Clover
Winter Camelina
Cicer Milkvetch
Kentucky Bluegrass
Sheeps Fescue
Purple Prairie Clover
Fast
Moderate
Slow
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Standardized composite score


Cluster heatmap of selected species and establishment/growth parameters
Species
Winter/Hairy Vetch
Spring Oats
Austrian Winter Peas
Spring Triticale
Meadow Barley
Yellowhead Alfalfa
Birds Foot Trefoil
Slender Wheatgrass
Tall Fescue
Daikon Radish
Italian Ryegrass
Fall rye
Perennial ryegrass
Alsike Clover
Double cut red clover
Rambler Alfalfa
Crested Wheatgrass
Organic Brown Flax
Purple Prairie Clover
Cicer Milkvetch
Kentucky Bluegrass
Dutch White Clover
Winter camelina
Crimson Clover
Sheep fescue
Braco Brand White Mustard
Organic Chickpeas
Germination Speed Index (GSI)
Mean Germination Time (MGT)
Average height-harvest1 (cm)
Dry weight-harvest1 (g)
Average height-harvest2 (cm)
Dry weight-harvest2 (g)
Total height (cm)
Total dry weight (g)
Growth and establishment parameters
Standardized value
3
2
1
0
−1
−2
−3

Key Considerations for Cover Cropping in Irrigated Vineyards

- The main challenge for cover cropping in irrigated vineyards is successful establishment.
  - Irrigation type and scheduling may need to be adjusted to support cover crop growth.
    - Overhead or sprinkler irrigation, with shallow and more frequent applications, can improve establishment.
  - Seeding date and seeding method are critical for successful cover crop performance.
  - Companion crops can be used to support early establishment and improve cover crop success.
  - Roller crimping may be a useful alternative to mowing for cover crop termination and residue management.
- With appropriate species selection and management, competition with grapevines can be minimized.
- Cover crop effects on soil and vine nitrogen status can be clearly detected.

Acknowledgements

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