Fertilization, vegetation control and stocking – nutrient relationships, study designs and results

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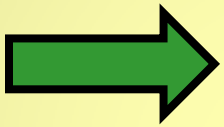
Intermountain Forest Tree Nutrition Cooperative

Forest Productivity depends on how natural resources are allocated for use and the yield of individual resources.

Factors Affecting Stand Productivity

Basic Resource

- Light
- Temperature
- Moisture
- Nutrients



Site and Stand Attributes

- Aspect
- Slope
- Elevation
- Habitat Type Series Groups
- Rock Type = Soil Substrate
- Soil Surficial Deposits
- Species Genotype
- Species Composition
- Density

Productivity Can Be Enhanced By:

- Planting Species/Genotypes that Can Utilize Site Resources More Successfully
- Maintain the Existing Resources by Protecting the Quantity /Quality of the Soil Profile
- Allocating Existing Resources to Trees Instead of Other Vegetation
- Reduce the Impacts of Disease and Insects
- Enhancing Limiting Resources

Silvicultural Regime

Harvest

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Site Prep

Slash – Burn - Spray

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Plant Genotypes

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Stocking Control

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Density Management

Pre or Commercial Thinning

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Fertilization

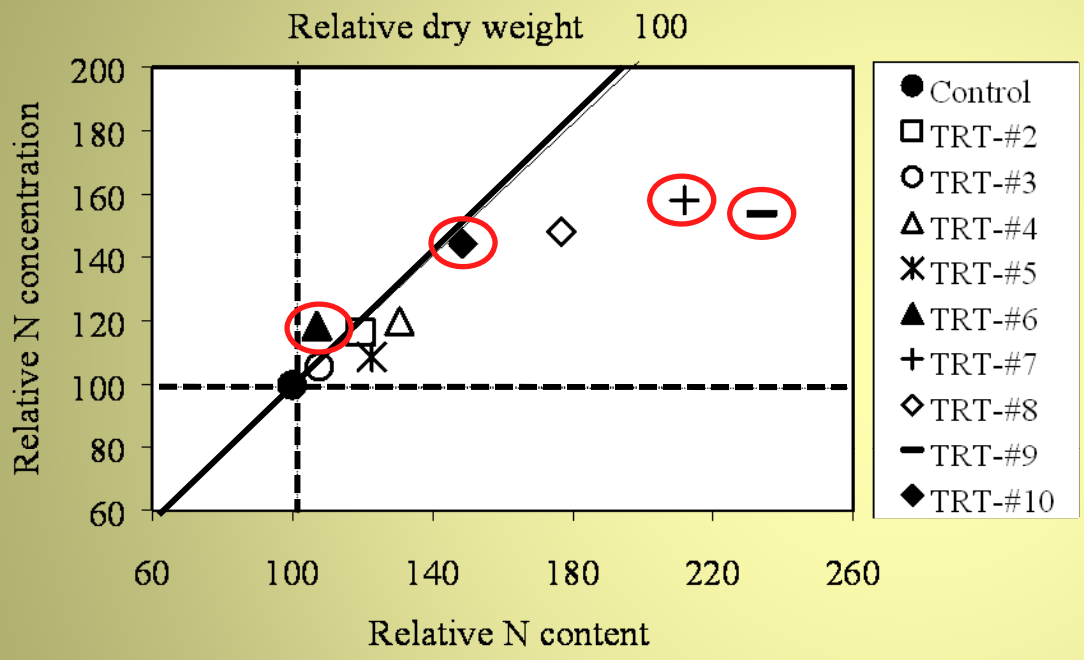
Weed & Feed

Nugent N+Weed Response Surface

TRT	N*-RATE	WEED*-RATE
1	0	0
2	0	2
3	0	4
4	29.3	0.59
5	29.3	3.41
6	100	0
7	100	2
8	170	0.59
9	170	3.41
10	200	0

*lbs/ac. Active - Source Urea and Pronone 10G

Nugent N+Weed Response Surface



TRT	N-RATE	WEED-RATE
1	0	0
2	0	2
3	0	4
4	29.3	0.59
5	29.3	3.41
6	100	0
7	100	2
8	170	0.59
9	170	3.41
10	200	0

Vector Analysis - Ponderosa Pine Foliage

Nugent N+Weed Response Surface

Ponderosa Pine Growth Response

TRT	N-RATE	WEED-RATE	% Response
1	0	0	
2	0	2	55
3	0	4	46
4	29.3	0.59	53
5	29.3	3.41	57
6	100	0	10
7	100	2	80
8	170	0.59	40
9	170	3.41	85
10	200	0	23

TRT	N-RATE	WEED-RATE	% Response
1	0	0	
2	0	2	13
3	0	4	1
4	29.3	0.59	-7
5	29.3	3.41	11
6	100	0	-27
7	100	2	10
8	170	0.59	0
9	170	3.41	50
10	200	0	-18

CALIPER RESPONSE

HEIGHT RESPONSE

WL and LP Weed+Feed Screening Trial

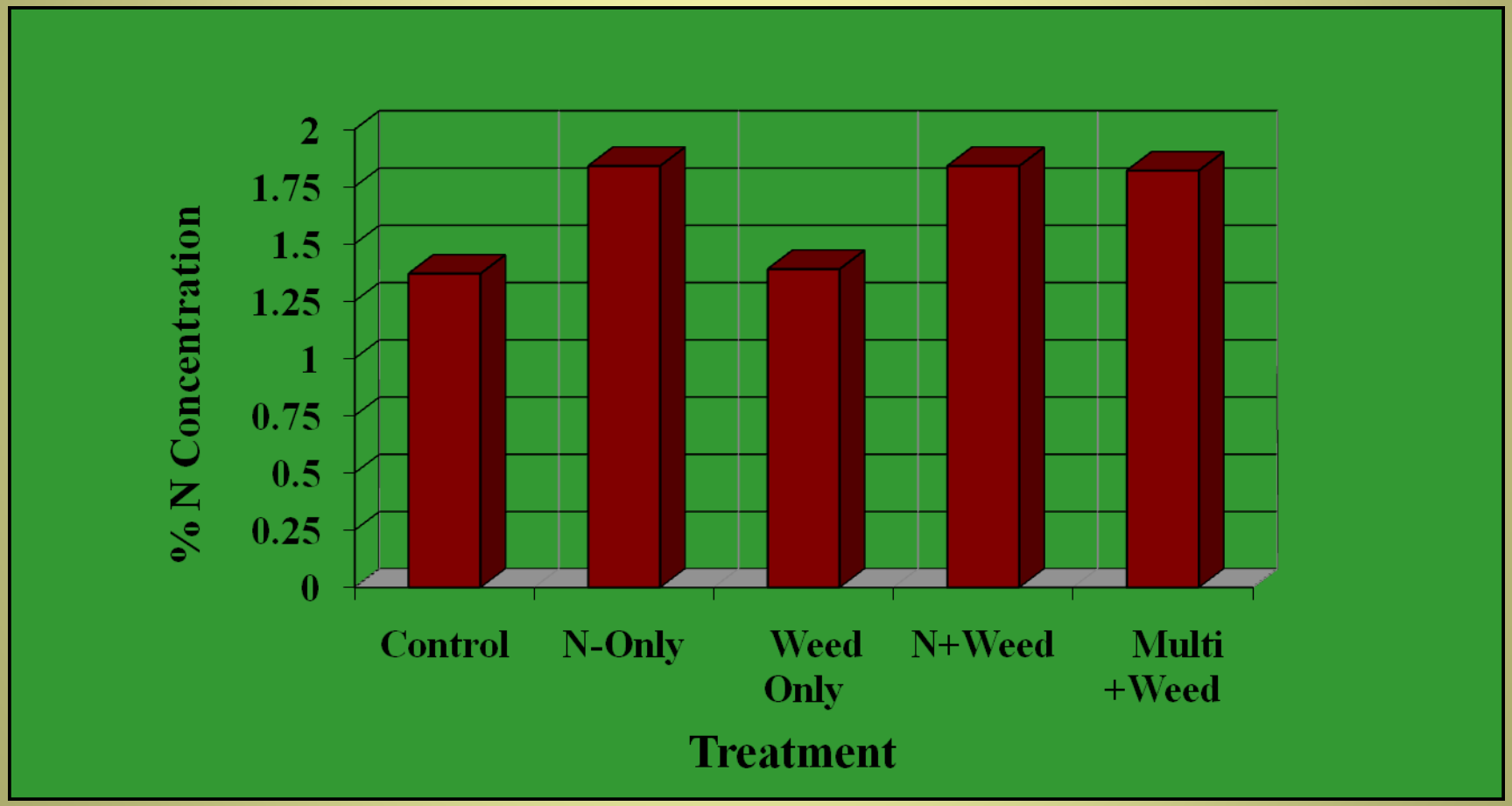
Treatment	Nutrient* Rate	Weed** Rate
Control	0	0
N-Only	200N	0
Weed-Only	0	Foliar
N+Weed	200N	Foliar
Multi+Weed	200N 170K 90S 3B	Foliar

*lbs/ac. Active - Source Urea, Potash, Ammonium Sulfate , Boron

**Chopper (1.6 oz/gal), Razor (4.3 oz/gal)

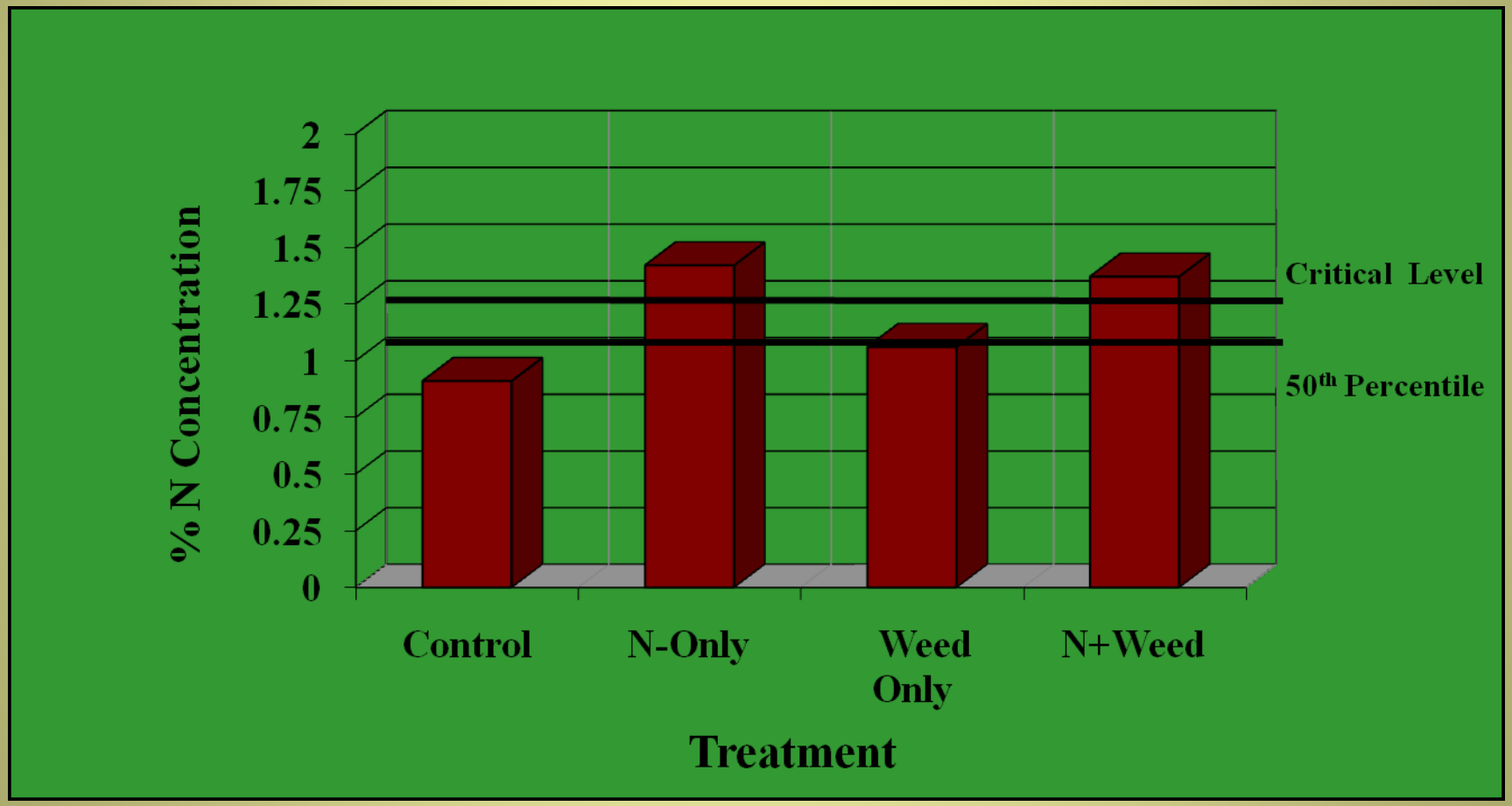
WL and LP Weed+Feed Screening Trials

Western Larch Foliar Nitrogen Concentrations



WL and LP Weed+Feed Screening Trials

Lodgepole Pine Foliar Nitrogen Concentrations



WL and LP Weed+Feed Screening Trials

2-YR Western Larch and Lodgepole Pine BA Growth Multipliers

Treatment	Western Larch			Lodgepole Pine		
	PBA1	PBA2	BAM	PBA1	PBA2	BAM
N-Only	1.23	1.12	1.19	1.32	1.33	1.32
Weed-Only	0.97	1.17	1.06	1.02	1.34	1.16
N+Weed	1.21	1.58	1.37	1.46	1.97	1.68
Multi+Weed	1.07	1.35	1.19			

PBA1 = basal area increment 1 year after treatment
PBA2 = basal area increment 2 years after treatment
BAM = annual mean basal area increment after treatment

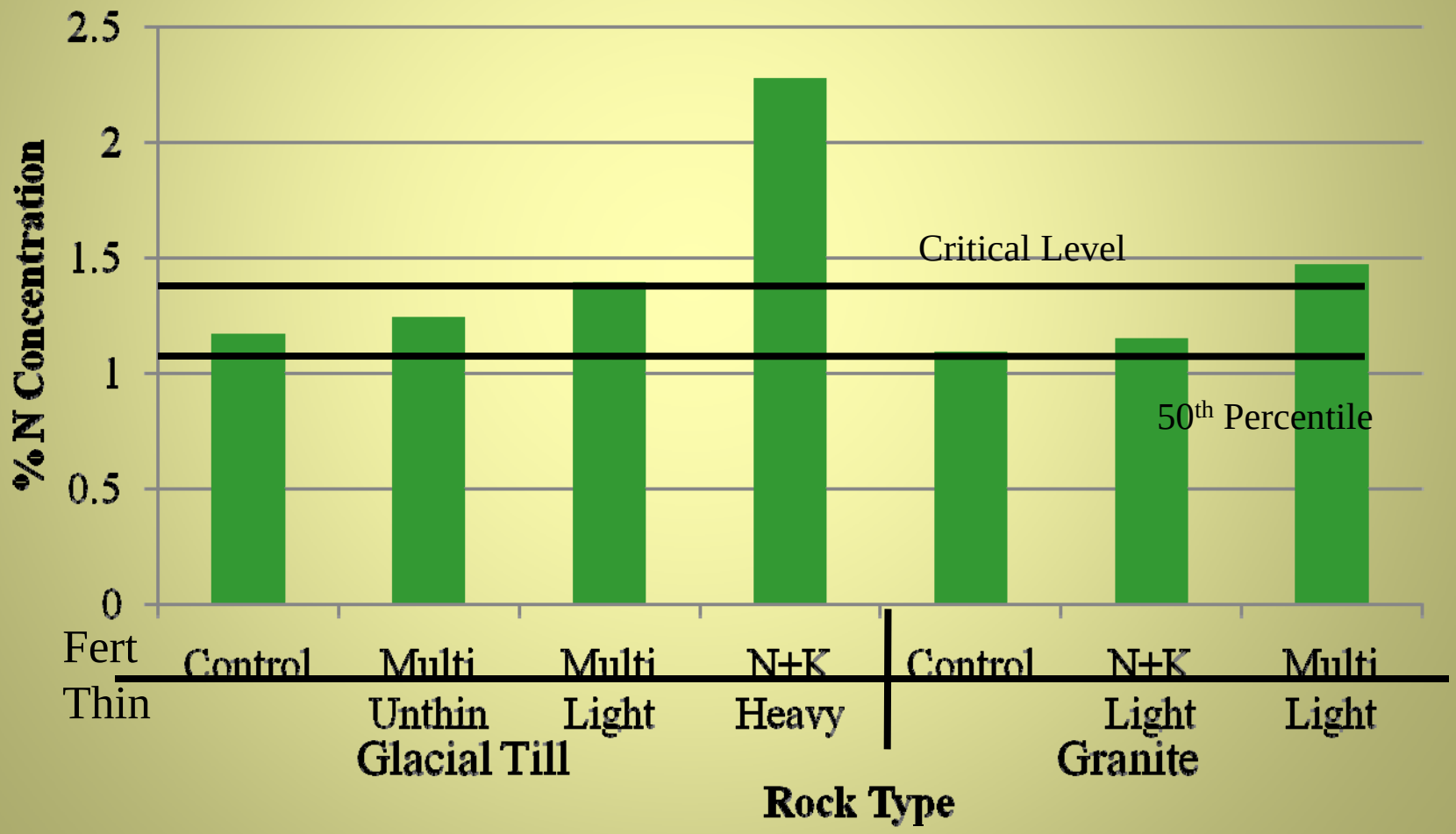
Fertilization & Stocking

Kentry Ridge Thin-Fert Study

Rock type	Thinning	Species	Treatment[§§]	Density (trees acre^{-1})
Glacial till	None	DF, PP	Multinutrient	790
	Light	DF, PP	Multinutrient	320
	Heavy	DF	N + K	180
Granite	Light	DF, PP	N + K (DF only) Multinutrient	280

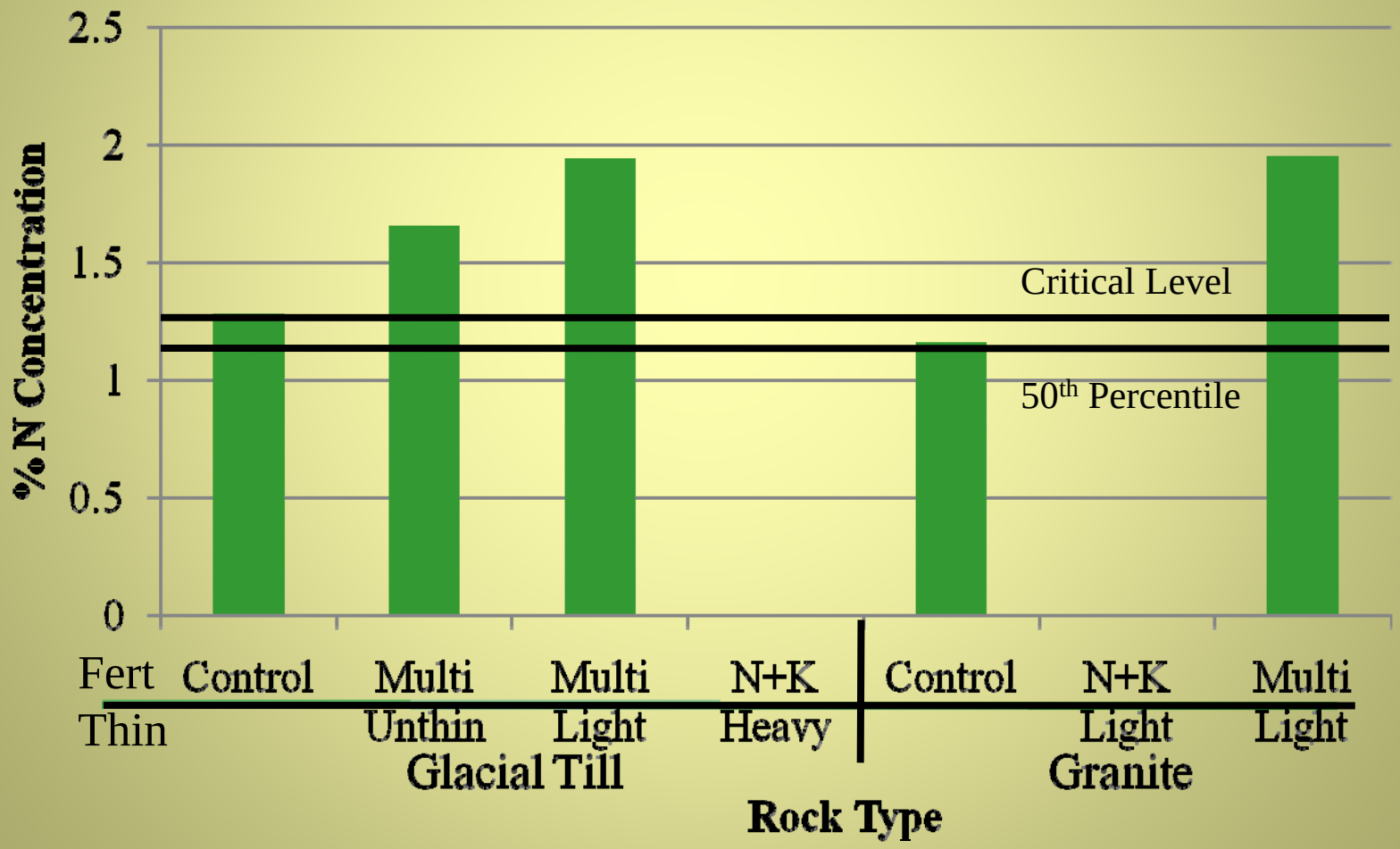
Kentry Ridge Thin and Feed Study

Douglas-fir Foliar Nitrogen Concentrations



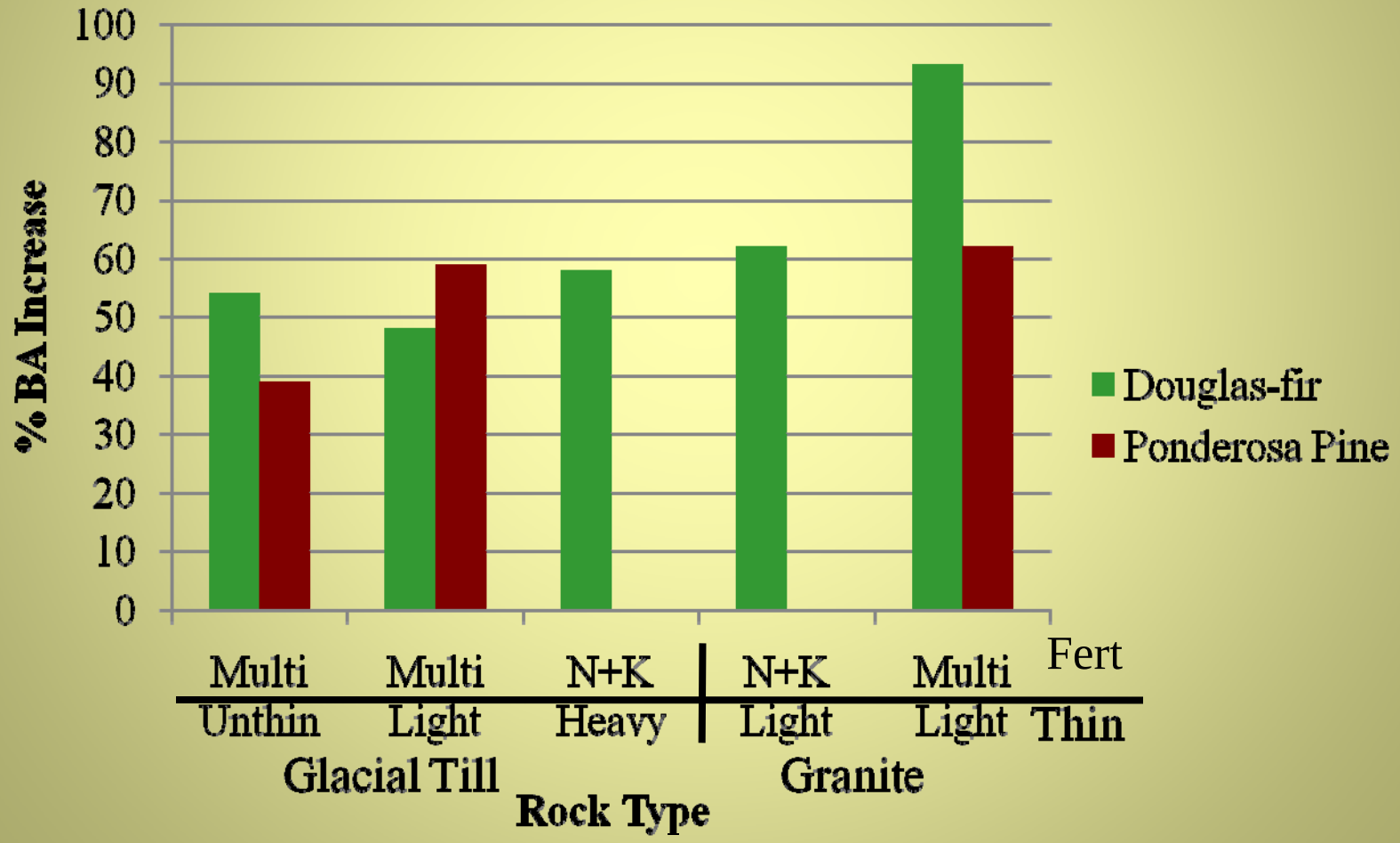
Kentry Ridge Thin and Feed Study

Ponderosa Pine Foliar Nitrogen Concentrations



Kentry Ridge Thin and Feed Study

Douglas-fir and Ponderosa Pine 2 Year % Basal Area Response



TIRED WOLF HALF AND HALF

Trt	Thin	Fertilization
1	No Thin	No Fert
2	No Thin	Multi Fert
3	Thin (16 x16)	No Fert
4	Thin (16 x 16)	Multi Fert
5	Thin (20 x 20)	No Fert
6	Thin (20 x 20)	Multi Fert

6 trts x 2 reps/trt = 12 plots

Western Larch Fertilization and Spacing Study

Treatment Code	Spacing (m)	Fertilizer	Thinning
1	2x2		No Thin
2	2x2		Thin
3*	3x3		No Thin
4*	3x3		Thin
5	4x4		No Thin
6	4x4		Thin
7	3x3	N-Only	No Thin
8	3x3	N-Only	Thin
9	3x3	Multi	No Thin
10	3x3	Multi	Thin

3 blks x 10 plots/trts = 30 plots
30 plots x 210 trees/plot = 6300 trees

These results suggest that nutrient availability is a dominant driver of productivity across Inland Northwest forests.

Future research should seek to better understand the mechanisms of nutrient demand, uptake and utilization in developing stands, as well as the factors controlling tree competition.

Special Thanks and Recognition

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