

Seedling Establishment Experiment

Intermountain Forest Tree Nutrition Cooperative

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Seedling Establishment/Nutrition Experiment

Region	Site	Name	Rock Type
Northeast Washington	401	Trail Divide	Clay schist (Bad)
	402	Scoop Mountain	Granite (Good)
Central Washington	403	Jungle Creek	Pyroclastics (Bad)
	404	Indian Creek	Sandstone (Good)
South-Central Washington	405	Holmes Creek	Andesite (Bad)
	406	North Quigley Butte	Basalt (Good)
North Idaho	407	Flat Creek I	Basalt (Good)
	408	Flat Creek II	Quartzite (Bad)
Central Idaho	409	Paddy Flats I	Granite (Bad)
	410	Paddy Flats II	Basalt (Good)
Northeast Oregon	411	Glass Hill	Andesite (Bad)
	412	Noregaard	Basalt (Good)

Seedling Establishment/Nutrition Experiment

Ponderosa Pine	1	2	3	1	2	3	Douglas-fir
	4	5	6	4	5	6	
Douglas-fir	1	2	3	1	2	3	Ponderosa Pine
	4	5	6	4	5	6	

Study Design

- 2 reps x 2 species x 6 treatments
- 4 blocks x 6 plots x 121 trees

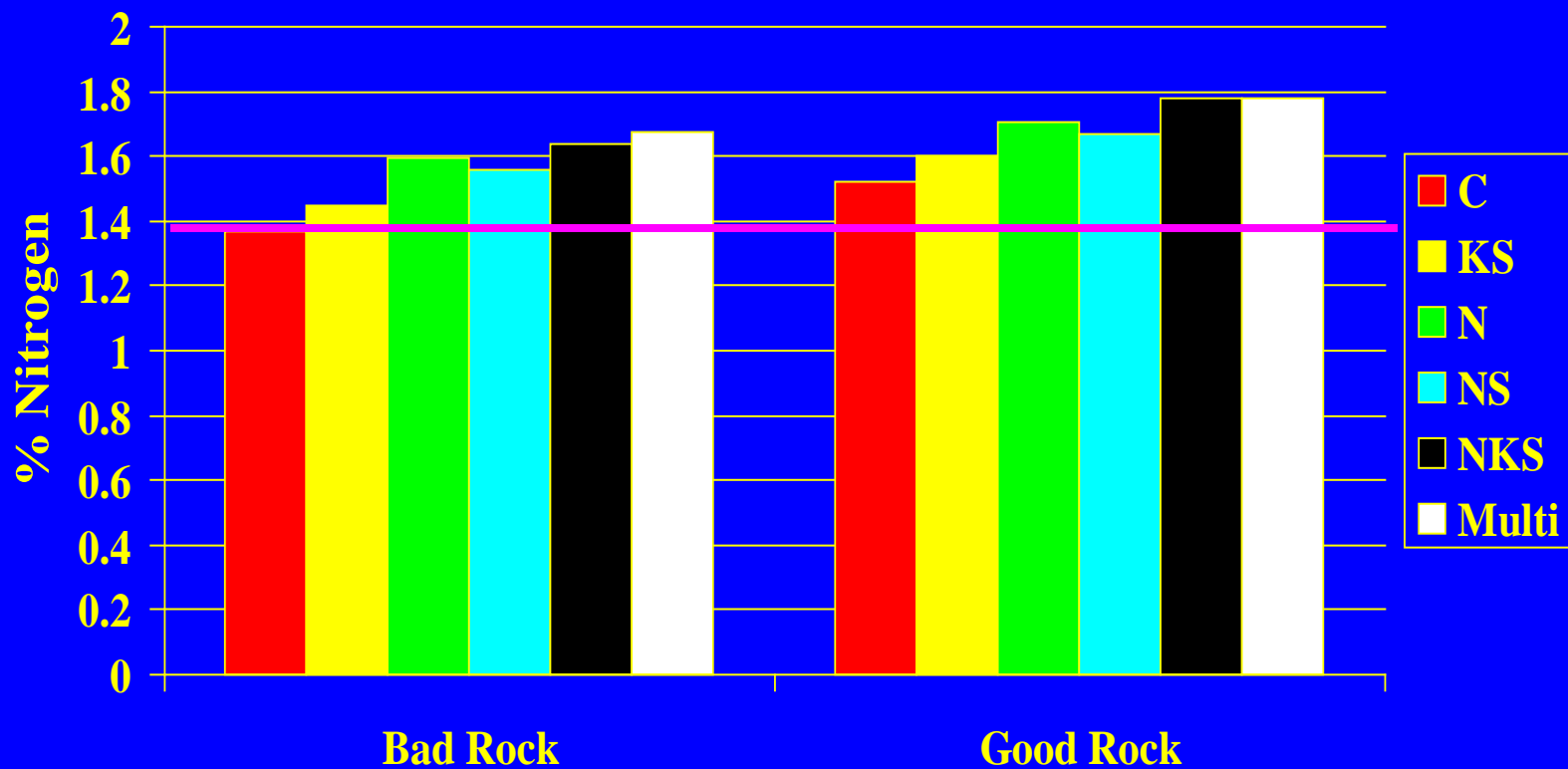
Paired Site Design

- Aspect, slope, elevation vegetation series and seed source were common for paired “bad / good” rock sites

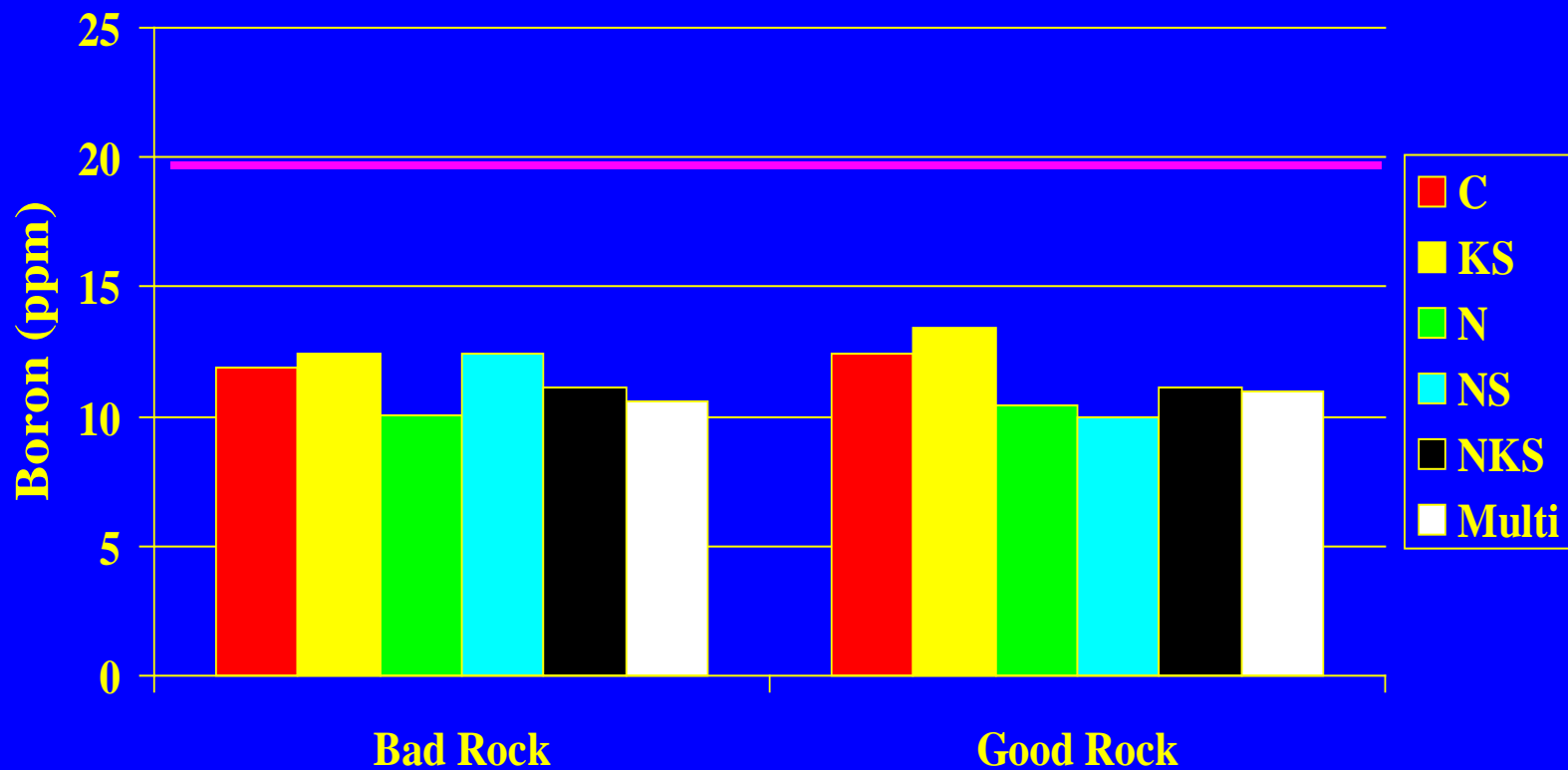
Initial (1998) Fertilization Sub-Surface Controlled-Release

- **No fertilizer (Control)**
- **16gN (N)**
- **16gN + 12gK + 4.8gS (NKS)**
- **16gN + 4.8gS (NS)**
- **12gK + 4.8gS (KS)**
- **16gN + 12gK + 4.8gS + 4.1gP + 0.61gMg + 0.01gB + 0.03gCu + 0.26gFe + 0.04gMn + 0.01gMo (Multi)**

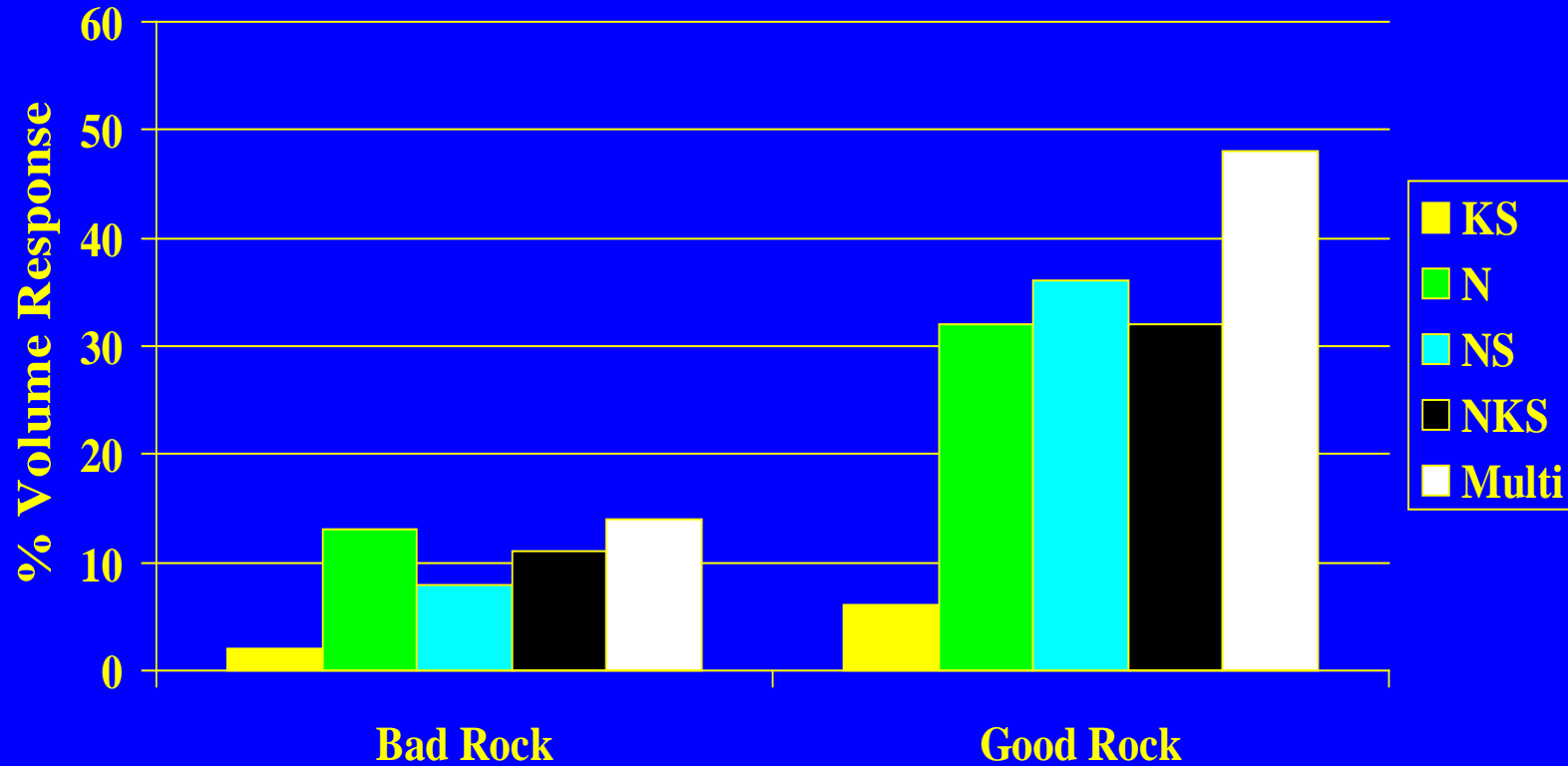
Nitrogen Concentrations 1 Year after Initial Treatment for Douglas-fir



Boron Concentrations 1 Year after Initial Treatment for Douglas-fir



1-Year % Volume Response

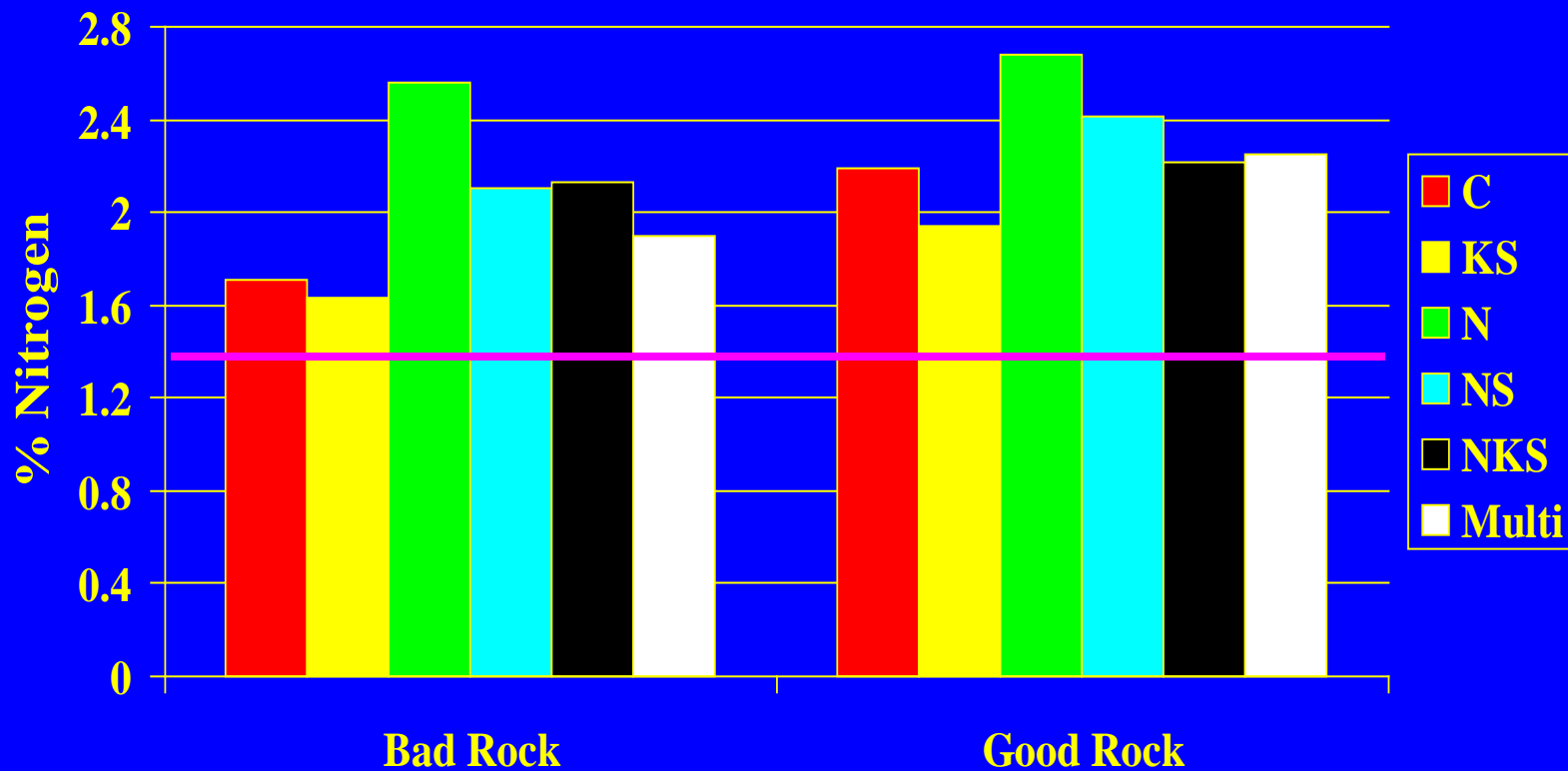


Second (1999) Fertilization

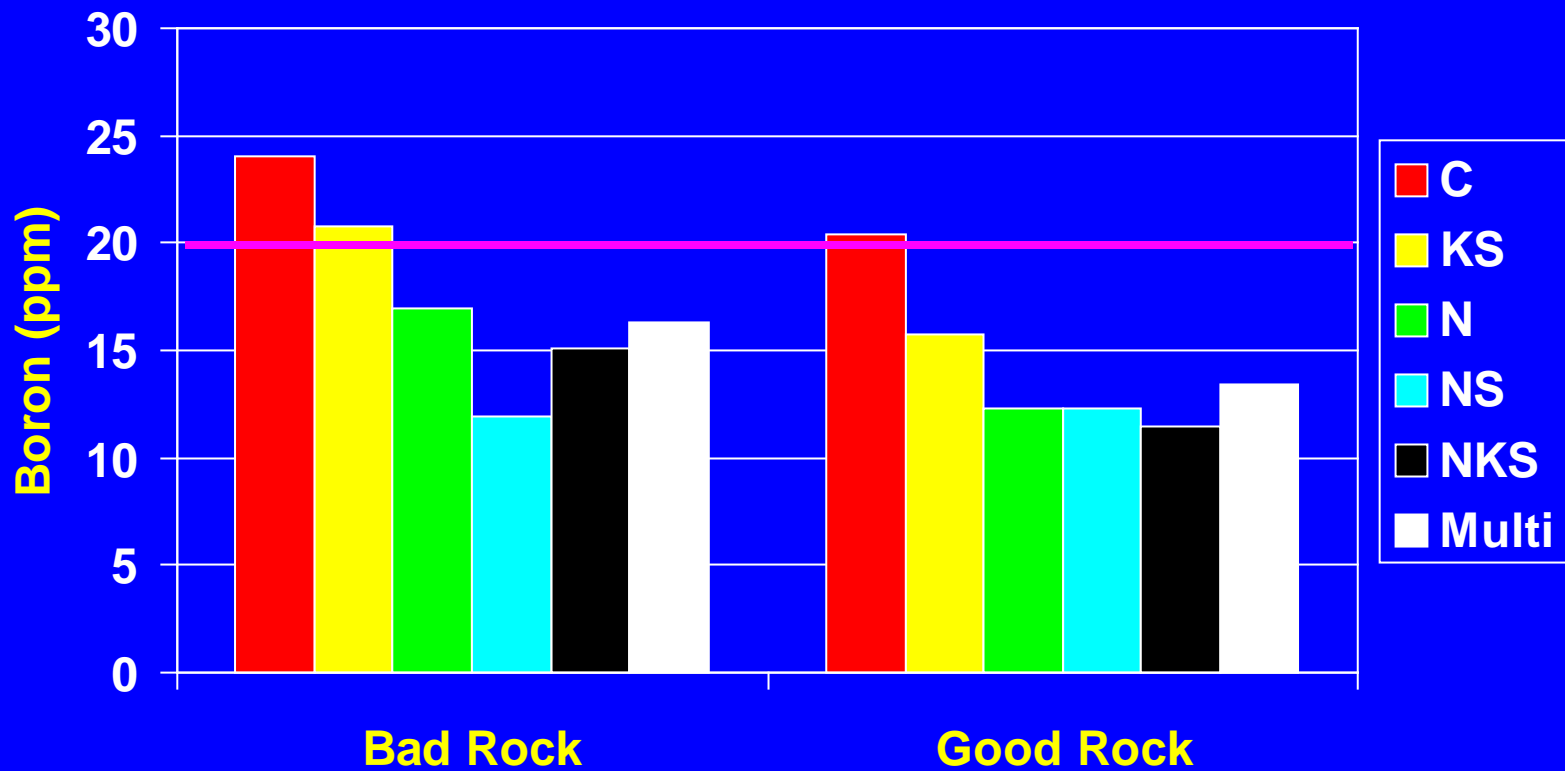
Spot Broadcast

- **No fertilizer (Control)**
- **32gN (N)**
- **32gN + 24gK + 9.6gS (NKS)**
- **32gN + 9.6gS (NS)**
- **24gK + 9.6gS (KS)**
- **32gN + 24gK + 9.6gS + 8.2gP + 1.22gMg + 0.02gB + 0.06gCu + 0.52gFe + 0.08gMn + 0.02gMo (Multi)**

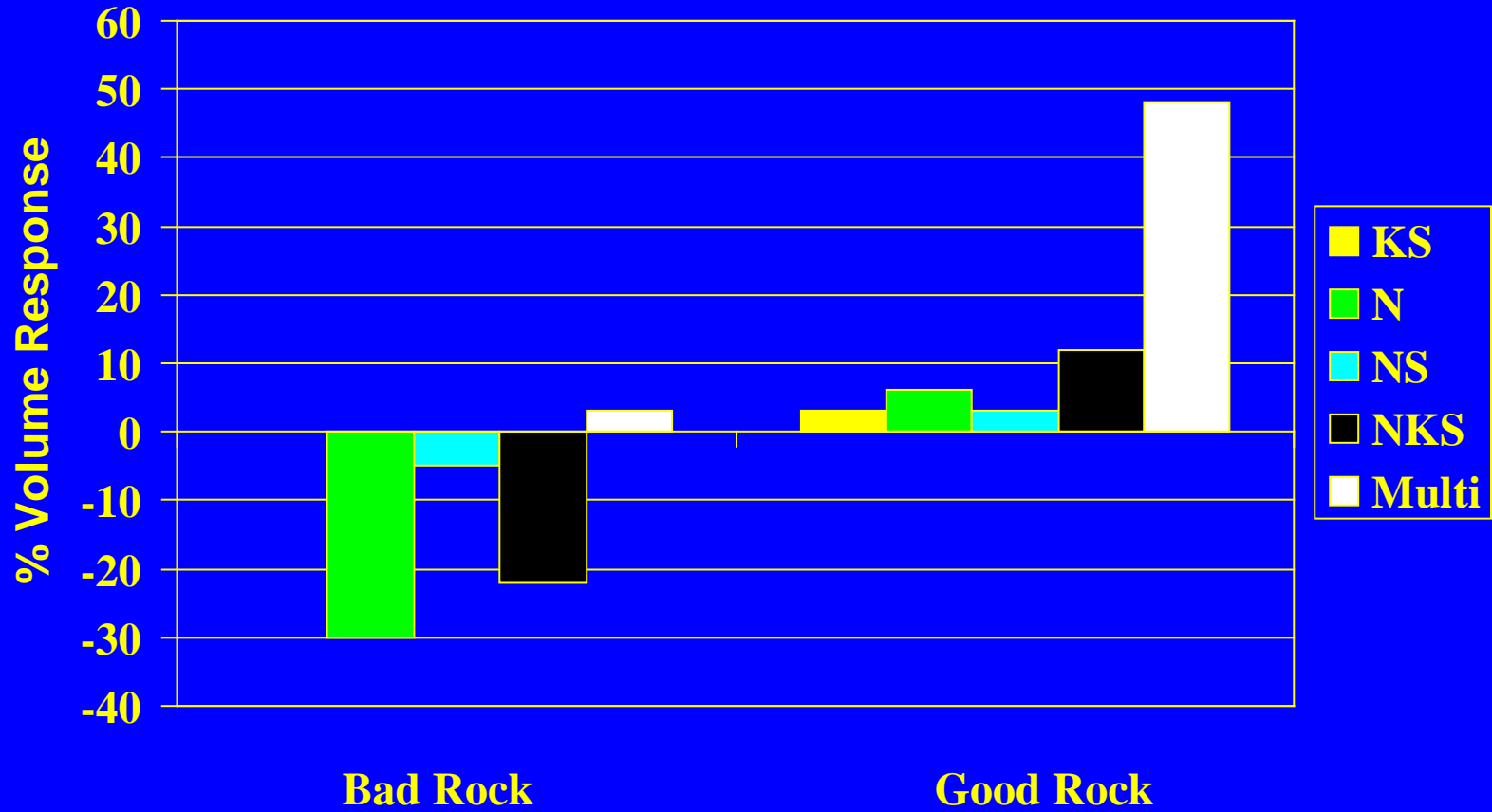
Nitrogen Concentrations 1 Year after Second Treatment for Douglas-fir



Boron Concentrations 1 Year after Second Treatment for Douglas-fir



3-Year % Volume Response



It is the rocks?

- What is it about the rocks?
 - Nutrient treatments did not have the hypothesized effects.
 - Was it low boron?
 - Are there differences in soil chemistry by rock class?
 - Are there differences in the soil biotic community by rock class?
 - Are other harmful elements present on bad rock sites?

Third (2001) Fertilization

Installations 401 (Bad Rock) & 402 (Good Rock)

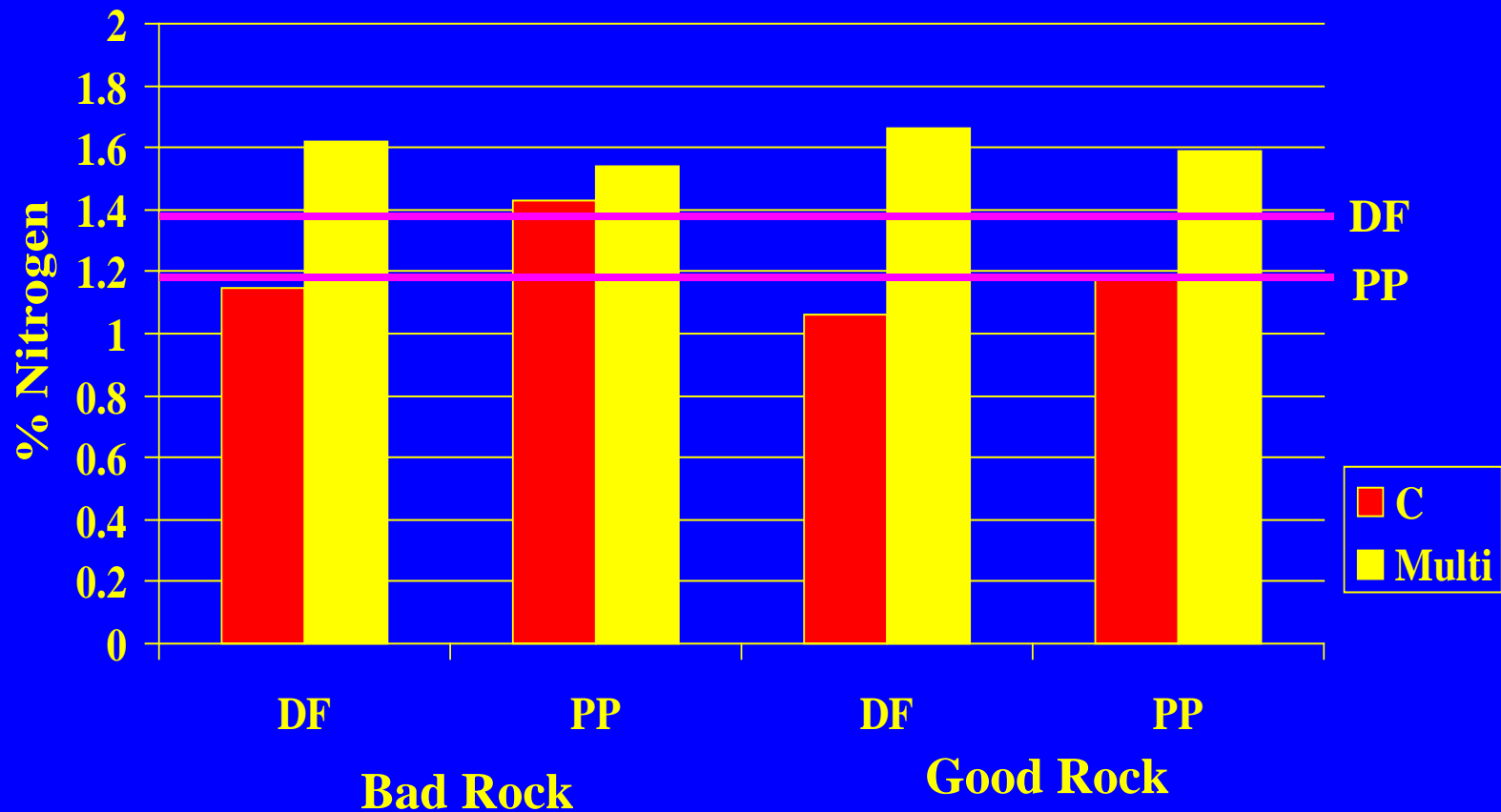
Surface Broadcast

Treatment	Rate lbs/ac
Nitrogen	50
Potassium	200
Sulfur	50
Boron	3
Copper	10
Zinc	10
Iron	10
Pronone	3

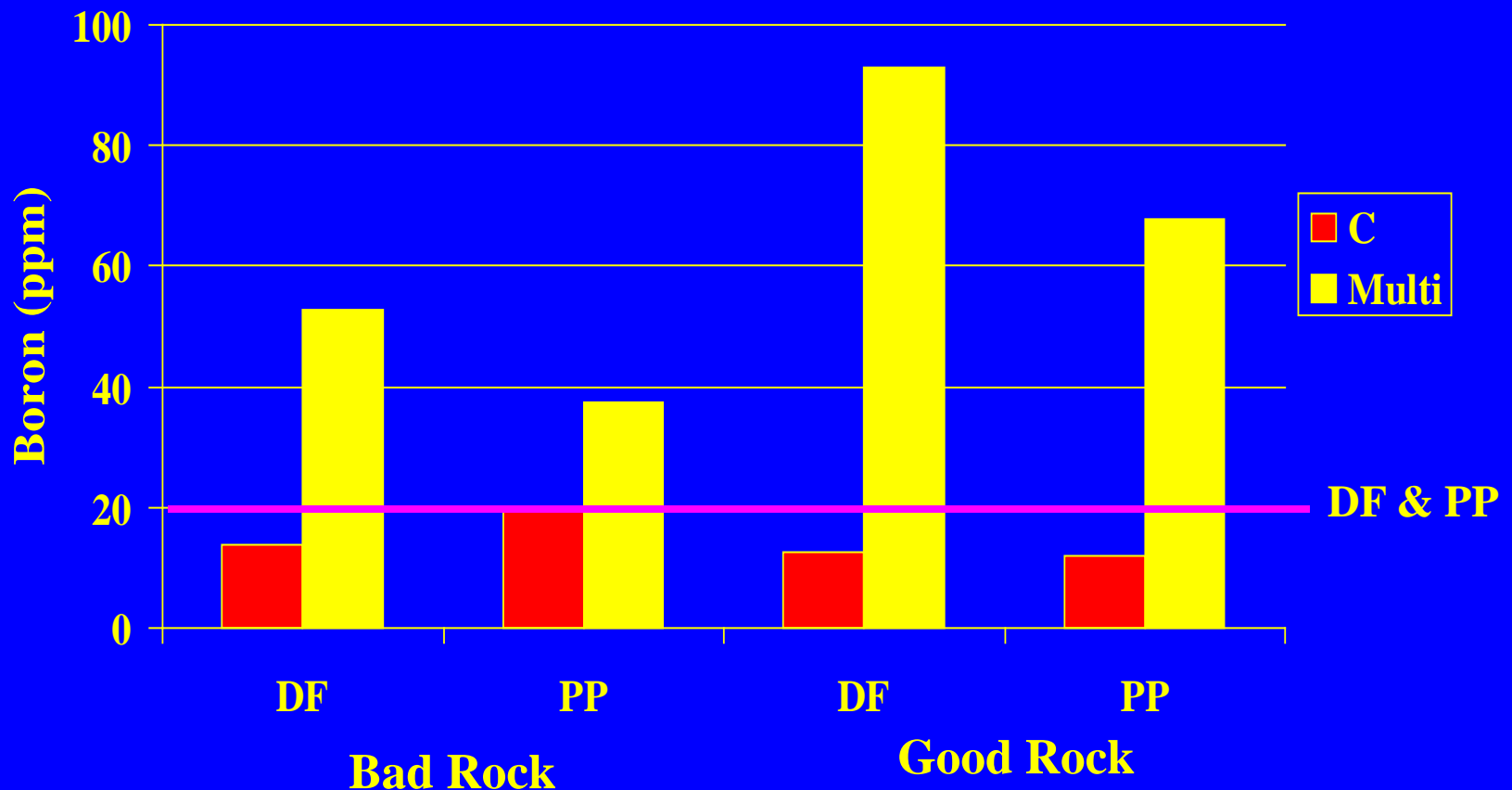
Douglas-fir			Ponderosa Pine		
1	2	3	1	2	3
4	5	6	4	5	6
1	2	3	1	2	3
4	5	6	4	5	6

■ Fertilized

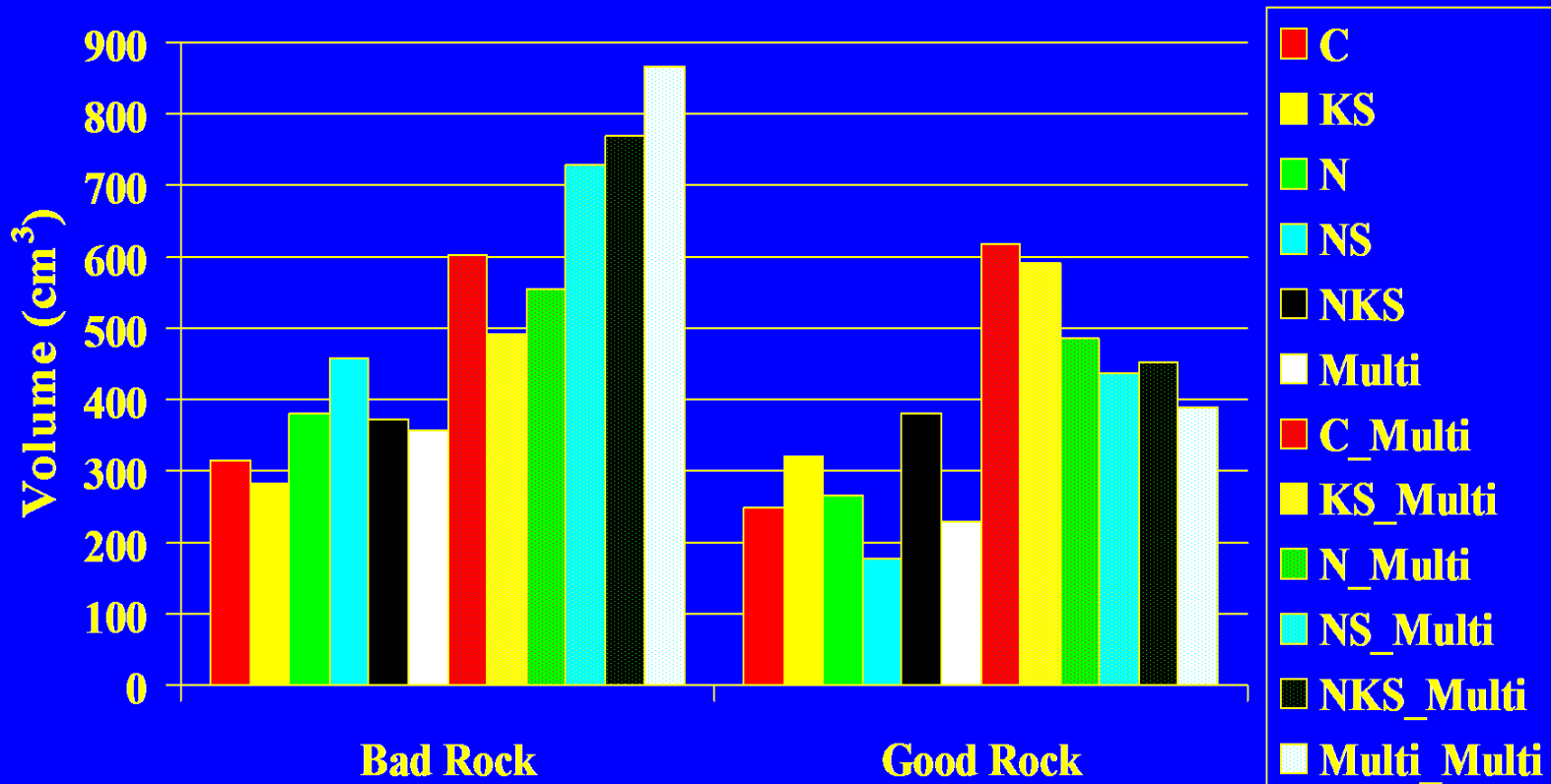
Nitrogen Concentrations 1 Year after Third Treatment for Douglas-fir and Ponderosa Pine



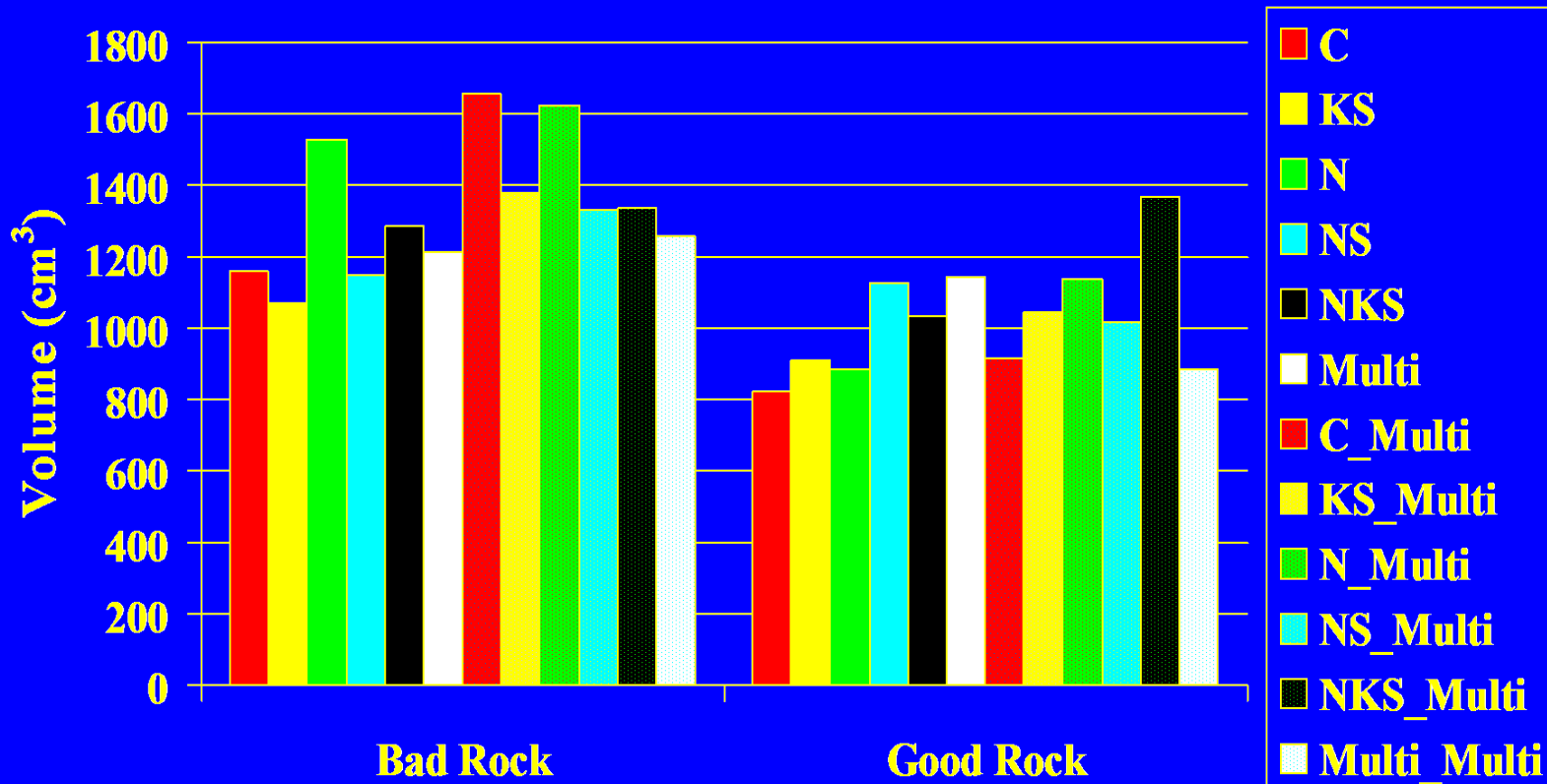
Boron Concentrations 1 Year after Third Treatment for Douglas-fir and Ponderosa Pine



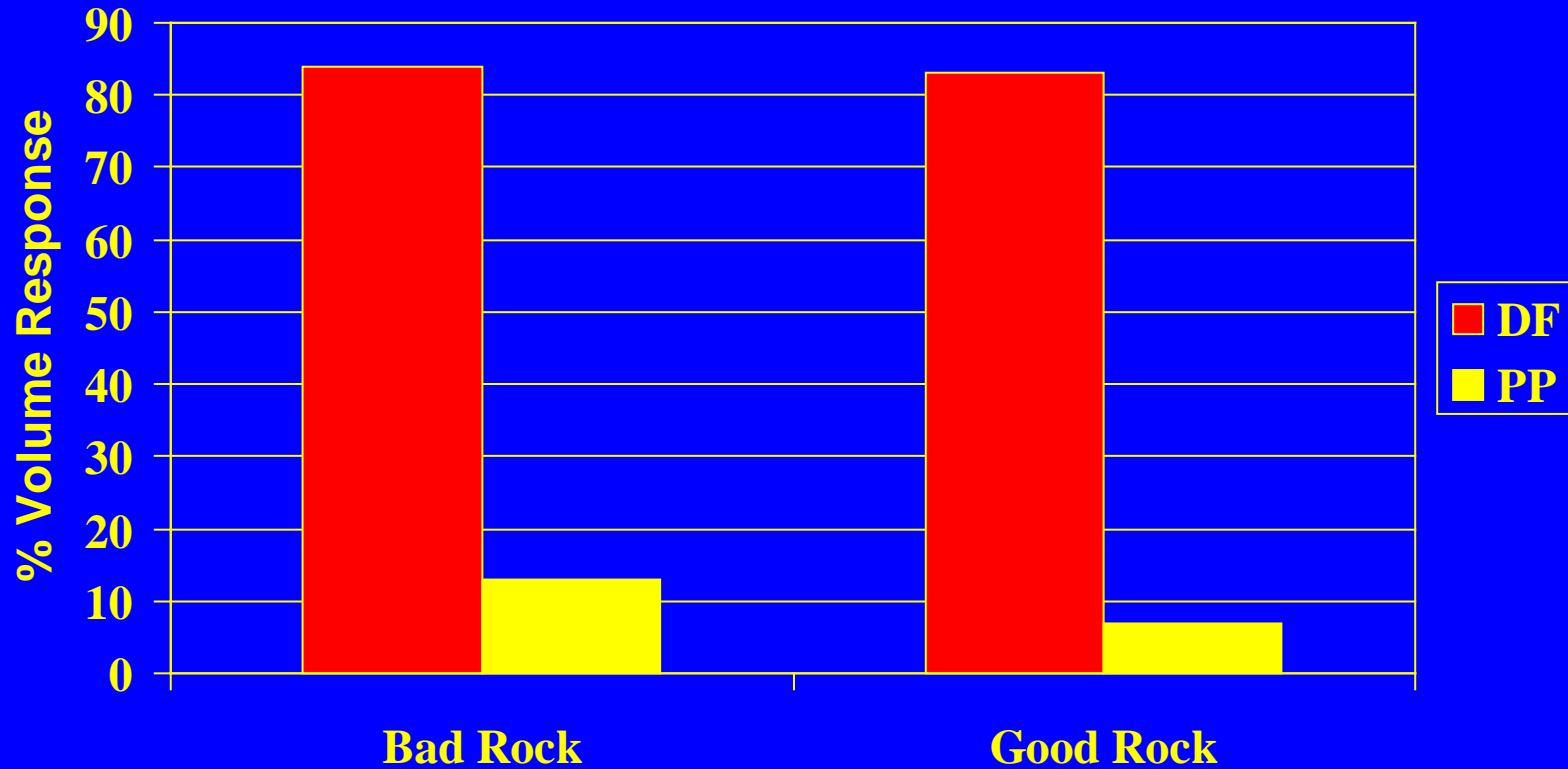
Douglas-fir Volume Increment for all Third Treatment Combinations



Ponderosa Pine Volume Increment for all Third Treatment Combinations



% Volume Response 1 Year after Third Treatment for Douglas-fir & Ponderosa Pine



Foliar Nutrient Response after Third Treatment

Nutrient	Douglas-fir		Ponderosa Pine	
	Bad	Good	Bad	Good
N	S	S	NS	S
K	NS	NS	NS	S
S	S	S	NS	S
B	S	S	S	S
Cu	S	NS	NS	S
Zn	NS	NS	NS	NS
Fe	NS	NS	NS	NS

NS = NOT SIGNIFICANT S = SIGNIFICANT

SUMMARY

- Foliar nutrient response was generally low for the first two treatment applications.
- Boron application rates applied at the nursery and during the initial and second field treatments were inadequate.
- Both species showed good foliar nutrient response to the third multi-nutrient retreatment.
- Growth response was higher on the good rock than the bad rock for the initial and second treatments but lower than the bad rock on the third treatment.
- Douglas-fir growth response was significantly high following the third multi-nutrient treatment application.