Establishment of hybrid Poplar on a Reclaimed Mine site in West Virginia

A. Hass,[1] R.S. Zalesny Jr.[1], D. Patel[2], J. Vandevender[3]

[1] West Virginia State University; Agricultural & Environmental Research Station; Institute, WV

[2] U.S. Forest Service; Northern Research Station; Rhinelander, WI

[3] U.S. USDA NRCS Plant Material Center, Alderson, WV

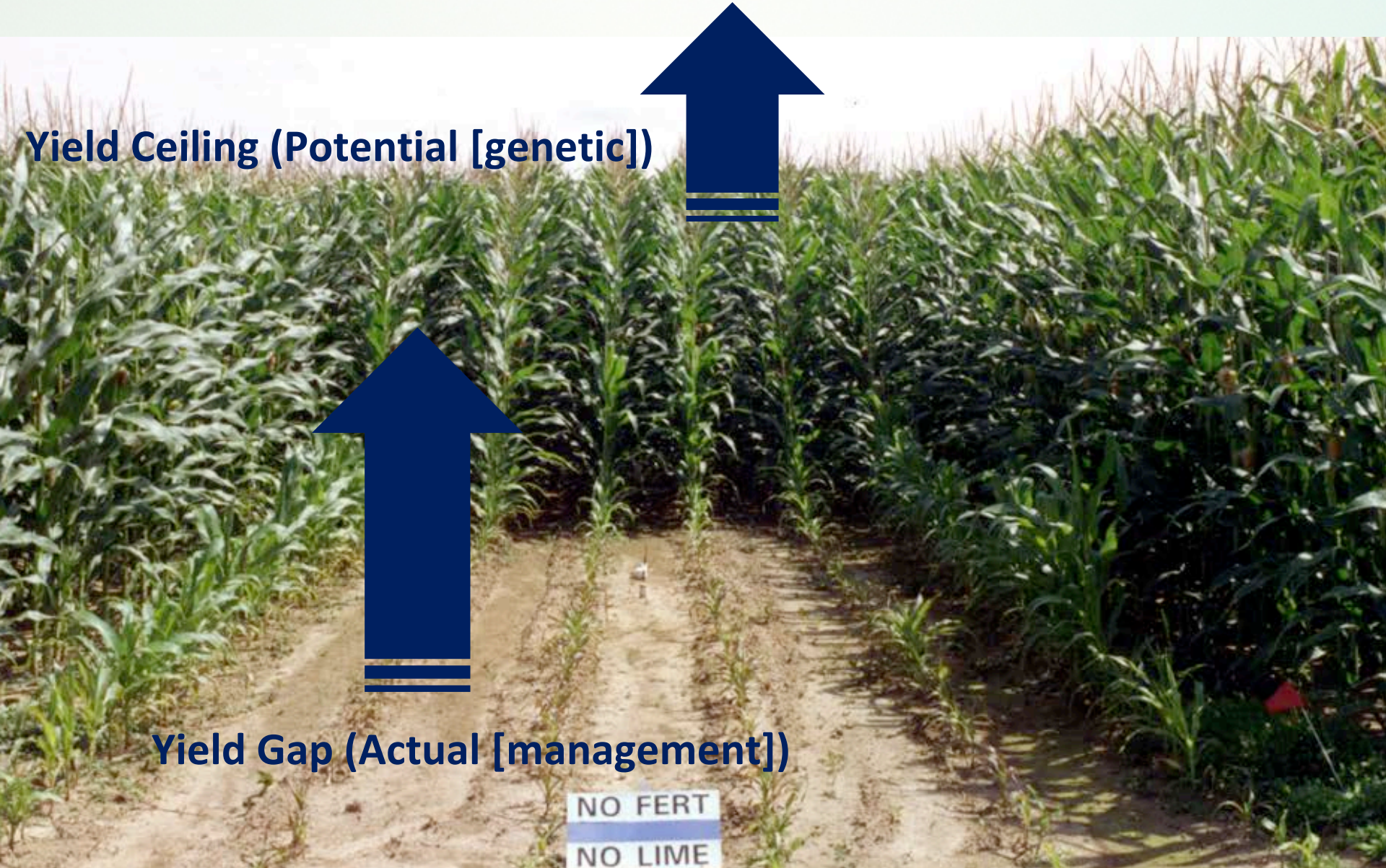
Land Productivity

Picture by Dale K. Ritchey

Land Productivity

Land Productivity

Land Productivity



Objectives

- Use phyto-recurrent selection to identify *Populus* genotypes that grow better on reclaimed mine sites.

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- Test whether biochar can improve tree survival & growth on reclaim mine site.

Site Prep and Soil Treatment

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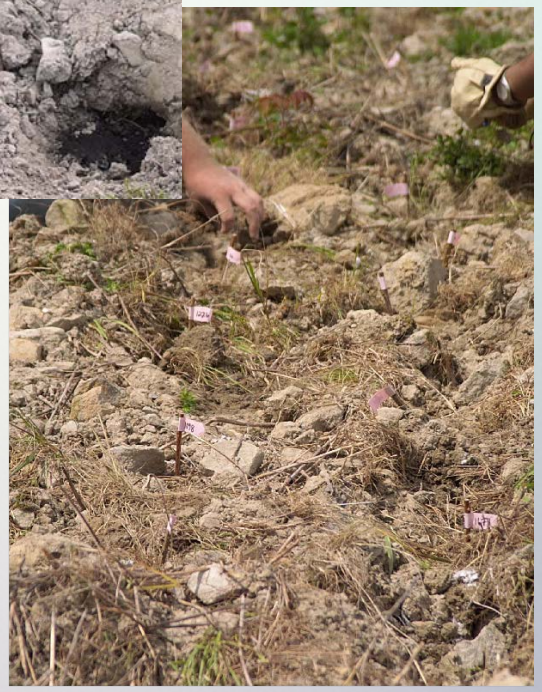

Genomic Group	Clone
P. deltoides 'D'	8000105, C910809, D105, D109, D110, D112, D117, D118, D121, D125, D133, D134
P. trichocarpa 'T'	0.20.3, 0.4.3, 0.6.3, 0.7.5, 1.1.5, 1.2.5, 1.3.1, 2.1.2, 3.2.2, 4.1.3, 5.2.2
P. deltoides × *P. deltoides* 'DD'	119.16
P. deltoides × *P. nigra* 'DN'	DN154, DN164, DN17, DN170, DN177, DN182, DN34, DN5, DN70, NE264
P. deltoides × *P. suaveolens* subsp. *maximowiczii* 'DM'	113.64, 412.52, 202.37, 313.23, 313.55, DM105, DM108, DM111, DM112, DM113, DM114, DM115, DM117, NC14103, NC14104, NC14105, NC14106, NC14107
P. nigra × *P. suaveolens* subsp. *maximowiczii* 'NM'	NM2, NM6
(P. trichocarpa × *P. deltoides)* × *P. deltoides* 'TDD'	NC13536, NC13555, NC13624, NC13728, NC13740, NC13820

Aigeiros Duby – *P. deltoides* Bartr. ex Marsh, *P. nigra* L.
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CYCLE 1

- Field (2014)
- Survival
- Ht, Diam
- Biomass
- Health

	Cycle 1	Cycle 2
Rep	8	8
Soil treatment	2	0
Clone	60	32

CYCLE 2

- Field (2015)
- Survival
- Ht, Diam
- Health

DEPLOYMENT

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CYCLE 1

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- Survival
- Ht, Diam
- Biomass
- Health

	Cycle 1	Cycle 2
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IV = 0.3*MASS + 0.15*HEIGHT + 0.15*DIAMETER + 0.2*SURVIVAL + 0.2*HEALTH

CYCLE 2

- Field (2015)
- Survival
- Ht, Diam
- Health

DEPLOYMENT

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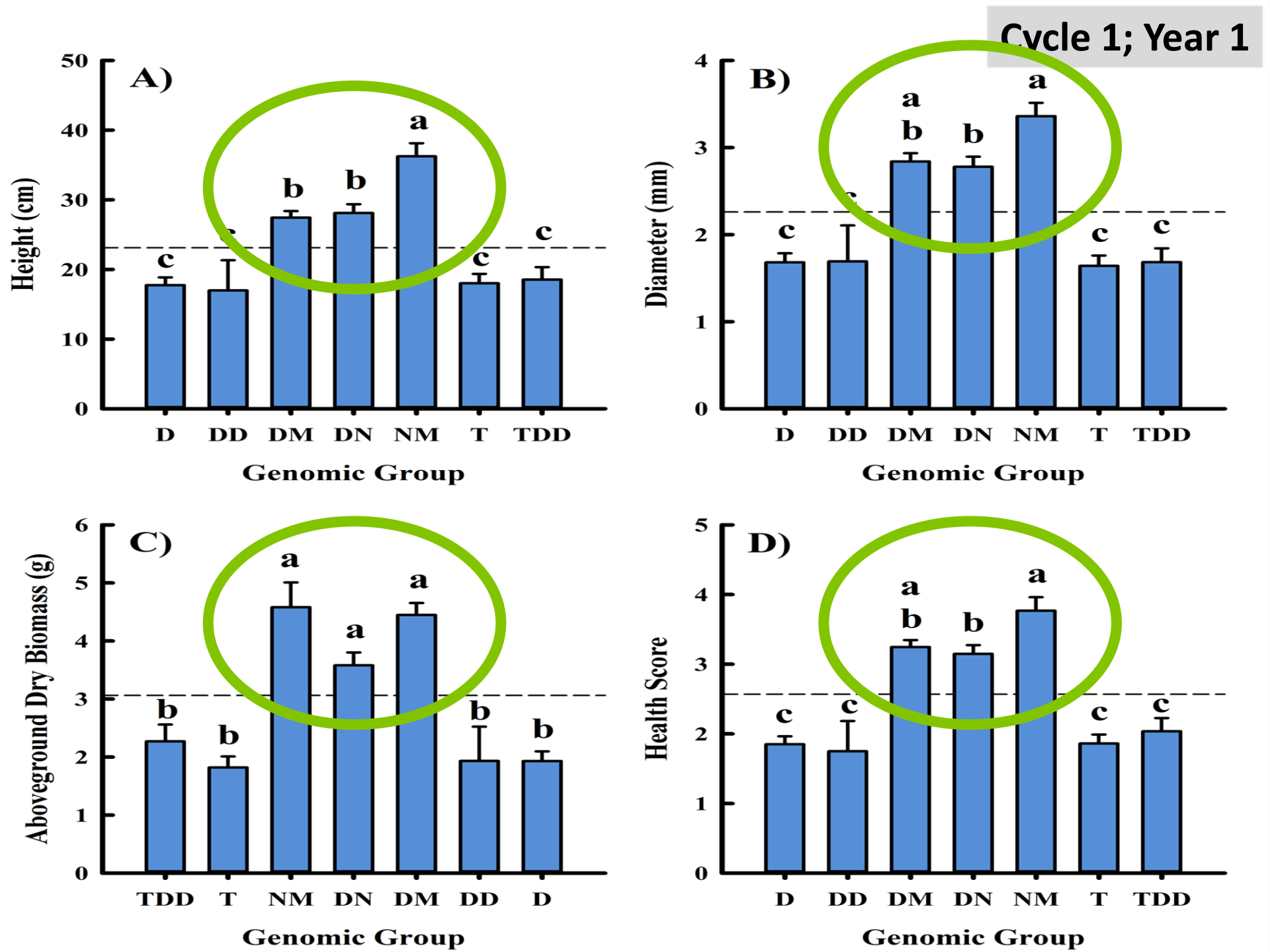
Cycle 1 Probability Values

Source of variation	Height	Diameter	Biomass	Health
Soil Amendment	0.4749	0.7067	0.9130	0.5402
Clone	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
Soil Treatment × Clone	0.6148	0.4565	0.8831	0.2175
Soil Amendment	0.3755	0.5484	0.9823	0.6691
Genomic Group	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
Soil Treatment × Genomic Group	0.4080	0.5404	0.2768	0.4137

Cycle 1; Year 1



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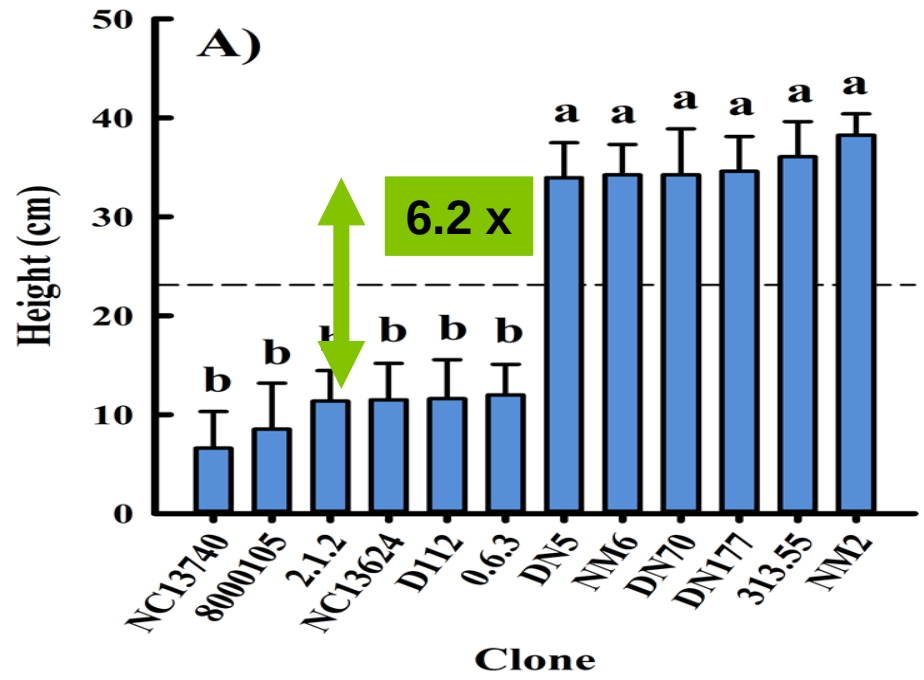
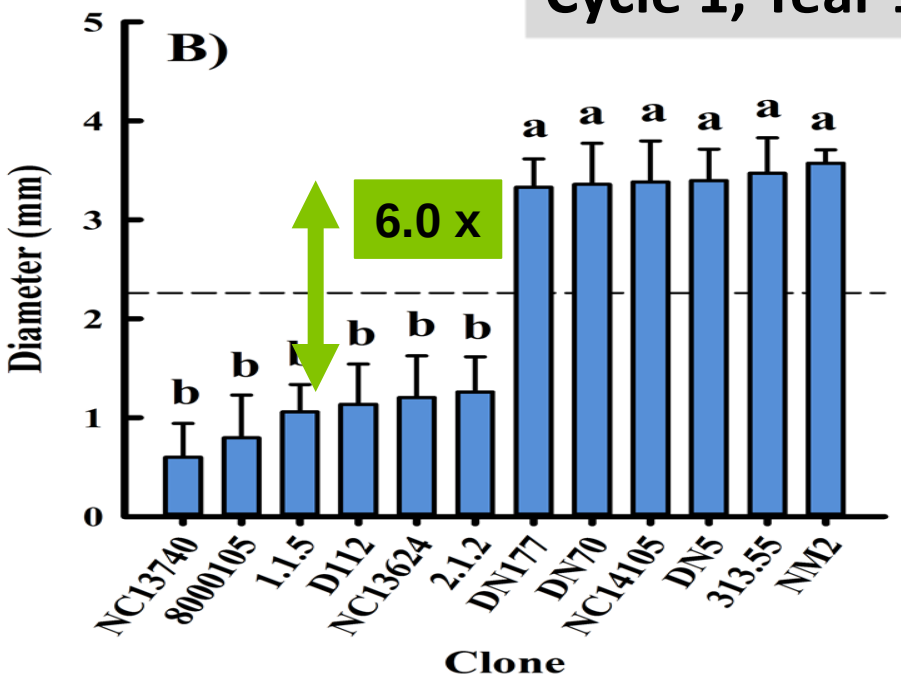
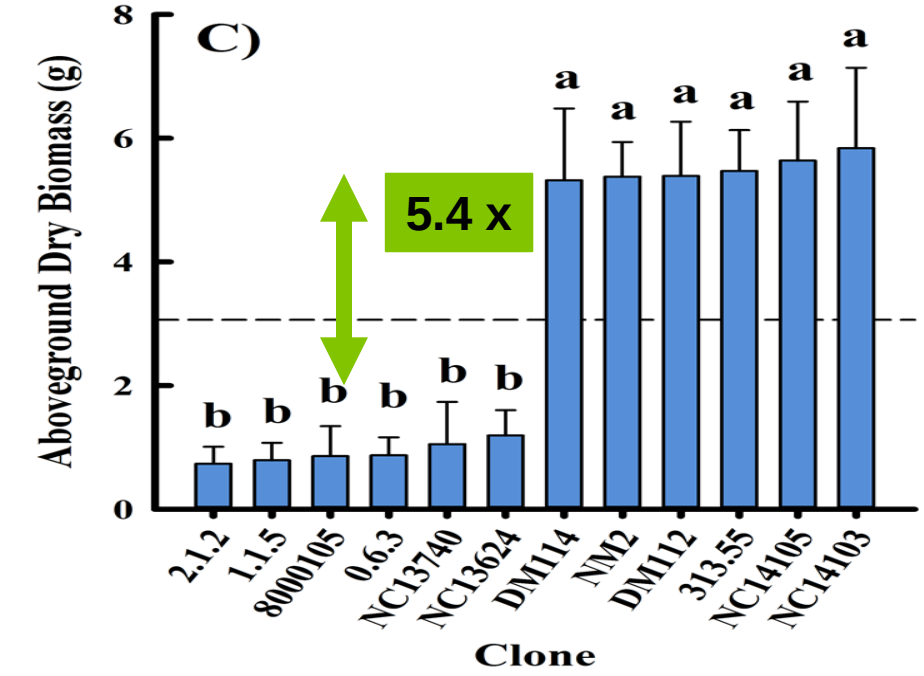
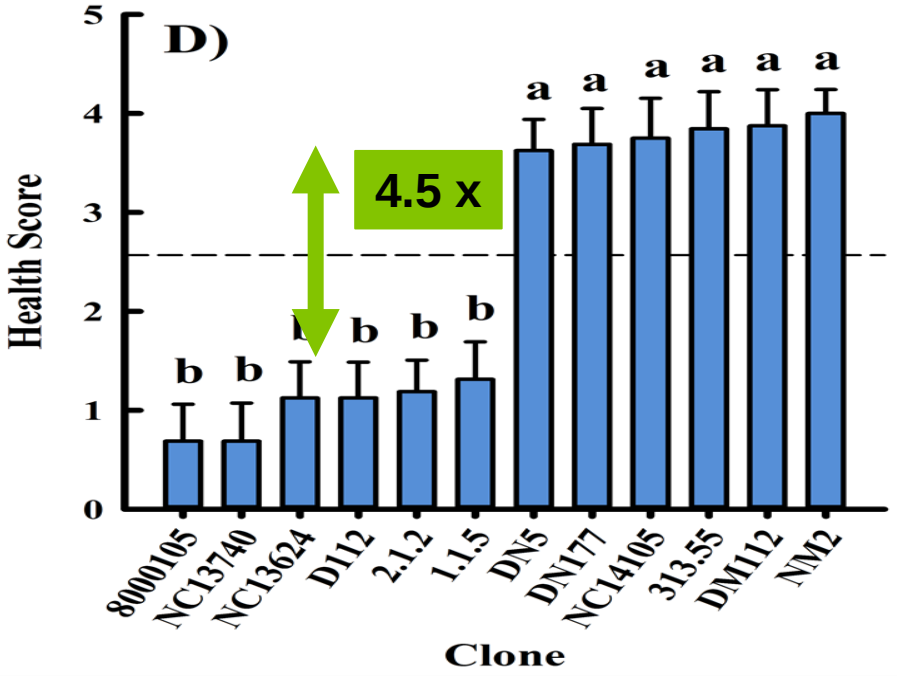
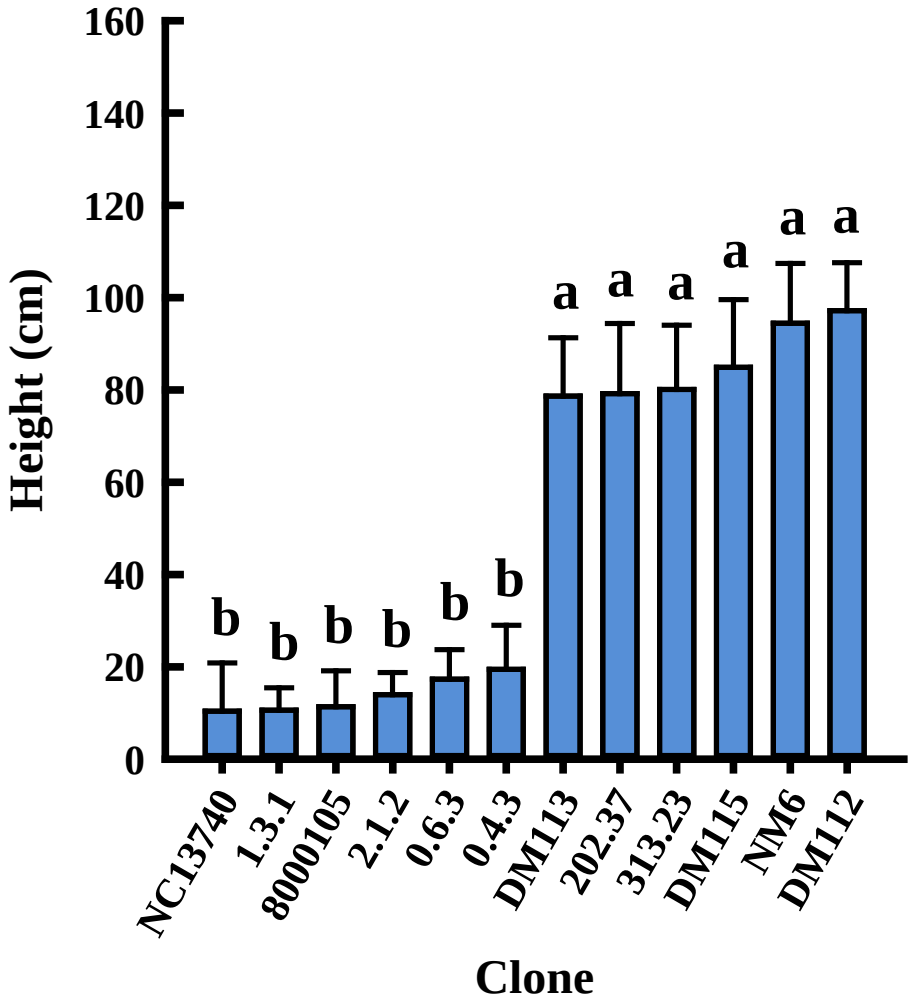


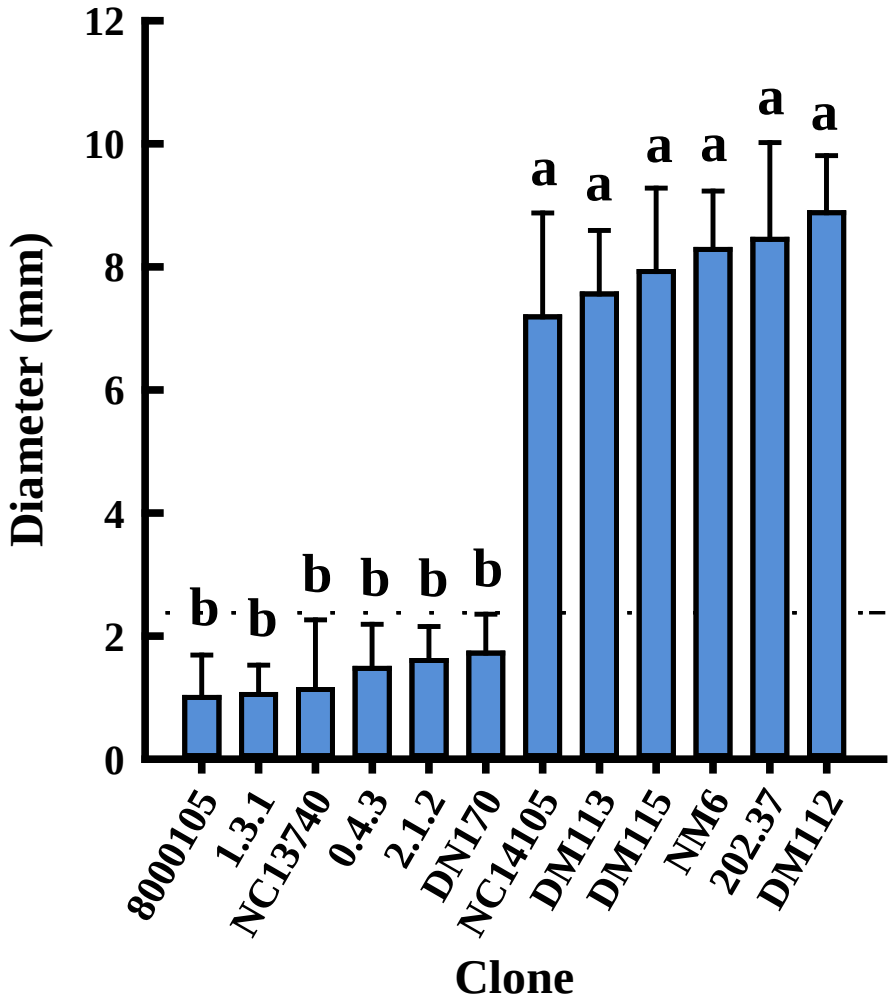






Cycle 1; Year 2





Rank	Clone	Genomic Group	Index Value	Rank	Clone	Genomic Group	Index Value
------- *Clones selected for cycle 2* -------				------- *Clones not selected for cycle 2* -------			
1	NM2	NM	8.89	32	1.3.1	T	5.27
2	313.55	DM	8.53	33	0.4.3	T	5.27
3	DN177	DN	8.13	34[a]	NC13728	TDD	5.11
4	NC14105	DM	8.11	35	D121	D	4.97
5	DN70	DN	8.03	36	D117	D	4.80
6	DN5	DN	7.86	37	1.2.5	T	4.78
7	NM6	NM	7.65	38	DN34	DN	4.69
8	NC14103	DM	7.56	39	5.2.2	T	4.67
9	DM112	DM	7.55	40	3.2.2	T	4.64
10	DM113	DM	7.23	41	113.64	DM	4.63
11	DM114	DM	7.17	42	NC13536	TDD	4.58
12	202.37	DM	7.05	43	D109	D	4.57
13	NC14104	DM	6.98	44	D110	D	4.48
14	NC14106	DM	6.69	45	D105	D	4.28
15	313.23	DM	6.67	46	4.1.3	T	3.88
16	DN17	DN	6.61	47	0.20.3	T	3.87
17	DN170	DN	6.60	48	119.16	DD	3.84
18	412.52	DM	6.55	49	D134	D	3.81
19	DM117	DM	6.53	50	D125	D	3.71
20	DM108	DM	6.42	51	0.7.5	T	3.56
21	NC13820	TDD	6.25	52	D133	D	3.40
22	C910809	D	6.01	53	D118	D	3.33
23	DN154	DN	5.90	54	1.1.5	T	2.83
24	NE264	DN	5.88	55	D112	D	2.74
25	DM115	DM	5.81	56	0.6.3	T	2.69
26	NC14107	DM	5.80	57	NC13624	TDD	2.58
27	DN164	DN	5.77	58	2.1.2	T	2.45
28	DM111	DM	5.75	59	8000105	D	1.83
29	DN182	DN	5.60	60	NC13740	TDD	1.58
30	DM105	DM	5.53				
31	NC13555	TDD	5.41				

[a] Despite not being ranked in the top 32 genotypes, clone NC13728 was advanced to cycle 2 in order to get adequate representation of the TDD clones for the genomic group analyses.

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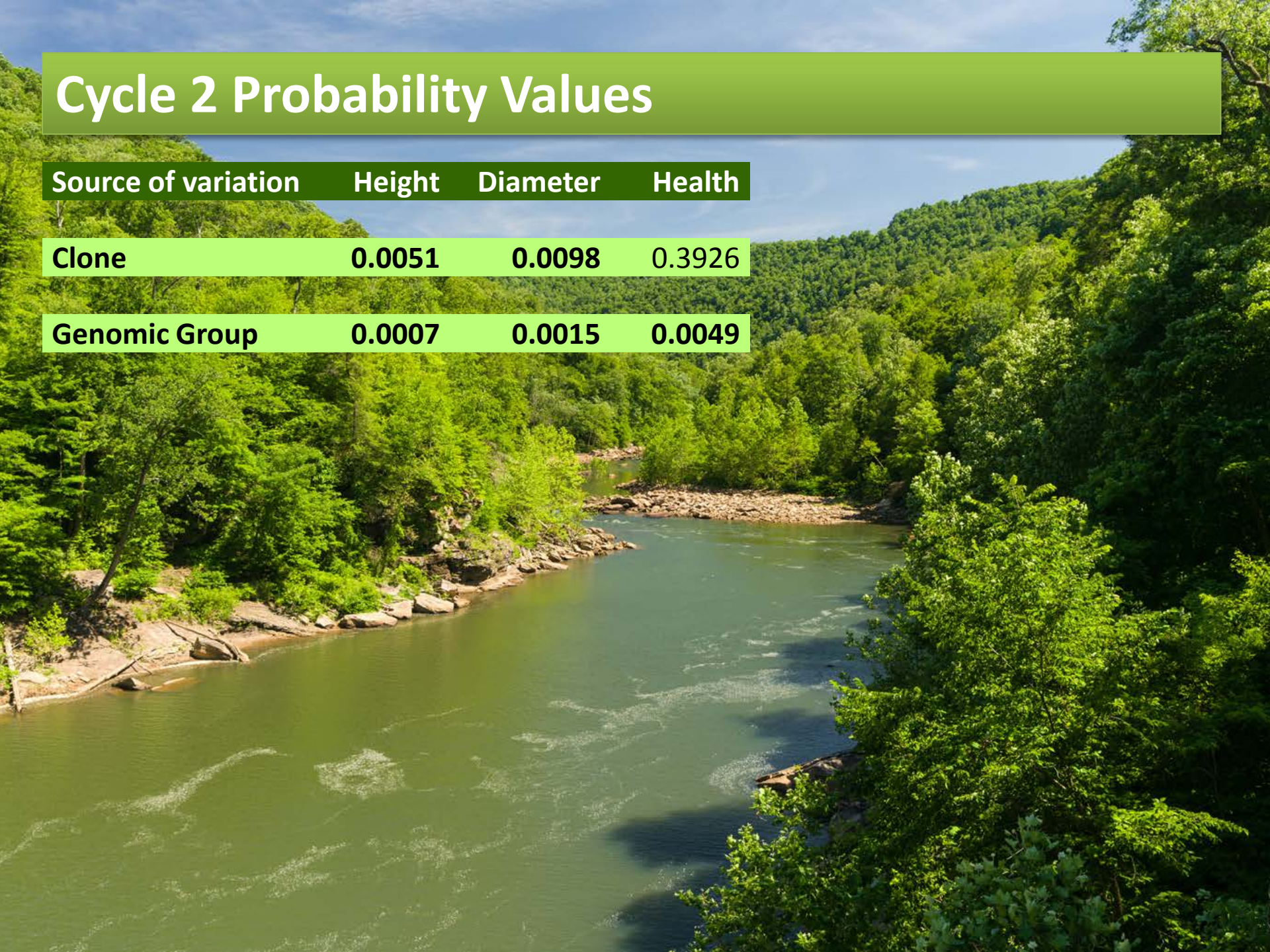
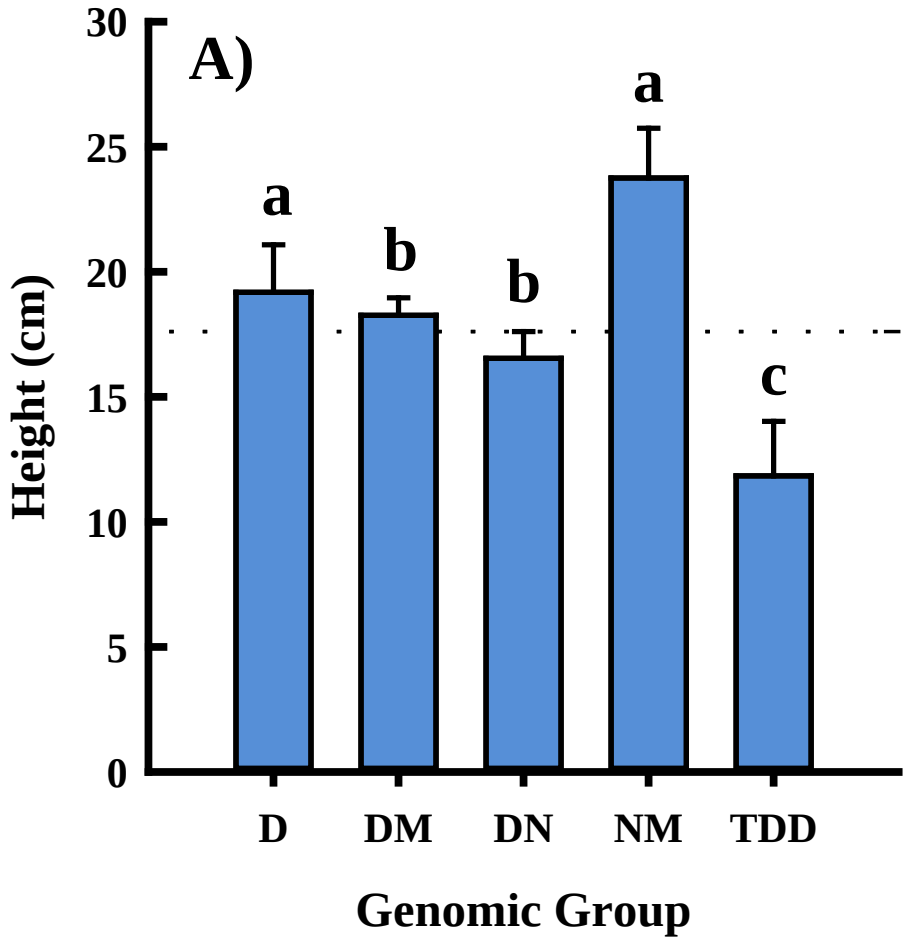
(P. trichocarpa × *P. deltoides)* × *P. deltoides* 'TDD'	NC13536, NC13555, NC13624, NC13728, NC13740, NC13820

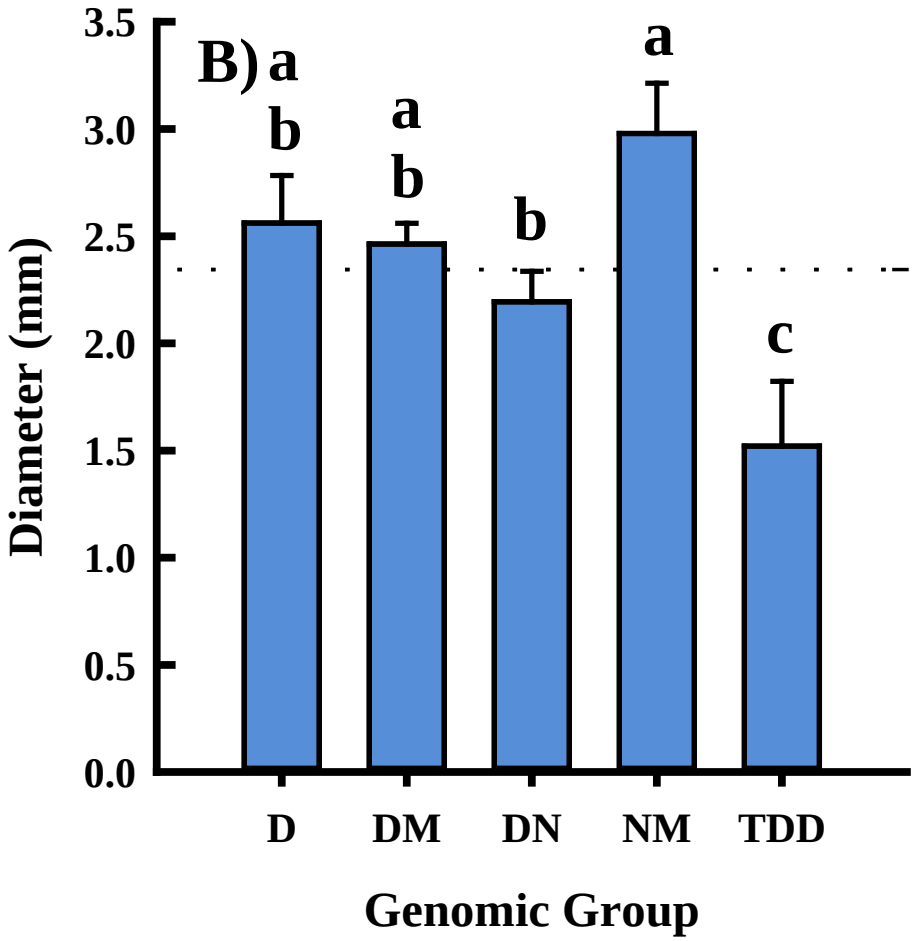
Cycle 2 Probability Values

Source of variation	Height	Diameter	Health
Clone	**0.0051**	**0.0098**	0.3926
Genomic Group	**0.0007**	**0.0015**	**0.0049**

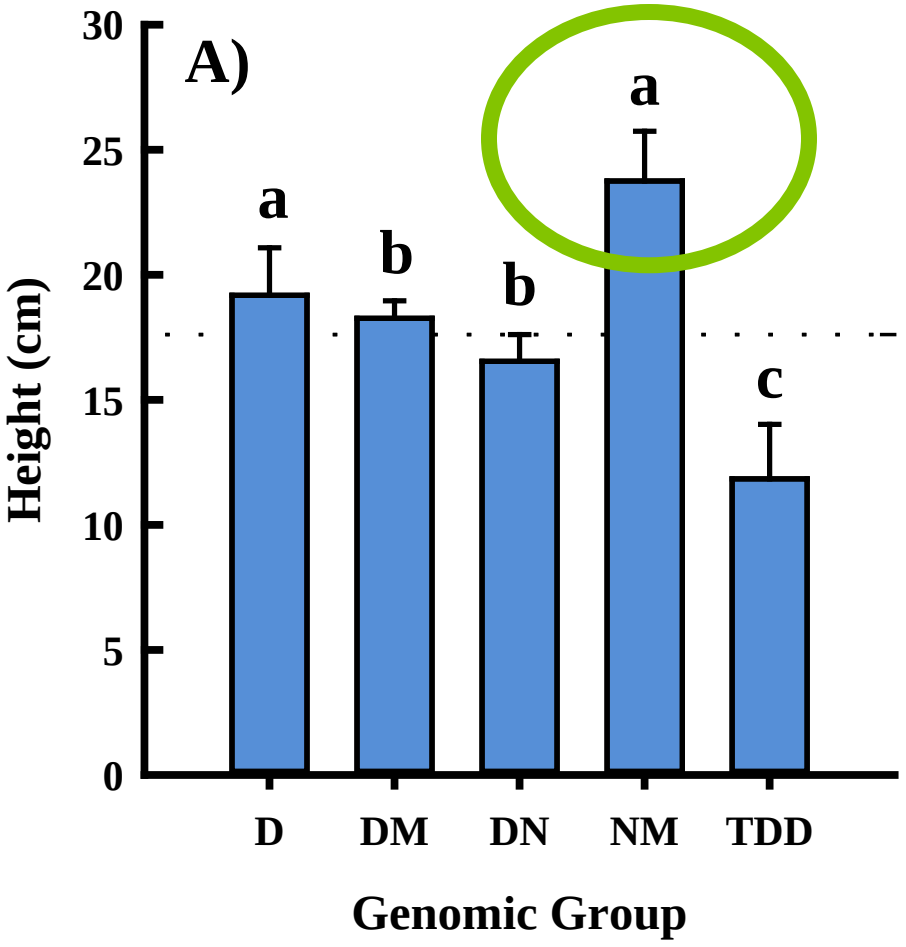


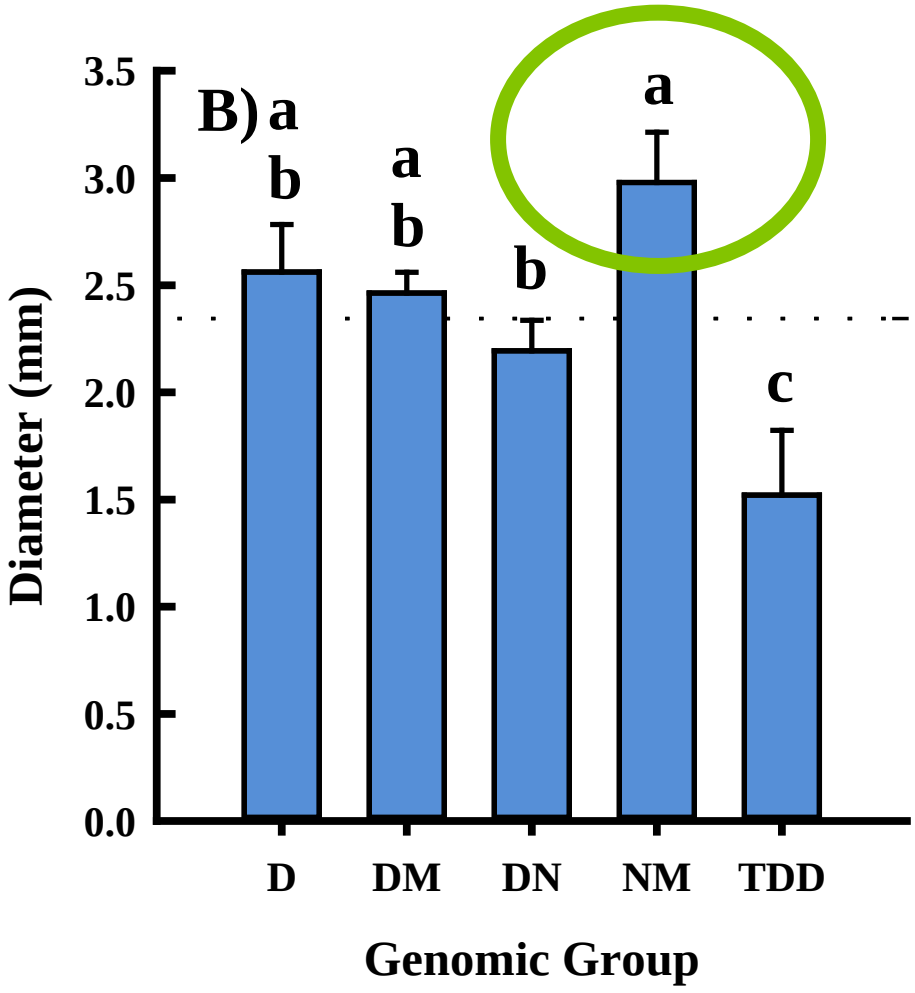
Cycle 2


A)
Height (cm)
30
25
20
15
10
5
0
a
b
b
a
c
D
DM
DN
NM
TDD
Genomic Group


B)
Diameter (mm)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
b
a
b
b
a
c
D
DM
DN
NM
TDD
Genomic Group

Cycle 2


A)
Height (cm)
30
25
20
15
10
5
0
a
b
b
a
c
D
DM
DN
NM
TDD
Genomic Group


B)
Diameter (mm)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
b
a
b
b
a
c
D
DM
DN
NM
TDD
Genomic Group

Conclusions

- **SOIL AMENDMENT PRACTICES**
  - **Biochar treatment DID NOT significantly increase tree survival & growth relative to standard soil ripping techniques without amendments**
- **PLANT SELECTION**
  - **Phyto-recurrent selection is a viable tool for selecting superior genotypes**
  - ***P. nigra* × *P. suaveolens* subsp. *maximowiczii* 'NM' performances were superior to all other genomic groups**

Funding

Renewable Energy Applications on Surface-Mined Lands Program

Administered by:
West Virginia Brownfields Assistance Center at Marshall University

A Program of:
Marshall University's Center for Environmental, Geotechnical & Applied Sciences (CEGAS)

Funded by & Under Direction of:
West Virginia Division of Energy Office of Coalfield Community Development
&
Appalachian Regional Commission

USDA

ARC APPALACHIAN REGIONAL COMMISSION

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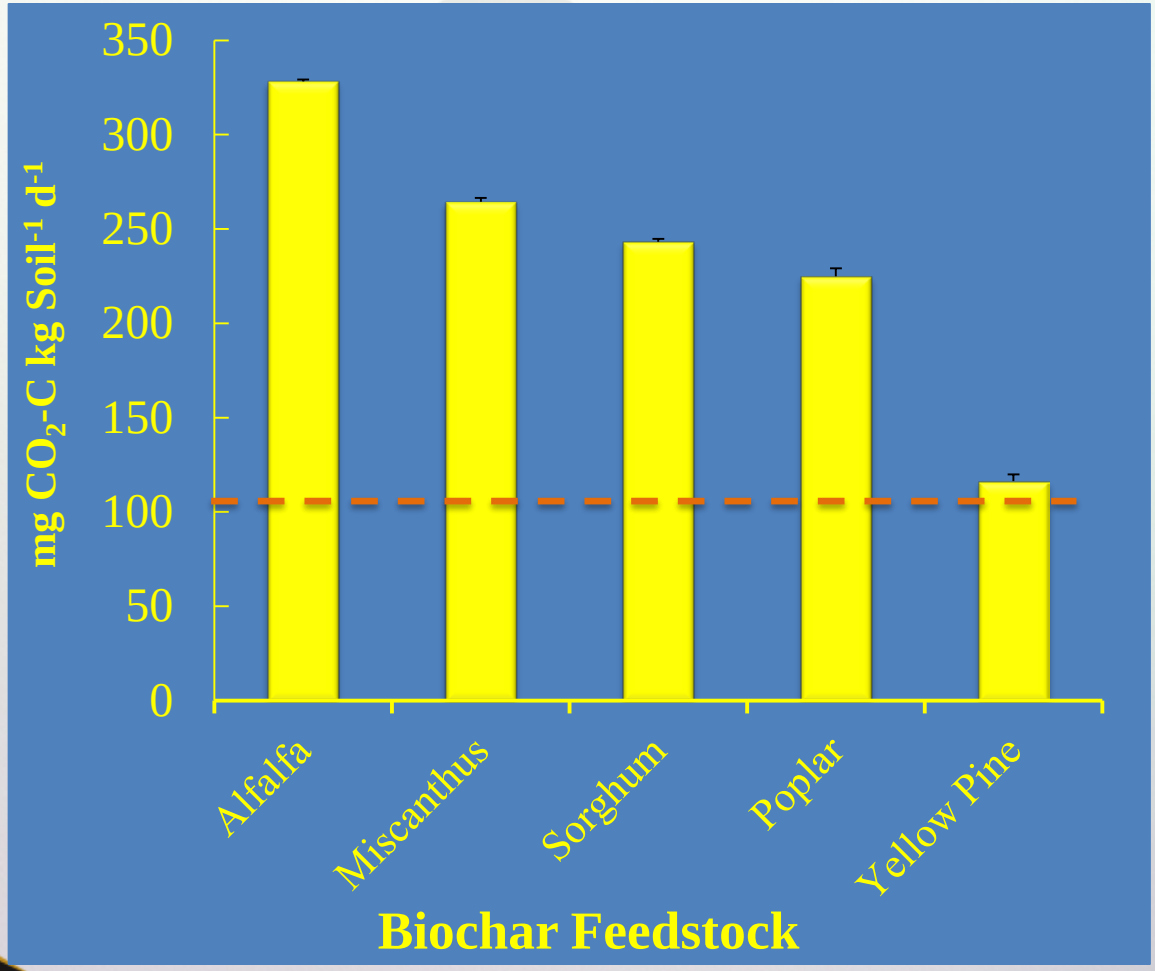
Soil Treatment - Biochar

Biochar	pH	EC (mS/cm)	Ash Content	P	S	C	N	O	C/N Ratio
			% weight						
Alfalfa	12	11.2	28.5	0.85	0.14	57	1.54	23	37
Miscanthus	8.3	7.08	27.3	1.22	0.19	54	1.04	25	52
Poplar	9.2	0.72	26.2	-	-	61	0.67	22	91
Sorghum	10	4.32	35.5	0.48	0.19	50	0.61	26	82
Yellow Pine	10	9.59	-	-	-	75	0.32	20	238

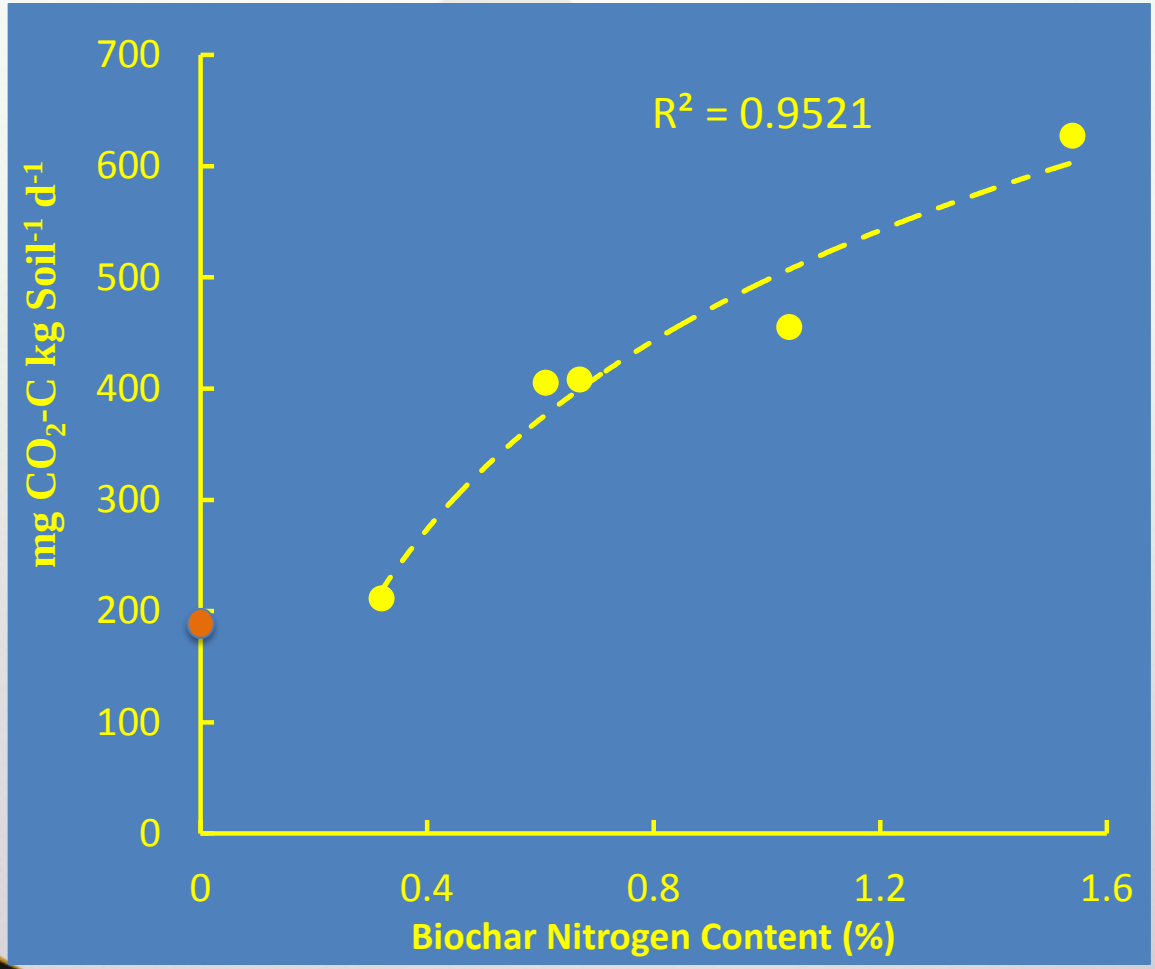
Soil Treatment - Biochar

CO_2 Release From Biochar Amended Soil – Feedstock Effect



Soil Treatment - Biochar

CO_2 Release From Biochar Amended Soil – Char TN Content

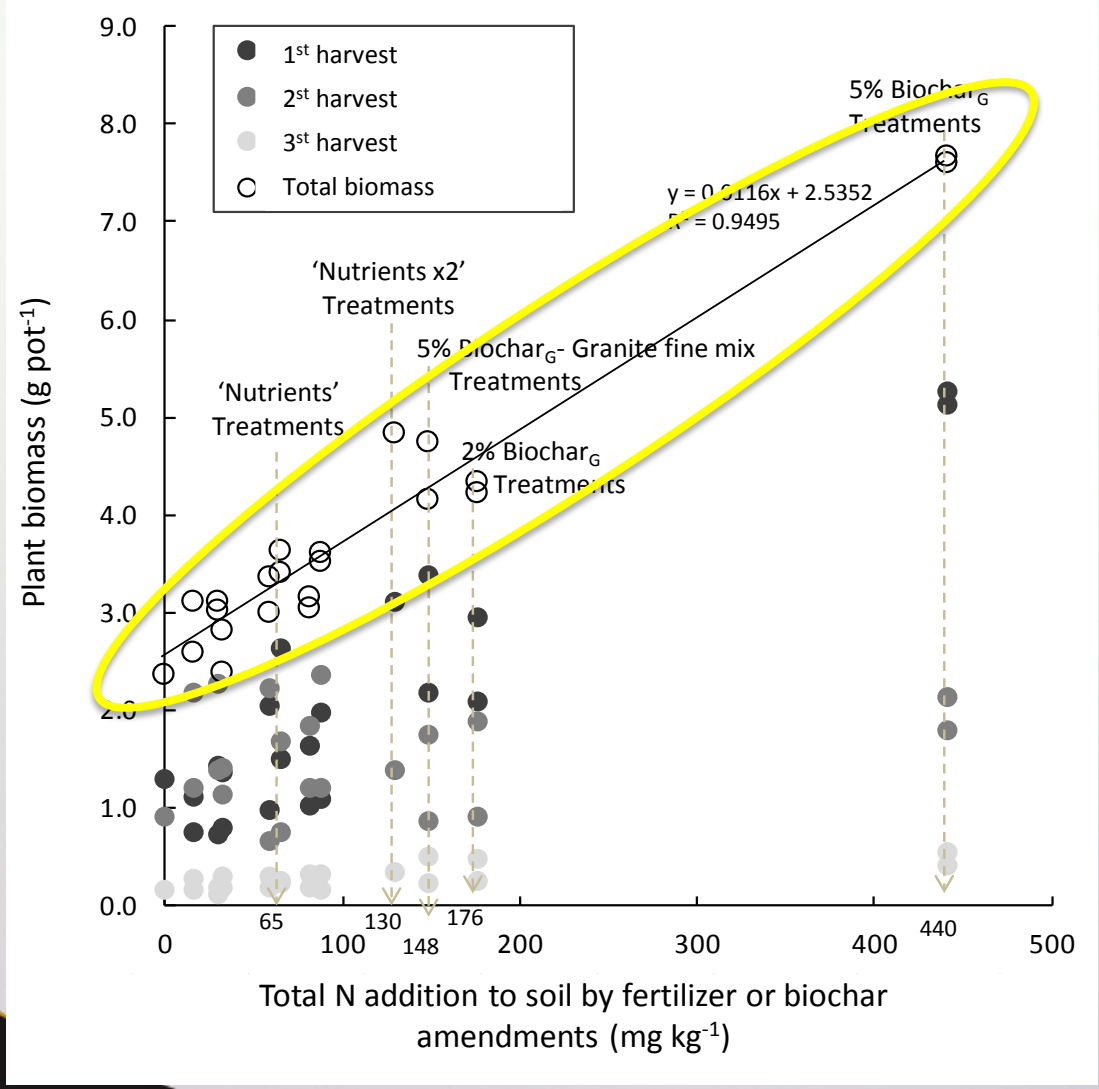


Soil Treatment - Biochar

Biochar Amended Soil – Foxtail Millet Growth Response

Soil Treatment - Biochar

Biochar Amended Soil – Foxtail Millet Growth Response



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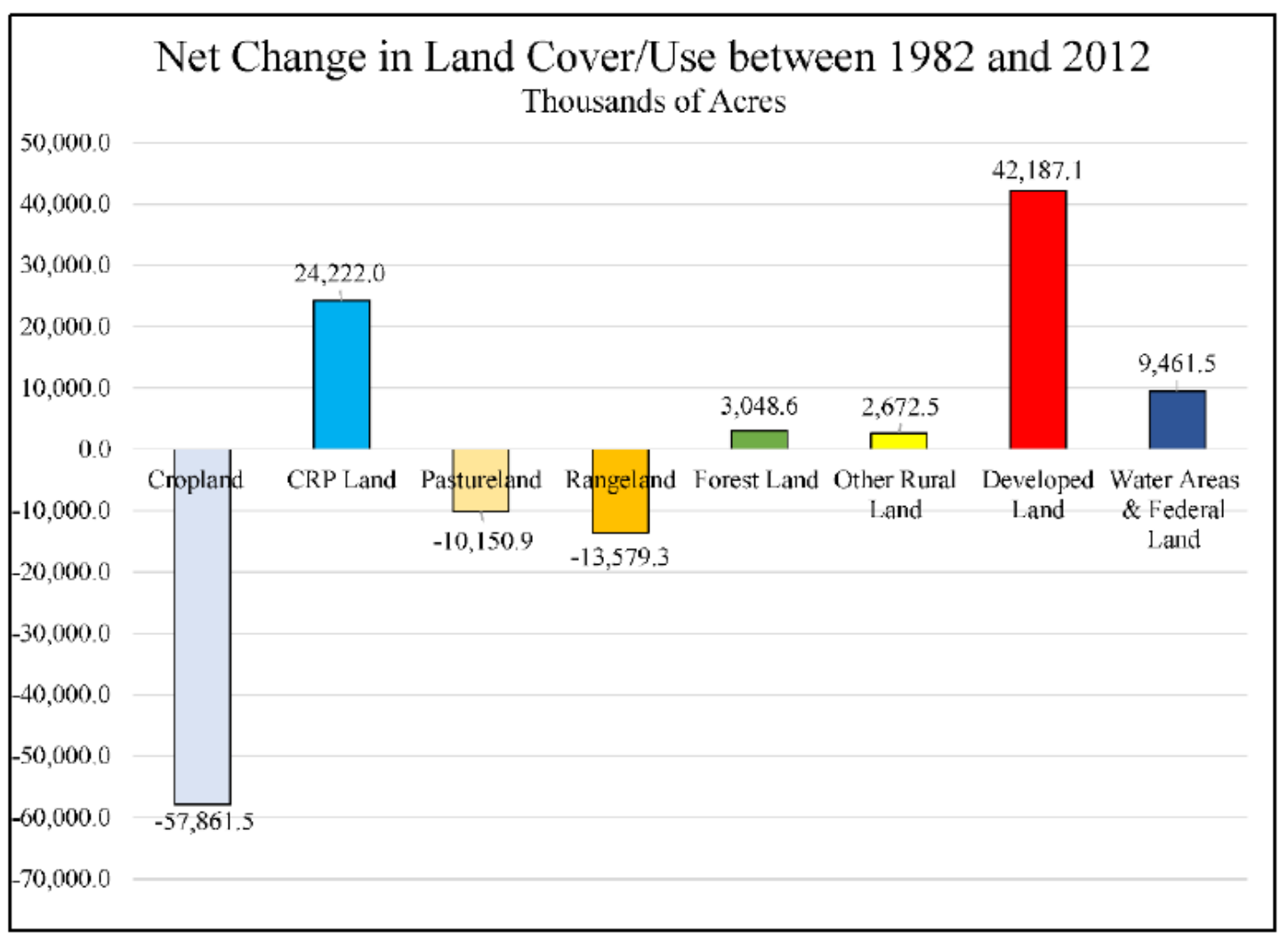
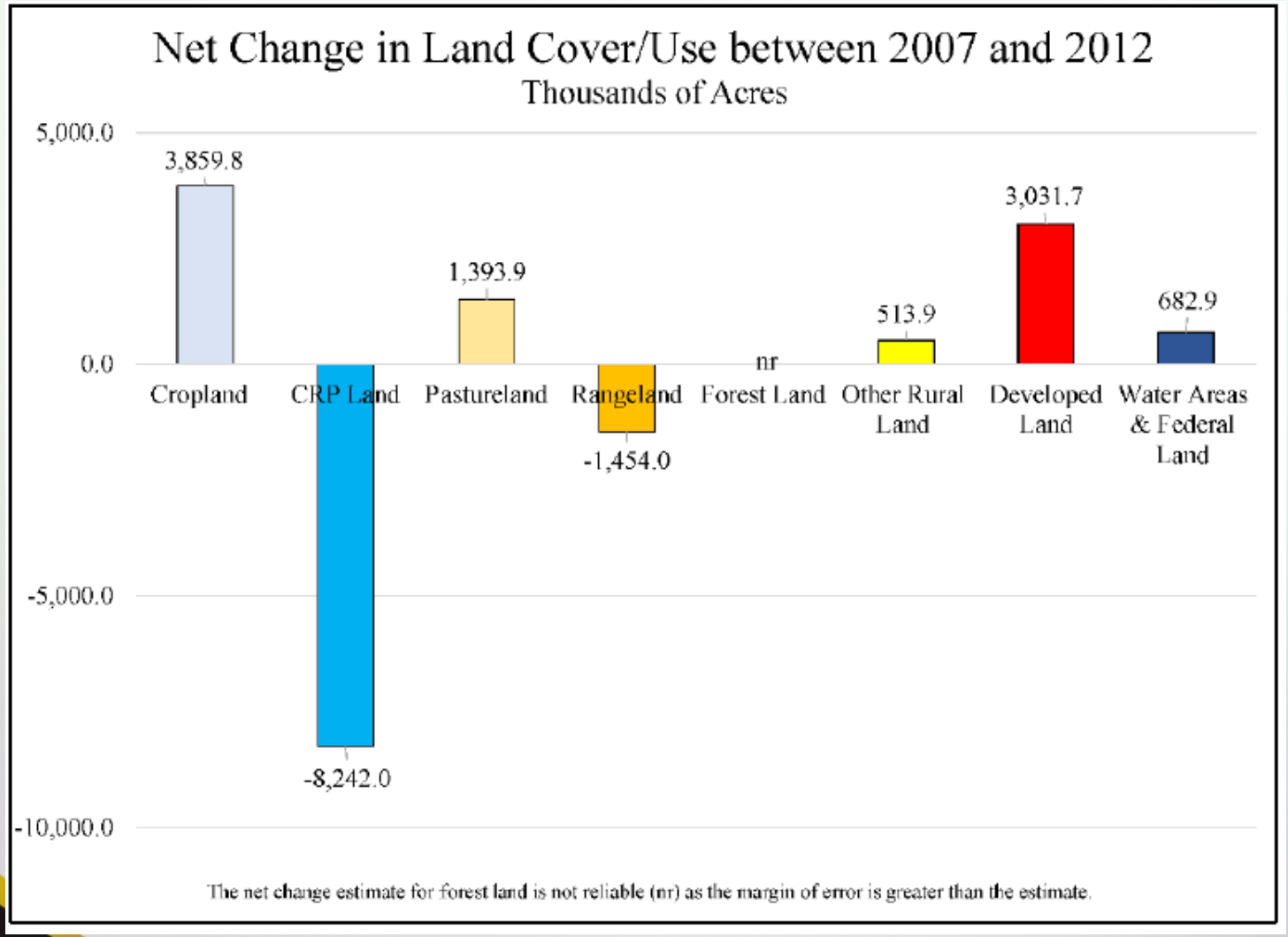


USDA 2015. 2012 National Resources Inventory


Net Change in Land Cover/Use between 2007 and 2012
Thousands of Acres
5,000.0
0.0
-5,000.0
-10,000.0
3,859.8
-8,242.0
1,393.9
-1,454.0
nr
513.9
3,031.7
682.9
Cropland
CRP Land
Pastureland
Rangeland
Forest Land
Other Rural Land
Developed Land
Water Areas & Federal Land
The net change estimate for forest land is not reliable (nr) as the margin of error is greater than the estimate.