Presented @
6/16/15 field
meetings

Yates Petroleum Corporation

State CO SWD System

Analytical Results

June 16, 2015

Google earth

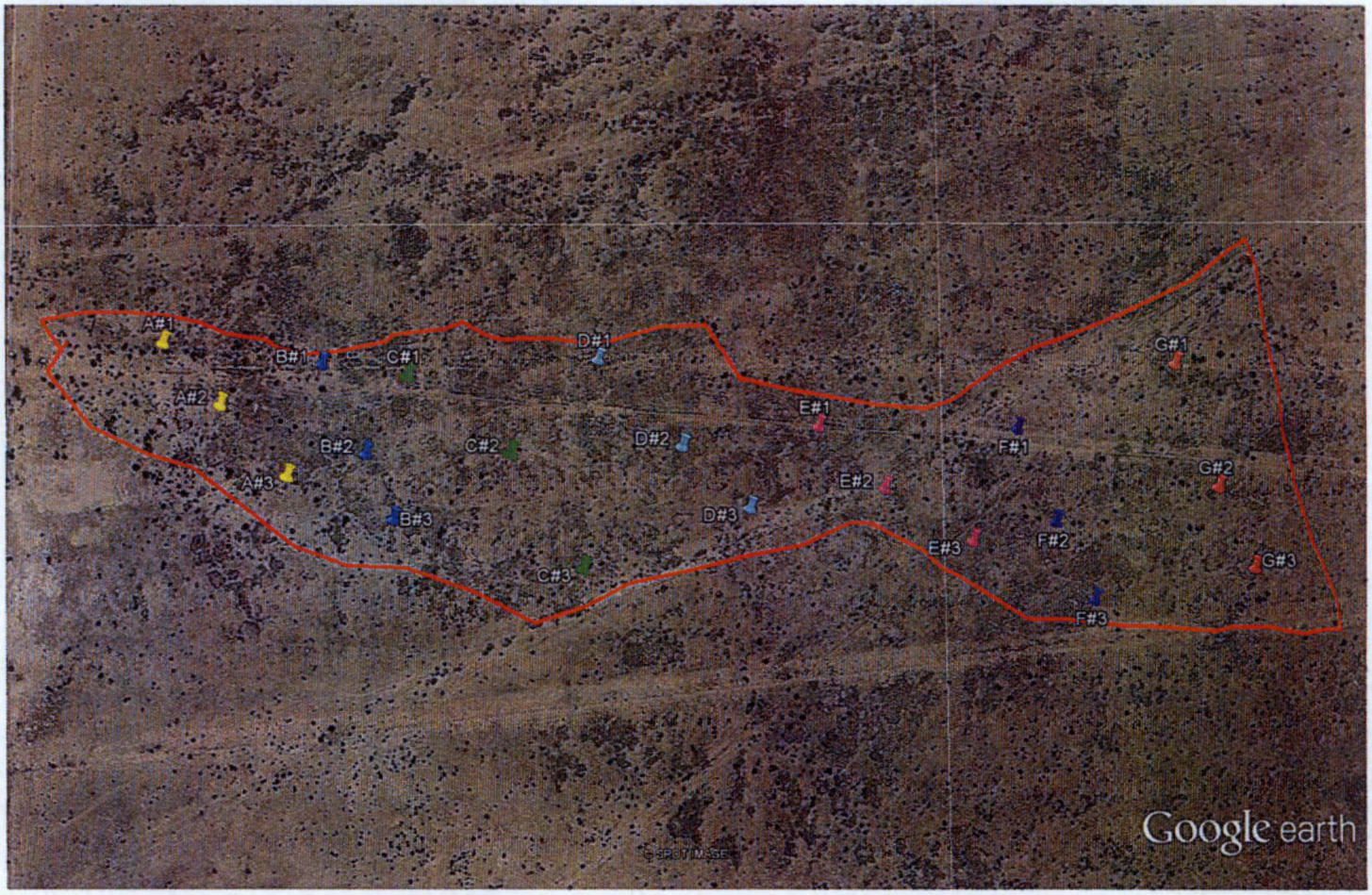
feet 800
meters 200

A-1 B-1 2' no liner

Analytical Report- H501382 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
A#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				4400
A#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				2880
A#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				2560
A#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				304
A#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				64
A#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				544
A#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				64
A#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				144
A#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				112
A#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				32
A#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				416
A#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				784
Analytical Report- H501372 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
A#2 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				7100
A#2 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				4700
A#2 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				6080
A#2 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				4160
A#2 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				2640
A#2 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				1880
A#2 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				1840
A#2 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				624
A#2 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				288
A#2 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				320
A#2 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				160
A#2 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				48
Analytical Report- H501373 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
A#3 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				6400
A#3 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				7280
A#3 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				5120
A#3 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				5040
A#3 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				5440
A#3 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				3440
A#3 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				1920
A#3 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				1090
A#3 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				786
A#3 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				1020
A#3 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				304
A#3 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				80

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date; 8/25/2014.

Site Ranking is Zero (0). DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.



Google earth

feet 800

meters 200

Analytical Report-H501369 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
B#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				8000
B#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				5700
B#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				2360
B#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				1400
B#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				752
B#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				304
B#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				160
B#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				768
B#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				400
B#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				416
B#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				128
B#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				224
Analytical Report-H501369 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
B#2 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				640
B#2 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				1490
B#2 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				1310
B#2 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				960
B#2 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				1460
B#2 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				1300
B#2 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				960
B#2 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				704
B#2 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				544
B#2 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				96
B#2 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				176
B#2 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				256
Analytical Report-H501369 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
B#3 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				7100
B#3 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				8800
B#3 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				6400
B#3 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				5700
B#3 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				4300
B#3 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				4000
B#3 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				2320
B#3 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				656
B#3 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				736
B#3 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				736
B#3 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				576
B#3 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				208

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date; 8/25/2014.

Site Ranking is Zero (0), DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.

Google earth

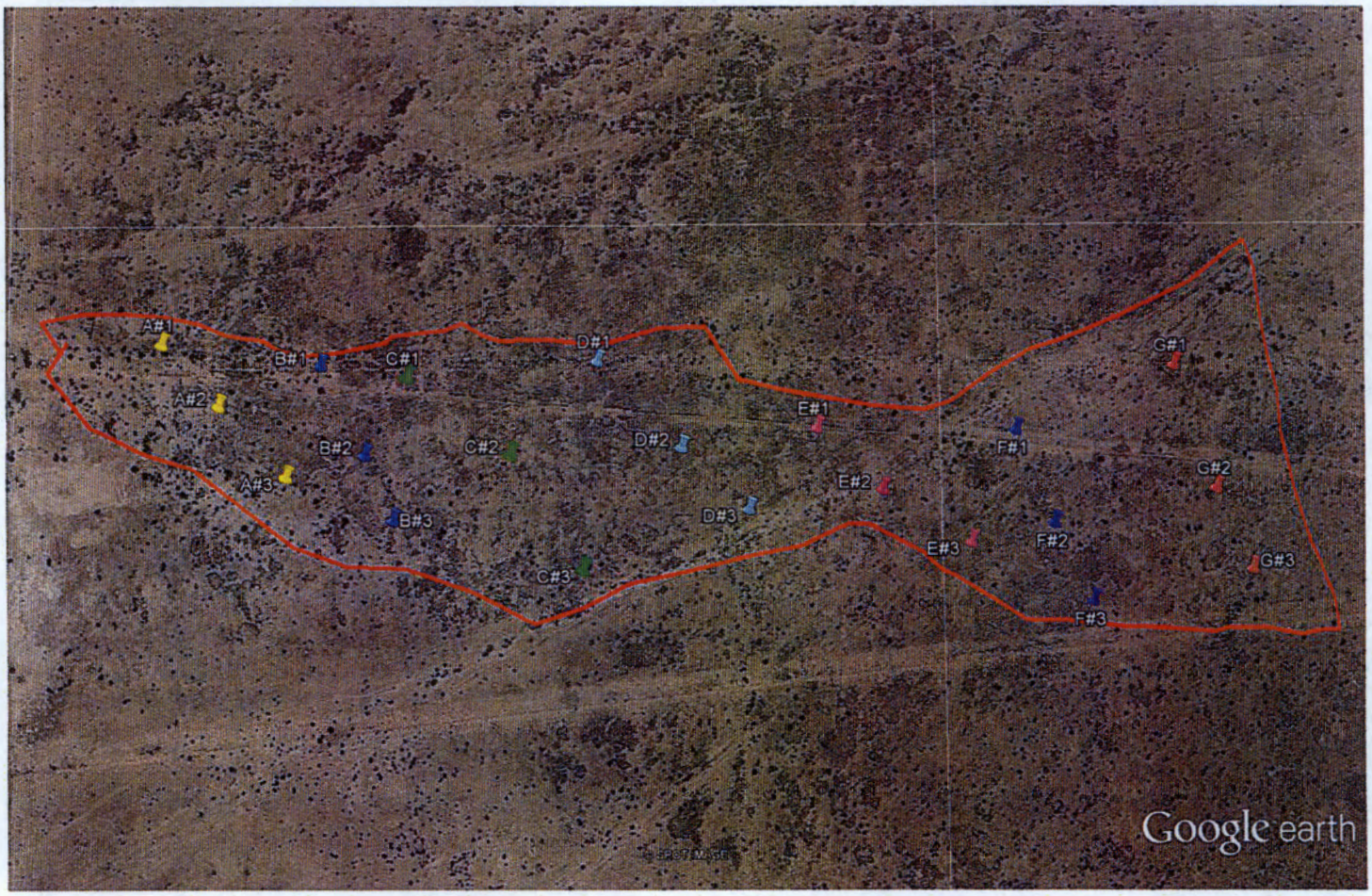
feet 800

meters 200

Analytical Report- H501366 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
C#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				608
C#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				160
C#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				64
C#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				320
C#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				752
C#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				544
C#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				3160
C#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				2120
C#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				464
C#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				208
C#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				304
C#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				384
Analytical Report- H501366 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
C#2 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				1340
C#2 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				2360
C#2 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				5040
C#2 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				4640
C#2 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				4240
C#2 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				3360
C#2 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				1500
C#2 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				2040
C#2 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				1600
C#2 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				688
C#2 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				480
C#2 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				128
Analytical Report- H501367 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
C#3 - 1.0	Release Area	5/27/2015	Grab/Trackhoe	1' (3' BSL)				2520
C#3 - 2.0	Release Area	5/27/2015	Grab/Trackhoe	2 (4' BSL)				2920
C#3 - 3.0	Release Area	5/27/2015	Grab/Trackhoe	3' (5 'BSL)				4720
C#3 - 4.0	Release Area	5/27/2015	Grab/Trackhoe	4' (6' BSL)				7120
C#3 - 5.0	Release Area	5/27/2015	Grab/Trackhoe	5' (7' BSL)				7440
C#3 - 6.0	Release Area	5/27/2015	Grab/Trackhoe	6' (8' BSL)				5520
C#3 - 8.0	Release Area	5/27/2015	Grab/Trackhoe	8' (10' BSL)				2200
C#3 - 10.0	Release Area	5/27/2015	Grab/Trackhoe	10' (12' BSL)				2720
C#3 - 12.0	Release Area	5/27/2015	Grab/Trackhoe	12' (14' BSL)				1710
C#3 - 14.0	Release Area	5/27/2015	Grab/Trackhoe	14' (16' BSL)				1120
C#3 - 16.0	Release Area	5/27/2015	Grab/Trackhoe	16' (18' BSL)				1360
C#3 - 18.0	Release Area	5/27/2015	Grab/Trackhoe	18' (20' BSL)				1730

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date: 8/25/2014.

Site Ranking is Zero (0), DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.



Google earth

feet 800

meters 200

Analytical Report- H501368 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
D#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				16
D#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				<16.0
D#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				80
D#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				16
D#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				48
D#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				96
D#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				96
D#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				480
D#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				224
D#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				400
D#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				288
D#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				160
Analytical Report- H501364 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
D#2 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				3960
D#2 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				5200
D#2 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				5280
D#2 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				4000
D#2 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				3440
D#2 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				3900
D#2 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				3040
D#2 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				688
D#2 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				352
D#2 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				336
D#2 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				384
D#2 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				336
Analytical Report- H501365 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
D#3 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				4800
D#3 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				6960
D#3 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				6480
D#3 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				6880
D#3 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				6560
D#3 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				4880
D#3 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				3440
D#3 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				3520
D#3 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				1840
D#3 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				1460
D#3 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				1090
D#3 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				1680

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date; 8/25/2014.

Site Ranking is Zero (0), DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.

Google earth

feet 800

meters 200

Analytical Report- H501369 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
E#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				<16.0
E#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				16
E#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				16
E#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				16
E#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				16
E#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				16
E#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				16
E#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				16
E#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				<16.0
E#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				16
E#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				16
E#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				32
Analytical Report- H501370 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
E#2 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				5700
E#2 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				8500
E#2 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				7800
E#2 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				7200
E#2 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				8100
E#2 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				7700
E#2 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				4500
E#2 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				3440
E#2 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				3520
E#2 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				5120
E#2 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				1120
E#2 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				800
Analytical Report- H501371 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
E#3 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				<16.0
E#3 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				16
E#3 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				16
E#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				16
E#3 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				16
E#3 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				16
E#3 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				16
E#3 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				16
E#3 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				<16.0
E#3 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				16
E#3 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				16
E#3 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				32

Site Ranking is Zero (0), DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date; 8/25/2014.

Google earth

feet 800

meters 200

Analytical Report- H501374 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
F#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				<16.0
F#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				<16.0
F#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				<16.0
F#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				<16.0
F#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				<16.0
F#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				<16.0
F#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				16
F#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				32
F#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				16
F#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				48
F#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				16
F#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				16
Analytical Report- H501376 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
F#2 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				3240
F#2 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				3200
F#2 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				4960
F#2 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				5200
F#2 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				6800
F#2 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				4480
F#2 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				2800
F#2 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				2920
F#2 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				2360
F#2 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				1260
F#2 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				784
F#2 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				848
Analytical Report- H501377 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
F#3 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				48
F#3 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				32
F#3 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				48
F#3 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				48
F#3 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				64
F#3 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				32
F#3 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				80
F#3 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				48
F#3 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				160
F#3 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				144
F#3 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				176
F#3 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				192

Site Ranking is Zero (0). DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date: 8/25/2014.

Google earth

feet 800

meters 200

Analytical Report- H501374 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
G#1 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (2' BSL)				16
G#1 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (3' BSL)				160
G#1 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (4 'BSL)				464
G#1 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (5' BSL)				640
G#1 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (6' BSL)				10300
G#1 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (7' BSL)				11800
G#1 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (9' BSL)				8300
G#1 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (11' BSL)				6500
G#1 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (13' BSL)				6000
G#1 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (15' BSL)				5200
G#1 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (17' BSL)				2040
G#1 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (19' BSL)				2680
Analytical Report- H501376 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
G#2 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				3240
G#2 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				3200
G#2 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				4960
G#2 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				5200
G#2 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				6800
G#2 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				4480
G#2 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				2800
G#2 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				2920
G#2 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				2360
G#2 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				1260
G#2 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				784
G#2 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				848
Analytical Report- H501377 (Cardinal)	Sample Area	Sample Date	Sample Type	Depth	BTEX	GRO	DRO	Chlorides
G#3 - 1.0	Release Area	5/28/2015	Grab/Trackhoe	1' (3' BSL)				48
G#3 - 2.0	Release Area	5/28/2015	Grab/Trackhoe	2 (4' BSL)				32
G#3 - 3.0	Release Area	5/28/2015	Grab/Trackhoe	3' (5 'BSL)				48
G#3 - 4.0	Release Area	5/28/2015	Grab/Trackhoe	4' (6' BSL)				48
G#3 - 5.0	Release Area	5/28/2015	Grab/Trackhoe	5' (7' BSL)				64
G#3 - 6.0	Release Area	5/28/2015	Grab/Trackhoe	6' (8' BSL)				32
G#3 - 8.0	Release Area	5/28/2015	Grab/Trackhoe	8' (10' BSL)				80
G#3 - 10.0	Release Area	5/28/2015	Grab/Trackhoe	10' (12' BSL)				48
G#3 - 12.0	Release Area	5/28/2015	Grab/Trackhoe	12' (14' BSL)				160
G#3 - 14.0	Release Area	5/28/2015	Grab/Trackhoe	14' (16' BSL)				144
G#3 - 16.0	Release Area	5/28/2015	Grab/Trackhoe	16' (18' BSL)				176
G#3 - 18.0	Release Area	5/28/2015	Grab/Trackhoe	18' (20' BSL)				192

Chlorides sampled for documentation. Released 400 B/PW; Recovered: 200 B/PW. Release Date: 8/25/2014.

Site Ranking is Zero (0). DTGW >100' (Approximately 132' – 175', per ChevronTexaco Trend Map) All results are ppm. BSL-Below Surface Level.

Jose Tall Wheatgrass

Scientific Name

Agropyron elgongatum (Host) P. Beauv.

Short Description

'Jose' ,a variety of Tall wheatgrasses, also called Rush wheatgrass, is a cool-season bunchgrass adapted to a wide range of soils and climates. 'Jose' is best known for being one of the most saline or alkali tolerant of the cultivated grasses.

Description

Tall wheatgrass is a cool-season long-lived perennial bunchgrass originating from Turkey in 1909 and now is found throughout most of the western United States. 'Jose' ranges in height from 3 feet to as much as 6 feet under the most ideal conditions. It is recommended in areas with an annual precipitation of more than 14 inches. One of the strongest characteristics of 'Jose' is it's ability to thrive in very wet, alkaline soils such as greasewood and saltgrass sites where the water table is from a few inches to several feet below ground surface. It has been cited to withstand as much as 1% soluble salts and increase production yields with salinity levels of 6000 to 16,000 ppm. 'Jose' is a late maturing grass enabling the producer to extend the grazing period over winter annual small grains. 'Jose' can be planted with the typical grain drill or broadcast with a spreader. 'Jose' responds favorably to the addition of nitrogen fertilizer and is most palatable during the early spring months. 'Jose' forage is best suited for maintaining mature animals since it produces a consistent quantity of forage, but generally not sufficient quality for stocker or growing animals without protein supplementation.

Taxonomy of Jose Tall Wheatgrass

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Liliosida
Subclass	Commelinidae
Order	Cyperales
Family	Poaceae
Genus	*Agropyron*
Species	*Agropyron elongatum* (Host) P. Beauv.

Plant Characteristics of Jose Tall Wheatgrass

Height	36 to 72 inches
Growth habit	bunchgrass
Bloom period	mid summer
Sun requirement	full sun to partial shade

In This Section

Alfalfa
Turf Grasses
Forage Grasses
- Wrangler Bermudagrass
- Stampede Plus Bermudagrass
- Riata Bermudagrass
- Bison Buffalograss
- Cimarron Switchgrass
- Verl Eastern Gamagrass
- Chet Sand Bluestem
- Kanlow Switchgrass
- Alamo Switchgrass
- Crabgrass
- **Jose Tall Wheatgrass**
- Weeping Lovegrass
- Old World Bluestem
- Tall Fescue
- Annual Ryegrass
- Perennial Ryegrass
- Teff Grass

Millets
Native Grasses
Wildflowers
Wildlife Products
Hybrid Sunflowers
BMR Forage Sorghum
BMR Sorghum Sudan
Grain Sorghum

Leaf foliage color	bluish-green
Seeds per pound	
Minimum soil temperature for germination	
Soil pH range	
Planting Rate	1 lb/2000 sq ft;15 PLS lbs/acre
Planting Depth	1/2 inch on clay; 3/4 inch on sand
Planting Season	Late summer, early fall

Fertilizers

Sweetlix Livestock Supplements

Cover Crop / Cover Graze

Use of Jose Tall Wheatgrass

Livestock

Jose Tall Wheatgrass is used extensively for hay and pasture in the central Great Plains. It produces high yields with moderately good quality, but typically does not have the quality of the other wheatgrasses. The best forage option for "white" or alkaline, salty ground.

Soil Erosion

Jose Tall Wheatgrass is often used along roadsides, in waterways, and other critical areas especially in high alkaline conditions where less tolerant grasses fail.

Wildlife

Provides nesting cover for some upland game birds.

Bermuda grass named 'Macho World Feeder'

US PP14436 P3

Publication number	USPP14436 P3
Publication type	Grant
Application number	US 10/062,726
Publication date	Dec 30, 2003
Filing date	Feb 5, 2002
Priority date	Feb 5, 2002
Also published as	US20030150040
Inventors	David C. Davidson, Jr.
Original Assignee	Davgor, Limited
Export Citation	BiBTeX, EndNote, RefMan

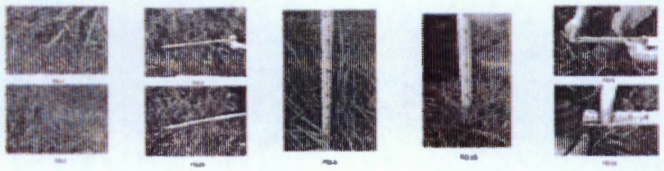
Classifications (4), Legal Events (1)

External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

This invention relates to a new and distinct Bermuda grass (*Cynodon dactylon*) designated 'Macho World Feeder' which is outstanding because of its 1) aggressive growth; 2) its excellent feed values; 3) its salt tolerance; and 4) its drought resistance.

IMAGES (5)



DESCRIPTION

Genus and species: Bermuda grass (*Cynodon dactylon* (L.)).

BACKGROUND

'Macho World Feeder' is a new and distinct cultivar of Bermuda grass which is developed for forage grass and turfgrass. An important characteristic of a forage grass is that it is good tasting to animals and nutritious by providing most or all the animals dietary needs.

SUMMARY OF THE INVENTION

This invention relates to a new and distinct Bermuda grass (*Cynodon dactylon*) designated 'Macho World Feeder' which is outstanding because of its 1) aggressive growth; 2) its excellent feed values; 3) its salt tolerance; and 4) its drought resistance. The claimed Bermuda grass 'Macho World Feeder' was primarily selected for these characteristics.

The present invention is a mutant that was discovered in August, 2000 after the inventor noticed an area of grass which was distinctly taller and larger-leafed and stemmed than the surrounding grass which was 'World Feeder' Bermuda Grass (U.S. Plant Pat. No. 7,081). The grass was selected, separated and propagated during September and October. Asexual reproduction of the grass by vegetative propagation in Poteet, Tex. confirmed that the plant does in fact maintain the characteristics described through successive propagations.

DEFINITIONS

In the description and tables which follow, a number of terms are used. In order to provide a clear and consistent understanding of the specification and claims, including the scope to be given such terms, the following definitions are provided:

Total Digestible Nutrients (TDN)—As used herein, the term "total digestible nutrients" is a measurement of the energy value of a feed or forage grass.

Acid Detergent Fiber (ADF)—As used herein, the term "acid detergent fiber" is a measurement of lignin and cellulose fiber content of a feed or forage which helps determine its digestibility. The desired range is between 28%-32%.

ORIGIN AND ASEXUAL REPRODUCTION

CLAIMS (1)

What is claimed is:

1. A new and distinct Bermuda Grass plant as described and illustrated herein.

Asexual reproduction of this turfgrass by vegetative propagation was directed by me, such reproduction establishing that the plant is stable and in fact maintain the characteristics described, in successive generations.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying photographs show as nearly true as it is reasonably possible to make the same, in color illustrations of this character, the new variety. All comparisons in these photographs were from samples that were planted at the same time and with identical environmental conditions.

FIG. 1 shows 'Macho World Feeder' Bermuda grass growing in a field next to the parental cultivar 'World Feeder' Bermuda Grass (U.S. Plant Pat. No. 7,081).

FIG. 2 shows 'Macho World Feeder' Bermuda grass growing in a field next to 'Coastal' Bermuda grass.

FIG. 3 and FIG. 3A show measurements of stolons from 'Macho World Feeder' Bermuda grass and parental cultivar 'World Feeder' Bermuda Grass respectively.

FIG. 4 and FIG. 4A show vertical growth of 'Macho World Feeder' and 'World Feeder' Bermuda Grass respectively.

FIG. 5 and FIG. 5A show the blade length of 'Macho World Feeder' and 'World Feeder' Bermuda Grass respectively.

DETAILED DESCRIPTION OF THE INVENTION

The following description is based on observations and measurements from plants that were approximately 6 months old in Poteet, Tex. Color references are primarily to the Munsell Color Charts for Plant Tissue.

Parentage: 'World Feeder' Bermuda Grass (U.S. Plant Pat. No. 7,081).

Propagation: Vegetative cuttings or sod.

Growth habit:

Stolons.—Stem distance between nodes: Average 14.8 cm on horizontal stolons; width of stolon is 2-3 mm; daily growth over 3 day period is 9 cm.

Leaves.—This high quality grass is medium rich green (RHS 5G 7/6) in color. The leaf blades are soft with a medium-fine texture. Leaf width averages 4-5 mm; leaf length averages 17 cm with several being 26-30 cm; leaf veins are obscure and margins are serrated.

Observations: This sterile hybrid establishes quickly by stolons and rhizomes, grows vigorously and spreads aggressively. The stems had very little lignification thus producing a higher feeding value forage as it contains more protein and requires less energy for consumption. The parent plant seed spikes measured 3.5 cm-8.5 cm in length and had 6-7 seed stems in a "star shaped" whorl.

Seed produced is very soft, ovoid shaped and light tan (2.5Y 6/4) with a darker tan (2.5Y 5/2) line at the base. The majority of the seeds are not intact and their edges are feathered. Seeds range in size from 33.25 mm-4.50 mm in length by 1 mm in width.

Grass grew approximately 15-16 inches over a 5-day period in the spring.

Cold tolerant.—Survived Texas and Oklahoma winters; further testing in Nebraska and Iowa.

Salt tolerant.—'Macho World Feeder' has survived 30,000 parts per million salt through two cutting cycles.

The grass is medium rich emerald green (5G 7/6) at the lower surface and lighter emerald green (7.5GY 4/4) (taking a very slight yellowish tinge) at the upper portion. Many of the blades observed had a purplish (5RP 4/2) hue at the stem base, the lower 3-6 cm, which indicates good nitrogen content.

The culms observed ranged 85.5 cm-92.1 cm in length from tip of the seed star stem to the very end tip of the longest root. The widest part of the culms was the rhizomes which measurements ranged from 16.5 cm-18 cm in width. The grass stems measured 54.5 cm-60 cm in length and the rhizomes 31.0-32.5 cm in length. The leaf blades were 1.8 mm-2.0 mm in width and the rhizomes lateral shoots measured 16.5 cm-18 cm in width. The color was the same as observed in the field.

Feed values:

At premium harvest age, protein levels of 26.8% have been obtained. A sample taken 10 days later measured 22.4% protein and a sample that was allowed to head out still measured 22% protein. Total digestible nutrients (TDN) measured from 68.6% to 72.6% and acid detergent fiber (ADF) measured from 26.3% to 29.8%.

One plot was allowed to grow uncut from early March to July 10. The protein was still 10.8%, ADF 38.7% and TDN 58.4%.

Comparison with parental cultivar:

'Macho World Feeder' grows approximately 300-400% faster than 'World Feeder' Bermuda grass (U.S. Plant Pat. No. 7,081). The leaf blades and stolons are much larger than 'World Feeder'. Additionally, 'Macho World Feeder' has a higher protein percent over 'World Feeder' Bermuda Grass.

When 'Macho World Feeder' is compared to coastal Bermuda, 'Macho World Feeder' is higher in quality, richer green in color, established quicker, had a sturdier root system and the seed spikes were longer and had more seed stems in each whorl.

Plant disease—drought resistance:

'Macho World Feeder' is very drought resistant and can tolerate long periods of flooding. This grass enters dormancy when temperatures drop below 45° F. (7.28° C.) and recovers quickly when temperatures begin to rise.

No plant diseases have been observed. The grass is susceptible to armyworms and grasshoppers.

CLASSIFICATIONS

U.S. Classification	PLT/389
International Classification	A01H5/12
Cooperative Classification	A01H5/12
European Classification	A01H5/12

LEGAL EVENTS

Date	Code	Event	Description
Feb 5, 2002	AS	Assignment	**Owner name:** DAVGOR, LIMITED, TEXAS **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAVIDSON, JR., DAVID C.;REEL/FRAME:012561/0607 **Effective date:** 20020129 **Owner name:** DAVGOR, LIMITED 1287 W FM476 ORGANIZED UNDER THE L **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAVIDSON, JR., DAVID C. /AR;REEL/FRAME:012561/0607 **Owner name:** DAVGOR, LIMITED 1287 W FM476 ORGANIZED UNDER THE L **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAVIDSON, JR., DAVID C. /AR;REEL/FRAME:012561/0607 **Effective date:** 20020129

Gordon's Gift bermuda grass

US PP7073 P

Publication number	USPP7073 P
Publication type	Grant
Application number	US 07/280,228
Publication date	Dec 12, 1989
Filing date	Dec 5, 1988
Priority date	Dec 5, 1988
Inventors	Louis R. Gordon
Export Citation	BiBTeX, EndNote, RefMan

Referenced by (1), Classifications (2)

External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

A variety of Bermuda grass, called Gordon's Gift, having all the desirable traits of Alicia Bermuda grass plus excellent cold hardiness.

IMAGES (1)

DESCRIPTION

Gordon's Gift Bermuda grass is a mutant developed through selection on my acreage in Bethany, Okla. It comes from a planting in 1973 of Alicia Bermuda grass and has all of the good qualities of Alicia. However, the drawback of Alicia was that it was not winter hardy in colder climates. The major difference is that Gordon's Gift Bermuda grass has proven winter hardy. It also differs from Alicia and World Feeder Bermuda grass by having shorter runners, which are larger in diameter, broader leaves, lower protein and twice as much fiber. It has thrived in the face of severe winters, where there were days on end of -5 to +10 degrees Fahrenheit with wind chill factors of -20 to -30 degrees. No winter kill has been evidenced during this time.

The Gordon's Gift Bermuda grass is a fast growing, hybrid Bermuda grass, averaging knee high in summer, growing approximately 1 inch per day in warm weather, has a deep penetrating root system, and is tender and succulent for pasture grazing and hay. The crude protein averages around 15% plus, with digestible protein approximately 75%. Tests show the crude fiber to be 33% and the fat 2.5%. It has great drought resistant qualities due to the deep root system and has a sweet taste. It retains 50% of its greenness even after a killing frost (November 1st in Oklahoma) and stays relatively green until late December. Emergence begins in April and by June 1 is in full growth.

GORDON'S GIFT BERMUDA GRASS

`Gordon's Gift` Bermuda grass, Cynodon dactylon var. aridus (seems to be the same variety as Alicia) is a stoloniferous sward-forming perennial with sparse long, slender, deeply penetrating rhizomes; surface stolons slender and very fast spreading, sometimes reaching lengths of 5-6 meters; culms slender, 8-40 cm. high and 1.5-2 mm. in diameter. Leaf-blades flat, or folded when dry, often short and narrow, 1-12 cm. long and 3-6 mm. wide, glaucous, scaberulous, with or without scattered hairs; ligule a membranous rim 0.2-0.3 mm. long, ciliate on the edge. Inflorescences frequent with 4-7 racemes usually 5-7 cm. long, in a single whorl. Spikelets 2-2.75 mm. long; glumes lanceolate in side view, 1-nerved, the upper 1/2-3/4 as long as the spikelet; lemma silky pubescent on the keel; palea glabrous. Growth habit results in production of a very loose mat rather than a turf.

CLAIMS (1)

I claim:

1. A new variety of Bermuda grass as shown and described in this application.

REFERENCED BY

Citing Patent	Filing date	Publication date	Applicant	Title
USPP11898	Jul 24, 1998	Jun 5, 2001	Kidwell Organics, Inc.	Bermudagrass named '90NB-Kid'

CLASSIFICATIONS

U.S. Classification	PLT/389

International Classification	A01H5/00

Bermudagrass named '90NB-Kid'

US PP11898 P2

Publication number	USPP11898 P2
Publication type	Grant
Application number	US 09/121,850
Publication date	Jun 5, 2001
Filing date	Jul 24, 1998
Priority date	Jul 24, 1998
Inventors	Jack Kidwell
Original Assignee	Kidwell Organics, Inc.
Export Citation	BiBTeX, EndNote, RefMan

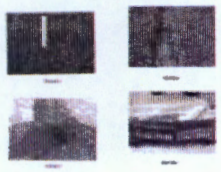
Patent Citations (9), Classifications (4), Legal Events (1)

External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

An asexually reproduced variety of bermudagrass with a unique combination of characters including excellent turf performance, aggressive growth, early green up ability, and excellent cold tolerance.

IMAGES (2)



DESCRIPTION

BACKGROUND OF THE INVENTION

90NB-Kid is a new and distinctly different variety of bermudagrass (*Cynodon dactylon*) (*SUBFAMILY Eragrostoid, tribe Chloridene). It was discovered near a heavily traveled sidewalk intersection on a college campus adjacent to an athletic field in Annapolis (Anne Arundel County), Md. 90NB-Kid was initially recognized and noted because it had naturalized and was thriving under heavy traffic in the extreme northern part of the transition zone (therefore, the range of bermudagrass adaptability).

A very small initial amount of the 90NB-Kid plant material was asexually propagated at a research and development farm near Baskerville (Mecklenburg County), Va. This was done by cutting stolons and rhizomes, rooting these in soil and planting the rooted cuttings to provide stock for studying performance and for comparisons with existing commercial and experimental varieties of bermudagrass. 90NB-Kid retained both performance and morphological characteristics after this propagation and after repeated repropagation prior to DNA testing.

BRIEF SUMMARY OF THE INVENTION

90NB-Kid is distinguished from other varieties of bermudagrass by the combination of excellent turf performance, particularly in resistance to disease and in recovery from intense traffic and compaction. The plant also exhibits aggressive growth, early green up ability, and excellent cold tolerance.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a color photograph of a patch of the bermudagrass of the invention at a growth height of about one inch.

FIG. 2 is a color photograph of the bermudagrass of the invention showing its reproductive parts and some root structure.

FIG. 3 is a color photograph of the bermudagrass of the invention showing its aggressive growth.

FIG. 4 is a color photograph of a cross section of the bermudagrass of the invention compared to a cross section of Tifway 419.

DESCRIPTION OF THE INVENTION

CLAIMS (1)

What is claimed:

1. A new and distinct variety of bermudagrass plant, substantially as herein shown and described, characterized particularly as to novelty by excellent turf performance, especially traffic and compaction resistance and recovery, excellent color and turf density, aggressive growth, early green up ability, and excellent cold tolerance.

90NB-Kid is a new and distinct variety of bermudagrass (*Cynodon dactylon*). The 90NB-Kid variety has been included in the Turfgrass Evaluation Program Trials at the Virginia Polytechnic Institute and State University Turfgrass Research Center in Blacksburg, Va. and at the North Carolina State University Turfgrass Field Laboratory in Raleigh, N.C. where it was favorably rated for winter hardiness, along with other commercial and experimental bermudagrass varieties. In a freeze study, 90NB-Kid was rated in the highest statistical grouping using Duncan's range test, and it was also rated above the Virginia Polytechnic Institute and State University's release, "Vamont", which is considered to be a freeze tolerant bermudagrass.

During extensive observations and studies at the research and development farm at Baskerville, Va., 90NB-Kid has commenced green up seven (7) to ten (10) days earlier than the other commercially propagated bermudagrass on the site. This was regardless of weather conditions and under comparable cultural practices. Typically, this occurs on or about March 25th at this location. However, the early green up did not subject the 90NB-Kid to late freeze damage.

This vigorous northern bermudagrass variety is easily transplanted by stolons or by sod and develops rapidly. Under proper mowing and fertility regimes, coverage from a planting demonstrates that the stolons spread laterally at a rate of 1.8 cm per day, which is also to say that 18 cuttings (sprigs) per square foot reach 90-100 percent ground cover in 45 days. 90 NB reliably produces a commercial sod, that when conventionally lifted is capable of not tearing apart when the strip is supported by ten (10%) percent of its length. It has a pleasing blue-green color, a medium fine texture, is very aggressive in its growth, has excellent resistance to and recovery from intense traffic and compaction, along with excellent cold temperature tolerance. The Turf Research Center, VPI & SU, Blacksburg, Va., conducted freeze studies during 1997 on 90NB-Kid and GN-1 bermudagrass cultivars, using a freeze chamber designed for this purpose. This process is conducted using washed grass materials (no soils), therefore, the temperature readings do not related to ambient temperatures, but rather to actual soil temperatures. GN-1 suffered damage (the ability to regrow normally) at +22 degrees Fahrenheit. When subjected to +18 degrees Fahrenheit, complete loss occurred. 90NB-Kid was subjected to +15 degrees Fahrenheit without injury (somewhat less than "Vamont" bermudagrass), and at +14 degrees Fahrenheit noticeable injury was observed, meaning the threshold for cold hardiness was between +15 degrees and +16 degrees Fahrenheit.

Salt tolerance is good and shade tolerance is average being somewhat better than many other bermudagrass varieties. Over a period of nine (9) years of observation, 90NB-Kid has not been seen to be susceptible to any disease or insect organisms. The fungus "dollar spot" (*Sclerotinia homeocarpa*) has been observed on the plants without causing any pathological symptoms. Under current management practices no significant thatch development has been evident even without clipping removal or cultivation. Overall, this new variety has excellent turf quality characteristics and a high degree of aggressiveness exceeding those of other cold tolerant bermudagrasses. This favorable combination has proven to be ideal for use on athletic fields of all types. To date, 90NB-Kid has been demonstrated on soccer and football fields as far north as Pennsylvania, and as far south as Florida with very favorable results in overall performance and durability.

The pleasing bluish-green color and texture can be seen in FIG. 1, and the vigor of the growth can be seen in FIG. 3 where the stolons between two patches of 90NB-Kid bermudagrass represent only ten (10) day's growth. This aggressive growth is remarkable. In a nineteen (19)-day wear-recovery test, the highly regarded Vamont received a high 4.0 rating, while the grass of the invention received an even higher 4.3 rating. Similarly, 90NB-Kid received one of the highest wear tolerance ratings; and, its four (4)-day recovery was even more favorable than Vamont. This, therefore, is a major reason why 90NB-Kid is particularly suited for athletic fields.

FIG. 4 shows a comparison between sod pieces of 90NB-Kid and the well-textured Tifway 419. The 90NB-Kid (on the left) is slightly coarser, but the texture of the 90NB-Kid permits it to withstand more traffic, and it recovers from wear almost twice as fast. FIG. 4 shows that 90NB-Kid has deep rhizomes, which may contribute to its cold hardiness. Also, its rhizomes and stolons are shown to be of a robust nature which accounts for its outstanding wear recovery.

DETAILED BOTANICAL DESCRIPTION

Parentage: Unknown (a natural mutation).

Propagation: Vegetative (asexual) by means of planting chopped stolons and rhizomes.

Growth habit: A low-growing warm season stoloniferous rhizomatous perennial grass forming a dense sod. Rhizomes are found at a depth of greater than 5 cm., allowing rapid regrowth and recovery from thick sod harvesting (3.75-4 cm.). Stolons and rhizomes branch from the nodes.

Average node diameter.—1.6 mm.

Average internode diameter.—1.0 mm.

Average internode length.—1.8 cm.

Leaf blade: Glabrous, folded in the bud shoot, 2.2-3.5 cm in length, 1.75-2.1 mm in width with parallel venation visible under low magnification (10×), tapers toward the tip to an acute point. Slightly variable with fertility and micro-fertility regimes.

Sheath: Open, shorter than the internode.

Ligule: A whitish fringe of hairs 1mm in length.

Collar: Narrow and continuous, constricted at the mid vein.

Auricle: Absent.

Inflorescence: Sparsely produced; not produced at typical athletic turf mowing heights of 1.25-3.75 cm. When produced, 4 to 5 digitate spikelets bearing seeds found to be of very low number and viability such as to be incompatible with commercial sod production.

Unmowed height: 15 cm.

Colors of Plant Parts as Compared to the Pantone® Book of Color, L. Eiseman & L. Herbert, Harry N. Abrams, Inc. Publishers, NY, NY @ 1990:

Area of 90NB-Kid	Pantone Color	Description
Leaf Surface	Chive	
Leaf underside	Black Forest	
Rhizome	Brown	
Stolon Sheath	Grasshopper striated with Pale Star	
Culm	Peridot	
Spikelet	Chive	3 each 21 mm long, 10 mm diameter, total seed head 50 mm tall
Ligule	Frozen Dew	Fringe of hairs
Collar	Frozen Dew	Narrow band restricted centrally
Anthers	Dawn Pink	
Stigmas	Black Forest	
Lemmas	Cidrada	
Node	Moth	
Internode	Murmur	

Rooting: As 90NB-Kid is vegatively propagated the roots arise from nodes of both stolons and rhizomes (nodal or adventitious roots), which are in the ground contact. Thus, the entire root system can be characterized as adventitious roots that develop further along laterally and tend to become rudimentary unless the stolon or rhizome is severed. In this case the rudimentary roots rapidly develop to support the severed portion of the plant. This is the reason that the variety is so easily vegetatively reproduced.

PATENT CITATIONS

Cited Patent	Filing date	Publication date	Applicant	Title
USPP7073	Dec 5, 1988	Dec 12, 1989		Gordon's Gift bermuda grass
USPP7081	Dec 5, 1988	Dec 19, 1989		World feeder Bermuda grass
USPP8963	Jun 25, 1993	Oct 25, 1994	Vaughn; Terrell	Bermuda grass `Vaughn's #1`
USPP9888	Oct 4, 1995	May 6, 1997	Brown Richard M	Champion dwarf hybrid Bermudagrass
USPP9976	Jul 26, 1995	Jul 22, 1997	Porter; William Emme	Bermudagrass plant TDS-BM1
USPP10079	Apr 19, 1996	Oct 21, 1997	The United States Of America As Represented By The Secretary Of Agriculture	`Tift 94` Bermudagrass
USPP10289	Jan 4, 1996	Mar 17, 1998	Mississippi State University	`MS-Express` Bermudagrass
USPP10290	Jan 4, 1996	Mar 17, 1998	Mississippi State University	`MS-Pride` Bermudagrass
USPP10332	Jan 4, 1996	Apr 14, 1998	Mississippi State University	`MS-Choice` bermudagrass

CLASSIFICATIONS

U.S. Classification	PLT/389

International Classification	A01H5/12
Cooperative Classification	A01H5/12
European Classification	A01H5/12

LEGAL EVENTS

Date	Code	Event	Description
Aug 7, 1998	AS	Assignment	**Owner name:** KIDWELL ORGANICS, INC., VIRGINIA **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:KIDWELL, JACK L.;REEL/FRAME:009376/0035 **Effective date:** 19980721