USDA Forest Service, Region 1
Native Grass and Forb Initial Evaluation
2003-2005
Preliminary Report (July 20, 2004)
Derek J. Tilley, Range Conservationist (Plants)
Loren St. John, Team Leader Aberdeen Plant Materials Center

INTRODUCTION

The purpose of this study is to evaluate native perennial grass and forb collections for use in revegetation and beautification projects in the Rocky Mountain and sagebrush steppe ecosystems of Montana and Northern Idaho. Large areas of national forest are in unsatisfactory ecological condition. Many areas are infested with invasive weeds such as cheatgrass, knapweed species, yellow starthistle, and leafy spurge. These weeds cause many problems and detract from the health and beauty of the ecosystem. When dry, the weeds provide flash fuels for fires. Increased fires create the potential for erosion and degradation of water quality and watershed values. Weeds also decrease plant community diversity, reduce habitat for wildlife and compete with threatened and endangered species.

In 2003, FS R1 collected forty one accessions of five native perennial grass species and eleven accessions of three native forb species which were sent to the USDA-Natural Resources Conservation Service-Plant Materials Center at Aberdeen, Idaho for evaluation. Of these, 37 grass and ten forb collections were chosen for testing based on seed quality and/or quantity. Total usable collections included: twelve bluebunch wheatgrass (*Pseudoroegneria spicata*), seven blue wildrye (*Elymus glaucus*), thirteen Idaho fescue (*Festuca idahoensis*), one Sandberg bluegrass (*Poa secunda*), three tufted hairgrass (*Deschampsia caespitosa*), eight common yarrow (*Achillea millefolium*), one lupine (*Lupinus* sp.) and one pearly everlasting (*Anaphalis margaritacea*). Appendix 1 lists the accessions collected, the size of each collection and collection location. This is a preliminary report of evaluations conducted in June and July, 2004.

MATERIALS AND METHODS

Harvested plant materials were cleaned at the PMC seed cleaning facilities using a wide range of machines and settings. Each accession was treated separately due to differences in the quality of pre-cleaned materials and variation in seed size. Appendix 2 provides general information regarding machine calibration and settings used for species. Adjustments will have to be made to achieve best seed purity results. Estimated viability was obtained using the kerosene heater “popping” method outlined in Ogle and Cornforth (2000). Some collections were also evaluated for viability using standard germination tests.

A seedling emergence trial was conducted in the greenhouse at the Aberdeen Plant Materials Center from February to March, 2004. The goal of this study was to determine if any accessions emerged quicker or had better seedling vigor than others. No significant differences were detected (data not shown).

The native grass field trial is being conducted at the Aberdeen Plant Materials Center, Fish and Game farm located approximately 5 miles northeast of Aberdeen, Idaho. Experimental design was a randomized complete block with four replications. Individual plots were 20 feet long and contained one row; rows were planted on three foot centers. Experimental design also contained plots of known industry standards from each species for comparison. Soil at the site is a Delco silt loam with pH of 7.4 to 8.4. Average annual precipitation is 8.75 inches. Ground was plowed in the fall of 2003 and subsequently disked and roller packed in the spring prior to planting.

Plots were seeded on May 10 and 11, 2004. Bluebunch wheatgrass and Idaho fescue were planted using a Planet Jr., while Blue wildrye, Sandberg bluegrass and tufted hairgrass were planted using a belt seeder. Planters were calibrated to plant approximately 25 Pure Live Seeds (PLS) per foot of row for large seeded species (bluebunch wheatgrass and blue wildrye) and 50 PLS per foot of row for small seeded species (Idaho fescue, Sandberg bluegrass and tufted hairgrass). Each species block contained at least two released cultivars to use as standards for comparison. Border rows of 'Tegmar' intermediate wheatgrass (*Thinopyrum intermedium*) were planted on the outside of the blocks to eliminate edge effect. Plots were sprinkler irrigated as needed throughout the growing season. Weeds were controlled with herbicide treatments and between row cultivating.

The first evaluation was conducted on June 14, 2004 when all species had reached a one to two leaf stage. Plots were evaluated for percent stand, plant density and seedling vigor. Percent stand was measured using a twenty foot rope marked with one foot increments stretched the length of the plot and anchored at either end. Plants intercepting the one foot increments are summed and recorded as a percentage. Plant density was measured by counting seedlings found in the middle two feet of row and converted to average plants per foot of row. Seedling vigor is measured on an ordinal scale of one to nine (one being most healthy and nine being dead). Entire plots were viewed and given a rating based on overall apparent vigor. Data from percent stand and plant density was analyzed for Analysis of Variance (ANOVA) and means were separated using Duncan's Multiple Range Test.

The native forb trial was planted on May 19, 2004 at the Aberdeen Plant Materials Center Home Farm approximately two miles north of Aberdeen. Site information, bed preparation and experimental design are identical to the grass trial. There are two industry standards included in the common yarrow plots, Eagle and Great Northern. There are no releases of lupine or pearly everlasting that would be comparable to our material. Yarrow plots were seeded with a target rate of 50 PLS per foot using a belt seeder. Lupine plots were seeded at 25 PLS per foot, and pearly everlasting plots were seeded at 50 PLS per foot using a Planet Jr. A border row of 'Appar' blue flax (*Linum perenne*) was planted on

either side of the trial to reduce edge effect. First evaluation was conducted on July 19, 2004. Plants ranged from two to six leaf stage. Forb plots were evaluated in the same manner as the grass plots.

2004 EVALUATIONS AND DISCUSSION (PRELIMINARY)

Evaluation of blue wildrye showed no significant differences in percent stand. Plant density showed low levels of significance. Accession 9076447 rated highest (39.0%), and Elkton rated lowest at 16.4%. Best vigor was recorded in accessions 9076446, 9076447 and Mariposa (1.8). Poorest vigor rated was 3.8 from 'Arlington' (see Table 1).

One collection of Sandberg bluegrass was compared against four industry releases (Table 2). Evaluations showed high levels of significance in all three categories solely due to the fact that accession 9076465 performed so poorly. Percent stand: worst accession 9076465 (26.5) best Mountain Home Source (95.5). Plant density: worst accession 9076465 (2.4) best Mountain Home (36.8). Seedling vigor: worst accession 9076465 (8.3) best Hanford Source (2.5).

Idaho fescue evaluations showed high significant differences in both rated categories. Accessions 9076469 and 9076437 had the highest percent stand at 75.0%. Industry standard Winchester Source ranked only slightly lower at 73.8% stand (see Table 3). The lowest rating came from accession 9076444 at 16.8%. Accession 9076473 had the highest plant density at 11 plants/foot of row. Lowest density was observed in accession 9076444 with an average 1.8 plants/foot. Best seedling vigor was observed in Winchester (2.8), while accession 9076444 showed the poorest vigor (7.8).

Bluebunch wheatgrass evaluations showed numerous collections outperforming industry standards (Table 4). Accession 9076436 ranked highest for percent stand at 81.8%. Plant density and seedling vigor comparisons showed accession 9076433 on top with 14.38 plants/foot of row and a 2.5 rating for vigor. Accession 9076463 ranked lowest in all three evaluations (27.8 % stand, 2.5 plants/foot and a vigor rating of 7.0).

Percent stand of 'Willamette' tufted hairgrass were significantly higher than all other accessions (86.0%). Lowest percent stand was observed in accession 9076435 (53.0%). Accession 9076429 had the best seedling vigor rating of 4.8, while accession 9076435 showed the lowest vigor (7.8). Plant density showed no significant differences (see Table 5).

Yarrow plots failed to show significant differences in percent stand, plant density or seedling vigor. Trends, however, show accession 9076460 first in all but one category, seedling vigor, where it placed second. Lupine and pearly everlasting plots had essentially no germination (data not shown).

This is a preliminary report of evaluations conducted in June and July, 2004. The trial will be evaluated again in late September, and a report summarizing the evaluations conducted during 2004 will be prepared.

REFERENCES

Ogle, D., and B. Cornforth. 2000. Technical Note 35: A Quick Method to Estimate Germination Percentages for Seed Species. USDA-NRCS, Boise, ID. ID-TN35, Mar. 2000. 3p. (9 KB) (ID# 2250)

TABLES

Table 1. Blue wildrye

Accession No.	% Est. viability	% PLS[3/]	% stand 6/14	Density[1/] 6/14	Vigor[2/] 6/14
9076439	79	71.1	92.8[4/]	38.1 a-b[5/]	2.3
9076445	77	69.3	91.5	30.1 a-c	2.8
9076446	80	72	91.5	22.8 b-c	1.8
9076447	72	64.8	93.0	39.0 a	1.8
9076448	66	59.4	72.3	22.6 b-c	3.3
9076449	69	62.1	95.8	36.6 a-b	2.0
9076472	82	73.8	87.5	26.0 a-c	3.0
Mariposa	*	94	95.8	28.4 a-c	1.8
Arlington	*	93	91.5	31.5 a-c	3.8
Elkton	*	92	95.5	16.4 c	3.5
LSD (0.05)			22.1	13.7	1.8

[1/] Plants per foot of row
[2/] Rated 1-9 with 1 best, 9 worst; not analyzed for significance
[3/] Percent PLS of USFS R1 collections based on estimated 90% purity
[4/] No significant difference detected between accessions
[5/] Means followed by the same letter are not significantly different
* Data not available from source

Table 2. Sandberg bluegrass

Accession No.	% Est. viability	% PLS	% stand 6/14	Density 6/14	Vigor 6/14
9076465	40	36	26.5 b	2.4 b	8.3
Sherman	80	75.8	84.8 a	29.1 a	2.5
High Plains	84	75.6	80.8 a	24.6 a	4.0
Hanford	88	85.0	91.5 a	27.5 a	6.0
Mtn. Home	76	74.3	95.5 a	36.8 a	5.0
LSD (0.05)			16.8	12.3	1.2

Table 3. Idaho fescue

Accession No.	% Est. viability	% PLS	% stand 6/14	Density 6/14	Vigor 6/14
9076473	58	52.2	62.5 a-b	11.0 a	3.8
9076431	61	54.9	37.8 c-e	2.5 b	6.5
9076432	76	68.4	50.0 b-c	6.1 a-b	6.0
9076437	61	54.9	75.0 a	7.4 a-b	4.5
9076438	80	72.0	72.3 a	7.4 a-b	5.8
9076443	45	40.5	68.3 a-b	10.5 a	5.0
9076444	13	11.7	16.8 e	1.8 b	7.8
9076453	50	45	69.5 a-b	7.6 a-b	5.5
9076462	30	27	34.8 c-e	2.3 b	6.8
9076467	71	63.9	48.5 b-d	5.1 a-b	6.3
9076469	68	61.2	75.0 a	10.4 a	3.5
9076471	67	60.3	27.8 d-e	3.9 b	6.5
9076427	45	40.5	54.3 a-c	7.3 a-b	5.5
Joseph	*	*	52.8 a-c	5.6 a-b	5.0
Winchester	*	*	73.8 a	9.9 a	2.8
Nezpurs	*	*	37.3 c-e	1.9 b	7.0
LSD (0.05)			19.3	5.0	1.9

Table 4. Bluebunch wheatgrass

Accession No.	% Est. viability	% PLS	% stand 6/14	Density 6/14	Vigor 6/14
9076426	76	68.4	70.8 a-c	9.9 a-b	3.0
9076428	56	50.4	49.8 c	5.8 b-c	5.0
9076433	75	67.5	77.8 a-b	14.4 a	2.5
9076434	69	62.1	61.3 a-c	7.9 b-c	4.0
9076436	69	62.1	81.8 a	8.1 b-c	3.3
9076441	56	50.4	69.5 a-c	6.8 b-c	4.0
9076442	86	77.4	70.8 a-c	7.3 b-c	3.0
9076450	73	65.7	57.0 b-c	6.8 b-c	3.8
9076463	58	52.2	27.8 d	2.5 c	7.0
9076464	65	58.5	64.0 a-c	10.8 a-b	3.0
9076466	64	57.6	66.5 a-c	11.4 a-b	2.8
Goldar	79	81.5	66.8 a-c	8.0 b-c	2.5
Anatone	87	85.4	51.5 c	5.8 b-c	3.5
P-7	85	81.1	66.8 a-c	5.5 b-c	3.0
LSD (0.05)			20.6	5.3	1.9

Table 5. Tufted hairgrass

Accession No.	% Est. viability	% PLS	% stand 6/14	Density 6/14	Vigor 6/14
9076429	49	44.1	68.0 b	19.0[1/]	4.8
9076430	52	46.8	62.8 b-c	17.8	6.5
9076435	55	49.5	53.0 c	6.1	7.8
Willamette	*	81	86.0 a	23.0	5.3
Tillamook	*	81	69.8 b	21.8	5.5
LSD (0.05)			11.6	11.6	1.5

[1/] No significant difference detected between accessions

Table 6. Common yarrow

Accession No.	% Est. viability	% PLS	% stand 7/16	Density 7/16	Vigor 7/16
9076454	84	75.6	37.5[1/]	2.4[1/]	4.8
9076456	73	65.7	32.0	1.5	6.0
9076457	86	77.4	32.0	0.3	5.5
9076458	80	72.0	59.7	2.8	3.8
9076459	91	81.9	47.2	1.3	4.0
9076460	67	60.3	75.0	3.1	3.5
9076474	37	33.3	45.9	2.9	5.8
9076475	71	63.9	45.9	3.0	4.5
Great Northern	93	71.6	45.9	2.3	2.8
Eagle	*	*	33.3	0.5	5.5
LSD (0.05)			33.6	3.3	3.2

[1/] No significant difference detected between accessions

Appendix 1. Collection data

Accession No.	Species	Date collected	Fresh wt. (lbs)	Cleaned wt. (lbs)	Forest	Location	Elevation (ft)
9076426	Bluebunch wheatgrass	7/17/2003	6	2.34	Lolo	N 46 51 38.6 W 114 10 18.4	4300
9076427	Idaho fescue	8/1/2003	1.5	0.22	Helena	N 46 28 20 W 111 54 42	5700
9076428	Bluebunch wheatgrass	8/1/2003	1.7	0.40	Helena	N 46 28 20 W 111 54 42	5700
9076429	Tufted hairgrass	8/6/2003	0.2	0.04	Lolo	N 46 42 31.3 W 114 35 31.6	4480
9076430	Tufted hairgrass	8/6/2003	0.6	0.12	Lolo	N 46 42 23.9 W 114 35 37.3	4480
9076431	Idaho fescue	7/22/2003	1.4	0.88	Beaver-Deer	N 45 51 15 W 112 22 08	7200
9076432	Idaho fescue	7/22/2003	1.3	1.02	Beaver-Deer	N45 51 27.3 W 112 28 48.2	6300
9076433	Bluebunch wheatgrass	8/6/2003	28	1.64	Beaver-Deer	N 45 42 47.7 W 112 35 10.3	7600
9076434	Bluebunch wheatgrass	8/12/2003	5.5	0.20	Beaver-Deer	N 45 42 47.7 W 112 35 10.3	7600
9076435	Tufted hairgrass	8/18/2003	4	0.60	Beaver-Deer	N 46 09 0.08 W 112 28 0.499	6400
9076436	Bluebunch wheatgrass	7/29/2003	7	1.00	Beaver-Deer	N45 2.247 46 W 111 56.904 08	6300
9076437	Idaho fescue	7/31/2003	9	2.40	Beaver-Deer	N45 7.332 36 W 111 51.832 43	8200
9076438	Idaho fescue	7/31/2003	3	0.94	Beaver-Deer	N 44 58.982 92 W 111 55.523 57	7500
9076439	Blue wildrye	8/20/2003	3.3	2.42	St. Joe Dist.	T43NR5E section 21	4600
9076440	Bluebunch wheatgrass	8/2/2003	0.8	0.12	Beaver-Deer	T7NR14W section 4 SW	5550
9076441	Bluebunch wheatgrass	7/25/2003	1.4	0.40	Beaver-Deer	T8NR14W section32-33 S	5850
9076442	Bluebunch wheatgrass	8/4/2003	1.1	0.44	Beaver-Deer	T5NR14W section 22 NW	6760
9076443	Idaho fescue	8/1/2003	1.3	0.40	Beaver-Deer	T4NR15W section 10	6460
9076444	Idaho fescue	7/29/2003	0.4	0.12	Beaver-Deer	T 7NR14W section 4	5890
9076445	Blue wildrye	8/21/2003	0.5	0.28	Flathead	T26NR22W section 26	5130
9076446	Blue wildrye	8/18/2003	2.1	0.78	Flathead	T29NR17W section 28,33,34	4500
9076447	Blue wildrye	8/19/2003	0.7	0.36	Flathead	T32NR25W section 22	5250
9076448	Blue wildrye	8/13/2003	1.4	0.46	Flathead	T30NR18W section 23	?
9076449	Blue wildrye	8/13/2003	1.9	0.95	Flathead	T29NR17W section 34	4600
9076450	Bluebunch wheatgrass	8/21/2003	0.4	0.22	Flathead	T26NR21W section 33	5000
9076451	Bluebunch wheatgrass	8/25/2003	0.1	0.03	Flathead	T26NR22W section 29	5700
9076452	Bluebunch wheatgrass	8/21/2003	0.3	0.08	Flathead	T26NR21W section 33	4980
9076453	Idaho fescue	8/25/2003	0.3	0.08	Flathead	T26NR22W section 29	5700
9076454	Common yarrow	8/21/2003	0.2	0.02	Flathead	T26NR22W section 15	4300
9076455	Common yarrow	8/13/2003	trace	trace	Flathead	T30NR18W section 23	3800
9076456	Common yarrow	8/21/2003	0.5	0.04	Flathead	T26NR21W section 33	4980
9076457	Common yarrow	9/4/2003	0.7	0.08	Flathead	T33NR21W section 26	4000
9076458	Common yarrow	8/20/2003	1.4	0.20	Flathead	T26NR21W section 29	?

9076459	Common yarrow	9/4/2003	2.5	0.86	Bitterroot	T2NR20W section 2,10,11	5600
9076460	Common yarrow	9/22/2003	0.5	0.38	Lolo	N46 42 14.7 W114 35 56.8	4500
9076461	Pearly everlasting	9/23/2003	1.8	0.03	Lolo	N46 41 48.5 W114 36 10.5	4600
9076462	Idaho fescue	7/24/2003	0.4	0.20	Bitterroot	T2NR20W section 11	5600
9076463	Bluebunch wheatgrass	7/24/2003	1.8	0.54	Bitterroot	T2NR20W section 2	5700
9076464	Bluebunch wheatgrass	7/14/2003	17.5	1.86	Gallatin	N45 40 08.32279 W1100026.177	5500
9076465	Sandberg bluegrass	7/15/2003	7	1.58	Gallatin	N45 58 43.57899 W1110012.792	6700
9076466	Bluebunch wheatgrass	7/30/2003	17	1.88	Gallatin	N452733.66724 W1104630.334	7200
9076467	Idaho fescue	7/30/2003	19	5.25	Gallatin	N452743.68577 W1104630.334	7400
9076468	Bluebunch wheatgrass	7/31/2003	9.5	0.00	Gallatin	N444430. W1110954	6570
9076469	Idaho fescue	8/4/2003	12.5	3.92	Gallatin	N454842. W1104642.	7200
9076470	Lupine	8/4/2003	9.5	1.08	Gallatin	N454842. W1104642.	7600
9076471	Idaho fescue	7/16/2003	17.5	3.00	Gallatin	N45 58 06. W110 57 24.	6400
9076472	Blue wildrye	8/1/2003	4.5	3.08	ID Panhandle	T45NR2W sec. 26	2800
9076473	Idaho fescue	7/25/2003	1	0.46	ID Panhandle	T48NR3W section 12	2400
9076474	Common yarrow	7/15/2003	15	0.98	Custer	T25NR46E section 19	4000
9076475	Common yarrow	9/5/2003	2.1	0.12	ID Panhandle	T19N R4E section 15	5200

Appendix 2. Seed cleaning calibrations

Blue Wildrye (*Elymus glaucus*)

1. Thrashing
    A. 3/8” screen followed by ¼” screen
2. Air screen cleaner
    A. screens
        1. top-4.350
        2. middle-3.550
        3. bottom-6 X 32
    B. valves
        1. 2.25
        2. 4.75
        3. 1.60
        4. intake-closed
    C. adjustments
        1. blower speed-4.4
        2. sieve boat-10
3. Debearder
    A. adjustments
        1. brush speed-10
        2. vacuum-on
4. Gravity table
    A. adjustments
        1. sieve boat-10
        2. blower speed-5
            i. valve-2.5
    B. table angle
        1. slope-1.0
        2. pitch-0.5

Bluebunch Wheatgrass (*Pseudoroegneria spicata*)

1. Thrashing
    A. #14 screen
    B. 3/8” screen top and ¼” screen bottom
2. Clipper
    A. screens
        1. 6-24
        2. #12
3. Air screen cleaner
    A. screens
        1. top-3.95 round
        2. middle-3.150 round
        3. bottom-6 X 24 slit
    B. valves
        1. 2.5
        2. 5.3
        3. 2.5
        4. intake-closed
    C. adjustments
        1. blower speed-6
        2. sieve boat-10
4. Indent cleaner
    A. spool-7.5
    B. adjustments
        1. catchpan-4.0
        2, sieve speed-10
5. Debearder
    A. adjustments
        1. brush speed-10
        2. gate-1.5
4. Gravity table
    A. adjustments
        1. sieve boat-10
        2. blower speed-8
            i. valve-3.0
    B. table angle
        1. slope-1.0
        2. pitch-0.5

Idaho Fescue (*Festuca idahoensis*)

1. Thrashing
    A. 3/8” screen
2. Clipper
    A. screens
        1. #12 top
3. Air screen cleaner
    A. screens
        1. top-3.750 round
        2. middle-2.350 round
        3. bottom-solid blank
    B. valves
        1. 2.1
        2. 5.25
        3. 2.5
        4. intake-closed
    C. adjustments
        1. blower speed-4.5
        2. sieve boat-10

Sandberg Bluegrass (*Poa secunda*) and Tufted Hairgrass (*Deschampsia caespitosa*)

1. Thrashing
    A. 3/8” screen
2. Air screen cleaner
    A. screens
        1. top-3.150 round
        2. middle-2.10
        3. bottom-6 X 32
    B. valves
        1. .25
        2. 2.5
        3. 3.5
        4. intake-closed
    C. adjustments
        1. blower speed-3.5
        2. sieve boat-10