Appalachian Plant Materials Center

Alderson, West Virginia

2006 – 2009

Technical Report

Crimson clover in blossom in Transition to Organics Technology Development Study

Study Number: **21033-82D**

Study Title:

An evaluation of *Arrenatherum elatius*, tall oatgrass as a forage for Appalachian small farms –A Cooperative Study with the University of Kentucky – Dr. Jimmy Henning

Introduction:

Tall oatgrass, *Arrenatherum elatius*, is a perennial, cool season bunchgrass that is easily established, adapted to somewhat excessively drained low fertility soils and is compatible with legumes. Joseph Ruffner found that tall oatgrass provided excellent short-term cover at moderately low fertility levels and was especially adapted to droughty soils in the Appalachian Region. He found that good stands developed in all field plantings he made, and that tall oatgrass rated as the best grass for short-term cover on mine soils.

Objective:

The objective is to select and release cooperatively a productive tall oatgrass cultivar adapted to the Appalachian Region, for use on droughty Appalachian pastures and mine soils.

Discussion:

Accession 9061649 was selected as superior to a collection of 80 accessions evaluated at the former Quicksand PMC. This accession is the product of a poly-cross block established at Quicksand in 1989. 9061649 has a high leaf to stem ratio, late boot date and low seed shattering. A seed increase field of 9061649 was established at Alderson PMC in the fall of 2000. Seed harvest from this field began in 2002. Seed production has continued through 2009. Accession 9061649 was released as a cultivar named 'Ruffner' in 2009. Release and technical documentation for this accession may be found in Appendix 1 of this Report.

Study Number: **21035-81G**

Study Title:

Evaluation of orchardgrass, *Dactylis glomerata*, for adaptation to droughty Appalachian hillside pastures - A cooperative study with the University of Kentucky- Dr. Jimmy Henning.

Introduction:

Orchardgrass, *Dactylis glomerata* L. is a perennial cool-season forage grass, which grows in clumps, producing an open sod. It is a native of Europe, but has become naturalized over much of North America and occupies an important place as a cultivated forage grass. Orchardgrass is widespread throughout the Appalachian Mountains, and is especially well adapted to Maryland, Pennsylvania, West Virginia, Kentucky, and Tennessee. The predominant cool-season forage grass species used in this region is *Festuca arundinacea* Schreb., tall fescue. However, observations in West Virginia indicate that some droughty hillside pastures were being naturally colonized by orchardgrass while the tall fescue in these pastures was declining.

Objective:

The objective of this study is to select and cooperatively release a productive drought-tolerant orchardgrass cultivar adapted to droughty hillside pastures in the Appalachian Region.

Discussion:

9007238 was selected at the former Quicksand PMC from a collection of 24 naturalized stands in VA, WV, and MD, six commercial varieties, and 37 foreign germplasm introductions from well-drained, shallow, low-fertility, acid soils. Selection of 9007238 was based on superior vigor and growth throughout the growing season, relative resistance to disease, long-term persistence under clipping, dry matter yield, and drought tolerance. A seed increase field of 9007238 was established at Alderson PMC in the fall of 2000. Seed harvest from this field began in 2002. Seed harvests continued through 2009. Accession 9007238 was released to commercial production in 2008. The release was named 'Augusta' in recognition of its' origin in Augusta County, Virginia. Release and technical documentation for this accession may be found in Appendix 2 of this Report.

Study Number: **21009-91E**

Study Title:

Evaluation of *Alnus serrulata*, smooth alder, for streambank stabilization in the Appalachian Region

Introduction:

On smaller streams in Appalachia, the major bank erosion problems are caused by high velocity flooding events and occasional gouging of the bank by ice floes in the winter and early spring. Those areas that are stripped of vegetation by water or ice then are highly susceptible to additional erosion and mass wasting of soil. *Alnus serrulata* can be observed naturally stabilizing streams in much of the Eastern United States. Field plantings have been made in the Northeast and South, using seedlings of a local collection of smooth alder. However, no work has been done to select a superior accession of smooth alder for the Appalachian Region. This project is part of a regional project to find better plants, both woody and herbaceous, for streambank stabilization.

Objective:

The objective of this study is to identify an accession of *Alnus serrulata* that exhibits superior production of numerous flexible stems and fibrous root systems.

Discussion:

Accession number 432411 was selected at the former Quicksand PMC as superior from an assembly of 54 smooth alder accessions and from a total of 540 individual plants (10 per accession). This cultivar is from wild provenance material collected at Panbowl Lake near Jackson, Kentucky. The Alderson, West Virginia PMC has registered the cultivar as 'Panbowl'. 'Panbowl' produces numerous flexible stems and a large fibrous root system and is longer living than is typical of the species. It is hardy in zones 5b to 8b (USDA) and like the species is best adapted to wet bottomland soils and along the margins of streams, but can be grown satisfactorily on well-drained upland soils as well. A seed orchard of 'Panbowl' was established at the Alderson PMC in 2000. Seed collection from this orchard began in 2006 and continued through 2009. The 'Panbowl' cultivar was released to commercial production in 2007. Release documentation for this accession may be obtained by contacting the Appalachian Plant Materials Center. A technology product for this accession may be found in Appendix 3 of this Report.

Study Number(s): **WVPMC-T-0201-0T**

Study Title(s): **Stones River National Battlefield Reimbursable Agreement**

Introduction:

Stones River National Battlefield has a need to preserve native plant resources and revegetate parklands with germplasm from within park boundaries where possible to maintain the genetic resources within the park. The NPS does not have the personnel, expertise, or equipment needed to propagate quantities of the required seed and plants. The NRCS has the personnel and is equipped to propagate and clean quantities of seed sufficient to meet the NPS needs within the required time frame and conduct evaluations on plant species to determine adaptation and cultural requirements for establishment.

Objective(s):

The objective of this study is to produce transplants of local ecotype native plants for use in landscape restoration within the confines of the battlefield, while developing technology products, e.g. propagation protocols, plant guides, etc., for these native species. Information on the culture of most of the native plants in this study is nonexistent.

Discussion:

To date, the Appalachian PMC has conducted evaluations of approximately 35-40 native plant species for the NPS, and has propagated and delivered several thousand plants for use in landscape restoration within Stones River National Battlefield. Several technology products, e.g. plant propagation protocols, have been developed from this study, and several additional technology products are in process. Technology products for this project developed through 2009 are presented in Appendix 4 of this Report.

Study Number: **WVPMC-T-0104-OT**

Study Title: **US Army Corps. of Engineers Ecosystem Restoration Reimbursable Project**

Introduction:

The Marmet Locks and Dam are located in Kanawha County, WV, on the Kanawha River a short distance upstream of Charleston, WV. The Marmet Locks and Dam Project includes building a new lock and approach channel located on the river right side to accommodate larger tows. The USACE , as a part of their site mitigation plan, wishes to preserve local plant ecotypes for re-establishment on the site upon completion of construction. The local ecotypes of interest are not available commercially.

Objective:

The objective of this project is to assemble or propagate and maintain specific numbers of local ecotypes of six woody species for use by the USACE at their Marmet construction site.

Discussion:

This project was initiated during 2001. Seedling plants of *Acer saccharinum* - silver maple, *Lindera benzoin* – spicebush, *Sambucus canadensis* – elderberry, *Asimina triloba* – pawpaw, and *Sassafras albidum* sassafras were lifted from the construction site during the spring and early summer. These plants were placed into pots and transported to the Alderson PMC. These plants are being maintained in shade structures at the PMC until completion of construction. Seed of *Acer saccharinum, Lindera benzoin, Asimina triloba,* and *Aesculus octandra* –yellow buckeye were also harvested from the site during 2001. These seeds were used to produce seedlings at the PMC to assist with fulfillment of the agreement with the USACE. It is important to note that all plants produced under this agreement are for the exclusive use by the USACE at the Marmet construction site. However, one or more of these species may be made available to the public by the Alderson PMC in the future as source identified releases in conjunction with the USACE. Reintroduction of plants to the site was begun in 2007, but was not completed until 2009 because of extensive construction delays. Plant performance on this highly disturbed site will be monitored for at least 5 years. Potential technology products resulting from this project include: propagation protocols, plant guides, journal articles, and technology notes pertaining to post construction establishment and management of native woody species.

Study Number: **WVPMC-P-0101-TE**

Study Title:

West Virginia Balsam Fir Increase – A cooperative project with The Nature Conservancy, US Fish and Wildlife Service, US Forest Service, and The West Virginia Highlands Conservancy.

Introduction:

In West Virginia, balsam fir is found only at high elevations and in conjunction with damp woods and mountain swamps. Although it is not listed as endangered, it is considered to be a somewhat rare plant in West Virginia. Dr. Earl Core, in Flora of West Virginia, describes balsam fir as a tree 10-25 meters tall, 1 meter in diameter, and having a bark warty with resin blisters. Hence, the name "blister pine" commonly used in the Alleghenies.

One of the more alarming contemporary problems in the Appalachians is the rapid depletion of balsam fir forests linked to the Balsam wooly adelgid, an exotic, sap-sucking insect that causes mortality within 2-3 years of initial contact. Although undetected for many years, the adelgid infestation is now widespread and appears to be growing in WV and elsewhere.

Objective:

The objective of this project is to maintain a seed bank for the West Virginia balsam fir, to propagate seedlings for replanting in the areas where the seed originated, and to develop source identified releases for West Virginia balsam fir.

Discussion:

In August 2000 ten volunteers harvested balsam fir seeds from 4 locations within the Allegheny Highlands of West Virginia. These seeds were processed and delivered to Alderson PMC for seed banking and production of seedlings. Limited quantities of seedlings of the four accessions were produced at the PMC in 2003. Approximately 100 seedlings were returned to Canaan Valley Wildlife Refuge in 2005. Additionally, several hundred seedlings were returned to the Park during the period from 2006 – 2009. Seedling production of all four accessions will be continued through circa 2012.

Study Number: WVPMC-T-0902-CP

Study Title:

Transition to Organic Production Cover Crop Trial and Field Corn Nitrogen Response to Rolled Cover Crop Mulches

Introduction:

Transition to organic production requires cessation of chemical herbicides for cover crop and weed suppression. The purpose of this study is to refine and transfer organic crop management techniques to the organic farming community.

Objective(s):

To evaluate the effectiveness of several cereal grains and annual legumes as soil cover in cropland.

To evaluate the effectiveness o delivery of nitrogen from the annual legume component of the cover crop to the succeeding crop.

To evaluate the effectiveness of a mechanical roller crimper as a non-herbicide means of achieving cover crop suppression.

Discussion:

This study was initiated in 2009 and will be repeated for at least 3 years. Data collection from the 2009 study is still in process. Detailed study information may be found in Appendix 5 of this Report.

Study Number(s): **WVPMC-P-0105-OT, WVPMC-P-0106-OT, WVPMC-P-0107-OT**

Study Title(s): **Intercenter Plant Evaluation Studies**

Introduction:

Intercenter plant evaluations are used to help determine the area of adaptation of potential releases. Additionally, these studies may be useful in evaluating potential aggressive or invasive properties of candidates for release under controlled conditions outside of the releasing PMC service area. Intercenter evaluation studies are developed with regard to the environmental diversity of the area served by the releasing PMC and the anticipated area of adaptation for the release candidate.

Objective:

The objective of these studies is to evaluate the area of adaptation for 4 species and 5 accessions that are potential releases from the Big Flats PMC.

Discussion:

The Alderson PMC received seed of *Agropyron* genus-intermediate wheatgrass, *Sorgastrum nutans*-Indiangrass, two accessions of *Spartina pectinata*-prairie cordgrass, and *Agrostis gigantea*-redtop in 2001. Seeds of each genus and accession were planted in cone-tainers in the greenhouse in late winter of 2001. Seedling plants were transplanted from the greenhouse to observation rows in Field 1 mid-spring of 2001. 100 plants of intermediate wheatgrass, Indiangrass, and redtop and 50 plants of each accession of prairie cordgrass were transplanted into the observation area. Plants were evaluated for survival in September 2001. All species and accessions exhibited 100 percent survival. These plants were evaluated twice annually through 2009. An adaptability report for each species is being prepared and will be available circa 2010.

APPENDIX 1.

‘Ruffner’ Tall Oatgrass Release and Technical Documentation

Release Documentation
For
Accession 9061649
Tall Oatgrass

John Vandevender, Appalachian Plant Materials Center
Alderson, West Virginia
and
Robert Glennon, USDA, Natural Resources Conservation Service
Washington, DC

The evaluation plan for tall oatgrass accessions for marginal sites in the Appalachian Region began with an evaluation of 120 accessions at the Quicksand, Kentucky Plant Materials Center (PMC) (USDA Hardiness Zone 6b, Major Land Resource Area 125 – Cumberland Plateau and Mountains). The initial evaluation planting was established in 1982 with 110 accessions assembled from outside the United States, 2 accessions from naturalized stands within the United States, 2 accessions from naturalized stands within Canada, 3 accessions of commercially available common seed, and 3 sources of the cultivar ‘Tualatin’ (Table 1). It was evaluated from 1982 through 1986 for vigor, insect and disease resistance, heat and drought tolerance, and recovery from forage harvest. The planting was also clipped to obtain data on forage production and recovery from clipping (Table 2).

Thirty-four plants representing 22 accessions were selected for advanced evaluation based on their forage production and a later maturity date (Table 3). Advanced evaluation was conducted in 1988 and 1989. Seven plants from each of 3 accessions were selected for a polycross block in the fall of 1989 based on seed production and germination, a low degree of seed shattering, and leafiness. Accessions represented in the polycross block were PI202273 (from Chile, Koppen Classification Csa – Temperate Mediterranean climate), PI233818 (from Belgium, Koppen classification Cfa – Temperate Mediterranean climate), and PI234439 (from Belgium, Koppen Classification Cfa – Temperate Humid climate). The progeny of this polycross block was assigned a new accession number, 9061649.

A seed production field using seed of accession 906169 was established in 1989. This seed field was culled to remove plants that were prostrate and diseased or exhibited little top growth or tiller production. Seed yields averaged 77 pounds per acre per year between 1989 and 1997 in Quicksand, Kentucky and 88 pounds per acre per year between 2002 and 2005 in Alderson, West Virginia. Seed quality in 1989 and 1990 at the

Quicksand Plant Materials Center averaged 99 percent purity, 88 percent germination, and 88 percent pure live seed. Forage harvested in late fall of 200 at the Appalachian Plant Materials Center in Alderson, West Virginia had 22 percent crude protein, 14.2 percent digestible protein, 28.2 percent acid detergent fiber, 53.1 percent neutral detergent fiber, and 57 percent total digestible nutrients.
The University of Kentucky at Lexington, Kentucky (USDA Plant Hardiness Zone 6a, Major Land Resource Area 121 – Kentucky Bluegrass) evaluated accession 9061649 in a forage variety trial with orchardgrass cultivars in 1994 and 1995. Tall oatgrass accession 9061649 had a forage yield that was equal to Benchmark and Crown orchardgrass cultivars in May of 1995 and yield significantly greater than Boone, Bronc, Haymate, Paiute, Pizza, Potomac, and Shiloh orchardgrass cultivars. In October 1995, forage yield of 9061649 tall oatgrass was equal to Benchmark, Boone, Bronc, Crown, Potomac, and Shiloh orchardgrasses and significantly greater than Haymate, Paiute, and Pizza orchardgrasses (Table 4).

The University of Kentucky evaluated 9061649 tall oatgrass with orchardgrass cultivars in a forage variety trial at its Robinson Substation in Quicksand, Breathitt County, Kentucky (USDA Plant Hardiness Zone 6b, Major Land Resource Area 125 – Cumberland Plateau and Mountains) in 1997 and 1998. Tall oatgrass accession 9061649 was the highest yielding entry in the trial (Table 6).

The Big Flats Plant Materials Center in Big Flats, New York (USDA Plant Hardiness Zone 5b, Major Land Resource Area 140 – Glaciated Allegheny Plateau and Catskill Mountains) evaluated tall oatgrass accession 9061649 and orchardgrass cultivars ‘Potomac’ and ‘Hallmark’ on a moist, well-drained soil over two growing seasons (Table 7). Yield of 9061649 was 30 percent less than the yield of ‘Hallmark’ and 10 percent less than the yield of ‘Potomac’. The second year 9061649 tall oatgrass yielded 30 percent more than the yield of ‘Hallmark’ and 2 percent more than the yield of ‘Potomac’.

Environmental Evaluation of Plant Materials Releases

Name of person scoring:	J. Vandevender	**Date of scoring:**	May 12, 2009
Scientific Name:	Arrhenatherum elatius ssp. elatius	**Common Name:**	Tall oatgrass
Release Name:	Ruffner		

Is the plant native to the US?	**Yes** **No**
Is the plant native to the area of intended use?	**Yes** **No**
Authority used to determine native status:	**PLANTS database**
What is the intended area of use for this plant?	**Appalachian Region of US; Plant Hardiness Zones 4 through 7**
What is the intended use for this plant?	**Forage & wildlife**
Areas in which the release is known to be invasive or has a high probability of being invasive:	**None referenced in PLANTS. Due to the potential invasiveness of *Arrhenatherum elatius*, 'Ruffner' is recommended for use only within the Appalachian Region. Seed for 'Ruffner' will not be provided to commercial growers outside the Appalachian Region.**

Summary of Criteria from Section A	**Score**
Part 1. Impact on Habitats, Ecosystems, and Land Use	**3**
Part 2. Ease of Management	**17**
Part 3. Conservation Need and Plant Use	**10**
Part 4. Biological Characteristics	**37**

Final Determination of Release Based on the Environmental Evaluation:

- ☐ **OK to Release**
- ☐ **OK to Release but qualify use and intended area of use***
- ☐ **Do Not Release - NPL determines if release is made***
- ☐ **Do Not Release - document and destroy materials**

I certify that this Environmental Evaluation was conducted with the most accurate and current information possible.

Signature of Person Scoring Date

Signature of NPL indicating that it is OK to make the release:

National Program Leader, PM **Date**

* An Environmental Assessment (EA) and/or Environmental Impact Statement (EIS) may be required prior to release. If required, attach the EA and/or EIS to this worksheet and to the release notice.

Table 1. Quicksand, Kentucky plant Materials Center Tall Oatgrass (*Arrhenatherum elatius* ssp. *elatius*) Accessions and Origins Established at Quicksand, Kentucky (Koppen Classification Cfa) in 1982 and 1983.

Type of Accession[1]	Accession	Cultivar	Origin	Koppen Classification[2]
PI	255399		Yugoslavia	Cfa[3]
PI	255400		Yugoslavia	Cfa
PI	255401		Yugoslavia	Cfa
PI	255402		Yugoslavia	Cfa
PI	255403		Yugoslavia	Cfa
PI	255404		Yugoslavia	Cfa
PI	255405		Yugoslavia	Cfa
PI	255406		Yugoslavia	Cfa
PI	255407		Yugoslavia	Cfa
PI	255408		Yugoslavia	Cfa
PI	255409		Yugoslavia	Cfa
PI	255466		Yugoslavia	Cfa
PI	272112		Poland	Cfa
PI	274603		Poland	Cfa
PI	283186		Poland	Cfa
PI	283187		Poland	Cfa
PI	285547		Poland	Cfa
PI	285549		Poland	Cfa
PI	287764		Spain	Csa[4]
PI	287765		Spain	Csa
PI	287766		Spain	Csa
PI	288927		Hungary	Cfa
PI	292848		Germany	Cfa
PI	302848		Spain	Csa
PI	302849		Spain	Csa
PI	302850		Spain	Csa
PI	302851		Spain	Csa
PI	302852		Spain	Csa
PI	302853		Spain	Csa
PI	302854		Spain	Csa
PI	302855		Spain	Csa
PI	303816		Canada	Unknown

Table 1 (cont.). Quicksand, Kentucky plant Materials Center Tall Oatgrass (*Arrhenatherum elatius* ssp. *elatius*) Accessions and Origins Established at Quicksand, Kentucky (Koppen Classification Cfa) in 1982 and 1983.				
Type of Accession[1]	Accession	Cultivar	Origin	Koppen Classification[2]
PI	311016		Romania	Cfa
PI	311017		Romania	Cfa
PI	314410		USSR	Dfb[5]
PI	314509		USSR	Dfb
PI	314510		USSR	Dfb
PI	315370		USSR	Dfb
PI	316159		Sweden	Cfb
PI	316160		Spain	Csa
PI	316161		Hungary	Cfa
PI	318940		Spain	Csa
PI	318941		Spain	Csa
PI	318942		Spain	Csa
PI	318943		Spain	Csa
PI	323481		Denmark	Cfa
PI	323482		Sweden	Cfb[6]
PI	323483		Yugoslavia	Cfa
PI	323484		Yugoslavia	Cfa
PI	323485		Yugoslavia	Cfa
PI	323486		Yugoslavia	Cfa
PI	323487		Poland	Cfa
PI	323488		Yugoslavia	Cfa
PI	323489		Yugoslavia	Cfa
PI	323490		Yugoslavia	Cfa
PI	323491		Yugoslavia	Cfa
PI	323492		Yugoslavia	Cfa
PI	323493		Turkey	Csa
PI	323494		Turkey	Csa
PI	323496		Spain	Csa
PI	325203		Russia	Dfb
PI	326359		USSR	Dfb
PI	338629		Greece	Csa
PI	345954		Norway	Cfb

Table 1 (cont.). Quicksand, Kentucky plant Materials Center Tall Oatgrass (*Arrhenatherum elatius* ssp. *elatius*) Accessions and Origins Established at Quicksand, Kentucky (Koppen Classification Cfa) in 1982 and 1983.				
Type of Accession[1]	Accession	Cultivar	Origin	Koppen Classification[2]
PI	370657		USSR	Dfb
PI	370658		USSR	Dfb
PI	370659		USSR	Dfb
PI	371946		USSR	Dfb
PI	406308		USSR	Dfb
PI	414028	Tualatin	USSR	Dfb
PI	414028	Tualatin	USSR	Dfb
PI	414029		USSR	Dfb
PI	418632		Romania	Cfa

[1] PI denotes Plant Introduction number assigned by the Agricultural Research Service
[2] Koppen climate classification system that is based on the concept that native vegetation

Table 2. Quicksand, Kentucky Plant Materials Center Tall Oatgrass Forage Yield Evaluation (dry matter yields expressed as grams per 3 m^2 by accession and clipping date).

Accession[1]	Clipping Date (g/3 m^2)							
	5/29/84	11/23/84	5/16/85	8/22/85	5/2/86	6/30/86	8/28/86	Total
T16211	361	135	262	68	25	25	3	871
T16677	1833	702	647	404	235	123	25	3968
T16678	777	302	556	137	166	95	21	2053
T16679	822	204	206	91	35	52	13	1422
T16680	693	215	186	98	40	88	0	1220
T18749	0	0	181	0	0	0	0	181
T30471	1072	640	655	321	96	115	38	2936
T34177	780	247	160	71	21	35	7	1320
T34178	889	660	494	300	99	77	16	2534
PI170239	555	43	160	67	22	38	0	884
PI194699	0	87	314	74	3	32	1	510
PI202273	0	183	519	92	16	80	1	891
PI233818	145	328	424	252	148	125	26	1447
PI234439	398	429	603	279	132	90	9	1940
PI234460	806	615	713	214	107	85	5	2545
PI234465	304	410	787	220	153	112	7	1991
PI234466	0	0	0	0	0	0	0	0
PI234467	1132	711	371	254	92	77	4	2641
PI234736	218	383	619	219	145	95	8	1686
PI235123	731	368	210	106	42	80	7	1545
PI235242	748	341	297	110	57	52	9	1614
PI235451	577	363	277	83	71	57	12	1429
PI235455	1029	592	601	166	99	84	17	2576
PI236774	212	246	644	231	107	107	8	1456
PI249687	1396	607	571	201	87	71	7	2940
PI249719	1162	490	875	213	227	125	9	3101
PI249720	363	451	547	178	71	42	2	1655
PI249916	0	53	300	0	4	4	0	380
PI251415	1468	814	658	316	150	112	31	3548
PI251526	1076	841	427	171	66	50	16	2648
PI251571	495	318	579	193	69	83	14	1752
PI251573	478	440	557	223	92	89	17	1896

Table 2 (cont). Quicksand, Kentucky Plant Materials Center Tall Oatgrass Forage Yield Evaluation (dry matter yields expressed as grams per 3 m^2 by accession and clipping date).

Accession[1]	Clipping Date (g/3 m^2)							
	5/29/84	11/23/84	5/16/85	8/22/85	5/2/86	6/30/86	8/28/86	Total
PI251574	777	534	489	236	125	78	9	2247
PI251661	1025	574	604	144	98	125	13	2584
PI251680	1122	326	320	129	94	58	8	2057
PI251801	816	528	373	129	56	50	4	1957
PI251802	763	343	263	79	16	20	1	1485
PI251946	281	261	439	121	49	30	1	1182
PI253292	263	65	165	22	36	46	3	590
PI253293	1465	882	455	423	68	54	2	3048
PI253294	1225	1371	672	216	126	93	3	3706
PI254870	1008	484	372	98	59	78	1	2100
PI255165	444	463	561	179	103	94	6	1850
PI255166	1050	734	589	191	144	91	6	2804
PI265167	1127	648	549	117	96	104	12	2653
PI255399	573	406	454	92	88	58	4	1674
PI255400	1032	547	810	337	207	116	12	3061
PI255401	1013	580	653	251	64	52	2	2616
PI255402	899	679	624	133	56	58	9	2457
PI255403	929	762	757	464	151	122	8	3193
PI255404	1404	853	743	169	101	45	3	3319
PI255405	753	260	179	86	40	41	0	1360
PI255406	1274	1159	759	271	90	46	1	3599
PI255407	1109	691	571	153	56	35	1	2617
PI255408	719	704	367	230	129	97	11	2257
PI255409	719	647	719	416	136	183	26	2845
PI255466	629	486	668	339	193	124	35	2473
PI272112	1107	689	409	166	70	76	1	2516
PI274603	582	330	351	126	36	41	1	1466
PI283186	551	263	294	60	24	37	1	1230
PI283187	1219	504	364	250	88	92	58	2575
PI283187	881	400	364	114	77	63	16	1914
PI285547	917	602	506	156	67	52	1	2300
PI285549	1582	956	485	199	77	57	5	3362

Table 2 (cont). Quicksand, Kentucky Plant Materials Center Tall Oatgrass Forage Yield Evaluation (dry matter yields expressed as grams per 3 m^2 by accession and clipping date).

Accession[1]	Clipping Date (g/3 m^2)							
	5/29/84	11/23/84	5/16/85	8/22/85	5/2/86	6/30/86	8/28/86	Total
PI287764	1051	479	421	182	101	107	29	2369
PI287765	701	331	443	105	53	83	4	1720
PI288927	767	183	264	112	55	79	3	1464
PI292848	748	726	498	189	108	83	7	2359
PI302848	566	72	85	0	0	0	0	723
PI302849	0	158	86	207	79	85	38	653
PI302850	121	71	44	0	0	0	0	235
PI302851	0	496	0	0	0	0	0	496
PI302852	599	1057	208	15	4	27	2	1911
PI302853	293	964	237	8	5	101	0	1608
PI302854	0	0	0	0	0	0	0	0
PI302855	0	0	0	0	0	23	0	23
PI303816	994	496	547	83	54	60	4	2238
PI311016	1567	1057	649	175	38	49	7	3542
PI311017	1356	964	437	173	33	46	8	3018
PI314410	1481	759	414	150	34	37	4	2879
PI314509	1461	775	586	213	56	44	1	3137
PI314510	1190	731	597	286	67	82	8	2961
PI315370	820	253	296	81	38	26	7	1520
PI316159	0	0	0	0	0	0	0	0
PI316160	1000	694	877	269	278	148	41	3307
PI316161	662	592	489	128	113	86	10	2080
PI318940	264	109	285	41	61	12	1	773
PI318941	127	23	582	34	14	5	0	785
PI318942	1136	495	600	161	120	98	9	2620
PI318943	748	329	272	44	14	32	0	1440
PI323481	441	344	495	145	56	47	1	1528
PI323482	1598	999	761	163	52	59	3	3634
PI323483	1142	1079	999	319	167	44	1	3751
PI323484	1290	1035	708	220	55	27	3	3338
PI323485	1616	872	598	240	101	60	2	3489
PI323486	1218	727	649	217	90	33	3	2937

Table 2 (cont). Quicksand, Kentucky Plant Materials Center Tall Oatgrass Forage Yield Evaluation (dry matter yields expressed as grams per 3 m^2 by accession and clipping date).

Accession[1]	Clipping Date (g/3 m^2)							
	5/29/84	11/23/84	5/16/85	8/22/85	5/2/86	6/30/86	8/28/86	Total
PI323487	965	595	653	243	123	77	12	2669
PI323488	1014	864	697	197	42	50	7	2870
PI323489	677	459	574	153	53	30	1	1948
PI323490	814	288	500	95	28	0	0	1724
PI323491	702	328	391	81	22	35	0	1569
PI323492	516	447	639	236	134	85	12	2069
PI323493	1400	887	753	266	88	62	19	3475
PI323494	1223	979	775	208	91	58	13	3347
PI323496	1078	854	520	253	83	35	3	2826
PI325203	383	416	418	150	31	26	2	1424
PI326359	492	341	431	220	75	40	6	1606
PI338629	392	578	540	331	137	156	8	2142
PI345954	316	11	38	10	7	31	0	414
PI370657	1050	365	308	135	41	56	0	1955
PI370658	754	300	278	80	57	63	7	1539
PI370659	977	155	150	23	76	45	15	1441
PI371946	1123	914	627	301	158	87	23	3233
PI406308	1236	642	442	182	76	80	14	2672
PI414028	441	266	428	196	60	48	14	1453
PI414028	708	230	137	62	32	42	2	1213
PI414029	652	512	455	131	81	62	6	1899
PI418632	0	0	0	0	0	0	0	0
AVERAGE	**774**	**494**	**444**	**158**	**74**	**62**	**8**	**2014**

[1] T - denotes temporary accession numbers assigned by the Plant Materials program

Table 3. Tall Oatgrass (*Arrhenatherum elatius* ssp. *elatius*) accessions and Origins Selected for Advanced Evaluation at the Quicksand, Kentucky Plant Materials Center (Koppen Classification Cfa) in 1988.

Accession	Cultivar	Origin	Koppen Classification[1]	Number of Plants
T34178		Commercial	Unknown	1
PI202273		Chile	Csa[2]	1
PI233818		Italy	Csa	3
PI234439		Belgium	Cfa	4
PI249719		Greece	Csa	1
PI251526		Yugoslavia	Cfa[3]	1
PI251571		Yugoslavia	Cfa	1
PI251574		Yugoslavia	Cfa	1
PI255165		Poland	Cfa	3
PI255166		Poland	Cfa	1
PI255402		Yugoslavia	Cfa	1
PI255406		Yugoslavia	Cfa	1
PI255409		Yugoslavia	Cfa	1
PI255466		Yugoslavia	Cfa	2
PI285549		Canada	Unknown	4
PI314410		USSR	Dfb[4]	1
PI318940		Spain	Csa	1
PI323482		Sweden	Cfb[5]	1
PI323487		Poland	Cfa	1
PI323493		Turkey	Csa	2
PI414028	Tualatin	USSR	Dfb	1

[1]Koppen climate classification system that is based on the concept that native vegetation is the best expression of climate
[2]Csa = Mediterranean climates
[3] Cfa=Humid subtropical climates
[4] Dfb=Warm summer continental or hemiboreal climates
[5]Cfb=Maritime temperate or oceanic climates

Table 4 – Quicksand Plant Materials Center Tall Oatgrass and Orchardgrass Comparative Yield Evaluation Data from University of Kentucky, Lexington, Kentucky[1]
(Yields expressed in T/Ac.)

Variety and Species	Maturity		1994 Yield						1995 Yield					2 Year Total Yield
	05/09/ 1994	05/10/ 1995	05/10	06/3	07/15	08/11	10/24	Total	05/10	06/08	08/07	10/30	Total	
Crown OG[2]	*10	9	**2.10	**1.67	*0.23	*0.31	*1.15	**5.46	*1.27	*.075	*0.36	**1.28	*3.66	*9.12
Benchmark OG	*10	*10	*2.02	1.43	*0.30	0.29	0.00	*5.27	*1.35	*0.68	0.30	*1.20	*3.53	*8.80
T7238 OG	*10	**11	1.67	1.40	*0.25	*0.36	*1.17	4.86	1.42	*0.74	*0.35	*1.19	**3.71	*8.56
Shiloh OG	*10	*10	*1.96	*1.55	*0.23	0.25	*1.11	*5.09	1.10	0.69	*0.32	*1.10	*3.2	*8.29
Bronc OG	7	7	1.81	*1.44	0.21	*0.33	0.00	*5.01	0.92	*0.84	*0.33	*1.15	*3.24	*8.24
Boone OG	*10	*10	1.54	1.30	*0.25	*0.34	*1.11	4.54	1.37	0.64	*0.34	*1.11	*3.46	*8.00
Potomac OG	*10	*10	1.64	1.40	0.17	0.29	*1.04	4.54	1.2	0.59	0.31	*1.15	*3.24	7.78
9061649 TOG[3]	*9	9	*2.03	0.99	**0.45	0.19	0.70	4.36	** *1.53	0.40	8.00	*1.06	*3.36	7.72
Pizza OG	6	6	*1.84	1.29	0.19	0.30	*1.05	4.67	0.73	*0.75	0.26	0.98	2.73	7.40
Paiute OG	*9	*9	1.72	1.34	0.18	*0.36	0.92	4.53	0.90	0.57	*0.33	0.97	2.77	7.29
Haymate OG	8	7	1.34	1.30	0.20	0.25	0.90	4.00	0.84	*0.76	*0.33	0.97	2.89	6.89
MEAN	9	8.9	1.72	1.34	0.23	0.28	1.05	4.62	1.02	0.67	0.32	1.05	3.07	7.69
CV, %	10.59	15.62	11.85	12.56	26.62	23.25	13.61	8.87	16.04	21.34	22.10	17.25	15.08	10.43
LSD, 0.05	1.31	1.87	0.29	0.24	0.09	0.09	0.20	0.58	0.22	0.20	0.10	0.26	0.65	1.13

Maturity Rating Scale: 7 = Late Boot; 9 = Early Head; 11 = Full Head

** = Highest entry in Column, * = Not Significantly Different form Other Entries with *

[1] Data from plots established September 7, 1993
[2] OG = orchardgrass
[3] TOG = tall oatgrass

Table 5 – Quicksand, Kentucky Plant Materials Center Evaluation of Tall Oatgrass And Orchardgrass Cultivars at the University of Kentucky in Lexington, Kentucky (Yield expressed in T/Ac.)

Variety	Maturity 5/14/97	1997 Forage Yields					1998 Forage Yields					2 – Year Total Yields
		5/20	7/08	8/21	11/13	Total	5/21	7/10	8/17	10/29	Total	
Benchmark OG[1]	*55	2.16	*3.42	*1.08	*.98	*7.65	2.60	*1.60	*0.30	*0.26	*4.75	*12.40
9061649 TOG[2]	51	*3.16	*2.33	0.72	*1.00	*7.20	2.42	*1.73	0.22	*0.29	*5.23	*11.86
Potomac OG	53	2.26	*2.23	*0.95	*0.81	*6.24	2.49	*1.46	*0.30	*0.21	4.46	*10.71
Hallmark OG	54	1.86	*2.16	*1.04	*0.90	*5.96	2.48	*1.47	*0.32	*0.24	4.51	*10.46
Haymate OG	49	1.82	*2.33	*0.89	0.53	5.57	*2.75	*1.51	0.25	*0.22	*4.73	*10.30
Progress OG	49	2.14	*2.17	*1.00	0.73	*6.05	2.03	*1.46	*0.33	*0.25	4.08	10.13
9007238 OG	*55	1.82	1.93	*0.87	0.57	5.19	2.36	1.34	*0.36	*0.26	4.32	9.51
Profile OG	52	2.05	*2.11	*0.89	0.59	5.65	2.27	1.34	*0.26	*0.21	4.08	9.73
Tekapo OG	48	0.77	*3.59	*0.97	0.55	*5.88	2.22	1.32	*0.30	*0.20	4.03	9.91
Mean	51.8	1.97	2.44	0.94	0.73	6.07	2.54	1.48	0.30	0.24	4.56	10.63
CV, %	1.92	9.86	49.22	16.85	25.22	22.80	13.04	19.04	23.64	32.01	9.69	14.76
LSD, 0.05	1.43	0.28	1.72	0.23	0.26	1.98	0.47	0.40	0.1.	0.11	0.63	2.24

Plots established August 23, 1996

Maturity Rating Scale: 45 = Boot Swollen, 50 = Beginning of Inflorescence Emergence, 58 = Complete Emergence of Inflorescence

* = Not Significantly Different form Other Entries with *

[1] OG = orchardgrass

[2] TOG = Tall oatgrass

Table 6 – Quicksand, Kentucky Plant Materials Center Evaluation of Tall Oatgrass And Orchardgrass Cultivars at the University of Kentucky in Quicksand, Kentucky (Yield expressed in T/Ac.)

Variety	Maturity 5/23/97	1997 Forage Yields					1998 Forage Yields				2 – Year Total Yields
		5/24	7/10	8/22	12/2	Total	06/02	7/23	11/05	Total	
9061649 TOG[1]	56.75	2.75	*1.93	0.31	*1.28	*6.28	*2.76	*1.06	*1.35	*5.17	*11.44
Takena OG[2]	50.00	2.21	*2.09	0.46	*1.15	*5.91	*2.63	0.52	*1.33	4.48	10.39
Haymate OG	49.00	1.76	*2.14	*0.64	*1.20	*5.81	*2.70	0.57	*1.29	4.56	10.37
Udder OG	50.00	2.21	*2.02	*0.58	*1.08	*5.90	*2.71	0.55	*1.18	4.44	10.34
Stampede OG	51.50	1.86	*2.05	*0.62	*1.20	*5.73	2.42	0.63	*1.29	4.34	10.07
Baridana OG	50.75	1.94	*2.01	0.47	*1.11	5.52	2.29	0.63	*1.39	4.30	9.83
Benchmark OG	*58.75	1.92	*2.034	0.50	*1.11	5.57	2.20	0.60	*1.39	4.19	9.76
T7238 OG	*60.00	1.94	*2.19	*0.82	*1.15	*5.89	1.89	0.56	*1.32	3.76	9.65
Potomac OG	57.00	2.15	*2.00	*0.63	*1.01	*5.78	2.00	0.50	*1.36	3.86	9.64
Hallmark OG	*58.25	1.87	*1.92	*0.62	*1.07	5.48	2.06	0.69	*1.20	3.95	9.42
Mean	54.12	2.06	2.06	0.57	1.16	5.85	2.34	0.63	1.29	4.26	10.11
CV, %	2.31	12.24	10.02	16.71	18.67	7.13	7.79	23.02	15.43	8.19	5.63
LSD, 0.05	1.78	0.36	0.29	0.14	0.31	0.60	0.26	0.21	0.28	0.50	0.81

Plots established August 20, 1996
Maturity Rating Scale: 50 = Beginning of Inflorescence Emergence, 58 = Complete Emergence of Inflorescence, 62 = Beginning of Pollen Shedding
* = Not Significantly Different form Other Entries with *
[1] TOG = Tall oatgrass
[2] OG = orchardgrass

Table 7 – Quicksand, Kentucky Plant Materials Center Tall Oatgrass Evaluation Conducted at the Big Flats, New York Plant Materials Center, 1993 – 1994				
August 6, 1993 Evaluation				
Criteria	Accession and Species			
	9061649 TOG[1]	9007238 OG[2]	Hallmark OG	Potomac OG
Leaf Color	Blue Green	Blue Green	Blue Green	Blue Green
Vegetative Stage	Boot	Vegetative	Vegetative	Vegetative
Height (cm)	26	21.6	17.6	19.4
October 6, 1993 Evaluation (data based on clipping 9sq. ft. area)				
Green Wt. (g)	184.0	182.8	348.8	244.0
Dry Wt. (g)	69.8	61.1	101.7	76.7
T/ac.	1.11	0.98	1.62	1.23
June 2, 1994 Evaluation				
Vigor[3]	3	6	5	2
Vegetative Stage	Early Head	Headed Out (pre-flowering)	Headed Out (Pre-flowering)	Headed Out (Pre-flowering)
Height (cm)	103.0	103.3	92.5	106.3
Dry Matter Yield (T/Ac.)	5.2	3.6	4.0	5.1
July 22, 1994 Evaluation				
Regrowth Height	48	84	84	84
Leaf Length (cm)	48	80	90	82
Flower Stem Length (cm)	135	125	120	130
Crown Density[3]	6	1	1	1
Flower Length (cm)	20.0	12.2	12.2	15.0
Amount of Flowering[3]	3	3	3	2
Crown Width (cm)	45	106	90	90
Leaf Diasease[3]	5	5	5	5
Leaf Texture (1 – 9, 1= widest	2	3	3	3
Lodging Resistance[3]	7	4	1	4

[1] TOG = Tall Oatgrass
[2] OG = Orchardgrass
[3] Rating Scale 1 to 9; 1 = Excellent, 9 = Very Poor

APPENDIX 2.

‘Augusta’ Orchardgrass Release and Technical Documentation

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
APPALACHIAN PLANT MATERIALS CENTER
ALDERSON, WEST VIRGINIA

NOTICE OF RELEASE OF THE CULTIVAR
‘AUGUSTA’ ORCHARDGRASS

The Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA) announces the release of the cultivar ‘Augusta’ orchardgrass (*Dactylis glomerata* L.) for the eastern United States. It has been assigned accession number 9007238 by NRCS and also evaluated as KY-2086 as designated by the Quicksand, Kentucky Plant Materials Center.

Collection Site Information: ‘Augusta’ orchardgrass was collected on June 1, 1979 by Wayne Hypes in Augusta County, Virginia. The collection site was a naturalized stand of orchardgrass growing on a Sequoia-Berks soil; a well-drained, shallow, low fertility, acid soil with medium to low water holding capacity that occurs on hillsides and ridgetops. The collection site is located in USDA Major Land Resource Area (MLRA) 147 (Northern Appalachian Ridges and Valleys) and USDA Plant Hardiness Zone 6b.

Description: Orchardgrass is a perennial cool season grass that exhibits a bunch or clump growth habit that produces in an open sod. It is native to Europe, but is widely distributed and has become naturalized across the United States and is an important cultivated grass for pasture and hay production. Culms typically occur in large clumps that range from two to four feet in height. Orchardgrass leaf blades are typically long and narrow and may be up to three feet long and one-eighth to three-eighths of an inch wide. The root system is typically densely fibrous. Orchardgrass is typically more drought tolerant that other cool season forage grasses of equal forage quality; e.g.timothy and Kentucky bluegrass. The drought tolerance of orchardgrass is due to its extensive root system. It will persist on shallow, moderately fertile soils and be moderately productive.

Method of Selection: In 1979, 67 accessions were assembled: 24 naturalized collections from Virginia, West Virginia, and western Maryland; 38 foreign introductions; and 5 cultivars. Two plantings were established for initial evaluation: one at the plant materials center in Quicksand, Kentucky on a moist, well-drained soil and another in Grant County, West Virginia on a droughty soil in a low rainfall area (an average of 30 inches precipitation annually). Both plantings were evaluated for traditional criteria and all plantings were clipped to evaluate forage production and recovery from clipping. The accession 9007238 was selected based on its superior disease resistance, drought tolerance, forage production, seed yield, and stand persistence. A seed production field was established at Quicksand, Kentucky in 1988. The field was culled in 1989 to remove plants that were prostrate and diseased and plants that exhibited little top growth or tillering. The University of Kentucky evaluated 9007238 in five forage variety trials at four different locations between 1994 and 2000. Accession 9007238 had forage yields equal to the best cultivars in each trial.

Ecological Considerations and Evaluation: This release is from a species native to Europe but in widespread agricultural use in the United States. There are many orchardgrass cultivars in the commercial seed market, but none are well adapted to droughty sites in the humid East. Eastern pastures and meadows

are frequently sown to tall fescue. Tall fescue is drought tolerant, but its forage quality is less than orchardgrass and stands tend to be monocultures due to its growth habit. The majority of Eastern pastures and meadows have been sown to 'Kentucky 31' tall fescue, a cultivar highly susceptible to infection by an endophytic fungus that produces a toxin harmful to livestock and wildlife. 'Augusta' orchardgrass is an excellent replacement for tall fescue since it is endophyte free and develops an open stand compatible with legumes and forbs.

The test plots supporting this release were in close proximity to natural and introduced plant ecosystems. There was no evidence of negative impacts or invasion into those ecosystems. 'Augusta' orchardgrass was documented as 'OK to Release' when evaluated through the "Worksheet for Conducting an Environmental Evaluation of NRCS Plant Releases".

Anticipated Use: The anticipated uses of 'Augusta' orchardgrass are: cool season forage for pasture and hay, cool season grass component in cool season grass and legume mixtures for wildlife habitat, and critical area stabilization on areas where seed mixtures are used or succession to woody species is desired. Its extensive fibrous root system is an excellent adaptation for drought tolerance. Its open growth habit allows establishment with legumes and forbs and allows succession to occur.

Area of Adaptation: 'Augusta' orchardgrass is adapted to the eastern United State (MLRA L, M, N, P, R, and S) and USDA plant hardiness zones 4 through 7. It is tolerant of droughty and well-drained soils, but does not tolerate poorly-drained soils. 'Augusta' tolerates moderately acid soils, but does not tolerate alkaline, saline, or extremely acid soils.

Availability of Plant Materials: The Appalachian Plant Materials Center in Alderson, West Virginia will maintain fields to produce breeders and foundation seed and will distribute foundation seed to commercial growers. Growers may produce certified seed from the foundation seed.

Prepared by: This notice of release of the cultivar 'Augusta' orchardgrass was prepared by John Vandevender, Manager, Appalachian Plant Materials Center in Alderson, West Virginia and Robert Glennon, Natural Resource Specialist, USDA, Natural Resources Conservation Service, Washington, DC.

Approvals for the Notice of Release of 'Augusta' Orchardgrass

_____ _____

Director
Ecological Sciences Division
United States Department of Agriculture
Natural Resources Conservation service
Washington, DC

Date

_____ _____

State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Morgantown, West Virginia

Date

Environmental Evaluation of Plant Materials Releases

Name of person scoring: John Vandevender **Date of scoring:** July 3, 2008

Scientific Name: Dactylis glomerata **Common Name:** Orchardgrass

Release Name: Augusta

Is the plant native to the US? **Yes** **No**
Is the plant native to the area of intended use? **Yes** **No**

Authority used to determine native status: **PLANTS Database**

What is the intended area of use for this plant? **Appalachian Region**

What is the intended use for this plant? **Forage, Reclamation**

Areas in which the release is known to be invasive or has a high probability of being invasive: **Northern half of US**

Summary of Criteria from Section A	**Score**
Part 1. Impact on Habitats, Ecosystems, and Land Use	**12**
Part 2. Ease of Management	**26**
Part 3. Conservation Need and Plant Use	**6**
Part 4. Biological Characteristics	**39**

Final Determination of Release Based on the Environmental Evaluation:

- [X] **OK to Release**
- [ ] **OK to Release but qualify use and intended area of use***
- [ ] **Do Not Release - NPL determines if release is made***
- [ ] **Do Not Release - document and destroy materials**

I certify that this Environmental Evaluation was conducted with the most accurate and current information possible.

Signature of Person Scoring Date

Signature of NPL indicating that it is OK to make the release:

National Program Leader, PM **Date**

* An Environmental Assessment (EA) and/or Environmental Impact Statement (EIS) may be required prior to release. If required, attach the EA and/or EIS to this worksheet and to the release notice.

APPENDIX 3.

Alnus serrulata, River Alder Technology Product

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant Materials Center

Alderson, West Virginia

Family Scientific Name: **Betulaceae**

Family Common Name: **Birch**

Scientific Name: ***Alnus serrulata* (Aiton) Willd. *Panbowl***

Common Name: **hazel alder, smooth alder, brookside alder, common alder**

Species Code: **ALSE2**

General Distribution: **Smooth alder is native to the eastern United States in USDA plant hardiness zones 5 through 8 where the precipitation exceeds 32 inches annually. It occurs from southern Maine to northern Florida and west to southeastern Oklahoma, Missouri and Illinois. It grows best in wet bottomlands and stream margins; however it will also grow in moist, well drained upland areas. River alder is adapted to a pH of 5.0 to 7.0. It is moderately shade tolerant, but is weak-wooded and susceptible to wind and ice damage. It is not adapted to alkaline, saline, droughty, or extremely acid soils. Although river alder is naturally widely distributed throughout the eastern United States, use of 'Panbowl' is recommended only in USDA Major Land Resource Aeas (MLRA's) where it was tested. Those MLRA's are: 99, 111, 114, 121, 124, 126, 127, 139, 147, and 148.**

Known Invasiveness: **None**

Propagation Goal: **Plants**

Propagation Method: **Seed**

Product Type: **Bareroot (field grown)**

Stock Type: **Bareroot**

Time To Grow: **1 Years**

Target Specifications:	**A second spring seedling ranging in height from 6" to 12" with a 1/16" to 1/8" caliper stem and a compact, well developed root system.**
Propagule Collection:	**Smooth alder is a monoecious plant. Flowering occurs in the spring before leaf emergence. Seed is produced in pistillate ovoid strobiles or conelets (cones). Pollen is contributed from staminate catkins which are formed the preceding autumn and occur in small clusters. The catkins are naked and erect during the winter and become much elongated and pendulous at maturity. Pistillate aments are also erect and naked during the winter and occur in short racemes or elongated panicles. Aments enlarge slightly at flowering and develop into ovate strobiles or conelets upon pollination. Smooth alder fruit (seed) is a small, compressed, slightly winged nutlet borne in pairs at the base of each cone scale. Fruit matures in autumn. Ripe cones are thick, somewhat woody and dark brown in color. Compared to other alder species, smooth alder is more densely branched and produces more fruit. Smooth alder produces fruit (seed) every year and a good seed crop every four years. Seed typically matures in late autumn (October and November). Cones with mature seed should be harvested promptly and stored in paper bags at room temperature only until the cones dry.**
Propagule Processing:	**Seeds are released as the cones dry. Cones may be shaken and/or crushed by hand or mechanically to extract the seed. Seed may be separated from the crushed cones by hand or a mechanical seed cleaner using combinations of #14, 9, 6, and 1/18 screens.**
Pre-Planting Treatments:	**Smooth alder seed does not maintain its germination in storage. Seed should be sown in nursery beds within one month of harvest.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Best germination and growth of seedlings is in raised beds or sandy soil with adequate moisture. Prepare beds by deep rototilling or other tillage methods that achieve thorough loosening and mixing of soil. Nursery beds must be inoculated with soil from an alder stand to provide the nitrogen fixing bacteria necessary for adequate growth. Seed can be broadcast over the bed and lightly covered with sand or soil or sown in 1/4 inch deep rows and covered lightly. Recommended seeding rates are 50 grams of seed broadcast per 100 square feet of bed or 15 grams of seed per 10 linear feet of row. Beds should be covered with a 2 - 3 inch thick layer of straw to insulate against frost heaving. When seedlings begin to emerge, one-half of the straw should be removed.**
Establishment Phase:	**Germination occurs in the spring after an overwinter period of cool, moist natural stratification.**
Length of Establishment Phase:	**4-6 months, including natural stratification period**
Active Growth Phase:	**Plants require little maintenance during active growth other than application of at least 1 inch of water per week during drouth conditions and elimination of weed competition. Weeds must be removed during early growth phases to avoid uprooting the alder seedlings.**

Length of Active Growth Phase: **6-8 months**

Hardening Phase: **Since the plants are grown outside, no additional hardening is required.**

Harvesting, Storage and Shipping: **Seedlings are harvested in late winter while dormant. The best harvesting method employs a nursery bed lifter/shaker which undercuts the seedlings and gently loosens the soil around the roots. Bare root seedlings are then plucked from the loosened soil by hand. Refrigeration is employed to maintain seedling dormancy after harvest until shipping. Optimal temperatures for maintenance of dormancy are 35-40 degrees Fahrenheit. Root dessication during storage is prevented through packing in aged, moistened hardwood sawdust.**

Length of Storage: **1-2 months**

Outplanting performance on typical sites: **For streambank stabilization, bare root smooth alder seedlings are planted two feet apart within rows with rows spaced two feet apart. A minimum of three rows should be planted for an effective erosion control planting. Smooth alder may be incorporated into a soil bioengineering system by planting at the toe of the bank just above any toe stabilization measures such as rip-rap, coir (coconut) logs, or fascines. When this alder is planted for wildlife habitat improvement, wetland mitigation or seed orchards, planting should be done at a 10 foot spacing to allow for crown development and optimal seed production.**

Other Comments: **River alder is resistant to most disease and insect pests. It is browsed by deer and domestic livestock and is very palatable to beaver. Seed orchards should be protected by fencing to prevent damage from deer and beaver.**

'Panbowl' was released by the Appalachian Plant Materials Center in 2007. 'Panbowl' was collected on Panbowl Lake in Jackson, Breathitt County, Kentucky in USDA plant hardiness zone 6b and MLRA 125. Foundation plants are available to commercial and government nurseries from the Appalachian Plant Materials Center in Alderson West Virginia to establish seed orchards.

References:

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Harrington, Constance A., Leslie Chandler Brodie, Dean S. DeBell, and C. S. Schopmeyer. 1979. *Alnus* P. Mill. published in Symbiotic Nitrogen Fixation in the Management of Temperate Forests. Gordon, J. C., C. T. Wheller and D. A. Perry, eds.

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USDA, Forest Service. 1948. Woody-Plant Seed Manual, Misc. Pub. No. 654, US Government Printing Office, Washington, DC.

Citation:

Vandevender, John 2008. Propagation protocol for production of field-grown *Alnus serrulata* (Aiton) Willd. *Panbowl* plants (Bareroot); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

APPENDIX 4.

Stones River National Battlefield Technology Products

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

United States Department of Agriculture
Natural Resources Conservation Service

Family Scientific Name:	**Cyperaceae**
Family Common Name:	**sedges**
Scientific Name:	***Carex amphibola* Steud.**
Common Name:	**eastern narrowleaf sedge**
Species Code:	**CAAM8**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source eastern narrowleaf sedge was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**Seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 30 days.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by bottom watering. Flats are placed in shallow trays that permit water levels around the flats to be maintained at approximately a one inch depth.**
Establishment Phase:	**Germination typically occurs 10- 14 days after placement in**

	the greenhouse.
Length of Establishment Phase:	**10-14 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 4-6 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**4-6 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 2-4 week period prior to transplanting.**
Length of Hardening Phase:	**2-4 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Carex amphibola* Steud. plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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USDA NRCS - Appalachian Plant Materials Center
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304-445-7049
John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Cyperaceae**
Family Common Name:	**sedges**
Scientific Name:	***Carex blanda* Dewey**
Common Name:	**eastern woodland sedge**
Species Code:	**CABL**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source eastern woodland sedge was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**Seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 30 days.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by bottom watering. Flats are placed in shallow trays that permit water levels around the flats to be maintained at approximately a one inch depth.**
Establishment Phase:	**Germination typically occurs 10- 14 days after placement in the greenhouse.**

Length of Establishment Phase:	**10-14 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 4-6 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**4-6 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 2-4 week period prior to transplanting.**
Length of Hardening Phase:	**2-4 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Carex blanda* Dewey plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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304-445-7049
John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Cyperaceae**
Family Common Name:	**sedges**
Scientific Name:	***Carex cherokeensis* Schwein**
Common Name:	**Cherokee sedge**
Species Code:	**CACH3**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source Cherokee sedge was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**Seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 30 days.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by bottom watering. Flats are placed in shallow trays that permit water levels around the flats to be maintained at approximately a one inch depth.**
Establishment Phase:	**Germination typically occurs 10- 14 days after placement in the greenhouse.**

Length of Establishment Phase:	**10-14 days**
Active Growth Phase:	**After germination, flats are removed from the trays of water and placed on greenhouse benches. Seedlings are maintained in a greenhouse environment 4-6 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**4-6 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 2-4 week period prior to transplanting.**
Length of Hardening Phase:	**2-4 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Carex cherokeensis* Schwein plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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304-445-7049
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Family Scientific Name:	**Cyperaceae**
Family Common Name:	**sedges**
Scientific Name:	***Carex oxylepis* Torr. & Hook.**
Common Name:	**sharpscale sedge**
Species Code:	**CAOX**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source sharpscale sedge was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**Seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 30 days.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by bottom watering. Flats are placed in shallow trays that permit water levels around the flats to be maintained at approximately a one inch depth.**
Establishment Phase:	**Germination typically occurs 10- 14 days after placement in the greenhouse.**

Length of Establishment Phase:	**10-14 days**
Active Growth Phase:	**After germination, flats are removed from the trays of water and placed on greenhouse benches. Seedlings are maintained in a greenhouse environment 4-6 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**4-6 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 2-4 week period prior to transplanting.**
Length of Hardening Phase:	**2-4 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Carex oxylepis* Torr. & Hook. plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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USDA NRCS - Appalachian Plant Materials Center
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Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium acuminatum* (Sw.) Gould & C. A. Clark**
Common Name:	**tapered rosette grass**
Species Code:	**DIAC2**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source tapered rosette grass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**Conditioned seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicnantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium acuminatum* (Sw.) Gould & C. A. Clark plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
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Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium commutatum* (Schult.) Gould**
Common Name:	**variable panicgrass**
Species Code:	**DICO2**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source variable panicgrass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicnantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium commutatum* (Schult.) Gould plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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USDA NRCS - Appalachian Plant Materials Center
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304-445-7049
John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium dichotomum* (L.) Gould**
Common Name:	**cypress panicgrass**
Species Code:	**DIDI6**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source cypress panicgrass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicnantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium dichotomum* (L.) Gould plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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John.Vandevender@wv.usda.gov

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Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium laxiflorum* (Lam.) Gould**
Common Name:	**openflower rosette grass**
Species Code:	**DILA9**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source openflower rosette grass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicnantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium laxiflorum* (Lam.) Gould plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

United States Department of Agriculture
Natural Resources Conservation Service

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium malacophyllum* (Nash) Gould**
Common Name:	**softleaf rosette grass**
Species Code:	**DIMA5**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source softleaf rosette grass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicnantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium malacophyllum* (Nash) Gould plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

United States Department of Agriculture
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Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Dichanthelium villosissmum* (Nash) Freckmann**
Common Name:	**whitehair rosette grass**
Species Code:	**DIVI7**
Ecotype:	**Stones River**
Known Invasiveness:	**none**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River source whitehair rosette grass was hand harvested from the primary (spring) flowering heads from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**

Length of Establishment Phase: **7-10 days**

Active Growth Phase: **After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**

Length of Active Growth Phase: **2-4 months**

Hardening Phase: **Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**

Length of Hardening Phase: **1-2 weeks**

Outplanting performance on typical sites: **To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

Other Comments: **Dicantheliums are characterized by two distinct blooming periods. The conspicuous primary flowering heads are terminal to the culms and are produced in late spring and early summer. Secondary flowering heads are produced from the leaf axils beginning in mid-summer and continuing into early autumn. The primary flowering heads usually have a lower seedset than the secondary ones, which have flowers that remain closed and are self pollinated. However, seed produced by the primary flowers appears to germinate more readily than seed from the secondary flowers.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2010. Propagation protocol for production of container *Dichanthelium villosissmum* (Nash) Freckmann plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 5 August 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant Materials Center

Alderson, West Virginia

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Andropogon ternarius* Michx.**
Common Name:	**splitbeard bluestem**
Species Code:	**ANTE2**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River ecotype splitbeard bluestem was hand harvested from existing populations within the confines of Stones River National Battlefield. Seed is conspicuously tufted or covered with silky white rather stiff racemes.**
Propagule Processing:	**Seed is de-tufted to facilitate handling. Tufts are typically removed by passing the seed through a brush machine equipped with a coarse mantle and medium stiff brushes at a brush speed of 10-12 cycles per minute.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 21 days.**

Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**2-4 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Andropogon ternarius* Michx. plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 24 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant
Materials Center
P. O. Box 390
Alderson, West Virginia 24910
304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant
Materials Center
Alderson, West Virginia

Family Scientific Name: **Poaceae**
Family Common Name: **Grass**
Scientific Name: ***Andropogon gyrans* Ashe**
Common Name: **Elliot's bluestem**
Species Code: **ANGY2**
Ecotype: **Stones River**
Known Invasiveness: **None**
Propagation Goal: **Plants**
Propagation Method: **Seed**
Product Type: **Container (plug)**
Time To Grow: **6 Months**
Target Specifications: **A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection: **Seed of Stones River ecotype Elliot's bluestem was hand harvested from existing populations within the confines of Stones River National Battlefield. Seed is conspicuously tufted or covered with silky white rather stiff racemes.**
Propagule Processing: **Seed is de-tufted to facilitate handling. Tufts are typically removed by passing the seed through a brush machine equipped with a coarse mantle and medium stiff brushes at a brush speed of 10-12 cycles per minute.**
Pre-Planting Treatments: **De-tufted seed is planted into round cell**

	greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 21 days.
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**

References: **USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Andropogon gyrans* Ashe plants; USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 24 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
P. O. Box 390
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304-445-7049
John.Vandevender@wv.usda.gov

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Alderson, West Virginia

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Chasmanthium latifolium* (Michx.) Yates**
Common Name:	**Indian woodoats**
Species Code:	**CHLA5**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River ecotype Indian woodoats was hand harvested from existing populations within the confines of Stones River National Battlefield. Seed is conspicuously tufted or covered with silky white rather stiff racemes.**
Pre-Planting Treatments:	**De-tufted seed is planted into round cell greenhouse flat liners with 38 cells per flat that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases. Prepared flats are lightly hand watered to slightly moisten the growing medium and cold stratified at 35 degrees Fahrenheit for a minimum of 21 days.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination**

	by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in the greenhouse.**
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting. Watering is reduced to overhead hand watering once daily. Seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**2-4 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart. Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Chasmanthium latifolium* (Michx.) Yates plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 24 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
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304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant Materials Center

Alderson, West Virginia

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Elymus riparius* Wiegand**
Common Name:	**riverbank wildrye**
Species Code:	**ELRI**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River ecotype riverbank wildrye was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-awned seed is planted into propagation 38 trays, greenhouse flat liners with 38 2.1 " diameter by 2.2" deep round cells per liner, that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in**

	the greenhouse.
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting.Watering is reduced to overhead hand watering once daily. seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**2-4 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart.Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Elymus riparius* Wiegand plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

Protocol Information

USDA NRCS - Appalachian Plant Materials Center
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304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant Materials Center

Alderson, West Virginia

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Elymus villosus* Muhl. ex Willd.**
Common Name:	**hairy wildrye**
Species Code:	**ELVI**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River ecotype hairy wildrye was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-awned seed is planted into propagation 38 trays, greenhouse flat liners with 38 2.1 " diameter by 2.2" deep round cells per liner, that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in**

	the greenhouse.
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting.Watering is reduced to overhead hand watering once daily. seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**2-4 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart.Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Elymus villosus* Muhl. ex Willd. plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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304-445-3005
304-445-7049
John.Vandevender@wv.usda.gov

Appalachian Plant Materials Center

Alderson, West Virginia

Family Scientific Name:	**Poaceae**
Family Common Name:	**Grass**
Scientific Name:	***Elymus virginicus* L.**
Common Name:	**Virginia wildrye**
Species Code:	**ELVI3**
Ecotype:	**Stones River**
Known Invasiveness:	**None**
Propagation Goal:	**Plants**
Propagation Method:	**Seed**
Product Type:	**Container (plug)**
Stock Type:	**1+0 container plug**
Time To Grow:	**6 Months**
Target Specifications:	**A well developed plant suitable for mechanical transplanting that has at least 6 inches of top growth and a dense, fibrous root system.**
Propagule Collection:	**Seed of Stones River ecotype Virginia wildrye was hand harvested from existing populations within the confines of Stones River National Battlefield.**
Pre-Planting Treatments:	**De-awned seed is planted into propagation 38 trays, greenhouse flat liners with 38 2.1 " diameter by 2.2" deep round cells per liner, that have been filled with coarse processed bark and composted pine bark growing medium. Seed is surface sown at a rate of 3-5 seeds per cell and lightly covered with starter sized, 1/16" - 1/8" diameter, granite poultry grit to combat damping off diseases.**
Growing Area Preparation/ Annual Practices for Perennial Crops:	**Stratified seed is placed in a greenhouse maintained under natural lighting and at a minimum temperature of 70 degrees Fahrenheit. Soil moisture is maintained during germination by an automatic overhead watering system set to cycle for 20 seconds every thirty minutes during daylight hours.**
Establishment Phase:	**Germination typically occurs 7 - 10 days after placement in**

	the greenhouse.
Length of Establishment Phase:	**7-10 days**
Active Growth Phase:	**After germination, seedlings are maintained in a greenhouse environment 2-4 months to promote development of a plug with at least 6 inches of top growth and a dense, fibrous root system suitable for mechanical transplanting.Watering is reduced to overhead hand watering once daily. seedlings receive a water soluble complete fertilizer bi-weekly until hardening.**
Length of Active Growth Phase:	**2-4 months**
Hardening Phase:	**Acclimation is typically accomplished through placement of seedlings outdoors in a protected location for a 1-2 week period prior to transplanting.**
Length of Hardening Phase:	**1-2 weeks**
Outplanting performance on typical sites:	**To establish seed production fields, plugs are mechanically transplanted into a conventionally tilled seedbed. Rows are typically spaced 40 inches apart.Spacing between plugs within rows is 12 inches. Once transplanting is completed, at least 1 inch of irrigation water is applied to enhance root-soil contact and stimulate plant growth.**
References:	**USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.**

Citation:

Vandevender, John 2008. Propagation protocol for production of container *Elymus virginicus* L. plants (1+0 container plug); USDA NRCS - Appalachian Plant Materials Center, Alderson, West Virginia. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 September 2010). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

APPENDIX 5.

Transition to Organic Production Cover Crop Trial and Field Corn Nitrogen Response to Rolled Cover Crop Mulch

USDA Plant Materials Center, Alderson West Virginia
2010 Cover Crop trial/Field Corn Nitrogen Response to Rolled Cover Crop Mulch
Replications: 4
Planting Dates: 4 dates , 1st planting: September 3rd; 2nd planting 16 or 17th Sept. ; 3rd planting Oct. 4-7 and 4th planting October 25-29
Treatments:

1) Crimson Clover
2) Crimson Clover/Aroos. Rye
3) Purple Bounty
4) Purple Bounty/Aroos. Rye
5) Common Vetch
6) Common Vetch/ Aroos. Rye
7) Cover Crop Wheat
8) Common Barley
9) Purple Bounty/Common Barley
10) Aroos. Rye

Treatment	Lbs/Acre	Ounces/ 30 ft sq. 16 oz = 1 lb	Grams / 30 ft. sq. 1 oz = 28.3495 grams
Crimson Clover	20 lb per acre	0.22	6 grams
Crimson Clover/Aroos. Rye	15 lbs crimson clover/ 112 lb rye		4.6 grams cc and 35 grams a. rye
Purple Bounty	30 lbs acre		9.4 grams
Purple Bounty/Aroos. Rye	30 lbs vetch and 112 lbsrye		9.4 grams vetch and 35 grams rye
Common Vetch	30 lb acre		9.4 grams vetch
Common Vetch/ Aroos. Rye	30 and 112		9.4 grams vetch and 35 grams rye
Cover Crop Wheat	120		37.5 grams wheat
Common Barley	100	1.1 oz	31.2 grams barley
Purple Bounty/Common Barley	30 and 100		9.4 grams vetch and 31.2 grams barley
Aroos. Rye	112		35 grams rye

Individual plot size: 2.5 ft by 10ft. Area: 25 ft^2
Space Between individual Plots: 2 ft. break, to be planted to oats at second planting
Total plot width: Ten treatment plots at 2.5 ft per plot so, 50 ft. Not including buffer strips of rye, 4 ft. each side

Total plot length: 16 treatment plots plus 2 ft break between each plot = 200 ft.

Cover Crop sequential planting plot map

	Buffer planted with tye seeder										
Buffer Planted with tye seeder	1 P 1 Rep 2 T 7	2 P 4 Rep 3 T 3	3 P 3 Rep 1 T 5	4 P 2 Rep 2 T 4	5 P 4 Rep 2 T 1	6 P 2 Rep 1 T 6	7 P 4 Rep 1 T 1	8 P1 Rep 1 T 9	9 P 1 Rep 2 T 9	10 P 2 Rep 2 T 3	Buffer Planted with tye seeder
	Buffer planted with research planter										
	11 P 4 Rep 1 T 7	12 P1 Rep 4 T 3	13 P 4 Rep 3 T 6	14 P 4 Rep 1 T 6	15 P 1 Rep 3 T 6	16 P 3 Rep 3 T 7	17 P 1 Rep 2 T 8	18 P 4 Rep 1 T 2	19 P 3 Rep 1 T 10	20 P 3 Rep 1 T 2	
	Buffer planted with research planter										
	21 P3 Rep 1 T 7	22 P 2 Rep 1 T 10	23 P 4 Rep 3 T 5	24 P 2 Rep 3 T 6	25 P 3 Rep 3 T 3	26 P 3 Rep 1 T 3	27 P 2 Rep 4 T 4	28 P 2 Rep 1 T 9	29 P 4 Rep 4 T 2	30 P1 Rep 3 T 5	
	Buffer planted with research planter										
	31 P 2 Rep 3 T 7	32 P2 Rep 1 T 1	33 P 3 Rep 2 T 3	34 P 1 Rep 2 T 10	35 P 2 Rep 4 T 1	36 P1 Rep 1 T 7	37 P 4 Rep 2 T 5	38 P 2 Rep 4 T 10	39 P 2 Rep 4 T 2	40 P 4 Rep 1 T 4	
	Buffer planted with research planter										
	41 P 3 Rep 2 T 9	42 P1 Rep1 T2	43 P 1 Rep 3 T 9	44 P3 Rep 4 T 7	45 P 4 Rep 2 T 10	46 P 4 Rep 2 T 9	47 P 3 Rep 1 T 9	48 P 1 Rep 1 T 6	49 P 2 Rep 1 T 4	50 P 1 Rep 2 T 3	
	Buffer planted with research planter										
	51 P 3 Rep 2 T 4	52 P 1 Rep 4 T 9	53 P 2 Rep 2 T 9	54 P 3 Rep 4 T 10	55 P 3 Rep 4 T 1	56 P 4 Rep 1 T 3	57 P 1 Rep 1 T3	58 P 3 Rep 4 T 4	59 P 1 Rep 1 T 1	60 P 4 Rep 3 T 4	
	Buffer planted with research planter										
	61 P 4 Rep 2 T 8	62 P 3 Rep 2 T 10	63 P2 Rep 1 T 2	64 P 2 Rep 3 T 2	65 P 3 Rep 2 T 7	66 P 1 Rep 4 T 5	67 P 3 Rep 2 T 5	68 P 2 Rep 2 T 10	69 P 1 Rep 2 T 4	70 P 2 Rep 2 T 8	
	Buffer planted with research planter										

71 P 1 Rep 4 T 8	72 P 4 Rep 4 T 9	73 P 2 Rep 3 T 3	74 P 3 Rep 1 T 1	75 P 4 Rep 4 T 6	76 P 3 Rep 4 T 6	77 P 2 Rep 4 T 7	78 P 4 Rep 1 T 10	79 P 1 Rep 4 T 1	80 P1 Rep 4 T 6
Buffer planted with research planter									
81 P 2 Rep 4 T 5	82 P 4 Rep 4 T 7	83 P 2 Rep 3 T 4	84 P 2 Rep 4 T 8	85 P 2 Rep 4 T 3	86 P 3 Rep 3 T 1	87 P 4 Rep 4 T 8	88 P 2 Rep 2 T 5	89 P 4 Rep 2 T 4	90 P 1 Rep 3 T 8
Buffer planted with research planter									
91 P1 Rep 4 T 2	92 P 4 Rep 3 T 10	93 P 2 Rep 2 T 6	94 P 1 Rep 3 T 7	95 P2 Rep 4 T 6	96 P 2 Rep 2 T 2	97 P 3 Rep 4 T 3	98 P 4 Rep 1 T 8	99 P 4 Rep 3 T 7	100 P 1 Rep 1 T 5
Buffer planted with research planter									
101 P 1 Rep 3 T 4	102 P 3 Rep 2 T 2	103 P 4 Rep 3 T 1	104 P 3 Rep 4 T 5	105 P 3 Rep 4 T 2	106 P 3 Rep 2 T 8	107 P 4 Rep 2 T 6	108 P 3 Rep 3 T 9	109 P 4 Rep 1 T 9	110 P 3 Rep 3 T2
Buffer planted with research planter									
111 P 3 Rep 4 T 9	112 P 4 Rep 2 T 3	113 P 1 Rep 2 T 1	114 P1 Rep 1 T10	115 P 1 Rep 1 T 8	116 P 4 Rep 4 T 1	117 P 1 Rep 2 T2	118 P1 Rep 3 T1	119 P 2 Rep 1 T 8	120 P 2 Rep 1 T 7
Buffer planted with research planter									
121 P 4 Rep 4 T 3	122 P1 Rep 3 T 2	123 P 3 Rep 1 T 4	124 P 2 Rep 1 T 3	125 P 4 Rep 3 T 2	126 P 2 Rep 4 T 9	127 P 3 Rep 1 T 6	128 P 2 Rep 2 T 1	129 P 1 Rep 3 T 10	130 P 3 Rep 3 T 4
Buffer planted with research planter									
131 P 1 Rep 1 T4	132 P 3 Rep 2 T 6	133 P 1 Rep 4 T 10	134 P 4 Rep 3 T8	135 P 1 Rep 4 T 7	136 P 1 Rep 2 T 5	137 P 1 Rep 3 T 3	138 P 2 Rep 3 T 9	139 P 4 Rep 4 T 4	140 P 3 Rep 2 T 1
Buffer planted with research planter									
141 P 2 Rep 3 T 1	142 P 4 Rep 2 T 7	143 P 4 Rep 4 T 5	144 P 2 Rep 3 T 10	145 P 1 Rep 2 T 6	146 P 3 Rep 3 T 10	147 P 4 Rep 1 T 5	148 P 2 Rep 2 T 7	149 P 4 Rep 2 T 2	150 P 2 Rep 3 T 8

	Buffer planted with research planter									
	151 P 1 Rep 4 T 4	152 P 3 Rep 3 T 8	153 P 3 Rep 4 T 8	154 P 2 Rep 3 T 5	155 P 4 Rep 3 T 9	156 P 2 Rep 1 T 5	157 P 3 Rep 3 T 5	158 P 3 Rep 1 T 8	159 P 3 Rep 3 T 6	160 P 4 Rep 4 T 10
	Buffer Planted with tye seeder									