

# TECHNICAL NOTES

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U.S. Department of Agriculture

Natural Resources Conservation Service

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TN- PLANT MATERIALS CA-75

August 2007

## ELKHORN SLOUGH WATERSHED GRASS PERFORMANCE CONSERVATION FIELD TRIAL RESULTS

Attached is Plant Materials Technical Note No. 75, Elkhorn Slough Watershed Grass Performance Conservation Field Trial Results

This technical note describes a two year conservation field trial designed to evaluate and promote the use of grasses for erosion control in northern Monterey County, California. This planting also provides an opportunity for the demonstration and identification of grasses that may be used in conjunction with conservation practices on the Central Coast of California.

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Prepared by Rita Bickel, State Conservation Agronomist, Resource Technology Staff, Natural Resources Conservation Service, Davis, CA.



# TECHNICAL NOTES

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U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

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PLANT MATERIALS TECHNICAL NOTE NO. 75

August, 2007

## ELKHORN SLOUGH WATERSHED GRASS PERFORMANCE CONSERVATION FIELD TRIAL RESULTS

Field Trial Designed, Implemented and Documented by:  
Cheryl L. Lambert

### ABSTRACT

This technical note describes a two year conservation field trial in the Elkhorn Slough Watershed located in northern Monterey County, California. Over the past twelve years, the NRCS Elkhorn Slough Watershed Project team in north Monterey County, California, has promoted conservation practices that reduce soil erosion and sedimentation of waterways caused by hillside farming in the watershed. The trial was initiated to determine useful erosion control grasses and as a demonstration of grass species for plant identification purposes. The information produced from the trial will be used by growers, landowners and staff. It is hopeful that the trial will also promote awareness and use of native and non-native grass species throughout the central California coast region. More than 50% of the farmers in the watershed are tenants on the land, farming strawberries, cane berries, flowers, herbs, vegetables or fruit orchard crops on relatively small hillside acreage. There is a need to promote native and/or non-invasive introduced species of grasses to be used for prevention of water erosion and runoff from farm roads, agricultural production fields and hillsides. Added benefits of using grasses may include wildlife habitat and beneficial insect habitat. Grasses are commonly and effectively used in many NRCS conservation practices.

In 2003, the first of two plantings of twenty-seven grass species was sown at 50 PLS per square foot or transplanted into 25 ft<sup>2</sup> plots. In 2004, a second planting consisting of fifteen grass species selected from planting I was sown. Both plantings were maintained for 3.5 years to allow perennials to mature and become established.

Estimates of attributes evaluated by the planner include percent cover, plant height, vigor, and regrowth in the second year, as well as plant response to weed pressure. Persistence of grass species was determined with observational information collected in the fall of 2006 and spring of 2007.

Annual species which appeared to provide the most adequate erosion control, cover, vigor, and persistence were, *Vulpia myuros hirsute* 'Zorro' and *Bromus hordeaceus* 'Blando'. Both annual species reseeded naturally. Seeded perennial species that appeared to have adequate long term performance were, *Dactylis glomerata* 'Berber' orchardgrass, *Agropyron intermedium*, intermediate wheatgrass, and *Phalaris aquatica* 'Perla' koleagrass.

**TABLE I: Key - Grass Identification**

SPECIES NAME	COMMON NAME	TYPE	SEED (S) OR VEGATATIVE	SEED RATE PLS PER SQUARE FOOT	GROUP
<i>Bromus carinatus</i> "Cucamonga"	'Cucamonga' California brome	AN	S	50	1
<i>Danthonia californica</i>	California oatgrass	PN	S	50	2
<i>Deschampsia caespitosa</i>	tufted hairgrass	PN	S	50	2
<i>Deschampsia elongate</i>	slender hairgrass	PN	S	50	2
<i>Deschampsia holciformis</i>	pacific hairgrass	PN	S	50	2
<i>Distichlis spicata</i>	seashore saltgrass	PN	P STOLENS	50	3
<i>Elymus glaucus</i> 'Mariposa'	'Mariposa' blue wildrye	PN	S	50	2
<i>Festuca californica</i>	California fescue	PN	S	50	2
<i>Festuca idahoensis</i>	Idaho fescue	PN	S	50	2
<i>Festuca rubra</i> 'Molate'	'Molate' red fescue	PN	S	50	2
<i>Hordeum brachyanthemum</i>	meadow barley	PN	S	50	2
<i>Leymus triticoides</i> 'Rio'	'Rio' creeping wildrye	PN	P PLUG	50	3
<i>Melica californica</i>	California melic	PN	S	50	2
<i>Melica imperfecta</i>	coast range melic	PN	S	50	2
<i>Muhlenbergia rigens</i>	deer grass	PN	P PLUG	50	3
<i>Nassella cernua</i>	nodding needlegrass	PN	S	50	2
<i>Nassella lepida</i>	foothill needlegrass	PN	S	50	2
<i>Nassella pulchra</i>	purple needlegrass	PN	S	50	2
<i>Phalaris californica</i>	California canarygrass	PN	S	50	2
<i>Poa scabrella</i>	pine bluegrass	PN	S	50	2
<i>Vulpia microstachys, pauciflora</i>	Pacific fescue	AN	S	50	1
<i>Agropyron intermedium</i>	intermediate wheatgrass	PI	S	50	2
<i>Bromus hordeaceus</i> 'Blando'	'Blando' brome	AI	S	50	1
<i>Dactylis glomerata</i> 'Berber'	'Berber' ochargrass	PI	S	50	2
<i>Hordeum vulgare</i>	common barley	AI	S	50	1
<i>Phalaris aquatica</i> 'Perla'	'Perla' koleagrass	PI	S	50	2
<i>Vulpia myuros hirsute</i> 'Zorro'	'Zorro' annual fescue	AI	S	50	1

A = Annual P= Perennial N = Native to California I = Introduced

Group 1 = annual from seed Group 2 = perennial from seed Group 3 = perennial from plug or stolens

A list of references consulted for grass species selection is provided at the end of this document.

## PLANTING I MATERIALS AND METHODS

The planting site was prepared by disking with a small tractor towing a disk and harrow. No chemical herbicides or fertilizers were used initially due to the preferences of the landowners. A cover crop of bell beans and barley was incorporated into the soil the season before planting. Winter rains helped initiate stand establishment. Irrigation by movable sprinklers was used during the dry months. Weeds were hoed by hand or cut with a string trimmer. The trial was mowed with a lawn mower in the spring to control weeds and to promote root growth.

Twenty-seven plots were staked out and seeded in October and November 2003, or planted with grass plugs in December 2003. A 4,500 Ft<sup>2</sup> area was utilized for the trial. Each plot was 25 ft.<sup>2</sup>. Three repetitions were made in three rows. Subterranean clover, *Trifolium subterraneum*, was planted in three-

foot wide bands between each row to be used as footpaths and for erosion control on the hillside. The hill slope in this area ranges from 2% to 6%. Soil type is ShC, Santa Inez Fine Sandy Loam.

## PLANTING I DISCUSSION

Table II consists of rankings for percent cover, vigor, regrowth and ability to establish under weed pressure. The rankings and species are from the first planting. Twelve entries exhibiting adequate early spring germination from the first planting (3/17/04) were selected for a second planting in the fall of 2004 (Table III). This planting was subsequently evaluated in June 2, 2005, by Dave Dyer, NRCS Lockeford, California, PMC Manager, and Cheryl Lambert, Elkhorn Project Coordinator. Observations of characteristics were recorded to assess percent cover, vigor, regrowth and establishment in spite of weed pressure. Rankings in each category were scored on a scale of 1 (lowest) to 10 (highest). Species were ranked with results presented in Table III. Perennial grasses tended to establish in the second year of growth.

**TABLE II: Planting I, Percent Cover, Vigor, Regrowth and Weed Control Rankings**

PERCENT COVER			VIGOR		
Rank	Botanical Name	Common Name	Rank	Botanical Name	Common Name
1	<i>Dactylis glomerata</i> 'Berber'	'Berber' orchardgrass	1	<i>Muhlenbergia rigens</i>	deer grass
2	<i>Festuca rubra</i> 'Molate'	'Molate' red fescue	2	<i>Nassella cernua</i>	nodding needlegrass
3	<i>Phalaris aquatica</i> 'Perla'	'Perla' koleagrass	3	<i>Elymus glaucus</i> 'Mariposa'	'Mariposa' blue wildrye
4	<i>Festuca idahoensis</i>	Idaho fescue	4	<i>Leymus triticoides</i> 'Rio'	'Rio' creeping wildrye
5	<i>Nassella pulchra</i>	purple needlegrass	5	1 <i>Agropyron</i> <i>intermedium</i>	1 intermediate wheatgrass
				2 <i>Festuca idahoensis</i>	2 Idaho Fescue
				3 <i>Distichlis spicata</i>	3 seashore saltgrass
REGROWTH			WEED CONTROL		
Rank	Botanical Name	Common Name	Rank	Botanical Name	Common Name
1	<i>Nassella cernua</i>	nodding needlegrass	1 (two-way tie)	1 <i>Nassella cernua</i>	1 nodding needlegrass
2	<i>Agropyron</i> <i>intermedium</i>	intermediate wheatgrass		2 <i>Argropyron</i> <i>intermedium</i>	2 intermediate wheatgrass
3	<i>Elymus glaucus</i> 'Mariposa'	blue wildrye	2	<i>Elymus glaucus</i> 'Mariposa'	'Mariposa' blue wildrye
4	<i>Leymus triticoides</i> 'Rio'	'Rio' creeping wildrye	3 (three-way tie)	1 <i>Distichlis spicata</i>	1 seashore saltgrass
5	<i>Distichlis spicata</i>	seashore saltgrass		2 <i>Leymus triticoides</i> "Rio"	2 'Rio' creeping wildrye
				3 <i>Muhlenbergia rigens</i>	3 deer grass
			4	<i>Festuca idahoensis</i>	Idaho fescue
			5	<i>Deschampsia elongata</i>	slender hairgrass

**Table II: Species from Planting I Selected for Second Planting**

<b>SPECIES BOTANICAL NAME</b>	<b>SPECIES COMMON NAME</b>	<b>TYPE</b>	<b>NATIVE CA OR INTRO</b>
<i>Vulpia myuros hirsute</i>	'Zorro' annual fescue	A	I
<i>Hordeum vulgare</i>	common barley	A	I
<i>Bromus hordeaceus</i>	'Blando' brome	A	I
<i>Phalaris aquatica</i>	'Perla' koleagrass	P	I
<i>Hordeum brachyanthemum</i>	meadow barley	P	N
<i>Vulpia microstachys</i>	Pacific fescue	P	N
<i>Elymus glaucus</i>	'Mariposa' blue wildrye	P	N
<i>Dactylis glomerata</i>	'Berber' orchardgrass	P	I
<i>Deschampsia elongata</i>	slender hairgrass	P	N
<i>Festuca rubra</i>	'Molate'' red fescue	P	N
<i>Deschampsia holciformis</i>	Pacific hairgrass	P	N
<i>Festuca Idahoensis</i>	Idaho fescue	P	N

**PLANTING II MATERIALS AND METHODS**

A second planting was sown in the fall of 2004 to replicate some of the species used from 2003/2004. Fifteen grasses from the first planting were selected according to ranking of percent cover, regrowth and ability to establish under weed pressure. Plants were selected and ranked using observational methods by the planner. Each plot was 100 ft<sup>2</sup>, and ten plots were made in three rows with walking paths in between rows. This planting was placed next to, and downhill from, the 2003 plots on an average 6 % slope with predominately Santa Inez (ShC) Fine Sandy Loam soil type.

The ground was prepared by disking the previous cover crop, then irrigated with sprinklers or watered by winter rains through April 2005. Supplemental irrigation was applied from July to October 2005 during the dry months. Weeding was done by hand with a hoe or with a string trimmer. A heavy seed bank of wild radish, mustard, chickweed and Italian ryegrass in this field, provided strong competition for the trial grass species. No fertilizer was applied, although a mature cover crop of bell beans and barley was worked into the soil the previous season. Plants were slow-growing and stunted due to low soil fertility. Soil samples were taken in 2004 and a standard laboratory test was performed. The soil test indicated low levels of nitrogen and phosphorus. Composted chicken manure was applied to the plots for both plantings in the fall of 2005 as a top dress fertilizer.

**PLANTING II DISCUSSION**

The results reflect how these species may perform in the Elkhorn Slough Watershed under challenging and typical farming circumstances. Several grasses performed well in Planting II. Data collection was performed bi-weekly from 1/25/05 to 5/24/05. The averages for these data are presented in Appendices I and II.

**PLANT HEIGHT**

One cannot compare plant height as a measure of plant vigor for the fifteen grass species planted in the trial, because various growth characteristics are represented in individual species selected to be included in the trial. However, the planner made subjective observational assumptions, which are summarized below.

Plants were generally stunted due to low soil fertility in this area of the field; however, these results are relative and may represent similar results under adverse growing conditions.

The tallest annual species, as measured during weekly visual observation of plots during the spring of 2005, with the greatest visible biomass at the end of the growing season, were *Bromus hordeaceus*, ‘Blando’ brome and *Vulpia myuros hirsute*, ‘Zorro’ annual fescue.

The native annual, *Vulpia microstachys*, var. pauciflora, Pacific fescue, appeared to grow and establish relatively quickly.

Perennials from seed that established adequately included: 1) *Hordeum brachyanthemum*, meadow barley, 2) *Phalaris aquatica*, ‘Perla’ koleagrass, 3) *Festuca idahoensis*, Idaho fescue (poor seed germ, however), and 4) *Dactylis glomerata*, ‘Berber’ orchardgrass.

## PERCENT COVER

Percent cover was measured visually from plot to plot on each data collection date during the spring growing season. Among the annual grasses that were selected for replanting, two of the introduced species, *Vulpia myuros hirsute*, ‘Zorro’ annual fescue, and *Bromus hordeaceus*, ‘Blando’ brome, provided the greatest percent cover. Both ‘Zorro’ annual fescue and ‘Blando’ brome provided excellent ground cover over the duration of the season. *Vulpia microstachys*, var. pauciflora, Pacific fescue, an annual native, also provided measurable cover in this trial. In the Elkhorn Watershed, common barley, generally having substantial biomass, is commonly used as a quick growing, vigorous winter cover crop and for erosion control on roads and slopes, however the control for this trial, *Hordeum vulgare*, common barley, exhibited poor seed germination.

Perennial grasses planted from seed which provided the greatest percent cover for the first year of Planting II were: 1) *Phalaris aquatica*, ‘Perla’ koleagrass, 2) *Deschampsia holciformis*, Pacific hairgrass, 3) *Hordeum brachyanthemum*, meadow barley, and 4) *Dactylis glomerata*, ‘Berber’ orchardgrass. These grasses have many different growth habits, and some species are native while others are introduced, therefore, it should be noted that one cannot compare these species in growth habit or performance. The intension of this trial is one of demonstration of plant materials for use in erosion control on a farm. Wildlife habitat and cover cropping provide added value to these selections. Future trials should be conducted to assess further characteristics and should be set up to compare vegetation with similar taxonomy.

Perennials provided good cover for a longer period of time before drying out or going dormant during the summer of 2005. Annuals provided quick ground cover, and made a good companion crop in combination with perennial grasses providing competition to weeds for the first year. *Leymus triticoides* “Rio”, creeping wildrye and *Muhlenbergia rigens*, deer grass, were established and growing well in the first year of Planting II, however, it took several months for a good cover to develop. These species were discussed under the Planting I results section.

**TABLE IV: Planting II First Year Results**

RANK	PERCENT COVER	SPECIES BOTANICAL NAME	SPECIES COMMON NAME	TYPE	NATIVE CA OR INTRODUCED
1	94	<i>Vulpia myuros hirsute</i> 'Zorro'	'Zorro' annual fescue	Annual	I
2	85	<i>Bromus hordeaceus</i>	'Blando' brome	Annual	I
3	80	<i>Vulpia microstachys</i> , var. pauciflora	Pacific fescue	Annual	N

1	75	<i>Phalaris aquatica</i> 'Perla'	'Perla' koleagrass	Perennial	I
2	65	<i>Deschampsia holciformis</i>	Pacific hairgrass	Perennial	N
3	63	<i>Hordeum brachyanthemum</i>	Meadow barley	Perennial	N
4	55	<i>Dactylis glomerata</i> 'Berber'	'Berber' orchardgrass	Perennial	I
1	35	<i>Leymus triticoides</i> 'Rio'	'Rio' creeping wildrye	Perennial Plug	N

## CONCLUSION

For further information, data was collected in the fall of 2006 and spring of 2007, year three. Information was collected from plantings I and II to evaluate species establishment and persistence. The trial was grazed by sheep in February 2007 and the final evaluation was conducted in April 2007. The results indicate expected results. Annuals germinated and established quick cover in the short term, and many perennials outgrew them and persisted in subsequent years. The level of weed suppression in the first year of growth makes a difference in overall stand establishment. Planting I had more broadleaf weeds removed in year one than Planting II. Different weed control methods were used on each planting that may have resulted in fewer perennials becoming established in Planting II. 'Blando' brome, Berber orchardgrass and Creeping wildrye 'Rio' established well in spite of weed competition. California canary grass from Planting I established in the third year.

**TABLE VI: Performance in Plantings I and II\***

ID	BOTANICAL NAME	COMMON NAME	PERSISTANT	OVERALL PERFORMANCE
<b>ANNUALS</b>				
W	<i>Bromus hordeaceus</i>	'Blando' brome	Yes reseeded	Excellent
AA	<i>Zorro annual fescue</i>	'Zorro' annual fescue	Yes reseeded	very good
<b>PERENNIALS</b>				
L	<i>Leymus triticoides</i>	Creeping wildrye 'Rio'	Yes	Excellent
Z	<i>Phalaris aquatica</i>	'Perla' koleagrass	Yes	Excellent
X	<i>Dactylis glomerata</i>	'Berber' orchardgrass	Yes	Excellent
V	<i>Agropyron intermedium</i>	Intermediate wheatgrass		Excellent
O	<i>Muhlenbergia rigens</i>	Deer grass	Yes	very good
S	<i>Phalaris californica</i>	California canary grass	Yes	very good
E	<i>Deschampsia holciformis</i>	Pacific hairgrass	dieback	very good
I	<i>Festuca idahoensis</i>	Idaho fescue		very good
J	<i>Festuca rubra</i>	'Molate' Red fescue	Yes dieback	very good
K	<i>Hordeum brachyanthemum</i>	Meadow barley		Good
U	<i>Vulpia microstachys, pauciflora</i>	Pacific fescue		Good
R	<i>Nassella pulchra</i>	Purple needlegrass		Good
P	<i>Nassella cernua</i>	Nodding needlegrass		Good
Q	<i>Nassella lepida</i>	Foothill needlegrass		Good
D	<i>Deschampsia elongata</i>	Slender hairgrass		Good

A	<i>Bromus carinatus</i>	California brome 'Cucamonga'		Good
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\* Assumption of planner's observational correlation of vigor, percent cover, height, regrowth, establishment.

## COMMENTS ON FUTURE ATTEMPTS TO REPLICATE THIS STUDY

To design an attempted replication of this experiment, it is important to consider the following. A strategy should be developed to properly draw valid conclusions from the results. The study should be planned utilizing a method of experimental design that consists of a population that allows comparable and measurable characteristics. The designer should keep in mind that a sampling unit is one of a set of objects in a sample that is drawn to make inferences about a population of those same objects. Therefore, further trials designed and conducted to assess measurable characteristics of the grass species in this study should be planned to compare grasses with similar taxonomy.

A more detailed examination of biomass could be conducted utilizing proper protocols for determining biomass of standing residue and/or flat residue respectively. Methods for measuring standing biomass can be found in the United States Department of Agriculture, Natural Resources Conservation Service, *National Range and Pasture Handbook*. Methods for measuring flat residue are found in the United States Department of Agriculture, Natural Resources Conservation Service, *National Agronomy Manual*.

Assessments or statements that attempt to qualify or quantify habitat and use of plants by insects or wildlife should be evaluated as to effectiveness through proper protocols.

## REFERENCES

Elkhorn Slough Foundation in cooperation with the California Department of Fish and Game and the U.S. Dept. of Commerce, National Oceanographic and Atmospheric Administration, The Native Species Planting Guide for the Elkhorn Slough National Estuarine Research Reserve, available at <http://www.elkhornslough.org/plants/restoration.htm>. February 2001.

Robins, Paul, Bring Farm Edges Back to Life!, Fourth Edition, Yolo County Resource Conservation District, available at <http://www.yolorcd.ca.gov>, Woodland, California, November 1999.

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Wrynski, Jeanette, Know Your Natives, A Pictorial Guide to California Native Grasses, Yolo County Resource Conservation District, available at <http://www.yolorcd.ca.gov>, Woodland, California, 2000.

**APPENDIX I AVERAGE PLANT HEIGHT ELKHORN GRASS CFT 053-0401 - PLANTING II, YEAR ONE DATA COLLECTED IN 2005**

PLOT NO.	COMMON NAME	BOTANICAL NAME	(INCHES)							
			1/25/2005	2/24/2005	3/9/2005	3/24/2005	4/6/2005	4/20/2005	5/5/2005	5/24/2005
AA	'Zorro' annual fescue	<i>Vulpia myuros hirsute</i> 'Zorro'	1	1.13	2.25	6.25	11.50	13.50	13.50	18.50
D	slender hairgrass	<i>Deschampsia elongata</i>	1	2.13	2.13	4.25	10.50	12.00	13.50	14.00
E	Pacific hairgrass	<i>Deschampsia holciformis</i>	0.5	1.00	1.00	2.25	3.25	3.50	5.00	4.00
F	*seashore saltgrass	<i>Distichlis spicata</i>	3	2.75	2.75	3.50	3.50	3.50	3.50	3.50
G	blue wildrye 'Mariposa'	<i>Elymus glaucus</i> 'Mariposa'	1.5	3.25	3.25	3.75	5.00	8.00	8.00	13.00
I	Idaho fescue	<i>Festuca idahoensis</i>	1.63	2.88	2.88	3.00	3.50	3.50	4.00	15.00
J	'Molate' red fescue	<i>Festuca rubra</i> 'Molate'	1	1.63	2.00	4.00	2.50	6.00	13.00	13.00
K	meadow barley	<i>Hordeum brachyanthemum</i>	1.63	2.00	2.00	4.00	5.00	6.00	8.50	16.50
L	*creeping wildrye 'Rio'	<i>Leymus triticoides</i> 'Rio'	6.25	6.25	10.00	15.50	15.50	19.50	22.00	24.00
U	Pacific fescue	<i>Vulpia microstachys</i>	1.38	3.63	4.25	7.00	12.00	15.00	16.00	17.00
O	*deer grass	<i>Muhlenbergia rigens</i>	2.25	2.30	2.50	5.00	10.00	12.00	12.00	12.00
W	'Blando' brome	<i>Bromus hordeaceus</i> 'Blando'	1.38	1.75	2.50	3.25	5.50	8.00	12.00	23.00
X	'Berber' orchardgrass	<i>Dactylis glomerata</i> 'Berber'	0.88	2.00	2.00	3.00	4.50	5.25	10.00	15.00
Y	common barley	<i>Hordeum vulgare</i>	0.75	3.25	3.25	11.00	11.00	11.00	12.00	12.00
Z	'Perla' koleagrass	<i>Phalaris aquatica</i> 'Perla'	1.63	2.38	3.25	7.25	5.50	8.00	9.00	15.50

\* Grown from plugs or stolens

**APPENDIX II AVERAGE PERCENT COVER ELKHORN GRASS CFT 053-0401 - PLANTING II, YEAR ONE DATA COLLECTED IN 2005**

PLOT NO.	COMMON NAME	BOTANICAL NAME	1/25/2005	2/24/2005	3/9/2005	3/24/2005	4/6/2005	4/20/2005	5/5/2005	5/24/2005
AA	'Zorro' annual fescue	<i>Vulpia myuros hirsute</i> 'Zorro'	45	80	80	90	93	94	94	94
D	slender hairgrass	<i>Deschampsia elongata</i>	5	10	15	28	33	35	38	38
E	Pacific hairgrass	<i>Deschampsia holciformis</i>	8	20	25	55	55	63	63	65
F	*seashore saltgrass	<i>Distichlis spicata</i>	5	8	8	8	5	3	1	1
G	blue wildrye 'Mariposa'	<i>Elymus glaucus</i> 'Mariposa'	7	15	18	20	21	23	25	25
I	Idaho fescue	<i>Festuca idahoensis</i>	8	8	10	25	25	30	30	33
J	'Molate' red fescue	<i>Festuca rubra</i> 'Molate'	6	8	10	20	20	23	35	35
K	meadow barley	<i>Hordeum brachyanthemum</i>	13	33	35	45	45	50	58	63
L	*creeping wildrye 'Rio'	<i>Leymus triticoides</i> 'Rio'	15	17	18	23	28	33	35	35
U	Pacific fescue	<i>Vulpia microstachys</i>	25	45	55	65	73	78	80	80
O	*deer grass	<i>Muhlenbergia rigens</i>	2	5	5	3	3	3	3	0
W	'Blando' brome	<i>Bromus hordeaceus</i> 'Blando'	33	75	80	83	83	85	85	85
X	'Berber' orchardgrass	<i>Dactylis glomerata</i> 'Berber'	13	30	35	48	50	53	55	55
Y	common barley	<i>Hordeum vulgare</i>	1	8	5	6	6	5	0	0
Z	'Perla' koleagrass	<i>Phalaris aquatica</i> 'Perla'	5	35	38	50	50	53	55	75

\* Grown from plugs or stolens