United States Department of Agriculture
Natural Resources Conservation Service

Lockeford Plant Materials Center
21001 N. Elliott Road
Lockeford, CA 95237

2012 Technical Report

Lockeford Plant Materials Center

Lockeford, California

May 2013

Lockeford Plant Materials Center

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INTRODUCTION

The Lockeford Plant Materials Center (CAPMC) is a federally owned and operated facility, currently under the administration of the California State Office of the USDA Natural Resources Conservation Service. The California Plant Materials Program began February 1935 with the Soil Conservation Service Plant Materials Nursery at Santa Paula, CA. In 1939 a 60-acre Plant Materials Center was established at Pleasanton, CA and in September 1973 was moved to the current site at Lockeford, CA.

The current CAPMC service area covers close to 62 million acres (96,700 mi^2) and includes 11 Major Land Resource Areas (MLRAs). The area served by the California Plant Materials Center is characterized by a Mediterranean climate with six month dry season in the summer, and six-month rainy season in the winter. The area has a very complex pattern of soils. The topography consists of broad valleys, rolling foothills, upland plateaus and rugged mountains. Elevation extremes are from 20 feet below sea level to 14,400 feet above sea level. Agriculture in the service area is extremely diversified, including fruits and vegetables, rangeland with extensive livestock production, dairies, and timber production. We continue to develop plant technologies to promote conservation to address resource concerns within our service area.

The CAPMC is 106.7 acres of prime farmland located along the Mokelumne River near Lockeford, California. Soils at the CAPMC are primarily Columbia fine sandy loam and Vina fine sandy loam. The levee is an Egbert silty clay loam. Soil pH ranges from 6.7 to 7.0, Irrigation water is available to all fields at the CAPMC as surface irrigation, and also with a new pressurized irrigation system installed at the CAPMC in 2012. The new irrigation system allow us to access all fields with up to date irrigation systems including sprinkler, through hand and wheel line and subsurface drip irrigation.

The service area has a complex topography composed of broad valleys, including the Central Valley, rolling foot-hills, upland plateaus, and rugged mountains. The CAPMC's conservation plant releases include native releases: purple needlegrass, California brome, blue wildrye, sulfur flower buckwheat, inland saltgrass, and fourwing saltbush. Our non-native releases include Berber orchard grass used for range and pasture enhancement, and 'Lana' woollypod vetch with utility for cover crops.

The mission of the CAPMC is to develop technology and plant materials to address the resource concerns of California. The majority of our work focuses on species that are native to California. The CAPMC is responsible for seed increase plantings of potentially valuable plant species and for the maintenance of seed stock of California cooperative releases. We collect promising plants and test their performance under a variety of soil, climatic, and use conditions. We work with NRCS field offices, public agencies, universities, conservation organizations, tribes, and commercial seed producers and nurseries. We continue to develop plant technology for addressing resource concerns, which in California include water-use efficiency for water quality and quantity, air quality wildlife habitat and land restoration especially in riparian areas.

Lockeford Plant Materials Center (PMC) Irrigation System Map

4/30/2012

Studies

Demonstration Pollinator Meadows

CAPMC-T-1203

Shirley Fowler, Amy Gomes, Margaret Smither-Kopperl

Partners: Thomas Moore, State Biologist
Jessa Guisse, The Xerces Society for Invertebrate Conservation
Kimiora Ward, UC Davis Department of Entomology

Introduction

Pollinator restoration plantings are typically designed to support a diverse community of native bees by providing a variety of floral resources that bloom throughout the growing season. Early efforts to sow wildflower seed mixes in agricultural settings have been largely successful in terms of establishing native plant cover, but have shown that establishing and maintaining a diverse mixture of native plants can be challenging. Different germination requirements, weed encroachment and competition among target native plants can all limit the diversity of species that eventually take hold.

The purpose of this planting was to demonstrate and test four wildflower seed mixes for their establishment success, for native bee attractiveness, and their compatibility with typical agricultural practices in California. This planting also provides the opportunity to test our ability to manipulate plant species composition by tailoring the seeding rate[1] of each species in the mix, or by using carefully timed management activities. For example, valley gum plant (*Grindelia camporum*) has been overly competitive in prior plantings installed by the Xerces Society and NRCS plantings so the seeding rate of this species in mixes was reduced. Limiting the spread of this plant by mowing plots prior to its seed set is another potential management technique. Based upon plot success, a management plan for all four seed mixes will be developed.The seasonality of the Xerces Almond Orchard mix will be addressed by the plan, because this plot may be vulnerable to weed invasion when the plants die back after spring.

Materials and Methods

Establishment

The area available for planting at the NRCS Lockeford Plant Materials Center in fall 2011 was approximately 1.7 acres (Figure 1). The soil type is Columbia fine sandy loam. Prior to seeding the area was fallow over the summer, disked and cultipacked. Weeds that germinated with early fall rains were treated with herbicide (glyphosate). Plot boundaries were delineated on October 27, after subtracting ten feet on the outside edge and five feet between plots for the grass border, each plot was approximately 0.3 acres, with length ranging from 180-196 feet (55-60 m) and width from 75-82 feet (23-25 meters). The plots were planted on

November 14 and 15, 2011 using a 5-foot wide TRUAX Trillion drop seeder. Polenta was added to each seed mix as a carrier, and the seeder was calibrated separately for each seed + polenta mix to accommodate differences in the delivery rate of each mix and the size of each plot. The cultipackers attached to the seeder ring-rolled the plots concurrently with seeding to provide good seed-soil contact.

Description of Pollinator Mixes

Plot 1: Simplified NRCS Mix. The Simplified NRCS Mix is comprised of seven species and includes a subset of the best-performing species in trials planted at the PMC and by the Neal Williams Lab of University of California at Davis at several sites in Yolo County (Tables 1&2). Species were chosen to provide bloom throughout the year, and also provide a simplified plant palette , which would be reasonably priced. Narrow-leaved milkweed was included to provide larval host plant material for the rapidly declining western monarch butterfly *(Danaus plexippus)*.[2]

Plot 2: Williams Lab (UC Davis) Species Trial Mix. This mix was designed to test native plant species that are preferred by wild bees in natural settings (Neal Williams, unpublished data) for their ability to successfully establish and compete with weeds without over-dominating the mix (Tables 3 & 4). This mix included 17 species and was planted at a higher seeding rate than others. Many of these species have very small seeds and are unusual so it was unknown how readily they would become established.

Plot 3: Xerces/Hedgerow Farms Central Valley pollinator mix. The Central Valley mix is designed to provide both foraging and nesting resources for pollinators by incorporating both wildflowers and native bunch grasses. (Tables 5 & 6). The 14 species include both annuals and perennials and provide floral resources from spring through fall. Narrow-leaf milkweed was also included because it is the larval host plant for western monarch butterflies.

Plot 4: Xerces/Hedgerow Farms Almond Orchard Mix. Plot 4 was planted to Almond Orchard mix . This seed mix is designed to provide supplemental forage for wild and managed bees adjacent to California almond orchards (Tables 7 & 8). The six annual species bloom immediately after almond to extend pollen and nectar resources for honey bees and blue orchard bees (*Osmia lignaria)*after the almond trees have finished flowering.

Maintenance and Monitoring

The plots were monitored for weeds and specified areas towards the levee were sprayed with glyphosate to control pale smartweed (*Polygonum lapithifolium*) and woollypod vetch (*Vicia villosa* subsp*. varia*). Fifty hours of hand weeding was conducted between February and May 2012.

No irrigation was applied to the plots over the course of the trial even through the winter of 2011 – 2012.

Plots were monitored biweekly during the season for abundance and bloom phenology. Photo points were established to monitor bloom over this period and notes were taken on weed status and maintenance needs.

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[2]http://www.xerces.org/wp-content/uploads/2011/03/western-monarchs-factsheet.pdf

Figure 1 Lockeford PMC Pollinator Plantings Fall 2011

Legend

- Corners of proposed planting
- Proposed plot outline
- Existing pollinator plots

1 = PMC Simple Mix
2 = UC Davis Mix
3 = Xerces/Hedgerow Farms Central Valley Mix
4 = Xerces/Hegerow Farms Almond Mix
border = grass border (designed by Margaret S-K)

N
W E
S

100 50 0 100 Feet

Results and Discussion

The results for abundance of plants and bloom phenology for the four plots and described below (Tables 1 –8). The overall development of plants and flowers in the plots for spring, summer and fall can be tracked in Figures 2 – 7.

Weeds were controlled by a combination of cultivation, herbicide treatments and mowing. The most troublesome weed was woollypod vetch, which was controlled by a combination of herbicide application and hand weeding.

Plot 1: Simplified PMC Mix. The most abundant plants over the year were California poppy (*Eschscholzia californica*) and California phacelia (*Phacelia californica*), all plant species were present except that the narrow leaved milkweed (*Asclepias fascicularis*) was not detected (Table 1). Early bloomers were annual lupine (*Lupinus succulentus*) and baby blue eyes (*Nemophila menziesii*), followed by California poppy (*Eschscholzia californica*), while Bolander's sunflower (*Helianthus bolanderi*) bloomed from August through September (Table 2).

Table 1. Pollinator Meadow Monitoring for Abundance –NRCS Simple Mix - 2012

	Mar		Apr		May		June		July		August		September
	3/27	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Asclepias fascicularis	0	0	0	0	0	1	0	0	0	0	0	0	0
Eschscholzia californica	3	3	3	3	3	2	2	3	3	2	3	2	1
Grindelia camporum	0	2	1	1	0	0	2	2	1	1	1	1	1
Helianthus bolanderi	0	0	2	1	0	1	2	2	2	1	1	1	1
Lupinus succulentus	3	3	2	2	1	1	2	1	1	0	0	0	0
Nemophila menziesii	3	3	3	2	1	0	0	0	1	0	0	0	0
Phacelia californica	2	2	2	2	2	2	2	2	2	2	2	2	1

0=Absent 1=Rare 2=Present 3=Abundant

Table 2. Pollinator Meadow Monitoring for Bloom –NRCS Simple Mix - 2012

	Mar		Apr		May		June		July		August		September
	3/29	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Asclepias fascicularis													
Eschscholzia californica													
Grindelia camporum													
Helianthus bolanderi													
Lupinus succulentus													
Nemophila menziesii													
Phacelia californica													

Percent Bloom over entire planting 1%-25% 26%-50% 51%-75% 76%-100%

Plot 2: Williams Lab (UC Davis) Species Trial Mix. The most abundant plants over the year were again California poppy (*Eschscholzia californica*) and California phacelia (*Phacelia californica*). Planted species that were not detected or found at very low levels included owls clover (*Triphysaria versicolor*), Pacific aster (*Symphotrichum chilensis*), and coyote mint (*Monardella villosa*)(Table 3). Prolific early bloomers were annual lupine (*Lupinus succulentus*) and miniature lupine (*Lupinus nanus*), and the annual tansy phacelia (*Phacelia tanacetifolia*). Salt heliotrope (*Heliotropium curassavicum*) bloomed consistently through June, July and August and vinegarweed (*Trichostema lanceolatum*) bloomed in August and September. (Table 4).

Table 3. Pollinator Meadow Monitoring for Abundance – Williams Lab UC Davis Mix - 2012

	Mar		Apr	May		June		July		August			September
	3/27	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Symphotrichum chilensis	0	0	0	1	0	0	0	0	0	0	0	0	0
Castilleja exserta	0	0	1	1	0	0	0	1	0	0	0	0	0
Clarkia purpurea	0	0	2	3	3	2	2	0	0	0	0	0	0
Clarkia unguiculata	3	3	2	3	3	2	2	1	0	0	0	0	0
Collinsia heterophylla	2	2	3	2	1	0	0	0	0	0	0	0	0
Eriophyllum lanatum	0	0	0	2	1	1	1	0	0	0	0	0	0
Eschscholzia californica	2	2	3	3	3	3	3	3	3	2	2	3	1
Heliotropium curassavicum	0	0	1	2	0	1	1	1	2	1	1	2	1
Layia chrysanthemoides	3	2	2	2	1	0	0	0	0	0	0	0	0
Lupinus nanus	3	3	3	2	2	1	2	2	2	1	0	0	0
Lupinus succulentus	3	3	2	1	2	2	0	2	0	0	0	0	0
Monardella villosa	0	0	0	0	0	0	0	1	0	0	0	0	0
Phacelia californica	2	2	2	2	2	2	3	2	2	2	2	2	1
Phacelia imbricata	3	0	1	1	0	0	0	0	0	0	0	0	0
Phacelia ciliata	0	2	3	1	0	0	0	0	0	0	0	0	0
Phacelia tanacetifolia	3	3	3	3	3	2	3	2	2	0	0	0	0
Salvia columbariae	2	2	1	2	1	0	0	0	0	0	0	0	0
Trichostema lanceolatum	0	0	0	0	0	1	1	1	1	2	1	2	2
Triphysaria versicolor	0	0	0	0	0	0	0	0	0	0	0	0	0

0=Absent 1=Rare 2=Present 3=Abundant

Table 4. Pollinator Meadow Monitoring for Bloom – Williams Lab UC Davis Mix - 2012

	Mar		Apr		May		June		July		August	September	
	3/29	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Symphotrichum chilensis													
Castilleja exserta													
Clarkia purpurea													
Clarkia unguiculata													
Collinsia heterophylla													
Eriophyllum lanatum													
Eschscholzia californica													
Heliotropium curassavicum													
Layia chrysanthemoides													
Lupinus nanus													
Lupinus succulentus													
Monardella villosa													
Phacelia californica													
Phacelia imbricata													
Phacelia ciliata													
Phacelia tanacetifolia													
Salvia columbariae													
Trichostema lanceolatum													
Triphysaria versicolor													

Percent Bloom over entire planting	1%-25%	26%-50%	51%-75%	76%-100%

Plot 3: Xerces/Hedgerow Farms Central Valley pollinator mix.

All species included in the mix were found in the plot, indicating how these species are adapted to the Central Valley. The most abundant plants over the year were California poppy (*Eschscholzia californica*), common madia (*Madia elegans*), and California phacelia (*Phacelia californica*) (Table 5). Common madia was particularly dominant during the summer (Table 6, Figure 6). Early bloomers were California poppy (*Eschscholzia californica*),annual lupine (*Lupinus succulentus*) and goldfields (*Lasthenia glabrata*). Abundant late bloomers were common madia, Bolander's sunflower (*Helianthus bolanderi*), narrowleaved milkweed and vinegarweed (*Trichostema lanceolatum*), which bloomed in in August and September. (Table 6).

Table 5. Pollinator Meadow Monitoring for Abundance-Xerces/Hedgerow Farms Central Valley Mix-2012

	Mar		Apr		May		June		July		August		September
	3/27	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Asclepias fascicularis	0	0	0	0	0	0	0	1	1	1	1	1	1
Clarkia gracilis 'Tracyi'	0	0	3	3	3	2	1	0	0	0	0	0	0
Eschscholzia californica	3	3	3	2	2	3	3	2	2	2	2	2	1
Grindelia camporum	0	2	0	0	0	0	2	0	0	1	1	1	1
Helianthus bolanderi	0	0	2	2	2	1	3	3	2	2	2	2	2
Lasthenia glabrata	3	3	2	2	0	0	0	0	0	0	1	0	0
Lupinus densiflorus	2	2	3	3	3	2	2	1	1	1	1	1	1
Lupinus succulentus	3	3	3	2	3	1	2	1	1	0	0	0	0
Madia elegans	3	2	3	3	3	3	3	3	3	3	3	3	3
Muhlenbergia rigens	0	0	0	0	0	0	1	1	1	1	1	1	1
Nassella pulchra	2	0	2	2	3	2	2	1	2	3	1	1	1
Oenothera elata	2	2	0	0	0	0	2	1	1	1	2	2	1
Phacelia californica	3	2	3	3	3	3	3	2	2	3	2	2	2
Trichostema lanceolatum	0	0	0	0	0	0	1	2	0	1	1	1	1

0=Absent 1=Rare 2=Present 3=Abundant

Table 6. Pollinator Meadow Monitoring for Bloom – Xerces/Hedgerow Farms Central Valley Mix - 2012

	Mar		Apr		May		June		July		August		September
	3/29	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Asclepias fascicularis													
Clarkia gracilis 'Tracyi'													
Eschscholzia californica													
Grindelia camporum													
Helianthus bolanderi													
Lasthenia glabrata													
Lupinus densiflorus													
Lupinus succulentus													
Madia elegans													
Muhlenbergia rigens													
Nassella pulchra													
Oenothera elata													
Phacelia californica													
Trichostema lanceolatum													

Percent Bloom over entire planting 1%-25% 26%-50% 51%-75% 76%-100%

Plot 4: Xerces/Hedgerow Farms Almond Orchard Mix. All 6 species in the mix were detected and bloomed early so fulfilling the purpose of the mix. California poppy (*Eschscholzia californica*) bloomed throughout the year, as this species is opportunistic and can survive as bote an annual and perennial (Table 7 and 8).

Table7. Pollinator Meadow Monitoring for Abundance – Xerces/Hedgerow Farms Almond Orchard Mix - 2012

	Mar		Apr		May		June		July		August		September	
	3/27	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Collinsia heterophylla	3	2	2	1	0	0	0	0	0	0	0	0	0
Eschscholzia californica	3	3	3	3	3	3	3	3	3	3	3	3	3
Lupinus bicolor	2	2	0	0	0	0	0	0	0	0	0	0	0
Nemophila maculata	3	2	0	0	0	0	0	0	0	0	0	0	0
Nemophila menziesii	3	3	2	1	1	0	0	0	0	0	0	0	0
Phacelia campanularia	3	2	1	1	1	1	1	0	0	0	0	0	0

0=Absent 1=Rare 2=Present 3=Abundant

Table 8. Pollinator Meadow Monitoring for Bloom – Xerces/Hedgerow Farms Almond Orchard Mix - 2012

	Mar		Apr		May		June		July		August		September	
	3/29	4/16	5/8	5/23	6/5	6/19	7/5	7/23	8/1	8/15	8/28	9/12	9/25
Collinsia heterophylla													
Eschscholzia californica													
Lupinus bicolor													
Nemophila maculata													
Nemophila menziesii													
Phacelia campanularia													

Percent Bloom over entire planting 1%-25% 26%-50% 51%-75% 76%-100%

Data is being gathered gathered on survival and bloom phenology for 2013, this information will be used as a component in determining optimum seeding mixes for pollinator sites.. During 2013, data will be gathered on pollinator visits by students and staff from the Williams Lab, UC Davis.

Figure 2. Plots from photo points on March 12, 2012

Plot 1. Simplified NRCS Mix

Plot 2. Williams Lab Trial Mix

Plot 3. Xerces/Hedgerow Farms Central Valley Mix

Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

Figure 3. Appearance of plots from photo points on April 16, 2012

	
Plot 1. Simplified NRCS Mix	Plot 2. Williams Lab Trial Mix
	
Plot 3. Xerces/Hedgerow Farms Central Valley Mix	Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

Figure 4. Appearance of plots from photo points on May 8, 2012

Plot 1. Simplified NRCS Mix

Plot 2. Williams Lab Trial Mix

Plot 3. Xerces/Hedgerow Farms Central Valley Mix

Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

Figure 5 . Appearance of plots from photo points on June 19, 2012

	
Plot 1. Simplified NRCS Mix	Plot 2. Williams Lab Trial Mix
	
Plot 3. Xerces/Hedgerow Farms Central Valley Mix	Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

Figure 6. Appearance of plots from photo points on August 15, 2012

Plot 1. Simplified NRCS Mix

Plot 2. Williams Lab Trial Mix

Plot 3. Xerces/Hedgerow Farms Central Valley Mix

Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

Figure 7. Appearance of plots from photo points on September 25, 2012

Plot 1. Simplified NRCS Mix

Plot 2. Williams Lab Trial Mix

Plot 3. Xerces/Hedgerow Farms Central Valley Mix

Plot 4. Xerces/Hedgerow Farms Almond Orchard Mix

During 2012 these Pollinator Meadows were an important component of outreach at the CAPMC including an Open House for NRCS and RCD staff in April 2012.

Operations and Maintenance of pollinator habitat is an area where further information is required. These plots will be used for such studies as a collaborative effort between the partners in the future.

Cover Crop Component Demonstration 2011 - 12

CAPMC-T-1206-CP

Margaret Smither-Kopperl

Partner: Tom Johnson, Kamprath Seed

Cover crops have many advantages including improving soil quality, prevention of erosion, enhanced moisture and nutrient availability, competition and reduction of weed species and better control of insect pests with an increase in on-farm biodiversity. There is a substantial body of research into cover crops going back decades, but the adaptability and suitability of a particular cover crop to a specific area needs to be tested locally

Field Office staff in the process of advising farmers may not have a clear idea of the types of cover crops available, the timing of growth and growth habits of different cover crop components. This demonstration planted with Tom Johnson of Kamprath Seed included 50 common components currently used as cover crops and as components of cover crop mixes including small grains, brassicas . large and small seeded legumes and legumes and native wild flowers, with cover crop potential and benefits as pollinators.

Soil was disked and cultipacked prior to planting. No fertilization was applied. The area had previously been fallow with some weed pressure in the area, with cheeseweed, *Malva* spp. as the most serious weed problem.

The plots 25 feet long by 4 feet wide, were planted with 6 plant lines per plot, alleys were 4 feet wide all around the plot, grassed and planted with perennial ryegrass for access (Table 1.). Planting was accomplished using a Planet Junior on November 8, 2011. Emergence was noted on November 14.

Rainfall occurred after planting throughout November for a total of 0.8 in for the month. There was no rainfall for the remainder of 2011 and no supplemental irrigation was applied. Drought conditions prompted application of 2 inches of water by sprinkler on January 6, 2012. No further irrigation was applied, total rainfall in Jan, Feb and Mar was, 2, 1, and 3 inches respectively. Early maturing plants had their seed heads removed mechanically.

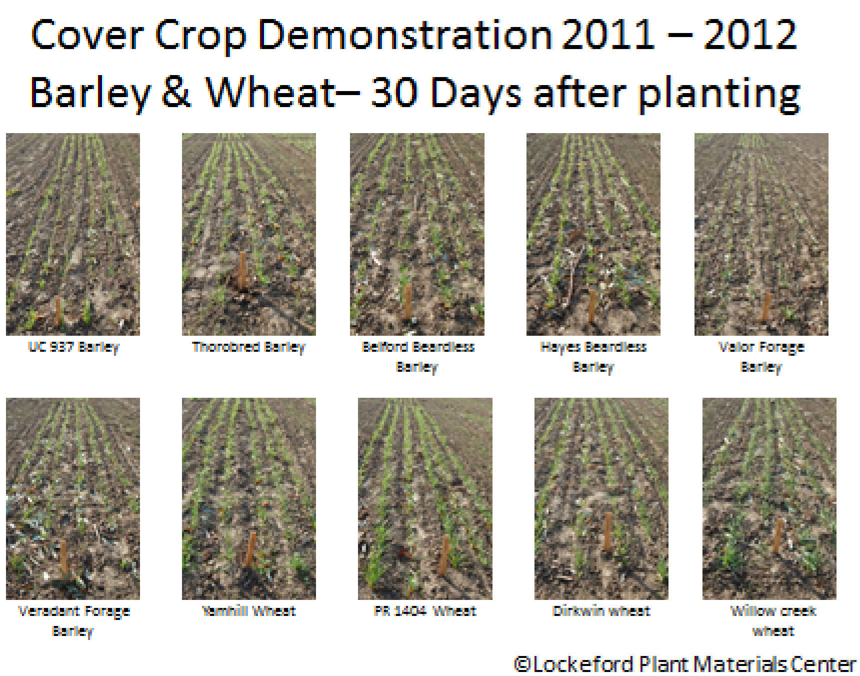
A record of growth was maintained by taking photographs of individual plots every 15 days over the course of the trial through April, 2012. The growth morphology of the different cover crop components can be tracked over the growing season and are shown below.

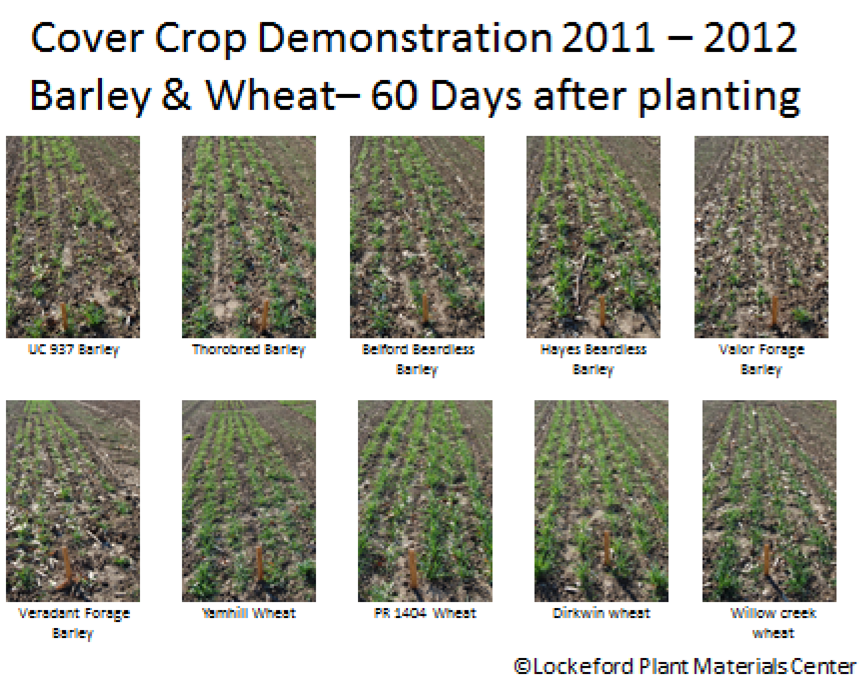
Table 1. Cover crop plantings - Plot Layout

			4'		4'
Tier 11	Bachelor Buttons	Phacelia	Five Spot	Baby Blue Eyes	Mountain Garland
Tier 10	Prima Gland Clover	GW-G Gland Clover	Lighting Persian Clover	GW-P Persian Clover	Nitro Persian Clover
Tier 9	Subclover Blend	GW-BR Berseem Clover	Elite Berseem Clover	GW-BA Balansa Clover	Frontier Balansa Clover
Tier 8	Antas Subclover	FS-8 Subclover	Campeda Subclover	Losa Subclover	Hykon Rose Clover
Tier 7	Crimson Clover	Scimitar Medic	Paraggio Medic	Angel Medic	Jester Medic
Tier 6	AW 4 Radish	Diakon Radish	Florida Mustard	Nemfix Mustard	Bracco Mustard
Tier 5	Common Vetch	Purple Vetch	Dundale Peas	Biomaster Peas	Austrian Winter Peas
Tier 4	Juan Triticale	Forerunner Triticale	Weaver Triticale	888 Triticale	Bell Beans
Tier 3	Montezuma Red Oats	Cayuse White Oats	Saia Black Oats	Fall Ryegrain	Merced Ryegrain
Tier 2	Yamhill Wheat	PR 1404 Wheat	Dirkwin Wheat	Willow Creek Wheat	Veradant Forage Barley
Tier 1	UC 937 Barley	Thorobred Barley	Belford Beardless Barley	Hayes Beardless Barley	Valor Forage Barley

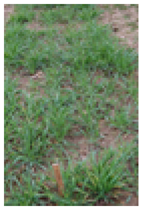
Alleys and headlands are planted with perennial ryegrass blend

Developmental stages of wheat and barley cultivars at 30, 60, 90 and 120 days are shown below.



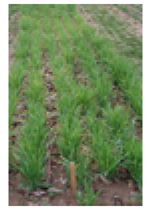


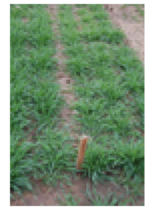
Cover Crop Demonstration 2011 – 2012
Barley & Wheat– 90 Days after planting

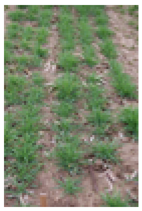

UC 937 Barley

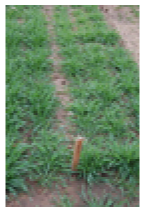

Thorobred Barley

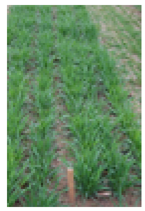

Belford Beardless Barley

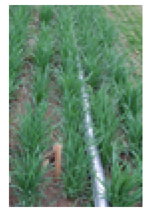

Hayes Beardless Barley

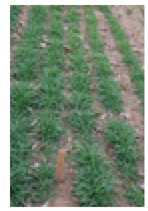

Valor Forage Barley


Veradant Forage Barley


Yamhill Wheat

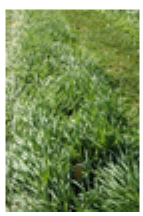

PR 1404 Wheat

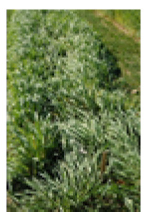

Dirkwin wheat

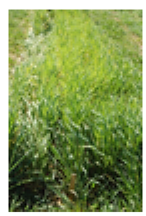

Willow creek wheat

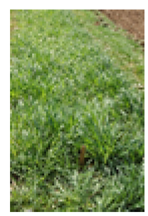
Cover Crop Demonstration 2011 – 2012
Barley & Wheat– 120 Days after planting

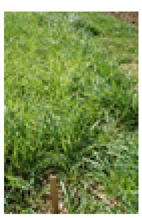

UC 937 Barley

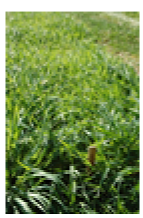

Thorobred Barley

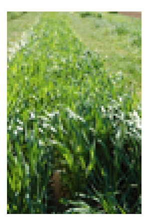

Belford Beardless Barley

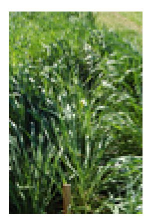

Hayes Beardless Barley

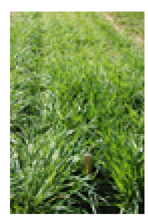

Valor Forage Barley


Veradant Forage Barley

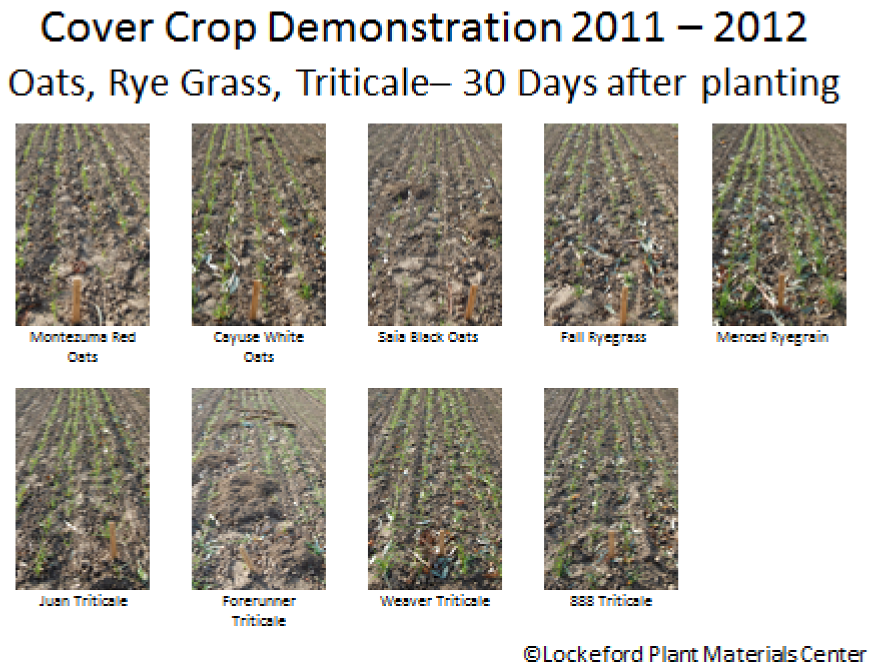

Yamhill Wheat

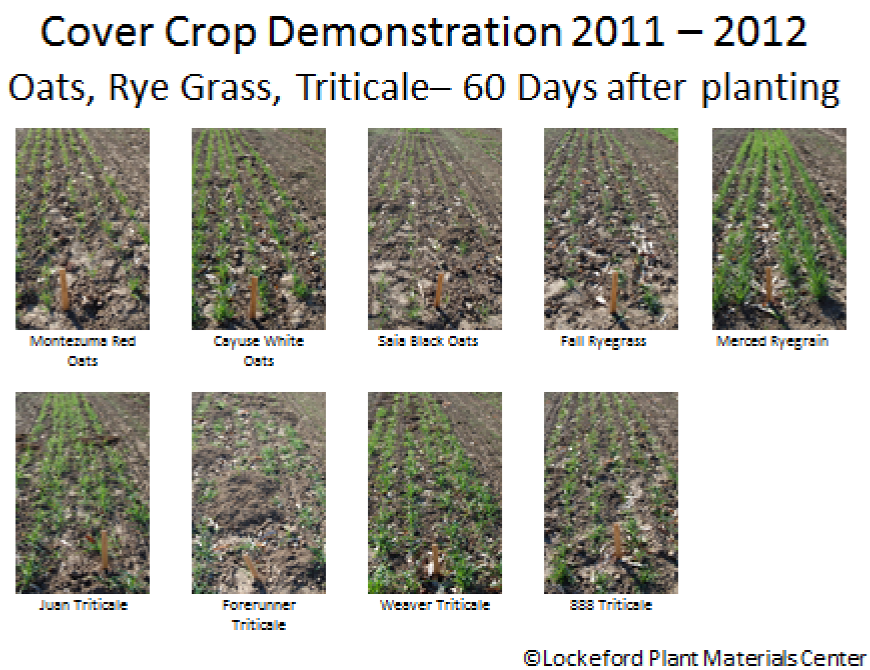

PR 1404 Wheat


Dirkwin wheat


Willow creek wheat

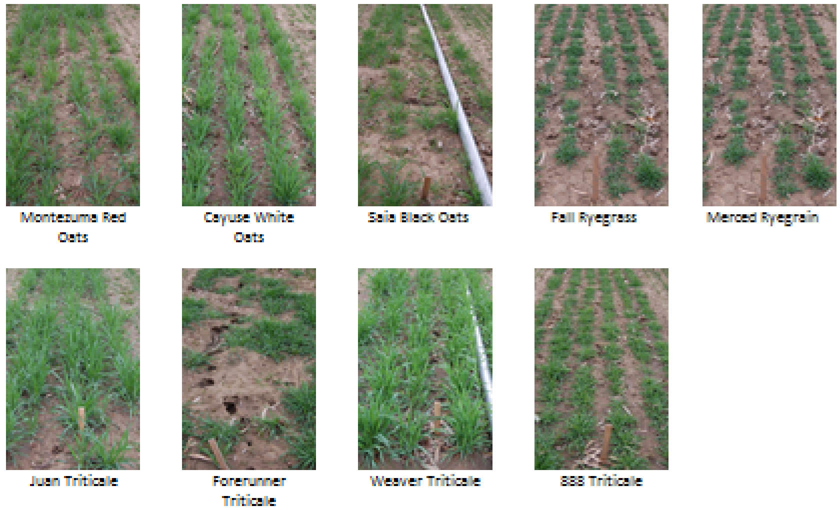
Developmental stages of oats, rye and triticale cultivars at 30, 60, 90 and 120 days are shown below.





Cover Crop Demonstration 2011 – 2012

Oats, Rye Grass, Triticale– 90 Days after planting



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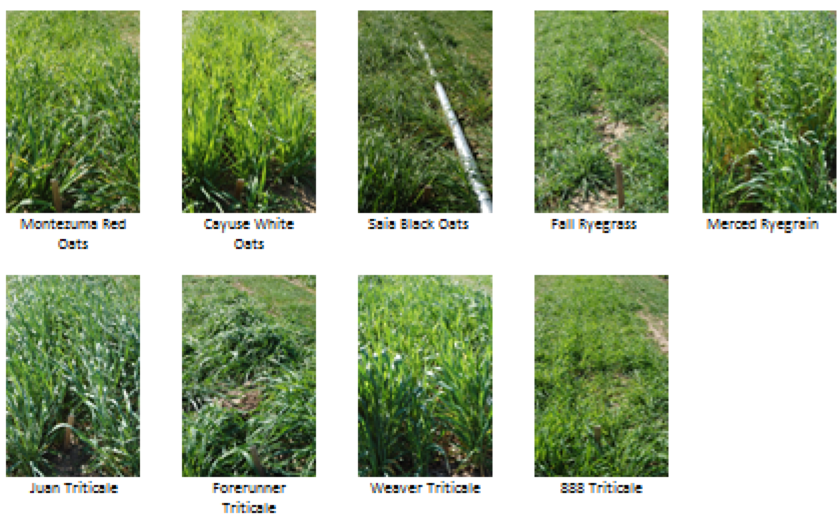
Cover Crop Demonstration 2011 – 2012

Oats, Rye Grass, Triticale– 120 Days after planting



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The cover crop component plantings at the PMC were viewed by NRCS staff at the Open Day in April 2012. In addition the plantings were used to demonstrate root growth of different plant species at the Irrigation 'Boot camp' training at the PMC in May, 2012.

Cover Crop Component Demonstration 2012 - 13

CAPMC-T-1303-CP

Margaret Smither-Kopperl

Partners: Dennis Chessman, State Agronomist
Tom Johnson, Kamprath Seed

A cover crop component demonstration trial was established in 2012, following the success of the cover crop component demonstration trial in 2011 – 2012. NRCS Field office staff appreciated the opportunity of examining the growth patterns of the different cover crop components. Cover crops have many advantages including improving soil quality, prevention of erosion, enhanced moisture and nutrient availability, competition and reduction of weed species and better control of insect pests with an increase in on-farm biodiversity. There is a substantial body of research into cover crops going back decades, but the adaptability and suitability of a particular cover crop to a specific area needs to be tested locally

This demonstration planted with Tom Johnson of Kamprath Seed included 50 common components currently used as cover crops and as components of cover crop mixes including small grains, brassicas, large and small seeded legumes (Table 1). In addition, additional plants that could be used as cover crops, such as flax, lentils and safflower were included.

Soil was disked and cultipacked prior to planting. No fertilization was applied. The area had previously been fallow with some weed pressure in the area, plots were weeded as cheeseweed, *Malva* spp. is the most serious weed problem.

The plots 25 feet long by 4 feet wide, were planted with 6 plant lines per plot, alleys were 4 feet wide all around the plot, grassed and planted with perennial ryegrass for access. Planting was accomplished using a Planet Junior on November 15, 2012. Emergence was noted on November 20. Rainfall was adequate, in excess of 4 inches in November and December and no supplemental irrigation was required. A record of growth was maintained by taking photographs of individual plots every 15 days over the course of the trial.

	
Plots showing emergence on 12/3/2012	Plots on 12/18/2012 with good growth under moist conditons

Table 1. Cover crop plantings - Plot Layout

Bracco mustard		Nemfix mustard		Oriental mustard		Canola		Daikon radish
Cayuse white oats		Montezuma Red oats		Swan Oats		Kanota Oats		UC142 oat
Bunker Triticale		888 Triticale		Pacheco Triticale		Weave Triticaler		Yamhill wheat
Merced Rye		Fall Rye		AGS 104 Rye		Saia black oat		Dirkwin wheat
UC 937 Barley		Veradant Barley		Belford Barley		Hayes beardless barley		Hard Red wheat
'Blando' brome		'Zorro' fescue		Com Annual Rye		Annual Hairgrass		Tetraploid Ryegrass
Scimitar Medic		Rose clover		Frontier Balansa Clover		Flax		Safflower
Jester Medic		Losa subclover		Anta subclover		Campeda		Denmark
Lupine		Berseem Clover		Lighting Persian clover		Nitro ersian clover		Crimson clover
Lentil		Com Vetch		Purple vetch		Hairy vetch		'Lana' woolypod vetch
Biomaster pea		Dundale pea		Austrian winter pea		Frosty pea		Faba bean

(North)

Biofuel Oilseed Study: Camelina Variety Trial
CAPMC-P-1204-BF

Margaret Smither-Kopperl

Partners: Jacqui Gaskill, State Energy Specialist, NRCS
Stephen Kaffka, Director, California Biomass Collaborative, UC Davis,
Jimin Zhang, , Plant Sciences UC Davis

Goals and Objectives

Camelina (*Camelina sativa*) is an annual oilseed crop in the Brassica Family. It originates in Europe and has been cultivated there for centuries. Depending on the location camelina may be spring or fall planted. It requires minimal inputs, and is tolerant of drought.

In 2011, the Farm Services Administration under the Biomass Crop Assistance Program (BCAP) announced up to 25,000 acres in selected counties of California were eligible for enrollment to receive annual payments for growing camelina for energy purposes. Growers were to sell their harvested biomass to the Project Sponsor, Altair Fuels LLC to produce biodiesel for the US Navy. Technical administration for the project was assigned to the NRCS. To qualify for the program, land enrolled must be covered by a conservation plan, which included, at a minimum, conservation crop rotation and Integrated Pest Management.

Although camelina production has been extensive in Montana over the past decade it has not been grown commercially in California. In 2011-2012, Dr. Stephen Kaffka of the California Biomass Collaborative had trials at the University of California at Davis and at University of California's Westside Research and Extension Center (WSREC) near Five Points, in western Fresno Our objective was to provide information to NRCS personnel and Field Offices to help them in assistance with the camelina BCAP program. This trial at the Lockeford Plant Materials Center was in collaboration the UC Davis researchers. The design was the same as trials at Davis and Five Points although the plan was to use no irrigation at the CAPMC.

Materials and Methods

Ten cultivars of camelina were tested for comparison of oilseed production. The cultivars were grown in a randomized complete block design with four replications. Plots were 30 feet in length and 5 feet in width. The land was prepared by disking and cultipacking prior to planting. The planting date was November 17 and 18 2011and was accomplished using a plot drill seeder from UC Davis at a rate of 6 lb/acre with Nitrogen at 80 lb/acre. No irrigation was applied to the plots during 2011.

Emergence of the plants occurred in December, but following no rainfall that month, 3 acre inches of water was applied by sprinkler irrigation on January 6 2012, this was the only irrigation applied. Soil was cultivated around the plots to control weeds but no weed control was used within the plots. The most serious weed was *Malva* spp., which was suppressed somewhat within plots compared to the bare soil, but was still a problem close to harvest. Plots were harvested by staff from UC Davis staff on May 8 with a plot combine.

Results and Discussion

Initial growth of the Camelina plants was slow due to drought conditions in December (Fig. 1). After irrigation in January and as temperatures increased in February, growth increased rapidly (Fig 2.). Plants had formed buds and started to bloom by the end of March 2012(Fig 3.) Seed pods werewell developedby the end of April (Fig. 4).

Figure 1 Camelina state of emergence on 1/23/2012

Figure 2 Good vegetative growth exhibited by camelina plants in plots 2/22/12

Figure 3. Camelina plants enter flowering stages 3/23/12

Fig 4. Camelina plants lodged with mature seed pods on 4/20/2012..

The data for yield and oil content are not yet available, due to staff turnover in the Camelina program at UC Davis, but we have been informed will be available in June 2013.

The plantings at the PMC were viewed by NRCS staff at the Open Day in April 2012 and the knowledge gained was informative and valuable for NRCS Field Office staff responsible for providing technical support for the Biomass Crop Assistance Program in California (BCAP) in 2011 and 2012.

Camelina and other biofuel seed crop trials will continue at the PMC in October of 2013 in collaboration with the University of California at Davis. Continuing these trials will give NRCS staff the opportunity to become more familiar with crops that will be grown in abundance in California in the coming future to meet the growing need for sustainable fuel. There are also two California based regulatory requirements, the Low Carbon Fuel Standard (LCFS) and Renewable Portfolio Standards (RPS), that are driving biofuel seed crop production, specifically for camelina and canola, both considered to be low carbon fuel feedstocks.

Soil Health Study: Effects of Mixed Species Cover Crops on Soil Health

CAPMC-T-1208-CP

Patrick Nicholson, Shirley Fowler, Margaret Smither-Kopperl

Objectives

The goals of this project are to document the effects of cover crop species composition on changes in soil health, to determine optimum seeding rates for cover crop mixes to affect soil health, and to demonstrate the use of cover crops in rotation with a commodity crop. This is a national study being carried out at six total Plant Materials Centers (CA, FL, MD, MO, ND, WA).

Cooperators

Plant Materials Program: John Englert, Ramona Garner, Joel Douglas, Jim Briggs, PMC staff

East NTSC Soil Health Team: David Lamm, Ray Archuleta, Gene Hardee

Soil Sciences Division: Susan Andrews

Dr. Rick Haney, ARS, Temple, TX

Dr. Larry West, NRCS Kellogg Soil Survey Laboratory

Sid Davis, Soil Regional Technical Team NRCS, Davis, CA

Overview and Establishment

Over the next three years the CAPMC will be evaluating different seeding rates and mixes of six plant species to observe their impact on soil health as part of a national soil health study. Cover crops will be planted each fall and corn will be planted each summer to represent a commodity crop. Replicated trials for this study were established in the fall of 2012. At multiple times during the life of the cover crop, the CAPMC will collect above-ground data to determine the consequences of treatments on plant cover, species composition, and total biomass. Dr. Larry West with NRCS's Kellogg Soil Survey Laboratory and Dr. Rick Haney with the ARS Grassland Soil and Water Research Laboratory will provide analysis on fertility, soil properties, and biological activity.

The trial was placed in Field 7 at the CAPMC, the site had been planted in cover for the past two years, with a high biomass cover in fall of 2011 and barley the previous year. The soil type is Vina fine sandy loam (Figure 2). A complete soil characterization was conducted by Sid Davis, Assistant State Soil Scientist. Irrigation was available through the pressurized irrigation system, and although sprinkler irrigation is available the corn would require another form of irrigation during the dry summer. Sub-surface drip irrigation was installed in early October with equipment provided by UC Davis and NRCS State Water Management Specialist Dan Johnson. The drip tape was difficult to install for the first block, so the ground was ripped before installing drip tape for the remaining three blocks.

The experimental design was a randomized complete block with 2 factors of cover crop diversity and seeding rate. There were three seeding mixes representing increasing diversity with the components rye, crimson clover, radish, hairy vetch, canola, and oats. (Table 1). The second factor was seeding rates of 20, 40 and 60 seeds per sq foot. In addition to these 9 treatments there was a control plot in each block. The plot sizes were 60' by 30' (Figure 2, Figure 3) so there were a total of forty plots in the 4 randomized blocks. Cover crop mixes were planted October 18-19, 2012. No irrigation was applied in 2012 as rainfall was adequate.

Table 1. Cover crop seed mix amounts in pounds.

	Mix 1	Mix 2	Mix 3
Rye	95.04	64.2	32.16
Crimson Clover	11.52	11.52	3.84
Radish	—	7.68	3.84
Hairy vetch	—	35.76	35.76
Oats	—	—	30.12
Canola	—	—	0.72

Data Collection

Data was collected on bulk density, resistance, biological assessment, and soil indicators the week before the cover crop mixes were seeded. Bulk density was measured from three samples in each plot at a depth of 0-2 inches and at a depth of 2-4 inches using a 3-inch diameter ring. The wet and dry weights of a 2 tablespoon subsample were measured in order to measure bulk density. Bulk density can serve as an indicator of compaction and relative restrictions to root growth. Bulk density values generally increase with depth in the soil profile. Soil resistance was measured at five samples in each plot using a soil penetrometer at a depth of 0-6 inches, 6-12 inches, and 12-18 inches. In some cases hard ground or a restrictive soil layer prevented the probe from penetrating the surface or produced readings that exceeded measurable values of the penetrometer. In those cases soil resistance values were entered as the maximum allowable value of 400 psi.

Soil samples from each plot were sent to Dr. Richard Haney with the USDA-ARS to conduct a biological assessment at a depth of 0-6 inches. Assessment included N-P-K, biological activity (Solvita 1-day Co_2-C), water extractable organic C, water extractable organic N, % organic N, organic C:N, organic N:P, total N, inorganic N, organic N release, organic N reserve, and %P saturation. The Solvita one-day CO_2-C test represents the amount of CO_2-C released in 24 hr period from soil microbes after soil has been dried and rewetted. A higher number represents more fertile soil. The organic C:N represents the ratio of organic C to organic N in the soil based on a water extraction. This number is a sensitive indicator of soil health and represents the activity of soil microbes.

Additional soil samples from each plot were sent to Dr. Larry West with the USDA-NRCS Kellogg Soil Survey Laboratory to measure soil indicators at depths of 0-2 inches and 2-6 inches. Assessment indicators include N-P-K, aggregate stability, available water capacity, organic matter, active C, pH, extractable phosphorus, and extractable potassium.

Soil temperature and moisture were recorded at the time of cover crop planting. Soil temperature was recorded from five samples in each plot at a depth of three inches. Soil moisture (volumetric water content and period) was measured with a HydroSense II moisture probe from five samples in each plot at a depth of seven inches.

Photographs were taken of representative plots every 15 days after the cover crops were planted. Canopy cover and plant height measurements were taken in each plot every 30 days after the cover crops were planted until 100% cover was attained or the cover was terminated. Plant height was measured as the average height of lush canopy growth excluding blooms and inflorescences from five random locations within a plot. Canopy cover was measured in one foot intervals by recording if any plant covered each point along a 50 foot transect placed diagonally across each plot. The type of plant was also recorded at each point where there was cover.

Photographs were taken of representative plots every 15 days after the cover crops were planted. Canopy cover and plant height measurements were taken in each plot every 30 days after the cover crops were planted until 100% cover was attained or the cover was terminated. Plant height was measured as the average height of lush canopy growth excluding blooms and inflorescences, with data gathered   from five random locations within a plot. Transects were placed diagonally across each plot to evaluate canopy cover.. Canopy cover was then measured in one foot intervals by   noting plant presence or absence along the 50 foot transects. The type of plant was also recorded at each point where there was cover.

Figure 1. Soil Health Study block showing randomized treatments on December 6, 2012. Note lay flat tape for subsurface drip irrigation.

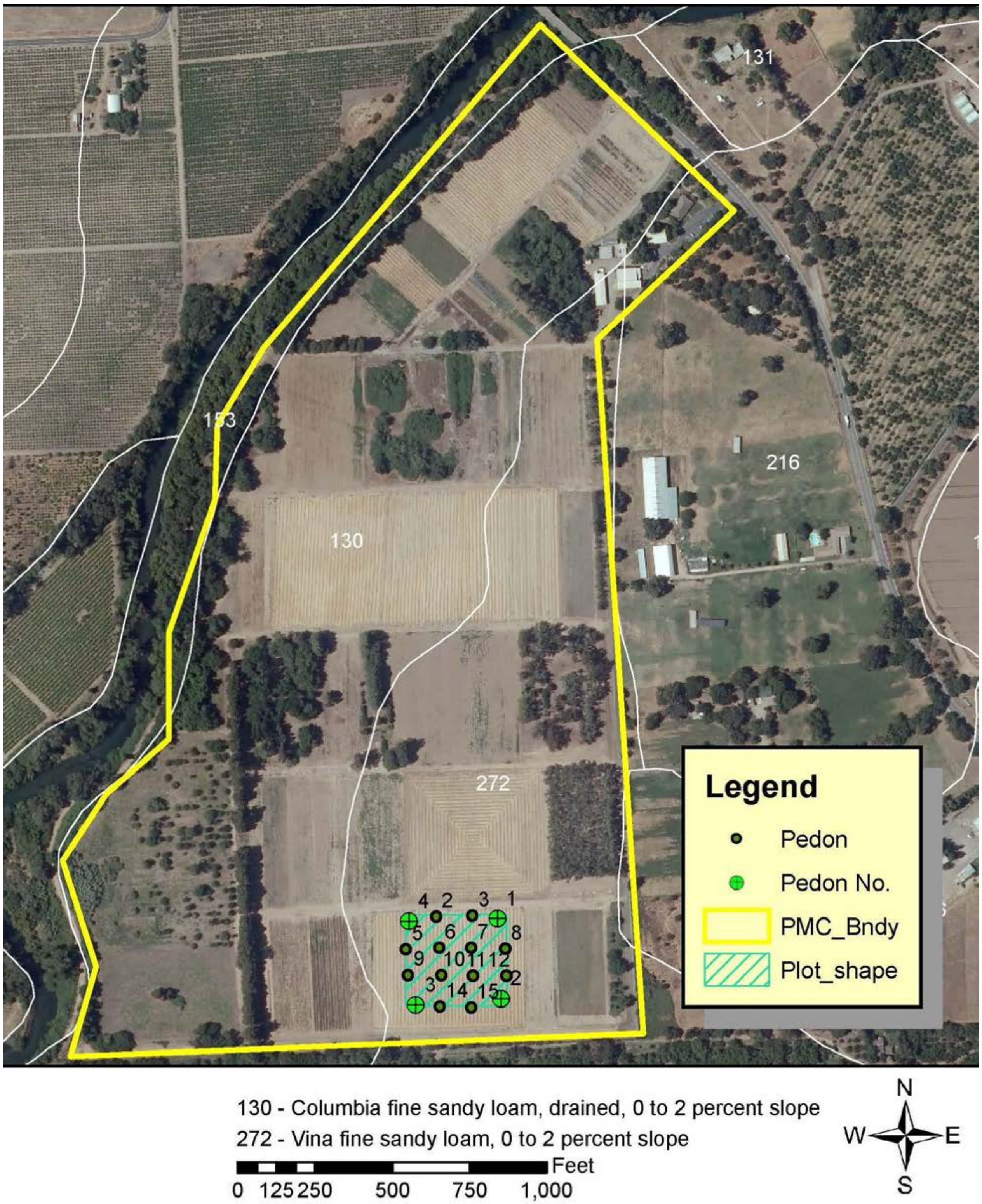

Figure 2. Outline of soil health study area and locations of initial soil characterization.

Figure 3. California Plant Materials Center – Plot Map for Soil Health Study

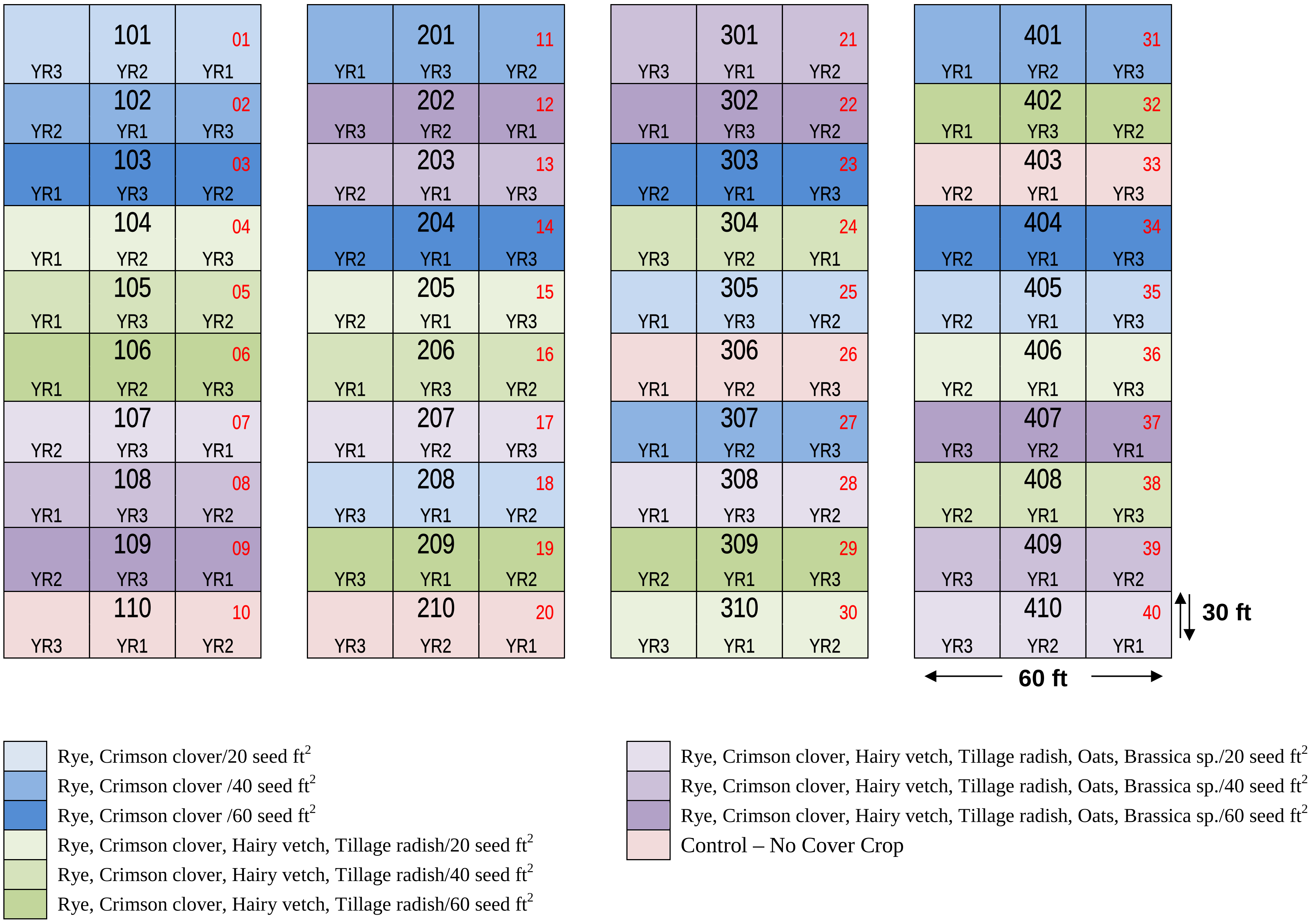

Figure 3. Plot map of soil health study.

Results

Initial measurements of soil resistance, soil water content, and soil bulk density are summarized in Table 2. Measurements of soil moisture and temperature taken at cover crop planting are summarized in Table 3.

Findings from the USDA-ARS soil biological assessment are summarized in tables 4 and 5. The total amount of N, P_2O_5, and K_2O available to plants is shown in Table 4. Additional measures of soil health including the Solvita one-Day CO_2-C test, organic C, organic N, organic C:N are shown in Table 5.

Results from the soil indicator analysis at the USDA-NRCS Kellogg Soil Survey are not yet available for 2012.

Average plant height 30 and 60 days post-planting is shown in Figure 3. Percent cover of planted components, weeds, and total cover 30 and 60 days post-planting is shown in Table 6. Percent cover of individual cover crop components is shown in Table 7.

Continuation of Study

The soil health study will last for a total of three years. Data collection on plant height and cover will continue every 30 days until cover crop is terminated in the spring. Cover crops will be terminated using glyphosphate and subsequently rolled down using a roller crimper approximately two weeks before planting commodity crop. Corn will be planted using a modified no-till seeder each spring as a summer commodity crop. The commodity crop will be irrigated as needed but no fertilizer will be applied. The same cover crop mixes will be planted each fall and data collection will continue into 2015. This will allow the CAPMC to compare initial values presented here with future data to document changes in soil health.

Table 2. Mean values for data collected before cover crop planting from 4 replicates. October 2012.

Cover Crop Mix Seeding Rate	Soil Resistance (psi) 0-6"	6-12"	12-18"	Soil Water Content (g/g) 0-2"	2-4"	Soil bulk density (g/cm^3) 0-2"	2-4"
Control – No Cover Crop							
--	252.5	300	325	0.031	0.069	1.345	1.300
Rye, Crimson clover							
20 seeds/ ft^2	277.5	307.5	330	0.023	0.062	1.295	1.345
40 seeds/ ft^2	250	275	310	0.031	0.076	1.329	1.324
60 seeds/ ft^2	255	295	325	0.027	0.071	1.351	1.552
Rye, Crimson clover, Hairy vetch, Tillage radish							
20 seeds/ ft^2	242.5	295	332.5	0.025	0.072	1.462	1.398
40 seeds/ ft^2	262.5	297.5	335	0.026	0.075	1.301	1.414
60 seeds/ ft^2	255	285	307.5	0.030	0.088	1.377	1.381
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.							
20 seeds/ ft^2	275	312.5	330	0.023	0.076	1.295	1.527
40 seeds/ ft^2	277.5	320	330	0.022	0.067	1.420	1.309
60 seeds/ ft^2	262.5	317.5	337.5	0.029	0.068	1.335	1.376
Average	**261**	**300.5**	**326.25**	**0.027**	**0.072**	**1.351**	**1.393**

Table 3. Mean values for data collected day of cover crop planting from four replicates. October 2012.

Cover Crop Mix Seeding Rate	Soil Moisture VWC %	PER µs	Soil Temperature (°C)
Control – No Cover Crop			
--	9.23	1.81	24.45
Rye, Crimson clover			
20 seeds/ ft^2	9.11	1.81	25.05
40 seeds/ ft^2	10.98	1.86	22.55
60 seeds/ ft^2	10.09	1.84	22.35
Rye, Crimson clover, Hairy vetch, Tillage radish			
20 seeds/ ft^2	10.29	1.85	25.35
40 seeds/ ft^2	11.02	1.87	25.25
60 seeds/ ft^2	13.08	1.93	24.6
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.			
20 seeds/ ft^2	10.24	1.85	27.7
40 seeds/ ft^2	9.93	1.83	24.15
60 seeds/ ft^2	9.12	1.81	23.45

Average	10.31	1.85	24.49

Table 4. Amount of nutrients available to plants in pounds per acre.

Cover Crop Mix Seeding Rate	N (lbs/acre)	P_2O_5 (lbs/acre)	K_2O (lbs/acre)
Control – No Cover Crop			
--	210.08	165.24	284.38
Rye, Crimson clover			
20 seeds/ft^2	139.38	164.43	256.43
40 seeds/ft^2	204.40	159.35	260.65
60 seeds/ft^2	165.00	155.49	221.00
Rye, Crimson clover, Hairy vetch, Tillage radish			
20 seeds/ft^2	166.45	161.38	249.28
40 seeds/ft^2	181.84	176.94	304.85
60 seeds/ft^2	231.84	164.79	272.68
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.			
20 seeds/ft^2	169.82	184.24	315.90
40 seeds/ft^2	179.71	180.50	281.13
60 seeds/ft^2	151.49	185.98	260.00
Average	**180.00**	**169.83**	**270.63**

Table 5. Measures of soil health.

Cover Crop Mix Seeding Rate	Solvita 1-day CO_2-C (ppm)	Organic C (ppm)	Organic N (ppm)	Organic C:N
Control – No Cover Crop				
--	82.38	413.17	28.84	14.52
Rye, Crimson clover				
20 seeds/ft^2	82.44	494.52	32.99	14.94
40 seeds/ft^2	72.09	398.37	29.90	14.39
60 seeds/ft^2	74.33	375.93	27.30	14.37
Rye, Crimson clover, Hairy vetch, Tillage radish				
20 seeds/ft^2	61.76	377.31	28.94	13.00
40 seeds/ft^2	101.09	543.94	34.20	16.48
60 seeds/ft^2	67.33	345.27	20.47	19.19
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.				
20 seeds/ft^2	82.25	530.95	38.03	13.94
40 seeds/ft^2	71.70	508.22	33.44	16.16
60 seeds/ft^2	85.76	447.01	30.91	13.94
Average	**78.11**	**443.47**	**30.50**	**15.09**

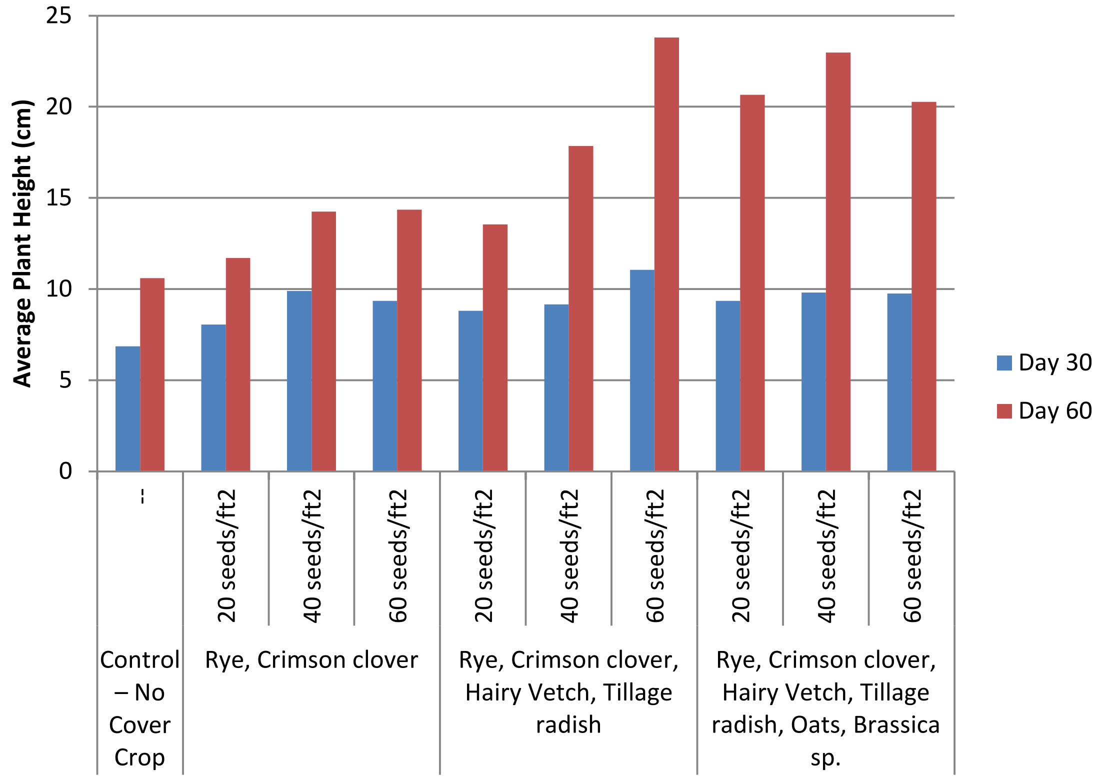

Figure 3. Average cover crop plant height at 30 and 60 days post-planting.

Table 6. Mean canopy cover percentage at 30 and 60 days post-planting.

Cover Crop Mix	**Average Planted Cover**		**Average Weed Cover**		**Average Total Cover**	
Seeding Rate	Day 30	Day 60	Day 30	Day 60	Day 30	Day 60
Control – No Cover Crop						
--	0%	0%	3%	27%	**3%**	**27%**
Rye, Crimson clover						
20 seeds/ft^2	18%	56%	6%	21%	**24%**	**77%**
40 seeds/ft^2	42%	73%	4%	16%	**45%**	**89%**
60 seeds/ft^2	49%	84%	3%	7%	**52%**	**91%**
Rye, Crimson clover, Hairy vetch, Tillage radish						
20 seeds/ft^2	36%	86%	2%	6%	**38%**	**92%**
40 seeds/ft^2	38%	87%	1%	5%	**38%**	**92%**
60 seeds/ft^2	52%	92%	1%	4%	**53%**	**96%**
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.						
20 seeds/ft^2	31%	84%	4%	6%	**34%**	**89%**
40 seeds/ft^2	33%	76%	3%	13%	**36%**	**89%**
60 seeds/ft^2	42%	90%	2%	3%	**44%**	**92%**

Table 7. Mean canopy cover % of cover crop components.

Cover Crop Mix Seeding Rate	Average Rye		Average Clover		Average Vetch		Average Radish		Average Oat		Average Rape	
	Day 30	**Day 60**	**Day 30**	**Day 60**	**Day 30**	**Day 60**	**Day 30**	**Day 60**	**Day 30**	**Day 60**	**Day 30**	**Day 60**
Control – No Cover Crop												
--	--	--	--	--	--	--	--	--	--	--	--	--
Rye, Crimson clover												
20 seeds/ft^2	16%	49%	2%	7%	--	--	--	--	--	--	--	--
40 seeds/ft^2	40%	70%	2%	3%	--	--	--	--	--	--	--	--
60 seeds/ft^2	45%	81%	4%	3%	--	--	--	--	--	--	--	--
Rye, Crimson clover, Hairy vetch, Tillage radish												
20 seeds/ft^2	23%	37%	1%	1%	6%	3%	7%	46%	--	--	--	--
40 seeds/ft^2	30%	26%	2%	1%	5%	2%	2%	59%	--	--	--	--
60 seeds/ft^2	40%	24%	0%	0%	5%	2%	7%	66%	--	--	--	--
Rye, Crimson clover, Hairy vetch, Tillage radish, Oats, Brassica sp.												
20 seeds/ft^2	10%	27%	1%	5%	5%	5%	2%	32%	13%	16%	0%	0%
40 seeds/ft^2	13%	22%	1%	0%	6%	4%	4%	36%	10%	15%	0%	0%
60 seeds/ft^2	17%	19%	2%	0%	5%	2%	7%	50%	11%	20%	1%	0%

Sainfoin Seeding Trials Fall 2012 – Fall 2014

Plant Materials Center, Lockeford, CA

Ceci Dale-Cesmat, State Rangeland Management Specialist

Study ID Code: CAPMC-T-1302-PA-(ONVI)

Title: Sainfoin adaptation to California using varieties Remont, Eski, Shoshone

Accession Numbers:		
	Remont	9105960
	Shoshone	9105961
	Eski	9105977

National Project Type: Pasture/Rangeland

Study Status: Active

Location: CAPMC Lockeford

Study Leader: Ceci Dale-Cesmat, State Rangeland Management Specialist

Duration: Fall 2012 - 2014

Cooperators: UC Cooperative Extension, Modoc County & NRCS Lakeport FO, Lake County

Related Study Plans: Range plantings in Modoc and Lake County

Land Use: Rangeland/Pasture – Grazing lands

Vegetative Practices: 550 Range Planting

Resource Concerns: Forage Quality & Quantity, Carbon Sequestration, Soil Quality, Pollinator Species, Upland Wildlife Habitat

Long Range Plan: Study and document the long-term survivorship of three different varieties of Sainfoin in California's climate.

Objectives and Description: The objective of this project is to study the persistence of Sainfoin and its ability to survive California's hot summer conditions. If over summer survival occurs, document growth habits and adaptation under irrigated and non-irrigated conditions.

Status of Knowledge: Sainfoin (Onobrychis viciifolia) has been used in the upper mid-west and high elevation rangelands of the west as a non-bloat forage source. Three varieties used in the seeding trails (Remont, Eski) were released by Montana Agricultural Experiment Station in 1971 and Montana State University in 1964, respectively. Shoshone was released by University of Wyoming in 2006. It has not been used in California, but ranchers have asked about its ability to be used in range seedings or as a forage in pasture mixes. This lack of knowledge led to this seeding trial.

Experimental Design: Sainfoin seed (Eski) was obtained from D and D Seed in Klamath Falls Oregon, and Remont and Shoshone varieties were obtained from Bighorn Sainfoin Seed Company, Clark, Wyoming. They were delivered in 2010 and stored in a cool dry seed storage container until November 2012 when they were planted on November 6 & 7. They were planted in 10'x100' plots three replications for each variety one set under irrigation and one set non-irrigated. The three treatments included Sainfoin alone, Sainfoin with Berber Orchardgrass and Sainfoin with Purple Needlegrass. Alfalfa was used as a control.

Data was collected according to the National Plant Material Observational Planting recommendations using the attached worksheet. Data was also collected on seedling germination rates, total biomass production, done in the spring at peak growth. Data will be collected again mid-summer on regrowth post-harvest and again in the late fall to determine over summer survival rates.

Sprayed area seeded in field with 1% round up solution on 1/2/2012
Seeded all Sainfoin and Berber Orchardgrass on 11/6/2012
Seeded Purple Needlegrass and Alfalfa on 11/7/2012

Materials and Methods: Plots were established in plots that were clean cultivated in the fall of 2012. Plantings were direct seeded using a Truax range drill. Seeding rates were 34 lbs/acre for all Sainfoin plots, 8 lbs/acre for Orchardgrass/Sainfoin plots and 10 lbs/ac for Purple Needlegrass/Sainfoin plots. There was a 10' break between each plot. Sainfoin was seeded in the plots in a north/south direction while grass seed was planted in an east/west direction.

Irrigated plots will be watered after the first hay cutting in May. Plants will be cut, baled and removed from the site to emulate livestock grazing. This will allow regrowth without excessive thatch on the site.

Areas between rows were mowed in April to control weed persistence.

Final Evaluations: Final Evaluations will be done in the fall of 2014 and a Tech Note will be developed.

Technology Transfer: Tech Note and update to plant guide if outcomes deem it is warranted.

Background Literature:

Plot Layout:

Photos:

Seedlings Emerged – 11/19/2012

Intercenter Strain Trials

2012 Final report of the evaluation of four alkali sacaton selections in four common gardens

James Briggs[3/], *H. Dial*[4/], *C. Smith*[5/], *G. Fenchel*[6/], *M. Smither-Koppperl*[7/], *B. Carr*[8/]

Abstract

Alkali sacaton, *Sporobolus airoides,* is a native warm season grass which is found in most states west of the Mississippi river. Alkali sacaton is considered valuable forage for domestic livestock and wildlife in arid-semi-arid environments and can be moderately grazed without ill effect. It is reported to be somewhat tolerant of fire, with recovery in 2-5 years after a burn. Alkali sacaton is frequently used for reseeding and has special applicability in revegetation of sites disturbed by oil exploration due to its ability to remove selenium from contaminated soils. The purpose of this study was to document performance differences among cultivars 'Saltalk' and 'Salado, Vegas Germplasm, and a California experimental line 9083020 in common gardens located at sites representing diverse western habitats.

Results from the Arizona, California, New Mexico trials shows the California experimental line 9083020 had the highest dry matter yield at all locations and the other lines had very similar yields when averaged across all locations and years. In 2012, under non-irrigated conditions,

9083020 had significantly (P <.05) greater biomass yield than Saltalk and Salado at the Arizona site; significantly greater biomass yield than Salado and Vegas Germplasm in California, and significantly more biomass than Salado, Saltalk, and Vegas at the New Mexico location. No significant differences in yield were observed under irrigated conditions in previous years. Onset of active spring growth patterns at the Arizona PMC may indicate the ability of Vegas Germplasm and accession 9083020 to be able to better utilize limited early spring soil moisture. 9083020 and Vegas were also rated as stemmier which may explain the higher biomass yields and could indicate greater drought tolerance, but poorer forage value.

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[6] G. Fenchel, Manage. USDA-NRCS Los Lunas Plant Materials Center, Los Lunas, New Mexico

[7] M. Smither-Kopperl, USDA-NRCS California Plant Materials Center, Lockeford, California

[8] B. Carr, Agronomist. USDA-NRCS James "Bud"Smith Plant Materials Center, Knox City, Texas

Introduction

Alkali sacaton, *Sporobolus airoides,* is a native warm season grass which grows throughout most states west of the Mississippi river. It typically grows on dry, sandy to gravelly flats or slopes, at elevations from 50 to 2350 m. It is usually associated with alkaline soils. Alkali sacaton grows in saline and nonsaline soils, sometimes in dense, pure stands and is frequently the dominant grass in the landscape. Alkali sacaton is rated as saline Tolerant which indicates it can tolerate approximately EC_e 6-10 dS/m without reduction in yield and EC_e 15-21 dS/m with only a 50% reduction in yield (Maas 1990). It grows in soil textures from sand to clay, usually with low organic matter. It is tolerant of both drought and inundation by water.

Alkali sacaton is considered valuable forage for domestic livestock and wildlife in arid-semi-arid environments and can be moderately grazed without ill effect. It is reported to be somewhat tolerant of fire, with recovery in 2-5 years after a burn. Alkali sacaton is frequently used for reseeding disturbed sites and has special applicability in revegetation of sites disturbed by oil exploration due to its ability to remove selenium from contaminated soils. The seed remains viable for up to 7 years. (Hatch 2004)

The purpose of this study was to document performance differences of the selections in common gardens located at sites representing diverse western habitats.

Materials and Methods

Seed of two cultivars, one selected class germplasm, and one experimental line of alkali sacaton were planted at the Tucson, Arizona, Knox City, Texas; Lockeford, California, and Los Lunas, New Mexico PMCs. The two cultivars are 'Salado', originally collected south of Claunch, NM at an elevation of 1170 m and annual precipitation of 300 mm; and 'Saltalk', which originated near Erick, Oklahoma (Alderson 1995). The selected class germplasm is 'Vegas' which is a composite of materials collected in Clark, Lincoln, and Nye Counties in southern Nevada (USDA1 undated). The California experimental line, 9083020, was collected near the Kern Nat'l Wildlife Refuge in Wasco, Kern County (southern San Joaquin Valley, MLRA 17). Each PMC is able to evaluate performance in different habitats described by Major Land Resource Areas (MLRA) (USDA 3 2006) and EPA eco-regions. The Tucson PMC is located in MLRA 40 (EPA Eco-region 81), the Knox City PMC is in MLRA 78 (EPA Eco-region 26), Los Lunas PMC is in MLRA 35 (EPA Eco-region 22), and the California PMC is in MLRA 17 (EPA-Ecoregion 7).

Alkali sacaton entries were planted into plots replicated 4 times using a Randomized Complete Block design. Each plot consists of four 50 foot long rows spaced 38 inches apart. Planting dates were variable and were appropriate to the site. Seeding rate was 20 Pure Live Seed (PLS) per foot. Plots were irrigated, as needed, to insure establishment. Irrigations after establishment occurred every 5 weeks as required. Weed and other pest control measures as well as fertilization were applied as needed.

Accessions were evaluated for stand and survival in the first year. In year 2-4 green-up, anthesis, and seed maturity dates were documented, stand evaluated, ocular evaluation of seed production, and air-dry biomass production determined by harvesting a 1 meter sample from interior plot rows that was representative plot growth.

Results and Discussion

Texas PMC plots were planted fall 2008. Stand estimates in 2009 and 2010 were highly variable (trial CVs of 94 and 107) and generally poor. Plant stand was estimated at 13-14% in 2009 and 2010 respectively, with no apparent relationship to accession. In efforts to control weeds in 2009 several plots were damaged. No differences in flowering dates (June 9-8 and June 15-18 in 2009 and 2010 respectively) or spring green-up (April 10 and April 12 in 2009-2010 respectively) was observed among accessions. No further evaluations of the Texas plots were made after 2010.

Arizona plots were established in 2008. Some plots had variable initial plant establishment, but this appeared related to irrigation rather than a difference in accessions. None of the accessions entered full dormancy during the 2009 winter period and all accessions were vigorously growing by mid March of 2009. 2010 yields were not significantly different (P <.05) among accessions and averaged 1.3 tons/ac for Salado to 2.2 tons/ac for Vegas Germplasm. 2010 results at the Arizona PMC are similar to an earlier study (Alba-Avila 1988) which showed that soil texture and depth of seeding had significant (P <.01 and .001) effects on above and below ground biomass production, while differences in biomass yield associated with the cultivars Salado and Saltalk were non-significant (P <.05).

California and New Mexico plots were established in the fall of 2010. Vegas germplasm and accession 9083020 had the best initial stand ratings in the spring of 2011, with Saltalk being rated as having the worst. By August of the same year stands were approaching equality. In New Mexico Saltalk and Salado were rated as having the best initial stands at approximately 70% with Vegas and accession 9083020 the worst at 50% and 20% respectively.

In 2011-2012 plots in Arizona and California were not irrigated during the growing season, New Mexico plots were not irrigated in 2012 as well, in an effort to evaluate accession performance under natural rainfall conditions (Table 1). In 2011 early spring moisture prior to active growth appeared to have little impact on performance of accessions as the Arizona PMC received less than 0.5 inches of rainfall prior to active growth and the California PMC received 8.5 inches during the same period, yet biomass yields were similar at both locations. Precipitation during the active growing period , April through July and August, depending on location, was 1.6 and 2.4 inches at the Arizona and California PMCs respectively.

Table 1. Average monthly precipitation during the growing season at the Arizona, New Mexico, and California Plant Material Centers in 2011-2012.

Month	Arizona PMC		California PMC		New Mexico PMC	
	-----------------------------Inches---------------------------					
	2011	2012	2011	2012	2011	2012
Jan	0.0	0.4	1.0	2.0	0.0	0.4
Feb	0.2	0.1	3.2	1.0	0.2	0.1
Mar	0.1	1.0	4.3	3.1	0.0	0.0
Apr	0.0 Growth begins	0.2	0.2 Growth Begins	1.8	0.0	0.7
May	0.0	0.0	1.2	0.0	0.0	0.1
June	0.1	0.4	1.0	0.0	0.0	0.1
July	1.6 Harvest	2.6 Harvest	0.0		1.2	0.6
Aug	1.4	-	0.0 Harvest	0.0 Harvest	0.8	1.6
Sep	5.6	-	0.0	-	1.1	0.7
Oct	0.1	-	0.2	-	1.1 Harvest	0.0 Harvest
Nov	1.0	-	0.6	-	0.2	-
Dec	2.0	-	0.2	-	1.7	-
Active growing season total (Month prior to growth inception-Harvest)	1.8	4.2	2.4	4.9	4.2	3.8

Initial spring growth at the Arizona PMC varied by accession in 2011. Vegas Germplasm began growth the earliest at mid-March, 9083020 late March, Saltalk mid April , and Saltalk not fully showing active growth until late May. In California none of the accessions became fully dormant, however, active spring growth began uniformly among all accessions beginning late in March through mid April. The trigger for the larger variation in spring growth in the Arizona plots is likely due to the ability of the Vegas Germplasm and accession 9083020 to utilize very low amounts of moisture; they appear to be better adapted to low moisture conditions. Saltalk and Salado sources come from regions with more precipitation (12-19 inches) and more severe winters 0-5^{o} degrees F (zone 7a) while Vegas Germplasm and accession 9083020 are from regions with very little precipitation (2-8 inches) and mild winters with low temperatures of 20-25^{o} F. (zone 9A) (USDA4, 2011). All the sources are from similar latitudes Saltalk and accession 9083020 are from sites at 35 ^{o} N. latitude and Salado is from 33^{o} N, and Vegas is composed of material collected from locations at 37^{o} N latitude.

In 2012 results from the Arizona, California, New Mexico trials shows the California experimental line 9083020 had the highest dry matter yield (Table 2) at all locations and the other lines had very similar yields when averaged across all locations. In 2012, under non-irrigated conditions, Accession 9083020 had significantly (P <.05) greater biomass yield than Saltalk and Salado at the Arizona site; significantly greater biomass yield than Salado and Vegas in California, and significantly more biomass than Salado, Saltalk, and Vegas at the new Mexico location. No significant differences in yield were observed under irrigated conditions in previous years. Accession 9083020 and Vegas Germplasm appear stemmier which may provide greater drought tolerance, but may have less value as a livestock forage than the cultivars Salado or Saltalk.

Table 2 . Mean yields of Vegas Germplasm, 'Salado', 'Saltalk', and 9083020 alkali sacaton accessions at the Arizona, New Mexico, and California Plant Materials Centers 2010-2012.

Accession	AZ PMC Tons per acre (dry wt)			CA PMC Tons per acre (dry wt)			NM PMC Tons per acre (dry wt)			Mean Yield Tons per acre (dry wt)
	2010	2011*	2012*	2010	2011*	2012*	2010	2011	2012*	
Salado	1.3	1.1	0.4	-	1.2	1.8	2.0	2.6	1.2	1.5
Saltalk	1.9	1.6	0.4	-	0.7	2.3	1.8	3.2	1.2	1.6
Vegas	2.2	2.4	0.7	-	0.8	1.8	1.7	2.7	1.1	1.7
9083020	1.9	2.1	1.0	-	1.2	3.6	2.7	4.0	2.7	2.4
LSD (P=<.05)	NS	NS	0.2		NS	1.3	NS	NS	1.2	

* Non-irrigated

Based on the performance of the lines included in the trial it is evident that alkali sacaton is well adapted to wide range of environments. All four accessions, from widely varying environments, performed equally well once established as long as moisture requirements are met. Under natural climatic conditions differences (spring green-up dates, drought tolerance, seed production, total biomass) begin to emerge which would likely affect the long term sustainability of given ecotypes within a given environment. Based on performance at the Tucson PMC and climate at from original collection sites of the released materials the range of recommended use of the 4 sacaton lines is as follows. In the hot desert areas, within the Western Range and Irrigated Region, where early spring moisture from winter rains is available, Vegas Germplasm would be the better choice (MLRA 29, 30, 31, and 40). In areas where summer rains predominate and can provide 11-15 inches of precipitation within the Western Range and Irrigated Region "Salado" would be the best choice (MLRA 35, 38, 41, and 42). "Saltalk" would be better used in the southern portions of the Western Great Plains Range and Irrigated Region, and the Central Great Plains Winter Wheat and Range Region where 15-30 inches of precipitation is available during the growing period.

Vegas Germplasm and 9083020 come from similar climatic regions and performed similarly. There was no significant difference in biomass production between either line in 2012 at the Arizona PMC and both begin growth about the same time. 9083020 is taller, more erect and with stronger stems.

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Observational Planting of Roemer's Fescue for Corvallis PMC

CAPMC-P-1201-NA

Margaret Smither-Kopperl

Roemer's fescue [*Festuca roemeri* (Pavlick) E. B. Alexeev; synonym: *F. idahoensis* var. *roemeri* Pavlick] is an important native grass of upland prairie and oak savanna plant communities within its natural range of western Oregon, western Washington, and northwestern California. It is a native cool season perennial bunchgrass with variable longevity and mostly basal foliage. It is short, fine textured, and densely tufted, and has stiff culms that grow 35-100 cm tall. The panicle (seed head) is open and 5-20 cm long. Leaves are often glaucous (covered with a whitish waxy coating) and color varies throughout a wide spectrum of greens and blues. Stem color ranges from light green to dark purple or red.

The objective of his observational planting was to assess the adaptability of five germplasm releases from Corvallis Oregon to conditions at the Lockeford PMC, MLRA 17 in the Central Valley of California.

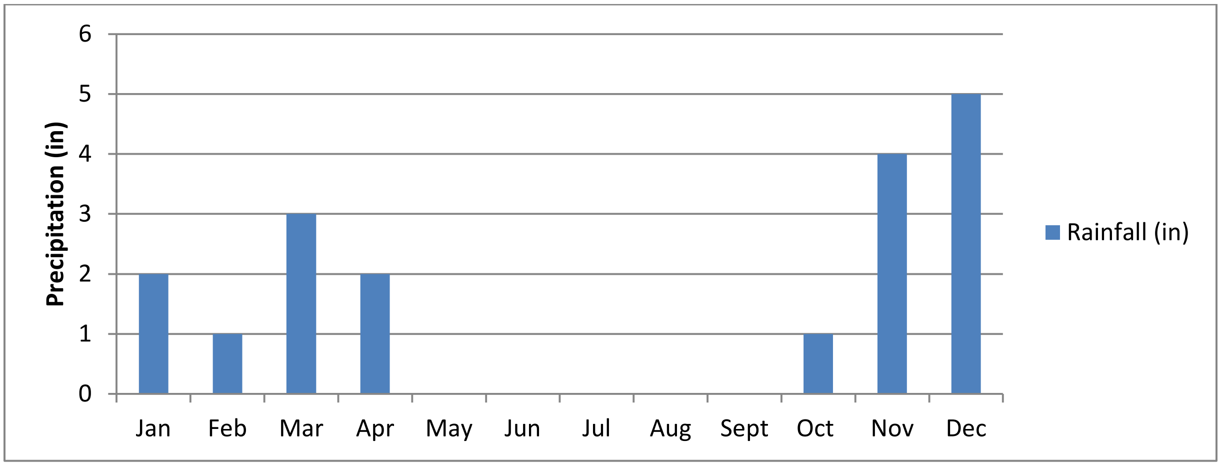
Materials and Methods

Seed of four accessions of *F. roemeri* var *roemeri* and one *F. roemeri* var *klamathensis* was provided by Corvallis PMC, OR (Table 1). Plantings were established onto 42 inch x 220 ft beds with 2 buried sub-surface drip lines. To achieve a seeding rate of 2.5 lbs/acre 11.88g of grass seeds were added to 100g of rice hulls mixed then planted using a Drop Spreader and the surface was raked. This process was the same from all 5 species and the planting date was November 4, 2011. Emergence was noted on November 21, 2011. Irrigation was applied after planting and through February 2012, after this no irrigation was applied during 2012.

Table 1. Accessions from Corvallis planted at the Lockeford PMC.

Accession Number	Scientific Name	Common Name	Release
9079511	*Festuca roemeri* var *klamathensis*	Klamath Roemer's fescue	Siskiyou Germplasm
9079484	*Festuca roemeri* var *roemeri*	Roemer's fescue	Coast Germplasm
9079512	*Festuca roemeri* var *roemeri*	Roemer's fescue	Puget Germplasm
9079513	*Festuca roemeri* var *roemeri*	Roemer's fescue	San Juan Germplasm
9079510	*Festuca roemeri* var *roemeri*	Roemer's fescue	Willamette Valley Germplasm

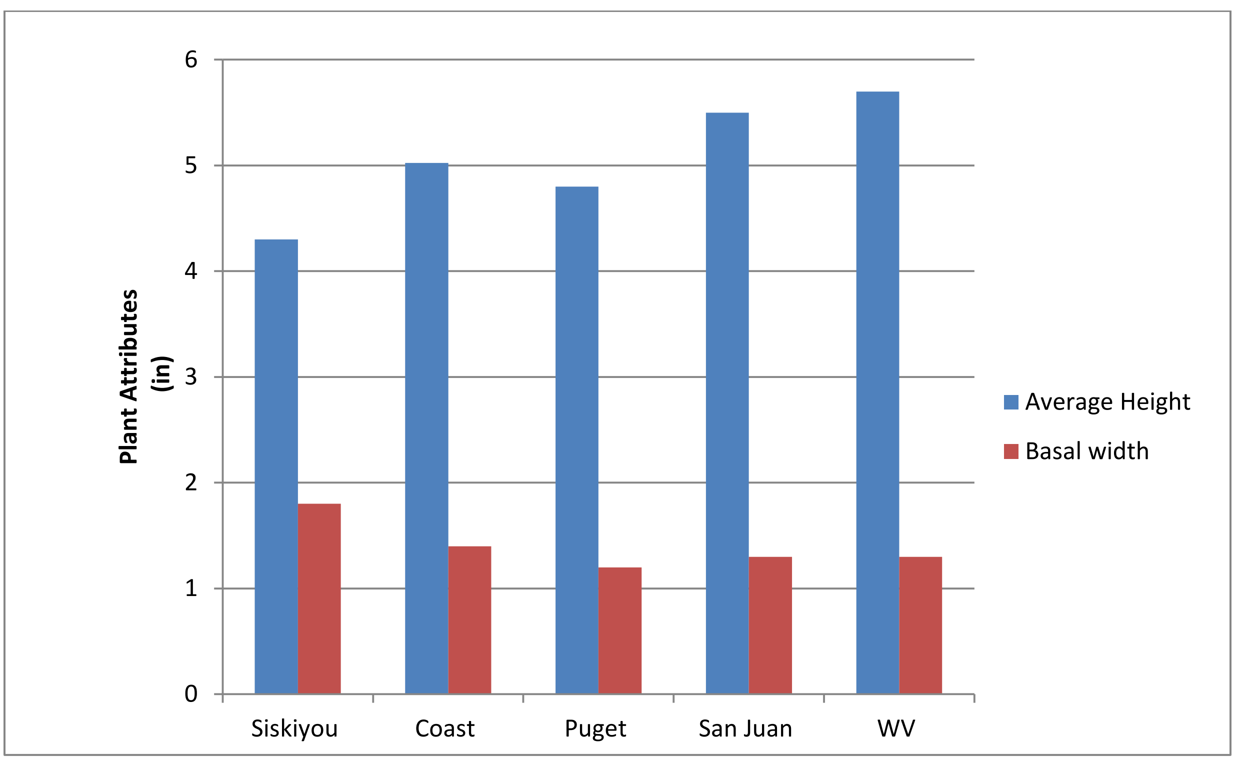
Figure 1. Rainfall during 2012.



Results and Discussion

There was no difference between the germplasm releases with respect to emergence, and all appeared to grow at similar rates. Growth was assessed on August 28, 2012. At that time the grasses had survived four months of drought conditions (Figure1) and there was no difference in vigor between them. With respect to plant height and base width the Siskiyou gerplans *F. roemeri* var *klamathensis* was shorter and broader than the of *F. roemeri* var *roemeri* releases (Figure2). No insect or dsease problems were noted.

Figure 2. Comparison of height and base width for Roemer's fescue releases



The gemplasm releases did not flower during 2012, growth slowed and stopped over the summer due to lack of water. Extreme drought tolerance of these plants is exhibited by their survival during the California summer of 2012 (Figure 3).

Figure 3. Accessions of Roemer's fescue actively growing after fall rains on Nov 29

Figure 3. Accessions of Roemer's fescue actively growing after fall rains on Nov 29, 2012.

The plants resumed active growth as soon as the rains came in November of 2012 and their growth will be monitored during 2013.

Literature Cited

1. Roemer's fescue germplasm for the Pacific Northwest
   Festuca roemeri (Pavlick) E.B. Alexeev Corvallis Plant Materials Center,
2. Roemer's fescue *Festuca roemeri* (Pavlick) E.B. Alexeev Plant Fact Sheet Plant Materials
   http://plant-materials.nrcs.usda.gov/

Evaluation of springbank clover as a native leguminous cover crop

Study No. ORPMC-T-1203, CAPMC-T-1301 (2012 – 2015)

Annie Young-Mathews, Margaret Smither-Kopperl

The purpose of this study is to perform an initial evaluation of springbank clover (*Trifolium wormskioldii* Lehm.) for use as a perennial cover crop in Oregon and California. Research and analysis will commence in year 2012 and conclude in 2015.

Objectives for this study are four fold:
1) Evaluate germination and establishment (1st year), phenology, rate of spread and stand persistence;
2) Quantify wet and dry biomass accumulation over the course of the growing season over three years with no supplemental management .Iirrigation will be applied at CAPMC due to California's Mediterranean climate
3) Identify insect and disease susceptibility of the species
4) Evaluate ability of the species to compete with and/or suppress weeds.

Springbank clover is a native perennial legume that shows potential as a new pollinator-attracting, nitrogen-fixing perennial cover crop for vineyards, orchards, and cane berries (Figure 1). Seed is not currently available on the commercial market, but a 2010 planting at the Corvallis PMC established quickly and has produced an abundance of seed for the last two years. This germplasm (accession 9079619) was originally collected in 2009 at Cummins Creek, USFS Siuslaw NF, Lincoln County, OR. Seed from the 2011 harvest of this germplasm (lot # SG1-11-OS619) was generously donated by the USFS for use in this trial. Two common, non-native cover crop species, white clover (*T. repens*) and strawberry clover (*T. fragiferum*), are being used as controls to compare their establishment and productivity to those of *T. wormskioldii* under simulated cover crop conditions.

Figure 1. Seed production field of springbank clover at the Corvallis PMC, with white clover in foreground, June 2012.

This trial is taking place at the Corvallis, OR PMC and the Lockeford, CA PMC. The plots at the Corvallis PMC are located on field 7-12 of Schmidt Farm. The trial was set up as a randomized complete block design with 6 treatments (3 species seeded at two different seeding rates) and 4 replicated blocks (Figures 2 & 3). Plots were seeded on October 9, 2012 using the small seed box of a Truax drop seeder followed by rolling with a tine roller to improve seed to soil contact. Corvallis PMC plots will receive no supplemental irrigation, fertilizer, or weed control other than one to two summer mowings as needed to keep down weed biomass and prevent weeds from going to seed.

The plots at the Lockeford PMC are located in Field 4. The trial was designed as a randomized complete block design with the species as the three treatments in 6 x 24 feet plots and 4 replicated blocks (Figure 4). Plots were seeded on November 14, 2012 using a Planet Junior seeder (Hole Size #2 for all species). There were10 rows in each plot with a goal of 60 seeds per square foot (Figure 2). Rainfall was abundant in the fall and no supplemental irrigation was required. Irrigation will be supplied by sprinkler as needed in future.

Data will be collected for the next three years on establishment, spread, stand persistence, weed competition, and biomass production of the three clover species, as well as any disease or pest problems.

Figure 2. *Species and seeding rates for perennial clover cover crop trial seeded in October and November, 2012.*

Trt #	Species	Common name	seeds/lb	PLS rate seeds/ft^2	PLS rate lb/acre	PLS rate g/ft^2	Purity	Germ	Bulk rate g/ft^2
1	*Trifolium wormskioldii*	springbank clover	348,000	60	7.5	0.08	95.26%	88%	0.09
2			348,000	120	15.0	0.16	95.26%	88%	0.19
3	*Trifolium repens*	white clover	776,000	60	3.4	0.04	65.63%	95%	0.06
4			776,000	120	6.7	0.07	65.63%	95%	0.11
5	*Trifolium fragiferum*	strawberry clover	300,000	60	8.7	0.09	65.98%	97%	0.14
6			300,000	120	17.4	0.18	65.98%	97%	0.28

Figure 3. *Plot layout of perennial clover cover crop trial in field 7-12 of the Corvallis PMC Schmidt Farm.*

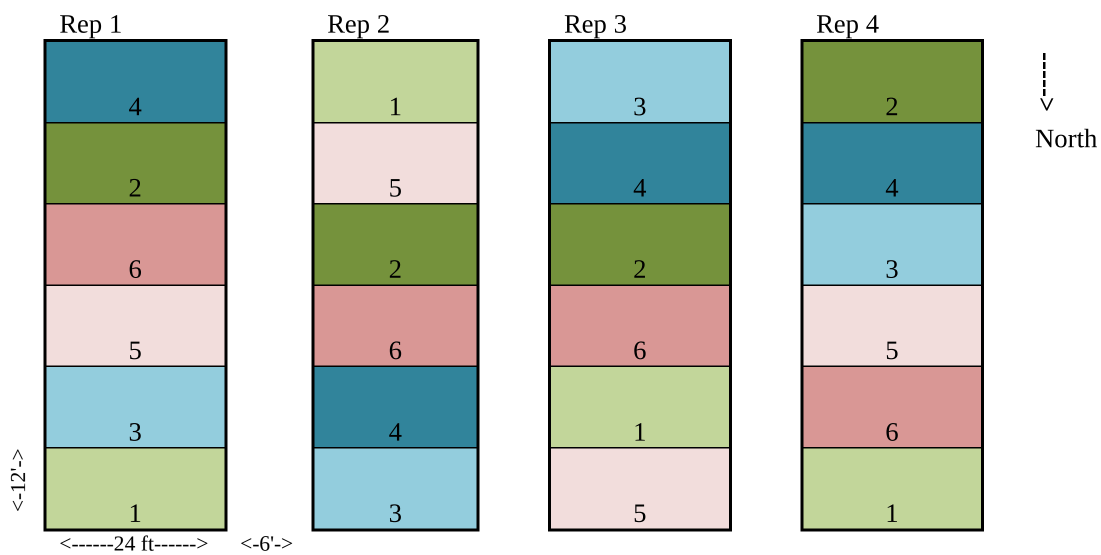
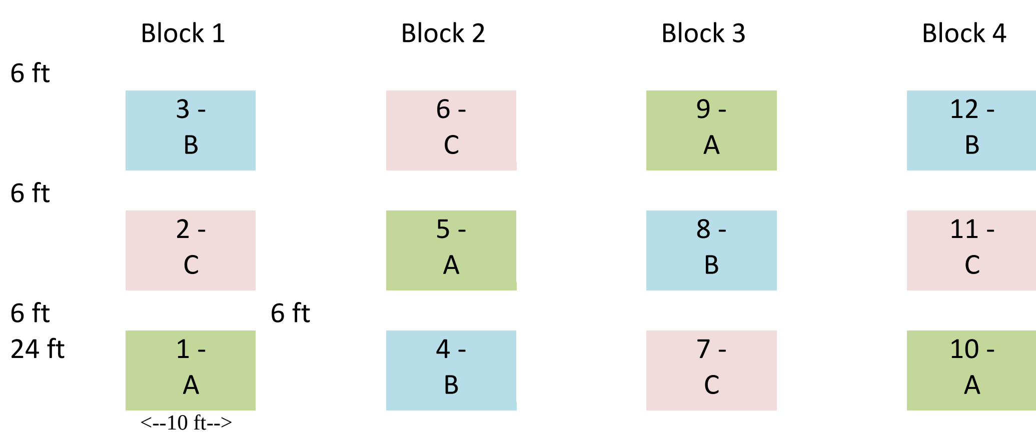


Figure 4. Plot randomization for perennial clover planted in Field 4 at the Lockeford PMC.



Demonstration planting of 'Windbreaker' big sacaton

CAPMC-T-1207-WI

Margaret Smither-Kopperl

Partners: Johnnie Siliznoff, NRCS Air Quality Specialist

'Windbreaker' big sacaton (*Sporobolus wrightii* Munro ex Scribn) is a recent release from the Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA) and New Mexico State University (NMSU) Agricultural Science Center at Los Lunas[1]. 'Windbreaker' big sacaton is a native, warm-season grass for the southwestern United States. 'Windbreaker' produces on a per acre basis more than 8,000 lbs of biomass, 200 bulk lbs. of seed, and can grow more than 3 meters in height. The plant is readily consumed by livestock and wildlife in spring and early summer. It has demonstrated in New Mexico and Arizona to be an excellent choice for use in wind strips protecting cropland from wind erosion. Big sacaton is endemic in southern California, but not the Central Valley[2].

The objective of this preliminary observational study was to examine the growth phenology of 'Windbreaker' big sacaton at the California PMC to assess its potential for use in the Central Valley of California, where air quality is a major resource concern. In addition, we evaluated germination and survival on two soils in the southern San Joaquin Valley.

Materials and Methods

Seed of 'Windbreaker' big sacaton, Accession number 9066790 was provided to the CAPMC by the Los Lunas PMC in 2011.

On February 22, 2012, seed was sown into two plug trays with 192 cells with Sunshine mix # 5. The trays were watered well and placed in the greenhouse , at temperatures of 60 F night and max 80 F day. Germination was noted on March 5, 2012. Plants were transferred into D16 Deepots (2" in diameter x 7" tall, 16 cubic inch) on April 12, 2012. Plants were placed in a lathe house in May and maintained with weekly fertilization and daily watering prior to planning on July 3, 2012

Two soil types were obtained from the southern Central Valley to test germination and growth of 'Windbreaker' big sacaton. These two soil types, Fresno, fine sandy loam, shallow and Travers sandy loam were tested for germination on May 12, 2012 along with a soil sample from the CAPMC of Columbia fine sandy loam. Seed was planted directly onto three replicate pots (3 x 3 x 8 inches) of these soils which were maintained in the lathe house and watered daily. Three replicate pots of soil were also planted with plug plants of each of the original planting were transplanted into these soils.

Transplanting of 'Windbreaker' big sacaton plugs was into a 42 inch width raised bed with two buried drip lines. Prior to planting the plants were clipped to 5 inches in height. (Figure 1.). Planting was in a double row with a 5 foot spacing staggered along the beds. Initially water was applied every other day.

Results and Discussion

Transplants of 'Windbreaker' big sacaton established well and grew rapidly. There was no loss of plants at transplanting. However, some plants were lost due to damage inflicted by deer grazing on the rapidly growing plants including pulling some plants out of the ground. No diseases were noted on the plants. By late September plants were a meter in height. Growth slowed in the fall and the plants were left with no additional irrigation over the winter.

		
Plug Planting, 7/3/2012	**Growth stage 7/31/12**	**My late September plants were 1 m tall. 9/13/12**

Growth of "Windbreaker' big sacaton plants will be monitored over the winter of 2012 and into -2013 to determine potential use for erosion control in the Central Valley. If the plant continues to look promising studies could start in 2014.

Big sacaton is not considered a weedy species or invasive species, but it could spread to adjoining vegetative communities under ideal environmental conditions. The fact that seed failed to germinate in any of the three soils tested in the lath house while transplanted plugs established and grew in all soil types indicates weediness is likely not a problem.

Literature cited

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[2]Jepson Flora Project: Jepson Interchange for California Floristics, *Sporobolus wrightii* Munro ex Scribn. http://ucjeps.berkeley.edu/cgi-bin/get_cpn.pl?SPWR2. Accessed May 14, 2013.

Seed Production

Seed Production at the CAPMC during 2012

PLANTS Code	Species	Release name	Common name	Accession #	Weight (lbs)
CAPMC Releases					
BRCA5	*Bromus carinatus*	Southern Cal 2600	California brome	9083079	1.16
BRCA5	*Bromus carinatus*	Northern Cal 40		9083079	5
ELGL	*Elymus glaucus*	'Mariposa'	Blue wildrye	9032907	1
ERUM	*Eriogonum umbellatum*	Sierra	Sulphur-flower buckwheat	421013	2.2
SPAI	*Sporobolus airoides*		Alkali sacaton	9083032	43
VIVIV8	*Vicia villosa*	Lana	Winter vetch	117430	94
VUMY	*Vulpia myuros*	Zorro	Rat-tail fescue	421020	145
Other Production					
ELEL5	*Elymus elymoides*	BLM	Squirreltail	9105974	45g
ELGL	Elymus glaucus	BLM	Blue wildrye	9105972	2.5
FECA	Festuca californica	BLM	California Fescue	9105975	0.5
NAPU4	Nassella pulchra	BLM	Purple tussockgrass	9105969	7
NAPU4	Nassella pulchra	BLM		9105970	4.5
LUBI	Lupinus bicolor	NPS	Miniature lupine	9105998	8.25
ELGL	Elymus glaucus	NPS	Blue wildrye	9105995	4.25
BRCA5	Bromus carinatus	NPS	California brome	9105993	11
PHCA	*Phacelia californica*	PMC	California phacelia	9105955	1.85

Conservation Field Trials

2012 Progress Report

First-Year Data Analysis, Conservation Field Trial Studies

Lewis Center for Educational Research; and Victor Valley College

December, 2012

Prepared For:

Natural Resources Conservation Service and Mojave Desert Resource Conservation District, Victorville, CA

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Project Sponsors

- Mojave Desert Resource Conservation District (MDRCD)
- Mojave Water Agency (MWA)
- Lewis Center for Educational Research (Department of Global Science) (LCER)
- Victor Valley College (Department of Agriculture and Natural Resources) (VVC)
- Natural Resources Conservation Service, Victorville Field Office (NRCS)
- California Plant Materials Center, NRCS, Lockeford, CA (CAPMC)

Project Contributors

- Reforestation Technologies International, Inc., Salinas, CA (RTI)
- Seed Dynamics, Inc. , Salinas, CA (SDI)

Background

Dense stands of saltcedar (*Tamarix* spp.) along the Mojave River in San Bernadino County have been recently reduced in cover and density through occurrence of wildfire, river flooding, and/or application of active control programs (herbicidal and mechanical) under the auspices of the MDRCD and MWA. Landowner entities that manage the land where these events have occurred (LCER and VVC) are desirous of restoring these sites to native plant communities, in coordination with ongoing management and maintenance control of resprouting saltcedar. As a result of disturbance and reduction of saltcedar cover and biomass, these sites are very susceptible to re-encroachment of saltcedar and secondary invasive species, as well as increased erosion from wind and water. These factors contribute to continued water loss through evapotranspiration without technically sound revegetation measures employed to restore self-sustaining native plant communities.

Conservation Field Trials (CFT's) were designed and implemented in response to these issues on the Lewis Center for Educational Research (LCER), Apple Valley, CA; and Victor Valley College (VVC), Victorville, CA. These CFT's were designed to evaluate optimum species selection, planting techniques, and water conservation measures in order to develop and apply best management practices (BMP's), plant materials, and techniques to these and other similarly affected sites. The objective of these CFT's was to determine the suitability and sustainability of applied revegetation strategies, technologies, and selected plant materials for site restoration on riparian and historic floodplain sites affected by natural and anthropogenic disturbance activities (i.e., flooding, fire, saltcedar infestation and removal) along the Mojave River in San Bernadino County. The study emphasized: a) native species selection and adaptation; b) revegetation species response to seeding and planting techniques, including mechanical techniques for seedbed preparation; and c) augmentation of soil moisture regime with polyacrylamide polymer and Zeolite™ columns.

Narrative summary observations based on only first-year data collection: LCER - May 19, 2012; VVC – May 27, 2012

I. <u>Lewis Center for Educational Research (LCER)</u>

- Pooled across planting type and polymer treatments, all species (inclusive of those that exhibited no survival) demonstrated no significant difference in survival within the primary treatments (Table 1). Three individual species exhibited no survival regardless of primary treatment or interactive treatment combination – BASA, ERFA, and SPAM as of May 19, 2012. With the exclusion of these non-surviving species, the remaining, surviving species did cumulatively exhibit significantly improved survival under the TZC (Zeolite™ column) primary treatment (84.4% vs. 63.2%, respectively)

- As described in Table 5 and Figure 2, the majority of this positive, significant effect from the TZC treatment is due to the positive responses of DISP, PRPU, and SPAI to placement adjacent to the Zeolite™ columns.

- Use of polyacrylamide polymer showed no significant effect when averaged across all species (both inclusive and exclusive of the three non-surviving species) within the TZC planting type (Tables 1and 2; Figure 1A).

- However, when separated and examined within the TP planting type only (Table 3, Figure 1B), polyacrylamide polymer application significantly benefitted survival for all species collectively [both inclusive (46.8% vs. 39.3%) and exclusive (68.6% vs. 57.8%) of the three non-surviving species]. This suggests that in general, standard transplants planted without irrigation or other forms of supplemental moisture supply (e.g., Zeolite™ columns) will benefit from polymer augmentation.

- Conversely, surviving transplants planted in association with Zeolite™ columns (TZC) not only derived no further benefit from polymer augmentation, but also exhibited generally higher overall survival (33% increase) compared to polymer-augmented standard transplants (TP) (compare mean values in Table 2 vs. Table 3; also Figure 1B). The interaction effect of planting type with polymer application also supports these findings (see Appendix 1, page 9).

- Examining surviving individual species that were common between the TP and TZC primary planting type treatments – i.e., ATCA and SPAI – only SPAI exhibited superior survival under Zeolite™ column treatment (87.5% vs. 66.7%) (Table 4; Figure 2A). Neither of these species exhibiting any significant response to polymer augmentation, regardless of planting type.

- When evaluated independently between planting type treatment (i.e., stand-alone analysis within TP vs. TZC), surviving individual species demonstrated relatively high survival within each planting type (Table 5; Figures 2B and 2C). Additionally, three species – DISP, PRPU, and SPAI – demonstrated significant positive response to polymer augmentation under the TP planting type. Conversely, as noted above, surviving species under the TZC treatment exhibited no response to polymer augmentation.

Notes on the statistical analysis (LCER only):

- See Appendix 1 for detailed outputs and results from the LCER analyses.

- Analysis of variance procedures were used (Statistix™ for Windows Analytical Software, Version 8.1), since they are reasonably robust in relation to data non-normality and to moderate violations of the assumption of homegeneity of variance. This robustness is maintained when the shapes of data distributions are similar, samples are obtained randomly, sample sizes are equal, and mean separations are evaluated at confidence levels of 95% or greater (Manly 1994, Bonham 1992, Steel and Torrie 1980).

- Factorial ANOVA analyses were conducted using planting type and polymer application as primary treatments, with replication effect accounted for as a separate variable. Within this context, analyses were conducted a) inclusive of all transplant species (9); and b) exclusive of species which did not survive (Tables 1, 2, and 3) – i.e., BASA, ERFA, and SPAM. The first approach reveals mean cumulative survival reflective of all species planted, while the latter approach more accurately reflects mean cumulative survival of those species which did survive, unaffected by the zero-survival species.

- For comparisons made between TP and TZC primary treatments, unequal sample sizes between the primary treatments (i.e., n = 8 plants per lowest-level treatment combination for TZC plots vs. 20 plants per lowest-level treatment combination for TP plots) weakens the power of the ANOVA analysis. However, ANOVA procedures remain relatively robust where a) the resultant p-values of the analyses remain less than 0.01; and b) 'n' for any given treatment combination is greater than 4. Additionally, as a result of this reduction in power of difference detection by the ANOVA's, analyses were run independently (separately) for TP and TZC primary treatments, allowing increased robustness and power of analysis within each treatment.

✓ Data were not analyzed for the seeding treatment (BCS) because no germination or emergence of seeded species was evident on any plot. Below-normal precipitation into spring and summer of 2012 following seeding application, combined with probable seed dormancy mechanisms prevalent among the native species that were seeded, are logical underlying reasons for the absence of germination, emergence and growth. The 2013 growing season will likely yield better results for the seeded plots.

II. <u>Victor Valley College (VVC)</u>

➢ Pooled across polymer and irrigation treatments, all species collectively demonstrated mean superior survival under polymer root dip treatment (80.2% vs. 72.7%) (Table 1; Figure 1A; Appendix 1). When ERFA was excluded because of zero survival regardless of polymer treatment, the difference is equally significant (89.2% vs. 80.7%).

➢ Most individual species demonstrated high survival across all treatment types (Tables 2 and 3; Appendix 1; Figure 2), with only SAGO (*Salix gooddingii*, Goodding's willow) and ERFA (*Eriogonum fasciculatum*, California buckwheat) showing poor or no survival (overall mean 23.8% and 0.0%, respectively) through the first data collection period (May 27, 2012).

➢ Individual species that responded positively and significantly to the polymer root dip treatment included BASA (*Baccharis sarothroides*, desert broom); SAEX (*Salix exigua*, narrowleaf willow); and SAGO (*Salix gooddingii*, Goodding's willow) (Tables 2 and 3; Figure 2). The remainder of the 10 test species responded equally (statistically) to polymer root dip and granular polymer treatments.

➢ There was no significant response to irrigation collectively (species pooled across all treatments) (Table 1; Figure 1B) or for nearly all individual species (Tables 2 and 3; Figure 2; Appendix 1). The lone exception was POFR (*Populus fremontii*, Fremont cottonwood), which exhibited superior survival under limited irrigation as averaged across polymer treatments (91.7% vs. 71.7%; Table 2). However, Table 3 reveals that this significant response was detected only within the polymer root dip treatment (TPD). While also exhibiting apparent trend toward superior survival under granular polymer treatment (TGP), the response was not significant statistically.

- Because of the essential lack of significant response to limited irrigation across nearly all individual test species, Figure 2 is simplified to depict only differences between the polymer application type primary treatment where several significant differences were detected.

- Zeolite™ Columns Independent Demonstration Study (VVC only) -

  - The Zeolite™ columns at this location (the active floodplain inside the levee directly east of the VVC primary study) were drilled and installed very deeply – approximately 14 feet (4.2 m) actual drilled depth in order to reach the capillary fringe (aka vadose zone) of the water table at this location during November 2012. This depth was considered as the typically deepest seasonal level of the vadose zone that would be encountered in most years at this floodplain location.

  - However, Zeolite™ column technology and function have (to my knowledge) never before been tested at this depth, with typical maximum functional depth (and cost-effectiveness) usually restricted to 6 feet (1.8 m) or less. The fact that these Zeolite™ columns may be functioning as designed (i.e., wicking moisture to the soil surface and transplant initial rooting zone) at this excessive depth, and within 4-6 weeks after installation in a sand substrate for the whole column depth, suggests that their occasional use may be beneficial and cost-effective using this technology in riparian zones (active floodplain or upper-level floodplain terraces). This would particularly be true for establishment of designed, small "island" plantings where sub-irrigation provided by these columns will stimulate vegetative spread, propagule distribution, and seedling dispersal.

  - Of further note is that the Zeolite™ columns in the LCER CFT study demonstrated equal or significantly better results (depending upon test species) at free water depths of 5-6 feet (1.5-1.8 m), thus suggesting (and confirming previous studies at other southwestern riparian locations - i.e., NM, AZ) that effectiveness increases with shallower depths to groundwater.

  - Results of the VVC Zeolite™ column demonstration were variable for the first data collection. One species – SAGO (*Salix gooddingii*, Goodding's willow) definitely benefitted from placement adjacent to Zeolite™ columns (100% survival), whereas SAGO exhibited no survival without Zeolite™ columns. This is suggestively important because Goodding's willow is a key native phreatophytic species typically adapted to the outer fringes (i.e. higher elevation floodplain terraces) of riparian systems throughout the desert Southwest, including the Mojave River system.

  - Eastern Mojave buckwheat (*Eriogonum fasciculatum*; ERFA) did not survive for either treatment, in line with equal non-survival within the VVC primary study. Thus, no indication of success for Zeolite™ columns can be derived from this test species.

  - For the remaining two test species of the VVC Zeolite™ column demonstration – BASA (*Baccharis sarothroides*, desert broom) and CHLI (*Chilopsis linearis*, desert willow) – results were equivocal between treatments, with Zeolite™ columns showing no apparent benefit compared to absence of these columns. The result for BASA is surprising, given its typical adaptation to, and need for mesic soil moisture regimes in most SW riparian habitats. The equal survival between treatments for CHLI is logical, as in similarity to ERFA, these latter two species are typically more adapted to upland, arid to xeric soil moisture regimes.

  - This demonstration will continue to be monitored simultaneous with monitoring for the VVC primary study.

Notes on the statistical analysis (VVC only; Zeolite™ column independent demonstration study not included):

- See Appendix 2 for detailed outputs and results from the VVC analyses. No statistical analyses were performed on the Zeolite™ column independent demonstration study because of the small sample size.

- Analysis of variance procedures were used (Statistix™ for Windows Analytical Software, Version 8.1), since they are reasonably robust in relation to data non-normality and to moderate violations of the assumption of homegeneity of variance. This robustness is maintained when the shapes of data distributions are similar, samples are obtained randomly, sample sizes are equal, and mean separations are evaluated at confidence levels of 95% or greater (Manly 1994, Bonham 1992, Steel and Torrie 1980).

- Factorial ANOVA analyses were conducted using polymer application type (TPD vs TGP) and irrigation (I vs NI) as primary treatments, with replication effect accounted for as a separate variable. Within this context, analyses were conducted a) inclusive of all transplant species (10); and b) exclusive of species which did not survive (Table 1) – i.e., ERFA. The first approach reveals mean cumulative survival reflective of all species planted, while the latter approach more accurately reflects mean cumulative survival of those species which did survive, unaffected by the zero-survival species.

✓ Data were not analyzed for the seeding treatment (BCS) because no germination or emergence of seeded species was evident on any plot. Below-normal precipitation into spring and summer of 2012 following seeding application, combined with probable seed dormancy mechanisms prevalent among the native species that were seeded, are logical underlying reasons for the absence of germination, emergence and growth. The 2013 growing season will likely yield better results for the seeded plots.

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I. TABULAR AND GRAPHIC SUMMARIES – 2012 RESULTS, LCER CFT

Table 1. Comparison of mean survival for all plant species common to both standard transplant (TP) and Zeolite™ column transplant (TZC) treatments – ATCA, BASA, ERFA, and SPAI.

INCLUDING BASA and ERFA

PLANTING TYPE

TP (Standard transplants) = 43.1%
TZC (Zeolite™ column transplants) = 42.2%

POLYMER APPLICATION

P (Polymer) = 43.7%
NP (No polymer) = 41.5%

* **Significantly different at $p < 0.01$ (yellow highlight).**

EXCLUDING BASA, ERFA, and SPAM †

PLANTING TYPE *

TP (Standard transplants) = 63.2%
TZC (Zeolite™ column transplants) = 84.4%

POLYMER APPLICATION

P (Polymer) = 74.9%
NP (No polymer) = 72.6%

† **No survival for BASA, ERFA and SPAM.**

Table 2. Comparison of mean survival for all plant species relative to polyacrylamide polymer application within the Zeolite™ column transplant (TZC) treatment only.

INCLUDING BASA and ERFA

POLYMER APPLICATION

P (Polymer) = 40.6%
NP (No polymer) = 43.8%

* **Significantly different at $p < 0.01$ (yellow highlight).**

EXCLUDING BASA and ERFA †

POLYMER APPLICATION

P (Polymer) = 81.3%
NP (No polymer) = 87.5%

† **No survival for BASA and ERFA.**

Table 3. Comparison of mean survival for all plant species relative to polyacrylamide polymer application within the standard transplant (TP) treatment only.

INCLUDING BASA and ERFA		EXCLUDING BASA, ERFA, and SPAM †	
POLYMER APPLICATION *		POLYMER APPLICATION *	
P (Polymer)	= 46.8%	P (Polymer)	= 68.6%
NP (No polymer)	= 39.3%	NP (No polymer)	= 57.8%

* **Significantly different at $p < 0.01$ (yellow highlight).**

† **No survival for BASA, ERFA, and SPAM.**

Table 4. Comparison of mean survival for selected individual, *surviving* plant species common to both standard transplant (TP) and Zeolite™ column transplant (TZC) treatments – ATCA and SPAI †.

ATCA (*Atriplex canescens*)		SPAI (*Sporobolus airoides*)	
PLANTING TYPE		PLANTING TYPE *	
TP (Standard transplants)	= 84.2%	TP (Standard transplants)	= 66.7%
TZC (Zeolite™ column transplants)	= 81.3%	TZC (Zeolite™ column transplants)	= 87.5%
POLYMER APPLICATION		POLYMER APPLICATION	
P (Polymer)	= 78.3%	P (Polymer)	= 81.3%
NP (No polymer)	= 87.1%	NP (No polymer)	= 72.9%

* **Significantly different at $p < 0.01$ (yellow highlight).**

† **No survival for BASA and ERFA.**

Table 5. Comparison of mean survival for individual species within the standard transplant (TP) and Zeolite™ column transplant (TZC) treatments relative to polymer response.

TP – Standard Transplants

	ATCA	BASA	DISP *	ERFA	LYAN	PRGL	PRPU *	SPAM	SPAI *
Polymer	81.7%	0.0%	76.7%	0.0%	41.7%	75.0%	61.7%	0.0%	75.0%
No Polymer	86.7%	0.0%	41.7%	0.0%	45.0%	71.7%	43.3%	0.0%	58.3%

TZC – Zeolite™ Column Transplants

	ATCA	BASA	ERFA	SPAI
Polymer	75.0%	0.0%	0.0%	87.5%
No Polymer	87.5%	0.0%	0.0%	87.5%

* **Significantly different at $p < 0.01$ (yellow highlight).**

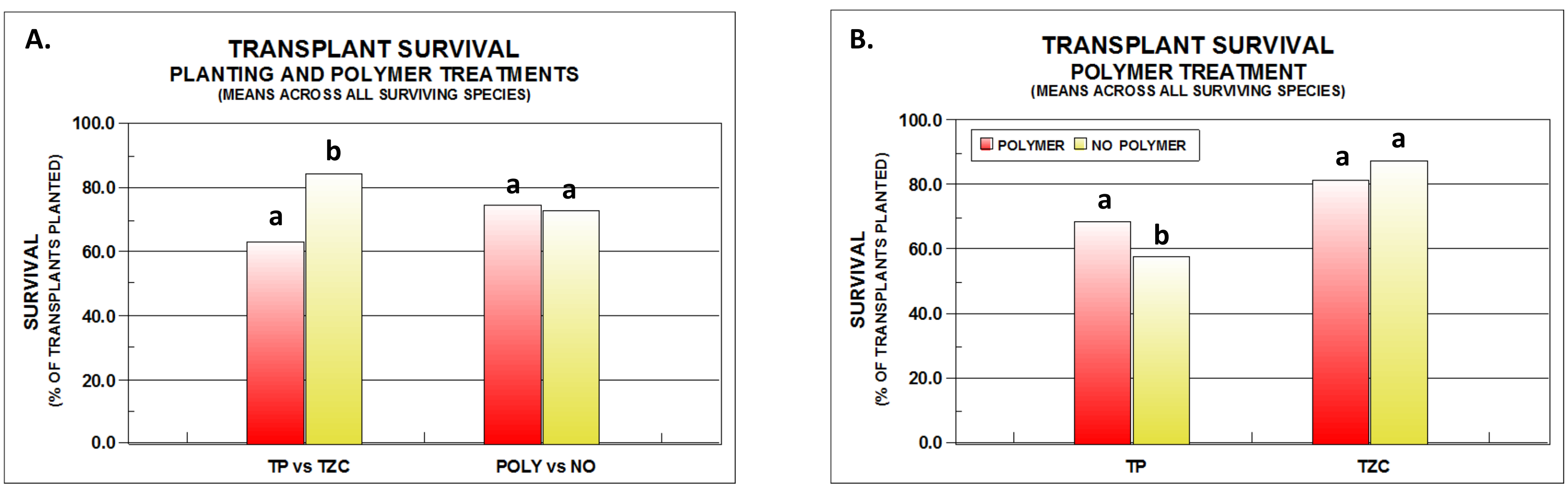


Figure 1. Transplant survival averaged across all *surviving* species (i.e., exclusive of BASA, ERFA, and SPAM). A) Survival within stand-alone primary treatments (ref. Table 1); and B) Survival as represented by the interaction between planting type and polymer treatments (ref. Table 3). Bars within a species exhibiting different letters are significantly different at $p < 0.01$.

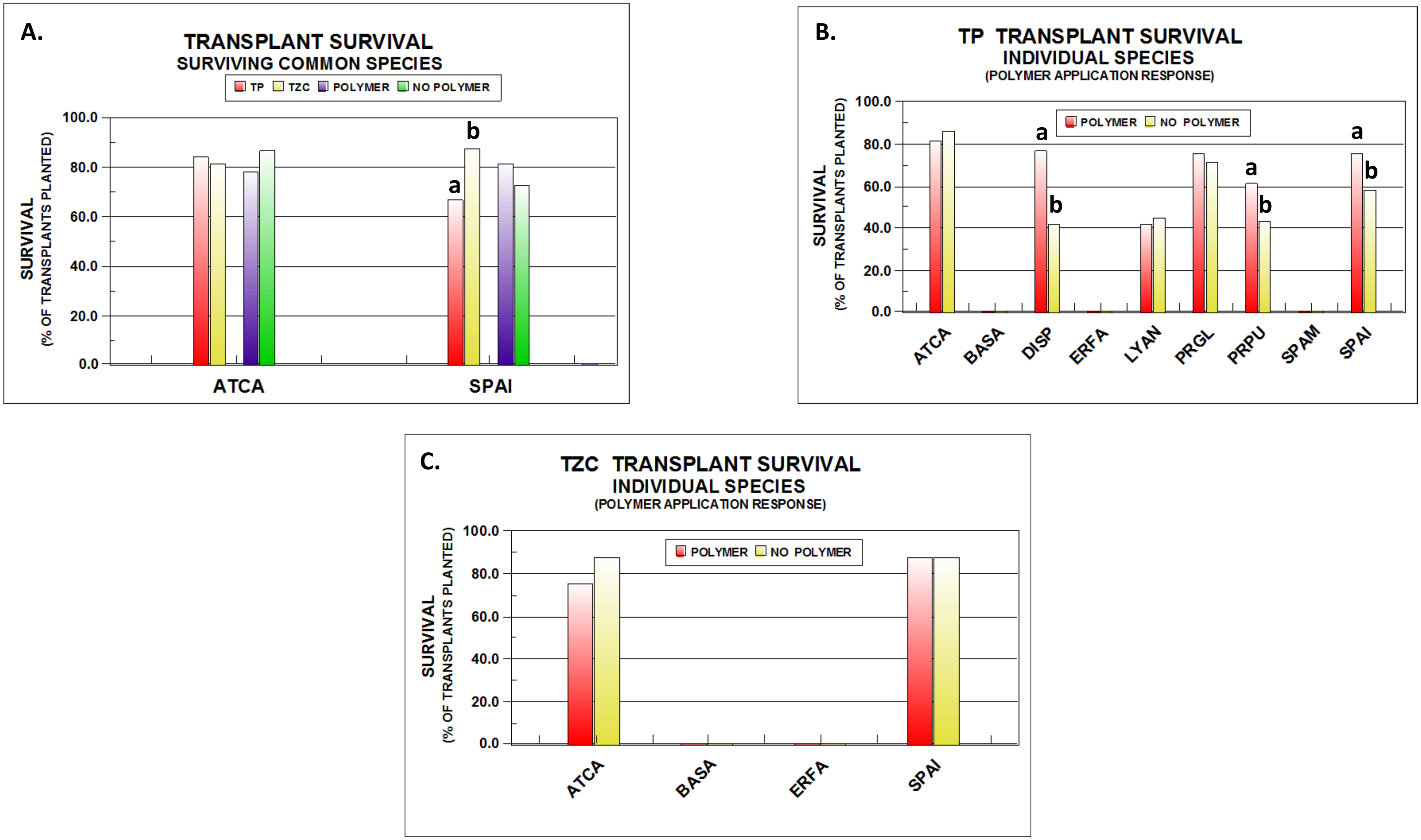


Figure 2. Transplant survival for individual species for the nine species tested at the LCER CFT study site, Spring 2012. A) Survival for species common to both TP and TZC treatments – ATCA and SPAI (i.e., exclusive of BASA, ERFA, and SPAM which exhibited no survival for any treatment combination) (ref. Table 4); B) Survival within stand-alone TP primary treatments (ref. Table 5); and C) Survival within stand-alone TZC primary treatment (ref. Table 5). Only significant differences within a species are depicted; bars

without letters within a species were not significantly different. Bars within a species exhibiting different letters are significantly different at $p < 0.01$.

II. TABULAR AND GRAPHIC SUMMARIES – 2012 RESULTS, VVC CFT

Table 1. Comparison of mean survival for all species collectively (i.e., pooled across polymer and irrigation treatments) for the LCER Conservation Field Trial.

	INCLUDING ERFA	EXCLUDING ERFA †
POLYMER APPLICATION TYPE *		
TPD (Polymer Root Dip)	80.2% *	89.2% *
TGP (Granular Polymer)	72.7% *	80.7% *
IRRIGATION		
I (Irrigated)	77.4%	86.1%
NI (Non-Irrigated)	75.5%	83.9%

* Significantly different at $p < 0.01$ (yellow highlight).

† No survival for ERFA.

Table 2. Comparison of mean survival for individual species relative to independent (stand-alone) analyses of the polymer and irrigation primary treatments.

	ATCA	BASA *	CHLI	LYAN	POFR	SAEX *	SAGO *	SPAM	PRGL	ERFA
TPD (Polymer Root Dip)	100.0%	98.3%	100.0%	95.0%	86.7%	90.0%	35.8%	98.3%	100.0%	0.0%
TGP (Granular Polymer)	98.3%	88.3%	95.0%	93.3%	76.7%	70.0%	11.7%	95.0%	100.0%	0.0%

	ATCA	BASA	CHLI	LYAN	POFR *	SAEX	SAGO	SPAM	PRGL	ERFA
I (Irrigated)	98.3%	88.3%	96.7%	95.0%	91.7%	80.0%	25.8%	96.7%	100.0%	0.0%
NI (Not Irrigated)	100.0%	93.3%	98.3%	93.3%	71.7%	80.0%	21.7%	96.7%	100.0%	0.0%

* Significantly different at $p < 0.01$ (yellow highlight).

Table 3. Comparison of mean survival for individual species relative to the *interaction* of polymer and irrigation primary treatments.

TPD – Polymer Root Dip

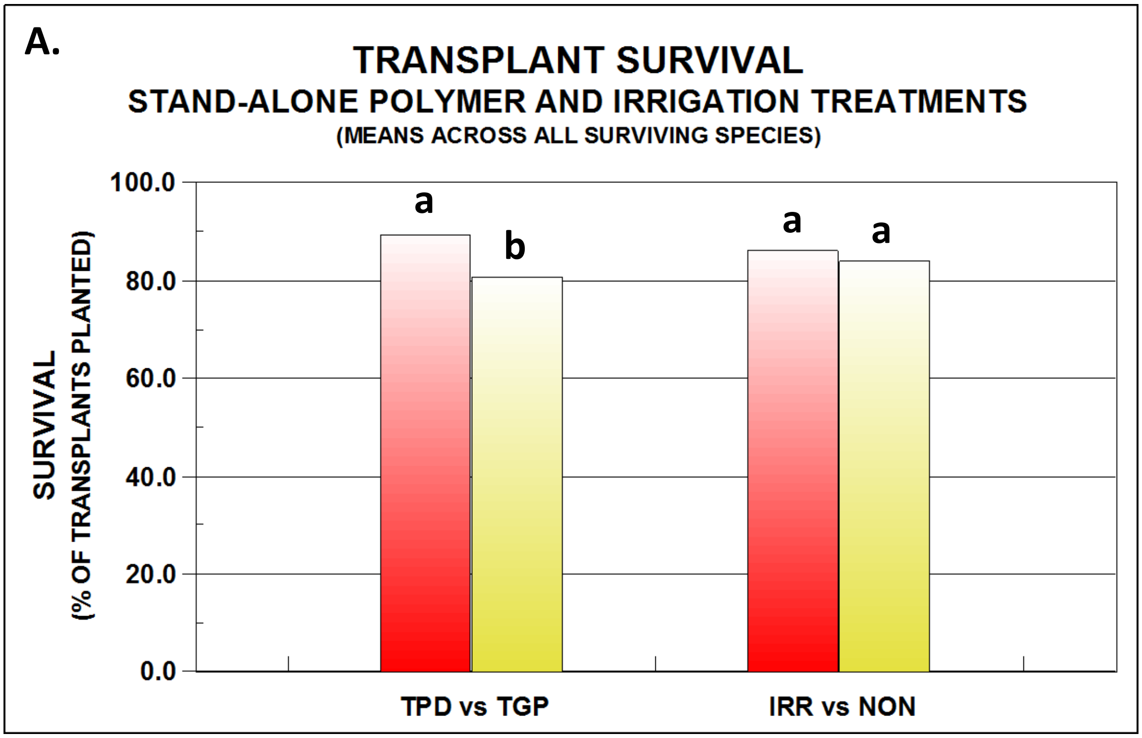
	ATCA	BASA	CHLI	LYAN	POFR *	SAEX	SAGO	SPAM	PRGL	ERFA
Irrigated †	**100**.0%	96.7%	100.0%	93.3%	100.0%	90.0%	41.6%	93.3%	100.0%	0.0%
Not irrigated	100.0%	100.0%	100.0%	96.6%	73.3%	90.0%	30.0%	96.7%	100.0%	0.0%

TGP – Granular Polymer

	ATCA	BASA	CHLI	LYAN	POFR	SAEX	SAGO	SPAM	PRGL	ERFA
Irrigated †	**96.7%**	**80.0%**	**93.3%**	**96.7%**	**83.3%**	**70.0%**	**10.0%**	**100.0%**	**100.0%**	**0.0%**
Not irrigated	**100.0%**	**86.7%**	**96.7%**	**90.0%**	**70.0%**	**70.0%**	**13.3%**	**96.7%**	**100.0%**	**0.0%**

* **Significantly different at $p < 0.01$ (yellow highlight).**

† **The irrigated half of the study received only limited water from three applications prior to data collection – thus the term "irrigated" is somewhat weak.**



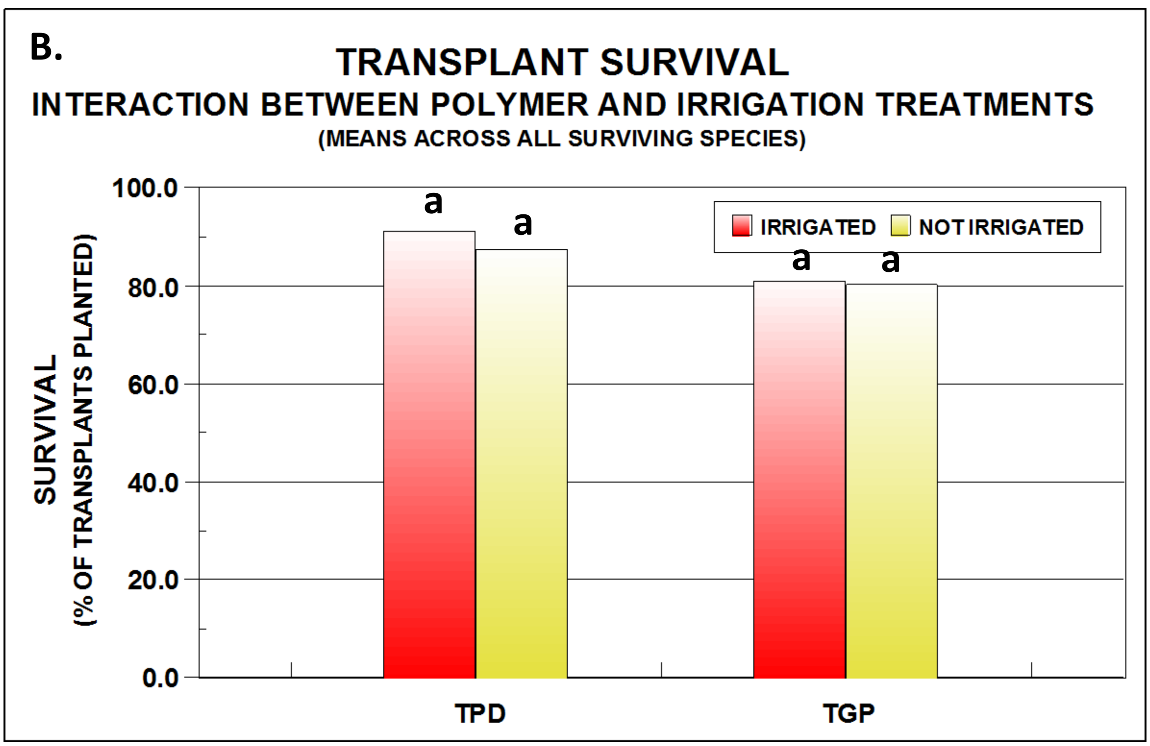


Figure 1. Transplant survival averaged across all *surviving* species (i.e., exclusive of ERFA). A) Mean survival within stand-alone primary treatments of polymer application and irrigation (ref. Table 1); and B) Survival as represented by the interaction between polymer application and irrigation (ref. Appendix 1). Bars within a species exhibiting different letters are significantly different at $p < 0.01$.

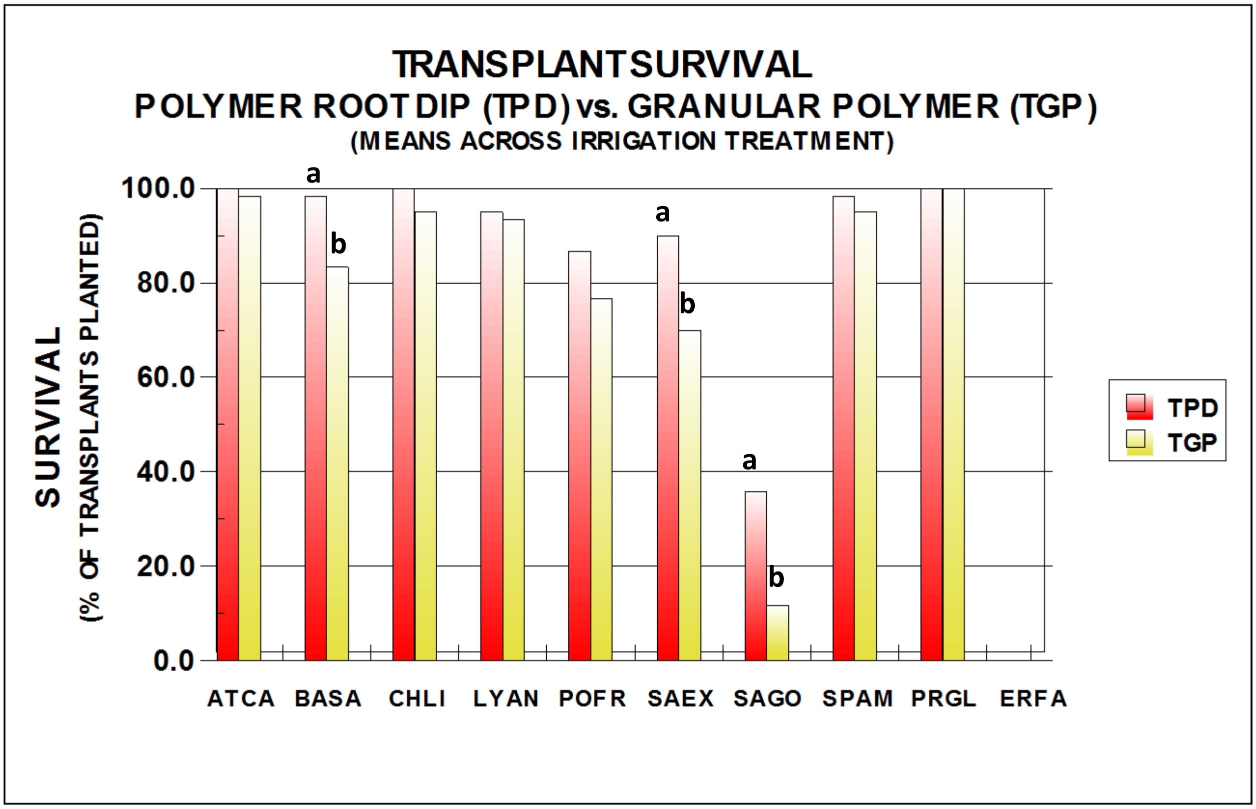


Figure 2. Transplant survival for individual species for the ten species tested at the VVC CFT study site, Spring 2012 (exclusive of ERFA, which exhibited no survival for any treatment combination) (ref. Table 3. Only significant differences within a species are depicted; bars without letters within a species were not significantly different. Bars within a species exhibiting different letters are significantly different at $p < 0.01$.

III. GRAPHIC SUMMARIES – 2012 RESULTS, VVC ZEOLITE™ COLUMN INDEPENDENT DEMONSTRATION STUDY

Table 4. Comparison of mean survival for individual species relative to demonstration of Zeolite™ columns in the Mojave River floodplain as a non-replicated, independent demonstration (i.e., not statistically analyzed) of the VVC Conservation Field Trial. Survival expressed as a percentage of four transplants per species per treatment that were originally planted (number of plants in parentheses). Statistical analyses not performed because of small sample size.

	SAGO	ERFA	BASA	CHLI
With Zeolite™ column	100.0% (4)	0.0% (0)	75.0% (3)	100.0% (4)
No Zeolite™ column	0.0% (0)	0.0% (0)	100.0% (4)	100.0% (4)

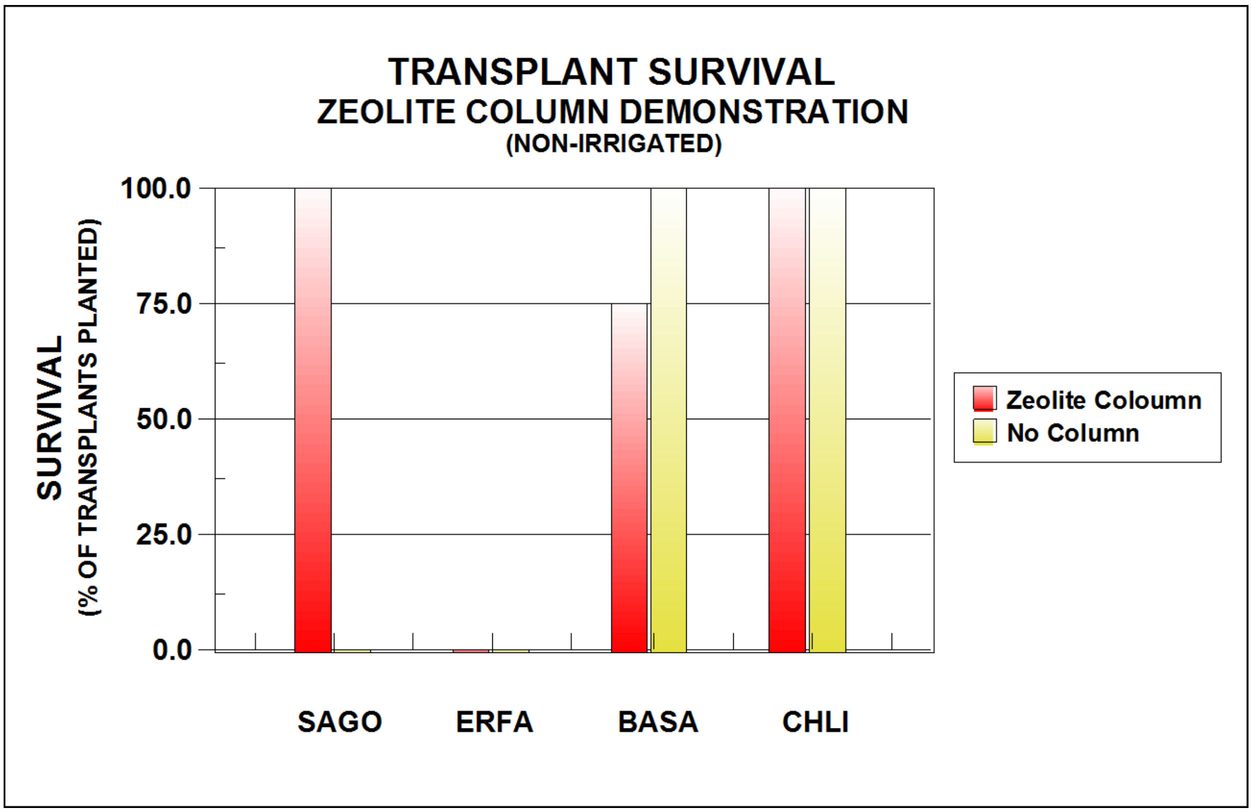


Figure 4. Transplant survival for individual species for the four species of the Zeolite column demonstration study at the VVC CFT study site, Spring 2012. The demonstration is a non-replicated, independent demonstration, and thus not statistically analyzed. Survival expressed as a percentage of four transplants per species per treatment that were originally planted.

2012 Progress Report

First-Year Data Analysis, Conservation Field Trial Study

THE EDIBLE CORM PLANT NAHAVITA (*DICHELOSTEMMA CAPITATUM*): SOURCE POPULATION ADAPTATION AND VEGETATIVE REPRODUCTION RESPONSE TO BIG PINE PAIUTE HARVESTING REGIMES

December, 2012

Prepared For:

Natural Resources Conservation Service and Inyo-Mono Resource Conservation District, Bishop, CA

Prepared By:

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Hesperia, CA

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Project Sponsors

- Big Pine Paiute Tribe of the Owens Valley, Big Pine Paiute Indian Reservation, Big Pine, CA (BPPT)
- Inyo-Mono Resource Conservation District (IMRCD)
- Natural Resources Conservation Service, Bishop Field Office (NRCS)
- National Ethnoecology Office, Natural Resources Conservation Service and University of California, Davis, CA (NEO)
- California Plant Materials Center, NRCS, Lockeford, CA (CAPMC)

Project Cooperators

- Desert Mountain Resource Conservation & Development Council, Ridgecrest, CA (RC&D)
- California Native Plant Society, Bristlecone Chapter, Bishop, CA (CNPS)
- Inyo and Mono Counties, University of California Cooperative Extension, Bishop, CA (UCCE)
- Inyo-Mono Advocates for Community Action, Bishop, CA (IMACA)
- Bureau of Land Management, Bishop Field Office, Bishop, CA (BLM)
- US Forest Service, Inyo National Forest, Bishop, CA (USFS)
- Yribarren Ranch, Big Pine, CA (YR)

Background

The major underground plant parts harvested historically by the Big Pine Paiute Tribe for foods are generally called bulbs, tubers, and corms (technically underground stems). These are often termed "root crops" or "Indian potatoes" in the local vernacular. These underground plant structures provide a very important starch and protein component of the Indian diet. Major kinds of "Indian potatoes" gathered by the Big Pine Paiute Tribe include Nahavita (aka bluedicks) (*Dichelostemma capitatum* (Benth.) Alph. Wood ssp. *capitatum*), and taboose (aka yellow nutsedge) (*Cyperus esculentus* L. var. *esculentus* L.). A number of traditional plant foods that have been important for subsistence to California Indians from archaeological time to the recent past are declining in abundance in the areas where Indians used to gather them, including various kinds of geophytes (e.g., *Lilium* spp; *Dichelostemma* spp.; *Triteleia* spp.; *Camassia* spp.). Nahavita used to be so plentiful that they covered California valleys and hills with tints of blue and purple, and it was gathered for its edible corm by over half of California's Indian tribes (Anderson 1997; Schmidt 1980).

Little is known about the ecological impacts of indigenous harvesting on geophytes and Nahavita plants specifically, including harvest and relocation of corms to non-native sites such as the BPPT headquarters for local management and production for tribal members. In order to address these issues, a Conservation Field Trial (CFT) was installed on the Big Pine Paiute Reservation involving two primary components: (1) collection and comprehensive documentation of native Nahavita corm materials from multiple (three) source populations (i.e., accessions) on or near the reservation; and (2) a replicated experimental study using these source materials to examine impact of harvest intensity on corm establishment, survival, and productivity. More specifically, 1) determine whether the quantity and quality of corm and cormlet production of Nahavita are affected by source population genetics; and 2) determine the degree to which differences in intensity of harvest, with and without replanting of cormlets, have any effect on size of corms, and corm and cormlet production compared to a control (i.e. no treatment).

Narrative summary observations based on only first-year data collection:

- The Symmes Creek accession demonstrated highest emergence and survival at the BPPT headquarters study location and soils during early to mid-spring (Figure 1). This result would likely be expected at least in terms of climatic adaptation, as the Symmes Creek accession was closest to the study site relative to elevation and mountain outwash toe-slope position. Relationship to soil characteristics will require further review. This superior performance diminished, however, by date 4 (May 4, 2012), resulting in no different from the Buttermilk or Pinon Creek accessions.

- In contrast, there is mild indication that the Buttermilk accession may (emphasis on ***may***) be able to sustain flower stalks longer into the spring season than the other accessions (Figure 2). This again might be expected, following a trend common among many other species – namely, where plants (i.e. seed or other propagules like corms) originating from significantly higher elevations (or latitudes), and then seeded or planted at lower elevations (or latitudes), tend to initiate flowering earlier and also continue to flower later into the growth season than they normally would at their originating location. If this ecological response to study site environmental factors is occurring in Nahavita, this may or may not be an advantage for corm survival, vigor and health going into the next year. It would seem largely dependent upon whether later flower growth adds or detracts from carbohydrate storage and associated vigor in the corm.

- Albeit with a very small number of surviving non-dormant plants by date 4, there is no indication that initial corm size exerts any influence on survival during the first establishment year (see Appendix 1). It will be interesting to see what occurs next year for corm size and accession independent variables, plus the introduction of harvest intensity. Even so, the Buttermilk accession still appears to slightly outperform the other accessions across all corm sizes during this first year.

Notes on the statistical analysis:

- See Appendix 1 for detailed outputs and results from the analyses.

- Analysis of variance procedures were used (Statistix™ for Windows Analytical Software, Version 8.1), since they are reasonably robust in relation to data non-normality and to moderate violations of the assumption of homegeneity of variance. This robustness is maintained when the shapes of data distributions are similar, samples are obtained randomly, sample sizes are equal, and mean separations are evaluated at confidence levels of 95% or greater (Manly 1994, Bonham 1992, Steel and Torrie 1980).

- Data were stratified and analyzed separately by data collection date for all four dates, as I felt that determining differences between dates (for this first basic analysis, and perhaps for all subsequent analyses) was less important than between accessions (dates 1-4) and between corm size (date 4 only). Each potential corm / plant was considered a point sample – thus facilitating the larger sample size overall.

- Additionally, each plot of the same corm accession was (for this first basic analysis) considered a replication (resulting in 10 reps for each accession) regardless of original location in the five design replications. This was done because of 1) the relatively small total number of corms counted per plot; and 2) the apparent variability of the soil substrate across the study area. This latter base resource variability, even on such a small total study area, still exhibited substantial degree of cobble content, presence of old backfill, and lack of accidental irrigation in a gradient working perpendicular (i.e., south to north) to the design sequence of replications (i.e., west to east). Given that, I thought that letting individual plots per accession across the study would better serve the concept of replications.

- Data collection date 4 (May 4, 2012) was analyzed in two ways – 1) univariate for accession differences, as with dates 1-3; and 2) multivariate for both accession and initial corm size (small, medium, and large), since this was the first data collection to split out corm size as a measured variable. However, this also results in skewed data because of the few surviving "live" (or perhaps better termed "non-dormant") counts by this last date, so its analysis should be interpreted cautiously.

- Emergence is defined as evidence (presence) of above-ground foliage and/or flowering stem(s) derived from planted corms within each plot. Flowering is defined as evidence (presence) of a recognizable flowering stem from 2012 growth derived from planted corms within each plot.

SUMMARY GRAPHICS –2012 RESULTS
BIG PINE PAIUTE TRIBE NAHAVITA HARVEST INTENSITY STUDY

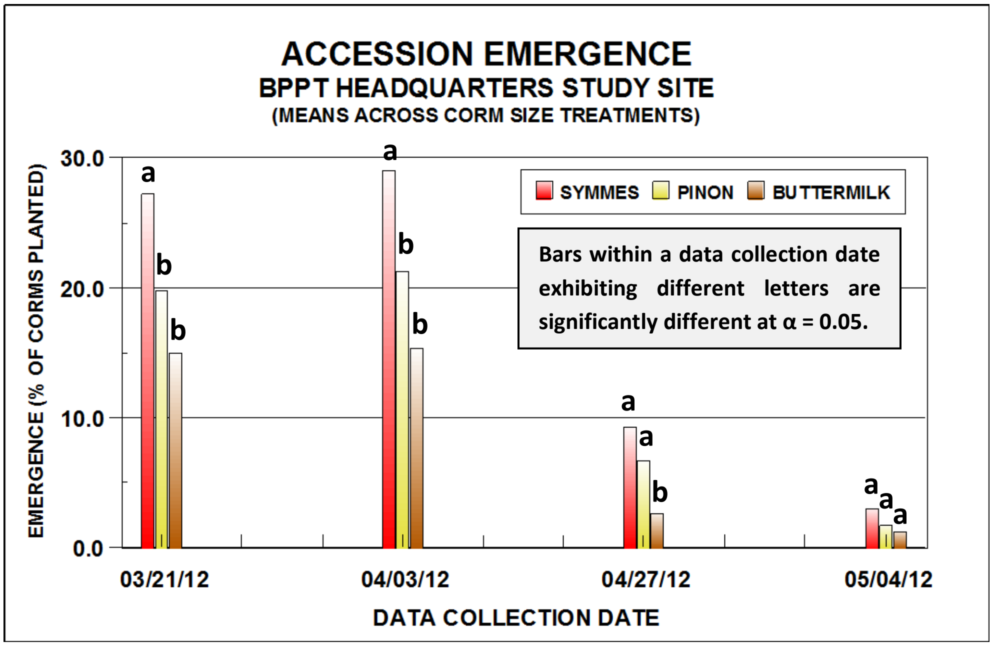


Figure 1. Comparison of emergence (% of corms planted per plot) for the three accessions of Nahavita (*Dichelostemma capitatum*) at the Big Pine Paiute Tribe headquarters study site, examined across four data collection dates in Spring 2012.

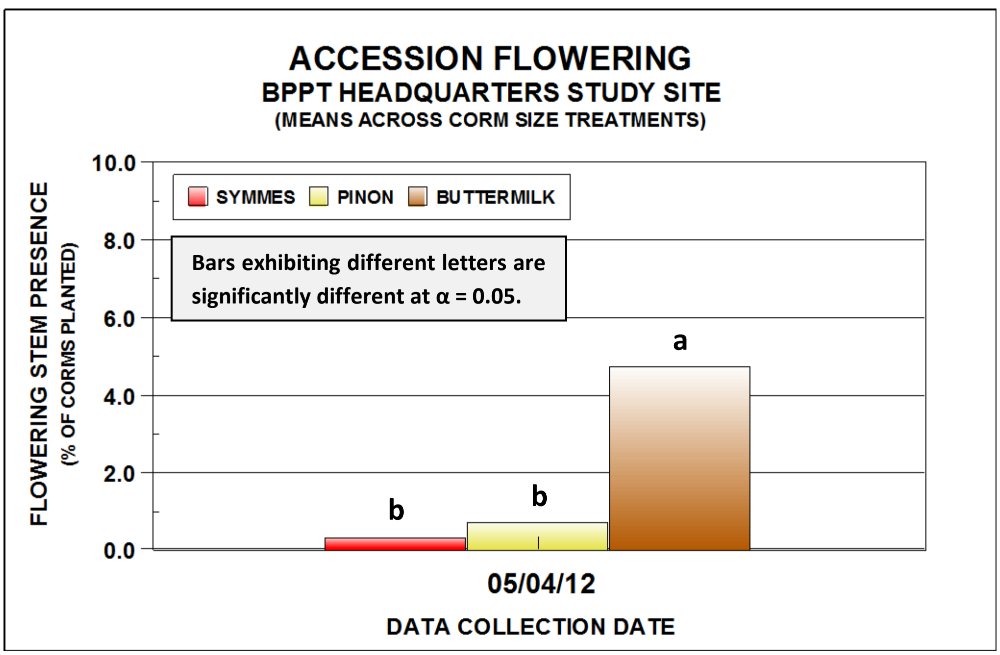


Figure 2. Comparison of accession flowering (% of corms planted per plot) for the three accessions of Nahavita (*Dichelostemma capitatum*) at the Big Pine Paiute Tribe headquarters study site, examined only for the May 5, 2012 data collection date.

Reimbursible Projects

California Plant Materials Center

Annual Report 2012

Native Plant Materials Development IGA

The long-term objective of this project is to increase the information and the availability of locally adapted native plant species for revegetation. The NRCS California Plant Materials Center (CAPMC) and the California office of the Bureau of Land Management (BLM) have entered into an agreement to collect native plant species in coordination with the Seeds of Success (SOS) Program. The SOS Program supports the systematic collection and development of native species, related native species research and provides the initial seed stock for commercial seed/plant increase efforts, products from which are used for revegetation of sites following disturbance.

Collection efforts follow Seeds of Success Protocol (available at: www.nps.gov/plants/sos/). Seeds of all species collected under this agreement will be cleaned and stored at the Bend Seed Extractory and/or the USDA-ARS Western Regional Plant Introduction Station, Pullman, WA.

This agreement also provides for the CAPMC to produce containerized plant material and increase seed stock of select species for specific BLM Field Office projects. Seed for propagation and increase will either be supplied by the Field Office or collected in the field in addition to seed collected for the SOS Program.

In this report, the CAPMC provides a Status of Tasks Completed in Support of the Statement of Work for 2012. The 2012 Annual Report submitted for Seeds of Success is also attached.

Task 1 – Seed Collections

- A total of 24 SOS collections from 23 species were made for the 2012 field season by CLM interns Marc Bliss and Patrick Nicholson..
- Species List Research
    - Information on species habitat, soil affinities, and reproductive phenology was collected. Targeted species for collection were the same as last season. Other species found on scouting trips are opportunistically collected to expand the breadth of the SOS and CA-BLM collection diversity.
- Field Office and Area Leads
    - Local field office botanists and area plant collection leads were contacted regarding promising sites/populations for collections, and approximate bloom time/ripe seed stage for target species in each area. Contacts with local Field Office Staff about collection schedule and activities were maintained..

- Collection Area Review
    - Field visits and orientation with local BLM Field Office Staff (ongoing)
    - Identify and investigate collection areas (ongoing)

- Field Reconnaissance for Target Species, listed by Field Office Service Area

<u>Ukiah Field Office</u>

- Sites surveyed include Walker Ridge and Cache Creek

- SOS Collections for the Ukiah Field Office Management Area:

Date	Scientific Name	Common Name	Area of collection
7/20/12	*Arctostaphylos manzanita*	Manzanita	Cache Creek
7/31/12	*Arctostaphylos viscid ssp. pulchella*	Sticky whiteleaf manzanita	Walker Ridge
7/31/12	*Hesperocyparis macnabiana*	McNab's cypress	Walker Ridge
8/23/12	*Cercis orbiculata*	Redbud	Cache Creek

***Arctostaphylos viscida*, Walker Ridge**

***Cercis orbiculata*, Walker Ridge**

<u>Motherlode Field Office</u>

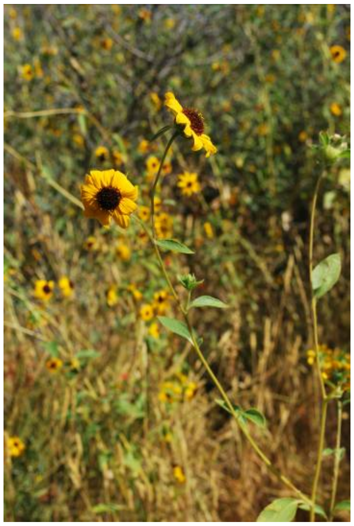
- Sites surveyed include Consumnes River Preserve and the Red Hills Area of Critical Environmental Concern

- We have been collaborating with other SOS interns in the Motherlode District for many of these collections

- SOS Collections for the Motherlode Field Office Management Area:

Date	Scientific Name	Common Name	Area of collection
7/16/2012	*Ceanothus cuneatus*	Buckbrush	Red Hills
7/18/2012	*Eleocharis macrostachya*	Pale spikerush	Cosumnes
7/24/2012	*Agrostis exarata*	Spike bentgrass	Cosumnes
7/24/2012	*Schoenoplectus fluviatilis*	River bulrush	Cosumnes
7/24/2012	*Schoenoplectus acutus*	Tule	Cosumnes
8/10/2012	*Grindelia camporum*	Gumweed	Cosumnes
8/10/2012	*Alisma triviale*	Northern water plantain	Cosumnes
8/24/2012	*Chlorogalum pomeridianum*	Soaproot	Cosumnes
8/24/2012	*Sparganium eurycarpum*	Bur reed	Cosumnes
8/24/2012	*Hemizonia congesta*	Tarweed	Cosumnes
8/24/2012	*Helianthus annuus*	Sunflower	Cosumnes
9/3/2012	*Bidens frondosa*	Devil's beggartick	Cosumnes
9/7/2012	*Eryngium articulatum*	Beethistle	Cosumnes
9/7/2012	*Mentzelia laevicaulis*	Blazing star	Cosumnes
9/14/2012	*Helianthus bolanderi*	Serpentine sunflower	Red Hills
9/14/2012	*Castilleja minor ssp. spiralis*	lesser Indian paintbrush	Red Hills

Castilleja minor, Red Hills



Helianthus bolanderi, Red Hills

Redding Field Office

- Sites surveyed include the Sacramento River Bend Outstanding Natural Area
- SOS Collections for the Redding Field Office Management Area:

Date	Scientific Name	Common Name	Area of collection
8/7/12	*Muhlenbergia rigens*	Deergrass	Sacramento River Bend
8/7/12	*Grindelia camporum*	Gumweed	Sacramento River Bend
8/7/12	*Elymus glaucus*	Blue wildrye	Sacramento River Bend

Grindelia camporum, Sacramento River Bend

Bakersfield, Alturas, Eagle Lake and Surprise Valley Field Offices

- We did not make collections in 2012

Task 2 – Field Increase Plantings

- For the Eagle Lake Field Office, 1 x 400 ft row of *Leymus cinereus* was planted for seed increase in fall 2012.
- For the Alturas and Surprise Field Offices, 4 x 400 ft rows each of *Achnatherum thurberianum*, *Agrostis stolonifera*, *Festuca idahoensis*, and *Pseudoroegneria spicata* were planted for seed increase in fall 2012.
- For the Ukiah Field Office, plantings of one accession of *Elymus glaucus* (Eaton Springs) and one accession of *Elymus elymoides* (Petray Mine) planted last year were harvested in 2012. Seed is being cleaned and stored at the PMC. Seed will continue to be harvested from the plantings in future years.

Seed harvest plantings at the CAPMC, above blue wildrye *Elymus glaucus* and below a mature plant of bottlebrush *Elymus elymoides.*

- For the Redding Field Office, plantings of two accessions of *Nassella pulchra* (Oak Slough and Coyote Pond) and one accession of *Festuca californica* (Trail 27) planted last year were harvested in 2012. Seed is being maintained at the PMC. Each accession is enrolled in the California Crop Improvement Association (CCIA) Foundation Seed Program under a tentative 'Source Identified' designation. Seed will continue to be harvested from the plantings in future years.

Task 3 – Container Plant Production

- Container plants propagated in previous years were maintained in our lathhouse and made available for pick up in 2012.
- The following plants were provided to Bakersfield and Ukiah.

Species **Common name**	**Number of Plants**	
Allenrolfea occidentalis iodinebush	102	Bakersfield
Malacothamnus orbiculatus	30	Bakersfield
Rhamnus crocea (coffeeberry)	309	Bakersfield
Eriogonum fasciculatum var p*orifolium* (California buckwheat)	184	Bakersfield
Glycyrrhiza lepidota (wild licorice)	2	Bakersfield
Cupressus macnabiana McNab's cypress	43	Ukiah
Ceanothus jepsonii musk brush	133	Ukiah

- In addition for the Ukiah FO we have 500 containers of saltgrass (*Distichlis spicata).*

Task 4 – Plant Guides and Technical Documents

- Plant Guides and Fact Sheets for the following plants: gumweed (*Grindelia* *camporum)* and woolly milkweed (*Ascelpias vestita)* have been completed and sent out for review. These will be posted on the USDA PLANTS database, once the Plant Materials review process has been completed.

Great Valley gumweed (*Grindelia camporum*)
Photo M. Bliss, NRCS Lockeford Plant Materials Center, 2012

Woolly milkweed (*Asclepias vestita*) ©Neal Kramer, 2010 @ *CalPhotos*

<u>Task 5 – Cosumnes River Preserve Cougar Wetlands Project</u>

We coordinated with the Cosumnes River Preserve on collecting and cleaning seed for four target species for the Cougar Wetlands restoration project.

- *Agrostis exarata*, spike bentgass
- *Grindelia camporum*, Great Valley gumweed
- *Phyla nodiflora*, turkey tangle fog fruit
- *Eryngium articulatum* Bee thistle

Seed collections were made at the Cosumnes preserve over the summer of 2012.
Seed was cleaned in preparation for planting in the fall.
As these are all wetland species, they were planted into 200 ft beds with buried drip. They will be maintained for seed harvest during 2013 and as required beyond that time.

Eryngium articulatum Bee thistle. Flowering at the Cosumnes preserve.

Seeds of Success Annual Report

Organization: USDA-NRCS California Plant Materials Center (CAPMC)	**Team Code:** CA930B
Location: Lockeford, CA	
Number of species collected: 23	**Number of collections made:** 24

Collecting Season Summary (accomplishments and challenges):

Two Conservation and Land Management (CLM) interns from the Chicago Botanic Garden, Marc Bliss and Patrick Nicholson, began their work with the PMC in May and June respectively. They attended the SOS training workshop held in Chicago at the end of June. Initial scouting trips began in June and seed collection started subsequently in July. Collections were made across a wide range across the central portion of the state in land owned by the BLM under the jurisdiction of the Motherlode, Redding, and Ukiah Field Offices. A total of 24 collections representing 23 species were collected from July through September. We have included a map of our collections below. These collections included species from the PMC's target list, species for the Cougar Wetlands restoration project at the Cosumnes River Preserve, species requested for the Discover the Delta Foundation's Discovery Center, and other species of interest encountered during collection trips.

This year was particularly dry, which made collection challenging. We were too late for a few species of grasses at the beginning of the season before the interns arrived and were trained. Additionally, we were unable to locate large enough populations producing enough viable seed from other target species. However, we now have a better idea of where to find these species and are hopeful that those collections will be easy to make for future interns in the coming years.

A major success this year was establishing a close working relationship with the CLM intern at the Cosumnes River Preserve, Patrick Reilly, who has subsequently joined our collection team on many collections. The interns collaborated on making collections at sites managed by the Cosumnes River Preserve (Motherlode FO) as well as at BLM sites managed by the Ukiah Field Office. The CAPMC is assisting with the Cougar Wetlands restoration project at the Cosumnes River Preserve by beginning plant propagation and seed grow-out for species collected through SOS.

We are continuing our propagation and seed increase efforts for revegetation projects with several California BLM field offices utilizing seed collected through SOS. This fall we planted seeds for 5 additional species of grasses collected by the SOS teams from the Surprise, Eagle Lake, and Alturas Field Offices.

Partners *(FWS, FS, NRCS, non-profit etc…)* and in what capacity you worked together:

As a USDA-NRCS office, collaboration with the BLM was crucial to learning about the conditions at collection sites and to using our collection time efficiently. We worked closely with the Cosumnes River Preserve. We completed several collections with their CLM intern and are currently growing out plants at the CAPMC for one of their restoration projects. The Cosumnes River Preserve botanist, Sarah Sweet, was a great asset to us. She was instrumental in helping us identify and locate plant populations. Additionally, we were able to coordinate with the Sacramento National Wildlife Refuge Complex, a FWS site, to complete one SOS collection in 2012.
Organizations that provided volunteers, and how many: • Sharifa Moore, a volunteer with Discover the Delta, accompanied us on scouting trips and helped collect seed for grow out at the CAPMC. • Monica Burkner, a volunteer and intern from California State University, Stanislaus, accompanied us on a scouting trip and has been involved with plant propagation at the CAPMC.

Education and Outreach: ***(include any work with other groups to promote or highlight Seeds of Success; i.e. citation for a newsletter, web article, conference/meeting display, or presentation on SOS and/or the Native Plant Materials Development Program, etc.)***

Format **(ex: talk, exhibit, publication)**	**Title**	**Event or Publication**	**Location** **Nearest City, State**	**Date**
Publication-USDA PLANTS database contribution	Plant Guide for *Grindelia camporum*	Web-based peer-reviewed plant guide	Lockeford, CA/ Beltsville, MD	TBA 2013
Publication-USDA PLANTS database contribution	Plant Guide for *Asclepias vestita*	Web-based peer-reviewed plant guide	Lockeford, CA/Beltsville, MD	TBA 2013
Publication-USDA PLANTS database contribution	Fact Sheet for *Grindelia camporum*	Web-based peer-reviewed plant guide	Lockeford, CA/ Beltsville, MD	TBA 2013
Publication-USDA PLANTS database contribution	Fact Sheet for *Asclepias vestita*	Web-based peer-reviewed plant guide	Lockeford, CA/Beltsville, MD	TBA 2013

Distributions: ***(include tracking information for collections that have been shipped out of your office to the Bend Seed Extractory or any other receiving institution)***

	SOS Seed Coll.	**Receiving**	**What the SOS Material will be Used**

Species	**Ref. Num** ***(ex: NV030-xx)***	**Institution**	**For**
Ceanothus cuneatus	CA930B-068	Bend	Seed Bank
Eleocharis macrostachya	CA930B-069	Bend	Seed Bank
Distichlis spicata	CA930B-070	Bend	Seed Bank
Arctostaphylos manzanita	CA930B-071	Bend	Seed Bank
Agrostis exarata	CA930B-072	Bend	Seed Bank; Cosumnes River Preserve revegetation
Schoenoplectus fluviatilis	CA930B-073	Bend	Seed Bank
Schoenoplectus acutus	CA930B-074	Bend	Seed Bank
Arctostaphylos viscida ssp. Pulchella	CA930B-075	Bend	Seed Bank
Hesperocyparis macnabiana	CA930B-076	Bend	Seed Bank
Muhlenbergia rigens	CA930B-077	Bend	Seed Bank
Grindelia camporum	CA930B-078	Bend	Seed Bank
Elymus glaucus	CA930B-079	Bend	Seed Bank
Grindelia camporum	CA930B-080	Bend	Seed Bank; Cosumnes River Preserve revegetation
Alisma triviale	CA930B-081	Bend	Seed Bank
Cercis orbiculata	CA930B-082	Bend	Seed Bank
Chlorogalum pomeridianum	CA930B-083	Bend	Seed Bank
Sparganium eurycarpum	CA930B-084	Bend	Seed Bank
Hemizonia congesta	CA930B-085	Bend	Seed Bank
Helianthus annuus	CA930B-086	Bend	Seed Bank
Bidens Frondosa	CA930B-087	Bend	Seed Bank

Eryngium articulatum	CA930B-088	Bend	Seed Bank; Cosumnes River Preserve revegetation
Mentzelia laevicaulis	CA930B-089	Bend	Seed Bank
Helianthus bolanderi	CA930B-090	Bend	Seed Bank
Castilleja minor ssp. *spiralis*	CA930B-091	Bend	Seed Bank

SEQUOIA AND KINGS CANYON NATIONAL PARK
FY2012 Annual Report
Prepared by
Margaret Smither-Kopperl

NATURAL RESOURCES CONSERVATION SERVICE
PLANT MATERIALS CENTER
LOCKEFORD, CALIFORNIA

INTRODUCTION

In 2011, the Lockeford California Plant Materials Center (PMC) entered into an agreement with Sequoia and Kings Canyon National Park (SEKI) to produce seed of two grasses, California brome (*Bromus carinatus*), and blue wild rye (*Elymus glaucus*) and one forb species, miniature lupine (*Lupinus bicolor*). Under the contract there is a specification for delivery of 12 lb of seed for both grass species and 10 lb for the miniature lupine, delivered over the period of the contract. In addition, seed of six additional species was delivered for cleaning and storage. The agreement will run through 2014.

The National Park Service requires that restoration of native plants be accomplished using germplasm from populations as closely related genetically and ecologically as possible to park populations. The PMC was chosen due to its ability to clean, propagate and produce the desired amounts of high quality seed within the required time frame. The PMC is also able to conduct studies to determine adaptation and cultural requirements for establishment and seed production.

ACCOMPLISHMENTS

California brome, blue wildrye and miniature lupine planted during the fall of 2011 were harvested in 2012. Seed of all three species were provided by SEKI and cleaned at the PMC. For all three species the PMC had seed in storage from a previous contract with SEKI in 2002, seeds of the lots of California brome and blue wild rye were combined to give enough seed to plant 0.25 acres of each species, germination and establishment was good. Seed of miniature lupine was planted as separate lots from the 2002 and 2011 collected seed, the stored seed germinated with 90% germination, the 2011 collected seed germination was poor at 20%. California brome and blue wildrye were harvested with a Flailvac which allowed more than one harvest, while the miniature lupine was initially harvested by hand, then the plants were swathed and dried prior to cleaning. The amounts of harvested seed obtained after cleaning is shown in Table 1.

After harvest the grasses were mowed and maintained with weed control by cultivation and broadleaf herbicide for harvest in 2013. Seed of miniature lupine, 0.1 acre was planted in fall 2012 from seed harvested in 2012.

Seed lots of sicklekeel lupine, California melic, one-sided bluegrass, Sierra needlegrass, and squirreltail cleaned during 2011 are being maintained in storage at the PMC.

Table 1. Seed harvested under contract to SEKI during 2012.

Code	Common Name	Year of harvest	Area (acres)	Seed cleaned (lb)	PLS amount	Date tested
BRCAC8	California brome	2012	0.25	11.00		
ELGLG	Blue wildrye	2012	0.25	4.25		
LUBI	Miniature lupine	2012	0.25	8.00	4.87	8/7/2012

Miniature lupine in bloom, April 4, 2012

Blue wild rye harvest with Flailvac.

Nevada Tahoe Conservation District
NRCS South Lake Tahoe Field Office

Tahoe Yellow Cress Propagation

Tahoe yellow cress (*Rorippa subumbellata)* in the Brassica Family is a candidate for listing as Endangered or Critically Endangered by the states of California and Nevada. The plant grows on the sandy beaches surrounding Lake Tahoe and is endemic to the area. A study found that 45% of the plant stems counted in the annual survey occurred on private lands of the lakeshore environment.

The states of California and Nevada will not down-list or de-list the species until a firm commitment for planning and preservation is in place for these areas. The District and NRCS have a common objective to help bring about the conservation of this threatened natural resource. This project involved educational outreach to homeowners with beach front that would include providing them with plants of Tahoe yellow cress for planting on their beach property.

The Lockeford Plant Materials Center was provided with seed and contracted to grow 1000 plants for 2011. However the winter and spring of 2011 was very wet and the lake levels were so high during the summer that this precluded planting. The PMC agreed to retain the plants until the summer of 2012. Plants were picked up in June of 2012 for distribution to homeowners and lake front planting.

Plants of Tahoe Yellow cress in bloom as distributed for planting

Outreach

Trainings at the Lockeford PMC 2012

An Irrigation 'Boot Camp' was held at the PMC May 8 and 9, 2012. This was organized by Dan Johnson, State Water Management Engineer and Greg Norris, Assistant State Engineer. The objective was to provide NRCS Field Office staff with basic information about various irrigation systems and to allow them to work with these systems. In this initial training, 18 people participated and worked in two groups of nine students. Margaret Smither-Kopperl, PMC Manager gave a field presentation on Plant root structure and irrigation needs, and Dennis Frommelt, Farmer discussed farm implements.

Figure 1. NRCS Field Office staff work with irrigation systems.

	
Students operate a valve for the surface irrigation system.	Setting out and assessing pressure of hand line for sprinkler irrigation.

'Cover crop 101' was held at the PMC on October 11, 2012 for NRCS Area II staff. The training was organized by Wendy Rash, District Conservationist, and included presentations by Dennis Chessman, State Agronomist and Lisa Shanks, Area 2 Resource Conservationist, who discussed case studies.

Figure 2. Demonstration of farm equipment at the PMC as part of 'Cover Crop 101' training.

	
Amy Gomes, Biological Science Technician discusses the newly purchased 'roller crimper' and its role in cover crop management.	Larry Sell, Farm technician demonstrates broad cast planting of a cover crop.

SLEWS-Restoring Riparian Habitat on the Mokelumne River

SLEWS (Student and Landowner Education and Watershed Stewardship) engage high school students in habitat restoration projects that enhance classroom learning, develop leadership skills and result in real habitat restoration. The SLEWS program is currently under the leadership of The Center for Land-Based Learning in Winters CA. Their mission is to inspire and motivate people of all ages, especially youth, to promote a healthy interplay between agriculture, nature, and society through their actions and as leaders in their communities.

During 2012 mentors and students from Lodi High School conducted a riparian restoration at the PMC. Five days of restoration activities were scheduled during the school year. The area for restoration was overgrown by weedy species including Himalayan blackberry and non-native annual grasses. The plan was complemented a vegetation management plan for the area and emphasized plantings of Santa Barbara sedge and beardless wildrye.

	
SLEWS mentors and Lodi High School students enthusiastically removing Himalayan blackberry along the levee at the PMC.	Students plant seeds of beardless wildrye, to be used for planting later in the project.
	
James Jones, mentor, SLEWS student and Nina Suzuki, SLEWS coordinator, digging a foundation for a wood duck box.	Students raise pole for a wood duck box.

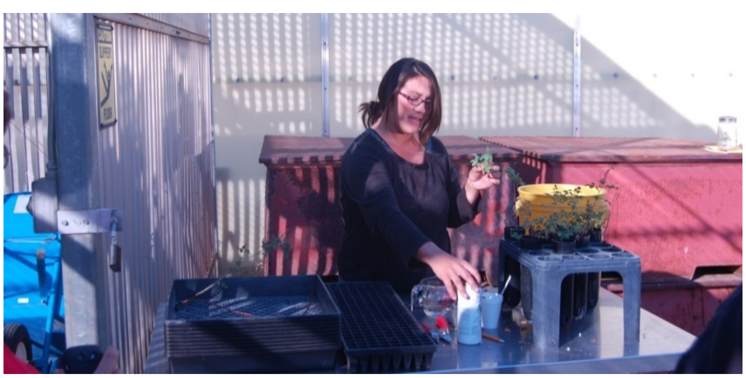
Indigenous Stewardship Methods and California Indian Outreach

The PMC works closely with Reina Rogers, NRCS Tribal Liaison in support of California tribes. A ten acre area of the PMC previous designated for native plantings will be managed to demonstrate and develop Indigenous Stewardship Methods. California has the highest population of Native Americans of any state; they face significant challenges including access to land and native plants.

A Youth Field Day on April 14, 2012 had attendees from several local tribes including the Buena Vista Rancheria, Ione Band of Miwok, Sheep Ranch Rancheria, and the Sierra Native Alliance. Students pruned native trees and planted saltgrass plugs. A picnic lunch was held in the area.

	
Circle of visitors listen to tribal elder.	Tribal youth work to prune trees.

A fall gathering and propagation workshop was held on November 7, 2012, with the aim of demonstrating propagation techniques to empower attendees to propagate plants from local plant materials. Attendees were from the Ione Band of Miwok, and



Amy Gomes, Biological Science Technician, demonstrates plant propagation techniques with California rose.

USDA People's Garden

Monica Burkner, an intern in Agricultural Sciences from California State University, Stanislaus was responsible for the USDA People's Garden vegetable garden at the Lockeford Plant Materials Center in 2012. CAPMC staff installed raised bed with drip tape, and the vegetable incorporated USDA People's Garden Program objectives to support community education and produce vegetables to donate to the local food bank.

The garden demonstrated best practices by installation of drip line, crop rotation, integrative pest and weed management and companion planting.

Activities provided an educational opportunity for community members and volunteers who helped tend the garden, and groups touring the PMC. There was a 260 lb. total donation of fresh vegetables to the local food bank.

Figure 3. USDA Peoples garden installed at the Lockeford Plant Materials Center, July 31, 2012.

Date presented: 4/24/2012
Title: Open House - Field Day
Presenter: Smither-Kopperl, M., Mann **Location:** Lockeford Plant Materials Center

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Date presented: 4/24/2012
Title: PMC Open House and Field Day
Presenter: Margaret Smither-Kopperl, **Location:** Lockeford PMC, Lockeford, CA

Date presented: 4/27/2012
Title: Native plants at the Plant Materials Center
Presenter: Smither-Kopperl, M **Location:** Lockeford PMC

Date presented: 5/3/2012
Title: Orientation for New Employees
Presenter: Smither-Kopperl, M, Mann, **Location:** Lockeford Plant Materials center

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Date presented: 5/8/2012
Title: Plant structure and Irrigation
Presenter: Smither-Kopperl, M **Location:** Lockeford PMC

Date presented: 5/9/2012
Title: Farm Implements
Presenter: Frommelt, D. **Location:** Lockeford PMC

Date presented: 5/10/2012
Title: PMC Tour
Presenter: Smither-Kopperl, M. **Location:** Lockeford Plant Materials Center

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Date presented: 5/23/2012
Title: Lockeford PMC - Partnering
Presenter: Smither-Kopperl, M **Location:** Elk Grove, Filed Office, Elk Grove

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Date presented: 8/1/2012
Title: Lockeford PMC Progress and Challenges
Presenter: Margaret Smither-Kopperl **Location:** Davis, CA

Date presented: 8/6/2012
Title: Lockeford PMC Update on Progress and Challenges 2012
Presenter: Margaret Smither-Kopperl **Location:** Davis, CA

Date presented: 10/11/2012
Title: Cover Crops 101
Presenter: Wendy Rash, Dennis Chess **Location:** Lockeford, PMC

Date presented: 10/31/2012
Title: Conservation Plantings at the Lockeford plant Materials Center.
Presenter: Margaret Smither-Kopperl **Location:** Lockeford, PMC

Date presented: 11/7/2012
Title: Tribal Propagation Workshop
Presenter: Margaret Smither-Kopperl **Location:** Lockeford PMC

Date presented: 12/14/2012
Title: Native Plant Materials
Presenter: Margaret Smither-Kopperl **Location:** Jackson, CA

Date presented: 1/26/2012
Title: Native Plants, tradional uses
Presenter: Amy Gomes, Shawn Vue **Location:** Stockton

Date presented: 4/4/2012
Title: Fourth Native American Field Day for Youth
Presenter: Margaret Smither-Kopperl **Location:** Lockeford PMC, Lockeford, CA

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Shirley, Cathey 2012. Sticky Whiteleaf Manznita Plant Guide. Lockeford Plant Materials Center, Lockeford, CA. May 25, 2012. 4p.

M. Smither-Kopperl 2012. Native Plant Materials Development IGA Second Quarter 2012. Lockeford Plant Materials Center, Lockeford, CA. Second Quarter 2012. 5p.

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CAPMC 2012. 'Cucamonga' California Brome Release Brochure. Lockeford Plant Materials Center, Lockeford, CA. June 2012. 2p.

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M.Smither-Kopperl 2013. Progress Report of Activities, 2012. Lockeford PMC, Lockeford, CA. December 2012. 4p.

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