LOS LUNAS PLANT MATERIALS CENTER
2011 PROGRESS REPORT OF ACTIVITIES

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Wasp, Honey Bee, and Fly on *Solidago speciosa*

IN THIS REPORT…

USDA-NRCS and the LLPMC Partner with Pecan Producers to Develop Cover Crop Treatments for Pecan Orchards

Using cover crops in pecan orchards is an uncommon practice in the southwestern United States, even though these crops can provide many benefits which include:

- Reducing surface erosion from wind and water
- Increasing surface organic matter
- Capturing and recycling nutrients in the soil profile
- Promoting biological nitrogen fixation
- Increasing biodiversity
- Suppressing weeds
- Providing supplemental forage
- Managing soil moisture
- Reducing particulate emissions in the atmosphere
- Minimizing and reducing soil compaction
- Attracting beneficial insects

The Los Lunas Plant Materials Center (LLPMC), the New Mexico State Agronomist, the South Area Agronomist, and Pecan Producers have partnered to develop cover crop treatments for pecan orchards. Using cover crops can save the producer money and provide for a cleaner and more sustainable farming operation.

The cover crop treatments were installed in April 2011 on three surface-irrigated farms in Anthony, New Mexico. Anthony is located in the southeast corner of the state on the Mexican border in the Chihuahuan desert. Soils ranged from fine sandy-loam to silty clay-loam.

We applied the following cover crop treatments:

- 'Durana' white clover
- 'El Lucero' New Zealand white clover
- Foxtail prairie clover (a New Mexico native)
- A cocktail mix composed of 'El Lucero', 'Lana' woollypod milkvetch, and 'Max-Q' fescue.

'Durana' white clover (a perennial legume) was selected because it has been successfully used as a cover crop in pecan orchards in the areas of Las Cruces, New Mexico and El Paso, Texas (Val Ryan with Pennington Seed, Inc., personal communication 2011).

The 'El Lucero' New Zealand white clover is a perennial legume and has been a persistent cover crop that was seeded under the canopy of fruit trees at the New Mexico State University Los Lunas Agricultural Science Center (LLASC). The foxtail prairie clover, an annual legume and a New Mexico native species, was originally collected in the Silver City, New Mexico area. It was easy to establish at the LLPMC, and where it has become established it naturally reseeded itself annually into a solid stand. The tall fescue in the cocktail mix was selected because of its shade tolerance characteristics, and historically it has been the most popular irrigated pasture and hay crop species. The woollypod milkvetch is an annual species which has been commonly used as a cover crop in California vineyards. This annual species also aggressively reseeds itself each growing season.

The subsoil pre-treatments were done by the pecan producers. Depending upon the site's soil condition, we prepared the soil surface for seeding using three pieces of equipment: a drag-harrow, a ridged cultipacker, and a water filled lawn roller. We used the drag-harrow to break-up the hard surface soil, the cultipacker to break-up dirt clods and smooth out the soil surface, and the lawn roller to firm-up the soil surface in preparation for the seeding.

We seeded all of the plots using a *Great Plains Land Pride Solid Stand Seeder* (a brillion-like seeder) which has a 6-ft. seeding swath (Figure1).

Figure 1: Keith White. NRCS Bio-Technician, operating the *Land Pride Solid Stand Seeder* to install the cover crop seeding at the Anthony Pecan Farm (April 4, 2011)

The seedbed at each location was prepared so the required ¼-inch seeding depth was consistent among the three sites (Figure 2).

We took soil surface samples (6 in. depth) and subsurface samples (24 in. depth) at each location to measure the active carbon which is an indicator of soil biological activity and reflects the soil health. Seedling emergence was observed on April 11, 2011, seven days after the planting was irrigated (Figure 3).

Figure 2: Rudy Garcia, NRCS New Mexico State Agronomist, checking the seeding depth after one pass with the Land Pride seeder.

Figure 3: Seedling emergence at the Anthony Pecan Farm (April 11, 2011)

The results of the cover crop study are pending and will be posted in next year's report.

Assisting Partners in the Development of Plant Materials

Plant materials development assistance was provided to the National Park Service (NPS), Bureau of Land Management (BLM), and Boulder County, Colorado Parks Department (BC). The various plant materials will be used for ecosystem restoration including surface erosion control on roadsides and slopes. Some of the locations where restoration is occurring are considered crown jewels of the National Park Service and include: Grand Canyon National Park, Zion National Park and Arches National Park. The BLM is primarily interested in the restoration of sites located on the Colorado Plateau which encompasses portions of New Mexico, Arizona, Utah, and Colorado.

Germplasm from local populations of grasses and forbs from planned restoration sites was provided to the LLPMC by the cooperators two to four years previously. Many of the original collections consisted of less than a couple of handfuls of seed. In 2011, the LLPMC had 16 native grass and forb species in production on approximately 15 acres and produced more than 350 lbs. of cleaned seed. The National Parks and Boulder County Parks will use their seed directly. The BLM would like to provide their seed to commercial producers so it may become commercially available for restoration projects.

Figure 4: Field 20S – Grand Canyon Spike Muhly Production

‘Windbreaker’ Big Sacaton Cultivar Release

In 2011, the USDA-NRCS Los Lunas Plant Materials Center (LLPMC) and the New Mexico State University Los Lunas Agricultural Science Center released the cultivar ‘Windbreaker’ big sacaton (*Sporobolus wrightii*). This cultivar of big sacaton has several conservation uses:

- Erosion control
- Biomass for-energy production
- Forage for livestock and wildlife
- Wildlife cover
- Hay mulch for seeding critical areas
- Landscape plant with low water use for urban and rural areas
- Noise barrier
- Natural fence
- Vegetative filter strips

Figure 5: ‘Windbreaker’ big sacaton (*Sporobolus wrightii*) growing at the Los Lunas Plant Materials Center

In 1984, 37 accessions of big sacaton were planted into a non-replicated initial evaluation planting (IEP) at the LLPMC composed of more than 700 plants. NRCS field personnel originally collected these accessions from native stands on bottom lands and alluvial fans subject to flooding from elevations of 3,800 – 6,000 ft. in New Mexico, Arizona, and Texas looking for only the largest phenotypes.

By 1992, ten accessions with the most robust plants had been identified. From each of the ten accessions, the largest plant was selected. These 10 plants averaged 3 meters in height by the third year, when spaced at a minimum of 3 ft centers, which is 50% taller than an average plant.

In 1999, wind erosion control of valuable cropland was identified as a critical need by New Mexico NRCS field offices in Deming, Tucumcari, Grants, Tatum, and Hobbs. Danny Goodson, agronomist at the LLPMC, began installing ‘Windbreaker’ big sacaton wind strip planting trials on several cooperators’ farms and at public facilities. These cooperators assisted with the installation of the plantings as well as their evaluation. Their assistance and interest in ‘Windbreaker’ has been paramount in the development of this release.

Breeder and/or foundation seed will be maintained at the LLPMC. This seed will be distributed to interested certified growers through the New Mexico State Seed Certification Program.

‘Windbreaker’ Marketing Status

Release brochures were mailed out to the commercial seed producers introducing them to this new product. Danny Goodson presented a poster exhibit at the New Mexico Association of Conservation Districts Annual Meeting in Santa Fe in October 2011 (Figure 6). He also introduced ‘Windbreaker’ at two Soil and Water Conservation Board Meetings (the Valencia SWCD and the East Torrence SWCD).

Figure 6: Windbreaker Poster Display NMACD Annual Conference Santa Fe, New Mexico

National ALMANAC Project

Training

Danny Goodson, Agronomist at the Los Lunas Plant Materials Center (LLPMC), attended a one-day training session on the Agricultural Research Service's (ARS) Agricultural Land Management Alternatives with Numerical Assessment Criteria (ALMANAC) prediction model. The session was held at the Lockeford Plant Materials Center in Lockeford, California, and was provided by the ARS Grassland Soil and Water Research Laboratory located in Temple, Texas. By participating in this training, it allows the LLPMC to gather data on New Mexico native southwestern plant species for inclusion in the ALMANAC model.

Vegetative Prediction Model Project

The ALMANAC model was developed to help understand the response of vegetation to various types of conservation strategies. The model was designed to simulate the interaction of two or more plant species competing for water, light and nutrients. The competing species can be any type from grass found growing in a forest, to a common cereal grain field invested with a weed species. ALMANAC can also be used to model typical farming monoculture such as corn, sorghum, or wheat crop, and it has been successfully used to model forage production on native rangeland.

The ARS's Grassland, Soil and Water Research Laboratory in Temple, Texas run the ALMANAC program, and all data gathered for inclusion in the model is sent to this location. The Plant Materials Centers are participating by collecting data on native species that are already established at the PMC. In 2011, the LLPMC began gathering data from 'Viva' galleta (*Pleuraphis jamesii*).which is in foundation seed production.

Figure 7: Danny Goodson, Agronomist at the LLPMC, using a ceptometer to measure light interception of galleta forage canopy.

Galleta grass is a native, warm-season range grass and is an important grazing species for large areas of the southwestern United States. A ceptometer is used to measure solar interception in the galleta field during the growing season. The ceptometer measures the amount of light being intercepted by a plant species. Both above and below canopy measurements are taken for a particular time of day at a specific location. Forage yield of the canopy is also needed, and this was done by clipping the plants at early, mid- and late-plant growth stages.

The ceptometer and forage weight data are sent to the ARS's Grassland, Soil and Water Research Laboratory for entry into the ALMANAC model. The developing ALMANAC model is an assessment tool that will help guide individuals, agencies and other types of land managers to make informed decisions to help sustain the land they manage.

In 2012, vine mesquite (*Panicum obtusum*) will be added to the project.

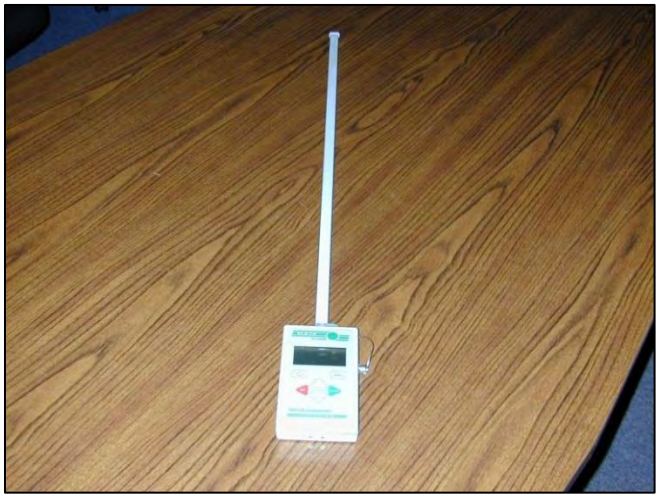

Figure 8: AccuPAR LP-80 Linear PAR Ceptometer

For more information about this project and the Agricultural Research Service's ALMANAC model, contact the Los Lunas Plant Materials Center at 505-865-4684 or Danny Goodson at danny.goodson@nm.usda.gov.

Continuation of the Biomass Bioenergy Evaluation Study

In 2011, the LLPMC continued the big sacaton (*Sporobolus wrightii*) biomass evaluation study. In 2009, the LLPMC had established a seed production field planting of big sacaton, and in 2010-2011the planting was used to provide a source for the biomass forage clipping study. Forage was clipped from random plots in the production field from April to August of 2011. The forage amounts harvested from the big sacaton were promising.

In 2011, green forage harvested from the plots averaged over 21,000 lbs. per acre, and the dried forage averaged over 10,000 lbs. per acre. The biomass clipping study will be continued in 2012. Three years of results will be analyzed to determine if big sacaton can be added to the list of potential native plants used for bioenergy production.

Figure 9: Field 1 – 2011 Big Sacaton Biomass Forage 2011 Clipping Study

Youth Soil and Water Conservation Awareness Days

On April 26-27, 2011 Danny Goodson, Agronomist at the LLPMC, attended the McKinley County Youth Water Awareness Day in Gallup, New Mexico. Danny was invited to present water conservation techniques and technologies to over 500 elementary through high school children during the two-day event. Danny used an exhibit with photographs of water conservation plantings and technologies along with live native plants to emphasize the need for using native species to reduce the amount of water used in daily life.

Figure 10: 2011 Water Awareness Day in Gallup, New Mexico

Riparian Technology Exported to Colorado, Montana, Oregon, Utah, and Texas

The LLPMC provided seven riparian restoration hands-on workshops and did eight presentations at professional meetings.

In addition to the New Mexico locations, the hands-on workshop locations included Grand Junction, Colorado; Moab, Utah; Escalante, Utah. Presentations included *Society for Range Management National Meeting* in Billings, Montana; Western Forestry and Conservation Association, *Fifth Western Native Plant Conference* in Portland, Oregon; *The Annual Colorado Watershed Assembly, Riparian Management Workshop, Solutions, and Opportunities for Restoration and Adaptive Management* in Durango, Colorado; *The Annual Saltcedar Biocontrol Consortium Meeting* in Alpine, Texas. Participants in the hands-on workshops and the presentation meetings were primarily interested in the 'longstem' deep-planting methodology developed by the LLPMC.

The loss of riparian habitat along the major rivers of the Southwest due to invasive woody species, wildfire, and/or changing hydrologic conditions has resulted in numerous efforts to restore cottonwoods and willows to these disturbed areas. Early research at the LLPMC in the 1980's and 1990 was focused exclusively on establishing cottonwoods and willows. Today planting cottonwoods and willows using LLPMC's pole cutting methodology has become a common practice in restoring Southwest riparian areas.

Our current riparian research has shifted to the establishment of the understory shrub community using techniques that require minimal follow-up maintenance.

The restoration of the shrub component of the riparian ecosystems has often been neglected because of the difficulty in establishing small woody transplants in arid and semi-arid environments. Conventional planting methods rely on frequent irrigation for a prolonged period of time until these phreatophytic species are able to utilize water in the capillary fringe above shallow floodplain water tables.

The LLPMC has developed a technique to deep plant riparian woody species with longstems by burying the root crown of the plant 3 to 7 feet deep to allow the rootball to be in contact with the capillary fringe and still have several feet of stem above ground. This deep-planting method is typically done in the fall or winter when the water table is usually at its lowest level and the transplants are subjected to reduced or minimal transpiration. Most riparian shrub species are well-adapted to sediment burial and rapidly develop adventitious roots along the buried stem and grow vigorously. This technique has been used at many different sites throughout New Mexico and Colorado, and survival rates are generally high (greater than 90 percent) unless the water table drops drastically after planting, the site is inundated the spring after planting for a prolonged period, or browsing by domestic or wild animals destroys above-ground shoots.

Drilling 8-foot holes in loose sand was a problem when using a standard 8 ft. long and 6 to 9 inches in diameter auger. The drilled hole would collapses as the auger was withdrawn. However, a new tool developed by the LLPMC has been used with a great amount of success. This tool consists of an 8-ft. long, 5-inch in diameter stinger that is mounted to a vibrating plate which is attached to the front-end loader of a farm tractor (Figure 10).

Figure 11: Stinger planting bar mounted to a vibrating plate attached to a front-end loader on a 65-hp farm tractor and drilling in loose sand.

As the stinger is driven in the sand by the vibrating plate and tractor, the sides of the hole get compacted providing some stability which enables us to place the plants into capillary water (Figure 12).

Figure 12: Hole drilled by stinger bar in loose sand.

Figures 13 and 14 demonstrate the dramatic change by adding shrubs to these plant communities using the 'longstem' deep-planting methodology. This planting did not require any follow-up irrigation, and it had a survival rate of 87% after six years.

Figure 13: Cottonwood/grass plant community on 40-acre site before planting shrubs.

Figure 14: Same location six years after planting shrubs using the 'longstem' deep-planting methodology.

Pollinator Plant Evaluation

Decline of honey bee and wild pollinator (e.g., native bee) populations are evident in the US and elsewhere and could affect agricultural crop production as well as natural plant communities. The Los Lunas Plant Materials Center (LLPMC) installed plantings in 2010 and 2011 to evaluate native and introduced species for pollinator activity; the combined species totals included 136 herbaceous perennials, 50 annuals and biennials, and 34 shrubs. This project is being conducted with the collaboration of Dr. Tess Grasswitz, an entomologist at the New Mexico State University (NMSU) Los Lunas Agricultural Science Center. We are evaluating the different species for pollinator use (abundance, diversity and phenology), plant survival, plant vigor, and duration of flowering.

Figure 15: Bumble Bee on *Pycnanthemum verticillatura* var. *pilosum (9/23/2011)*

The pollinators collected in 2011 are being identified to genus for native bees and to family for wasps (predatory and parasitic) and flies. In 2010, less extensive plantings were installed at a rural high school in Reserve, NM and at the Whitfield Wildlife Conservation Area near Belen, NM. In 2011, fairly comprehensive plantings were installed at NMSU's Farmington and Tucumcari Agricultural Science Centers as well as at a demonstration farm for disadvantaged novice growers south of Las Cruces, NM.

Weekly pollinator observations were made from early March 2011 to early November 2011 and were compiled to yield qualitative pollinator abundance and diversity data for each plant species. Considerable variability in pollinator activity for a particular plant species was observed from week to week as the sources of pollen and nectar were continuously changing as other species came into bloom. Obvious differences in pollinator activity for a species were also noted between morning and afternoon observations.

The bloom times were recorded for most of the species that had some pollinator activity. It became apparent that the bloom periods were not consistent between 2010 and 2011 due to a number of factors including the:

- Extreme cold in February 2011 (-13° F) followed by a very warm spring,
- Influence of planting date (for example, whether the species had overwintered versus having been planted out as a seedling in the spring).

Figure 16: Bumble Bee on *Tithonia rotund ifolia* (8/31/2011)

Table 1 lists those species which had the highest abundance of insect visitors during 2011. The predominant insect groups observed on each plant species during 2011 are listed, as well as a qualitative rating of pollinator diversity at the family level. The bloom periods are presented in broad categories of semi-seasons because of the inconsistencies in flowering time noted above. The native status of the species is also noted.

Table 1. Annual, perennial, and shrub species with the greatest abundance of pollinator activity during 2011 at the LLPMC Pollinator Plant Evaluation Garden including the predominant insect groups observed, the diversity of pollinators observed, bloom period, and native status.

				Bloom Period						
Species Name	**Common Name**	**Predominant Insect Groups***	**Diversity of Insect Species**	**Late Winter Feb 4 - Mar 20**	**Early Spring Mar 21 - May 7**	**Late Spring May 8 - Jun 20**	**Early Summer Jun 21 - Aug 8**	**Late Summer Aug 9 - Sep 22**	**Early Fall Sep 23 - Nov 6**	**Native Status****
Annuals										
Monarda citriodora	lemon beebalm	BB, NB	Low				**X**	**X**	**X**	NM
Phacelia integrifolia	gypsum phacelia	NB	Medium			**X**				NM
Verbesina encelioides	golden crownbeard	NB, F, W	High				**X**	**X**		NM
Cosmos bipinnatus	garden cosmos	NB, W, BB, HB	High					**X**	**X**	Intro.
Foeniculum vulgare var. azoricum	sweet fennel	W, F	High					**X**	**X**	Intro.
Perennials										
Scrophularia californica	California figwort	HB, F, W	Medium					**X**	**X**	WC
Pycnanthemum verticillatum var. pilosum	whorled mountainmint	W, NB, BB, HB	High					**X**	**X**	TX & OK
Achillea millefolium	common yarrow	W, F	High			**X**	**X**			NM
Dalea candida	white prairie clover	W, NB, HB, BB	High			**X**	**X**	**X**		NM
Gaillardia pinnatifida	red dome blanketflower	NB	High			**X**	**X**			NM
Gaillardia pulchella	firewheel	NB, HB, W,BB	High			**X**	**X**	**X**	**X**	NM
Helenium autumnale	common sneezeweed	NB, HB	Medium						**X**	NM
Helianthus maximiliani	Maximilian sunflower	NB	High					**X**		NM
Heliomeris multiflora var. multiflora	showy goldeneye	NB, F	High			**X**				NM
Ratibida columnifera	mexican hat	W, NB	High				**X**	**X**	**X**	NM
Rudbeckia hirta	blackeyed Susan	NB, W, F	High			**X**	**X**	**X**	**X**	NM
Solidago nemoralis	gray goldenrod	W, NB, F, BT, BF	High					**X**	**X**	NM
Solidago petiolaris	downy ragged goldenrod	W, NB, BF, F	High					**X**		NM
Solidago speciosa	showy goldenrod	BB, NB, HB, F, W	High					**X**	**X**	NM
Symphyotrichum oblongifolium	aromatic aster	NB, W, F, HB	High						**X**	NM
Thelesperma filifolium	stiff greenthread	F, NB, W	High			**X**	**X**	**X**	**X**	NM
Nepeta cataria	catnip	NB, BB, HB, W, F	High					**X**	**X**	Intro.
Scabiosa atropurpurea	mourningbride	NB, HB,BB, W, F	High					**X**	**X**	Intro.
Shrubs										
Baccharis emoryi	Emory's baccharis	W, F, NB, HB	High						**X**	NM
Dalea bicolor var. argyrea	silver prairie clover	HB	Low						**X**	NM
Ericameria nauseosa	rubber rabbitbrush	NB, W, HB, F, BB, BF	High					**X**	**X**	NM
Eriogonum corymbosum	crispleaf buckwheat	W, F	High					**X**		NM
Parthenium incanum	mariola	W, F, NB	High					**X**		NM
Poliomintha incana	frosted mint	NB, W, F, HB	High			**X**	**X**	**X**	**X**	NM
Salix irrorata	dewystem willow	NB, HB, F	Medium	**X**						NM
Salix lasiolepis	arroyo willow	NB, HB, F	Medium	**X**						NM

*W = Predatory and Parasitic Wasps, F = Flies, NB = Other Native Bees, BB = Bumblebees, HB = Domsticated Honey Bees, BF = Butterflies, BT = Beetles

** Native to NM = New Mexico, WC = West Coast States, TX & OK = Texas and Oklahoma, Intro. = Introduced

Los Lunas Plant Materials Center Staff: (Front row L-R): Danny Goodson, David Dreesen, Joe Aragon, Alex Taylor; (Back row L-R); Eric Carabajal, Keith White, Greg Fenchel, Dennis Price.

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