United States Department of Agriculture
Natural Resources Conservation Service

2010 ANNUAL TECHNICAL REPORT

Manhattan Plant Materials Center

Serving Kansas, Nebraska, northern Oklahoma, and northeastern Colorado

http://plant-materials.nrcs.usda.gov/kspmc

Notices

The 2010 Annual Technical Report (ATR) is a report to the plant materials discipline and cooperating agencies. This ATR is a compilation of preliminary reports of results from various studies conducted by the Plant Materials Center (PMC) Staff at Manhattan, Kansas. Conclusions may change with continued investigations or upon further analysis. Written authorization must be obtained from the authors before publishing data from these reports. Contact the PMC Manager for more information at 3800 South 20th Street, Manhattan, KS 66502, or (785) 539-8761.

Refer to our Web site: http://plant-materials.nrcs.usda.gov/kspmc/ for additional information about the Plant Materials Program.

This ATR uses currently accepted scientific names as they appear in the PLANTS (Plant List of Accepted Nomenclature, Taxonomy, & Symbols) database where practical. PLANTS is maintained by the National Plant Data Collection Center. See the Web site at http://plants.usda.gov/. The Flora of the Great Plains, University Press of Kansas, is the authority regarding the usage of common names of plants native or naturalized to North America. Hortus Third, Macmillian Publishing Company, New York is the authority regarding the usage of common names of introduced species.

Mention of trade and company names does not imply any guarantee, warranty, or endorsement by the U. S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and does not imply its approval to the exclusion of other products that are also suitable.

Acronyms used in this report to identify various Plant Materials Centers are those listed in POMS (Plant Materials Operations and Management System).

This document conforms to the *Manhattan Plant Materials Center Style Manual for Technical Documents* (Copies available upon request).

On the cover: UL–Harvesting grayhead prairie coneflower; UR–Jennifer Hopwood (center), Midwest Pollinator Outreach Coordinator for the Xerces Society, with Pollinator Short Course participants; ML–snow covers chestnut trees at the PMC; MR–Allen Casey and Rich Wynia collect stand data on sand bluestem trial; LL–Chip Taylor (pointing down) talks about pollinator habitat to group at the PMC; LR–Cumulonimbus clouds to the south of the PMC in early spring.

U. S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

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CONTENTS

FOREWORD AND ACKNOWLEDGEMENTS

The Manhattan Plant Materials Center (PMC) at Manhattan, Kansas, is a federally owned and operated facility under the administration of the Kansas State Office of the Natural Resources Conservation Service (NRCS). Conservation plant research underway at the PMC is directed by the PMC's Long-Range Plan with guidance from a State Conservationists' Plant Materials Advisory Committee with representation from Kansas, Nebraska, Oklahoma, and Colorado. The PMC maintains cooperative agreements for plant testing and development with the Agricultural Experiment Stations (Kansas State University [KSU], University of Nebraska-Lincoln [UNL], and Oklahoma State University); Kansas Biological Survey, U. S. Department of Interior (USDI) Fish & Wildlife Service, U. S. Department of Agriculture (USDA) Agricultural Research Service (ARS), U. S. Army-Fort Riley Military Reservation, U. S. Army-Corps of Engineers, and Kansas Department of Wildlife and Parks.

The PMC was established in 1936 as a Soil Conservation Service (SCS) nursery. It is located on a 169-acre irrigated farm in the Kansas River Valley, 10 miles west and south of Manhattan, Kansas. Initial and advanced evaluations of new plant materials, seed increase plantings of promising accessions, and foundation seed increases of released plant materials are located at this site. Field evaluation plantings are located off the PMC at federal and state cooperator sites. Field plantings are located in the PMC's service area on conservation district cooperator sites.

The PMC acknowledges the efforts of the following individuals who have contributed to its accomplishments: Dr. Walter Fick, Agronomy Department, KSU; Dr. Wayne Geyer, Horticulture, Forestry and Recreation, KSU; Vernon Schaffer, Agronomy Department, KSU; and Mary Knapp, State Climatologist, KSU. Assistance provided by these individuals and entities is greatly appreciated.

INTRODUCTION

The purpose of the annual technical report is to inform the plant materials discipline of the Natural Resources Conservation Service (NRCS), its cooperators, and others interested in plant materials work of progress and new developments.

Mission: *The mission of the Manhattan Plant Materials Center* (PMC) *is to develop and transfer plant materials and plant technology for the conservation of natural resources. In working with a broad range of plant species, including grasses, forbs, trees, and shrubs, the program seeks to address priority needs of field offices and land managers in both public and private sectors. Emphasis is focused on using native plants as a healthy way to solve conservation problems and protect ecosystems.*

Objectives: The objectives of plant materials activities are to select and develop special and improved plants and to determine reliable techniques for successfully establishing and maintaining plants for conservation uses. These uses include controlling soil erosion and improving soil on all lands. Finding suitable plants for stabilizing critical high-yielding sediment sources, including sand dunes, streambanks, and shorelines; windbreaks and shelterbelts; toxic or problem soils; improving forage quantity and quality for pasture and rangelands; wildlife food and cover; beautification; and recreation areas are of particular importance. Culturally significant plants, threatened and endangered species and invasive species are also areas of concern.

Long-range Priorities: Each of the states served by the PMC has identified its plant material problems, needs, and priorities in its respective current state's long-range Plant Materials Program. PMC activities are directed toward meeting the needs and priorities as set forth in the long-range plans of the four states.

The major priority items identified are:

1. Suitable plants and improved methods of establishment on critical areas for stabilization and erosion control. These critical areas include saline and alkali areas; surface mine areas, streambank and shoreline protection, road cuts and fills, blowout areas, etc.

2. Selected varieties of grasses and legumes for use in range seeding, interseeding, and pasture planting. This will include the development of techniques for production, re-establishment, and maintenance.

3. Woody selections with superiority in hardiness and resistance to drought, heat, disease, and insects for use in field and farmstead windbreaks.

4. Shrub species to supplement or replace those most commonly used for the shrub row in multiple-row windbreaks, for interplanting with trees in single-row windbreaks, and for specific needs in recreational developments.

5. Shrubs, browse, and herbaceous plants to provide improved cover and food for upland game birds, waterfowl, and other wildlife species.

6. Studies leading to improvements in cultural practices to improve plant establishment, maintenance, pest control, yield, harvest, and seed processing technology.

Service Area: The PMC primarily serves Nebraska, Kansas, northern Oklahoma, and northeastern Colorado. The service area consists of an area with much diversity and is covered by five regions designated as:

Western Great Plains Range and Irrigated
Southwestern Prairies Cotton and Forage
Central Great Plains Winter Wheat and Range
Central Feed Grains and Livestock
East and Central Farming and Forest

Service Area Description: This area, in general, was originally native grass prairie. It is dissected by a number of major streams. Areas of timber follow the stream courses and extend to the slopes in the east where sufficient precipitation supports a mixed hardwood forest. Elevations range from 700 to 5000 feet. Annual precipitation rates vary from 42 inches in parts of Oklahoma and southeast Kansas to 12.7 inches at the other extreme in northeastern Colorado. Distribution of the rainfall is typical of a warm-season grassland climate with 75 percent of the total falling from April to September. Temperatures fluctuate widely and can be accompanied by high winds and long periods without effective precipitation. Soils vary widely from the clay pans of southeast Kansas and northeast Oklahoma to the loess-derived silt loams of the High Plains and the Sandhill Region of northern Nebraska.

Location: The PMC is located in the Kansas River Valley, 10 miles west and south of Manhattan, Kansas, at an elevation of 1030 feet, longitude 96°37' and latitude 39°37'.

Facilities: The facility includes 169 acres of land, 10 buildings, 2 greenhouses, a lathhouse with walk-in cooler, and 4 irrigation wells. Portions of the land holdings are used by Kansas State University Agricultural Experiment Station under provisions of a multi-year working agreement.

Climate and Soils: The soils found on the PMC are Belvue silt loam (formerly Haynie very fine sandy loam), Eudora silt loam, Bourbonais-Bismarckgrove complex, Stonehouse-Eudora complex (formerly Carr-Sarpy complex), and Fluvents (formerly Sarpy loamy fine sand). The PMC is in Major Land Resource Area 76. Average annual precipitation is 34.8 inches (30-year average 1971-2000). The average frost-free period is 178 days. Prevailing surface winds are southerly in the summer months and northerly in the winter months.

OUTREACH

Outreach activities consist of providing assistance to Native American Indian tribes of the Central Great Plains. The PMC provides assistance in the collection and propagation of culturally significant plants. Such efforts result in the establishment of plant propagation nurseries, and educational and ceremonial displays. Ethnobotanical information and plant descriptions may also be provided. In 2010, technical assistance was provided to the Creek Nation, Okmulgee, Oklahoma with the collection and propagation of red-root willow and winged primrose-willow (Table 1). See page 7 of Technology Transfer for further information regarding outreach activities in 2010.

Table 1. Plant materials provided to tribes in 2010.

Tribe/Entity	Location	Plant Material
Creek Nation	Okmulgee, OK	red-root willow
Creek Nation	Okmulgee, OK	winged primrose-willow

COOPERATIVE EFFORTS

The PMC is involved in many collaborative efforts with cooperating universities, USDA ARS, seedsmen, and nurserymen. The PMC, at a minimum, provides seed for research and quite often technical assistance is provided. On-site studies include land for the study, and in some cases, labor and other PMC resources are provided. The following list is not comprehensive but captures many of the cooperative efforts the PMC was involved with in 2010.

Cooperator	Affiliation	Research Interest
Dr. Mike Casler	USDA ARS-Dairy Forage Res. Central Univ. of Wisconsin	Adaptation zones of switchgrass populations
Alex Hazlehurst	University of Rhode Island	Mead's milkweed host specificity
Karla Hernandez/ Dr. Vance Owens	South Dakota State Univ.	Prairie cordgrass biofuel study
Andrew Jakubowski	University of Wisconsin	Intraspecific diversity and local adaptation in native grasses
Dr. Loretta Johnson	KSU	Ecotypic variation in big bluestem
Dr. Justin Moss	Oklahoma State University	Ornamental selection of native grasses
Dr. Tim Springer	USDA ARS-Southern Plains Res. Sta.	Sand bluestem comparison trials
Dr. Tim Springer	USDA ARS-Southern Plains Res. Sta.	Quail preference for native grass and forb seeds

TECHNOLOGY TRANSFER

The dissemination of information resulting from plant materials work is in the form of presentations, tours, and printed materials. Printed materials include newsletters, release brochures, technical notes, planting guides, conservation plant fact sheets, national news articles, reports, etc. While most of the publications and events listed here occurred in 2010, the list may include those not previously reported. Author's given name is reduced to initials following first appearance in this section of the annual technical report. Any deviation from this scheme indicates that the author's given name is not known.

Events and Presentations

Conference Room: The PMC conference room is used by federal, state, and local conservation agencies for meetings and training activities. Approximately 130 people used the facility this year for the following activities:

Kansas Native Plant Society Roadside Management Committee
Kansas Pollinator Conservation Short Course
Kansas Section Society for Range Mangement Fall Meeting
Pollinator Workshop
State Conservationist's Plant Materials Advisory Committee Meeting
Vegetative Sampling Protocol Meeting

Events: Events hosted by the PMC.

North American Butterfly Association (NABA) Summer Butterfly Count. July 14, 2010. Participants: 10

Off-Center Tours: PMC staff participation is off-Center plant-related events.

Wildflower Tour. Riley County, Kansas. P. Allen Casey. August 8, 2010. Participants: 18

Fall Wildflower Tour, Russell County, Kansas. P. A. Casey. September 26, 2010. Participants: 150

Presentations: Presentations are made by PMC Staff to update various groups about local, regional, and national Plant Materials Program activities and to facilitate technology transfer.

Comparative Studies of Two, Small, Freshwater Wetlands in Ellis County, Kansas. Kansas Natural Resources Conference. February 4-5, 2010. Wichita, KS. P. A. Casey.

Kansas Natural Resource Conservation Service Practices for Pollinators. Kansas Pollinator Conservation Short Course. September 2, 2010. Manhattan PMC, Manhattan, KS. Mark A. Janzen.

Manhattan Plant Materials Center Program Update. Nebraska Plant Materials Committee Meeting. Lincoln, NE. Richard L. Wynia.

Manhattan Plant Materials Center Program Update. State Conservationist's Plant Materials Advisory Committee Meeting. Manhattan PMC, Manhattan, KS. R. L. Wynia.

North American Butterfly Association Summer Butterfly Count Introduction. July 14, 2010. Manhattan PMC, Manhattan, KS. P. A. Casey.

Plant Materials and Conservation Practice Review. Kansas Area Specialist Meeting. January 28, 2010. Salina, KS. M. A. Janzen.

Plant Materials, Forestry and USDA Programs. Kansas Forest Service Training. June 7, 2010. Salina, KS. M. A. Janzen.

Plant Materials Program Overview. Clyde Community Development Committee. February 15, 2010. Clyde, KS. M. A. Janzen.

Plant Materials Relating To Cultural Preservation. To Bridge A Gap Conference. April 1, 2010. Tulsa, OK. M. A. Janzen.

Plant Materials Work in Woody Vegetation. Agroforestry Field Day. May 20, 2010. Cimarron, KS. M. A. Janzen.

Pollinators and Plants Conservation. Cowley County, Kansas. September 15, 2010. P. A. Casey.

Roses are Red. Kansas Pollinator Conservation Short Course. September 2, 2010. Manhattan PMC, Manhattan, KS. P. A. Casey.

Variances, Rules, Regulations and Responsibilities. Kansas Area Specialist Meeting. May 5, 2010. Salina, KS. M. A. Janzen.

Viability of Native Warm-Season Grass Seed Stored Under Two Different Environments following 35 Years of Storage*. National Native Seed Conference. Snowbird, UT. May 17-21, 2010. J. M. Row.

Why Plant Pure Live Seed? 22nd North American Prairie Conference, August 19, 2009. Cedar Rapids, IA. John M. Row.

Tours: The PMC Staff welcomes visitors and readily conducts tours. The number of visitors was down in calendar year 2010; however, more than 140 people visited the PMC, of which 125 toured the PMC. The following groups are representative of the yearly interest in the Plant Materials Program:

Kansas Chapter Society for Range Management
Kansas NRCS Student Trainees
Kansas Native Plant Society Roadside Management Committee
Pollinator Workshop – Bee Habitat
State Conservationist's Plant Materials Advisory Committee

Training Sessions: The PMC Staff puts on training sessions or takes part in training sessions to train staff, cooperators, and the general public about various aspects of the Plant Materials Program.

Introduction to Plant Materials Operations and Management System (POMS). Manhattan PMC, May 17, 2010. J. M. Row. Trainees: 1

Kansas NRCS Student Trainee Orientation. Manhattan PMC, June 9, 2010. R. L. Wynia. Trainees: 16

Orientation for Biological Science Aids, Part 1, Manhattan PMC, May 17, 2010. J. M. Row. Trainees: 4

Orientation for Biological Science Aids, Part 2, Manhattan PMC, May 28, 2010. J. M. Row. Trainees: 4

Pollinators and Plants Conservation. Cowley County Conservation Field Day. Cowley County, Kansas. September 15, 2010. P. A. Casey. Trainees: 150

Workshops: Workshops put on or hosted by the PMC. The PMC hosted three workshops in 2010.

Pollinator Workshop. June 2, 2010. Featured Speaker: Dr. Orley R. "Chip" Taylor. Your Future Flies on the Wings of Pollinators: Things You Should Know about Pollinators and Pollinations. Manhattan PMC, Manhattan, KS. Attendance: 34

Butterfly Identification Workshop. July 8, 2010. Featured Speaker: Betsy Betros. Konza Prairie Biological Station, Manhattan, KS. Attendance: 19

Kansas Pollinator Conservation Short Course. September 2, 2010. Featured Speaker: Jennifer Hopwood. Manhattan PMC, Manhattan, KS. Attendance: 40

Interviews

Newscast: Personal interview and filming of PMC staff concerning plant materials related events.

NABA Butterfly Count at the Manhattan PMC. July 14, 2010. Featured Speaker: P. A. Casey. KSNT-TV 27 News. Topeka, KS.

Publications

Abstracts: Published in conference proceedings or program.

Biomass Yield and Adaptation of an Annual Tropical Legume (Crotalaria juncea L.) in Manhattan, Kansas. R. L. Wynia, J. M. Row, and P. A. Casey. Kansas Waters – Signs of Prosperity and Health. Kansas Natural Resources Conference. Wichita, KS. February 4-5, 2010. 34p.

Comparative Studies of Two Small, Freshwater Wetlands in Ellis County, Kansas. P. A. Casey. Kansas Waters – Signs of Prosperity and Health. Kansas Natural Resources Conference. Wichita, KS. February 4-5, 2010. 34p.

Comparative Studies of Two, Small, Freshwater Wetlands in Ellis County, Kansas*. P. A. Casey. Working Landscapes – Providing for the Future. 63rd Society for Range Mangement Annual Meeting. Denver, CO. February 7-11, 2010. https://srm.conference-services.net/reports/template/onetextabstract.xml?xsl=template/onetextabstract.xsl&conferenceID=1756&abstractID=342760

Habitat Creation and Management for Native Pollinating Insects at the Manhattan Plant Materials Center, Kansas*. P. A. Casey, R. L. Wynia, and J. M. Row. National Native Seed Conference. Program & Schedule of Activities. Snowbird, UT. May 17-21, 2010. 44p.

Why Plant Pure Live Seed?* J. M. Row and P. A. Casey. Restoring a National Treasure. 22nd North American Prairie Conference Program. Cedar Rapids, IA. August 1-5, 2010. 118p.

Major Publications: Publications longer than a Technical Note but not quite a book, produced by PMC staff.

Culturally Significant Plants*. P. A. Casey and R. L. Wynia. Manhattan, KS. September 2010. 52p.

Newsletters: Periodically the PMC publishes its newsletter, Plant for the Heartland that is distributed to cooperators and customers in the PMC's service area. The PMCs newsletters are also available to the general public via the Internet. From time-to-time PMC staff makes contributions to the newletters of other organizations.

Earth Team Volunteers Monitor Butterfly Migrations and Populations. P. A. Casey. *In:* Volunteer Voice Newsletter. USDA NRCS. Fall 2010. 8p.

NRCS Study: Mead's Milkweed. P. A. Casey. *In:* Kansas Native Plant Society Newsletter. Volume 32 No. 3. 2010.

Plants for the Heartland. Volume 17. Issue 1. 2010. P. A. Casey and J. M. Row. 2p.

Plants for the Heartland. Volume 16. Issue 2. 2010. M. A. Janzen, P. A. Casey, and J. M. Row. 2p.

Plants for the Heartland. Volume 16. Issue 3. 2010. P. A. Casey, M. A. Janzen, and J. M. Row. 2p.

Plants for the Heartland. Volume 16. Issue 4. 2010. P. A. Casey and J. M. Row. 2p.

Plants for the Heartland. Volume 16. Issue 5. 2010. J. M. Row and P. A. Casey. 2p.

Plant Fact Sheets: Plant fact sheets are produced for the PLANTS Database and NRCS Plant Materials Program Web sites that are of benefit to the Plant Materials Program and NRCS programs and its cooperators.

Black Willow (*Salix nigra* Marsh.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. J. M. Row and W. A. Geyer. 2p.

Chickasaw Plum (*Prunus angustafolia* Marsh.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. J. M. Row and W. A. Geyer. 2p.

Kansas Hawthorne (*Crataegus americanus* L.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. R. L. Wynia. 2p.

Kochia (*Kochia scoparia* L.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. P. A. Casey. 2p.

New Jersey tea (*Ceanothus americanus* L.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. R. L. Wynia. 2p.

Sago Pond Weed [*Stukenia pectinata* (L.) Boerner] Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. P. A. Casey. 2p.

Silver Maple (*Acer saccharinum* L.) Plant Fact Sheet. Plant Materials Program Web site. USDA NRCS. 2010. W. A. Geyer, John Dickerson, and J. M. Row. 2p.

Plant Guides: Plant guides are produced for the PLANTS Database and NRCS Plant Materials Program Websites that are of benefit to the Plant Materials Program and NRCS programs and its cooperators.

Black Willow (*Salix nigra* Marsh.) Plant Guide. Plant Materials Program Web site. USDA NRCS. 2010. J. M. Row and W. A. Geyer. 6p.

Chickasaw Plum (*Prunus angustafolia* Marsh.) Plant Guide. Plant Materials Program Web site. USDA NRCS. 2010. J. M. Row and W. A. Geyer. 4p.

Kochia (*Kochia scoparia* L.) Plant Guide. Plant Materials Program Web site. USDA NRCS. 2010. P. A. Casey. 6p.

Sago Pond Weed [*Stukenia pectinata* (L.) Boerner] Plant Guide. Plant Materials Program Web site. USDA NRCS. 2010. P. A. Casey. 6p.

Southern Catalpa (*Catalpa bignoides* L.) Plant Guide. PLANTS Database. USDA NRCS National Plant Data Center. Baton Rouge, LA. 2010. W. A. Geyer, Patrick J. Broyles, and J. M. Row. 4p.
Posters: Posters are produced and/or presented by PMC staff at various functions.

Biomass Yield and Adaptation of an Annual Tropical Legume (*Crotalaria juncea* L.) in Manhattan, Kansas. R. L. Wynia, J. M. Row, and P. A. Casey. Kansas Natural Resources Conference. Wichita, KS. February 4-5, 2010.

Comparative Studies of Two, Small, Freshwater Wetlands in Ellis County, Kansas. P. A. Casey. 63rd Society for Range Mangement Annual Meeting. Denver, CO. February 7-11, 2010.

Habitat Creation and Management for Native Pollinating Insects at the Manhattan Plant Materials Center, Kansas. P. A. Casey, R. L. Wynia, and J. M. Row. National Native Seed Conference. Snowbird, UT. May 17-21, 2010.

Viability of Native Warm-Season Grass Seed Stored Under Two Different Environments following 35 Years of Storage*. J. M. Row. National Native Seed Conference. Snowbird, UT. May 17-21, 2010.

Why Plant Pure Live Seed*? J. M. Row and R. L. Wynia. 22nd North American Prairie Conference Program. Cedar Rapids, IA. August 1-5, 2010.

Working Insects of the Prairie*. August 2010. P. A. Casey. Cowley County Conservation Field Day. Cowley County, Kansas. September 15, 2010.

Reports: Annual and technical reports produced by PMC Staff documenting plant materials activities for a given period of time.

2009 Annual Technical Report, Manhattan Plant Materials Center. Salina, KS. 100p.

2009 Progress Report of Activities, Manhattan Plant Materials Center. Salina, KS. 6p.

2010 Progress Report of Activities, Manhattan Plant Materials Center. Salina, KS. 6p.

Technical Notes: Technical Notes are developed by the Plant Materials Program to convey technical information.

Windbreak Condition. Kansas Forestry Technical Note KS11. January 19, 2010. Salina, KS. M. A. Janzen. 2p.

* In addition to Plant Fact Sheets, Plant Guides, and Plants for the Heartland newsletter, document titles followed by an asterisk can be found on the World Wide Web. Go to http://plants.usda.gov/ or http://plant-materials.nrcs.usda.gov/kspmc/ to find these documents.

PLANT MATERIALS DEVELOPMENT FLOW CHART

Assembly	Initial Evaluations	Initial Seed/ Plant Increase	Advanced Evaluations	Field Evaluation Plantings	Seed/Plant Increase	Field Plantings	Release
FORBS AND LEGUMES							
					Echinacea angustifolia	*Echinacea angustifolia*	
					Liatris punctata	*Liatris punctata*	
					Silphium laciniatum	*Silphium laciniatum* (S)	
GRASSES AND GRASS-LIKE PLANTS							
Muhlenbergia pungens		*Andropogon gerardii*				*Bouteloua gracilis* (F)	
Redfieldia flexuosa		*Calamovilfa gigantea* (F)					
	Panicum virgatum		*Panicum virgatum*				
Scirpus sp.							
Sporobolus giganteus			*Schizachyrium scoparium*				
TREES AND SHRUBS							
		Amorpha fruticosa			*Betula nigra*	*Betula nigra* (T)	
		Amorpha canescens		*Celtis occidentalis*	*Celtis occidentalis* (S)	*Amorpha fruticosa*	
						Amorpha canescens (S)	
		Ceanothus herbaceus				*Ceanothus herbaceus* (S)	
		Cotoneaster lucida (S)		*Platycladus orientalis*	*Platycladus orientalis* (S)		
	Quercus macrocarpa					*Prunus americana* (S)	
		Cephalanthus occidentalis		*Ulmus pumila* (S)	*Ribes aureum* var *villosum*	*Ribes aureum* var *villosum* (S)	
		Salix exigua		*Ulmus parvifolia*		*Salix exigua* (S)	

Anticipated Release Type: F-Formal SI-Source Identified S-Selected T-Tested

SELECTION AND INITIAL INCREASE OF SUPERIOR PLANTS

Initial increase is the production of seed or other propagules of potentially useful plants selected on the basis of initial or advanced evaluation for further evaluation or research. The following accessions are currently in the status of initial seed or plant increase.

Accession No.	PI No.	Common Name	Species	Study No.
9049944	514675	lead plant	*Amorpha canescens*	20I023H
ORIGIN/SOURCE: A polycross composed of accessions 9013351, Comanche Co., KS; 9013344, Washita Co., OK; 9013354, Stephens Co., OK; and 9017622, Saline Co., KS				
9050575		desert false indigo	*Amorpha fruticosa*	20I042E
ORIGIN/SOURCE: A polycross composed of accessions 9050277, Holt Co., NE; 9050280, Dickinson Co., KS; 9050307, Colfax Co., NE; 9050308, Cheyenne Co., KS; 9050314, Dodge Co., NE; 9050318, Kingman Co., KS; 9050321, Howard Co., NE; 9050324, Harvey Co., KS; 9050349, Haskell Co., OK; 9050384, Sumner Co., KS; and 9050400, Clay Co., KS				
9034682		river birch	*Betula nigra*	20I010K
ORIGIN/SOURCE: Houston Co., MN				
9050018		big sandreed	*Calamovilfa gigantea*	20I032X
ORIGIN/SOURCE: A polycross composed of accessions 9026760, Reno Co., KS; 9026777, Payne Co., OK; 9035891, Lipscomb Co., TX; 9042800, Garza Co., TX; 9042911, Winkler Co., TX; 9049764, Rice Co., KS; 9049765, Stafford Co., KS; 9049823, Stafford Co., KS; and 9049866, Comanche Co., KS				
9049952	514676	New Jersey tea	*Ceanothus herbaceus var pubscens*	20I024H
ORIGIN/SOURCE: A polycross composed of accessions 9013414, Osborne Co., KS; and PI-421286, Wabaunsee Co., KS				
9050600		common hackberry	*Celtis occidentalis*	20I026K
ORIGIN/SOURCE: A composite of accessions 9004261, Pierce Co., NE; 9004262 and 9004263 Cheyenne Co., KS; 9004264 and 9004265, Sherman Co., KS; 9004266, Dickinson Co., KS; 9013415, Greeley Co., NE; 9013417, Wallace Co., KS; 9013437, Gove Co., KS; 9013440, Sheridan Co., KS; 9013446, Phillips Co., KS; 9030313, KSU Forestry; and 9030314, NE.				
9050496		common buttonbush	*Cephalanthus occidentalis*	20I043E
ORIGIN/SOURCE: A polycross composed of accessions 9050287, Hodgeman Co., KS; 9050296, Miami Co., KS; 9050311, Douglas Co., KS; 9050323, Harvey Co., KS; 9050340, Cleveland Co., OK; 9050359, Harvey/Reno Co., KS; 9050360, Osage Co., KS; 9050371, Butler Co., KS; 9050375, Montgomery Co., KS; 9050389, Douglas Co., KS; 9050392, Johnston Co., OK; and 9050395, Logan Co., OK				

SELECTION AND INITIAL INCREASE OF SUPERIOR PLANTS (continued)

Accession No.	PI No.	Common Name	Species	Study No.
	325270	hedge cotoneaster	*Cotoneaster lucidus*	20I033K
ORIGIN/SOURCE: USSR				
9023353		black sampson	*Echinacea angustifolia*	20I018S
ORIGIN/SOURCE: A polycross composed of accessions PI-421340, Butler Co., KS; PI-421331, Logan Co., OK; PI-421362, Ellis Co., KS; PI-421307, Noble Co., OK				
9049894		dotted gay-feather	*Liatris punctata*	20I022S
ORIGIN/SOURCE: A polycross composed of PI-421419, Woodson Co., KS; PI-421497, Lane Co., KS; and PI-421488, Rush Co., KS				
9049968		switchgrass	*Panicum virgatum*	20I039E
ORIGIN/SOURCE: Roger Mills Co., OK				
9049945	514677	American plum	*Prunus americana*	20I028J
ORIGIN/SOURCE: A polycross composed of accessions 9013483, Gove Co., KS; 9013498, Valley Co., NE; 9013500, Valley Co., NE; 9013515, Harlan Co., NE; and 9013544, Kingman Co., KS				
9050270		buffalo currant	*Ribes aureum var villosum*	20I036X
ORIGIN/SOURCE: A polycross composed of accessions 9049770, Morris Co., KS; 9049773, Ellis Co., KS; 9049806, Holt Co., NE; 9049810, Sheridan Co., NE; and 9049884, Loup Co., NE				
9050135		sandbar willow	*Salix exigua*	20I040E
ORIGIN/SOURCE: Brown Co., KS				
9050148		sandbar willow	*Salix exigua*	20I040E
ORIGIN/SOURCE: Sarpy Co., NE				
	421557	compass plant	*Silphium laciniatum*	20I020H
ORIGIN/SOURCE: Okmulgee Co., OK				

SEED AND PLANT PRODUCTION

Cultivar	Genus/Species	Common Name	Origin	Class	Acres
		HERBACEOUS			
		Forbs			
Riley	*Chamaecrista fasciculata*	showy partridge pea	Riley Co., KS	FND	0
Kaneb	*Dalea purpurea*	purple prairie clover	Riley Co., KS	FND	0.32
Reno Germplasm	*Desmanthus illinoensis*	Illinois bundleflower	Reno Co., KS	G2	0
9023353	*Echinacea angustifolia*	blacksampson	unknown	SFP	0.17
Prairie Gold	*Helianthus maximiliani*	Maximilian sunflower	KS	FND	0.2
Midas	*Heliopsis helianthoides var scabra*	false sunflower	KS	FND	0.12
Kanoka	*Lespedeza capitata*	round-head lespedeza	KS, OK	FND	0
9049894	*Liatris punctata*	dotted gay-feather	KS	G2	0.19
Eureka	*Liatris pycnostachya*	thickspike gay-feather	KS	FND	0.07
Sunglow	*Ratibida pinnata*	grayhead prairie coneflower	unknown	FND	0.24
Nekan	*Salvia azurea var grandiflora*	pitcher sage	KS	FND	0.16
421557	*Silphium laciniatum*	compass plant	Okmulgee Co., OK	G2	0.02
		Grasses			
Kaw	*Andropogon gerardii*	big bluestem	Riley Co., KS	FND	1.0
Garden	*Andropogon hallii*	sand bluestem	Garden Co., NE	SFP	0.68
El Reno	*Bouteloua curtipendula*	sideoats grama	Canadian Co., OK	FND	0
Pronghorn	*Calamovilfa longifolia*	prairie sandreed	NE	FND	0.75
9050018	*Calamovilfa gigantea*	giant sandreed	KS, OK, TX	SFP	0.60
Bend	*Eragrostis trichodes*	sand lovegrass	KS, OK	FND	0.24
Blackwell	*Panicum virgatum*	switchgrass	Blackwell, OK	FND	1.23
Kanlow	*Panicum virgatum*	switchgrass	Wetumka, OK	FND	0.72
Barton	*Pascopyrum smithii*	western wheatgrass	Barton Co., KS	FND	2.0
Southwind	*Phragmites australis*	common reed	KS, OK	FND	0.8
Aldous	*Schizachyrium scoparium*	little bluestem	KS Flinthills	FND	1.6
Cimarron	*Schizachyrium scoparium*	little bluestem	KS, OK	FND	0.82
Cheyenne	*Sorghastrum nutans*	yellow Indian grass	Fort Supply, OK	SFP	0.35
Osage	*Sorghastrum nutans*	yellow Indian grass	KS, OK	FND	1.0
Atkins Germplasm	*Spartina pectinata*	prairie cordgrass	Washington Co., NE	G2	0.83
Pete	*Tripsacum dactyloides*	eastern gamagrass	KS, OK	FND	0.4
		WOODY			
9049944	*Amorpha canescens*	lead plant	KS, OK	G2	0.07
9050575	*Amorpha fruticosa*	desert false indigo	KS, NE, OK	G1	0.07
9034682	*Betula nigra*	river birch	Houston Co., MN	G1	0.15
9049952	*Ceanothus herbaceus var pubscens*	New Jersey tea	KS	G2	0.11
9050496	*Cephalanthus occidentalis*	common buttonbush	KS, OK	G1	0.08
325270	*Cotoneaster lucidus*		USSR	FND	0.05
Pink Lady	*Euonymus bungeanum*	winterberry	China	FND	0.03
9049945	*Prunus americana*	American plum	KS, NE	FND	0.26
Chisholm Germplasm	*Prunus angustifolia*	Chickasaw plum	KS, OK	FND	0.12
Lippert	*Quercus macrocarpa*	bur oak	Stillwater, OK	FND	0.02
Konza	*Rhus aromatica var serotina*	aromatic sumac	KS	FND	0.09
9050270	*Ribes aureum var villosum*	buffalo currant	KS, NE	FND	0.05
9050135	*Salix exigua*	sandbar willow	Brown Co., KS	G1	0.09
9050148	*Salix exigua*	sandbar willow	Sarpy Co., NE	G1	0.11
9004450	*Juglans microcarpa*	little walnut	Beckham Co. & Washita Co., OK	SFP	0.1

DISTRIBUTION OF PLANT MATERIALS IN 2010

The Plant Materials Program distributes plant materials to conservation districts; cooperating universities, federal and state agencies, and private entities. These materials are provided for conservation field trials, seed or plant increase, research, demonstration plantings, and for educational purposes. The following table shows the distribution of plant materials from the PMC. A total of 20 seed and plant orders were shipped to 10 states and one foreign country with over 423 pounds of seed, 604 plants, and 480 rhizomes distributed in 2010.

Herbaceous Plant Materials

		Seed Orders			Plant Orders		
State	Use	Number	Number of Packets	Bulk Pounds	Number	Number of Rhizomes	Number of Plants
Kansas	CD	1		136.0	1		277
	CI	1		17.2			
	SA				1		20
	UNIV	1	9	1.0	1	80	
Subtotal		3	9	154.2	3	80	297
Oklahoma	CD	1		2.4	2	400	304
	CI	1		7.3			
	ARS	1		16.5			
	UNIV	1	10	1.1			
Subtotal		4	10	27.3	2	400	304
Colorado	CI	1		1.0			
Nebraska	ARS	1	1	0.1			
Other States	CI	3		174.7			
	PMC	3		10.2			
	UNIV	1		15.1	1		3
Subtotal		9	1	201.1	1	0	3
Foreign Countries							
UK	NIAB	1	1	0.1			
Total		17	21	382.7	6	480	604

Legend: ARS=Agricultural Research Service, CD=Conservation Districts, CI=Commercial Increase, NIAB=National Institute of Agricultural Botany, OR=Outreach, PMC=Plant Materials Centers, RES=Research, SA=State Agencies, UK=United Kingdom, UNIV=Universities

Woody Plant Materials

		Seed Orders			Plant Orders		
State	Use	Number	Number of Packets	Bulk Pounds	Number	Number of Cuttings	Number of Plants
Kansas	CD				1		29
	SA				2		70
Subtotal		0	0	0	3	0	99
Oklahoma	CD	1		30.0	1		10
	OR				1		3
Subtotal		1	0	30.0	2	0	13
California	ARS	1	1	0.1			
Nebraska	SA	1		10.5			
Subtotal		2	1	10.6	0	0	0
Total		3	1	40.6	5	0	112

YEAR 2010 CLIMATALOGICAL DATA FOR MANHATTAN

2010 Data

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg Max	32.3	37.5	54.8	72.9	74.0	89.2	91.4	94.4	83.3	75.2	56.9	42.1	67.0
Avg Min	12.5	17.0	29.2	41.8	50.8	63.7	68.3	65.1	53.6	43.0	31.7	20.7	41.4
Avg Mean	22.4	27.3	42.0	57.8	62.4	76.5	79.8	79.7	68.4	59.1	44.3	31.4	54.3
High	57	58	81	88	89	98	100	107	98	91	77	66	83.4
Low	-10	5	15	30	37	54	57	48	42	31	17	7	25.2
Max[1] > 90	0	0	0	0	0	13	17	23	6	1	0	0	60
Precip	0.41	0.56	2.78	3.45	3.95	7.68	3.83	4.04	3.52	1.15	1.90	0.07	33.34
PMC[2]	0.14	0.49	2.28	3.72	3.55	7.43	4.26	3.20	3.72	1.19	1.94	T	31.92
Precip†	8	9	10	8	14	10	8	9	13	6	5	3	103
Snow	4.4	3.2	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1
Heat DD*	1321	1057	692	242	173	0	0	1	41	198	642	1008	5372
Cool DD*	0	0	6	15	89	345	459	458	144	16	0	0	1529

Normal Values (1971-2000)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg Max	39.5	46.8	57.5	67.9	77.5	87.1	92.5	90.8	82.1	70.7	54.5	42.9	67.5
Avg Min	16.1	21.5	31.4	42.2	52.5	62.3	67.3	65.1	55.5	43.2	30.2	19.9	42.3
Avg Mean	27.8	34.2	44.5	55.1	65.0	74.7	79.9	78.0	68.8	57.0	42.4	31.4	54.9
Precip	0.86	1.00	2.59	3.07	5.08	5.23	4.10	3.27	3.67	2.77	2.10	1.06	34.8
Snow	4.8	4.9	3.4	0.9	0.1	0	0	0	0	0.2	1	3.7	18.8
Heat DD*	1153	864	637	315	106	7	0	4	48	265	679	1042	5120
Cool DD*	0	0	0	17	106	298	461	405	163	15	0	0	1465

Departure From Normal

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg Max	-7.2	-9.3	-2.7	5.0	-3.5	2.1	-1.1	3.6	1.2	4.5	2.4	-0.8	-0.5
Avg Min	-3.6	-4.5	-2.2	-0.4	-1.8	1.4	1.0	0.0	-1.9	-0.2	1.5	0.8	-0.8
Avg Mean	-5.4	-7.0	-2.5	2.7	-2.6	1.8	-0.1	1.7	-0.4	2.1	1.9	0.0	-0.6
Precip	-0.45	-0.44	0.19	0.38	-1.13	2.45	-0.27	0.77	-0.15	-1.62	-0.2	-0.99	-1.46
Snow	-0.4	-1.7	0.1	-0.9	-0.1	0.0	0.0	0.0	0.0	-0.2	-1.0	-3.7	-7.9
Heat DD*	168	193	55	-73	67	-7	0	-4	-7	-67	-38	-35	252
Cool DD*	0	0	6	-3	-18	47	-2	53	-20	1	0	0	64

*Daily values were computed from mean temperatures. Each degree that a day's mean is below (or above) 65°F is counted for 1 heating (or cooling) degree day. [1]Number of days; [2]PMC Precipitation; T=Trace

Official Recording Station, Manhattan, Kansas

CLIMATIC SUMMARY 2010

Temperature Extremes: -10ºF January 10; 107ºF August 7

First Killing Frost*: October 27 (low of 31ºF) *Frost = 32ºF or less

Last Killing Frost: April 8 (low of 30ºF) Number of Frost Free Days: 203

Temperature: January was the 14th coldest since 1890. The cold winter conditions prevailed in February. Temperatures averaged 6.9 degrees colder than normal, which placed it as the 17th coldest February on record. Chilly weather dominated the month of March. The warmest day of the month was the last day of the month. Despite a warm end to the month March ended up 2.5 degrees colder than normal continuing the colder than normal trend for the year. April was warmer than normal. The last freeze occurred on the 8th when temperatures dipped to 30°F. May was colder than normal. Warm weather really did not arrive until the end of the month, with the warmest reading on May 29. The first day with temperatures above 80°F was the 23rd. June was warmer than normal. While temperatures did not set records, high humidity values brought heat indices well above 100, despite the warm weather to end the month. July averaged slightly cooler than normal. High temperatures did not break the century mark until the last day of the month. Heat indices, however, were frequently above 100 as humidity levels were high. August saw warmer than normal temperatures. With a mean temperature of 79.7°F, it was the 41st warmest since 1890. This places it at the warmer end of the middle of the range. The warmest August was in 1934 where the mean temperature was 86.6°F, and there were 23 days with high temperatures above 100°F. Eight days reached 100°F this year, compared to the average of 4 days. No records were set. September was just barely cooler than normal at one tenth of a degree. With a mean of 69.2°F, it is right in the middle of range for temperatures since 1890. October was slightly warmer than normal. While the highs were warmer than normal, the lows ranged below normal. The first frost of the season occurred on the 28th, which was 2 weeks later than average. November was warmer than normal. The swing between daily highs and lows was greater than average, with the largest swing on the 25th. Temperatures that day went from a high of 60°F to a low of 17°F. The mean temperature was only a tenth of a degree cooler than normal in December. Temperatures averaged slightly warmer than normal for the year.

Precipitation and Storms: Drier than normal conditions prevailed in January, despite the lower than normal precipitation, January was memorable for the persistent fog and cloud cover. Fog was reported on 10 days, much of it occurring when temperatures were below freezing. Snow totals were lower than normal for February. Although light, precipitation fell on half of the days of the month. March precipitation was slightly above normal, as was snowfall. April was wetter than normal. The last half of the month was marked by more wind than usual, and 3 days with thunder. Some minor tree damage was reported, but no hail. May was drier than normal, despite having 14 days with precipitation. There were 6 days with thunderstorms none of which produced significant damage or rainfall. Most of the rain events were the result of very light drizzle, although 3 days had rainfall amounts in excess of half an inch. The highest daily rainfall total was 1.27 inches on May 29. June was much wetter than normal. The extra moisture brought the annual total to above normal as well. The big feature of the month was the rainfall from the 13th through the 17th. Flooding was a problem in various locations. July rainfall was heaviest in the first half of the month and the total for the month was slightly above normal. Greater than normal precipitation continued in August, though not as ample as the previous year. On August 13, a severe storm with 93 mile per hour winds caused extensive damage to trees and power lines. The large 85-ft tall ponderosa pine in front of the PMC's Office was blown over in the storm. September rainfall was slightly less than normal. While there were 18 days with precipitation, the total for the month was below normal. Despite the dry conditions for the month, the area was still ahead on precipitation for the year. The dry, fall pattern continued in October. There were only 6 days with precipitation. The month ended 1.62 inches below normal and 0.23 inches below normal for the year. Only a trace of snow was recorded in November, thus the drier than normal trend continued. Only a trace of snow fell in December, in stark contrast to last year, with only 0.07 inches of precipitation, which tied the 9th driest December on record.

Excerpts from "Monthly Weather Summary" for Manhattan, Mary Knapp, State Climatologist. Additional comments by John M. Row.

STUDIES

Studies are planned and developed by the PMC Staff to solve high-priority problems identified in the Center's Long-Range Program. All PMC studies are listed as part of the National Plant Materials Program projects. Currently 23 studies were active in on-site (On) and off-site (Off) locations in 2010 (Table 1). Details of active studies can be found on the subsequent pages.

Table 1. Status of studies conducted by PMC Staff.

Study No.	Study Name	Site Location	Status	Start Date	End Date	Project No.
20A107T	Seed storage study	On	Active	1973	2020	RN 1.1
20A126L	Adaptation trials of superior grasses and forbs selected for advanced testing	On	Active	1992	2030	NA 1.1
20A215H	Rrps of little bluestem	On	Active	1992	2012	RA 1.1
20C007Ta	Propagation of Mead's milkweed	On	Active	1996	2012	NA 1.1
20I003L	Evaluation of miscellaneous grasses	On	Active	1970	2020	NA 1.1
20I010K	Evaluation of miscellaneous trees and shrubs	On	Active	1961	2030	CP 4.1
20I026K	Evaluation of hackberry	On	Active	1979	2012	CP 4.1
20I037K	Evaluation of selected common hackberry	On	Active	1988	2013	CP 4.1
20I038K	Bur oak seed source study	On	Active	1991	2015	CP 4.1
20I039E	Evaluation of switchgrass germplasm for rhizomatous characteristics	On	Active	1992	2012	CP 4.1
20I041K	Evaluation of Siberian elm	Off	Active	1997	2020	CP 4.1
KSPMS-T-9902-OT	Assist Native American Tribes with the reestablishment of culturally significant plants	OK, KS, NE	Active	1999	2020	- - -
KSPMS-T-0001-CR	Conservation field trial: reclamation of blue shale outcrop sites in Jewell County, Kansas	Off	Active	2000	2012	ML 1.1
KSPMS-T-0201-CR	Plant species for revegetation of natural and man-induced saline areas	Off	Active	2002	2012	CP 3.1
KSPMC-T-0502-RA	Laboratory evaluation of plant materials to determine seed analysis, germination, and propagation techniques	On	Active	2004	2020	RA 1.1
KSPMC-P-0601-RA	Increasing seedling vigor and stand establishment of giant sandreed	On	Active	2006	2012	RA 1.1
KSPMS-T-0705-PA	Evaluation of 'Laramie' Tifton burclover interseeding trial in established cool-season forage grasses	Off	Active	2006	2012	PA 1.1
KSPMC-ST-0801-RA	Big bluestem Inter Center Strain Trial	On	Active	2008	2011	RA 1.1
KSPMC-T-0802-RA	Evaluate sand bluestem germplasm lines with improved seedling establishment under field conditions	On	Active	2008	2011	RA 1.1
KSPMC-T-0803-RA	Evaluation of miscellaneous forbs and legumes	On	Active	2008	2020	RA 1.1
KSPMC-T-1001-WL	Survey of pollinating insects at the Manhattan PMC	ON	Active	2010	2015	WL 1.1
KSPMC-T-1002-CP	Evaluate the adaptability of 'Tropic Sun' Sunn Hemp (*Crotalaria juncea* L.)	On	Active	2010	2010	CP 1.1
KSPMC-T-1003-WL	Evaluation of Chinese chestnut	On	Active		2015	WL 1.1

Advanced Evaluations

Seed Storage Study

Study No. 20A107T

National Project Nos. Critical Areas 1.1, Cropland 2.1, Natural Areas 1.1, Pasture/Hayland 2.1, Rangeland 1.1, Water Quality 4.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: Long-term storage facilities can provide a source of valuable seed stocks without maintaining large numbers of plants for seed production. Bass (1980) underlined the importance of maintaining small samples of many kinds of seeds, indefinitely, for breeding purposes. Seeds stored in unheated buildings are, however, subject to wide fluctuations in temperature and humidity in eastern Kansas, where the average annual humidity ranges from 51 to 81% and average annual temperatures range from -9° to 33°C (16° to 92°F). Such conditions are detrimental to the longevity of grass seeds in storage (Priestly *et al*. 1985).

In 1973, the USDA-SCS built a seed storage facility to preserve valuable seed stocks at the Manhattan Plant Materials Center (PMC), Manhattan, Kansas. This facility is rodent proof and is temperature and humidity controlled. Although the storage requirements for many plant species are known, there is little information available documenting the benefits of a controlled versus an uncontrolled environment for storing native plant seeds in eastern Kansas. Harrington's (1959) rule of thumb is that the percent relative humidity (RH) + temperature in degrees Fahrenheit should not exceed 100 for safe seed storage. Rincker and Maguire (1979) and Rincker (1981) found that even after 14 years, germination was greater than 80% for several grasses stored at -15°C (5°F) and 60% RH (Ackigoz and Knowles 1983).

This study was set up initially to compare the viability and longevity of warm-season and cool-season grasses when the seed storage facility was newly constructed in 1973. Forbs and legumes were added to the study in 1979.

Objective: Evaluate how controlled temperature and humidity and uncontrolled warehouse conditions affect native plant seeds.

Procedure: Seeds of 21 plant species were assembled. Eighteen of the species were native, consisting of 5 forbs, 2 legumes, 11 warm-season grasses, and 1 cool-season grass. Three introduced cool-season grasses were also included in the study.

Seed storage facilities consisted of a seed storage facility with a room with a controlled environment and an uninsulated temporary seed storage facility without a controlled environment. The temporary seed storage facility was wood frame on a concrete slab with clapboard siding. It was subject to wide fluctuations in temperature and humidity. The seed storage facility was of all metal construction and insulated throughout. The environmentally controlled seed storage room itself was sealed to exclude outside air and humidity was.

Temperature and humidity in the seed storage room were controlled by a UNA-DYN (Model A30T) 2 tower, desiccant bed dehumidifier and a standard air conditioning unit. Temperature controls were set to maintain 18.3°C (65°F) summer, 12.8°C (55°F) fall-spring, and -1.1° to 7.2°C (30 to 45°F) in the winter. Relative humidity was maintained between 10 to 20%. A hygro-thermograph was used to monitor temperature and humidity. Each seed lot was divided into 2 portions and placed in burlap and/or cotton duck bags for storage. One sack of each lot was placed in the warehouse in a steel drum to prevent rodent damage. Pest strips containing 2-2 dichlorovynyl dimethyl phosphate (Vapona) (20% AI) were placed in each barrel for insect control. The second sack of each seed lot was placed on shelves inside the seed storage room. The initial purity (see tables) and germination test and subsequent germination

tests were conducted in accordance with the Association of Official Seed Analysts Rules for Seed Testing (Anonymous 1978). Samples of all lots were taken annually thereafter and sent to the Kansas State Board of Agriculture Seed Laboratory through 1993 for standard germination tests. Kansas Crop Improvement Association conducted germination tests from 1994 to the present. The protocol calls for seed lots to be removed from the study when germination test results for that lot fall below 10% of the original test.

No testing was conducted for years 17 and 19 (therefore no data [ND]) in the grasses since year-to-year changes were slight in most cases. No testing was conducted in years 11 and 13 for the forbs. Later on, it was decided that it was not a good idea to skip a year of testing in case viability for a particular lot was declining, so testing was resumed on an annual basis. Testing was discontinued for the uncontrolled storage environment entries after 13 years for warm-season grasses, 7 years for cool-season grasses, and after 6 years for most forbs. Testing was discontinued in 2000 for cool-season grasses in a controlled storage environment following 27 years of study. Results for cool-season grass seed germination test results were last reported in the 2007 Annual Technical Report.

Potential Products: Information Technology

Progress or Status:

Warm-Season Grasses

Seeds of most of the warm-season chaffy grasses continued to decline in germination though test results were up from last year. The viability of 'Garden' sand bluestem (*Andropogon hallii* Hack.) stands at the 29% level after a decline of 60% from last year's test. The viability of 'Kaw' big bluestem (*Andropogon gerardii* Vitman) dropped to 23%, its lowest level to date. Buffalo grass (*Bouteloua dactyloides* [Nutt.] Engelm.) improved 5% over last year and was 1% higher than it was 13 years ago. 'Aldous' little bluestem (*Schizachyrium scoparium* Michx.), dropped 4% from last year and is back to where it was 8 years ago. At 77%, the viability of 'Osage' Indian grass (*Sorghastrum nutans* [L.] Nash) was 2% better than a year ago. 'El Reno' sideoats grama (*Bouteloua curtipendula* Michx.) was back to 57%, the same level of viability as 2 years ago. Among the non-chaffy warm-season grasses the viability of 'Pete' eastern gamagrass (*Tripsacum dactyloides* [L.] L.) continued to drop, at 31% it is where it stood 23 years ago. 'Blackwell' (*P. virgatum* L.) an upland-type of switchgrass, increased 1% from last year to 91%, the same level as 6 years ago. The viability of 'Kanlow' switchgrass (*Panicum virgatum* L.), a lowland-type of switchgrass, went the opposite direction with a decline of 5% over the previous year and back to the 57% level of 2 years ago. **'**Bend' sand lovegrass (*Eragrostis trichodes* [Nutt.] Wood) fell sharply to 23%, down 34% from last year. Refer to Tables 1A, 1B, and 1C for germination test results of warm-season grasses for the past 37 years.

The warm-season grasses in this study continue to sustain a level of viability that exceeds the minimum acceptable level established in Kansas Seed Certification Standards, except for big bluestem and sand bluestem.

Forbs

Two forb entries remain in the controlled storage environment test following 31 years of storage, 'Kaneb' purple prairie clover (*Dalea purpurea* Vent.), and 'Prairie Gold' Maximilian sunflower (*Helianthus maximiliani* Schrad.) continue to show viability (Tables 2A and 2B). 'Kanoka' round-head lespedeza (*Lespedeza capitata* Michx.), which was added to the study in 1985, continues to be viable following 25 years of storage in a controlled storage environment. Prairie Gold remained steady with last year's results at 6% and will finally be dropped from the study. Kaneb fell back to 64%, 4% lower than last year and 1% higher than 6 years ago. Kanoka was down 6% from the previous year and at 56% is at its lowest level in the study.

Table 1A. Germination test results for selected warm-season grasses over a period of years under controlled and uncontrolled storage environments.

Species/Initial Purity	Entry	Storage	Years of Storage 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Andropogon gerardii	Kaw	Cont.	63	74	82	73	65	73	87	77	81	78	74	66	78	80	69	88	57
Purity: 82.31		Uncont.	63	77	68	77	65	62	42	29	13	1	TE						
Andropogon hallii	Garden	Cont.	74	80	77	79	81	81	86	70	87	78	81	78	85	71	70	88	79
Purity: 96.39		Uncont.	74	76	75	74	76	73	68	24	33	30	13	4	1	TE			
Bouteloua curtipendula	El Reno	Cont.	22	66	76	69	73	73	72	70	69	74	76	71	64	71	78	86	73
Purity: 92.17		Uncont.	22	72	74	79	74	68	66	64	45	31	24	5	TE				
Bouteloua dactyloides	PMT-	Cont.	73	72	72	73	70	74	60	70	44	57	71	57	61	76	74	45	67
Purity: 58.20	1181	Uncont.	73	60	71	76	81	67	62	66	43	50	42	48	18	4	TE		
Eragrostis trichodes	Bend	Cont.	77	82	68	78	76	73	72	76	73	71	83	60	61	67	67	63	ND
Purity: 99.83		Uncont.	77	78	72	57	51	20	9	22	0	TE							
Panicum virgatum	Blackwell	Cont.	85	90	89	92	92	92	95	91	94	95	94	93	93	91	92	98	95
Purity: 99.98		Uncont.	85	91	91	90	92	81	84	81	80	71	62	43	25	10	TE		
Panicum virgatum	Kanlow	Cont.	66	70	70	72	74	68	67	73	72	70	77	74	61	65	67	68	65
Purity: 99.52		Uncont.	66	74	65	71	64	54	45	37	31	16	13	2	TE				
Schizachyrium scoparium	Aldous	Cont.	70	78	76	70	73	66	78	69	64	72	68	59	74	60	64	81	60
Purity: 85.06		Uncont.	70	71	76	67	63	54	44	36	22	12	6	4	6	TE			
Sorghastrum nutans	Osage	Cont.	75	64	78	75	71	74	84	72	79	69	76	63	74	59	67	88	70
Purity: 87.39		Uncont.	75	68	83	70	48	44	30	5	7	0	TE						
Spartina pectinata	PMK-	Cont.	67	75	68	60	48	55	54	56	24	11	51	46	64	45	48	38	24
Purity: 77.71	1800	Uncont.	67	63	34	0	TE												
Tripsacum dactyloides	Pete	Cont.	10	41	27	43	24	39	31	46	41	36	47	31	43	37	32	58	28
Purity: 99.55		Uncont.	10	50	40	46	35	40	17	26	24	4	TE						

Table 1B. Germination test results for selected warm-season grasses over a period of years under the controlled storage environment.

Species	Entry	Years of Storage 0	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Andropogon gerardii	Kaw	63	ND	77	ND	60	68	61	70	40	45	40	52	39	41	30	36	47	27	28
Andropogon hallii	Garden	74	ND	88	ND	73	82	75	76	74	71	37	71	56	65	47	48	57	49	39
Bouteloua curtipendula	El Reno	22	ND	88	ND	75	79	69	67	70	68	74	66	64	69	62	68	60	62	61
Bouteloua dactyloides	PMT-1181	73	ND	75	ND	61	69	75	72	45	67	67	60	72	71	66	49	57	59	63
Eragrostis trichodes	Bend	77	50	ND	70	55	ND	64	66	48	53	30	50	51	28	33	26	42	56	47
Panicum virgatum	Blackwell	85	ND	96	ND	93	93	90	90	96	88	85	87	93	92	91	91	89	89	82
Panicum virgatum	Kanlow	66	ND	77	ND	73	59	63	69	66	79	57	64	63	71	58	66	49	64	62
Schizachyrium scoparium	Aldous	70	ND	65	ND	66	ND	67	68	61	76	62	72	64	70	61	67	63	67	65
Sorghastrum nutans	Osage	74	ND	78	ND	71	93	85	78	60	75	83	81	78	89	77	72	79	78	78
Spartina pectinata	PMK-1800	67	ND	17	ND	9	16	3	1	TE										
Tripsacum dactyloides	Pete	10	ND	47	ND	53	50	46	47	43	45	43	44	42	35	42	38	39	38	37

Table 1C. Germination test results for selected warm-season grasses over a period of years under the controlled storage environment.

		Years of Storage			
Species	Entry	0	35	36	37
Andropogon gerardii	Kaw	63	28	29	23
Andropogon hallii	Garden	74	49	48	29
Bouteloua curtipendula	El Reno	22	57	68	57
Bouteloua dactyloides	PMT-1181	73	63	63	68
Eragrostis trichodes	Bend	77	57	23	
Panicum virgatum	Blackwell	85	88	90	91
Panicum virgatum	Kanlow	66	56	61	56
Schizachyrium scoparium	Aldous	70	66	65	61
Sorghastrum nutans	Osage	74	73	75	77
Tripsacum dactyloides	Pete	10	39	36	31

Table 2A. Germination test results for selected forbs over a period of years under controlled and uncontrolled storage environments.

			Years of Storage																
Species/Initial Purity	Entry	Storage	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dalea purpurea	Kaneb	Cont.	81	77	84	83	87	85	82	86	83	82	86	ND	86	ND	81	64	77
Purity: 98.61		Uncont.	81	83	83	77	79	82	75	59	39	20	18	TE					
Helianthus maximiliani	Prairie	Cont.	66	70	67	68	81	72	77	65	69	71	61	ND	62	ND	38	39	62
Purity: 99.66	Gold	Uncont.	66	65	57	36	38	1	TE										
Heliopsis helianthoides	Midas	Cont.	78	74	68	68	65	61	69	33	49	54	54	ND	39	ND	31	36	56
Purity: 98.72		Uncont.	78	65	65	56	51	40	6	TE									
Lespedeza capitata	Kanoka	Cont.	83	89	86	94	85	ND	88	ND	80	91	92	89	84	97	68	72	43
Purity:		Uncont.	83	83	30	32	ND	ND	15	TE									
Liatris pycnostachya	Eureka	Cont.	56	44	17	13	15	24	ND	6	15	11	10	ND	13	ND	11	3	3
Purity: 97.80		Uncont.	56	30	2	TE													
Ratibida pinnata	Sunglow	Cont.	82	89	81	82	79	70	68	62	60	55	39	ND	24	ND	6	11	11
Purity: 82.02		Uncont.	82	93	76	24	8	2	TE										
Salvia azurea var	Nekan	Cont.	30	33	37	26	29	33	26	21	22	19	11	ND	26	ND	23	4	21
grandiflora Purity: 98.57		Uncont.	30	30	14	14	6	5	TE										

Table 2B. Germination test results for selected forbs over a period of years under the controlled storage environment.

		---------- Years of Storage ----------															
Species	Entry	0	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Dalea purpurea	Kaneb	81	71	85	68	54	60	96	76	67	63	77	68	68	74	68	64
Helianthus maximiliani	Prairie Gold	66	43	17	79	19	20	11	40	17	20	25	30	16	20	6	6
Heliopsis helianthoides	Midas	78	26	22	34	11	10	30	25	8	6	6	5	1	TE		
Lespedeza capitata	Kanoka	83	79	69	59	70	64	66	60	62	56						
Liatris pycnostachya	Eureka	56	0	TE													
Ratibida pinnata	Sunglow	82	4	TE													
Salvia azurea var *grandiflora*	Nekan	30	9	7	4	3	TE										

Tables Legend: Cont. = controlled; Uncont. = uncontrolled; ND = no data; TE = testing ended

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Adaptation Trials of Superior Grasses and Forbs Selected for Advanced Testing

Study No. 20A126L

National Project Nos. Critical Areas 1.1, Cropland 2.1, Natural Areas 1.1, Pasture/Hayland 2.1, Rangeland 1.1, Water Quality 4.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: Part of the release process for a superior plant material selected for release is to test the plant's area of adaptation. The Manhattan Plant Materials Center (PMC), Manhattan, Kansas, is often called upon by other PMCs and other entities for the purpose of testing superior plants that they have selected for release.

Objective: The purpose of this study is to provide a standard means by which superior plants will be evaluated for adaptation.

Procedure: The experimental design used for this study is a randomized complete-block with a 3X replicated planting. The superior plant will be established in 3.05-m (10-ft) rod rows with 1.83-m (6-ft) spacing (unless otherwise specified) between rows with a Kincaid Cone Planter (Kincaid Equipment Manufacturing, Haven, KS, USA). A known cultivar will be planted adjacent to the superior plant as a standard of comparison (if available). Plantings are irrigated as needed during the initial growing season to aid establishment. Factors for evaluation will include plant vigor, stand, seed production, and resistance to disease, drought, and cold.

Potential Products: Information technology and cultivar release.

Progress or status: The following warm-season grass species are currently under test at Manhattan: big bluestem (*Andropogon gerardii* Vitman), blue grama (*Bouteloua gracilis* [Willd. ex Kunth] Lag. ex Griffiths), and little bluestem (*Schizachyrium scoparium* [Michx.] Nash), which is part of an Inter Center Strain Trial (ICST), to test the adaptation of to the local climate. There are currently no forb entries under test in this study.

Grasses

Big Bluestem: The ability to establish a stand of native grass from seed in crucial to the success of a released variety. Therefore, carry-over seed from the big bluestem ICST spaced plant nursery, Study No. KSPMC-ST-0801-RA, was used to plant rod rows of 9 entries.

Big bluestem prevarietal releases and cultivars under test in rod row seeding at Manhattan.

Release Name	Accession Number	Origin	Source of Plant Material
Hampton Germplasm	9056854	AR, MO, and OK	Booneville PMC
OZ-70 Germplasm	9078831	73 accessions from AR, MO, and OK	Elsberry PMC
	9083274	Logan Co., AR	Elsberry PMC
Rountree	474216	Monona County, IA	Elsberry PMC
Kaw	421276	Flint Hills south of Manhattan, KS	Manhattan PMC
	483446	southcentral KS and eastern OK	Manhattan PMC
Pawnee	9005159	Pawnee County, NE	Stock Seed Farms
Bonanza	641701	derived from Pawnee	Stock Seed Farms
Goldmine	641702	derived from Kaw	Sharp Bros. Seed Co.

The trial, planted 17 June 2008, was not evaluated the establishment year. Maintenance consisted of mowing several times throughout the growing season to control weed competition. Stand ranged from

81.7% for 'Bonanza' to 15% for Hampton Germplasm in 2010. Stand improved for all entries following 3 years of plant growth. Bonanza surpassed 'Kaw' for the 1st place ranking. 'Goldmine' edged out Accession 483446 for 3rd place. There were no changes in rank for 'Pawnee' and Accession 9083274. OZ-70 Germplasm surpassed 'Rountree' for 7th place and Hampton remained at the bottom of the rankings in 9th place.

Mean percent stand for nine big bluestem prevarietal release and cultivar seeding trial at Manhattan.

Entry	Stand (%)		Rank	
	Mean	Range	2009	2010
Bonanza	81.7	66.7 – 90.0	3	1
Kaw	76.1	68.3 – 88.3	1	2
Goldmine	63.4	41.7 – 81.7	4	3
483446	63.3	51.7 – 73.3	2	4
Pawnee	58.9	41.7 – 71.7	5	5
9083274	35.5	8.3 – 60	6	6
OZ-70 Germplasm	28.3	8.3 – 47.7	8	7
Rountree	27.8	5 – 58.3	7	8
Hampton Germplasm	15.0	11.7 – 16.7	9	9

Blue grama: Compare performance of blue grama accessions 421282, 421283, 9050485, with 'Hachita' and Bad River Ecotype blue grama releases in an ICST. Participating PMCs are James E. Bud PMC, Knox City, Texas, and Elsberry PMC, Elsberry, Missouri. The Manhattan PMC provided seeds of accessions 421282, 421283, and 9050485, to participating PMCs. Participating PMCs were invited to add a "standard of comparison" of their choice. On June 10, 2008, a replicated planting was made at Manhattan involving five accessions listed in the following table. The James E. Bud PMC established rod-row plantings of 421282, 421283, and 9050485, in 2007.

Accession	Release Name	Origin
421282	N/A	southern Nebraska/ northwest Kansas
421283	N/A	western Kansas/Texas Panhandle
9050485	N/A	Nebraska
591814	Bad River Ecotype	Haakon County, South Dakota
439880	Hachita	Hachita Mountain, New Mexico

N/A = Not Applicable

Results of blue grama ICST at Manhattan, Kansas and Knox City, Texas, for the 2010 growing season.

Location / Accession	Manhattan			Knox City	
	% Stand	Foliage Height[1]	Plant Height[1]	% Stand	Plant Height[1]
421282	67.7	35.4	69.7	95	61
421283	82.8	41.4	66.6	90	51
9050485	71.9	45.0	72.7	70	48
591814	82.8	25.7	49.0	-	-
439880	71.9	56.4	99.0	-	-

[1]Centimeters

Stand improved for all entries due to increased plant growth. Accession 421283 and Bad River had the best stands at 82.8% each. Hachita was superior in plant height and foliage height to all other entries.

Little Bluestem: Seeds of OK Select Germplasm little bluestem, accession 9029926, were planted 17 June 2008, at the request of the James E. Bud PMC, Knox City, Texas. 'Cimarron' little bluestem was included as a "standard of comparison." A malfunctioning sprayer caused herbicide damage to some of the plots this year biasing any evaluations that might have been made. The situation will be reevaluated in 2011 to determine whether it is feasible to resume evaluations.

Evaluation of Little Bluestem

Study No. 20A215H

National Project No(s). Rangeland 1.1

Study Leader: Richard L. Wynia, Plant Materials Center Manager

Introduction: Little bluestem (*Schizachyrium scoparium* Michx.) is a native, warm-season, perennial bunchgrass with a deep, fibrous root system. It is widely distributed over much of North America extending from Quebec, Canada, and Maine west to Alberta, Canada, and Idaho, and southward to Arizona and Florida. It occurs with other tall-grass prairie species, such as big bluestem, Indian grass, and switchgrass, in the plains where moisture conditions are favorable. In the drier mixed-grass prairie it is associated with blue grama, sideoats grama, green needlegrass, western wheatgrass, prairie sandreed, and needle-and-thread. It possesses moderate drought and shade tolerance. It also tolerates a wide range of soils with adequate soil moisture.

Problem: There is a need for an adapted cultivar of little bluestem for range seeding, critical area planting, recreational area development, and other conservation uses in western Kansas and Nebraska.

Objective: To utilize recurrent selection techniques to improve 421554, (PMK-1840) germplasm and select a superior little bluestem cultivar for the Kansas/Nebraska Service Area.

Procedure: Flats of little bluestem were planted in the greenhouse in spring 1992. Seedlings were selected at the 2- to 3-leaf stage and transplanted to 164-mL (10-in^3) single cell Ray Leach "Cone-tainers"^{TM} for continued development in the greenhouse. Seedlings were selected based on performance and root morphology. Criteria such as speed of germination, coleoptile length, and subcoleoptile internode root production were used to select seedlings in the greenhouse screening. Plants were transplanted to a 2- x 2-m (7- x 7-ft) spaced plant field nursery at the Manhattan Plant Materials Center, Manhattan, Kansas, approximately 6 weeks later.

Plants will be evaluated for vigor, forage production, flowering date, disease resistance, seed production, and seed size. A grid-type evaluation system will be used to make selections of plants for inclusion in a polycross nursery. Evaluations will be conducted for 2 to 3 years with 10 to 20% of the nursery plants selected. Seed from the selected plant polycross will be tested against standard varieties or used to begin another cycle of recurrent phenotypic selection.

Potential Products: Cultivar Release

Progress or Status: Minimal maintenance and observations were conducted this year. Seed was not collected from plots this year.

Increasing Seedling Vigor and Stand Establishment of Giant Sandreed

Study No. KSPMC-P-0601-RA

National Project No(s). Rangeland 1.1, Critical Areas 1.1

Study Leader: Richard L. Wynia, Plant Materials Center Manager

Introduction: Giant sandreed (*Calamovilfa gigantea* [Nutt.] Scribn. & Merr.) is a tall, native, robust, rhizomatous, warm-season perennial grass. It is found growing on sandy hills, dunes, and along stream margins in southern Kansas, Oklahoma, from Texas to Arizona, and from Kansas to Utah.

Problem: The genus Calamovilfa in general has weak seedling vigor and trouble with stand establishment. To ensure a varieties' success in the commercial market place it must have a certain level of seedling vigor and ability to form a productive stand in a reasonable length of time. Commercial seed producers will not tolerate or produce a cultivar with substandard vigor and slow establishment.

Objective: Improve stand establishment of giant sandreed by selecting plants with improved seed production qualities.

Procedure: A bulk seed sample was first divided into 3 fractions based on weight (Heavy, Heavy 2X, and Heaviest) using a South Dakota Seed Blower to determine which weight fraction had the best germination. An unsorted sample was kept as a control. Approximately 1 pound of seed was then blown on the South Dakota Seed Blower at full air strength on a full length column for 1 minute. To provide adequate separation, only 50-100 ml of seed was blown at a time. The light sample trapped at the top of the column was collected, labeled, and set aside. The heavier seed from the bottom of the column was also collected. A uniform sample was pulled from this material and labeled as the "Heavy" fraction. The rest of the heavy seed was run through the blower again at full air strength on a full length column for 1 minute. The seed from the top of the column was labeled and set aside. A uniform sample was pulled from the bottom of the column and labeled as the "Heavy 2X" fraction since it had been blown twice. The remaining seed from the bottom of the column was run through the Dakota Seed Blower again at full air power and full length column for 1 minute, but yielded little separation. The column was then shortened by removing the middle section, and the remaining seed was blown at full air power for 1 minute in the short column. A uniform sample of the seed remaining in the bottom of the blower was collected and labeled as the "Heaviest" fraction. Seed weights for each fraction, Unsorted, Heavy, Heavy 2X, and Heaviest were obtained on an analytical balance using 10 replications of 100 seeds. Seed size and speed of germination will be evaluated after every cycle of selection to assess improvements.

Potential Product: Technology Transfer and Cultivar Release

Progress or Status: Seed was harvested from the plots this year.

Big Bluestem Inter Center Strain Trial

Study No. KSPMC-ST-0801-RA

National Project No(s). Cropland 2.1, Rangeland 1.1

Study Leader: Richard L. Wynia, Plant Materials Center Manager

Introduction: Big bluestem, *Andropogon gerardii* Vitman, is a warm-season, perennial grass native to the tall and mid-grass regions of the central and southern Great Plains States of North America. It is generally characterized as a tall grass and has short thick rhizomes and a deeply penetrating root system. It is considered an excellent native forage grass and has high potential for use in establishing range, hay, and pasture land and in stabilizing critically eroding areas. There have been several prevarietal releases of big bluestem made in recent years by Plant Materials Centers (PMCs) in Booneville, Arkansas, and Elsberry, Missouri. Comparative evaluations of these prevarietal releases and a selection from the Manhattan Plant Materials Center, Manhattan, Kansas, are needed to further document their performance and adaptation in other geographical regions. Information gained from these plantings may be used to provide data to support elevating lower class releases (e.g., source identified and selected class) to a higher release category (e.g., tested class or cultivar). In addition to these releases, standard big bluestem cultivars commonly used in NRCS conservation plantings and programs will be included in the trial along with other cultivars developed by the USDA-ARS, Lincoln, Nebraska.

Objective: Evaluate big bluestem prevarietal releases across locations for potential upgrade in class of release.

Procedure: Big bluestem entries were established at the following PMCs: Booneville, Arkansas; Elsberry, Missouri; Coffeeville, Mississippi; and Manhattan, Kansas; in 2008. Plants were grown out by each participating PMC, (see Table 1). At Manhattan, plants were transplanted from 164 mL (10 in^3) single cell Ray Leach "Cone-tainers"^{TM} to randomized plots on a 2.74 m x 5.49 m (9 ft x 18 ft) plot spacing on a Belvue silt loam in Field C-2, 9 June 2008. The individual plants were spaced 0.9 m (3 ft) apart. Plant height was measured prior to each harvest. Four plants per plot were hand-harvested by shearing the plants at ~20.3 cm (8 in) above ground level and weighed. A grab sample of each plot was taken to determine dry matter yield. All-Pairwise Comparisons Tests were run on all data (Analytical Software, 1985-2003).

Table 1. Big bluestem prevarietal releases and cultivars under test in Inter Center Strain Trial.

Release Name	Accession Number	Origin	Source of Plant Material
Hampton Germplasm	9056854	AR, MO, and OK	Booneville PMC
OZ-70 Germplasm	9078831	73 accessions from AR, MO, and OK	Elsberry PMC
Refuge Germplasm	9078832	AR	Elsberry PMC
	9083274	Logan Co., AR	Elsberry PMC
Northern Missouri Germplasm	9079000	accessions from northern MO	Elsberry PMC
Rountree	474216	Monona County, IA	Elsberry PMC
Kaw	421276	Flint Hills south of Manhattan, KS	Manhattan PMC
	483446	southcentral KS and eastern OK	Manhattan PMC
Pawnee	9005159	Pawnee County, NE	Stock Seed Farms
Bonanza	641701	derived from Pawnee	Stock Seed Farms
Goldmine	641702	derived from Kaw	Sharp Bros. Seed Co.

Progress or Status: The first harvest was conducted 22 July 2010 at the late boot stage and an aftermath harvest was conducted 9 November 2010. Plant vigor was noted prior to first harvest.

First Harvest: 'Kaw' ranked 1st in dry-matter yield though not significantly different from the next 7 rankings, while 'Goldmine', which was derived from Kaw, ranked 2nd. Accession 483446 (a Kansas entry) also improved from 9th to 4th place this year. Hampton Germplasm was top ranked in 2009 but fell to 8th place in 2010. 'Bonanza' which was derived from 'Pawnee' improved to 6th place. Pawnee fell from 5th to 10th place. Accession 9083274 slipped to 11th place while Refuge Germplasm moved up to 9th place, Table 2. Hampton produced the most vigorous looking plants but lacked the size of 7 higher ranked entries in terms of dry-matter yield. In terms of plant height 'Rountree' sustained the top ranking for the second year. It barely edged out Bonanza which ran a close second, the two not significantly different from Northern Missouri Germplasm. Goldmine and Kaw improved from 6th and 8th rankings last year. Hampton declined the most in rank for height going from 4th last year to 10th this year, Table 3. There was not a significant difference in vigor for most to the entries with Refuge being least vigorous of the 11 entries. Diseased foliage was a factor in Pawnee's poor performance this year.

Table 2. Mean comparisons of first harvest yield*, big bluestem ICST, 22 July 2010, Manhattan.

Entry	Dry Matter Yield (kg)	t/ha[1†]		Rank Previous Year
Kaw	3.3	9.8	A	4
Goldmine	3.2	9.6	AB	6
Rountree	3.1	9.4	ABC	3
483446	2.8	8.2	ABCD	9
OZ-70	2.7	8.0	ABCD	2
Bonanza	2.5	7.5	ABCDE	8
Northern Missouri	2.4	7.1	BCDE	7
Hampton	2.3	6.9	CDE	1
Refuge	2.2	6.6	DE	11
Pawnee	2.0	6.1	DE	5
9083274	1.8	5.3	E	10

*Relative yields due to plant spacing; †Means in a column followed by the same letter are not significantly different from one another at P<0.05. [1]Metric tons/hectare

Table 3. Mean comparisons of plant height and plant vigor, big bluestem ICST, 20 July 2010, Manhattan.

Entry	Plant Height† (cm)		Rank Previous Year	Plant Vigor† Rating (1-9)*	
Rountree	227	A	1	2.8	A
Bonanza	225	A	3	4.0	ABC
Northern Missouri	212	AB	2	2.8	A
Goldmine	203	BC	6	3.5	AB
Kaw	200	BC	8	3.8	AB
Pawnee	196	BC	5	3.8	AB
OZ-70	196	BC	7	3.0	A
9083274	196	BC	11	3.8	AB
483446	193	C	10	4.5	BC
Hampton	189	CD	4	2.8	A
Refuge	174	D	9	5.3	C

*Rating 1-9, least-most; †Means in a column followed by the same letter are not significantly different from one another at P<0.05.

Aftermath Harvest: Six entries were ranked the same as last year with Kaw and 483446 holding the 1st and 2nd rankings and Pawnee, Refuge, and Bonanza rounding out the bottom of the field. Forage yields were significantly lower than the first harvest due to drier and warmer weather setting in by mid July, Table 4.

Table 4. Mean comparisons of aftermath harvest yield*, big bluestem ICST, 9 November 2010, Manhattan.

Entry	Dry Matter Yield (g)	t/ha[1†]		Rank Previous Year
Kaw	530	1.58	A	1
483446	507	1.52	A	2
Goldmine	502	1.50	A	4
Rountree	488	1.46	AB	7
OZ-70	459	1.37	ABC	3
9083274	336	1.00	BCD	6
Hampton	319	0.95	CD	8
Northern Missouri	286	0.85	D	5
Pawnee	222	0.66	DE	9
Refuge	211	0.63	DE	10
Bonanza	133	0.40	E	11

*Relative yields due to plant spacing; †Means in a column followed by the same letter are not significantly different from one another at P<0.05. [1]Metric tons/hectare

Accession 9083274 responded with the greatest regrowth in terms of plant height, substantially taller but not significantly different from the 5 tallest entries at the end of the growing season. Goldmine and OZ-70 Germplasm improved to take the 2nd and 3rd rankings leaving Kaw down one from last year in 4th place. Accession 483446 dropped from 1st to 6th and Bonanza went from 10th to 9th in 2010, Table 5.

Table 5. Mean comparisons of plant height, big bluestem ICST, Manhattan, 9 November 2010.

Entry	Plant Height† (cm)		Rank Previous Year
9083274	133	A	2
Goldmine	114	AB	7
OZ-70	109	AB	6
Kaw	107	AB	3
Hampton	104	AB	11
483446	99	BC	1
Refuge	96	BC	9
Rountree	92	BC	10
Bonanza	73	CD	4
Pawnee	54	D	8
Northern Missouri	49	D	5

†Means in a column followed by the same letter are not significantly different from one another at P<0.05.

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Cultural Evaluations and Special Studies

Propagation of Mead's Milkweed

Study No. 20C007Ta

National Project No(s). Natural Areas 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: Mead's milkweed (*Asclepias meadii* Torr. *ex* Gray) is a federally-listed, threatened species. The Plant Materials Program Strategic Plan has identified the recovery of threatened species as an emerging regional and national resource need. This study was initiated in 1996 at the request of the Kansas Biological Survey, Lawrence, Kansas. Seeds were collected that year on the Rockefeller Native Prairie (RNP) near Lawrence. Germination studies were conducted on the few seeds that were available for collection. The initial seedlings obtained from the germination studies were transplanted to single cell Ray Leach "Cone-tainers"^{TM} in 1997 and grown out in the greenhouse-lathhouse-complex; the first field planting that year was to a buffalo grass-tall grass (BG-TG) mixed prairie. In 1998 plantings were made in 2 additional field scenarios: Red Group and Yellow Group on the "Salac Prairie" on the Manhattan Plant Materials Center (PMC), Manhattan, Kansas, and Blue Group and White Group monoculture plantings on a tilled site on the PMC. The Blue Group plants were lifted and transplanted in a row 2.74 m (5.8 ft) from the White Group spring 2002. The prairie plantings were made in open areas of the existing sod where maintenance consists of an annual spring burn. The monoculture plants receive some weed control and tillage of adjacent areas for the first 5 years, afterwhich all tillage was curtailed. The Salac Prairie evolved from a grass-forb seeding mixture study involving various species native to the central Great Plains. Established in 1973, it has been allowed to persist as a prairie since the time when that study was completed. The (BG-TG) mixed prairie evolved from a buffalo grass cultivar trial established in 1992. Grasses and forbs native to the local area began to invade the plots as the study ended. The prairie is currently dominated by Indian grass (*Sorghastrum nutans* [L.] Nash), Illinois bundleflower (*Desmanthus illinoensis* [Michx.] MacM. ex B.L. Robins. & Fern.), and round-head lespedeza (*Lespedeza capitata* Michx.).

Problem: The need exists to learn more about propagation requirements and establishment techniques for establishing Mead's milkweed plants in native prairie. The information will lend itself to recovery efforts for the species.

Objectives: Collect enough seed from identified native populations to establish a maintenance population. The maintenance population will be used to conduct further research on germination requirements, seed storage, and cultural techniques. Monitor the established prairie and monoculture plantings throughout the growing season and collect growth measurements and reproductive data. Collect additional seeds from the RNP near Lawrence, Kansas. Obtain or collect seeds from other plant populations in eastern Kansas to compare performance with the Rockefeller collections.

Procedure: Continue to monitor established plants in the Red, Yellow, Blue, White, Orange, and BG-TG groupings. Refer to the 2004 Annual Technical Report for details on procedures carried out on various phases of this study (USDA NRCS, 2004).

Progress or Status: Established Field Plantings**.** The decision not to burn the plots in 2010 may have been a mistake as plant performance was dismal with a lot of no-shows and poor reproductive effort. Survival declined for all but the Yellow Group. Hardest hit were the Blue Group and BG-TG with over 40% no-shows in each group, Table 1. In most cases, flowering was not observed due to timing of observations and rodent damage. Reproductive activity in the BG-TG was nil. Plants possessing structures sufficient to support reproduction failed to do so in 2010, closing the gap between flowering and non-flowering plants in plant size. No follicles were produced this year. Plant growth increases were noted in the Red Group. There was insufficient data to make many comparisons in the various groups this year (Table 4 to Table 8). Ramets produced in the White and Blue groups persisted.

Table 1. Spring recovery and survival of established plants by group.

Group	Established Plants	Spring Recovery	% Survival	Current Stand	Previous Years Stand	Change
Yellow	7	1	85.7	14.3	14.3	0
Red	16	8	87.5	50.0	68.8	-18.8
Blue	10	3	100.0	33.3	80.0	-46.7
White	11	5	91.7	45.5	54.5	-9
BG-TG	7	3	100.0	42.9	85.7	-42.8

Table 2. Summary of Blue Group flowering by date of observation.

	24 May 2010				June 2010	
Plant No.	Potential Umbels	No. of Umbels	Buds/ Umbel	Flowers/ Umbel	Buds/ Umbel	Flowers/ Umbel
9	2	1	-	-	-	-
9R	2	1	22	NO	10	NO
Total	4	2	22	-	10	-
Mean	2	1	-	-	-	-

NO = Not Observed; R = Ramet

Table 3. Summary of White Group flowering by date of observation.

	24 May 2010		June 2010		
Plant No.	No. of Umbels	Buds/ Umbel	No. of Umbels	Buds/ Umbel	Flowers/ Umbel
4	1	NO	NO	NO	NO
7B	2	NO	NO	NO	NO
11	1	NO	NO	NO	NO
Total	4	NO	NO	NO	NO
Mean	1.3	-	-	-	-

NO = Not Observed

Table 4. Summary of plant growth (length and width measurement means) for the Red Group “Salac Prairie” 12-year old plants.

Date	11 May 2010		24 May 2010		June 2010	
		Range		Range		Range
No. of Plants	8	---	6	---	7	---
No. of Stems	14	---	11	---	12	---
Plant Length (cm)	26	10-61	27	16-70	27	14-71
No. of stems sampled	12	---	8	---	12	---
Leaf Width (mm)	9	2-29	9	2-37	11	2-37
No. sampled	7	---	8	---	5	---
Leaf Length (mm)	44	21-65	45	31-73	53	35-77
No. sampled	7	---	8	---	5	---
Stem Caliper (mm)	---	---	1.8	0.7-3.7	2.8	1.3-4.4
No. sampled	---	---	15	---	2	---

Table 5. Summary of plant growth (length and width measurement means) for the Buffalo Grass-Tall Grass (BG-TG) prairie 13-year old plants.

Date	11 May 2010		24 May 2010		June 2010	
		Range		Range		Range
No. of Plants	1	---	1	---	2	---
No. of Stems	3	---	1	---	2	---
Plant Length (cm)	6	5.6-6.0	36	-	32	21-42
No. of stems sampled	3	---	1	---	2	---
Leaf Width (mm)	Not Measured		4	-	4	3-5
No. sampled			1	---	2	---
Leaf Length (mm)			56	-	41	22-59
No. sampled			1	---	2	---

Table 6. Summary of plant growth (length and width measurement means) for the White Group 12-year old plants.

Date	24 May 2010		June 2010	
		Range		Range
No. of Plants	5	---	4	---
No. of Stems	9	---	5	---
Plant Length (cm)	20	8-40	36	22-58
No. of stems sampled	9	---	5	---
Leaf Width (mm)	11	5-21	34	30-38
No. sampled	8	---	2	---
Leaf Length (mm)	27	15-43	70	68-72
No. sampled	8	---	2	---

Table 7. Summary of plant growth (length and width measurement means) for the Blue Group 12-year old plants.

Date	24 May 2010		June 2010	
		Range		Range
No. of Plants	3	---	3	---
No. of Stems	3	---	4	---
Plant Length (cm)	30	27-33	41	29-58
No. of stems sampled	3	---	4	---
Leaf Width (mm)	12	11-14	13	6-27
No. sampled	3	---	4	---
Leaf Length (mm)	50	35-65	77	62-91
No. sampled	3	---	4	---

Table 8. Size comparisons of plant length, leaf width, length, and stem caliper of flowering and non-flowering Mead's milkweed plants June 2010.

	Stem Samples		Leaf Samples			Stem Samples	
Group	No.	Length (cm)	No.	Width (mm)	Length (mm)	No.	Caliper (mm)
White f*	2	37	1	30	68	1	2.6
White n**	3	35	1	38	72	1	2.7
Blue f*	2	50	2	18	88	2	2.0
Blue n**	2	33	2	9	66	2	1.4
Red f*	1	71	1	37	77	1	4.4
Red n**	11	21	4	5	47	11	1.3
BGTG f*	0	0	0	0	0	0	0
BGTG n**	0	0	0	0	0	0	0

f*=flowering; n**=non-flowering

Literature Cited:

USDA NRCS. 2004. 2004 Annual Technical Report, Manhattan Plant Materials Center, Manhattan, KS. 112p.

Laboratory Evaluation of Plant Materials to Determine Seed Analysis, Germination, and Propagation Techniques

Study No. KSPMC-T-0502-RA

National Project No(s). Forestland 1.1, Natural Areas 1.1, Rangeland 1.1, Water Quality 4.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: The Plant Materials Program deals with a wide variety of plant materials, many of which are not in common use in the seed industry. Therefore, little is known about their germination and propagation requirements. Additionally, purity analysis information and techniques for testing such seeds are lacking. Many of these species are difficult to germinate or the mechanisms required for successful germination are unknown. This study serves as a clearinghouse for species that are not a part of other PMC studies.

Objective: Develop procedures and techniques for testing seeds based on literature reviews and on the wealth of current knowledge about seed development and germination. Establish species protocols based on the results of experiments and study trials.

Procedure: Conduct replicated trials set at various seed-blower settings; temperature regimes in germination tests, time frames, and planting depths. Evaluate seedlings and seedling vigor; conduct viability tests.

Potential Products: Technology Transfer

Progress or Status: Fremont's leather flower, *Clematis fremontii* S. Wats., is currently under study.

Plant production of Fremont's leather flower. Fremont's leather flower, described as one of our rarest plants, is a protected species in Missouri (FGCM, 2009). A collection of Fremont's leather flower was made in Webster Co., Nebraska, in 2008. It was assigned Accession No. 9050534, being a rare endemic, it is desirable to attempt to collect viable seed units and to propagate them and return plants to the place of origin to expand the local plant population.

Seed units were blown with the South Dakota Seed Blower at various aperture settings from 25 to 29 cm. Seed units captured in the top of the air column were examined by bisecting each seed unit. Of the seed units examined, few contained any evidence of caryopsis development. Seed units remaining at the bottom of the air column were weighed. The Mean Seed Unit Weight was .013 grams. The seed unit in *C. fremontii* is called an achene. There were approximately 35,290 achenes per pound in Lot No. 2.

The remaining achenes were placed in fine mesh sacks and surface sterilized using 10:1 solution of purified water and sodium hypochlorite (5.25% AI) for 20 minutes with agitation and allowed to soak for 5 additional minutes. The seeds were triple rinsed in purified water for 2 to 3 minutes each rinse. The achenes were placed between blotters moistened with purified water in plastic germination boxes. The seeds were stratified at 3º to 4ºC (37.4º to 39.2ºF). The boxes were checked weekly and watered as needed. At 68 and 97 days, achenes were removed from stratification and planted to 10.2-cm^3 (4-in^3) single cell Ray Leach "Cone-tainers"^{TM} containing PRO-MIX 'BX' growing medium. First emergence was noted 50 days after the second planting (Rack 209). By mid-August the cotyledons were showing in 2 of the cells. They did not survive as there was insufficient growth to overwinter them in the plant cooler at the PMC. The remaining cells containing non-germinating achenes were over wintered in the plant cooler. The following spring the cells were brought back into the greenhouse where 8 more achenes germinated and developed into seedlings. A total of 10% of achenes in Rack 209 germinated.

Table 1. Results of Fremont's leather flower germination trials.

2009			
	Pre chill (days)	Planting Date	% Germination
Rack 109	68	5/12	0
Rack 209	97	6/10	2
2010			
	Date in greenhouse		% Germination
Rack 109	3/5		0
Rack 209	3/5		8
Total			10
2010 Replant			
		Replant Date	
Rack 109		5/4	8
Rack 209		5/26	0

Seed viability question in common reed, *Phragmites australis* (Cav.) Trin. Ex Steud. The question arose as to whether common reed growing along the banks of the North Platte River in Lincoln County, Nebraska, produces viable seed. Considerable variation has been reported world wide regarding seed germination in *P. australis*. Viable embryos were produced from 0.3 to 8.0% of florets in a Swedish population (Tucker 1990). Harris and Marshall (1960) reported 50% germination for seed stored 7 months at room temperature and 30% after 8 months of storage. "Large quantities of seed are produced, however research has shown that few are viable" (Rhoades and Block 2002). Volunteer seedlings found growing on a mudflat at the Mud Lake National Wildlife Refuge were determined to be *P. australis* (Harris and Marshall, 1960), indicating that reseeding does occur in nature. However, it was Haslam's (1972) view that once reedbeds are established, propagation from seed is not too likely due to a low level of self-fertilization and because seeds require light in order to germinate. Welling (1987) reported from a study of a two-year drawdown on a lacustrine marsh that 7% of phragmites seed germinated (in comparison with other species this was considered low). Sterile populations are known to occur in Romania.

Seed units collected in 2008 were sent to the PMC for testing. Two replicates of 100 seeds were tested at 20/30°C alternating temperature in comparison with Accession 9050017. After 4 days in the germinator, germination of the Lincoln County source, Accession 9050538, was 45.5% and Accession 9050017 was 43.5%. The rapidity at which the seed units germinated was not surprising. Tucker (1990), reported that temperature influences germination, with the rate increasing linearly from 16 to 26°C, the number of days required for germination decreases, 25 at 16°C to 10 at 26°C.

Seeds of phragmites are spread by wind and water but the main pathway is through plant transfer (IN.gov 2005). Whether viable seed of phragmites produced along the banks of the North Platte River has not been investigated, the species main mode of dispersal is most likely vegetative.

Propagation of Kentucky coffeetree, *Gymnocladus dioicus* (L.) K. Koch. Cooperator interest in Kentucky coffeetree launched an effort to try and germinate seeds and grow out some plants. Seeds of Accession 9050577, collected in Kingfisher Co, Oklahoma, was identified as a specimen tree that produced an unusual amount of seed.

The seeds of Kentucky coffeetree are oval, about 1.9-cm long with a thick, very hard, and bony coat. They have been compared to small jawbreakers only 2000 times as hard. The seeds generally remain in the pod until it falls and is broken up by decay, a process which may take 2 years or longer. The impermeable seed coat is the only hindrance to germination. A 2-to-4 hour treatment of concentrated sulfuric acid (H_2SO_4) is ideal for breaking down the seed coat. Once treated the seeds imbibe water quickly and are reported to germinate uniformly when sown (Row and Geyer 2007). Can the same be said for seed of various ages? The PMC just happended to be in possession of some coffeetree seeds of various ages. The seeds ranged in age from less than a year old to 4 years old and a few seeds approximately 25 years old. Each age class of seed was collected from different locations, Table 2. The Oklahoma source seeds were noticeably smaller. Seventy-five seeds of each accession were weighed

since a minable amount of seed was available, except for the Nebraska source which consisted of just 10 seeds. Individual seed weights were approximately 1.5 and 2.0 g for the Oklahoma and Kansas sources, respectively. The Nebraska source seeds appeared to be slightly larger than the Kansas source. The protocol used to break dormancy was to scarify the seeds with concentrated H_2SO_4 at a 2:1 ratio with the seed following a 24-hour soak in water. The seed were stirred periodically with a wooden stake during the 2-hour scarification process. The seed units were then rinsed in cold water and placed in plastic boxes containing moist sand. The boxes were placed in a germinator at 20/30°C. In 6 days emergence was noted in the youngest-aged seeds with radicals developed to 3 cm with 55% of the Oklahoma source germinating. The 4-year-old seeds were second with 7% germinating initially and a total of 44% a few days later. However, not the entire Kansas source swelled. Early detection was impaired since seed were buried in the sand. After 29 days it was assumed that no more seeds would germinate. Non-germinating seeds were recovered from the sand in the Kansas source. These hard seeds were then washed off and retreated for a 1 hour and 15 minute acid scarification using acid saved from the initial scarification process. These were replanted and 11 of them subsequently germinated. Ten percent of the 25-year-old seed germinated. Once radicals had reached approximately 3 cm in length, the germinated seeds were potted up to treepots in a soilless mix and moved to the greenhouse. Not all seeds of the Kansas source that germinated were successfully transplanted. Final germination results for the Oklahoma and Kansas sources were: Accession 9090977, 86.2% and Accession 9050580, 80%.

The Nebraska source seed may have been damaged by too long of treatment as the seed coats were partially eaten through exposing the sensitive tissues of the seed. This most likely explains the poor result, however, one cannot rule out other factors such as storage conditions which were quite variable over the course of 25 years.

Table 2. Results of Kentucky coffeetree seed germination and transplant success.

Accession No.	Source	No. Seeds Tested	% Germination	% Transplant Survival	Seed Weight[1]
9050577	Kingfisher Co., OK	29	86.2	100	1.463
9050579	Nemaha Co., NE	10	10	100	NM
9050580	Riley Co., KS	30	80.0	91.7	1.978

[1]Seed Weight: grams per seed; NM=Not Measured

Literature Cited:

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Evaluate Sand Bluestem Germplasm Lines with Improved Seedling Establishment under Field Conditions

Study No. KSPMC-ST-0802-RA

National Project No(s). Rangeland 1.1

Study Leaders: Dr. Tim Springer, Agricultural Research Service (ARS), Woodward, Oklahoma, and Richard L. Wynia, Plant Materials Center Manager

Introduction: Sand bluestem, *Andropogon hallii* Hack., is a warm-season, perennial grass native to the southern and western parts of the Great Plains Region. This tall, vigorous, strongly rhizomatous sod-forming grass is primarily adapted to deep, sandy soils. It is an important component of sand hills prairie. It is one of the most valuable erosion-control grasses for sandy soils. Sand bluestem is considered an excellent native forage grass and has high potential for use in establishing range, hay and pasture land, and in stabilizing critically eroding areas.

Recurrent phenotypic mass selection was used to create 2 synthetic populations from 2 lines of sand bluestem developed at USDA's Southern Plains Range Research Station (SPRRS), Woodward, Oklahoma. The base populations, designated 'AB Medium' and 'CD Tall', were originally selected for growth, re-growth, disease resistance, leafiness, seedling vigor, and plant height. AB Medium (Syn-0 population) was released in 2004, as 'Chet' sand bluestem.

Problem: Seedling establishment under field conditions needs improvement.

Objective: Evaluate sand bluestem germplasm lines with improved seedling establishment under field conditions at multiple locations.

Procedure: From the 2-base populations of AB Medium and CD Tall, selection criterion was to germinate seed at a reduced water potential and generate seedlings with ability to germinate under water deficit conditions. Seed units were placed in germination chambers in clear plastic boxes with a blotter substrate moistened with 17 mL of a water potential solution of D-mannitol at -0.8 MPa. After 7 days in the germinator all germinated seedlings were removed, washed with deionized water and planted in a soil mixture and maintained in the greenhouse. Two cycles of selection were made using this method thus yielding the base population and 2 selected populations designated Syn-1 and Syn-2. Approximately 7% of the base populations exposed to the D-mannitol germinated. Seed of the 6 populations (Table 1) were increased and used to plant replicated plots at 3 test locations: Woodward, Oklahoma; Knox City, Texas; and Manhattan, Kansas. Selections will be evaluated for establishment, forage yield, and persistence. The entries in Table 1 were established in 2 x 10 m (6.6 x 32.8 ft) plots in a randomized complete-block design with four replications at SPRRS Woodward and the PMCs at Knox City and Manhattan in 2010. The seeding population was equivalent to 108 pure live seeds per m². The planting at Manhattan was installed 29 June 2010, on a Belvue silt loam soil. Stand emergence on this plot was recorded at 30, 60 and 90 days after planting. Seedling emergence (plants/m²) was determined using the grid system method determined by Vogel and masters (2001).

Table 1. Selected populations used in this study.

Population
Medium height Syn-0 (Chet)
Medium height Syn-1
Medium height Syn-2
Tall height Syn-0
Tall height Syn-1
Tall height Syn-2

Potential Products: Cultivar Release and Technology Transfer

Progress or Status: The 2008 planting was harvested using a Carter Forage Harvester on 29 July 2010. The 1 x 2 m (3 x 6 ft) plots were harvested and total forage production was weighed wet; a grab sample was taken from the total sample, weighed wet, and then placed in the forage dryer to be dried to a constant weight and then weighed again to determine dry-matter forage yield for each plot. The total weight, wet grab sample weight, and dry weight were sent to SPRRS in Woodward.

Literature Cited: Vogel, K. P. and R. A. Masters. 2001. Frequency grid – a simple tool for measuring grassland establishment. *Journal of Range Management* 54:653-655.

Evaluate the Adaptability of 'Tropic Sun' Sunn Hemp (*Crotalaria juncea* L.)

Study No. KSPMC-T-0901-CP

National Project No(s). Cropland 1.1

Study Leader: Ramona Garner, East Regional Plant Materials Specialist

Introduction: Sunn Hemp (*Crotalaria juncea)* has been touted as a great green manure and cover crop since the 1930s, when it was reported to be an excellent soil-improving crop. Sunn hemp produces high organic matter yields while fixing large amounts of nitrogen. However, the difficulty in acquiring seed and cheap fertilizer prices caused many farmers to abandon the use of this crop. Energy costs have brought leguminous cover crops back to the forefront for sustainable agriculture production and have led to efforts to increase production of sunn hemp seed.

This study attempts to determine the areas of the country with the potential to use sunn hemp for green manure and cover crops. The anticipated use of sunn hemp is as a 30-45 day green manure crop. Sunn hemp does not produce seed above 28 degrees N latitude (southern tip or Florida or Texas). Since it does not produce seed through most of the United States and is sensitive to frost it has little potential to be weedy.

Sunn hemp is a tropical or sub-tropical plant that acts like a summer annual when grown in the continental United States. Sunn hemp's adaptation to a wide range of soils and superior performance on poor sandy soils has attracted attention.

As a cover crop, sunn hemp can produce 5,000-6,000 pounds of biomass per acre in southern climates in 60-90 days. It also can produce 120-140 pounds of nitrogen in the same amount of time.

Objective: Determine the areas of the country with the potential to use sunn hemp for green manure and cover crops.

Procedure: Sunn hemp seed was inoculated with *Bradyrhizobium* sp., a cow-pea type inoculant prior to planting. The planting at the Manhattan Plant Materials Center (PMC), Manhattan, Kansas, was drilled on 12 July 2010, which corresponds to a time period that would allow a producer to plant sunn hemp as a cover crop between continuous wheat harvesting and planting. Sunn hemp was planted at 22.4, 44.8, and 67.2 kg/ha (20, 40, and 60 lbs/acre) rates on 17.8 cm (7 in) spacing in a randomized split plot design, with 4 replications. The seed bed was disked and harrowed. No irrigation water was applied due to season-long ample rainfall. An electric fence was used to protect the plot from deer. Measurements of plant density using a frequency grid were made on 29 July 2010, approximately 2 weeks after planting. Measurements and calculations on above-ground biomass (AGB), fraction intercepted photosynthetically active radiation (FI-PAR), leaf area index (LAI), and height were taken at 45 and 60 days after planting (DAP). Two, 1.0 m^2 plots, per each planting rate, per each replication, per sampling period, were clipped just above the soil surface for a total of 24 per harvest date. Fresh clipped material was weighed for each harvest. Grab samples were collected from each of the plots from each replication and planting rate treatment. FI-PAR was measured and LAI calculated using a ceptometer. Ten measurements at 4 different places for each replication of each treatment were taken to get a good representation of the light intercepted by the plant canopy. Measurements of stem diameter and AGB were made on 8 December 2010, approximately 6 weeks after killing frost. One, 1.0 m^2 plot, per each planting rate, per each replication were clipped just above the soil surface and weighed. Grab samples were collected from each 1.0 m^2 plot. Grab samples from all harvest dates were dried and then weighed. The dry and wet weights were used to calculate AGB for all treatments for all sampling periods. Measures of stem diameters from 10 stems from each treatment and replication were taken using calipers.

Potential Products: Technology Transfer - national tech note, state tech notes, referred journal article

Progress and Status: Planting was done on 12 July 2010. Measurements of plant density using a frequency grid were made on 29 July 2010. Measurements and calculations on AGB, FI-PAR, LAI, and

height were taken at 45 and 60 DAP. Evidence of fruiting was noted on 27 October 2010. Killing frost occurred the morning of 28 October 2010. Measurements of stem diameter and AGB were made on 8 December 2010, approximately 6 weeks after killing frost.

The results of the 2010 growing season for 45 and 60 DAP are presented in Tables 1-3. Two weeks after planting, the plant density was 19.6, 28.0, and 36.6 plants/m^2 for the 22.4, 44.8, and 67.2 kg/ha seeding rates, respectively. Mean stem diameter was 12.23, 10.09, and 8.93 mm for the 22.4, 44.8, and 67.2 kg/ha seeding rates, respectively. Analysis of variance ($\alpha = 0.05$) was used to test for significant difference between seeding rates, harvest dates, and plant densities.

Although there was a significant difference in plant density between the 3 seeding rates ($P \leq 0.05$), there was not a significant difference in the AGB related to the 3 seeding rates at 45 or 60 DAP. The mean plant heights for the 3 seeding rates were the same and thus there was no difference in height of the plants based on varying levels of seeding rates.

The mean stem diameter measurements indicate a trend that as seeding rate was increased there was a decrease in the mean stem diameter of the plants. There was a significant difference ($P \leq 0.05$) in the AGB between the sampling dates, as the sunn hemp produced 175, 188, and 150 kg AGB/ day for the 22.4, 44.8, and 67.2 kg/ha seeding rates, respectively, between the 45 and 60 DAP sampling periods.

Table 1. Plant Density from frequency quadrat on 29 July 2010 (17 DAP).

Rate (kg/ha)	Plant Density† (plants/m^2)
22.4	19.6 A
44.8	28 B
67.2	36.6 C

†Means in a column followed by different letters are significantly different from one another at $P < 0.05$

Table 2. Results of 2010 sunn hemp study at the Manhattan PMC.

DAP	Seeding Rate (kg/ha)	Mean Plant Height (m)	Mean AGB† (kg/ha)	Mean FI-PAR	Mean LAI
45	22.4	1.8	5239 A	0.838	5.43
	44.8	1.8	5402 A	0.961	6.98
	67.2	1.8	6049 A	0.977	8.05
60	22.4	2.2	7861 B	0.961	6.79
	44.8	2.2	8217 B	0.988	7.57
	67.2	2.2	8303 B	0.992	8.13

†Means in a column followed by the same letter are not significantly different from one another at $P < 0.05$

Table 3. Mean above ground biomass and mean stem diameter of sunn hemp on 9 December 2010 (~6 weeks after killing frost).

Seeding Rate (kg/ha)	Mean AGB (kg/ha)	Mean Stem Diameter (mm)
22.4	14205.01	12.23
44.8	15433.15	10.09
67.2	15183.40	8.93

Conservation Field Trial: Revegetation of an Exposed Blue Shale Outcrop Site in Jewell County, Kansas

Study No. KSPMS-T-0001-CR

National Project No(s). Critical Areas 1.1

Study Leader: Mark A. Janzen, Plant Materials Specialist

Introduction: Past management and natural slumping has exposed raw shale areas ranging in size from 1 to 5 acres. The geology of the area is such that the underlying impervious shale layer conducts groundwater along its interface with the overlying soil. Where the shale outcrops on hillsides, natural springs occur. Slumping results where the overlaying soil on hillsides becomes saturated and subsequently moves. Once these areas are exposed, they are prone to water erosion, resulting in offsite deposition, which degrades the downslope plant communities. Because of the exposed shale, the quality of water flowing offsite is also a primary concern. The quality of the water flowing offsite is very acidic (pH 3-5) which also results in severe degradation of the downstream plant communities. This study is being conducted in cooperation with the Kansas Department of Health and Environment and the Jewell County Conservation District.

Problem: The need exists to evaluate plant species for potential use for site revegetation and subsequent stabilization.

Objective: Evaluate common reed (*Phragmites australis* [Cav.] Trin. Ex Steud.) for establishment, survival, rate of spread, and stabilization potential on a typical blue shale site.

Procedure: One typical blue shale site was selected for the planting and evaluation of the adaptability and survival of common reed. Approximately 2,000 common reed sprigs were planted on 18 April 2000, with assistance from the Manhattan Plant Materials Center, Manhattan, Kansas. The sprigs were hand planted within select reaches of the primary drainageways within the study area in Jewell County. Planting was restricted to those areas within the study area that appeared to have the greatest potential for supplemental moisture. The plantings will be monitored for establishment, survival, and spread. Evaluations will continue through 2010.

Potential Product: Technology Transfer

Progress or Status: Vegetation continues to spread over the planting area. Management of the area has been limited, which includes an unsuccessful attempt to burn the area. Upper reaches of the slopes remain unvegetated. The soils and plant ecology remain fragile. Affected areas of exposed shale seems to be expanding due to management of adjacent resources. Few native grass species such as big bluestem, little bluestem and switchgrass are beginning to establish in the stabilized vegetated areas of blue shale. Seed collections were made from these native plants.

Plants from collected seed along with known varieties were established in single cell Ray Leach “Cone-tainers”^{TM} and planted in a field planting within the non-vegetated areas of the blue shale to determine if these plants have adaptability to blue shale sites and tolerance to low pH soils. Evaluations after first growing season resulted in 260 out of 263 plants planted surviving. Many of these plants produced seed. Evaluation of the site will continue for several years. Additional collections of seed are planned along with establishing additional field plantings.

Plant Species for Revegetation of Natural and Man-induced Saline Areas

Study No. KSPMS-T-0201-CR

National Project No(s). Critical Areas 1.1

Study Leader: Mark A. Janzen, Plant Materials Specialist

Introduction: Small areas of pasture and rangeland have been damaged through the spillage of brine water associated with oil drilling activity. Natural saline seeps have formed in cropland fields due to cropping practices, soil geology, and drainage configuration. These areas while small in size (typically less than 5 acres) are extremely erosive and contribute heavy sediment loads (including contaminants) to adjacent water bodies. Because these sites are typically high in salts, poor in soil structure, and low in organic matter, revegetation is extremely difficult without considerable economic input.

Objective: To evaluate various plant species for use in revegetating saline areas and to evaluate the effect of various surface treatments on plant species establishment.

Procedure: Sixteen different species/selections were seeded at 4 different locations: Perry and Okmulgee in Oklahoma; El Dorado and Eureka in Kansas. Sixteen different soil amendment treatments were applied at the Eureka and El Dorado sites. The Manhattan Plant Materials Center, Manhattan, Kansas, assisted with installation of the trials. Soil salinity analyses were performed on all sites prior to and following species establishment. Refer to Table 1, for a list of plant species that were included in this study. Treatments for the Kansas locations are provided in Figure 1. The Okmulgee and Perry locations were seeded in the spring of 2002. The Eureka and El Dorado sites were seeded in May 2003. In 2007, as part of a Resource Conservation and Development project, an additional site totaling 2.3 acres near Eureka was selected for an additional planting. Based on the findings on the other Kansas sites, horse manure, compost, and various crop residues were applied and incorporated by deep ripping prior to drilling grass. Within the 2.3 acres, 18 replicated plots were established with various surface treatments that included:

Manure & Wheat Straw	Manure	Native Hay	Wheat Straw	Gypsum & Wheat Straw	Compost	Manure	Manure & Wheat Straw	Compost
Wheat Straw	Gypsum & Wheat Straw	Compost	Manure	Native Hay	Manure & Wheat Straw	Gypsum & Wheat Straw	Wheat Straw	Native Hay

The entire 2.3 acres was then seeded to a mix of the following grasses:

Alkali sacaton
Tall wheatgrass
Alkali-grass
Switchgrass ('Kanlow')
Western wheatgrass
Russian wild rye
Inland saltgrass
Four-wing saltbush

Potential Products: A summary of the study with appropriate recommendations regarding soil amendments and species selection will be developed and provided in the form of a technical note.

Progress or Status: This study initiated with 2 planting sites in Kansas and 2 planting sites in Oklahoma. Only the 2 sites in Kansas, Eureka and El Dorado, remain active sites. Due to heavy grazing and continued overflow of water, the El Dorado site is slowly transitioning back to its original barren eroded state. Primary vegetation at this site is inland saltgrass that has been heavily grazed. The vegetation at the Eureka site remains limited to the areas where residue was added following planting. Primary vegetation is inland saltgrass, alkali sacaton, and tall wheatgrass.

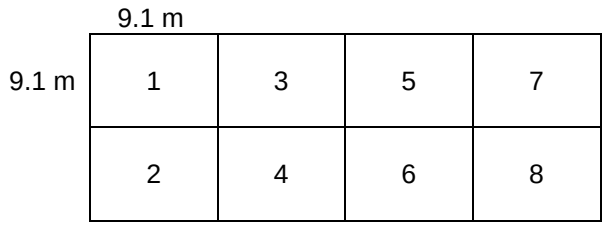
The 2007 Eureka site planting has experienced heavy grazing along with water overflow from adjacent land in 2010. Vegetation in the study plots remains, but individual plots are not recognizable due to cattle and water overflow. Currently, there is a good stand of mixed grass on the site along with a few small isolated areas that remain bare.

Initial observations indicate that organic matter incorporated into the soil along with seeding salt-tolerant grasses is important in establishing vegetation on these sites.

Table 1. Plant species per location.

Plant Species	Location			
	Okmulgee	Perry	El Dorado	Eureka
Havard's panic grass	X		X	X
Alkali sacaton, 'Saltalk'	X	X	X	X
Big sacaton / 434453	X	X	X	X
Four-wing saltbush			X	X
Texas dropseed / 9029930	X	X	X	X
Texas dropseed / 9029932	X	X	X	X
Sideoats grama, 'Premier'	X	X	X	X
Inland saltgrass	X	X	X	X
Blue panicum	X	X	X	X
Alkali-grass, 'Fults'	X	X	X	X
Switchgrass, 'Kanlow'	X	X	X	X
Western wheatgrass, 'Barton'	X	X	X	X
Western wheatgrass / Knox City source	X		X	X
Tall wheatgrass, 'Jose'	X	X	X	X
Russian wild rye, 'Bozoiski-Select'	X	X	X	X
Western indigo / Knox City source	X		X	X
Illinois bundleflower, Reno Germplasm	X		X	X
Showy partridge pea, 'Riley'	X		X	X

Figure 1. Surface treatments for each site.



Treatment No.	
1 – Control: no amendment	5 – Incorporated wood chips* (manure)
2 – Incorporated gypsum	6 – Incorporated gypsum and wood chips* (manure)
3 – Incorporated straw	7 – Annual crop**
4 – Incorporated gypsum and straw	8 – Incorporated gypsum then seed annual crop**

*Wood chips applied at Eureka location; manure at El Dorado location
**Perennial species seeded 1 year after seeding of annual crop

Rate of Amendment Application and Incorporation

Gypsum – 385.4 net cwt/ha (7.8 t/ac) El Dorado; 523.8 net cwt/ha (10.6 t/ac) Eureka
Manure – 741.2 net cwt/ha (15 t/ac)
Wood chips – 642.4 net cwt/ha (13 t/ac)
Straw – 148.2 net cwt/ha (3 t/ac)

Rate of Surface Mulch Application

Straw – 148.2 net cwt/ha (3 t/ac) Surface mulch will be applied to ½ of each treatment immediately after seeding of the perennial plant species.

Evaluation of 'Laramie' Tifton Burclover Interseeding Trial in Established Cool-Season Forage Grasses

Study No. KSPMS-T-0705-PA

National Project No(s). Cropland 1.1

Study Leader: Mark A. Janzen, Plant Materials Specialist

Introduction: 'Laramie' Tifton burclover (*Medicago rigidula* [L.] All.) is an annual legume that has potential both as a cover crop and companion crop with many grain and forage crops. Laramie germinates in the fall providing winter cover and nitrogen fixation until it reaches maturity in late May or June. This study will evaluate the potential Laramie has as a potential cover crop as well as its ability to sustain itself over time.

Procedure: Utilized perennial cool-season forage grasses from study number 20C006G from the Wallace County study site. Laramie was broadcast into the west one-half of the replicated plot in the fall 2006. No incorporation of the seed was applied. By applying to one-half of the perennial cool-season forage grasses it provides a visual observation to the affects of a nitrogen fixing cover.

Progress or Status: The broadcast seeding of Laramie annual medicago was evaluated in 2010. Numerous plants were established throughout the planted area. Plants displayed good health and vigor. Continued evaluation of the planting will continue to determine long-term longevity of the plant. There continues to be interest in Laramie as a companion cover crop.

Plant Adaption Study for Sandy Seeding Site

Study No: KSPMS-T-095-PA

National Project No(s). Critical Areas 1.1, Cropland 3.1

Study Leader: Mark A. Janzen, Plant Materials Specialist

Introduction: Irrigation water tables are dropping in areas of Western Kansas making it nearly impossible to crop some of these acreages that consist of sandy soils and low rainfall. As a result some of these irrigated acres have been planted to native grasses under the Conservation Reserve Enhancement Program (CREP). It has been very difficult to achieve stands of grass to provide adequate protection of the natural resources. Species selected for this study are well adapted to coarse soils and to areas with low rainfall. Most of these species have been tested under similar conditions and released by plant materials centers as new cultivars. This study will evaluate these species in a planting to determine adaptability to sandy soil in a Western Kansas climate.

Objective: To evaluate the adaptability of both existing and new cultivars on a sandy planting site. These cultivars are adapted to coarse soils and generally require little moisture.

Procedure: Species meeting the adaptation requirements for this study were assembled. Cultivars and germplasm releases were included along with experimental lines from NRCS Plant Materials Centers, where available. These species have characteristics for being adapted to the deep sandy soils and climate of the study site located in southeastern Kearney County, Kansas. The assembled seed was planted in plots ~1.5 x 6.1 m (5 x 20 ft) with 5 rows per plot spaced ~30.5 cm (1 ft) apart in a Randomized Complete Block Design replicated 3 times. A wheat straw mat was placed on the seeded plots and stapled down to simulate residue and reduce the potential for wind erosion.

Species planted include:

'Vavilov' Siberian wheatgrass
'Pronghorn' prairie sandreed
'Bend' sand lovegrass
9066585 and 9066789, needle-and-thread
9066233, sandhill muhly
Borden County Germplasm sand dropseed
PMT-389 Arizonia cottontop
'Nogal' black grama
'Garden' sand bluestem
'Volga' mammoth wildrye
'Paloma' Indian ricegrass
9066585, blowout grass
9050018, big sandreed
Potter County Germplasm spike dropseed
'Viva' galleta grass

Potential Products: Cultivars with adaptive traits to the study site will be incorporated into the eField Office Technical Guide and into technical notes.

Progress or Status: The planting was conducted 1 April 2009, into moist soil conditions. A few remaining snow drifts were visible on the landscape, but not on the planting site. Plots along with the wheat mat were installed. Evaluations completed in the fall yielded very little planted grass.

The planting was again evaluated both in the spring and fall in 2010. Several species identified in the fall 2010 review included: sand bluestem, sand lovegrass, black grama, prairie sandreed, sand dropseed and needle-and-thread. Other non-planted species such as little bluestem, sideoats grama and blue grama were identified throughout the planting. It appears that seed and/or plants of these species were on the planting area when study was planted. The planting will be evaluated in 2011 to monitor progress. Many of the species that are establishing in the planting are already part of the seed mixture being planted on these sites. The study may need to be expanded in the future to look at the effect cover crops have on a native grass planting on sandy sites.

Initial Evaluations

Evaluation of Miscellaneous Grasses

Study No. 20I003L

National Project Nos. Critical Areas 1.1, Rangeland 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: This study serves as a clearinghouse for the evaluation of miscellaneous collections of grasses received by the Manhattan Plant Materials Center (PMC), Manhattan, Kansas, which have potential for conservation use. These collections may be tested for adaptation to the local climate in a rod-row planting. Standards of comparison may be included such as an existing cultivar that is available in the seed trade.

Objective: Provide a means to test plant materials where limited seed or plants are available.

Procedure: Plant seeds or plants in a non-replicated 6.1 m (20 ft) rod row with a between row spacing of 2.2-m (6-ft), except where noted. Plants will be spaced 1 foot apart in the row at the PMC unless otherwise specified. A standard of comparison may also be included. Evaluation factors include: plant vigor, stand, seed production, growth factors, and resistance to disease, drought, and cold.

Potential Products: Cultivar Release and Technology Transfer

Progress or Status: Canada wild rye (*Elymus canadensis* [L.]), riverbank wild rye (*E. riparius* [Wieg.]), and little bluestem (*Schizachyrium scoparium* [Michx.] Nash), are species currently under test in this study. Arizona cottontop (*Digitaria californica* [Benth.] Henr.) was dropped from this study in 2009.

Canada Wild Rye and Riverbank Wild Rye: The plant materials specialist for Michigan initiated an ICST to test the adaptation of Accession 9084347, Icy Blue Germplasm Canada wild rye and Accession 9086450, riverbank wild rye (*E. riparius* [Wieg.]). The Rose Lake PMC provided 20 plants of each accession which were planted in rod rows 24 May 2006. Stand has been on the decline since 2009 for both wild rye entries. They were not evaluated in 2010 and were earmarked for removal.

Arizona Cottontop: The James E. Bud PMC, Knox City, Texas, initiated an ICST to test the adaptation of Accession 469253 Arizona cottontop (*Digitaria californica* [Benth.] Henr.). Twenty plants were planted in a rod row 9 June 2008, in Field C-2. The plants did not survive the winter; however they did produce viable seed. Seed that had fallen on the ground germinated in the spring 2009 but were destroyed. One volunteer plant was found in the planting area in 2010.

Little Bluestem: The James E. Bud PMC, initiated an ICST to test the adaptation of Accession 9029926, OK Select Germplasm little bluestem (*Schizachyrium scoparium* [Michx.] Nash). Twenty plants were planted in a rod row 9 June 2008, in Field C-2. 'Cimarron' little bluestem was included as a "standard of comparison." Cimarron was damaged due to a malfunction in herbicide application which stunted the plants. Therefore Cimarron was not evaluated this year. Accession 9029926 maintained a 100% stand, while plants were shorter this year, Table 1. The plants were not clipped in 2010.

Table 1. Evaluation data for little bluestem, *Schizachyrium scoparium*, 2010.

Accession	Plant Height (cm)	Stand (%)
421552	NM	NM
9029926	130	100

NM = Not Measured

Evaluation of Miscellaneous Trees and Shrubs

Study No. 20I010K

National Project Nos. Forestland 1.1, Natural Areas 1.1, Urban 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: Plantings of woody materials were initiated in 1961. Since that time plants have been added for evaluation with multiple objectives in mind. The evaluation of woody plant materials has been a cooperative effort between the Manhattan Plant Materials Center (PMC), Manhattan, Kansas, and interested parties in the central Great Plains. These include: Kansas State University-Department of Horticulture and Forestry; the USDA Agricultural Research Service (ARS) Plant Introduction System NC-7 Trials; the USDA Forest Service; State and Extension Foresters, and Natural Resources Conservation Service (NRCS) staff foresters and biologists of Oklahoma, Nebraska, Kansas, and Colorado; and the Plains and Prairie Forestry Association (formerly the Great Plains Agricultural Council GP-13 Forestry Committee).

Problem: Adapted tree and shrub selections are needed to provide for windbreak, recreation, and multi-purpose use in the High Plains and provide multiple wildlife benefits throughout a four-state area which includes Colorado, Kansas, Nebraska, and Oklahoma.

Objectives: Identify superior specimens of shrubs and trees which have potential to solve conservation problems; produce or have produced, limited quantities of promising woody plants for field evaluation and field plantings; fulfill tree improvement committee efforts to find and test superior specimens and origins of woody plants; find a suitable replacement for the American and Siberian elms in Midwest urban conservation plantings; and develop and cooperatively release the best adapted cultivars for multiple uses in the area served by the PMC.

Procedure: Containerized or bareroot stock is spaced 4.88 m (16 ft) apart in rows spaced 4.88 m apart. Drip irrigation is used to aid in establishment which may be needed for several years. In the miscellaneous woody tables, number established (No. EST) column, a number in parentheses (n) may appear below the number established indicating the initial number of woody plants planted. Percent survival is based on the number of plants established rather than the number planted. So, if a tree or shrub planted in a given year did not recover the following spring, it was considered to have not established. There may be a variety of reasons why the plant material failed to establish, such as unfavorable environmental conditions in the initial growing season, planting stock in poor condition, and predation. Such conditions may not have any reflection on the plant material itself. It is possible that the plant material is simply not adapted to the site. However, in an initial evaluation, an attempt to reestablish the plant material should be made before declaring a plant material as not adapted to the site. The way percent survival is currently calculated may change data reported in past reports. In cases where it is clear that herbicides killed the plant, the survival rate is adjusted to compensate for such an intervention. Once woody stock has been established on site it can be evaluated for adaptation for a period of time, as much as 20 years or more for long lived species. This nursery is located primarily on a Belvue silt loam soil in fields F and G. Due to wildlife pressures, newly established woody entries must be fenced to reduce browse and rub damage caused by deer.

Potential Products: Information Technology and Cultivar Release

Progress or Status: The assembly consists of 144 accessions representing 99 species in 58 genera, of which 30 are named cultivars. Forty-five percent of the species are native to North America. The plant materials come from many sources such as other PMCs, NRCS field collections, and ARS collections: High Plains Horticulture Research Station (HPHRS) at Cheyenne, Wyoming; Southern Plains Range Research Station (SPRRS), Woodward, Oklahoma; the North Central Regional Plant Introduction Station (NCRPIS), Ames, Iowa; and the US Forest Service's Rocky Mountain Forest and Range Experiment Station (RMFRS), University of Nebraska-Lincoln (UNL), Nebraska. Participating PMCs include TXPMC, Knox City, Texas; GAPMC, Americus, Georgia; KSPMC, Manhattan, Kansas; National PMC (MDPMC),

Beltsville, Maryland; MIPMC, East Lansing, Michigan; MOPMC, Elsberry, Missouri; and NDPMC, Bismarck, North Dakota.

Sixty-eight accessions were evaluated this year. There were 4 new acquisitions this year, Table 1.

Table 1. New acquisitions to the miscellaneous tree and shrub evaluations in 2010.

Species	Common Name	Accession Number	Origin/Source
Caragana microphylla	littleleaf peashrub	9050581	/NCRPIS
Ginkgo biloba	ginkgo	9050582	/NCRPIS
Platanus occidentalis var. *glabrata*	smooth sycamore	9050583	Real Co., TX /NCRPIS
Tetradium sp.	bee-bee tree	9050584	/NCRPIS

The pines continue to decline due to disease and other factors. There were more losses in the Scot's pine accessions requiring removal of individual trees succumbing to pine wilt. A windbreak row of Ponderosa pines has succumbed to do this trauma and will need to be taken out as well. In August a 90+ mph straight line wind brought down the Ponderosa pine that graced the PMC headquarters for many years. It took a one-quarter twist and was snapped off 2 feet below ground level. In counting the trees rings it was estimated to be 65-70 years of age. With a diameter at breast height (dbh) of 27.4 inches the estimated height of 85 feet.

Two black chokeberry, *Photinia molanocarpa*, currently under evaluation at the PMC, 'McKenzie' a release out of the Bismarck PMC produced an abundant crop of berries this year while 'Iroguois Beauty' continued to struggle.

American hazelnut, *Corylus americana*, Accession 9083247, from Elsberry PMC produced fruit for the first time this year.

Deer caused extensive damage to Mongolian pine; *Pinus sylvestris* var. *mongolica*, during the rut stags beat up on them destroy the growing point of many of the trees. The Modoc cypress was not invasive. Amazingly, a few of them still survive (40%).

Refer to Table 2, List of Miscellaneous Trees and Shrubs for further information regarding plot designations. Refer to Figures 1 and 2, for plot locations in fields F and G. An x designates location of an existing plant in the plot. Trees and shrubs removed in 2010 are listed in Table 3. Evaluation data are presented in Table 4.

Table 2. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs under evaluation in 2010. Page 1

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
			Block 1			
B1 17 1-10	1976	9004450		*Juglans microcarpa*	little walnut	Washita & Beckman Co., OK /KSPMC
B1 18 1-25	1964			*Taxodium distichum*	baldcypress	/Commercial/KSU Ext. Forestry
B1 C4 19-21	1981	9004384		*Prunus serotina*	black cherry	Ann Arundel Co., MD /MDPMC
B1 C5 19-20	1981	9007345		*Prunus serotina*	black cherry	Hampshire Co., WV /MDPMC
B1 E 1-13	1990	483442	Flame	*Acer ginnala*	Amur maple	Eastern Asia /MOPMC
B1 E 14-35	1990	468117	Indigo	*Cornus amomum*	silky dogwood	Clinton Co., MI /MIPMC
B1 E 36-48	1990	478000	Midwest	*Malus baccata mandshurica*	Manchurian crab apple	Manchuria /NDPMC
B1 3 1-20	2006	9069052	Riverbend GP	*Salix* sp.	willow	/MIPMC
			Block 2			
B2 1 1	19XX	566824	Boomer	*Quercus macrocarpa*	bur oak	Custer Co., OK /TXPMC, Knox City
B2 2 1	19XX	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., OK /KSPMC
B2 3 1-5	2008	9050529		*Celastrus scandens*	American bittersweet	Winneshiek Co., IA /NCRPIS
B2 S	1930s	20-1303		*Syringa vulgaris*	common lilac	
			Block 2			
B3 E1 1-23	1975	70314		*Castanea mollisima*	Chinese chestnut	/MDPMC
B3 E2 1-31	1975	70314		*Castanea mollisima*	Chinese chestnut	/MDPMC
B3 SE 17-26	1977	514275	Magenta	*Malus* sp.	hybrid crabapple	Clinton Co., MI /MIPMC
B3 SW 9-42	1987	483442	Flame	*Acer ginnala*	Amur maple	Eastern Asia /MOPMC
C1 20 A-E	1961	9004302		*Fraxinus pennsylvanica*	green ash	Butler Co., KS /KSPMC
C1 21 A-E	1961	9004304		*Fraxinus pennsylvanica*	green ash	Franklin Co., KS /KSPMC
C3 W1 6-42	1967	20-1068		*Juniperus chinensis phitzeriana*	Phitzer juniper	/Riley Co., KS /KSPMC
C3 W2	1968	9001209		*Picea pungens*	Colorado blue spruce	Forrest Keeling Nursery, Elsberry, MO /KSPMC
E3 21 5-7	2001	9050416		*Quercus prinoides*	dwarf chinkapin oak	Salem, NE /NCRPIS
			Block 1			
F1 1 1-2	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, NE /UNL
F1 1 10-19	1966	107630		*Ligustrum vulgare*	Cheyenne European privet	/NCRPIS
F1 2 1	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, NE /UNL
F1 2 2-3	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., NE /UNL
F1 2 4	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, NE /UNL
F1 2 5	1985	9049955		*Platanus occidentalis*	sycamore	Marysville, KS /UNL
F1 3 1	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., NE /UNL
F1 3 2-3	1985	9049955		*Platanus occidentalis*	sycamore	Marysville, KS /UNL
F1 3 4-5	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., NE /UNL
F1 4 3-5	1997	9050263		*Celtis laevigata*	sugarberry	Newark, OH /NCRPIS
F1 11 2-11	1989	9055585	Redstone	*Cornus mas*	Cornelian cherry dogwood	Cen Europe /NY /MOPMC
F1 12 1-2	1984	325270		*Cotoneaster lucida*	cotoneaster	USSR /MDPMC
F1 12 3-12	2007	9083247		*Corylus americana*	American hazelnut	/MOPMC
F1 13 1-5	2007	9050524		*Elaeagnus* X 'Jefmorg'	Silverscape®olive	Lincoln-Oakes Nursery, Bismarck, ND
F1 13 6-10	2007	9050522		*Physocarpus opulifolius*	common ninebark	Bucks Co., PA /NCRPIS
F1 14 1-5	2007	9082687		*Ribes americanum*	American black currant	/NDPMC
F1 14 6-10	2008	9050530	June Bride™	*Philadelphus microphyllus*	littleleaf mock orange	Sevier Co., UT /NCRPIS
F1 15 1-5	2008	9050531	Center Glow	*Physocarpus opulifolius*	common ninebark	/NCRPIS
F1 15 6-10	2010	9050581	Mongolian Silver Spires	*Caragana microphylla*	littleleaf peashrub	/NCRPIS
F1 18 1-5	1990	477010		*Ligustrum obtusifolium*	border privet	/MIPMC /NCRPIS

Table 2. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs under evaluation in 2010. Page 2

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
F1 19 1-5	2006	9050500	Iroquois Beauty	*Photinia melanocarpa*	black chokeberry	/NCRPIS
F1 19 6-10	2006	323957	McKenzie	*Photinia melanocarpa*	black chokeberry	/NDPMC/NCRPIS
F1 20 1-5	2003	9050482	Royal Guard	*Viburnum rufidulum*	southern black haw	Holden Arboretum /NCRPIS
F1 20 6-10	2003	9050483		*Viburnum rufidulum*	southern black haw	ISU Hort. Farm /NCRPIS
F1 21 1-5	2001	9050417		*Spiraea flexuosa*		Northern Mongolia /NCRPIS
F1 21 6-10	2001	9050418		*Xanthoceras sorbilolium*	yellowhorn	Northern China/NCRPIS
F1 22 1-5	2002	9050425		*Cornus sanguinea*	blood-twig dogwood	IA /NCRPIS
F1 22 6-10	2002	9050426		*Cornus sanguinea*	blood-twig dogwood	IA /NCRPIS
F1 23 1-5	2002	9050427		*Cotinus coggygria*	smokebush	IA /NCRPIS
F1 23 6-10	2006	9050498		*Hydrangea arborescens radiata*	silver leaf hydrangea	/NCRPIS
F1 24 1-5	2002	9050429		*Sorbus aucuparia*	mountain ash	IA /NCRPIS
F1 24 6-10	2002	9050430		*Sorbus torminalis*	wild service tree	IA /NCRPIS
F1 25 1-5	2002	9050431		*Shepherdia argentea*	silver buffalo berry	IA /NCRPIS
F1 25 6-10	2002	9050432		*Sorbus torminalis*	wild service tree	IA /NCRPIS
F1 26 1-6	1985	9050007		*Syringa vulgaris*	common lilac	Phillips Co., KS /KSPMC
				Block 2		
F2 4 1-10	1967	9006095	McDermand	*Pyrus ussuriensis*	Harbin pear	Morden, Manitoba, CAN /NDPMC
F2 6 1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2 7 1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2 8 1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2 9 1-4	1989	9050011		*Diospyros virginiana*	common persimmon	IA /NCRPIS
F2 11 1-5	2007	9050519		*Celtis reticulata* var *laevigata*	netleaf hackberry	Union Co., NM/NCRPIS
F2 11 6-10	2007	9050518	September Sun	*Alnus maritima*	seaside alder	Oklahoma/NCRPIS
F2 12 1-5	2007	9050520		*Cercis canadensis*	red bud	Van Buren Co., IA/NCRPIS
F2 12 6-10	2007	9050521		*Cercis canadensis*	red bud	Keokuk, Lee Co., IA /NCRPIS
F2 13 1-5	2007	9050523		*Ptelea trifoliata*	common hop-tree	Van Buren Co., IA /NCRPIS
F2 13 6-10	2007	9076686		*Crataegus chrysocarpa*	fireberry hawthorn	/NDPMC
F2 14 1-5	2008	9050532		*Quercus alba*	white oak	Richardson Co., NE /NCRPIS
F2 14 6-10	2009	9050537	Morton Prairie Flame	*Rhus copallinum*	shining sumac	Iroquois Co., IL /NCRPIS
F2 15 1-5	2010	9050584		*Tetradium* sp.	bee-bee tree	/NCRPIS
F2 15 6-10	2009	9050543		*Chilopsis linearis*	desert willow	Meade Co., KS /KSPMC
F2 24 1-5	1973	9006225		*Syringa pekinensis*	Peking lilac	/NDPMC
F2 24 6-10	1973	9034667		*Forsythia europaea* X *ovata*	early forsythia hybrid	/NCRPIS
				Block 3		
F3 2 1-11	1967	9001069		*Quercus palustris*	pin oak	/Manhattan Nurs., Manhattan, KS /KSPMC
F3 3 2-6	2002	486339	Dynasty	*Ulmus parvifolia*	lace-bark elm	IA /NCRPIS
F3 5 1-5	1969	9004305		*Fraxinus pennsylvanica*	green ash	Butler Co., KS /KSPMC
F3 7 1	2003	9050478	Varen	*Betula papyrifera*	paper birch	NDSU /NCRPIS
F3 7 2-4	2006	9050499		*Populus alba*	white poplar	South Korea/NCRPIS
F3 7 6-10	2003	9050481		*Tilia cordata*	littleleaf linden	Ukraine /NCRPIS
F3 7 7-11	2009	9050535	NE-Arb Prairie Gold	*Populus tremuloides*	quaking aspen	/NCRPIS
F3 8 1-5	2003	9050479		*Carpinus betulus*	European hornbeam	Ukraine /NCRPIS
F3 8 6-10	2003	9050480		*Carpinus betulus*	European hornbeam	Ukraine /NCRPIS

Table 2. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs under evaluation in 2010. Page 3

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
F3 10 1-10	1971	9034682		*Betula nigra*	river birch	Houston Co., MN /NCRPIS
F3 12 1-10	2006	9050497		*Celtis occidentalis*	common hackberry	Forest Keeling Nurs., Elsberry, MO /KSPMC
F3 13 1-10	2006	9066615		*Celtis occidentalis*	common hackberry	Oklahoma/KSPMC/NMPMC
F3 14 1-5	2006	9050501	J. N. Select	*Carpinus caroliniana*	American hornbeam	MN, WI/NCRPIS
F3 14 6-10	2006	9050503		*Ulmus thomasii*	rock elm	Dixon Co., NE/NCRPIS
F3 15 1-10	2006	9050502		*Foresteria pubescens* var *pubescens*	elbow bush	/NCRPIS
F3 16 1-5	2010	9050582		*Ginkgo biloba*	Ginkgo	/NCRPIS
F3 16 6-10	2010	9050583		*Plantanus occidentalis* var *glabrata*	sycamore	Real Co., TX /NCRPIS
F3 19 1-10	1971	9004302		*Fraxinus pennsylvanica*	green ash	Butler Co., KS
F3 20 1-5	1971	341756	Groeneveld	*Ulmus* X *hollandica*	Holland elm hybrid	/NCRPIS
F3 20 6-10	1973	265620	Hessei	*Fraxinus excelsior*	European ash	W. Germany /NCRPIS
F3 21 1-5	1972	9034674		*Quercus* sp.	Swedish hybrid oak	/UNL /NCRPIS
F3 21 6-10	1972	9017646		*Quercus robur*	English oak	/ISU Hort Farm /NCRPIS
F3 22 6-10	1990	9050022		*Quercus phellos*	willow oak	TN /NCRPIS
F3 23 6-10	1972	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., OK
F3 24 1-10	1973	434253	Athens	*Quercus acutissima*	sawtooth oak	/GAPMC
				Block 4		
F4 5 10-11	1973	323932	Emerald Sea	*Juniperus conferta*	shore juniper	/MDPMC
F4 10 9-13	1975	9004334		*Juniperus* sp.	columnar juniper	Custer Co., NE /PI Sta., Cheyenne, WY
F4 11 1-10	2006	9050504		*Cupressus bakeri*	Modoc cypress	/Lawyer Nurs., Plains, MT /KSU
F4 12 1-5	2009	9076719		*Pinus sylvestris* var. *mongolica*	Mongolian pine	Shangzhi, China /NDPMC /NCRPIS
F4 12 6-10	2009	9076718		*Pinus sylvestris* var. *mongolica*	Mongolian pine	Nenjiang, China/ NDPMC /NCRPIS
F4 13 1-5	2009	9050542		*Taxodium distichum*	bald cypress	Real Co, TX /NCRPIS
F4 18 1-10	1982	477011	Affinity	*Thuja occidentalis*	northern white cedar	/MIPMC
F4 19 1-6	1976	343949		*Pinus sylvestris*	Scots pine	Ankara, Turkey /MDPMC
F4 20 7-9	1976	343948		*Pinus sylvestris*	Scots pine	Ankara, Turkey /MDPMC
F4 21 1-10	1974	9034668		*Picea abies*	Norway spruce	/Griffith St. Nurs., Wisconsin Rapids, WI /KSPMC
F4 22 1-9	1973	9004363		*Pinus strobiformis*	Mexican white pine	Lincoln Co., NM/Rky Mtn Exp Sta., NE /KSPMC
F4 23 1-10	1973	9004364		*Pinus nigra*	Austrian pine	N. Turkey /Rky Mtn Exp Sta., NE /KSPMC
F4 25 8-17	1973	9034669		*Pinus heldreichii*	Heldreich pine	Yugoslavia /Rky Mtn Exp Sta., NE /MDPMC
				Block 1		
G 1 W'-B	1991	250278	Elsmo	*Ulmus parvifolia*	lace-bark elm	Rochester, NY /MOPMC
G 1 C-E	1974	9004437		*Ulmus parvifolia*	lace-bark elm	Woodward /SO, OK /KSPMC
G 2 W'-Z'	1991	250278	Elsmo	*Ulmus parvifolia*	lace-bark elm	Rochester, NY /MOPMC
G 2 A-E	1963	9004439		*Ulmus* species	Offerle elm	Edwards Co., KS /KSPMC
G 3 B-E	1963	9013711		*Ulmus parvifolia*	Chinese elm	/ARS, Woodward, OK /KSPMC
G 3 F-J	1963	9004256		*Celtis occidentalis*	common hackberry	Pottawatamie Co., KS /KSPMC
G 4 A-E	1963	9004440		*Ulmus* species	hybrid elm	/KSU Horticulture Farm
G 8 F-J	1963	9004255		*Celtis occidentalis*	common hackberry	Central Oklahoma
G 9 F-J	1963	9034679		*Carya illinoensis*	pecan	/KSU Forestry, KS
G 10 F-J	1963	9034680		*Carya illinoensis*	pecan	/KSU Forestry, KS
G 2 K-O	1963	9004329		*Juniperus virginiana*	eastern red cedar	/KSU Forestry, KS
G 4 K-O	1963	9004333		*Juniperus virginiana*	eastern red cedar	Harper Co., OK /KSPMC

Table 2. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs under evaluation in 2010. Page 4

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
G 6 K-O	1963	9004332		*Juniperus virginiana glauca*	silver eastern red cedar	/USDA-ARS, Woodward, OK /KSPMC
G 8 K-O	1963	9034671		*Pinus ponderosa*	ponderosa pine	/KSU Forestry, KS
G 15 U-Y	1964	9034673		*Quercus acutissima*	sawtooth oak	/GAPMC, Americus
				Block 2		
G2 16 1-8	1976	9004462	Sapparo Autumn Gold	*Ulmus* species	elm	/Univ. of WI/PI Sta. Ames, IA
G2 17 1-3	1977	9004312		*Juglans nigra*	black walnut	Doniphan Co., KS /KSPMC
G2 23 6-8	1981	9030309		*Aesculus glabra*	OH buckeye	/PI Sta. Ames, IA
G2 24 6-7	1981	9030308	Royal Red	*Acer plantanoides*	Norway maple	/PI Sta. Ames, IA
				Block 3		
G3 16 1-8	1976	9008245		*Quercus acutissima*	sawtooth oak	/TXPMC, Knox City
G3 18 1-8	1976	9004392		*Quercus macrocarpa*	bur oak	City Park, Stillwater, OK
G3 19 7	1976	9034858		*Castanea crenata*	chestnut hybrid	MOPMC
				Block 1		
HQ1 1 1	1966	9050506		*Nyssa sylvatica*	black gum	/Forrest Keeling Nursery, Elsberry, MO /KSPMC
HQ1 1 2				*Carya illinoensis*	pecan	
HQ1 1 3	1963	9050509		*Pseudotsuga menziesii*	Douglas fir	MOPMC
HQ1 1 4-11	1968	9001209		*Picea pungens*	Colorado blue spruce	/Forest Keeling Nursery, Elsberry, MO
HQ1 2 1	1983	9005161		*Crataegus phaenopyrum*	Washington hawthorn	DuPage Co., Ill. /MOPMC
HQ1 2 2	1977	514275	Magenta	*Malus* sp.	hybrid crabapple	Clinton Co., MI /MIPMC;
HQ1 2 3	1964	9050507		*Pinus edulis*	pinyon pine	/ARS, Woodward, OK
HQ1 2 4-6	1968	9001209		*Picea pungens*	Colorado blue spruce	/Forest Keeling Nursery, Elsberry, MO
HQ1 3 1	1966	9050505		*Tilia* X *euchlora*	Redmond Crimean linden	/Plumfield Nursery, Fremont, NE
HQ1 4 1,3	1982	9030989		*Forsythia ovata*	early forsythia	/NCRPIS
HQ1 4 2	1988	9049784		*Ribes odoratum*	buffalo currant	Dickinson Co., KS /KSPMC
HQ1 5 1-4	1982	9030990	Blue Star	*Juniperus squamata*	blue star juniper	Holland /NCRPIS
HQ1 5 1-4				*Yucca glauca*	soapweed	
HQ1 7 1	1984	20-1846		*Picea abies*	Norway spruce	/Griffith State Nursery, Wisconsin Rapids, WI
HQ1 7 2	1964	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., OK
HQ1 8 1		9050508		*Caragana boisii*	Siberian pea shrub	/ARS Hort. Sta., Cheyenne, WY
HQ1 8 2		483442	Flame	*Acer ginnala*	Amur maple	Eastern Asia /MOPMC
HQ1 8 3	1977	9004363		*Pinus strobiformis*	Mexican white pine	Lincoln Co., NM/Rky Mtn Exp Sta., NE
HQ1 9 1	1988			*Cerus canadensis*	red bud	Riley Co., KS
HQ1 9 2	1967	9001069		*Quercus palustris*	pin oak	/Manhattan Nursery, Manhattan, KS
				Block 2		
HQ2 1 1-15				*Crataegus phaenopyrum*	Washington hawthorn	/Lawyer Nursery, Plains, MT
HQ2 2 1-15		113095	Centennial	*Cotoneaster integerrimus*	cotoneaster	China /NDPMC
HQ2 2 2-14		540442	Regal	*Prunus tenella*	dwarf flowering almond	/NDPMC
HQ2 2 16	1976	9050510		*Syringa oblata dilatate*	Korean early lilac	/ARS Hort. Sta., Cheyenne, WY
HQ2 3 1	1977	421614		*Ulmus davidiana* var *japonica*	Japanese elm	/ARS Nursery Crops Res. Lab., Delaware, OH
HQ2 3 3		516476	Redstone	*Cornus mas*	Cornelian cherry dogwood	Asia /MOPMC
HQ2 3 4-15				*Syringa vulgaris*	common lilac	
HQ2 3 16	1976	9050511		*Spiraea sargentiana*	Sargent spirea	/ARS Hort. Sta., Cheyenne, WY
HQ2 3 17	1992			*Quercus robur*	English oak	Ill. /McKendree College
HQ2 3 18	1992	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., OK /KSPMC
HQ2 3 19	1977	514275	Magenta	*Malus* sp.	hybrid crab apple	Clinton Co., MI /MIPMC

Table 2. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs under evaluation in 2010. Page 5

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	
HQ2 4 1-6	1992			*Pyracantha*	firethorn	Blueville Nursery, Manhattan, KS
HQ2 4 7	1992	483442	Flame	*Acer ginnala*	Amur maple	E. Asia /MOPMC
HQ2 4 8	1992	478000	Midwest	*Malus baccata mandshurica*	Manchurian crab apple	Asia /Canada/NDPMC
HQ2 4 9	1966	9034666		*Euonymus atropurpureus*	wahoo	Riley Co., KS /KSPMC
P W 1	1966	9050512		*Liquidambar styraciflua*	American sweetgum	/Forest Keeling Nursery, Elsberry, MO
P W 2	1965	9050514		*Juniperus virginiana canaerti*	Canert juniper	/Nelson Nursery, Enid, OK
P W 3	1966	9050513		*Juniperus horizontalis glauca*	blue creeping juniper	/MIPMC
P W 4	1966	9000399		*Quercus rubra*	northern red oak	Greenwood Co, KS /KSPMC
P W 5-6	1971	9001455	Emerald	*Fraxinus* sp.	ash	Marshall Nursery, Arlington, NE /KSPMC
P 21 1-6	2001	9050416		*Quercus prinoides*	dwarf chinkapin oak	Salem, NE /PI Sta. Ames, IA
P 22 1-5	2001	566597	Patriot	*Ulmus* hybrid	elm	US Nat'l Arboretum /NCRPIS
P S 1-6, 8-10	1977	399400		*Pinus nigra*	Austrian pine	Yugoslavia /NCRPIS
P S 7, 11-30	1981	9034670		*Pinus nigra*	Austrian pine	/KSU Forestry
PQ S 31-50	1977	399402		*Pinus sylvestris*	Scots pine	Yugoslavia /NCRPIS
Q S 51-70	1977	399403		*Pinus sylvestris*	Scots pine	Yugoslavia /NCRPIS
Q S 71-90	1977	399404		*Pinus sylvestris*	Scots pine	Yugoslavia /NCRPIS

Table 3. Initial evaluation: Study No. 20I010K - list of miscellaneous trees and shrubs removed in 2010.

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Germplasm Release Name	Genus/ Species	Common Name	Origin/ Source
HQ1 2 3	1964	9050507		*Pinus edulis*	pinyon pine	/ARS, Woodward, OK
HQ2 3 2	Unkn			*Pinus ponderosa*	ponderosa pine	

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs. Page 1

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B1C4 19-21	PRSE2	9004384	black cherry	81	82	3	3	100	1	2	2	155	160		
			Prunus serotina		83		3	100	1	2	3	240	260		
			Ann Arundel Co., MD		05		3	100					941		
			/MDPMC		10		2	67					1163		
B1C5 19-20	PRSE2	9007345	black cherry	81	82	2	2	100	1	2	2	175	190		
			Prunus serotina		83		2	100	1	3	2	265	275		
			Hampshire Co., WV		05		2	100					990		
			/MDPMC		10		2	100					1213		
B2 3 1-5		9050529	bitter sweet	08	08	5	5	100							
			Celastrus scandans		09		5	100				23	47		
			IA /NCRPIS		10		5	100							
C1 20 A-E	FRPE	9004302	green ash	61	70	5	5	100	2			605	798	17	
			Fraxinus pennsylvanica		74		5	100	3			658	1054	20	
			Butler Co., KS /KSPMC		78		5	100	3			650	1150		
					79		5	100	3			800	1150		
					83		5	100	3	4	3	800	1175	27	
					85		4	80	3		4		1219	28	
					86		4	80	5	5		975		29	
					88		4	80	1			933		34	
					90		4	80	3	5					
					93		4	80					1372	36	
					05		4	80					1411		
					06		4	80						41	
					10		3	60					1425	45	WD, severe
C1 21 A-E	FRPE	9004304	green ash	61	70	5	5	100	1			566	833	17	
			Fraxinus pennsylvanica		74		5	100	3			622	1041	21	
			Franklin Co., KS /KSPMC		78		5	100	3			800	1100		
					79		5	100	1			800	1100		
					83		5	100	3	4	3	900	1310	30	
					85		5	100	3				1280	30	
					86		5	100	6			762			
					88		5	100	2			733		33	
					90		5	100	1	1					
					93		5	100					1292	36	
					05		4	80					1416		
					06		4	80						44	
					10		1	20					1325	63	WD, severe
E3 (see bur oak map)		9050077	white oak	95	02	4	4	100					448	6	
			Quercus alba		05		4	100					568	10	
			Lancaster Co., NE /KSPMC		07		4	100					728	12	

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs. Page 2

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
E3 21 5-7 /P21 1-6	QUPR	9050416	dwarf chinkapin oak *Quercus prinoides* /NCRPIS	01	01	9	9	100					23		
					02		8	89	6	7	5	26	31		IN - LCB
					03		8	89				42	41		
					04		8	89				67	66		DB, some
					05		8	89		5	4	93	83		
					06		8	89		1	4	109	109		Nos. - 6 DD; 7 MD, severe
					10		8	89					179		
F1 1 1-2; 2 1,4	PLOC	9049957	*Platanus occidentalis* Brownville, NE /UNL-Lincoln	85	85	4	4	100	3		2	89	178		
					86		4	100	4	4		260	240		
					87		4	100	5			442	487	6	
					88		4	100	3	3	3	553	615	10	
					89		4	100	5	5		587	714	13	
					95		4	100					1213	27	
					04		4	100					1786	36	
					09		4	100					2063	40	
F1 1 10-19	LIVU	107630	Cheyenne European privet *Ligustrum vulgare* /NDPMC	66	70	10	5	50	1			290	320		
					71		5	50	1			320	396		
					73		5	50	1						
					74		5	50	1			411	503		
					75		5	50	5			490	620		
					76		5	50	5			506	650		
					78		5	50	3			650	650		
					79		5	50	1			600	500		
					87		5	50	4			630	300		
					95		5	50					332		
					98		5	50					351		
					00		5	50					366		
					05		5	50					342		
					10										
F1 2 2-3; 3 1,4-5	PLOC	9049956	*Platanus occidentalis* Burt Co., NE /UNL-Lincoln	85	85	5	5	100	3		2	93	189		
					86		5	100	2	4		176	290		
					87		5	100	3			401	492	6	
					88		5	100	2	3	2	505	607	10	
					89		5	100	4	5		545	707	12	
					95		5	100					1225	25	
					04		5	100					1625	31	
					09		5	100					1770	33	

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs. Page 3

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F1 2 5; 3 2-3	PLOC	9049955	*Platanus occidentalis* Marysville, KS /UNL-Lincoln	85	85	3	3	100	2		2	102	183		
					86		3	100	1	4		200	310		
					87		3	100	3			453	512	7	
					88		3	100	2	3	2	557	615	11	
					89		3	100	4	5		608	723	14	
					95		3	100					1304	30	
					04		3	100					1787	39	
					09		3	100					1925	44	
F1 4 3-5	CELA	9050263	sugarberry *Celtis laevigata* /NCRPIS	97	97	3	3	100	5				107		
					99		3	100					337		
					00		3	100					465		
					01		3	100	1				558		
					02		3	100	4	1	3	509	593		
					06		3	100					908	18	
					07		3	100				753	1005	20	
F1 11 1-11	COMA21	9055585	Cornelian cherry dogwood *Cornus mas* Central Europe /NY /MOPMC	89	89	11	11	100	2	5		3	8		
					90		11	100	2	4	2	31	78		1,4-5 - frost damage, some die back
					91		11	100				45	98		
					92		11	100				53	135		
					93		11	100		3		92	173		
2-11					99	10	10	100				259	334		Good fruiting; 1- HD
					03		10	100					353		All but 2 with good fruit production
					08		10	100					365		
					10		4	40							HD
F1 12 3-12	COMA3	9083247	American hazelnut *Corylus Americana* /MOPMC	07	07	10	10	100				13	44		
					08		10	100				28	51		
					09		10	100				47	60		
					10		10	100		3	2	86	85		One produced fruit
F1 13 1-5	ELAEA	9050524	Silverscape®olive *Elaeagnus* X 'Jefmorg' Lincoln-Oakes Nursery /NDPMC	07	07	5	5	100				60	69		
					08		5	100				210	225		
					09		5	100				314	315		
					10		5	100		5	2	422	380		2,3 – WD
F1 13 6-10	PHOP	9050522	common ninebark *Physocarpus opulifolius* Bucks Co., PA /NCRPIS	07	07	3	3	100				65	45		
					08		3	100				118	91		
					09		3	100				167	116		
					10		3	100		4	1	260	142		
F1 14 1-5	RIAM2	9082687	American black currant *Ribes americanum* /Big Sioux Nursery Watertown, SD /NDPMC	07	07	3	3	100				32	51		
					08	5	5	100				51	60		1,2 - replants
					09		5	100				63	63		
					10		5	100		6	1	96	86		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs. Page 4

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F1 14 6-10	PHMI4	9050530	littleleaf mock orange	08	08	5	5	100				42	46		
			Philadelphus microphyllus		09		5	100				37	40		
			Sevier Co., UT /NCRPIS		10		5	100	8			25	31		Not adapted
F1 15 1-5	PHOP	9050531	common ninebark	08	08	5	5	100				67	56		
			Physocarpus opulifolius		09		5	100				78	94		
			/NCRPIS		10		5	100		2	1	149	135		
F1 15 6-10	CAMI48	9050581	littleleaf peashrub	10	10	3	3	100		1	1	30	80		
			Caragana microphylla			(5)									
			/NCRPIS												
F1 18 1-5	LIOB	477010	border privet	90	90	5	5	100	1	2	1	58	55		
			Ligustrum obtusifolium		91		5	100				84	79		
			/MIPMC/NCRPIS		92		5	100				111	102		
					93		5	100				190	137		
					94		5	100	2			235	164		
					99		5	100				386	288		Excellent fruit production
					05		5	100					296		
					10		5	100		3	1	558	396		
F1 19 1-5	PHME13	9050500	black chokeberry	06	06	4	4	100					54		
			Photinia melanocarpa		07	(5)	4	100				36	48		
			/NCRPIS		08		4	100				51	67		
					09		4	100				43	63		
					10		4	80				53	69		
F1 19 6-10	PHME13	323957	black chokeberry	06	06	5	5	100				42	46		
			Photinia melanocarpa		07		5	100				47	47		
			/NDPMC		08		5	100				69	72		
					09		5	100				86	77		
					10		5	100				117	100		
F1 20 1-5	VIRU	9050482	southern black haw	03	03	4	4	100	7			51	39		
			Viburnum rufidulum		04	(5)	3	80	6			30	34		
			/NCRPIS		05		3	80				38	62		
					06		3	80					76		
					07		3	80				83	160		
					08		3	80				121	161		
F1 20 6-10	VIRU	9050483	southern black haw	03	03	5	5	100	6			36	44		
			Viburnum rufidulum		04		5	100	5			33	46		
			/NCRPIS		05		5	100				47	69		
					06		5	100					84		
					07		5	100				102	130		
					08		5	100				142	162		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F1 21 1-5	SPFL9	9050417	spiraea	01	01	5	5	100	2			56	78		Weed comp; IN - LCB
			Spiraea flexuosa		02		5	100	6	6	2	42	49		DB, heavy
			/NCRPIS		03		5	100	5			49	64		Fall flowers - 3 plants
					04		5	100	6			44	58		
					05		4	80				48	53		No. 5 - gone
					06		3	60				64	73		
F1 21 6-10	XASO3	9050418	yellowhorn	01	01	5	5	100	3			34	60		Weed comp; leaf cutter bee damage
			Xanthoceras sorbifolium		02		5	100	4	7	3	39	56		DB, medium
			/NCRPIS		03		5	100	4			81	89		No. 5 - die back; recovered summer
					04		5	100	5			93	105		
					05		5	100				117	134		
					06		5	100		2	1	177	178		
					08		5	100							First flowering and fruit production
F1 22 1-5	COSA81	9050425	blood-twig dogwood	02	02	5	5	100	4	4	4	27	80		Heavy browse
			Cornus sanguinea		03		5	100	3			69	106		No. 3 - tip breakage - boring insect
			/NCRPIS		04		5	100	6		7	170	148		
					05		5	100				260	198		
					06		5	100				297	224		Second flush - flowering/fruiting-Sept.
					07		5	100				363	256		
F1 22 6-10	COSA81	9050426	blood-twig dogwood	02	02	5	5	100	3	6	5	42	57		Medium browse
			Cornus sanguinea		03		5	100	6		5	74	81		
			/NCRPIS		04		5	100	3		4	181	169		
					05		5	100				241	212		
					06		5	100				259	226		Second flush - flowering/fruiting-Sept
					07		4	80				236	240		No. 1 – dead
F1 23 1-5	COCO10	9050427	smokebush	02	02	5	5	100	2	3	2	50	84		Slight browse
			Cotinus coggygria		03		5	100	1			92	151		
			/NCRPIS		04		5	100	4			137	219		
					05		5	100				185	258		
					06		5	100				243	307		
					07		5	100				253	329		
F1 23 6-10	HYAR6	9050498	silver leaf hydrangea	06	06	5	5	100				15	36		
			Hydrangea arborescens		07		4	80				31	35		
			radiata		08		4	80				45	51		
			/NCRPIS		09		3	60				49	49		
					10		3	60				68	81		

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs. Page 6

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F1 24 1-5	SOAU	9050429	mountain ash	02	02	5	5	100	6	7	4	20	46		Browse
			Sorbus aucuparia		03		3	60	5			39	93		
			/NCRPIS		04		2	40	3			53	120		
					05		2	40				88	180		
					06		2	40				123	238		DD
					07		2	40				148	296		
F1 24 6-10	SOTO8	9050430	wild service tree	02	02	5	5	100	5	5	6	16	61		Browse
			Sorbus torminalis		03		5	100	6			21	68		
			/NCRPIS		04		5	100	3	6	6	17	92		No. 2 - girdled by deer
					05		5	100				28	139		
					06		5	100				40	180		
					07		5	100				36	186		
F1 25 1-3	SHAR	9050431	silver buffalo berry	02	02	2	2	100	6	6	7	14	61		Browse
			Shepherdia argentea		03		2	100	3			31	104		
			/NCRPIS		04		2	100	5			82	176		Mechanical damage
					05	1	1	100				117	211		No. 1 - Disked out.
					06	(2)	1	100				146	268		
					07		1	100				191	315		
F1 25 6-10	SOTO8	9050432	wild service tree	02	02	4	4	100	7	1	2	16	47		Browse
			Sorbus torminalis		03		4	100	8			23	39		No. 9 - replanted
			/NCRPIS		04		3	60	5	5	5	17	60		No. 3 - DD
					05		3	60				25	104		
					06		3	60				36	144		
					07		3	60				41	174		
F1 26 1-6	SYVU	9050007	common lilac	85	91	6	6	100							Transplanted from Field G
			Syringa vulgaris		92		6	100				106	121		Powdery mildew
			Phillips Co., KS /KSPMC		93		6	100				152	150		No. 6 - leaves dried up early
					94		6	100							Mildew
					95		5	83					186		
					05		5	83					252		
					09		5	83					266		

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs. Page 7

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F2 4 1-10	PYUS2	9006095	Harbin pear	67	70	10	10	100	3			210	238		
			Pyrus ussuriensis		71		10	100	3			213	322		
			Morden, Manitoba, CAN		73		10	100	3						
			/NDPMC		74		10	100	3			488	533		
					75		10	100	3			549	610		
					76		10	100	3			640	732		
					78		10	100	3			670	750		
					79		10	100				770	770		
					83		10	100	3	4	3	1000	825		
					88		10	100	2	2	3	1280	880		
					93		9	90					1045	24	Good fruit production; No. 6 - WD
					96		9	90	1				1119		
					01		8	80	4				974	24	
					07		8	80					1159	33	
F2 9 1-4	DIVI5	9050011	common persimmon	89	89	4	4	100	9	3		3	13		
			Diospyros virginiana		90		4	100	1			22	45		
			/NCRPIS		91		4	100				29	68		
					92		4	100				70	129		
					93		4	100		3	5	125	203		
					98		4	100				345	476		Mean shoot growth - 42-cm
					99		4	100					605		Nos. 1 & 2 - HD
					03		4	100					605		No. 1 - a resprout; fruit amount - 5
					08		4	100					767		
F2 11 1-5	CELAR	9050519	netleaf hackberry	07	07	5	5	100				26	47		
			Celtis laevigata var		08		5	100				30	50		
			canadensis		09		5	100				35	51		
			Union Co., NM		10		5	100		7	3	90	98		
			/NCRPIS												
F2 11 6-10	ALMA7	9050518	seaside alder	07	07	4	4	100				42	64		
			Alnus maritime subsp.		08	(5)	4	100				91	110		
			oklahomensis		09		4	100				150	184		
			Tishomingo, OK/ISU,		10		4	100		2	2	212	243		2 – WD
			Ames, IA /NCRPIS												
F2 12 1-5	CECA4	9050520	red bud	07	07	5	5	100				49	58		
			Cercis canadensis		08		5	100	5			74	72		
			Van Buren Co., IA		09		5	100				94	78		
			/NCRPIS		10		5	100		7	6	138	110		
F2 12 6-10	CECA4	9050521	red bud	07	07	5	5	100				51	65		
			Cercis canadensis		08		5	100	3			77	80		
			Keokuk, Lee Co., IA		09		5	100				103	104		
			/NCRPIS		10		5	100		7	7	180	171		IN - LCB; GH

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs. Page 8

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F2 13 1-5	PTTR	9050523	common hop-tree	07	07	5	5	100				59	115		
			Ptelea trifoliate		08		5	100				115	151		
			Van Buren Co., IA		09		5	100				189	191		
			/NCRPIS		10		5	100			8	252	257		WD; IN - WF; attractive fruits
F2 13 6-10	CRCH	9076686	fireberry hawthorn	07	07	5	5	100				15	37		
			Crataegus chrysocarpa		08		5	100					51		
			Lincoln-Oakes Nursery		09		5	100				32	55		
			/NDPMC		10		5	100		8		42	81		
F2 14 1-5	QUAL	9050532	white oak	08	08	5	5	100				47	59		
			Quercus alba		09		5	100				65	81		
			Richardson Co., NE /NCRPIS		10		5	100		4	3	100	159		IN - BW; 1 - rub
F2 14 6-10	RHCO	9050537	shining sumac	09	09	5	5	100				86	69		
			Rhus copallinum		10		5	100				133	102		
			Iroquois Co., IL /NCRPIS												
F2 15 1-5	TETRA25	9050584	*Tetradium* sp.	10	10										
F2 15 6-10	CHLI	9050543	desert willow	09	09	5	5	100				23	47		
			Chilopsis linearis		10		4	80				176	147		
			Meade Co., KS /KSPMC												
F2 24 1-5	SYPE2	9006225	Peking lilac	73	73	5	5	100	3			78	70		
			Syringa pekinensis		74		5	100	3			157	130		
			/NDPMC		75		5	100	3			210	230		
					76		5	100	3			310	315		
					78		5	100	3			440	400		
					79		5	100	1			440	500		
					83		5	100	1	3	2	700	610		
					93		5	100					665		
					02		5	100					768		
					07		5	100					793		
F2 24 6-10	FORSY	9034667	early forsythia hybrid	73	73	5	5	100	1			88	73		
			Forsythia europaea X		74		5	100	1			116	143		
			ovata		75		5	100	3			142	189		
			/NCRPIS		76		5	100	3			180	201		
					77		5	100	3			210	215		
					78		5	100	3			315	255		
					79		5	100	1			300	300		
					83		5	100	1	2	2	470	350		
					93		5	100					350		
					02		5	100					305		
					07		5	100					252		

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs. Page 9

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F3 2 1-11	QUPA2	9001069	pin oak	67	70	11	9	82	3						
			Quercus palustris		71		9	82	5			290	332		
			/Manhattan Nursery		74		9	82	5			457	518		
			Manhattan, KS		75		9	82				488	700		
					76		9	82				670	762		
					78		8	73				800	960		
					01		8	73					1334	37	
					07		7	67					1670	43	
F3 3 2-6	ULPA	486339	lace-bark elm	02	02	3	3	100	4	1	3	19	58		
			Ulmus parvifolia		03	5	5	100				30	78		Added 2 new plants
			/NCRPIS		04		5	100	2	2	2	73	163		Good clean foliage
					05		5	100				123	250		
					06		5	100					317		
					07		5	100					384		
F3 7 1-5	BEPA	9050478	paper birch	03	03	5	5	100					147		
F3 7 1			*Betula papyrifera*		04		1	20	6	5	3	86	173		
			western North Dakota		05		1	20				82	188		
			/NCRPIS		06		1	20					191		DD
					07		1	20				89	201		
					08		1	20				136	245		
F3 7 2-4	POAL7	9050499	white poplar	06	06	3	3	100					168		No. 2 - DD
			Populus alba		07		3	100				268	315		
			South Korea /NCRPIS		08		3	100					499		
					09		3	100				486	778		
					10		3	100		2	3		902		2 – Premature leaf fall
F3 7 6-10	TICO2	9050481	littleleaf linden	03	03	2	2	100				20	40		
6			*Tilia cordata*		04		1	50	5	4	5	51	67		
			Ukraine /NCRPIS		05		1	50				83	110		
					06		1	50					167		
					07		1	50				127	240		
					08		1	50				196	300		
F3 7 7-11	POTR5	9050535	quaking aspen	09	09	5	5	100				100	189		
			Populus tremuloides		10		5	100		8	3	106	195		
			Platte Co., NE/NCRPIS												
F3 8 1-5	CABE8	9050479	European hornbeam	03	03	5	5	100				22	67		
			Carpinus betulus		04		5	100	4	4	5	38	83		
			Ukraine /NCRPIS		05		4	80				58	104		
					06		4	80					156		
					07		4	80				75	158		
					08		4	80				111	204		

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs. Page 10

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F3 8 6-10	CABE8	9050480	European hornbeam	03	03	3	3	100				28	62		
			Carpinus betulus		04		3	100	5	4	3	32	61		
			Ukraine /NCRPIS		05		3	100				43	73		
					06		3	100					90		
					07		3	100				48	73		
					08		3	100				87	119		
F3 10 1-10	BENI	9034682	river birch	71	83	10	10	100	1	4	3	1100	1220		
			Betula nigra		86		10	100				1280	1300		
			Houston Co., MN		95		10	100					1359		
			/NCRPIS		07		10	100					1525	32	
					10		10	100					1611		3 – WD, top
F3 12 1-10	CEOC	9050497	common hackberry	06	06	10	10	100					78		
			Celtis occidentalis		07		10	100				60	90		
			Forest Keeling Nursery		08		10	100				75	100		
			Elsberry, MO		09		10	100				74	125		DB, heavy
					10		10	100		6	5	176	197		
F3 13 1-10	CEOC	9066615	common hackberry	06	06	10	10	100					116		
			Celtis occidentalis		07		10	100				106	138		
			Oklahoma		08		10	100				162	204		
			/KSPMC/NMPMC		09		10	100				216	298		DB, heavy
					10		10	100		2	2	346	384		
F3 14 1-5	CACA18	9050501	American hornbeam	06	06	5	5	100					60		
			Carpinus caroliniana		07		5	100				43	66		
			MN, Wisc. /NCRPIS		08		5	100				68	80		
					09		5	100				89	112		
					10		5	100		4	3	138	181		
F3 14 6-10	ULTH	9050503	rock elm	06	06	5	5	100					69		
			Ulmus thomasii		07		5	100				29	66		
			Dixon Co., NE /NCRPIS		08		5	100				88	86		
					09		5	100				31	69		
					10		5	100		7	2	32	65		
F3 15 1-10	FOPOP	9050502	elbow bush	06	06	10	10	100					92		
			Foresteria pubescens var		07		9	90				20	106		
			pubescens		08		9	90				23	127		
			/NCRPIS		09		9	90					165		
					10		9	90		2	1	36	229		
F3 16 1-5	GIBI2	9050582	Ginkgo	10	10	5	5	100		4	1	41	63		
			Ginkgo biloba												
			/NCRPIS												

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F3 16 6-10	PLOC	9050583	Smooth sycamore *Platanus occidentalis* var *glabrata* /NCRPIS	10	10	5	5	100		3	2	107	182		
F3 19 1-10	FRPE	9004302	green ash *Fraxinus pennsylvanica* Butler Co., KS /KSPMC	71	75	10	10	100	1			305	457		
					76		10	100	1			396	518		
					78		10	100	1			475	670		
					86		10	100	5			732	1200		
					87		10	100	5				1043		
					88		10	100	2	3		798			
					90		10	100	4	2					
					95		9	90					1173		
					05		8	80					1236		No. 1 – dead
					10		8	80					1083		9 – major top damage; declining
F3 20 1-5	ULMUS	341756	Holland elm hybrid *Ulmus* X *hollandica* /NCRPIS	71	75	5	4	80	5			225	430		
					76		4	80	5			290	470		
					77		4	80	3			335	500		
					78		4	80	3			390	550		
					79		4	80	3			400	650		
					86		4	80	5			457	1200		
					95		3	60					1104		No. 1 – top dead
					05		3	60					1214		
					10										
F3 20 6-10	FREX80	265620	European ash *Fraxinus excelsior* West Germany /NCRPIS	73	73	5	5	100				30	174		
					74		5	100				61	226		
					75		5	100	5			104	310		
					76		5	100	5			155	350		
					77		5	100	3			244	457		
					78		5	100	3			260	490		
					79		5	100	1			347	536		
					96		4	80					664	24	No. 4 - is a sucker
					07		1	20					822	34	

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F3 21 1-5	QUERC	9034674	Swedish hybrid oak	72	72	5	5	100	3			9	37		
			Quercus sp.		73		5	100	3			27	61		
			/UNL-Lincoln /NCRPIS		74		5	100	3			52	113		
					75		5	100	5			132	192		
					76		5	100	5			183	275		
					77		5	100	5			250	350		
					78		5	100	5			290	430		
					79		5	100	5			350	500		
					83		5	100	3	6	4	500	650	15	
					88		5	100	3	3	3	661			
					89		5	100					873		
					90		5	100	4	8	9				
					93		5	100					897	23	No. 3 - top out
					96		5	100	8				941		
					01		5	100					1000	29	
					06		5	100					1200	28	
F3 21 6-10	QURO2	9017646	English oak	72	72	4	4	100	3			15	73		
			Quercus robur.		73	(5)	4	100	5			61	107		
			/ISU Hort Farm /NCRPIS		74		4	100	3			94	183		
					75		4	100	5			138	295		
					76		4	100	5			195	365		
					77		4	100	5			220	435		
					78		4	100	5			270	525		
					79		4	100	3			350	600		
					83		4	100	1	1	1	600	780	18	
					88		4	100	2		9	740		25	
					89		4	100	2	1	9		909		
					90		4	100	3						
					96		4	100	5				951	32	No. 6 - top dead
					01		4	100					984		
					06		4	100					1123	32	
F3 22 6-10	QUPH	9050022	willow oak	90	90	5	5	100		2	3	22	32		
			Quercus phellos		91		4	80				21	34		DB, severe
			central TN /NCRPIS		92		4	80				52	81		
					93		4	80				97	151		No. 9 - small
					94		4	80	4			137	241	1	No. 9 - winter injury
					98		3	60							1 dead, mechanical
					99		3	60					363		
					04		3	60					504		
					09		3	60				408	832		Comp., severe

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F3 23 6-10	QUMA2	9004392	bur oak	72	72	5	5	100	5			17	26		
			Quercus macrocarpa		73		5	100	3			82	125		
			Payne Co., OK /KSPMC		74		5	100	3			76	184		
					75		5	100	3			160	300		
					76		5	100	3			240	365		
					78		5	100	3			330	512		
					79		5	100	1			425	600		
					81		5	100	1		8	800	670	18	
					83		5	100	1	6	1		840	25	
					85		5	100	1				980		
					89		5	100	1				980	29	
					90		5	100	1						
					93		5	100	1				1021	32	
					96		5	100	1				1112		
					01		5	100	1				1171	36	
					07		5	100					1318	38	
F3 24 1-10	QUAC80	434253	sawtooth oak	73	73		10	100	3			64	66		
			Quercus acutissima		74		10	100	3			111	137		
			/GAPMC		75		10	100	3			200	270		
					76		10	100	3			275	305		
					78		10	100	3			400	550		
					79		10	100	3			450	650		
					83		10	100	1	3	3	650	800	20	
					89		10	100	3		1		951		
					93		10	100					959	43	No. 8 - suckers
					02		10	100					1230	30	
					07		9	90					1242	33	No. 4 - top gone
F4 5 10-11	JUCO12	323932	shore juniper	73	75	7	7	100	5			100	25		
			Juniperus conferta		76	(9)	7	100	3			160	25		
			/MDPMC		78		7	100	3			170	40		
					79		7	100	3			245	50		
					83		7	100	2	3	3	400	50		
					93		7	100					59		
					02		7	100	3	5			46		
					07		7	100		2		224	42		
F4 10 9-13	JUNIP	9004334	columnar juniper	75	78	5	5	100	5			60	175		
			Juniperus sp		79		5	100	5			70	220		
			Custer Co., NE /HPHRS,		83		5	100	3	5	3	160	430		Cedar-Apple rust
					99		5	100					963		
					04		5	100					1060		
					09		5	100				199	1112		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F4 11 1-10	CUBA	9050504	Modoc cypress	06	06	10	10	100				17	35		
			Cupressus bakeri		07		9	90				28	45		
			/Lawyer Nursery Plains,		08		6	60		6		39	54		
			MT		09		6	60				53	58		
					10		4	40							DD - 25%
F4 12 1-5	PISYM	9076719	Mongolian pine	09	09	4	4	100				42	44		
			Pinus sylvestris var. *mongolica*		10	(5)	4	100				62	77		DD - 50%
			Shangzhi, China /NCRPIS												
F4 12 1-10	PISYM	9076718	Mongolian pine	09	09	5	5	100				51	55		
			Pinus sylvestris var. *mongolica*		10		5	100				72	86		DD, severe - 100%
			Nenjiang, China /NCRPIS												
F4 13 1-5	TADI2	9050542	bald cypress	09	09	5	5	100				35	77		
			Taxodium distichum		10		5	100				128	140		DD
			Real Co., TX /NCRPIS												
F4 18 1-10	THOC2	477011	northern white cedar	82	83	10	10	100	5	5	3	47	73		
			Thuja occidentalis		96		10	100	3				472		
			/MIPMC		07		10	100					590		No. 3 – Comp.
F4 19 1-6	PISY	343949	Scots pine	76	76	(9)	4		7			20	15		
			Pinus sylvestris		77	6	6	100	5			40	30		
			/MDPMC		78		6	100	5			50	45		
					79		6	100	3			85	65		
					83		6	100	2	3	3	230	210	4	
					95		6	100					745		
					00		6	100					1027		
					05		6	100							
					07		4	67					1120		Nos. 1- dying; 3 & 5 - dead
F4 20 7-9	PISY	343948	Scots pine	76	76	(9)	1		7			30	15		
			Pinus sylvestris		77	3	3	100	7			20	20		
			/MDPMC		78		3	100	7			35	32		
					79		3	100	5			40	60		
					83		3	100	3	3	3	215	185	2	
					86		3	100				340	370		
					95		3	100					691		
					00		3	100					924		
					05		3	100							No. 9 - 90% dead
					07		1	33					975		Nos. 7 - dying; 8 & 9 - dead

Table 4. Initial evaluation data: Study No. 20I010K – miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
F4 21/ 1-10	PIAB	9034668	Norway spruce	74	74	10	10	100	5			23	27		
			Picea abies		75		10	100	5			25	40		
			/Griffith State Nursery		76		10	100	5			40	60		
			Wisconsin Rapids, WI		77		10	100	3			60	75		
			/KSPMC		78		10	100	3			80	100		
					79		10	100	3			110	120		
					83		10	100	4			230	240	4	
					94		10	100	1				642		
					98		10	100					832		
					02		8	80							
					03		8	80					932		
					07		8	80							Nos. 6 -7 - dead
					08		8	80					1083		No. 8 - dying
F4 22/ 1-10	PIST3	9004363	Mexican white pine	73	74	10	10	100	5						
			Pinus strobiformis		75		10	100	3			50	60		
			Lincoln Co. NM /RMFRS		76		10	100	3			75	95		
			/KSPMC		78		9	90	3			140	120		
					79		9	90	3			150	160		
					83		9	90	2			350	340	7	
					93		9	90					677	15	
					02		8	80					985		
					07		6	60					1149		Nos. 1, 5, & 8 - dead
F4 23/ 1-10	PINI	9004364	Austrian pine	73	75	10	10	100	3			70	75		
			Pinus nigra		76		10	100	3			120	110		
			N. Turkey /RMFRS		78		10	100	3			190	195		
			/KSPMC		79		10	100	3			200	220		
					83		10	100	1			430	465	15	
					93		10	100					843	23	No. 10 - disease resistant
					02		10	100					1112		Nos. 1 - dying: 4 - dead
					07		6	60					1010		
F4 25/ 8-20	PIHE	9034669	Heldreich pine	73	73	13	13	100	7						
			Pinus leucodermis		74	(20)	10	77	7						
			Yugoslavia /RMFRS, NE		75		8	61	7			10	15		
			/MDPMC		76		8	61	5			20	25		
					78		7	54	7			27	33		
					79		7	54	7			27	35		
					83		6	46	7			70	85		
					93		6	46					258		
					03		5	38					494	8	
					07		3	23					552		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
GA 1 1-4	ULPA	250278	Chinese elm	91	91	10	10	100				14	53		
2 1-4			*Ulmus parvifolia*		92		10	100					59		
G 1/ A-B			Rochester, NY /MOPMC		93		10	100				60	96		
					94		10	100	2			84	113		DB
					95		10	100					138		1 destroyed by deer, heavy browse
					05		10	100					742	11	
					10		10	100					1167		Canopy encroachment
G 1/ B-E	ULPA	9004437	Chinese elm	74	77	4	3	75	3			130	175		
			Ulmus parvifolia		78		3	75	3			185	215		
			Woodard, OK /NRCS SO,		79		3	75	3			220	300		
			Stillwater, OK /KSPMC		83		3	75	4			400	600	8	
					93		3	75						16	
					98		3	75					1285		
					02		3	75					1321		
					03		3	75						30	
					04		3	75					1604		
					07		3	75					1783	31	E - top missing
G 2/ A-E	ULMUS	9004439	Offerle elm	63	70	5	5	100	5			323	643	10	
			Ulmus species		74		4	80	5			451	991	14	
			Edwards Co., KS /KSPMC		78		4	80	3			500	1050		
					79		4	80	1			500	1100		
					83		4	80	2			650	1330	27	
					93		4	80						33	
					97		3	60							C - dead
					02		2	40					1585	42	
					07		2	40					1775	45	
G 3/ A-E	ULPA	9013711	Chinese elm	63	70	5	5	100	3			457	640	11	
			Ulmus parvifolia		74		4	80	3			564	914	18	
			/USDA ARS, Woodard, OK		78		4	80	3			500	1500		
			/KSPMC		79		4	80	3			650	1450	28	
					83		4	80	3			600	1300	35	
					93		4	80							
					97		4	80					1574		
					02		4	80					1699	39	
					07		4	80					1850	42	D - top broken; E - main stem broken
G 3/ F-J	CEOC	9004256	common hackberry	63	66	5	5	100	2			415	445	6	
			Celtis occidentalis		70		5	100	2			530	713	15	
			Pottawatamie Co., KS		74		5	100	3			615	927	20	
			/KSPMC		78		5	100	5			500	850		
					93		2	40						45	
					97		2	40					1387		
					02		2	40					1433	55	
					07		2	40					1588	56	

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
G 4/ A-E	ULMUS	9004440	hybrid elm	63	70	5	5	100	3			299	689	10	
			Ulmus species		74		5	100	4			439	1006	15	
			/KSU Horticulture Farm		78		5	100	3			400	1100		
			Manhattan, KS		79		5	100	3			400	1300		
					83		5	100	5			400	1250	24	
					93		5	100						31	
					97		5	100					1428		
					02		5	100					1487	37	
					07		5	100					1600	40	B - top dead
G 8/ F-J	CEOC	9004255	common hackberry	63	66	5	5	100	1			390	427	5	
			Celtis occidentalis		70		5	100	3			597	668	14	
			Central Oklahoma /KSPMC		74		5	100	2			732	920	22	
					78		5	100	3			900	1100		
					79		5	100	1				1125		
					83		4	80	7			800	1200	33	I, J - much dead wood - herbicide
					93		3	60						45	
					97		3	60					1707		
					02		3	60					1960	54	
					07		3	60					1933	56	
G 9/ F-J	CAIL2	9034679	pecan	63	70	5	5	100	5			183	326		
			Carya illinoensis		74		5	100	3			427	628	9	
			/KSU Forestry, KS		83		5	100	3			450	1150	16	
					93		5	100						23	
					97		5	100					1747		
					02		5	100					1823	26	
					07		5	100					1905	28	
G 10/ F-J	CAIL2	9034680	pecan	63	70	5	4	80	4			207	290		
			Carya illinoensis		74		4	80	3			436	695	10	
			/KSU Forestry, KS		78		4	80	5			450	800		
					79		4	80	3			500	880		
					83		4	80	3			600	760	23	
					93		4	80						31	
					97		4	80					1833		
					02		4	80					1996	36	
					07		4	80					2176	39	
G 2/ K-O	JUVI	9004329	eastern red cedar	63	70	5	5	100	1			323	421	9	
			Juniperus virginiana		74		5	100	1			451	567	15	
			/KSU Forestry, KS		78		5	100	3			500	750		
					79		5	100	1			500	750		
					83		5	100	3			600	760		
					02		5	100					1055		
					07		5	100					1149		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
G 4/ K-N	JUVI	9004333	eastern red cedar	63	70	4	4	100	1			299	351	6	
			Juniperus virginiana		74		4	100	1			457	564	12	
			Harper Co., OK		78		4	100	1			500	700		
					83		4	100	3			600	825		
					02		4	100					1126		
					07		4	100					1266		
G 6/ K-O	JUVI	9004332	silver eastern red cedar	63	70	5	5	100	1			378	424	9	
			Juniperus virginiana		74		5	100	1			530	530	17	
			/SPR Sta.		78		5	100	3			550	700		
					83		5	100	4			750	900		
					02		5	100					1256		
					07		4	80					1303		
G 8/ K-O	PIPO	9034671	ponderosa pine	63	70	5	3	60	7			131	152		
			Pinus ponderosa		74		3	60	7			296	375	9	
			/KSU Forestry, KS		78		3	60	5			300	550		
					83		3	60	5			500	1250		
					02		3	60					1530		
					07		3	60					1682		
G 9/ K-O	PINI	9013469	Austrian pine	63	70	5	5	100	6			143	140		
			Pinus nigra		74		5	100	4			311	341		
			/KSU Forestry, KS		78		5	100	3			500	600		
					79		5	100	5			500	670		
					83		5	100	3			700	750		
					97		5	100							
					02		3	60					1311		
					07		0	0							
G 15/ U-Y	QUAC80	9034673	sawtooth oak	64	70	5	4	80	4			286	390	6	
			Quercus acutissima		74		4	80	3			533	701	12	
			/GAPMC		75		4	80	4			579	732		
					78		4	80	3			900	1000		
					79		4	80	3			850	1000		
					93		3	60					938	39	
					96		2	40					1055		
					98		2	40					1098	43	
					03		2	40						45	
					04		2	40					1205		
					09		2	40					1213	48	

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Plot Location		PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
G1 17	1-3	JUNI	9004312	black walnut	77	77	3	3	100	3			10	45		
				Juglans nigra		78		3	100	1			80	117		
				Doniphan Co., KS		79		3	100	1			250	240		
						83		3	100		1		550	575	9	
						93		3	100					1155	18	
						01		3	100					1329	24	
						06		3	100					1600	31	
G2 16	1-8	ULMUS	9004462	elm	76	76	8	8	100	3			110	130		
				Ulmus sp.		77		8	100	3			270	174		
				/NCRPIS		78		8	100	1			420	315		
						79		8	100	1			600	400		
						83		8	100	1	3	3	900	860		
						86		8	100				914	1200		
						00		8	100					1551		
						05		8	100					1713		
						10		8	100					1850		
G2 23	6-8	AEGL	9030309	Ohio buckeye	81	81	3	3	100				15	52		
				Aesculus glabra		82		3	100				15	58		
				/NCRPIS		83		3	100	6	6	3	24	64		Leaves dropping 8/20.
						85		3	100	5		8		88		
						86		3	100	4	4	5	95	142		
						91		3	100				206	236		
						93		3	100					278		
						05		3	100					501		
						10		3	100					579		No. 2 removed - encroachment
G2 24	6-7	ACPL	9030308	Norway maple	81	81	3	3	100				21	118		
				Acer plantanoides		82		3	100				30	104		
				/NCRPIS		83		2	67	6	5	5	55	110		
						85		2	67	5			120	274	5	
						87		2	67	5	5	5	100	280		
						93		1	33					364		
						05		1	33					478		
						10		1	33					654		
G3 16	1-8	QUAC80	9008245	sawtooth oak	76	76	8	8	100	5			25	40		
				Quercus acutissima		77		8	100	5			90	70		
				/TXPMC, Knox City		78		8	100	3			150	170		
						79		8	100	5			220	300		
						83		8	100	3	3	3	420	550	7	
						85		8	100	1	1	2	427	518		
						95		8	100					953	18	
						00		8	100					1055		
						05		8	100					1095	23	
						10		8	100					1256	28	No. 1 – top broken

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Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
G3 18 1-8	QUMA2	9004392	bur oak	76	76	8	8	100	3			15	80		
			Quercus macrocarpa		77		8	100	3			80	140		
			City Park, Stillwater, OK		78		8	100	3			100	180		
			/KSPMC		79		8	100	3			260	300		
					81		8	100	3				425		
					83		8	100	3	1	4	560	575	13	
					85		8	100	5			457	518	23	
					86		8	100	2			549	600		
					89		8	100						22	
					93		8	100					853	27	
					95		8	100					933	30	
					00		8	100					1048		
					05		8	100					1042	35	
					10		8	100					1203	39	
G3 19 7	CACR27	9034858	chestnut hybrid	76	76	1	1	100	5			5	15		
			Castanea crenata		77	(8)	1	100	3			25	45		
			/MOPMC		78		1	100	3			80	90		
					79		1	100	3			180	200		
					83		1	100	1	1	2	520	440		
					85		1	100	1			460	457		
					93		1	100					679		
					95		1	100					738		
					00		1	100					884		
					05		1	100					842		
					10		1	100							
HQ1 1/1	NYSY	9050506	black gum	66	66	1	1	100							
			Nyssa sylvatica		06		1	100					1050	22	
			/Forrest Keeling Nursery, Elsberry, MO		10		1	100					1175	24	
HQ1 2/2	MALUS	514275	hybrid crab apple	77	77	1	1	100							
			Malus sp.		07		1	100					900	29	
			Clinton Co., MI /MIPMC		10					8					Cedar-apple rust; WD
HQ1 2/3	PIED	9050507	pinyon pine	64	64										
			Pinus edulis		10		1						539		Removed – poor siting
			/ARS, Woodward, OK												
HQ1 3/1	TIEU3	9050505	Redmond Crimean linden	66	66	1	1	100							
			Tilia X *euchlora*		06		1	100				1483	1580	88	
			/Plumfield Nursery, Fremont, NE		10		1	100				1457	1800	90	

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
HQ1 8/3	PIST3	9004363	Mexican white pine	77	77	1	1	100							
			Pinus strobiformis		06		1	100					1150		
			Lincoln Co., NM /RMFRS, NE												
HQ2 2/16	SYOBD	9050510	Korean early lilac	76	76	1	1	100							
			Syringa oblate dilatate		06		1	100				732	268		
			/HPHRS		10		1	100				631	276		
HQ2 3/1	ULDAJ	421614	Japanese elm	77	77	1	1	100							
			Ulmus davidiana var		82		1	100	1	3	3	475	470	6	
			japonica		83		1	100	1	2	3	450	600	9	
			/USDA ARS Nurs. Crops Res. Sta., Delaware, OH		06		1	100					1925	75	
HQ2 4/9	EUAT	9034666	wahoo	66	66	1	1	100							
			Euonymus atropurpureus		10		1	100				815	437		
			Riley Co., KS /KSPMC												
P 22 1-5	ULMUS	566597	elm	01	01	5	5	100					103		
			Ulmus hybrid		02		5	100	1	2	2	74	125		Medium browse
			/NCRPIS		03		5	100				81	109		Severe rubbing and browse damage
					04		5	100			7	104	156		DB, heavy
					05		5	100				154	225		
					06		5	100		3	7	212	293		
					10		5	100					679		
P/S 1-6, 8-10	PINI	399400	Austrian pine	77	77	9	9	100	7			13	12		
			Pinus nigra		78	(10)	9	100	7			30	23		
			/NCRPIS		79		9	100	5			47	48		
					83		9	100	3			205	210	3	
					86		9	100	5			296	380		No. 9 - PS
					96		9	100					668		
					01		9	100					817		
					06		8	89					1039		
P/S 7, 11-30, 55, 57, 83, 85	PINI	9034670	Austrian pine	81	83	25	25	100	5		3	28	22		
			Pinus nigra		86	(26)	23	92	5			64	62		No. 55 - PS
			/KSU Forestry, Manhattan, KS		95		23	92					337		
					01		21	84					615	20	
					05		21	84					750		
					10		20	80					914		

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
PQ/S 31-35, 37-50	PISY	399402	Scots pine	77	77	20	20	100	3			14	21		
			Pinus sylvestris		78		20	100	3			33	36		
			/NCRPIS		79		20	100	3			52	56		
					83		19	95	2		3	230	225	4	
					86		19	95	5			345	342		Nos. 48 & 50 - PS
					96		19	95					728		
					01		19	95					844	25	
					06		13	65					1009		
					10		5	25					1005		PW
P/W 1/ 1	LIST2	9050512	sweetgum	66	66	2	2	100							
			Liquidambar styraciflua		06		1	50				1564	1430	72	
			/Forest Keeling Nursery, Elsberry, MO		10		1	50					1487	76	
P/W 1/ 2	JUVI	9050514	Canert juniper	65	65	1	1	100							
			Juniperus virginiana canaerti		06		1	100							Over topped with vines
			/Nelson Nursery, Enid, OK		10										
P/W 1/ 3	JUHO2	9050513	blue creeping juniper	66	66	1	1	100							
			Juniperus horizontalis glauca		07		1	100							
			/MIPMC		10										
P/W 1/ 4	QURU	9000399	northern red oak	66	66	1	1	100							
			Quercus rubra		06		1	100				1501	1130	44	
			Greenwood Co., KS /KSPMC		10		1	100					1189	51	
P/W 1/ 5-6	FRPE	9001455	ash	71	71	2	2	100							
			Fraxinus sp.		06		2	100					1225	65	
			/Marshall Nursery, Arlington, NE		10		2	100					1245	70	
Q/S 51-54, 56, 58-70	PISY	399403	Scots pine	77	77	18	18	100	3			18	24		
			Pinus sylvestris		78	(20)	18	100	3			35	36		
			/NCRPIS		79		18	100	3			55	57		
					83		18	100	1	4	3	245	240	5	
					86		18	100	5			381	413		52, 53, 58, 61-62, 65, 68 - PS
					96		18	100					819		
					01		18	100					945	28	
					06		13	72					1178		
					10		12	67					1053		PW

Table 4. Initial evaluation data: Study No. 20I010K - miscellaneous trees and shrubs.

Plot Location	PLT SYM	Accession Number	Species Origin/Source	YR PLT	YR REC	NO. EST	NO. SRV	PCT SRV	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
Q/S 71-82,	PISY	399404	Scots pine	77	77	18	18	100	5			12	16		
84, 86-90			*Pinus sylvestris*		78	(20)	18	100	5			26	21		
			/NCRPIS		79		18	100	5			40	36		
					83		18	100	3	3	3	175	175	2	
					86		18	100	5			294	315		
					96		18	100					714		
					01		18	100					832	31	
					06		18	100					991		
					10		11	61					950		PW

Legend for miscellaneous tree and shrub evaluations:

Plot Location: Field number, row number, and plot (numbered spaces in the row).

E.g., B3 1 9-14 = Field B3, Row 1, Plot numbers 9-14

Data Element Designations

CAN COV: Crown width or ground cover as measured in centimeters
DI: Disease Resistance, rating 1-9
IN: Insect Resistance, rating 1-9
NO. EST: Number Established
NO. SRV: Number Surviving
PCT SRV: Percent Survival
PLT DBH: Diameter at Breast Height in centimeters, measured at 137 cm above the ground
PLT HGT: Total plant height as measured in centimeters
VI: Plant Vigor, rating 1-9
YR PLT: Year Planted
YR REC: Year of Record

Plot Remarks: Frequently Used Abbreviations

BW: Bagworms
Comp.: Competition
DB: Deer Browse
DD: Deer Damage
GH: Grass Hoppers
HD: Herbicide Damage
IN: Insects
LCB: Leaf Cutter Bee
MD: Mechanical Damage
PS: Produced Seed
PW: Pine Wilt
WD: Wind Damage
WF: White Flies

* May not agree with current plot number designations.

Figure 1. Plot Map Field F. Study No. 20I010K - miscellaneous trees and shrubs. ▲ North ▲

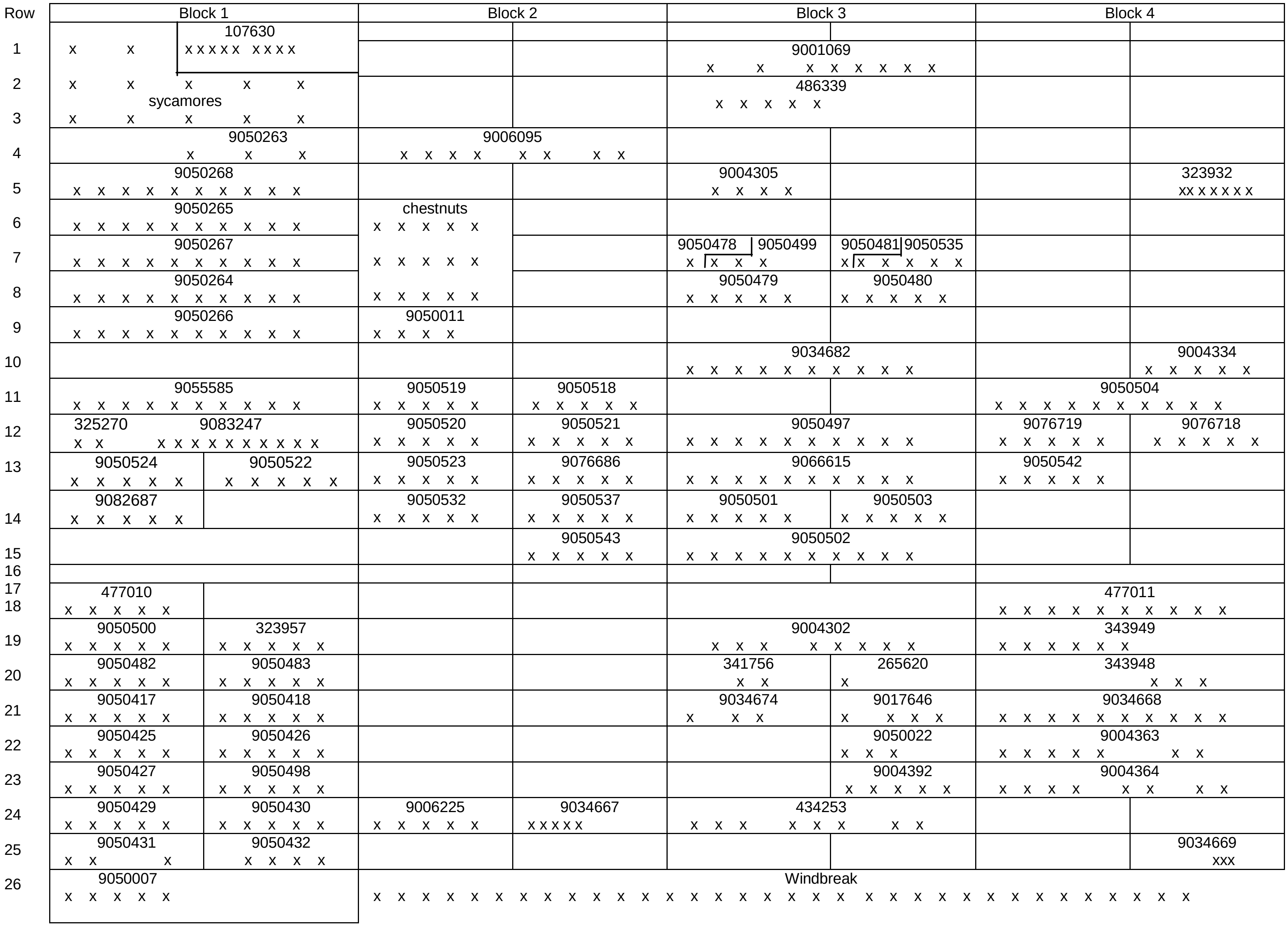
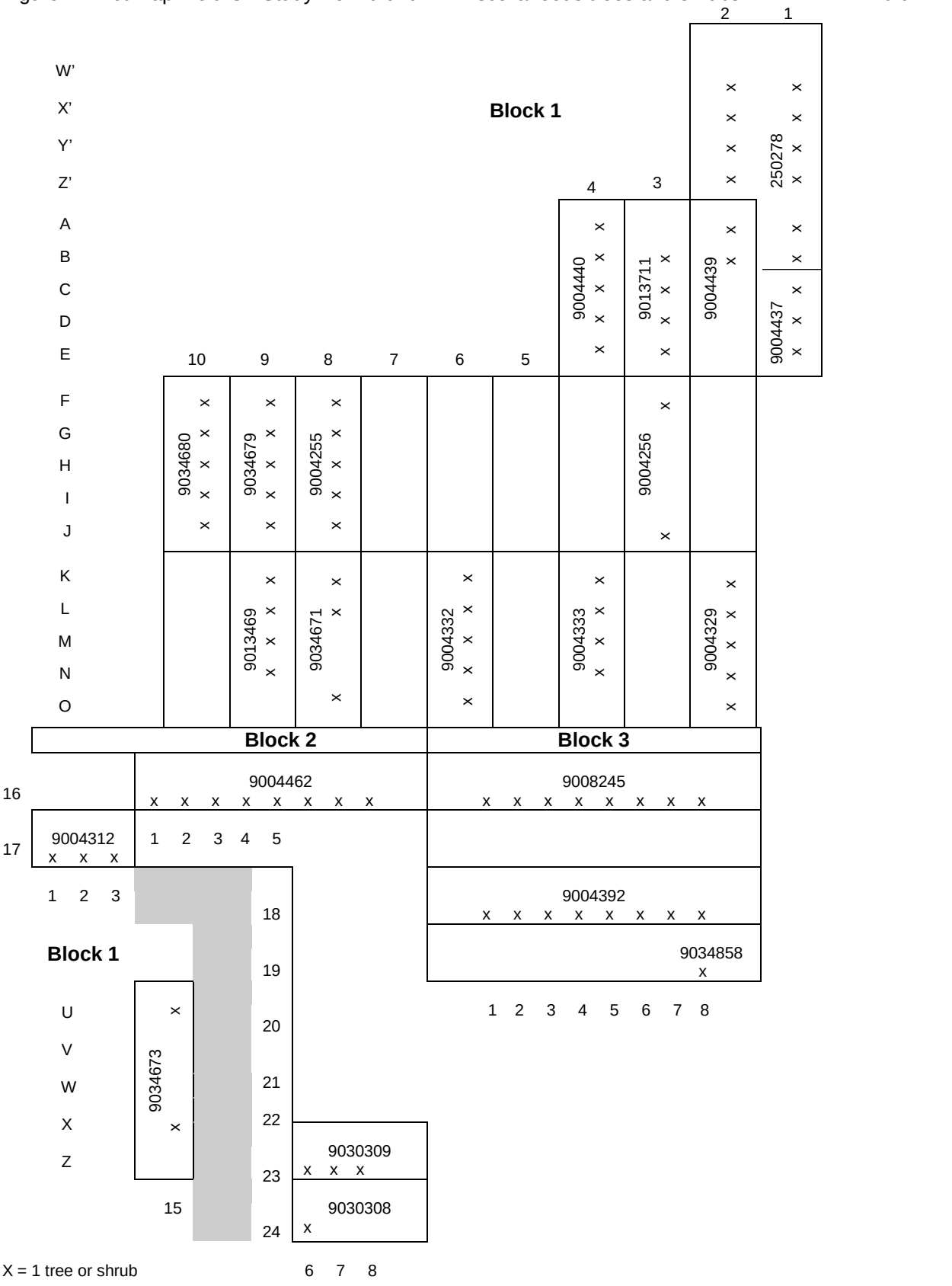


Figure 2. Plot Map Field G. Study No. 20I010K – miscellaneous trees and shrubs. ▲ North ▲



Evaluation of Selected Common Hackberry

Study No. 20I037K

National Project Nos. Cropland 2.1, Natural Areas 1.1, Wildlife 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: The selection of woody plant materials is typically lengthy. The process can take 20 years or more. George and Frank (1973) observed that tree seedlings having larger stem diameters at 1 year continued to display that same characteristic following the second growing season in the nursery. Green ash (*Fraxinus pennsylvanica* Marsh.) seedlings graded into 4 grades based on height and stem diameters were field grown for 29 years. The growth rate of grade 1 stock exceeded the other grades in both diameter and height over the 29-year period. Grade 2 stock, likewise exceeded grades 3 and 4. Similar results were observed for American elm (*Ulmus americana* L.) where grade 1 stock exceeded two other grades in height for 20 years and diameter for 15 years. Clausen (1963) reported that birch trees originally classified as small, medium, and large, maintained their relative position after 9 years in the field. A hypothesis was developed whereby superior seedling trees of common hackberry (*Celtis occidentalis* L.) might be selected from the nursery bed. The criteria for selection would be to select seedlings based on height, stem caliper, and form. It was theorized that such seedlings would prove to be superior. The work of George and Frank supports this theory. If true, the established trees would become the source material and eliminate the amount of time required to establish a productive seed orchard.

Problem: There are no reliable seed sources for hackberry cultivars adapted to western parts of Nebraska, Kansas, Oklahoma, and northeastern Colorado. Existing nursery stock is often of unknown origin and therefore of questionable quality. A tested and proven superior cultivar is needed to provide consistent, high quality plant material for farmstead and field windbreak plantings. The process for selecting quality nursery stock is lengthy.

Objective: Evaluate and select a superior source of common hackberry as an adapted native tree for use in windbreak and wildlife plantings in western Kansas, Nebraska, Oklahoma, and northeastern Colorado.

Procedure: The best single seedling was selected from 30 different accessions growing in a seedling production nursery at the Manhattan Plant Materials Center, Manhattan, Kansas. The origin of all accessions was from collection locations south of the Platte River in Nebraska. Seedlings (n) originating from Kansas (11), Nebraska (4), Missouri (8), Oklahoma (5), Iowa (1), and Arkansas (1), were selected. The 1-0 seedlings were planted in a spaced plant nursery on 9.1 m (30 ft) spacing, on a Belvue silt loam soil, 21 March 1988, in Field D-1 at Manhattan. Plants will be evaluated for vigor; growth rate and uniformity; resistance to insects, disease, and climatic factors.

Potential Products: Cultivar Release

Progress or Status: Minimal observation and site maintenance were performed this year.

Literature Cited:

Clausen, K. E. 1963. Nursery selection affects survival and growth of birch. USDA Forest Service Research Note LS-31. Lake States Forest Experiment Station. Washington, DC

George, E. J. and A. B. Frank. 1973. Graded nursery stock in shelterbelt type planting evaluated over 29-year span. *Tree Planters' Notes* 24:30-32.

Bur Oak Seed Source Study

Study No. 20I038K

National Project Nos. Cropland 2.1, Forestland 1.1, Natural Areas 1.1, Wildlife 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: Bur oak (*Quercus macrocarpa* Michx.) is a hardy, drought resistant, long-lived tree adapted to a wide range of growing conditions. On favorable sites it may attain heights of up to 30.5 m (100 feet). Bur oak is well known for its deep taproot system which provides drought tolerance and resistance to wind-throw. The principal factor discouraging the use of bur oak in Great Plains shelterbelts has been slow growth, especially the first year after planting.

Bur oak is widely distributed in the Great Plains. Its range extends from Texas north to central Saskatchewan. Most of the native populations are found on deep soils in bottomlands and occasionally on upland sites. A Nebraska study, reported by Dickie and Bagley (1980), suggested that there is considerable genetic variability in the species and that further evaluation is warranted. At the 1990 Great Plains Tree Improvement Committee (GP13) meeting, a motion was passed to initiate a bur oak seed source study for the Great Plains of North America.

Problem: No known cultivars of bur oak are available for conservation use. Superior bur oak cultivars are needed for watershed protection, for multi-row windbreaks, for landscape plantings for farmsteads and parks, for reforestation on disturbed lands, and for wildlife plantings throughout the Great Plains.

Objective: The principal objectives of the study are to determine the nature and extent of genetic variation present among bur oak families from selected sources in the Great Plains, to provide genetically improved bur oak seed for shelterbelt planting, provide germplasm that can be used for selection and trait improvement as well as advanced generation breeding, and to survey acorn weevil *Curculio* sp. distribution and its impact on seed quality.

Procedure: Acorns were collected from individual trees displaying superior phenotypic characteristics in the fall of 1990. Seed collections, consisting of 400 acorns, were shipped to the Nebraska Forest Service, Lincoln, Nebraska, for assembly of collections. Thirty acorns of selected accessions were shipped to trial sites for grow out. The Manhattan Plant Materials Center (PMC), Manhattan, Kansas, requested 52 accessions from central Great Plains sources. The PMC received only 22 accessions due to a poor acorn crop in some parts of the Great Plains. In addition to these collections, 2 local collections were included in the study at Manhattan, 'Lippert', Accession 9004392, and Accession 9050065. Accession 9050065, a collection that was made on the PMC, was also entered in the GP13 assembly for planting out at other trial sites. Acorns were planted in a soil-less mix in 656-mL (40-in^3) deepot^{TM} cells (Stuewe & Sons, Inc., Tangent, OR) in the spring of 1991 and placed in the greenhouse for grow out. Only enough trees from 16 accessions were available for the planting. The plot layout consisted of 5 replications with 2 plants per plot. The plants were spaced 4.6 x 4.6 m (15 x 15 ft) apart in a randomized complete-block design in the fall of 1992. A second collection was conducted in the fall of 1992. Sixteen accessions were received by the PMC from the second collection. These acorns were grown out in the greenhouse in 1993 and planted in the field 14 June 1993. There were enough seedlings to establish a 68.6 x 91.4 m (225 x 300 ft) field plot consisting of 26 accessions (Figure 1). The plot was surrounded by a border row composed of trees from the same sources. Some of the northern sources and individual trees of other entries did poorly. These were replaced by either white oak, (*Quercus alba* L.), Accession 9050077, or by green ash, (*Fraxinus Pennsylvania* Marsh.), Accession 9050087, to provide adequate competition for the remaining trees. A complete list of sources established at the Manhattan PMC, is listed in Table 1.

Table 1. Sources of bur oak established in the seed source study at Manhattan PMC.

Source ID	County	State	Accession Number	MLRA
275	Riley	KS	9050065	076
KSPMC	Payne	OK	9004392	80A
122	Bottineau	ND	9050153	055A
125	Shelby	IA	9050154	107
132	Pennington	MN	9050155	056
137	Allamakee	IA	9050156	105
225	Doniphan	KS	9050157	106
241	Thayer	NE	9050164	075
245	Gage	NE	9050158	106
246	Jefferson	NE	9050163	075
249	Douglas	NE	9050169	107
253	Nance	NE	9050160	102B
262	Dickinson	KS	9050159	075
265	Johnson	NE	9050161	106
267	Richardson	NE	9050162	106
269	Nemaha	KS	9050165	106
271	Miami	KS	9050166	112
274	Harvey	KS	9050167	075
501	Holt	MO	9050168	107
510	Platte	MO	9050169	107
520	Lafayette	MO	9050170	107
521	Howard	MO	9050171	115
523	Cherokee	OK	9050172	117
554	Creek	OK	9050173	084A
556	Sequoyah	OK	9050174	117
567	Woodward	OK	9050175	078

Potential Products: Cultivar Release

Progress or Status: Minimal observation and site maintenance were performed this year.

Literature Cited:

Dickie, S. G. and W. T. Bagley 1980. Variability of *Quercus macrocarpa* Michx. in an eastern Nebraska provenance study. *Silvae Genetica* 29:171-176.

► North ►

Figure 1. Plot Map Field E-2, PMC, Manhattan, KS. Study No. 20I038K - Bur Oak Seed Source Study.

B	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	B
B	520-1-1 9050170	520-1-2 9050170	267-1-1 9050162	267-1-2 9050162	137-1-1 9050156	137-1-2 9050156	567-1-1 9050175	567-1-2 9050175	Border	Border	Border	Border	Border	Border	B
B	125-1-1 9050154	125-1-2 9050154	246-1-1 9050163	246-1-2 9050163	392-1-1 9004392	392-1-2 9004392	262-1-1 9050159	262-1-2 9050159	274-1-1 9050167	274-1-2 9050167	265-1-1 9050161	265-1-2 9050161	510-1-1 9050169	510-1-2 9050169	B
B	253-1-1 9050160	253-1-2 9050160	087-1-1 9050087	523-1-2 9050172	521-1-1 9050171	521-1-2 9050171	225-1-1 9050157	225-1-2 9050157	267-1-1 9050162	267-1-2 9050162	122-1-1 9050153	122-1-2 9050153	245-1-1 9050158	245-1-2 9050158	B
B	501-1-1 9050168	501-1-2 9050168	087-1-1 9050087	275-1-2 9050065	249-1-1 9050176	249-1-2 9050176	241-1-1 9050164	241-1-2 9050164	132-1-1 9050155	132-1-2 9050155	556-1-1 9050174	556-1-2 9050174	554-1-1 9050173	554-1-2 9050173	B
B	267-2-1 9050162	267-2-2 9050162	241-2-1 9050164	241-2-2 9050164	249-2-1 9050176	087-2-2 9050087	501-2-1 9050168	501-2-2 9050168	125-2-1 9050154	125-2-2 9050154	225-2-1 9050157	225-2-2 9050157	271-1-1 9050166	271-1-2 9050166	B
B	275-2-1 9050065	087-2-2 9050087	392-2-1 9004392	392-2-2 9004392	271-2-1 9050166	271-2-2 9050166	554-2-1 9050173	554-2-2 9050173	265-2-1 9050161	265-2-2 9050161	137-2-1 9050156	137-2-2 9050156	556-2-1 9050174	556-2-2 9050174	B
B	246-2-1 9050163	246-2-2 9050163	567-2-1 9050175	567-2-2 9050175	122-2-1 9050153	122-2-2 9050153	523-2-1 9050172	523-2-2 9050172	269-2-1 9050165	269-2-2 9050165	274-2-1 9050167	274-2-2 9050167	520-2-1 9050170	520-2-2 9050170	B
B	087-3-1 9050087	521-3-2 9050171	253-2-1 9050160	253-2-2 9050160	132-2-1 9050155	132-2-2 9050155	245-2-1 9050158	245-2-2 9050158	521-2-1 9050171	521-2-2 9050171	510-2-1 9050169	510-2-2 9050169	262-2-1 9050159	087-2-2 9050087	B
B	262-3-1 9050159	262-3-2 9050159	249-3-1 9050176	077-3-2 9050077	510-3-1 9050169	510-3-2 9050169	087-3-1 9050087	523-3-2 9050172	253-3-1 9050160	253-3-2 9050160	125-3-1 9050154	125-3-2 9050154	077-3-1 9050077	554-3-2 9050173	B
B	225-3-1 9050157	225-3-2 9050157	269-3-1 9050165	269-3-2 9050165	137-3-1 9050156	137-3-2 9050156	271-3-1 9050166	271-3-2 9050166	265-3-1 9050161	265-3-2 9050161	556-3-1 9050174	556-3-2 9050174	267-3-1 9050162	267-3-2 9050162	B
B	241-3-1 9050164	241-3-2 9050164	501-3-1 9050168	501-3-2 9050168	392-3-1 9004392	392-3-2 9004392	245-3-1 9050158	245-3-2 9050158	520-3-1 9050170	520-3-2 9050170	132-3-1 9050155	132-3-2 9050155	122-3-1 9050153	122-3-2 9050153	B
B	262-4-1 9050159	262-4-2 9050159	269-4-1 9050165	269-4-2 9050165	245-4-1 9050158	245-4-2 9050158	274-3-1 9050167	274-3-2 9050167	275-3-1 9050065	275-3-2 9050065	246-3-1 9050163	246-3-2 9050163	567-3-1 9050175	567-3-2 9050175	B
B	132-4-1 9050155	132-4-2 9050155	501-4-1 9050168	501-4-2 9050168	567-4-1 9050175	567-4-2 9050175	249-4-1 9050176	249-4-2 9050176	253-4-1 9050160	253-4-1 9050160	520-4-1 9050170	520-4-2 9050170	125-4-1 9050154	125-4-2 9050154	B
B	241-4-1 9050164	241-4-2 9050164	521-4-1 9050171	521-4-2 9050171	271-4-1 9050166	271-4-2 9050166	392-4-1 9004392	392-4-2 9004392	556-4-1 9050174	556-4-2 9050174	267-4-1 9050162	267-4-2 9050162	510-4-1 9050169	510-4-2 9050169	B
B	265-4-1 9050161	265-4-2 9050161	274-4-1 9050167	087-4-2 9050087	225-4-1 9050157	225-4-2 9050157	137-4-1 9050156	137-4-2 9050156	275-4-1 9050065	275-4-2 9050065	523-4-1 9050172	523-4-2 9050172	122-4-1 9050153	122-4-2 9050153	B
B	267-6-1 9050162	267-6-2 9050162	392-5-1 9004392	392-5-2 9004392	271-5-1 9050166	271-5-2 9050166	087-5-1 9050087	122-5-2 9050153	554-5-1 9050173	554-5-2 9050173	246-4-1 9050163	246-4-2 9050163	554-4-1 9050173	554-4-2 9050173	B
B	249-5-1 9050176	249-5-2 9050176	501-5-1 9050168	501-5-2 9050168	245-5-1 9050158	245-5-2 9050158	265-5-1 9050161	265-5-2 9050161	556-5-1 9050174	556-5-2 9050174	521-5-1 9050171	521-5-2 9050171	262-5-1 9050159	262-5-2 9050159	B
B	275-5-1 9050065	275-5-2 9050065	523-5-1 9050172	523-5-2 9050172	087-5-1 9050087	077-5-2 9050077	274-5-1 9050167	087-5-2 9050087	269-5-1 9050165	269-5-2 9050165	225-5-1 9050157	225-5-2 9050157	241-5-1 9050164	241-5-2 9050164	B
B	253-5-1 9050160	253-5-2 9050160	246-5-1 9050163	246-5-2 9050163	267-5-1 9050162	267-5-2 9050162	520-5-1 9050170	520-5-2 9050170	125-5-1 9050154	125-5-2 9050154	567-5-1 9050175	567-5-2 9050175	137-5-1 9050156	137-5-2 9050156	B
B	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	B

Legend: Entry-Rep-Tree = 520-1-1
Accession No. = 9050170

Evaluation of Switchgrass Germplasm for Rhizomatous Characteristics

Study No. 20I039E

National Project Nos. Critical Areas 1.1

Study Leader: Richard L. Wynia, Plant Materials Center Manager

Introduction: Switchgrass (*Panicum virgatum* L.) is a perennial, warm-season grass that is widely distributed over much of the continental United States. It occurs naturally with other tall-grass prairie species such as big bluestem and Indian grass. Forage quality of switchgrass is generally recognized as being excellent for grazing. In addition to its forage value, it is widely used in areas where soil-conserving practices are needed. Switchgrass is also recognized as a species of wide diversity in growth forms, which often proves valuable in a plant-breeding program. Heritable variation has been observed in endemic strains collected from native grasslands. Newell and Eberhart (1959, 1961) discussed the heritability of certain morphological characteristics from switchgrass strains collected in different locations in the Great Plains of North America. Their studies indicated that a significant proportion of the total variation is due to genetic differences. A source material collected in Roger Mills Co., Oklahoma, Accession 9049968, was screened using recurrent selection techniques to select for a highly rhizomatous type of switchgrass at the Manhattan Plant Materials Center (PMC) Manhattan, Kansas.

Objective: The goal of this work is to select superior seed to improve the germination and seedling vigor of rhizomatous switchgrass to promote rapid establishment of this species for re-vegetation projects, waterway establishment, and commercial seed production.

Procedure: Selected materials from the various stress tests were grown out in the greenhouse. Plants from this pool were established in a poly-cross nursery. The largest, healthiest plants were transplanted to the field in a Latin Square design. Seed was harvested at the end of the 2008 growing season and compared to the data from the previous year to mark any improvements in germination and seed size. There were three plants that did not survive to produce seed for 2008. Four 100 seed replicates were planted to moist blotter in 10.16 x 10.16 cm (4 x 4 in) plastic boxes from each seed collection. The seeds were tested for germination in a growth chamber set at 21°C (70°F) with 12 hours light and 12 hours dark for 21 days. The germination was counted and recorded at 7-, 14-, and 21-day intervals.

Potential Products: Cultivar Release

Progress or Status: Activity in 2010 consisted of plot maintenance and seed harvest.

Literature Cited:

Newell, L. C. and S. A. Eberhart. 1961. Clone and progeny evaluation in the improvement of switchgrass, *Panicum virgatum* L. *Crop Science* 1:117-121.

Evaluation of Siberian Elm

Study No. 20I041K

National Project Nos. Critical Areas 1.1, Cropland 2.1

Study Leader: Richard L. Wynia, Plant Materials Center Manager

Introduction: Siberian elm (*Ulmus pumila* L.) has been planted and tested in the Central and Northern Plains States since the early 1900s. This species once became of interest to researchers because of its apparent rapid rate of growth. Thus, early tests indicated that it warranted further distribution and additional adaptability studies. Extremes in weather conditions have proven challenging to the species over the years on the plains states. It begins blooming early in the year if weather conditions permit and is one of the last deciduous trees to defoliate in the fall. Therefore, this species tends to be frequently damaged by freezes early in the spring or fall of the year. Early fall ice or sleet storms on the plains tend to damage Siberian elm more severely because of the late loss of leaves and brittle wood that is subject to breakage. This species is also susceptible to a number of diseases such as Tubercularia canker and Botryodiplodia canker and wet wood. Common insect pests are cankerworm and elm leaf beetle.

Despite these faults and its relative short life span there are many locations where Siberian elm can be effectively utilized in shelterbelts and windbreaks.

Problem: The need exists to develop an improved Siberian elm for use in shelterbelt and windbreak conservation practices in semiarid regions of the service area: northeastern Colorado, western Kansas, western Nebraska, and southeastern Wyoming.

Objectives: Select individual seedlings from the available germplasm with the following characteristics: improved initial survival, growth rate, insect and disease resistance, drought resistance, and earlier fall defoliation.

Procedures: Siberian elm accessions grown in raised beds at the Manhattan Plant Materials Center (PMC) Manhattan, Kansas, were lifted on 25 March 1999. Seedling production by the various accessions met with mixed success. Some accessions produced abundant, healthy seedlings and other accessions produced limited numbers of seedlings. The production of a limited number of seedlings by some accessions caused evaluation plots to be limited in number and scope. Evaluation plots were designated for western Nebraska and eastern Colorado to test the accessions in the environment in which it will be used.

A randomized evaluation plot containing 11 accessions and 3 seedlings per plot with 3 replications, (Figure 1) was established on 15 April 1999, in Akron, Colorado. The plot was established in a recently tilled area on the USDA Agricultural Research Station (ARS) Central Great Plains Research Station, 4 miles east of Akron. The elm seedlings were planted using a tractor-drawn tree planter which made the planting quick and efficient. Due to the extremely windy conditions experienced the day of planting, the weed barrier fabric (1.83 m (6 ft) Sunbelt) was not installed until 19 May 1999.

The Akron Site is located in Logan County, Colorado. The planting was established in cooperation with the ARS at Akron. The site is located within Major Land Resource Area (MLRA) 72. Average annual precipitation is 40.6 cm (16 in). The soils are classified as a Rago silt loam.

A randomized evaluation plot containing 11 accessions and 3 seedlings per plot with 3 replications, (Figure 2) was established on 18 May 1999, in Sidney, Nebraska. The plot was established in a disked area that was planted to wheat the previous growing season. The elm seedlings were planted by hand and then a tractor was used to install the 1.83 m (6 ft) Sunbelt weed barrier fabric to the plot.

The Sidney site is located in Cheyenne County, Nebraska. The planting was established in cooperation with the Nebraska State Forestry Service. The planting was established on the Tom Knighttengale farm

located approximately 4 miles north of Sidney, Nebraska. The site is located within MLRA 72. Average annual precipitation is 40.6 cm (16 in). The soils are classified as Goshen silt loam.
Factors for evaluation include survival, plant growth, vigor, winter injury, disease, and insect resistance.

Potential Products: Cultivar Release

Progress or Status: A site visit was not made in 2010.

Figure 1. Plot Map. Study No. 20I041K - Siberian Elm, *Ulmus pumila*, FEP - Akron, CO ▲ North ▲

Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border
Border	9050214 1-1	9050184 1-1	9050217 1-1	9050225 2-1	9050214 2-1	9050219 2-1	9050225 3-1	9050241 3-1	9050228 3-1	Border
Border	9050214 1-2	9050184 1-2	9050217 1-2	9050225 2-2	9050214 2-2	9050219 2-2	9050225 3-2	9050241 3-2	9050228 3-2	Border
Border	9050214 1-3	9050184 1-3	9050217 1-3	9050225 2-3	9050214 2-3	9050219 2-3	9050225 3-3	9050241 3-3	9050228 3-3	Border
Border	9050226 1-1	9050233 1-1	9050241 1-1	9050233 2-1	9050241 2-1	9050235 2-1	9050184 3-1	9050224 3-1	9050240 3-1	Border
Border	9050226 1-2	9050233 1-2	9050241 1-2	9050233 2-2	9050241 2-2	9050235 2-2	9050184 3-2	9050224 3-2	9050240 3-2	Border
Border	9050226 1-3	9050233 1-3	9050241 1-3	9050233 2-3	9050241 2-3	9050235 2-3	9050184 3-3	9050224 3-3	9050240 3-3	Border
Border	9050213 1-1	9050222 1-1	9050240 1-1	9050184 2-1	9050240 2-1	9050213 2-1	9050222 3-1	9050216 3-1	9050233 3-1	Border
Border	9050213 1-2	9050222 1-2	9050240 1-2	9050184 2-2	9050240 2-2	9050213 2-2	9050222 3-2	9050216 3-2	9050233 3-2	Border
Border	9050213 1-3	9050222 1-3	9050240 1-3	9050184 2-3	9050240 2-3	9050213 2-3	9050222 3-3	9050216 3-3	9050233 3-3	Border
Border	9050216 1-1	9050228 1-1	9050224 1-1	9050224 2-1	9050222 2-1	9050226 2-1	9050226 3-1	9050219 3-1	9050235 3-1	Border
Border	9050216 1-2	9050228 1-2	9050224 1-2	9050224 2-2	9050222 2-2	9050226 2-2	9050226 3-2	9050219 3-2	9050235 3-2	Border
Border	9050216 1-3	9050228 1-3	9050224 1-3	9050224 2-3	9050222 2-3	9050226 2-3	9050226 3-3	9050219 3-3	9050235 3-3	Border
Border	9050219 1-1	9050235 1-1	9050225 1-1	9050228 2-1	9050217 2-1	9050216 2-1	9050213 3-1	9050217 3-1	9050214 3-1	Border
Border	9050219 1-2	9050235 1-2	9050225 1-2	9050228 2-2	9050217 2-2	9050216 2-2	9050213 3-2	9050217 3-2	9050214 3-2	Border
Border	9050219 1-3	9050235 1-3	9050225 1-3	9050228 2-3	9050217 2-3	9050216 2-3	9050213 3-3	9050217 3-3	9050214 3-3	Border
Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border

Legend: Accession No. = 9050214
Rep-Tree = 1-1

Figure 2. Plot Map. Study No. 20I041K - Siberian Elm, *Ulmus pumila*, FEP - Sidney, NE ▲ North ▲

Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border
Border	9050213 3-1	9050240 3-1	9050217 3-1	9050184 3-1	9050217 2-1	9050226 2-1	9050217 1-1	9050219 1-1	9050233 1-1	Border
Border	9050213 3-2	9050240 3-2	9050217 3-2	9050184 3-2	9050217 2-2	9050226 2-2	9050217 1-2	9050219 1-2	9050233 1-2	Border
Border	9050213 3-3	9050240 3-3	9050217 3-3	9050184 3-3	9050217 2-3	9050226 2-3	9050217 1-3	9050219 1-3	9050233 1-3	Border
Border	Border	9050233 3-1	9050226 3-1	9050214 3-1	9050240 2-1	9050233 2-1	9050214 1-1	9050226 1-1	9050240 1-1	Border
Border	Border	9050233 3-2	9050226 3-2	9050214 3-2	9050240 2-2	9050233 2-2	9050214 1-2	9050226 1-2	9050240 1-2	Border
Border	Border	9050233 3-3	9050226 3-3	9050214 3-3	9050240 2-3	9050233 2-3	9050214 1-3	9050226 1-3	9050240 1-3	Border
Border	Border	9050224 3-1	9050222 3-1	9050213 2-1	9050219 2-1	9050184 2-1	9050184 1-1	9050213 1-1	9050222 1-1	Border
Border	Border	9050224 3-2	9050222 3-2	9050213 2-2	9050219 2-2	9050184 2-2	9050184 1-2	9050213 1-2	9050222 1-2	Border
Border	Border	9050224 3-3	9050222 3-3	9050213 2-3	9050219 2-3	9050184 2-3	9050184 1-3	9050213 1-3	9050222 1-3	Border
Border	Border	9050228 3-1	9050219 3-1	9050222 2-1	9050224 2-1	9050214 2-1	9050228 2-1	9050228 1-1	9050224 1-1	Border
Border	Border	9050228 3-2	9050219 3-2	9050222 2-2	9050224 2-2	9050214 2-2	9050228 2-2	9050228 1-2	9050224 1-2	Border
Border	Border	9050228 3-3	9050219 3-3	9050222 2-3	9050224 2-3	9050214 2-3	9050228 2-3	9050228 1-3	9050224 1-3	Border
Border	Border	Border	Border	Border	Border	Border	Border	Border	Border	Border

Legend: Accession No. = 9050217
Rep-Tree = 1-1

Table 1. Initial evaluation data: Study No. 20I041K - Siberian elm (*Ulmus pumila*), Akron, CO

Accession Number	Origin/Source	YR PLT	YR REC	EVA DAT	NO PLT	NO SRV	PCT SRV	FOL DEN	FOL RET	PLT HGT	BAS DIA	Remarks Plot Designation: e.g. 2/1 = rep/ tree no.
9050184	Roger Mills Co., OK	99	00		9	9	100			173		
			01			9	100			244		
			02			9	100			245		
			03	288		9	100		2.1	282		
			05	291		9	100	94	6.7	353	10.4	
			06	247		9	100		8.3	356		
			09	278		9	100		8.3	426		1/2 – DB; 2/1-3 – DB; 3/1,3 - DB
9050213	Woodward Co., OK	99	00		9	9	100			157		
			01			9	100			238		
			02			9	100			241		
			03	288		9	100		2.0	289		
			05	291		9	100	67	5.0	341	10.6	
			06	247		9	100		7.6	348		
			09	278		9	100		4.1	416		1/1,2 – DB; 2/2,3 – DB; 3/1 - DB
9050214	Beaver Co., OK	99	00		9	9	100			180		
			01			9	100			262		
			02			9	100			262		
			03	288		9	100		4.1	276		2/1 – DB
			05	291		9	100	78	5.7	342	12.0	
			06	247		9	100		7.8	356		2/1 – DB
			09	278		8	89		6.0	404		1/3 – DB; 2/1,2 – DB; 3/1,3 – DB; 3/2 – Dd
9050216	Ellis Co., OK	99	00		9	9	100			171		
			01			9	100			257		
			02			9	100			261		
			03	288		9	100		1.7	304		
			05	291		9	100	83	6.0	345	12.0	
			06	247		9	100		8.8	335		2/3 – DB; dying
			09	278		7	78		6.3	449		1/1 – Dd; 1/2,3 DB; 2/1,2 - DB; 2/3 - Dd; 3/3-DB
9050217	Ellis Co., OK	99	00		9	9	100			173		
			01			9	100			253		
			02			9	100			254		
			03	288		9	100		1.3	298		
			05	291		9	100	72	5.3	308	11.2	
			06	247		9	100		5.6	318		2/3 – DB
			09	278		7	78		5.8	347		1/1,3 – 75% DB; 1/2 – DB; 2/1 – Dd; 2/3 – 67% DB; 3/2 – Dd; 3/3 - DB
9050219	Stevens Co., KS	99	00		9	9	100			185		
			01			9	100			268		
			02			9	100			273		
			03	288		8	89		1.8	310		2/1 – Dd
			05	291		8	89	75	5.5	359	11.5	
			06	247		8	89		8.0	367		
			09	278		8	89		6.9	468		3/1,3 – DB

Table 1. Initial evaluation data: Study No. 20I041K - Siberian elm (*Ulmus pumila*), Akron, CO

Accession Number	Origin/Source	YR PLT	YR REC	EVA DAT	NO PLT	NO SRV	PCT SRV	FOL DEN	FOL RET	PLT HGT	BAS DIA	Remarks
9050222	Custer Co., OK	99	00		9	9	100			180		
			01			9	100			269		
			02			9	100			267		
			03	288		9	100		3.3	301		
			05	291		9	100	100	7.0	342	11.1	
			06	247		9	100		8.8	349		1/2 – DB
			09	278		8	89		8.6	434		1/2 – DB; 2/1 – DB; 2/3 – Dd; 3/1,3 – DB
9050224	Custer Co., OK	99	00		9	9	100			180		
			01			9	100			271		
			02			9	100			278		
			03	288		9	100		6.0	319		
			05	291		9	100	100	7.0	381	11.6	
			06	247		9	100		8.6	392		
			09	278		9	100		8.3	470		1/1-3 – DB; 2/1-3 – DB; 3/1-3 – DB
9050225	Custer Co., OK	99	00		9	9	100			164		
			01			9	100			248		
			02			9	100			251		
			03	288		9	100		2.3	278		3/1 – DB
			05	291		7	78	100	6.2	359	11.5	2/1 – Dd; 3/1 – Dd
			06	247		8	89		8.2	339		2/1 – Resprout, DB
			09	278		7	78		7.8	434		1/1,2 – DB; 2/1 – Dd; 2/2 – DB; 3/3 – DB
9050226	Custer Co., OK	99	00		9	9	100			173		
			01			9	100			258		
			02			8	89			260		3/3 – Dd
			03	288		8	89		4.3	290		
			05	291		8	89	100	6.2	337	11.5	
			06	247		8	89		8.5	347		
			09	278		8	89		6.9	409		1/2,3 – DB; 2/1,3 – DB; 2/2- 25% DB; 3/2 – 50% DB
9050228	Custer Co., OK	99	00		9	9	100			167		
			01			9	100			252		
			02			9	100			256		
			03	288		9	100		3.0	297		
			05	291		9	100	94	6.7	359	10.9	
			06	247		9	100		8.3	368		
			09	278		9	100		7.1	426		1/1-3 – DB; 2/2 – DB; 2/3 – 75% DB; 3/1-3 – DB
9050233	Harper Co., OK	99	00		9	9	100			154		
			01			9	100			237		
			02			9	100			245		
			03	288		9	100		3.0	264		3/3 – DB
			05	291		9	100	83	6.0	312	10.9	
			06	247		9	100		7.6	322		3/3 – DB
			09	278		9	100		7.2	402		1/1-3 – DB; 2/1-3 – DB; 3/1-3 – DB

Table 1. Initial evaluation data: Study No. 20I041K - Siberian elm (*Ulmus pumila*), Akron, CO

Accession Number	Origin/Source	YR PLT	YR REC	EVA DAT	NO PLT	NO SRV	PCT SRV	FOL DEN	FOL RET	PLT HGT	BAS DIA	Remarks
9050235	Garfield Co., OK	99	00		9	9	100			169		
			01			9	100			261		
			02			9	100			262		
			03	288		9	100		2.8	317		
			05	291		9	100	83	6.0	370	11.2	
			06	247		9	100		7.9	380		
			09	278		9	100		6.8	437		1/1-3 – DB; 2/2-3 – DB; 3/1-2 – DB
9050240	Cotton Co., OK	99	00		9	9	100			163		
			01			9	100			245		
			02			9	100			249		
			03	288		9	100		3.4	267		1/2 – DB
			05	291		8	89	94	6.7	354	11.9	1/2 – Dd
			06	247		8	89		8.8	367		1/2 – DB
			09	278		6	67		8.9	414		1/1 – DB; 1/3 - 50% DB; 2/2 – DB; 3/1-2 – Dd
9050241	Cotton Co., OK	99	00		9	9	100			178		
			01			9	100			252		
			02			9	100			255		
			03	288		9	100		4.8	278		1/2 – DB
			05	291		9	100	94	6.7	328	10.5	
			06	247		9	100		7.8	328		1/2 – DB
			09	278		8	89		8.5	414		1/1 – Dd; 1/2 – DD; 1/3 – DB; 2/1-3 – DB; 3/1 – 75% DB; 3/2 – 25% DB

Legend for Siberian elm evaluations:
DB: Die Back (Dead Branches)
Dd: Dead
DD: Deer Damage
EVA DAT: Evaluation Date (Julian Calender Date)
FOL DEN: Foliage Density: Percent
FOL RET: Foliage Retention, rating 1=0%, 9=100%
NO. PLT: Number of trees planted
NO. SRV: Number Surviving
PCT SRV: Percent Survival
Plot Designation: e.g. 2/1 = rep/ tree no.
YR PLT: Year Planted
YR REC: Year of Record

Calendar Conversion

Julian Calender Dates	Gregorian Calender Dates
247	9/04
278	10/05
288	10/15
291	10/18

Table 2. Initial evaluation data: Study No. 20I041K - Siberian elm (*Ulmus pumila*), Sidney, NE Page 1

Accession Number	Origin/Source	YR PLT	YR REC	EVA DAT	NO PLT	NO SRV	PCT SRV	FOL DEN	FOL RET	PLT HGT	BAS DIA	Remarks Plot Designation: e.g. 2/1 = rep/ tree no.
9050184	Roger Mills Co., OK	99	00		9	9	100			186		
			01			9	100			232		
			02			9	100			285		
			03	288		9	100		3.7	312		
			05	291		9	100	67	5.0	326	11.4	
			06	247		9	100		8.0	332		2/1 – DB
			09	279		8	89		7.0	357		1/1-3 – DB; 2/1 – Dd; 2/2 – DB; 3/1– 25% DB; 3/2 – 75% DB; 3/3 33% DB
9050213	Woodward Co., OK	99	00		9	9	100			139		
			01			8	89			176		3/1 – Dd
			02			8	89			242		
			03	288		8	89		1.8	271		
			05	291		8	89	29	2.7	315	10.9	
			06	247		7	67		6.9	323		1/1 – Dd
			09	279		7	67		7.3	370		1/3 – DB; 2/1,3 – DB; 2/2 – 50% DB; 3/2– 25% DB; 3/3 – 50% DB
9050214	Beaver Co., OK	99	00		9	9	100			197		
			01			9	100			243		
			02			9	100			290		
			03	288		8	89		4.0	315		1/2 – Dd
			05	291		7	78	93	6.6	365	11.9	3/1 – Dd
			06	247		6	67		7.2	332		1/2 – Dd; 2/2 – DB; 3/2 – 75% DB
			09	279		6	67		8.0	358		1/1 – Resprout, 75% DB; 2/2 – 75% DB; 3/1-2 – Dd; 3/3 – DB
9050217	Ellis Co., OK	99	00		9	9	100			178		
			01			9	100			215		
			02			9	100			255		
			03	288		7	78		1.9	272		2/3 – Dd; 3/3 – Dd
			05	291		8	89	50	3.9	323	11.9	
			06	247		6	67		8.9	287		1/2-3 – Dd; 2/1 – DB; 2/3 – Dd; 3/1 – DB
			09	279		6	67		7.5	365		2/1-2 – 25% DB; 3/1 – 25% DB
9050219	Stevens Co., KS	99	00		9	9	100			165		
			01			9	100			193		1/3 – resprout from base
			02			9	100			261		
			03	288		9	100		2.3	279		
			05	291		9	100	67	4.0	289	13.1	
			06	247		8	89		7.9	210		1/1 – 90% DB; 1/2-3 – DB; 2/1-2 – DB; 2/3 – Dd; 3/1-3 – DB
			09	279		6	67		7.3	308		1/1 – Dd; 1/2-3 – 25% DB; 2/1 – DB; 2/3 50% – DB; 3/1-2 – 50% DB; 3/1– Dd
9050222	Custer Co., OK	99	00		9	9	100			155		
			01			9	100			193		
			02			9	100			256		
			03	288		9	100		3.0	278		
			05	291		9	100	56	4.4	318	11.5	
			06	247		8	89		8.4	332		1/2 – 50% DB; 2/3 – 50% DB; 3/3 – Dd
			09	279		7	78		8.7	392		1/2 – Dd; 2/2 – DB; 2/3 – 33% DB; 3/1 – 13% DB; 3/2 – DB

Table 2. Initial evaluation data: Study No. 20I041K - Siberian elm (*Ulmus pumila*), Sidney, NE

Accession Number	Origin/Source	YR PLT	YR REC	EVA DAT	NO PLT	NO SRV	PCT SRV	FOL DEN	FOL RET	PLT HGT	BAS DIA	Remarks
9050224	Custer Co., OK	99	00		9	9	100			175		
			01			9	100			207		
			02			9	100			249		
			03	288		9	100		3.7	272		
			05	291		9	100	78	6.0	315	10.6	
			06	247		8	89		8.9	322		1/1 – DB; 3/2 – Dd
			09	279		8	89		7.4	381		1/1,3 – DB; 1/2 – 75% DB; 2/1-3 – DB; 3/1,3 – DB
9050226	Custer Co., OK	99	00		9	9	100			165		
			01			9	100			200		
			02			9	100			257		
			03	288		8	89		4.7	291		
			05	291		9	100	78	5.7	345	13.4	
			06	247		8	89		8.8	334		1/1 – DB; 2/1 – DB; 2/2 Dd; 3/1 – 98% DB; 3/2 – 50% DB
			09	279		6	67		7.0	369		1/1 33% – DB;2/1 – Dd; 2/3 – 33% DB; 3/1 – Dd; 3/2-3 – 50% DB
9050228	Custer Co., OK	99	00		9	9	100			172		
			01			9	100			206		
			02			9	100			230		
			03	288		8	89		4.1	247		3/1 – Dd
			05	291		8	89	81	5.6	292	13.2	
			06	247		8	89		7.5	309		3/3 – 50% DB
			09	279		8	89		7.8	332		1/1 – DB; 1/2 – 25% DB; 2/1 – DB; 3/2-2 – DB; 3/3 – 75% DB
9050233	Harper Co., OK	99	00		9	9	100			150		
			01			9	100			190		
			02			9	100			226		
			03	288		9	100		3.3	251		
			05	291		9	100	75	4.8	290	12.3	
			06	247		8	89		8.6	331		3/3 – Dd
			09	279		8	89		6.8	387		2/2 – DB; 3/2 – DB
9050240	Cotton Co., OK	99	00		9	9	100			165		
			01			9	100			211		
			02			9	100			254		
			03	288		8	89		4.3	276		1/2 – DB; 2/3 – Dd
			05	291		8	89	99	5.0	351	12.5	
			06	247		8	89		9.1	363		1/2 – DB; 1/3 – 50% DB;
			09	279		7	78		7.8	364		1/1 – 75% DB; 1/2 – DB; 1/3 – Dd; 2/2 – 33% DB; 3/1-2 – 25% DB; 3/3 – 50% DB

Evaluation of Miscellaneous Forbs and Legumes

Study No. KSPMC-T-0803-RA

National Project Nos. Critical Areas 1.1, Natural Areas 1.1, Rangeland 1.1

Study Leader: John M. Row, Plant Materials Specialist

Introduction: This study serves as a clearinghouse for the evaluation of miscellaneous collections of forbs and legumes received by the Manhattan Plant Materials Center (PMC), Manhattan, Kansas, which have potential for conservation use. These collections may be tested for adaptation to the local climate in a rod-row planting. Standards of comparison may be included such as an existing cultivar that is available in the seed trade. This study replaces Study No. 20I009S, which was closed in 1990.

Objective: Provide a means to test plant materials where limited seed or plants are available.

Procedure: Plant seeds or plants in a 6.1 m (20 ft) rod row with a between row spacing of 2.2 m (6 ft), except where noted. A standard of comparison may also be planted. Factors for evaluation may include plant vigor, stand, seed production, growth factors, and resistance to disease, drought, and cold.

Seeds of Accession 9085672, prairie acacia (*Acacia angustissima* [Mill.] Kuntze), were received from the James E. "Bud" Smith PMC, Knox City, Texas, in 2008. Plants were established in 164 mL (10 in^3) single cell Ray Leach "Cone-tainers"^{TM}.

Potential Products: Cultivar Release and Technology Transfer

Progress or Status: Twenty plants of prairie acacia were set out 30 June 2008, in a rod row in Field B-3. The stand at the end of the growing season was 80%. The plants were well anchored in the soil and appeared to have established but failed to recover in the following spring. Due to the late planting in 2008, a decision was made to try again. A new set of plants from 2-0 stock was established in 2009 for further evaluation. In the spring 2010, a 90% recovery rate was observed with one plant disturbed by rodent activity. The mean height of plants was 47 cm. The young plants flowered and a few produced seed.

Technology Development

Survey of Pollinating Insects at the Manhattan PMC

Study No. KSPMC-T-1001-WL

National Project Nos. Wildlife 1.1

Study Leader: P. Allen Casey, Career Intern

Introduction: Pollinators are keystone species to which many plants rely on to complete their reproductive lifecycle (Shepherd et al. 2003). Insects by far are the most numerous group of all of the pollinators. Pollinating insects are also considered to be an indicator species and can be used to determine ecosystem health (Shepherd et al. 2003). Pollinating insects provide for heterogeneity of the floral gene pool, larger fruit and seed size, and more even development of fruits or seeds. Bees are often the insect pollinators that are commonly referred to, and they are one of the biggest contributors to pollination. However, there are many other types of insect pollinators that are involved in pollinating flora. There is a need to identify what species of pollinating insects occur at the Kansas Plant Materials Center, in order to develop artificial nesting sites and best management practices (BMPs) to increase the populations of those species. Increasing pollinator numbers will provide for better fruit and seed development for many of the plant materials that are being produced and evaluated. The objective of this study is to utilize aerial net capture, trap nesting, pan, and malaise trapping techniques to capture as many pollinating insects as possible and then identify them as close to species as possible. The data will then be used for determination of appropriate BMPs and development of appropriate artificial nesting sites.

Objective: Determine what species are present at the PMC so that appropriate BMP's for pollinating insects can be implemented.

Procedure: Three trap nests were built and set at 3 different places at the PMC. They were mounted on recycled, plastic fence posts and placed facing a southeast direction in early April 2010. Plastic bowl traps were used at various places around the PMC to collect insects. Two blue bowls and two white bowls were filled ¾ full with water and a few drops of dish soap. They were set near blooming flowers multiple times from May–September 2010. An aerial net was used multiple times from May–November 2010. The aerial net was primarily used to catch butterflies, but was also used to sweep vegetation to catch all insects. The aerial net was also used 13 August 2010 to sweep behind tractor and crimper that was used to crimp the sunn hemp. The malaise trap was set up multiple times in multiple locations on the PMC from May–November 2010. Insects that were caught were killed and mounted to entomology pins and stored in museum display drawers for study and observation.

Potential Products: Technology Transfer

Progress or Status: About ¾ of the insects collected have been pinned and labels put on with the location and capture method used. There were 300 insect specimens mounted to pins with location labels, Table 1.

Table 1. Number and to what taxonomic categories the mounted specimens have been identified to.

	Lepidoptera (butterflies and moths)	Hymenoptera (bees and wasps)	Diptera (flies)	Coleoptera (beetles)	Orthoptera (grasshoppers)	Other
Order	12	129	58	18	5	4
Family	31	43	0	0	0	0
Species	31	0	0	0	0	0

Literature Cited:

Hopwood, J.L. 2008. The contribution of roadside grassland restorations to native bee conservation. Biological Conservation 141: 2632-2640.

Shepherd, M., S.L. Buchmann, M. Vaughan, and S.H. Black. 2003. Pollinator Conservation Handbook. The Xerces Society in Assoc. with The Bee Works. Portland, OR. 145p.

NEW STUDIES INITIATED

One new study was initiated in 2010. The study plan for each of the following named studies can be found on subsequent pages.

Study No.	Study Name
KSPMC-T-1001-WL	Survey of pollinating insects at the Manhattan PMC

Note: The documents that follow are signed documents; they may not conform to the style manual for the 2010 Annual Technical Report. The only modifications have been formatting to fit this report.

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
STUDY PLAN

Study ID Code	KSPMC-T-1001-WL
Title	Survey of pollinating insects at the Manhattan PMC
Project Number	Wildlife 1.1
Study Type	Technology Development Study
Study Status	Active
Location	KSPMC
Study Leader	P. Allen Casey
Duration	2010 through 2015
Cooperators	The Xerces Society
Land Use	Wildlife Habitat
Vegetative Practices	Primary 386 FIELD BORDER Secondary 512 PASTURE AND HAYLAND PLANTING
Resource Concern(s)	Resource: Consideration/Problem Wildlife: Wildlife Habitat conservation, construction, and reclamation
Long Range Plan	Part I, Strategic goal 1, Objective 1.4 of the KSPMC LRP

Description

Pollinators are keystone species to which many plants rely on to complete their reproductive lifecycle (Shepherd et al. 2003). Insects by far are the most numerous group of all of the pollinators. Pollinating insects are also considered to be an indicator species and can be used to determine ecosystem health (Shepherd et al. 2003). Pollinating insects provide for heterogeneity of the floral gene pool, larger fruit and seed size, and more even development of fruits or seeds. Bees are often the insect pollinators that are commonly referred to, and they are one of the biggest contributors to pollination. However, there are many other types of insect pollinators that are involved in pollinating flora.

Status of Knowledge

There is a need to identify what species of pollinating insects occur at the Kansas Plant Materials Center, in order to develop artificial nesting sites and best management practices (BMPs) to increase the populations of those species. Increasing pollinator numbers will provide for better fruit and seed development for many of the plant materials that are being produced and evaluated. The objective of this study is to utilize aerial net capture, trap nesting, pan, and malaise trapping techniques to capture as many pollinating insects as possible and then identify them as close to species as possible. The data will then be used for determination of appropriate BMPs and development of appropriate artificial nesting sites.

Experimental Design

Field survey

Materials and Methods

Trap/capture method established

1. Trap nest establishment: Trap nests will be constructed from 4x6 softwood blocks with nesting holes drilled in them, attached to fence

	posts, and set out in areas with a high probability of attracting pollinators. 2. Pan traps: Pan traps constructed and placed in areas with high probability of attracting pollinators. Pan traps used on ground and at varying heights to capture as many different species as possible 3. Aerial net capture: Aerial net used to sweep insects off of flowers along transect lines that are walked at a slow pace. 4. Malaise trap: Traps located in areas likely for multiple species of flying pollinators to be captured. Captured insects identified as close to species as possible. Management: 1. Aerial net capture and pan trapping should be done roughly between 9am and 2pm on warm (>20 C (68 F)) and sunny (<60% cloud cover) days that have average wind speeds of less than 5 m/s (11 mph) (Hopwood, 2008). 2. Trap nest should be checked periodically to determine utilization.
Final Evaluations	Resulting data used to determine appropriate management of nesting habitat
Technology Transfer Products	Technical notes, poster papers, newsletter articles, oral presentations
Literature Cited	Hopwood, J.L. 2008. The Contribution of roadside grassland restorations to native bee conservation. Biological Conservation 141: 2632-2640. Shepherd, M., S.L. Buchmann, M. Vaughan, and S.H. Black. 2003. Pollinator Conservation Handbook. Xerces Society in Association with The Bee Works. Portland, Oregon.
Keywords	Native pollinator, wildlife habitat, field border, hayland
Reviewed by:	Plant Materials Specialist __Mark Janzen_/s/__3/29/2010_____ State Resource Conservationist _Terry M. Conway_/s/__3/30/2010_____ Regional Plant Materials Specialist _Joel L. Douglas_/s/__3/22/2010_____
Approvals:	State Conservationist __Kasey Taylor_/s/___Acting__3/30/2010_____