United States Department of Agriculture
Natural Resources Conservation Service

2005 ANNUAL TECHNICAL REPORT

Manhattan Plant Materials Center

Serving Kansas, Nebraska, northern Oklahoma, and northeastern Colorado

Notices

The Manhattan Plant Materials Center (PMC) Annual Technical Report is a report to the plant materials discipline and cooperating agencies. This is a preliminary report of results from various studies conducted by the PMC Center staff. 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 website at http://Plant-Materials.nrcs.usda.gov/ for additional information about our program.

This report 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 their website at http://plants.usda.gov/. The Flora of the Great Plains, University Press of Kansas is the authority regarding the usage of common names.

Mention of trade and company names does not imply any guarantee, warranty, or endorsement by the United States 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.

Abbreviations of state names used in the text are according to The Gregg Reference Manual Ninth Edition. W.A. Sabin, McGraw-Hill Book Company 2001, with the exception of tables with space limitations where two letter postal designations are used.

On the cover: UL – 'Sunglow' grayhead prairie coneflower foundation seed increase field; UR – Sunrise on the PMC; ML – Viceroy on common buttonbush; MR – Steve Shuler, KCIA Field Inspector, inspecting 'Midas' false sunflower foundation seed increase field; LL – John Row, PMC Specialist, estimating yield of 'Konza' aromatic sumac; LR – Biological Science Technicians Jerry Longren and Don Garwood harvesting foundation seed increase field of 'Kaw' big bluestem.

UNITED STATES DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

MANHATTAN PLANT MATERIALS CENTER

2005 ANNUAL TECHNICAL REPORT

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FOREWORD AND ACKNOWLEDGEMENTS

The Manhattan Plant Materials Center (PMC) 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 a PMC Long-Range Plan with guidance from a State Conservationist's 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, and Oklahoma State University], Kansas Biological Survey, United States Department of Interior (USDI)-Fish & Wildlife Service, United States Department of Agriculture (USDA)-Agricultural Research Service (ARS), United States Army-Fort Riley Military Reservation, United States Army-Corps of Engineers, and Kansas Department of Wildlife and Parks.

The PMC was established in 1936 as a Soil Conservation Service 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-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: Bobby Brown, Research Assistant, Entomology Department; Dr. Walter Fick, Agronomy Department; Dr. Wayne Geyer, Horticulture, Forestry and Recreation; Mary Knapp, State Climatologist and Vernon Schaffer, Agronomy Department, from KSU, Manhattan, Kansas. It also recognizes the assistance of Mary Shaffer, Public Affairs Specialist and staff, NRCS, Salina, Kansas. Assistance provided by these individuals is greatly appreciated.

INTRODUCTION

The purpose of the Manhattan PMC Annual Technical Report is to inform the NRCS plant materials discipline, its cooperators, and others interested in plant materials work of progress and new developments.

Mission: The Mission of the NRCS Plant Materials Program

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, stream banks, 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 materials problems, needs, and priorities in their respective 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, stream bank 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
Central Great Plains Winter Wheat and Range
Southwestern Prairies Cotton and Forage
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 an annual 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. 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 Manhattan PMC provides assistance in the collection and propagation of culturally significant plants. Such efforts result in the establishment of plant propagation nurseries, educational, and ceremonial displays. Ethnobotanical information and plant descriptions may also be provided. The following tribes were assisted in 2005.

Tribe	Location	Plant
Cheyene/Arapho Conferated Tribe	Oklahoma	Sweetgrass
Comanche	Oklahoma	Sweetgrass

The Shawnee Tribe of Oklahoma was assisted with development of an outdoor classroom. The Medicine Wheel at the Center was completed this year. See Technology Transfer, page 6, for further information regarding outreach activities in 2005.

COOPERATIVE EFFORTS

The Manhattan 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 2005.

Cooperator	Affiliation	Research Interest
Dr. Mike Casler	USDA-ARS-Dairy Forage Res. Cen.-Univ. of Wisconsin	Adaptation zones of switchgrass populations
Shauna Dendy	Kansas State Univ.	Rust in warm-season grasses
Phil Fay	Kansas State Univ.	Greenhouse studies of grasses
Dr. Steven Fransen	Washington State Univ.– Prosser	Warm-season grass trials; grass-legume mixtures
Dr. Karen Garrett	Kansas State Univ.	Diseases of warm-season grasses
Dr. Wayne Geyer	Kansas State Univ.	Evaluation of green ash
Dr. Lawrence Hagen	USDA-ARS-Wind Erosion Res. Unit	Wind erosion effects
Ari Jumpponen	Kansas State Univ.	Warm-season grass endophytes
Steve Masterson	USDA-ARS-Univ. of Nebraska-Lincoln	Biochemistry of seed germination and seedling development in switchgrass
Dr. Rob Mitchell	USDA-ARS-Univ. of Nebraska-Lincoln	Interseeding legumes in grass swards
Dr. Joe Moyer	Kansas State Univ.	Warm-season grasses
Dr. Tim Springer	USDA-ARS-Southern Plains Res. Sta.	Tannin levels in roundhead lespedeza
Dr. Tim Springer	USDA-ARS-Southern Plains Res. Sta.	Big bluestem comparison trials
April Stahnke	South Dakota State Univ.	Native perennial sunflowers
Dr. Charles Taliaferro	Okla State Univ.	Upland switchgrass biomass
Dr. Kenneth Vogel	USDA-ARS-Univ. of Nebraska-Lincoln	Warm-season grasses
Becky White	Carson Engineering Center	Warm-season grasses – mine tailings
Gail Wilson	Kansas State Univ.	Warm-season grass C3-C4 evaluations

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. The following publications and events occurred in 2005. Author's given name 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.

Year 2005 publications and events.

Abstracts: Published in conference proceedings.

Seed storage and longevity of 15 grass species under two storage environments: Results of a 30-year study. John M. Row and Richard L. Wynia. 58th Annual Meeting of the Society for Range Management. Denver, Colo. Feb. 2005. 110p.

Brochures: Brochures produced by the plant materials program or co-authored with other units of government.

Manhattan Plant Materials Center. USDA-NRCS Manhattan, Kans. 2p.

Conference Room: The PMC conference room is used by federal, state, and local conservation agencies for meetings and training activities. Over 100 people used the facility this year for the following activities:

Kansas State University Agricultural Engineering Department Faculty Retreat
Kansas Range Youth Camp
NRCS Central NTSC Plant Materials Workshop
State Conservationist's Plant Materials Advisory Committee Meeting

Misc. Publications: Articles published in various organizations publications that do not fit in another category.

Western Kansas bur oak evaluation update. Mark A. Janzen. Plains & Prairie Forestry Assoc. of North America Newsletter. Vol. 10 (1). Manhattan, Kans. 12p.

Newsletters: The Manhattan PMC publishes a quarterly newsletter that is distributed in the service area to all field locations. The newsletter has been published and distributed since 1994.

Manhattan PMC Newsletter. Jan. 2005. M.A. Janzen, R.L. Wynia and J.M. Row

Manhattan PMC Newsletter. Apr. 2005. R.L. Wynia, M.A. Janzen, and J.M. Row

Manhattan PMC Newsletter. July 2005. R.L. Wynia and J.M. Row

Manhattan PMC Newsletter. Oct. 2005. R.L. Wynia and J.M. Row

Plant Fact Sheets: Plant Fact Sheets are produced for the PLANTS Database that benefit the Plant Materials Program and NRCS programs.

Northern Catalpa [*Catalpa speciosa* (Warder) Warder ex Englem.] Plant Fact Sheet. PLANTS Database. June 2005. Wayne Geyer and Patrick J. Broyles. 2p.

Southern Catalpa [*Catalpa speciosa* (Warder) Warder ex Englem.] Plant Fact Sheet. PLANTS Database. June 2005. W. Geyer and P.J. Broyles. 2p.

Yellow coneflower [*Ratibida pinnata* (Vent.) Barnh.] Plant Fact Sheet. PLANTS Database. July 2005. R. Alan Shadow. 2p.

Plant Guides: Plant Guides are produced for the PLANTS Database that benefit the Plant Materials Program and NRCS programs.

Northern Catalpa [*Catalpa speciosa* (Warder) Warder ex Englem.] Plant Guide. PLANTS Database. June 2005. W. Geyer and P.J. Broyles. 5p.

Posters: Posters are produced and/or presented by the PMC at various functions.

Seed storage and longevity of 13 grass species under two storage environments: Results of a 30-year study. 58th Annual Meeting of the Society for Range Management, February 8, 2005. Fort Worth, Tex. J.M. Row and R.L. Wynia

Presentations: Presentations are made by PMC staff to update various groups about plant materials program activities and facilitate technology transfer.

Experiences in production of native forbs and legumes at the Manhattan Plant Materials Center. 5th Annual Native Seed Quality Conference, February 23, 2005. Omaha, Nebr. R.L. Wynia.

Plant Materials Program, Oklahoma Association of Conservation Districts Annual Meeting, February 28, 2005. Oklahoma City, Okla. M.A. Janzen

Plant Materials Program, Area II District Conservationist Meeting, March 9, 2005. Dodge City, Kans. M.A. Janzen

Colorado Plant Materials Committee Meeting Update, April 5, 2005. Lakewood, Colo. R.L. Wynia.

Plant Materials Program, Area IV District Conservationist's Meeting, Haskell University, June 28, 2005, Lawrence, KS. M.A. Janzen

Ethnobotany of the Northern Great Plains. American Indian Program Delivery AI/ANAE Meeting, June 30, 2005. Polson, Mont. P.J. Broyles.

Plant Materials Update at the Kansas Area IV District Conservationist's Meeting, July 13, 2005. Manhattan, Kans. R.L. Wynia.

Nebraska Plant Materials Committee Meeting Update, Sep. 8, 2005. Univ. of Nebr., Research and Development Center. R.L. Wynia.

Plant Materials Center Update to the NRCS State Conservationist's Plant Materials Committee Meeting, September 13, 2005. Manhattan, Kans. R.L. Wynia.

Update of Plant Materials Center Activities, Kansas NRCS Management Team Meeting, October 27, 2005. Salina, Kans. R.L. Wynia.

Plant Materials Centers: Seeking vegetation solutions to conservation problems, November 8, 2005. Kansas State Univ., Manhattan, Kans. R.L. Wynia.

IEP and AEP Update at the Manhattan Plant Materials Center, November 15, 2005. NRCS Central NTCS Plant Materials Workshop, Manhattan, Kans. R.L. Wynia.

Plant Materials Program Activities. Oklahoma Plant Materials Committee, November 30, 2005. Woodward, Okla. M.A. Janzen.

Refereed Journal Articles: Articles authored or co-authored by PMC staff which appear in refereed professional publications.

Performance of green ash seed sources at four locations in the Great Plains Region. W. Geyer, Keith Lynch, J. Row, Pete Schaeffer, and Walter Bagley. Northern J. of Applied Forestry, Soc. of American Foresters. Vol. 22 (1) 54-58. Mar. 2005. 5p.

Registration of 'Chet' sand bluestem. Tim L. Springer, Chester L. Dewald, Phillip L. Sims, R.L. Gillen, V.H. Louthan, W.J. Cooper, Charles M. Taliaferro, R.L. Wynia, Morris J. Houck Jr., Rudy G. Esquivel, James A. Stevens, and Melinda R. Brakie. Crop Sci. 45: 2125. 2005.

Registration of 'Verl' eastern gamagrass. T.L. Springer, C.L. Dewald, P.L. Sims, R.L. Gillen, V.H. Louthan, W.J. Cooper, C.M. Taliaferro, Clarence Maura, Sharon Pfaff, R.L. Wynia, Joel Douglas, Jimmy Henry, Steve Bruckerhoff, Martin van der Grinten, Paul Salon, M.J. Houck Jr., R.G. Esquivel, J.A. Stevens, and M.R. Brakie. Crop Sci. 45: . 2005.

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

2004 Annual Technical Report, Manhattan Plant Materials Center, Manhattan, Kans. 112p.

2004 Progress Report of Activities. Manhattan Plant Materials Center, Manhattan, Kans. 4p.

Technical Notes: Technical Notes are produced by the plant materials program for the benefits of its customers.

Eastern gamagrass. James Henson, James Alderson, M. Brakie, John Dickerson, Janet Grabowski, J. Douglas, M. Houck, Malcom Kirkland, Rebecca Noricks, S. Pfaff, J. Row, P. Salon, J. Stevens, and R. Wynia. Plants Data Base, Baton Rouge, La. 2005. 29p.

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.

Orientation for Biological Science Aids, Manhattan PMC, May 16, 2005. J.M. Row. Trainees: 5

Biofuels: Using woody plant materials as an alternative fuel source? North Carolina A&T State Univ., Greensboro, N.C. July 17, 2005. J.M. Row. Trainees: 30

Tours: The PMC staff welcomes visitors and readily conducts tours. During calendar year 2005, more than 145 people visited the Center, of which 123 toured the Center. The following groups are representative of the yearly interest in the Manhattan Plant Materials Program:

Kansas Range Youth Camp
Kansas State University Agronomy Field Day – Joint PMC Tour
Kansas State University Extension Specialists
NRCS Central NTSC Plant Materials Workshop Attendees
State Conservationist's Plant Materials Advisory Committee

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							
		Asclepias tuberosa (SI)			*Chamaecrista fasciculata*		*Chamaecrista fasciculata* (F)
		Echinacea angustifolia				*Liatris punctata*	
		Liatris punctata					
		Silphium laciniatum (S)					
GRASSES AND GRASS-LIKE PLANTS							
Redfieldia flexuosa	*Panicum virgatum*		*Panicum virgatum*				
		Calamovilfa gigantea (F)					
Scirpus sp.			*Schizachyrium scoparium*				
					Bouteloua gracilis		*Bouteloua Gracilis* (F)
TREES AND SHRUBS							
	Amorpha fruticosa	*Amorpha canescens* (S)			*Betula nigra*	*Betula nigra* (T)	
	Celtis occidentalis	*Ceanothus herbaceous*		*Celtis occidentalis* (S)			
		Cotoneaster lucida (F)	*Fraxinus pennsylvanica* (S)				
	Platycladus orientalis	*Prunus americana*		*Platycladus orientalis* (S)		*Prunus americana* (F)	
	Quercus macrocarpa	*Cephalanthus occidentalis*			*Prunus angustifolia*	*Prunus angustifolia*	*Prunus angustifolia* (F)
		Salix exigua (S)		*Ulmus pumila* (S)	*Ribes aureum* var *villosum*	*Ribes aureum* var *villosum* (F)	
				Ulmus parvifolia			

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., Kans.; 9013344, Washita Co., Okla.; 9013354, Stephens Co., Okla.; and 9017622, Saline Co., Kans.				
	421278	butterfly milkweed	*Asclepias tuberosa*	20I009S
ORIGIN/SOURCE: Saunders Co., Nebr.				
9034682		river birch	*Betula nigra*	20I010K
ORIGIN/SOURCE: Houston Co., Minn.				
9050018		big sandreed	*Calamovilfa gigantea*	20I032X
ORIGIN/SOURCE: A polycross composed of accessions 9026760, Reno Co., Kans.; 9026777, Payne Co., Okla.; 9035891, Lipscomb Co., Tex.; 9042800, Garza Co., Tex.; 9042911, Winkler Co., Tex.; 9049764, Rice Co., Kans.; 9049765, Stafford Co., Kans.; 9049823, Stafford Co., Kans.; and 9049866, Comanche Co., Kans.				
9049952	514676	New Jersey tea	*Ceanothus herbaceous* var *pubscens*	20I024H
ORIGIN/SOURCE: A polycross composed of accessions 9013414, Osborne Co., Kans.; and PI-421286, Wabaunsee Co., Kans.				
9050496		Common buttonbush	*Cephalanthus occidentalis*	20I043E
ORIGIN/SOURCE: A polycross composed of accessions 9050287, Hodgeman Co., Kans.; 9050296, Miami Co., Kans.; 9050311, Douglas Co., Kans.; 9050323, Harvey Co., Kans.; 9050340, Cleveland Co., Okla.; 9050359, Harvey/Reno Co., Kans.; 9050360, Osage Co., Kans.; 9050371, Butler Co., Kans.; 9050375, Montgomery Co., Kans.; 9050389, Douglas Co., Kans.; 9050392, Johnston Co., Okla.; and 9050395, Logan Co., Okla.				
	325270		*Cotoneaster lucidus*	20I033K
ORIGIN/SOURCE: USSR				
9023353		black samson	*Echinacea angustifolia*	20I018S
ORIGIN/SOURCE: A polycross composed of accessions PI-421340, Butler Co., Kans.; PI-421331, Logan Co., Okla.; PI-421362, Ellis Co., Kans.; PI-421307, Noble Co., Okla.				

Accession No.	PI No.	Common Name	Species	Study No.
9049894		dotted gayfeather	*Liatris punctata*	20I022S
ORIGIN/SOURCE: A polycross composed of PI-421419, Woodson Co., Kans.; PI-421497, Lane Co., Kans.; and PI-421488, Rush Co., Kans.				
9049945	514677	American plum	*Prunus americana*	20I028J
ORIGIN/SOURCE: A polycross composed of accessions 9013483, Gove Co., Kans.; 9013498, Valley Co., Nebr.; 9013500, Valley Co., Nebr.; 9013515, Harlan Co., Nebr.; and 9013544, Kingman Co., Kans.				
9049970		Chickasaw plum	*Prunus angustifolia*	20I029J
ORIGIN/SOURCE: A polycross composed of accessions 9013486, Gove Co., Kans.; 9013519, Kingfisher Co., Okla.; 9013524, Roger Mills Co., Okla.; 9013527, Woods Co., Okla.; 9013528, Woods Co., Okla.; 9013543, Gray Co., Kans.; 9013547, Garfield Co., Okla.; and 9013548, Kingfisher Co., Okla.				
9050270		buffalo currant	*Ribes aureum* var *villosum*	20I036X
ORIGIN/SOURCE: A polycross composed of accessions 9049770, Morris Co., Kans.; 9049773, Ellis Co., Kans.; 9049806, Holt Co., Nebr.; 9049810, Sheridan Co., Nebr.; and 9049884, Loup Co., Nebr.				
9050135		sandbar willow	*Salix exigua*	20I040E
ORIGIN/SOURCE: Brown Co., Kans.				
9050148		sandbar willow	*Salix exigua*	20I040E
ORIGIN/SOURCE: Sarpy Co., Nebr.				
	421557	compass plant	*Silphium laciniatum*	20I020H
ORIGIN/SOURCE: Okmulgee Co., Okla.				

SEED AND PLANT PRODUCTION

Variety	Genus/Species	Common Name	Origin	Class	Acres
		HERBACEOUS			
		Forbs			
Riley Germplasm	*Chamaecrista fasciculata*	showy partridge pea	Riley Co., Kans.	G2	0.5
Kaneb	*Dalea purpurea*	purple prairie clover	Riley Co., Kans.	FND	0
Reno Germplasm	*Desmanthus illinoensis*	Illinois bundleflower	Reno Co., Kans.	G2	0
9023353	*Echinacea angustifolia*	black sampson		FND	0.17
Prairie Gold	*Helianthus maximiliani*	Maximilian sunflower	Kans.	FND	0.12
Midas	*Heliopsis helianthoides* var *scabra*	false sunflower	Kans.	FND	0.12
Kanoka	*Lespedeza capitata*	round-head lespedeza	Kans., Okla.	FND	0.28
9049894	*Liatris punctata*	dotted gayfeather	Kans.	G2	0.19
9004455	*Penstemon cobaea*	Cobaea penstemon		G2	0
Eureka	*Liatris pycnostachya*	thickspike gay-feather	Kans.	FND	0.07
Sunglow	*Ratibida pinnata*	grayhead prairie coneflower	unknown	FND	0.24
Nekan	*Salvia azurea* var *grandiflora*	pitcher sage	Kans.	FND	0.23
421557	*Silphium laciniatum*	compass plant	Okmulgee Co., Okla.	G2	0.02
		Grasses			
Kaw	*Andropogon gerardii*	big bluestem	Riley Co., Kans.	FND	1.0
Garden	*Andropogon hallii*	sand bluestem	Garden Co., Nebr.	SFP	0.57
El Reno	*Bouteloua curtipendula*	sideoats grama	Canadian Co., Okla.	FND	0.84
9050485	*Bouteloua gracilis*	blue grama		FND	1.37
Pronghorn	*Calamovilfa longifolia*	prairie sandreed	Nebr.	FND	0.75
9050018	*Calamovilfa gigantea*	giant sandreed	Kans., Okla., Tex.	FND	0.35
Bend	*Eragrostis trichodes*	sand lovegrass	Kans., Okla.	FND	0.24
Blackwell	*Panicum virgatum*	switchgrass	Blackwell, Okla.	FND	1.23
Kanlow	*Panicum virgatum*	switchgrass	Wetumka, Okla.	FND	0.72
Barton	*Pascopyrum smithii*	western wheatgrass	Barton Co., Kans.	FND	1.0
Southwind	*Phragmites australis*	common reed	Kans., Okla.	FND	0.8
Aldous	*Schizachyrium scoparium*	little bluestem	Kansas Flinthills	FND	2.4
Cimarron	*Schizachyrium scoparium*	little bluestem	Kans., Okla.	FND	1.57
Cheyenne	*Sorghastrum nutans*	yellow Indian grass	Fort Supply, Okla.	SFP	0.35
Osage	*Sorghastrum nutans*	yellow Indian grass	Kans., Okla.	FND	1.0
Atkins Germplasm	*Spartina pectinata*	prairie cordgrass	Washington Co., Nebr.	G2	0.83
Pete	*Tripsacum dactyloides*	eastern gamagrass	Kans., Okla.	FND	1.6
		WOODY			
9049944	*Amorpha canescens*	lead plant	Kans., Okla.	G2	0.07
9034682	*Betula nigra*	river birch	Houston Co., Minn.	G2	0.15
9049952	*Ceanothus herbaceous* var *pubscens*	New Jersey tea	Kans.	G2	0.11
325270	*Cotoneaster lucidus*		USSR	FND	0.05
Pink Lady	*Euonymus bungeanum*	winterberry	China	FND	0.03
9049945	*Prunus americana*	American plum	Kans., Nebr.	FND	0.05
9049970	*Prunus angustifolia*	Chickasaw plum	Kans., Okla.	FND	0.12
Lippert	*Quercus macrocarpa*	bur oak	Stillwater, Okla.	FND	0.02
Konza	*Rhus aromatica* var *serotina*	aromatic sumac	Kans.	FND	0.09
9050270	*Ribes aureum* var *villosum*	buffalo currant	Kans., Nebr.	FND	0.05
9050135	*Salix exigua*	sandbar willow	Brown Co., Kans.	G2	0.09
9050148	*Salix exigua*	sandbar willow	Sarpy Co., Nebr.	G2	0.11

DISTRIBUTION OF PLANT MATERIALS IN 2005

The following tables show the distribution of plant materials from the Manhattan PMC. A total of 34 orders were shipped to 13 states, 3 plant materials centers, and 1 foreign country during the calendar year 2005. Seven hundred and ninety-one pounds of seed, 104 rhizomes, and 179 plants were shipped to conservation districts, universities, federal and state agencies, and private entities. These materials were used in field trials, research, seed or plant increase, and demonstration plantings and for educational purposes.

Table 1. Herbaceous Plant Materials Distributed by the Manhattan Plant Materials Center in 2005.

		Seed Orders			Plant Orders		
State	Use	Number	Number of Packets	Bulk Pounds	Number	Number of Rhizomes	Number of Plants
Kansas	CI	4		516.3			
	RES	3	3	1.1			
Subtotal		7	3	517.4			
Nebraska	CI	3		138.7			
	FA	1		4.0			
	RES	1		5.0			
Subtotal		5		147.7			
Oklahoma	OR				2		179
	RES	2		42.7			
Subtotal		2		42.7	2		179
Colorado	CI	2		13.4			
Other States	CD	2	1	0.5			
	GPP				2	24	
	PMC	3	3	1.6			
	RES	6	7	46.9	1	80	
Subtotal		13	11	62.4	3	104	
Total		27	14	770.2	5	104	179

Table 2. Woody Plant Materials Distributed by the Manhattan Plant Materials Center in 2005.

		Seed Orders		Plant Orders		
State	Use	Seed Orders	Bulk Pounds	Number	Number of Cuttings	Number of Plants
Montana	CI	1	6.5			
Oklahoma	RC&D	1	14.3			
Total		2	20.8			

Legend: CD=Conservation Districts CI=Commercial Increase FA=Federal Agencies GPP=Germ plasm Preservation OR=Outreach PMC=Plant Materials Centers RC&D=Resource Conservation & Development RES=Research at public and private institutions

YEAR 2005 CLIMATOLOGICAL DATA FOR MANHATTAN, KANSAS

2005 Data

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg Max	37.3	50.4	59.3	70.9	79.7	88.8	92.8	89.9	85.5	71.4	59.4	40.2	68.8
Avg Min	18.5	27.5	32.1	44.3	51.1	64.6	66.9	64.5	59.0	43.8	32.3	19.9	43.7
Avg Mean	27.9	38.9	45.7	57.3	65.4	76.7	79.9	77.2	72.2	57.6	45.9	30.1	56.2
High	68	69	78	89	95	100	103	102	97	90	81	66	
Low	-2	1	12	25	28	53	51	50	35	24	12	-9	
Min† < 10	8	1	0	0	0	0	0	0	0	0	0	5	14
Min† < 32	29	20	16	4	2	0	0	0	0	6	15	26	118
Max† > 90	0	0	0	0	4	12	21	13	6	0	0	0	56
Precip	0.85	2.96	0.84	0.67	1.45	11.81	2.26	5.61	4.36	3.27	0.68	0.78	35.5
PMC‡	-	-	-	2.44	1.66	9.43	2.25	5.03	4.48	3.08	0.38	-	-
Precip†	7	15	8	10	9	12	8	15	13	9	5	7	118
Snow	4.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	15.2	21.5
Heat DD*	1152	730	590	272	114	0	1	0	20	286	596	1048	4806
Cool DD*	0	0	2	37	127	351	461	379	236	56	3	0	1651

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	-2.2	3.6	1.8	3.0	2.2	1.7	0.3	-0.9	3.4	0.7	4.9	-2.7	1.3
Avg Min	2.4	6.0	0.7	2.1	-1.4	2.3	-0.4	-0.6	3.5	0.6	2.1	0.0	1.4
Avg Mean	0.1	4.7	1.2	2.2	0.4	2.0	0.0	-0.8	3.4	0.6	3.5	-1.3	1.3
Precip	0.01	1.96	1.75	-2.4	3.63	6.58	1.84	2.34	0.69	0.5	1.42	0.28	0.74
Snow	0.1	-3.9	-3.4	-0.9	-0.1	0.0	0.0	0.0	0.0	-0.2	-0.6	11.5	2.5
Heat DD*	-2	-135	-47	-44	8	-7	1	-4	-29	21	-83	6	-314
Cool DD*	0	0	2	20	21	53	0	-27	73	41	3	0	186

*Daily values were computed from mean temperatures. Each degree that a day's mean is below (or above) 65°F is counted for one heating (or cooling) degree day. † Number of days. ‡ Gauge in operation April 4 to November 23.

Official Recording Station, Manhattan, KS

CLIMATIC SUMMARY 2005

Temperature Extremes: -9°F on December 9
103°F on July 21, 22, and 23

First Killing Frost: October 7 at 32°F

Last Killing Frost: May 3 at 30°F

Number of Frost Free Days: 156

Temperature: Record high temperatures on January 1st were quickly replaced by much colder weather. Monthly mean temperatures were unusually close to normal with only a tenth of a degree warmer. February was warmer than normal; however, no records were set. Most of the warmth came from warmer than normal low temperatures. March was slightly warmer than normal, though not as warm as last year and no records were set. Despite record setting cold at the end of the month, April was slightly warmer than normal. May was slightly cooler than normal. A new record low of 28°F was set for May 2. The previous record was 29°F, set in 1961. This was the last of the extremely cold weather. The daily average high ran several degrees above normal. While there were several readings in the 90's, temperatures did not break the century mark. June was warmer than normal with temperatures falling in the middle range for June records. July was a study in contrasting temperatures. The first half of the month was nearly normal with highs near 90, and lows in the 60's. This was followed by a heat wave with highs in the 100's and lows in the 70's. The month ended with two new record lows set on the 27th and 28th. Despite the warm start, August ended cooler than normal; however, no records were set. September was warmer than normal. Cold weather did not arrive until the 29th, when the low reached 35°F, but no freezing occurred. October was just barely warmer than normal despite the warm beginning to the month. There were fewer days with highs above 70 than usual. November was a wild month with warm conditions through mid-month giving way to winter. True winter conditions arrived on the 27th. Tornadoes in the vicinity, including Ft. Riley and Keats, gave way to temperatures in the teens with winds in excess of 30 mph. December was a month of contrasts. The first half of the month was cold and snowy, but it ended warm and dry. A new record low for the day was set on the 9th at -9°F, yet only 1.5 degrees colder than normal for the month.

Precipitation: Sleet, snow, and ice the first week of January was unusual in its persistence. Although the greatest depth was only 3 inches, the slippery mess remained until the 19th. In contrast, the 2 inches of snow received on the 29th melted away the next day. The monthly mean for total moisture was only one hundredth of an inch short of normal. February was above normal for precipitation but below normal in snow fall. March was much drier than normal. Most of the moisture came in a lingering storm that started with 0.66 inches on the 22nd. In April there were more than the usual days with rain. However, the precipitation was slight leaving the month significantly drier than normal. May was much drier than normal making the period March through May the driest since 1890. After an extremely dry spring, June began on a wet note. Six of the first twelve days had rainfall of over an inch. The 3.99 inches on June 10th set a record for that day. The 11.81 inches for the month made it the 3rd wettest June on record. Drier than normal conditions returned in July. August, while wetter than normal, the monthly precipitation fell in the middle range for the month. September was wetter than normal, but most of the rain was delayed until the end of the month. Storms October 21-22 brought welcome relief to the dry fall. October ended 0.50 inches wetter than normal. The first snow of the season fell on November 16th, but melted on contact. December started out snowy. A new record monthly snowfall was set with 15.2 inches replacing the old record of 14.8 from 1983, however, the month ended drier than normal.

Extracted from comments by Mary Knapp, State Climatologist, Weather Data Library, Kansas State University.

STUDIES

Studies are planned and developed by the Plant Materials Center 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. Twenty-two studies were active in on-site and off-site (OS) trials in 2005 (Table 1.1). Details of active studies can be found on the subsequent pages.

Table 1.1. Status of studies conducted by PMC staff.

Study No.	Study Name	Location	Status	Start Date	End Date	Project No.
20A107T	Seed storage study.	KSPMC	Active	1973	2050	RN 1.1
20A126L	Adaptation trials of superior grasses and forbs selected for advanced testing.	KSPMC	Active	1992	2050	NA 1.1
20A127K	Evaluation of PMK-1 and other *Fraxinus pennsylvanica* germ plasm for resistance to ash borers.	KSPMC	Active	1997	2020	CP 4.1
20A215H	Rrps of little bluestem (*Schizachyrium scoparium*).	KSPMC	Active	1992	2010	RN 1.1
20C006G	Evaluation of perennial cool-season forage grasses.	OS KS	Inactive	1996	2005	PH 1.1
20C007Ta	Propagation of Mead's milkweed (*Asclepias meadii*).	KSPMC	Active	1996	2010	NA 1.1
20C007Tb	Propagation of earleaf gerardia (*Agalinis auriculata*).	KSPMC	Inactive	1996	------	NA 1.1
20C008L	Evaluation of plant materials for use in soil bioengineering techniques.	KSPMC	Inactive	1998	------	WA 3.1
20C009J	Conservation Reserve Program seeding enhancement study.	OS KS	Active	1997	2008	CP 3.1
20I003L	Evaluation of miscellaneous grasses.	KSPMC	Active	1970	2020	NA 1.1
20I010K	Evaluation of miscellaneous trees and shrubs.	KSPMC	Active	1961	2050	CP 4.1
20I026K	Evaluation of hackberry (*Celtis* sp.).	KSPMC/ OS KS	Active	1979	2010	CP 4.1
20I031K	Evaluation of Oriental arborvitae (*Platycladus orientalis*).	KSPMC/ OS OK	Active	1979	2007	CP 4.1
20I037K	Evaluation of selected common hackberry (*C. occidentalis*).	KSPMC	Active	1988	2008	CP 4.1
20I038K	Bur oak seed source study.	KSPMC	Active	1991	2015	CP 4.1
20I039E	Evaluation of switchgrass (*P. virgatum*) germplasm for rhizomatous characteristics.	KSPMC	Active	1992	2010	CP 4.1
20I041K	Evaluation of Siberian elm (*Ulmus pumila*).	OS CO/NE	Active	1997	2020	CP 4.1
20I042E	Initial evaluation of indigobush (*Amorpha fruticosa*) for use in streambank stabilization, shoreline protection, and wetland restoration and enhancement.	KSPMC	Active	1997	2007	WQ 3.1
20I043E	Evaluation of common buttonbush (*Cephalanthus occidentalis*).	KSPMC	Active	2000	2010	WQ 2.1
KSPMS-T-9902-OT	Assist Native American Tribes with the reestablishment of culturally significant plants.	OK, KS, NE	Active	1999	2020	- - -
KSPMS-F-9903-CR	Evaluation of Salix species for stream corridors and shoreline stabilization.	KSPMC	Active	1999	2005	WQ 3.1
KSPMS-T-0001-CR	Conservation field trial; reclamation of blue shale outcrop sites in Jewell County, Kansas.	OS KS	Active	2000	2010	ML 1.1
KSPMS-T-0201-CR	Plant species for revegetation of natural and man-induced saline areas.	OS KS	Active	2002	2010	CP 3.1
KSPMC-T-0501-RA	Longevity of native warm-season grass seed: storage viability vs. seedling vigor/stand establishment.	KSPMC/ OS KS	Active	2005	2008	RA 1.1
KSPMC-T-0502-RA	Laboratory evaluation of plant materials to determine seed analysis, germination, and propagation techniques.	KSPMC	Active	2004	2020	RA 1.1

A. Advanced Evaluations

1. Study No. 20A107T - Seed storage study.

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 percent 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 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 percent for several grasses stored at 5°F (-15°C) and 60 percent 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 a cool-season grass. Three introduced cool-season grasses were also included in the study.

Seed storage facilities consisted of a seed storage building with controlled environment and an uninsulated building (hereafter referred to as the warehouse) without a controlled environment. The warehouse was wood frame on a concrete slab with clapboard siding. The warehouse was subject to wide fluctuations in temperature and humidity. The seed storage building was of all metal construction and insulated throughout. The storage room itself was sealed to exclude outside air and humidity.

Temperature and humidity in the seed storage building were controlled by a UNA-DYN (Model A30T) two 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 percent. A hygro-thermograph was used to monitor temperature and humidity. Each seed lot was divided into two 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% active ingredient) were placed in each barrel for insect control. The second sack of each seed lot was placed on shelves inside the seed storage building. The initial purity 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 (100 g) 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. Seed lots were removed from the study when germination test results for that lot dropped below 10 percent of the original test.

No testing was conducted for years 17 & 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 for cool-season grasses in a controlled storage environment this year.

Potential Products: Information Technology

Progress or Status:

Warm-Season Grasses

The germination level in the warm-season grass entries in the controlled storage environment continued to follow an up-and-down trend. Five entries were up and five were down from the previous year. 'Kaw' big bluestem (*Andropogan gerardii Vitman*) and 'Garden' sand bluestem (*Andropogan hallii* Hack.) continued to rebound in germination level from lows two years ago (Tables 1.1 and 1.2).

The germination level of 'Kanlow' switchgrass (*Panicum virgatum* L.), a lowland-type of switchgrass and 'Bend' sand lovegrass [*Eragrostis trichodes* (Nutt.) Wood] dropped to all time lows over the course of the study. Kanlow and Bend dropped to 49 and 26 percent germination, respectively, while 'Blackwell' an upland-type of switchgrass dropped only slightly following 32 years in a controlled storage environment.

Forbs

Three entries remain in the controlled storage environment test following 26 years of storage. One legume, 'Kaneb' purple prairie clover (*Dalea purpurea* Vent.), and two genera of the Asteraceae family, 'Prairie Gold' Maximilian sunflower (*Helianthus maximiliani* Schrad.) and 'Midas' false-sunflower [*Heliopsis helianthoides* (L.) Sweet var. *scabra* (Dun.) Fern.] continue to show viability (Tables 1.3). 'Kanoka' round-head lespedeza (*Lespedeza capitata* Michx.), which was added to the study in 1980, continues to be viable following 20 years of storage in a controlled storage environment. Prairie Gold continued to rebound with a 5-point increase in germination from the previous year. The germination level for Midas has leveled out at 8 percent and will be dropped from the study. Kaneb continued its up and down trend.

Literature Cited:

Ackigoz, E. and R.P. Knowles. 1983. Long-term storage of grass seeds. Can. J. Plant Sci. 63:669-674.

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Rincker, C.M. 1981. Long-term subfreezing storage of forage crop seeds. Crop Sci. 21:424-427.

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Table 1.1 Germination test results for selected warm-season grasses over a period of years under controlled and uncontrolled storage environments.

Species	Entry	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
		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
		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
		Uncont.	22	72	74	79	74	68	66	64	45	31	24	5	TE				
Buchloe dactyloides	PMT-1181	Cont.	73	72	72	73	70	74	60	70	44	57	71	57	61	76	74	45	67
		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
		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
		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
		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
		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
		Uncont.	75	68	83	70	48	44	30	5	7	0	TE						
Spartina pectinata	PMK-1800	Cont.	67	75	68	60	48	55	54	56	24	11	51	46	64	45	48	38	24
		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
		Uncont.	10	50	40	46	35	40	17	26	24	4	TE						

Table 1.2 Germination test results for selected cool-season grasses over a period of years under controlled and uncontrolled storage environments.

Species	Entry	Storage	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Thinopyrum ponticum	Jose	Cont.	89	91	94	98	94	95	93	92	91	85	80	89	78	73	50	61	36
		Uncont.	89	94	95	92	83	60	9	2	TE								
Bromus inermis	Elsberry	Cont.	ND	ND	ND	54	49	37	17	9	12	2							
		Uncont.	ND	ND	ND	54	21	8	3	TE									
Pascopyrum smithii	Barton	Cont.	10	46	59	75	81	84	79	75	55	64	49	72	65	55	75	52	84
		Uncont.	10	51	70	79	52	32	7	2	TE								
Phalaris arundinacea	Ioreed	Cont.	82	92	87	77	83	88	81	81	73	70	80	75	67	68	70	77	56
		Uncont.	82	88	77	70	52	16	1	TE									

Table 1.1 Germination test results for selected warm-season grasses over a period of years under controlled and uncontrolled storage environments (continued).

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

Table 1.2 Germination test results for selected cool-season grasses over a period of years under controlled and uncontrolled storage environments (continued).

Species	Entry	Storage	0	17	18	19	20	21	22	23	24	25	26	27	28
Thinopyrum ponticum	Jose	Cont.	89	ND	36	ND	14	7	7	TE					
		Uncont.	89												
Pascopyrum smithii	Barton	Cont.	10	ND	75	ND	67	18	18	14	9	4	TE		
		Uncont.	10												
Phalaris arundinacea	Ioreed	Cont.	82	ND	42	ND	41	31	23	22	15	16	8	2	TE
		Uncont.	82												

Table 1.3 Germination test results for selected forbs over a period of years under controlled and uncontrolled storage environments.

Species	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
		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
	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
		Uncont.	78	65	65	56	51	40	6	TE									
Lespedeza capitata	9026784	Cont.	83	89	86	94	85	ND	88	ND	80	91	92	89	84	97	68	72	43
		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
		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
		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		Uncont.	30	30	14	14	6	5	TE										

Table 1.3 Germination test results for selected forbs over a period of years under controlled and uncontrolled storage environments (continued).

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

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

2. Study No. 20A126L - Adaptation trials of superior grasses and forbs selected for advanced testing.

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 PMC is often called upon by other PMCs and others 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 superior plant will be established in 6.1-m (20-ft) rows with a 2.1-m (6-ft) spacing (unless otherwise specified) between rows. A known cultivar will be planted adjacent to the superior plant as a standard of comparison (if available) in a 3X replicated planting. Plantings are irrigated as needed during the initial growing season to aid establishment.

Evaluation Factors: 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 grasses are currently under test at the Manhattan PMC: Upland-type switchgrass (*Panicum virgatum* L.), and prairie sandreed [*Calamovilfa longifolia* (Hook.) Schribn.] which is part of an inter-center strain trial. Forbs that are currently under test are a number of ticktrefoils: Dillenius' ticktrefoil [*Desmodium glabellum* (Michx.)], Illinois ticktrefoil (*Desmodium illinoense* Gray), and panicledleaf ticktrefoil [*Desmodium paniculatum* (L.) DC.]

a. Adaptation zones of switchgrass populations: Switchgrass as a species is broadly adapted to most of the latitudinal range of the lower 48 states (lat. 25 to 49˚ N). It is thought that most switchgrass populations have northern or southern limits beyond which they are relatively unadapted. The purpose of this study is to answer some basic questions about geographic adaptation of six switchgrass populations. The objective is to determine the relative importance of latitudinal vs. longitudinal adaptation zones of switchgrass populations collected from native prairie remnants. Six switchgrass populations with little or no plant breeding history from Wisconsin south to Blackwell, Oklahoma, will be included in the study. This trial is in cooperation with Dr. Mike Casler, USDA-ARS-Dairy Research Center, University of Wisconsin. It consists of four cultivars: 'Blackwell', 'Cave-in-Rock', 'Pathfinder', 'Sunburst', and two experimental lines. It was planted June 19, 2001, at Manhattan in field D-2. Plots 1.2 x 7.6-m (4 x 25-ft) with six replications were solid seeded in a Latin square design with 0.3-m (1-ft) drill spacing on a Belvue silt loam (sil) soil.

Plots were harvested in 2005. A 0.03-m (1-ft) square sample of plant material was harvested from 5 of the 6 entries in 3 replications of the study. Only Wisconsin experimental WS 98-SB was not harvested for this study. Harvest dates at each site were June 15, July 6, July 27, and August 17, without regard to morphological stage of the switchgrass. The harvested materials were sent to Rob Mitchell (USDA-ARS) for analysis. The intent is to study growth stage of the same lines at different locations to determine adaptation of materials to various latitudes.

b. Prairie sandreed: The plant materials specialist for Michigan requested that the Manhattan PMC participate in an inter-center strain trial to test the adaptation of a selection of prairie sandreed to our local climate. The Rose Lake PMC at East Lansing, Michigan, provided both plants and seed for the trial. Twelve plants of accession 9086408 were planted one foot apart in a rod row in Field B-3 at Manhattan. Refer to Study No. 20I003L, page 34, for further information on spaced plants. Hulled seed was planted in 3-m (10-ft) rod rows spaced 1.8-m (6-ft) apart with 3 replications on May 26, 2005, with a Kinkaid Cone Planter. 'Pronghorn' prairie sandreed was also planted as a standard of comparison. The plots received a good soaking June 3 and 6 with over 5 inches of rain. The hulled seed of 9086408 came up and established fairly well considering the remainder of the summer was very dry. A stand of 54.2% was

recorded on August 18. There was difficulty in establishing the Pronghorn which will need to be replanted in 2006.

c. Desmodium Species: The plant materials specialist for Michigan requested that the Manhattan PMC participate in an inter-center strain trial to test the adaptation of three Desmodium selections to our local climate. The Rose Lake PMC at East Lansing, Michigan, provided both plants and seed for the trial. The Manhattan PMC added two entries to the planting at Manhattan. One local collection and a collection from McPherson County, Kansas, were added to the trial that was established from seed. In all, five accessions were placed in the trial. Refer to Table 2.1, for a listing of the entries.

Table 2.1 Five Desmodium seed collections planted at Manhattan, Kans., June 7, 2005.

Accession	Variety	Species	Common Name
9005087	Marion	*Desmodium glabellum*	Dillenius' ticktrefoil
9013451	VNS	*Desmodium illinoense*	Illinois ticktrefoil
9050393	VNS	*Desmodium* sp.	ticktrefoil
9055415	Alcona	*Desmodium glabellum*	Dillenius' ticktrefoil
9055428	Grant	*Desmodium paniculatum*	panicledleaf ticktrefoil

Seed was planted in 3-m (10-ft) rod rows spaced 1.8-m (6-ft) apart with 3 replications on May 26, 2005, with a Kinkaid Cone Planter. Plants were set out June 7, 2005, in rod rows with an in-row spacing of 45.7-cm (18-in) apart. Poor stands were obtained from seed even though it was scarified. The dry weather is thought to have been a factor in the lack of success in establishing a stand. Stand ranged from 0 to 16.1 percent, Table 2.2. The failure of accession 9013451 comes as no surprise considering the age of the seed. It was hoped that some viability remained in the seed since it had been stored in the PMCs seed storage facility for thirty years. There may be some seed that remained dormant and a reevaluation will be made in 2006.

Table 2.2 Desmodium seeding trial plant growth data, percent stand, and number of plants per accession at Manhattan, Kans.

Accession	Plant Height*	Plant Canopy*	Percent Stand	No. of Plants Evaluated	Total No. of Plants	Mean No. of Plants
9005087	44.0	20.3	7.1	7	16	5.3
9013451	0.0	0.0	0.0	0	0	0.0
9050393	55.6	65.8	16.1	7	13	4.3
9055415	52.2	18.2	2.9	3	4	1.3
9055428	46.4	24.9	11.9	13	26	8.7

*cm

The establishment of spaced plants varied among accessions as did plant growth data and stand, Table 2.3. The tallest plants occurred among the seeding trial entries where plant height ranged from 10-90 cm (4-35-in).

Table 2.3 Desmodium spaced plant growth data and percent stand at Manhattan, Kans.

Accession	Plant Height*	Plant Canopy*	Range of Plant Heights*	Percent Stand
9005087	49.1	39.0	14-63	75.0
9055415	67.0	51.8	56-77	50.0
9055428	66.6	41.6	50-83	66.7

*cm

3. Study No. 20A127K - Evaluation of PMK-1 green ash for resistance to ash borers.

Introduction: Green ash (*Fraxinus pennsylvanica* Marsh.) was widely planted in the Northern Plains as a windbreak and landscape tree. Larval damage by the lilac (ash) borer, *Podosesia syringue*, and banded ash clearwing, *Podosesia aureocincta*, have severely reduced the use of green ash especially in the more southern portion of the tree's range. Larvae bore into the young tree trunk near the soil line weakening the seedling so that they may break off in the wind. Tree borers are among the most difficult insect pests to control because the insects feed within the tree. Thus, pesticides are generally ineffective in controlling ash borers. Keeping trees healthy and growing vigorously helps to reduce or prevent borer attack.

Problem: The Manhattan PMC has germ plasm of green ash that has been tested as PMK-1 for several years. PMK-1 has not been formally tested to determine if it has ash borer resistance or if there are management methods in ash establishment that might limit or lessen ash borer damage to trees.

Objective: To test PMK-1 for borer resistance.

Procedure: Seeds of PMK-1 were pretreated and then stratified 60 days warm stratification at 20ºC followed by a 60-day prechill at 4ºC. At the end of pretreatment the seeds were placed on blotters in germination boxes and allowed to germinate in a plant growth chamber at 20º-30ºC (night/day). The seedlings were transplanted to 656-ml (40-in^3) "deep pot cells", later batches were transplanted to 164-ml (4-in^3) Ray Leach "Cone-tainers"^{TM}, and additional stratified seeds were direct seeded into cone-tainers. On September 27, 2001, 2-0 deep pot stock and cone-tainer stock were transplanted to 6 plots at the Kansas Crop Improvement Association (KCIA) headquarters in Manhattan, Kansas. The KCIA site was chosen because of a history with borer problems on green ash. The 2-tree plots consisted of 1 deep potted plant and 1 cone-tainer plant (designated A and B respectively) spaced 50- to 60-cm (19.7- to 23.6-in) apart on a Wymore silty clay loam soil. Six 2-tree plots at the PMC were divided into 2 areas. One area was a compacted, rocky, old roadbed (critical area site designated CA) and the other site was the typical Belvue sil soil on the PMC. All plantings were caged to reduce browse damage by herbivores.

Potential Products: Cultivar Release

Progress or Status: Two trees were dead by the end of the growing season on the PMC CA site where the other trees suffered through the at times dry summer. Losses at the KCIA site were due to alteration of a drainage way off of the KCIA parking lot where two plants were severely damaged in the B plots. Mechanical damage to one tree was caused by a service truck backing into it on several visits to the site. The damage was the result of reconstructing and extending the parking lot area. The data for KCIA B plots was skewed upward as a result. Good growth was noted on KCIA and PMC plants while trees on the PMC CA site continued to struggle. Measurements were taken after leaf fall due to some trees aborting leaves during the summer drought. Increases in canopy growth were still evident. A bias exists in plots 2-6 at KCIA where the benefit of runoff from the nearby office and parking lot is channeled in that direction. Three plots from the KCIA site were selected to compare with the PMC and PMC CA sites. There was a significant difference in plant height and stem caliper between the PMC CA and the KCIA and PMC sites, Table 3.1. There was also a significant difference in plant height X environment interaction across the three sites, Table 3.2. There was not a significant difference in plant height or stem caliper and size of container stock. No borer activity has been detected to date in any of the plots. With the increased growth and loss of several plants at the KCIA site, one tree will be destroyed from each plot where two trees remained in 2005. The best of the pair will be retained and observations on the remaining trees will continue.

Table 3.1 Plant growth means for PMK-1 green ash at three Manhattan, Kansas locations for plots A and B.

Location	Plot	Plant Height†	Plant Canopy†	Stem Caliper†	No. Stems	No. Stems Range	Remarks
KCIA	A	158.0 a	64.6	3.7 a	2.0	1-3	1 plant MD
	B	139.7 ab	82.4	3.4 a	2.3	1-6	2 plants destroyed
PMC CA	A	56.7 b	---	1.1 b	1.0	none	2 plants dead
	B	55.0 b	---	0.9 b	2.7	1-6	---
PMC	A	156.0 a	---	3.1 a	1.7	1-3	---
	B	135.7 ab	---	4.0 a	1.7	1-3	---

Means followed by the same lowercase letter in a column not significantly different at P<.01
†cm; * Rating (1-9 = Best – Worst); MD = Mechanical Damage

Table 3.2 Comparison of overall plant growth means by location at Manhattan, Kansas

Location	---	Plant Height†	Stem Caliper†
KCIA	---	148.8 a	3.6 a
PMC	---	145.8 a	3.6 a
PMC CA	---	55.8 b	1.0 b

Means followed by the same lowercase letter in a column not significantly different at P<.01
†cm; * Rating (1-9 = Best – Worst)

Literature Cited:

Association of Official Seed Analysts. 1999. Rules for Testing Seeds. 126p.

Young, J.A. and C.G. Young. 1992. Seeds of Woody Plants in North America. Dioscorides Press. Portland, Oreg. 407p.

4. Study 20A215H: Evaluation of little bluestem.

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, side-oats 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 variety 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) germ plasm and select a superior little bluestem variety for the Kansas/Nebraska Service Area.

Procedure: Flats of little bluestem were planted in the greenhouse in spring 1992. Seedlings were selected at the two-to-three leaf stage and transplanted to cone-tainers 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 approximately six weeks later.

Evaluation Factors: 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 two to three years with 10-to-20 percent 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: Seed was collected from plots this year.

B. Cultural Evaluations and Special Studies

1. Study No. 20C006G - Evaluation of perennial cool-season forage grasses.

Introduction: Little information is available regarding the establishment, persistence, and management of adapted cool-season perennial grasses for use in MLRAs 72, 77, and 78. The use of adapted cool-season grasses can provide a livestock producer an option for lengthening the green grazing period. This study is being conducted in cooperation with Kansas State University's Agronomy Department.

Problem: The need exists to evaluate the adaptability and performance of cool-season perennial grass forage species for potential use in grazing strategies.

Objective: Evaluate various native and introduced cool-season perennial grasses for site adaptation and performance.

Procedure: Eleven different varieties of cool-season grasses (Table 1.1) were seeded in a randomized complete block design at three sites in Kansas: Clark, Phillips, and Wallace Counties. Plots 1.5- x 6-m (5 x 20-ft), consisting of five rows spaced 0.3-m (1-ft) apart, were planted with a Kincaid Cone Planter. Each variety was replicated 4X.

Table 1.1 Cool-season grass varieties in trials at three Kansas locations.

Variety	Common Name	Species
'Hycrest'	crested wheatgrass	*Agropyron cristatum*
VNS	smooth bromegrass	*Bromus inermis*
'Jose'	tall wheatgrass	*Thinopyrum ponticum*
'Rush'	intermediate wheatgrass	*Elytrigia intermedia*
'Reliant'	intermediate wheatgrass	*Elytrigia intermedia*
'Slate'	intermediate wheatgrass	*Elytrigia intermedia*
'Barton'	western wheatgrass	*Pascopyrum smithii*
'Mankota'	Russian wild rye	*Psathyrostachys juncea*
'Bozoisky-Select'	Russian wild rye	*Psathyrostachys juncea*
'Manska'	pubescent intermediate wheatgrass	*Thinopyrum intermedium*
'Luna'	pubescent wheatgrass	*Thinopyrum intermedium*

VNS=Variety Not Stated

Potential Products: Technology Transfer and Revision of FOTG

Evaluation Factors: All varieties will be evaluated for establishment, persistence, forage quantity, and quality.

Progress or Status: Site visit, no evaluations were conducted this year.

2. Study No. 20C007Ta - Propagation of Mead's milkweed.

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 cone-tainers 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 two additional field scenarios: Red Group and Yellow Group on the "Salac Prairie" on the PMC, 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. 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. The Salac Prairie evolved from a grass-forb seeding mixture study involving various species native to the central Great Plains Region. 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 variety 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, Illinois bundleflower and round-head lespedeza.

Problem: The need exists to learn more about propagation requirements and establishment techniques. 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. Obtain or collect seeds from other plant populations in eastern Kansas to compare performance with the RNP collections.

Procedure: A protocol was developed based on previous findings in this study to test additional seeds collected in 2003 on the RNP by Galen Pittman and the Goetz property by Jackie Goetz. Refer to the 2004 Annual Technical Report for details about the procedures that were used. In 2004, germination trials were conducted using stratified seed and various planting media and containers. Germination Trial 2 (GT-2) was continued in 2005 to determine effects of carrying over the plants in the containers for a second growing season.

Germination Trial 2: Direct seeding to containerized planting options.

Surface sterilized seeds collected from White Group plants were planted to 32-in^3 plant bands or 164-ml cone-tainers containing PRO-MIX 'BX' growing medium or a commercial source of top soil per Schedule 1-GT-2 and placed in the PMC's plant cooler for 6 to 8 weeks stratification depending on conditions in the cooler.

Schedule 1-GT-2. Containers with growing medium.

Start Date	Date Out	Patch	Weeks Stratification	No. Seeds	Medium/ Container
Feb 5	Apr 1	PMC	6-8	36	PRO-MIX 'BX' in plant bands
Feb 5	Apr 1	PMC	6-8	35	PRO-MIX 'BX' in cone-tainers
Feb 5	Apr 1	PMC	6-8	35	Commercial top soil in cone-tainers

One hundred and eight seeds were sterilized as previously described and placed in a plastic germination box and stratified for 6 weeks in the laboratory cooler. Direct seed the stratified seeds to 50- x-150-mm (13- x-38-in) peat pellets and cone-tainers and place them in the greenhouse per Schedule 2-GT-2.

Schedule 2-GT-2. Peat pellets and Cone-tainers.

Peat pellets.

Start Date	Date Out	Patch	Weeks Stratification	Seeds Per Rep	Reps	No. Seeds
Feb 4	Mar 17	PMC	6	32	2	64

Cone-tainers

Start Date	Date Out	Patch	Weeks Stratification	Seeds Per Rep	Reps	No. Seeds
Feb 4	Mar 17	PMC	6	22	2	44

Progress or Status: Established Field Plantings**.** A series of late freezes resulted in a rough start for plants this year. A check May 26 revealed that many plants froze back to the ground. In most cases a new shoot replaced the dead one. Flowering was greatly reduced with two plants flowering in the monoculture and one in the BG-TG mixed prairie. No pods were produced. The stand declined from the previous year in all but the Yellow Group and Red Group plants, Table 2.1.

Table 2.1 Spring recovery and percent stand of established plants by group.

Group	Established Plants	Spring Recovery	Percent Stand	Percent Change
Yellow	7	3	42.9	-28.5
Red	16	7	43.8	-37.5
White[1]	11	6	54.5	0
BG-TG	7	7	100	0
Prairie[2] (all)	30	17	56.7	-23.3

Monoculture[1]; Prairie[2] - Yellow, Red, BG-TG Groups;

Containerized Stock. Direct seeding into peat pellets was more successful than for any combination of soil mix and container stock, Table 2.2. A total of 17 seeds were germinated on peat pellets. There was a notable difference in plant growth among the various container and growth medium combinations, Table 2.3. The seedlings grown in peat pellets produced the most vigorous plants the first year. In the 2nd year the benefits of using peat pellets was apparent. Plants grown in peat pellets exceeded all container grown plants for all parameters measured, Table 2.4.

Table 2.2 Germination results of direct seeding of Mead's milkweed to various plant growth media.

Group	Container	Medium	Stratification Method	Planting Date	No. Seeds Sown	% Germ
A	none	Peat Pellet	Pre-stratified	3/18/04	32	10
B	none	Peat Pellet	Pre-stratified		31	7
C	Large Cone	Commercial Topsoil	Pre-stratified	3/17/04	22	7
D	Large Cone	PRO-MIX 'BX'	Direct in soil		18	3
E	Large Cone	Commercial Topsoil	Pre-stratified	4/01/04	22	3
F	Large Cone	PRO-MIX 'BX'	Direct in soil	4/01/04	18	2
G	Large Cone	Commercial Topsoil	Direct in soil	4/01/04	38	2
H	Plant Band	PRO-MIX 'BX'	Direct in soil	4/01/04	35	4

Table 2.3 Results of direct seeding of Mead's milkweed to various plant growth media and plant growth comparison, May 5, 2004.

Group	Container	Medium	Planting Date	No. Plants Sampled	Plant Length Length (mm)	Plant Length Range (mm)	Leaf Length (mm)	Leaf Width (mm)	Remarks
A	none	Peat Pellet	3/18/04	10	96.9	62-170	27.6	2.0	
B	none	Peat Pellet		7	57.4	31-116	20.3	1.5	
C	Large Cone	Commercial Topsoil	3/17/04	7	93.4	63-123	20.1	1.7	1 with 3 stems
D	Large Cone	PRO-MIX 'BX'		3	117.0	113-121	26.7	1.7	
E	Large Cone	Commercial Topsoil	4/01/04	3	87.0	12-120	32.6	1.5	
F	Large Cone	PRO-MIX 'BX'	4/01/04	2	100.0	87-113	23.0	1.5	
G	Large Cone	Commercial Topsoil	4/01/04	2	81.0	60-102	25.0	1.5	
H	Plant Band	PRO-MIX 'BX'	4/01/04	4	90.7	85-96	27.0	1.7	
I	Small Cone	PRO-MIX 'BX'		10	99.4	66-150	15.6	2.0	transplants
Overall Means				48	91.4	---	24.2	1.7	

Table 2.4 Mead's milkweed plant growth comparison for different types of media and containers.

Group	Container	Medium	Planting Date	No. Plants Sampled	Plant Length (mm)	No. Leaves	Leaf Length (mm)	Leaf Width (mm)	Stem Caliper (mm)
A	none	Peat Pellet	3/18/04	6	206.3	14.3	54.5	5.3	1.44
C	Large Cone	Commercial Topsoil	3/17/04	5	162.2	11.4	42.2	3.6	1.20
E	Large Cone	Commercial Topsoil	4/01/04	3	134.7	13.7	47.0	4.0	0.90
F	Large Cone	PRO-MIX 'BX'	4/01/04	1	139.0	12	41.0	3.0	0.78
G	Large Cone	Commercial Topsoil	4/01/04	2	178.5	10.5	33.3	2.3	0.98
H	Plant Band	PRO-MIX 'BX'	4/01/04	5	123.4	12.6	31.8	2.1	0.75
Overall Means				22	157.4	12.4	41.6	3.4	1.01

TS=topsoil; LC=large cones; PB=plants bands

Literature Cited:

Betz, Robert F. 1989. Ecology of Mead's milkweed (*Asclepias meadii* Torrey). Proc. Eleventh North Amer. Prairie Conf. T.B. Bragg & J. Stubbendieck, eds. Univ. of Nebr. At Lincoln. p. 187-191.

3. Study No. 20C009J - Conservation Reserve Program seeding enhancement study.

Introduction: Conservation Reserve Program (CRP) lands may be eligible for re-enrollment depending on a number of environmental factors. One environmental factor that will increase the number of quality points awarded to each CRP offer is the agreement for interseeding of broadleaf species (native and introduced forbs and legumes) into established stands. The purpose of the interseeding or enhancement is to provide greater wildlife benefits from the standpoint of improved plant species diversity. Little information is currently available regarding the best methods for successful enhancement seedings. This study is being conducted in cooperation with Kansas State University.

Purpose: Evaluate the effectiveness of preplant treatments and planting methods on the establishment of native and introduced forb and legume species into existing CRP stands of native grass.

Procedure: All plantings were established at the Southwest Kansas Research Extension Center at Tribune, Kansas, where the average annual precipitation is 16 inches. The site is located in MLRA 72 where the soils are predominately silt loam and are classified as a Keith-Richfield-Ulysses Complex. The experiment layout was a randomized complete block design. Forty-eight plots were established consisting of three replications of 16 different preplant treatments/planting methods combinations. Plot size was 12.2- x 30.5-m (40- x 100-ft). Preplant treatments consisted of mowing, tillage, burning, chemical spraying, and no treatment to serve as the control. The plots were seeded by drilling and by broadcasting at two different time periods, spring and fall (Table 3.1).

Table 3.1 Treatments and application dates for Conservation Reserve Program seeding enhancement study, Tribune, Kansas.

	Application by Date
Treatments	November 1997
1	No preplant treatment, no filler, drill at 2X rate
2	No preplant treatment, drill
3	No preplant treatment, drill, fertilizer added
4	Mow, drill
5	2 shallow passes with off-set disk, drill
6	1 shallow pass with off-set disk, broadcast
	January 1998
7	No preplant treatment, drill
	March 1998
8	No preplant treatment, drill
9	Mow, drill
10	2 shallow passes with off-set disk, drill
11	1 shallow pass with off-set disk, broadcast
12	Burn, drill
13	Burn, broadcast
	August 1998
14	Chemical suppression, drill September 1998
15	Chemical suppression, drill March 1999
	September 1998
16	No preplant treatment, drill

One-half of each plot was seeded to introduced legume species and one-half to native forb/legume species. Introduced legumes included in the seeding were alfalfa (*Medicago sativa*) and sweet clover (*Melilotus officinalis*). Native species seeded included Maximilian sunflower (*Helianthus maximiliani*), purple prairie clover (*Dalea purpurea*), black-eyed susan (*Rudbeckia hirta*), and Illinois bundleflower (*Desmanthus illinoensis*). The seeding rate of the alfalfa-sweet clover mix, and the native mix was 330 g PLS/ha (1.8 lbs. PLS/ac). Vermiculite was added as filler at the rate of 1.36-kg (3-lbs.) vermiculite to 454 g (1-lbs.) of seed. This was added to the seed mix on all treatments except No. 1.

Evaluation Factors: Plots will be evaluated for species germination and establishment during 1998 - 2000.

Potential Products: Technology Transfer and revision of FOTG

Progress or Status: Site visit, no evaluations were conducted this year.

4. Study No. KSPMS-T-0001-CR – Conservation Field Trial: Revegetation of an exposed blue shale outcrop site in Jewell County, Kansas.

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 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 2000 common reed sprigs were planted on April 18, 2000. The sprigs were hand planted within select reaches of the primary drainageways within the study area. Planting was restricted to those areas within the study area that appeared to have the greatest potential for supplemental moisture.

Potential Product: Technology Transfer

Evaluation Factors: The plantings will be monitored for establishment, survival, and spread. Evaluations will continue through 2010.

Progress or Status: No evaluations were conducted this year.

Literature Cited:

Schaller, F.W. and P. Sutton, 1978. Reclamation of Drastically Disturbed lands.

Soil Survey for Jewell County, Kansas. Published USDA Soil Conservation Service, 1981.

5. Study No. KSPMC-T0501-RA – Longevity of native warm-season grass seed: storage viability vs. seedling vigor/stand establishment.

Introduction: Native warm-season grass seeds can remain viable for long periods of time under certain storage conditions. Buffalo grass seeds found in the 25 year old sod of a sod house in western Kansas were still germinable. The Manhattan PMC built a seed storage facility in 1973 where temperature and humidity levels are controlled. This has enabled the PMC to store carry-over seed lots for extended periods of time. Controlled storage is necessary in cultivar development and to meet the fluctuating needs for foundation seed by the seed industry. Periodic seed tests have indicated good viability under standardized temperature and moisture conditions. Although seedling vigor has been questioned, it has not been investigated. Growers have questioned their ability to obtain a stand with carry over seed.

Objective: Plant seed of warm-season grass species from multiple harvest years in comparison trials to test their stand establishment ability.

Procedure: Draw samples of seed lots stored at Manhattan PMC to retest their germinability in the seed lab. Plant seeds (30 PLS/ft) in a 3-m (10-ft.) row, 1 row per plot with 3 replications at 2 locations using a Kinkaid Cone Planter with 2.5-cm depth bands. Evaluate for stand and maintain for two growing seasons. Management: fertilizer – none; irrigation – none; weed control – preemergent and postemergent herbicides, and mowing may be used.

Evaluating factors: Stand

Potential Products: Technology Transfer

Progress: Seeds from 4 native, warm-season grass varieties from 3 crop years (Table 5.1) were planted according to the procedure described earlier. An additional crop year of 'Garden' sand bluestem was planted on the PMC, including a 1988 lot of hulled Garden. The PMC planting was made on May 26, 2005, in Field B-3, on a Belvue silt loam soil (0-1 percent slope), and on the North Agronomy Farm (NAF), Kansas State University, Manhattan, Kansas, on June 1, 2005, on a Wymore silty clay loam soil (1-3 percent slope).

Table 5.1 Grass variety information for the 2005 warm-season grass trial at Manhattan PMC and the North Agronomy Farm.

Accession	Variety	Species	Common Name	Crop Years
421276	Kaw	*Andropogon gerardii*	Big bluestem	1990, 1997, 2004
421277	Garden	*Andropogon hallii*	Sand bluestem	1973, 1988*, 1993, 2004
421553	Aldous	*Schizachyrium scoparium*	Little bluestem	1973, 1990, 2003
421594	Osage	*Sorghastrum nutans*	Indian grass	1970, 1989, 2004

* Not planted on the North Agromomy Farm

Table 5.2 Seed analysis information for crop years under test in 2005 trials.

Cultivar	Crop Year	Purity	Percent Standard Germination	Percent Dormant Seed	Percent Pure Live Seed	Test Date	Estimated Seeds Per Foot of Row
Aldous	1973	85.06	66	1	56.99		52.6
Aldous	1990	96.94	79	4	80.46		37.3
Aldous	2003	76.27	34	3	28.22		106.3
Garden	1973	96.39	46	2	46.27		64.8
Garden	1988 NC				77.00		38.9
Garden	1988	88.19	76	1	67.91		44.2
Garden	1993	69.00	67	1	46.92		63.9
Garden	2004	89.52	72	1	65.35		45.9
Kaw	1990	96.40	89	1	86.76		34.6
Kaw	1997	96.37	77	3	77.10		38.9
Kaw	2004	88.16	76	1	67.88		44.2
Osage	1970	92.57	49	12	56.47		53.1
Osage	1989	93.73	57	7	59.99		50.0
Osage	2004	98.25	86	4	88.43		33.9

NC-naked caryopsis

Garden was superior in stand establishment of any of the four warm season grass species under test at the PMC. Garden took the top five spots followed by 'Kaw' big bluestem, which took the next three places. There was no significant difference in stand among any of the Garden seed lots. However, the stand of the 2004 crop was slightly better than the 1988 crop. There was not a significant difference between the 1988 crop and the 1988 NC seed. Stand was determined by the line transect method.

The NAF farm planting was planted on the contour in rows spaced 10 ft apart. A heavy rain following the planting washed over the lower two rows where little or no seedlings emerged. There was too little data to be able to run a statistical analysis. The best results were with the 2004 and 1993 crop years of Garden followed by the 1973 crop of Aldous little bluestem. The 2004 crop of Garden performed the best at both locations. Osage Indian grass failed in all three replications on the NAF.

Table 5.2 Carryover vs. current years seed. Mean percent stand for four warm-season varieties at Manhattan PMC.

Variety	Crop Year	Percent Stand[1]	P<0.05	P<0.01
Garden	2004	62.5	A	A
Garden-NC	1988	61.8	A	A
Garden	1988	60.4	A	A
Garden	1973	56.3	AB	AB
Garden	1993	50.0	ABC	ABC
Kaw	1997	41.0	ABCD	ABCD
Kaw	2004	39.6	BCDE	ABCD
Kaw	1990	35.4	CDE	ABCD
Aldous	2003	34.7	CDE	ABCD
Osage	2004	33.3	CDE	ABCD
Osage	1989	29.2	DE	BCD
Aldous	1990	26.4	DE	CD
Aldous	1973	24.3	E	CD
Osage	1970	23.6	E	D

[1]Means in a column followed by the same letter are not significantly different. NC – naked caryopsis

The number of individuals plus canopy (weighting of 2) was used to calculate percent stand.

Table 5.3 Stand data for carryover vs. current years seed at the North Agronomy Farm, Manhattan, Kans.

Variety	Crop Year	Percent Stand	No. for Mean	Single Measurement*	Range
Garden	2004	55.2	2	---	52.1-58.3
Garden	1993	54.2	2	---	50.0-58.3
Garden	1988	0	---	---	---
Kaw	2004	*	---	60.4	---
Kaw	1997	30.2	2	---	10.4-50.0
Kaw	1990	*	---	14.6	---
Aldous	2003	27.8	3	---	10.4-37.5
Aldous	1990	*	---	33.3	---
Aldous	1973	42.7	2	---	---
Osage	2004	0	---	---	---
Osage	1989	0	---	---	---
Osage	1970	0	---	---	---

*Single Measurement

C. Initial Evaluations

1. Study No. 20I003L – Evaluation of miscellaneous grasses.

Introduction: This study serves as a clearing house for the evaluation of miscellaneous collections of grasses received by the PMC that 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 6.1-m (20-ft) rod row with a spacing of 2.2-m (6-ft) between rows, except where noted. A standard of comparison may also be planted.

Evaluating factors: Plant vigor, stand, seed production, growth factors, and resistance to disease, drought, and cold.

Potential Products: Cultivar Release and Technology Transfer

Progress or Status: Big bluestem (*Andropogan gerardii Vitman*), prairie sandreed, [*Calamovilfa longifolia* (Hook.) Scribn.], sweetgrass, [*Hierochloë odorata* (L.) Beauv.], and northern sweetgrass, [*Hierochloë odorata* (Schrank) Borbás spp. *artica* (J. Presl) G. Weim.], are species currently under test in this study.

Big bluestem: Twelve plants of accession 9057029 were planted one foot apart in a rod row in Field B-3 at Manhattan PMC at the request of the Booneville Plant Materials Center, Booneville, Arkansas.

Prairie sandreed: The plant materials specialist for Michigan requested that the Manhattan PMC participate in an inter-center strain trial to test the adaptation of a selection of prairie sandreed to our local climate. The Rose Lake PMC at East Lansing, Michigan provided both plants and seed for the trial. Twelve plants of accession 9086408 were planted one foot apart in a rod row in Field B-3 at Manhattan.

Sweetgrass Intercenter Strain Trial: Sweetgrass is a culturally significant plant to the American Indians with potential as a conservation plant and a plant community species for restorations. Five plant materials centers have been working with various strains of sweetgrass, Upper Colorado Environmental Plant Center, Meeker, Colorado; Manhattan Plant Materials Center, Manhattan, Kansas; Bridger Plant Materials Center, Bridger, Montana; Roselake Plant Materials Center, East Lansing, Michigan; and Bismarck Plant Materials Center, Bismarck, North Dakota. In 2002, each Center shared some of its material with the other Centers to establish a comparison trial of the different strains of material. 'Radora', a release from South Dakota State University, was planted as a standard of comparison.

Ten plants of each line were spaced 0.7-m (2-ft) apart in rod rows in Field B-1 on a Belvue sil soil, June 2002, Table 1.1. Establishment was difficult due to hot dry weather at the time the plants were received. Establishment was also hampered by local herbivore activity. Radora was received late and did not establish. In 2003, replacement plants where available, were planted to fill in the missing spaces. An increase in seed production was noted from previous years. The number of seed culms increased 16 fold for accession 9050243 from the previous year. Accession 9070255 had the best stand on June 1, Table 1.2.

Table 1.1 Sweetgrass Intercenter Strain Trial Plot Layout.

Plot	Source	Species
Border	KSPMC	*Hierochloë odorata*
9063128	NDPMC	*Hierochloë odorata*
9050243	KSPMC	*Hierochloë odorata*
9070988	COEPC	*Hierochloë hirta*
9063351	MTPMC	*Hierochloë odorata*
9070255	MIPMC	*Hierochloë hirta*
Radora	SDSU	*Hierochloë odorata*
Border	KSPMC	*Hierochloë odorata*

North ►

Table 1.2 Percent stand and number of seed culms for six *Hierochloë* lines at Manhattan, Kans.

Accession	% Stand	No. of Seed Culms
9063128	10.0	0
9050243	25.0	16
9070988	38.3	0
9063351	20.0	3
9070255	46.7	7
Radora	0	---

* Rating (1-9 = Best – Worst)

2. Study No. 20I010K - Evaluation of trees and shrubs.

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 PMC and interested parties in the Central Great Plains Region. These include: Kansas State University-Department of Horticulture and Forestry, the USDA-Agricultural Research Service (ARS) Plant Introduction System NC-7 Trials, and the State and Extension Foresters and 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 multipurpose use in the High Plains region and provide multiple wildlife benefits throughout the four-state area.

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 bare root stock is spaced 16 ft apart in rows spaced 16 ft apart. Drip irrigation is used to aid in establishment which may be needed for several years. In the miscellaneous woody tables, number planted (No. PLT) has been changed to number established (No. EST). The initial number of woody plants planted in a given plot is shown in parentheses where the number disagrees with the number established. This change results from the belief that a tree or shrub planted in a given year that does not recover the following spring did not establish. 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, predation, etc. 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. 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 change brings changes to the data in terms of survival ratings that were reported previously. In cases where it is clear that herbicides killed the plant, the survival rate is adjusted to compensate for such an intervention. This nursery is located primarily on a Belvue silt loam soil in fields F and G.

Potential Products: Information Technology and Cultivar Release

Progress or Status: The assembly consists of 126 accessions representing 86 species in 47 genera, of which 22 are named cultivars. Over 39 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:

Wyoming Horticulture Station at Cheyenne, Wyoming; Southern Plains Research Station, Woodward, Oklahoma; and the North Central Regional Plant Introduction Station, Ames, Iowa.

Forty-nine accessions were evaluated this year. There was one new acquisition this year, Arizona cypress, *Cupressus arizonica*. Three accessions were removed, refer to Appendix Table 1.2 for further information.

Drought and wildlife pressures continue to impact the success of newly established woody entries in this study. Browsing and rubbing by deer has increased steadily over the past 7 to 8 years requiring year-round fencing of new plantings. Such fencing poses problems for plot maintenance.

Evaluation data are presented in Appendix Tables 1.3A, 1.3B, and 1.3C. Refer to Appendix Table 1.1, List of Miscellaneous Trees and Shrubs for further information regarding plot designations. Plot locations can be found in Plot Maps, refer to Appendix Figures 1.1 and 1.2, an x designates location of an existing plant in the plot. Plants removed at the end of the evaluation period are listed in Appendix Table 1.2.

3. Study No. 20I026K - Evaluation of hackberry.

Introduction: Common hackberry (*Celtis occidentalis* L.) is a small-to-medium tree 9.1 to 15.2-m (30- to 50-ft) tall and 0.5 to 0.6-m (18 to 24-in) in diameter varying greatly in response to habitat. Potentially the species may attain heights upwards of 30.5 to 39.6-m (100 to 130-ft) and trunk diameters up to 1.2-m (4-ft). The crown is normally rounded and composed of large spreading branches. Hackberry is drought resistant and has survived extremely dry periods on the Great Plains. It is a long-lived species, believed to live 150 to 200 years (USDA Forest Service 1965; Rehder 1940).

A native to North America, common hackberry is commonly found throughout the eastern three-quarters of the Great Plains and stretching on east to the east coast. Hackberry grows on rich, moist soils along stream banks, on flood plains, and on rocky hillsides in open woodlands. In western Nebraska, hackberry grows on the north side of sand dunes and in river valleys.

Problem: There are no reliable seed sources for common hackberry cultivars adapted to western Nebraska and western Kansas. Existing nursery stock is very 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.

On-PMC evaluations of plant materials for western Nebraska and western Kansas have proven to be unsatisfactory. Extreme differences in climate make initial evaluation at Manhattan unreliable and insufficient. For this reason, initial evaluations are being conducted where the species is needed.

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

Procedure: The original assembly consisted of 43 accessions. The seed was planted in a seedling nursery in the fall of 1979. Seedlings 0.3-m (1-ft) tall were lifted in the fall of 1980 and placed in cold storage. An initial evaluation planting (IEP) at the Manhattan PMC and field evaluation plantings (FEP) at the Tribune Experiment Station and Sheridan Wildlife Area near Quinter, Kansas, were made in the spring of 1981. A field planting was made at Valentine, Nebraska. The only successful plantings were the Manhattan IEP and the Tribune FEP. The Manhattan IEP consists of one to six plants per plot in a non-replicated randomized planting; refer to Appendix Figures 2.1 and 2.2 for plot locations. The Tribune FEP was established in a completely randomized design, three plants/plot and three replications. The spacing between plants was 4.6- x 5.5-m (15- x 18-ft).

Potential Products: Cultivar Release

Progress or Status: Twenty-five year growth measurements were taken this year at Manhattan. The tallest tree was in accession 9013434, Tulsa Co., Oklahoma, with a height of 1725 cm and a DBH of 51.8 cm. The shortest tree was from accession 9013439, Harmon Co., Oklahoma, with a plant height of 611 cm and a DBH of 10.41 cm. Means for plant height ranged from 748.3 – 1446.3 cm and DBH ranged from 16.5 to 37.8 cm. Individual trees ranged in height from 611 to 1725 cm and DBH's ran from 9.4 – 58.7 cm. Refer to Appendix Tables 2.1A and 2.1B, for a complete list of entries and plant growth data on individual accessions.

Literature Cited:

Rehder, A. Manual of Cultivated Trees and Shrubs. The Macmillan Company, New York, 1940, 996 p.

USDA Forest Service. Silvics of Forest Trees of the United States. Agric. Handbook No. 271. Compiled and revised by H. A. Fowells. Washington, D.C., 1965.

4. Study No. 20I031K - Evaluation of Oriental arborvitae.

Introduction: Oriental arborvitae [*Platycladus orientalis* (L.) Franco] is a medium-sized tree reaching heights of 9 to 11-m (30 to 36-ft) at maturity. Growth habit is normally pyramidal or bushy. Many cultivars exhibiting unique characteristics of growth form and color have been selected for landscape use.

Oriental arborvitae is native to Asia occurring in northern and western China and Korea. It is an aromatic evergreen with scale-like appearance. Male and female flowers are borne on the same tree but usually on separate twigs or branches. Flower buds form in the fall and develop into small cones, 1.1 to 2.5-cm (0.4 to 1-in) long with 6 to 8 scales per cone. The cones mature the following spring. *Platycladus orientalis* is easily distinguished from a similar species native to the U.S.; eastern white cedar (*Thuja occidentalis* L.) which has a vertical disposition of leaf sprays, thick cone scales, and wingless seed.

Oriental arborvitae is adapted to a wide range of soil types and excellent survival can generally be expected from the use of bare-root stock.

Problem: Eastern red cedar (*Juniperus virginiana* L.) and Rocky Mountain juniper (*J. scopulorum* Sarg.) are two commonly planted evergreens in the Western Great Plains which serve as alternate hosts for cedar apple rust. In addition, eastern red cedar is often considered a weed pest in poorly managed pasture and rangeland. Evergreen species that do not pose a threat to fruit orchards or occur as a weed pest are needed for use in field and farmstead windbreaks. Diversity within windbreak plantings is desirable to ensure continued function with outbreaks of specific disease and insect pests. Oriental arborvitae offers a potential alternative evergreen for use in place of or in addition to eastern red cedar or Rocky Mountain juniper.

No adapted cultivars of oriental arborvitae are available for use in Major Land Resource Areas (MLRAs) 64, 65, 67, 71-73, and 77-80 in western Nebraska and Kansas. Oriental arborvitae is available through the Oklahoma State Forestry Nursery, but this material is unproven over a large portion of the total area for which the species could be adapted. A tested and proven cultivar of oriental arborvitae is needed to provide consistent high quality plant material for farmstead and field windbreak plantings in the Great Plains.

On-PMC evaluation of plant materials for the Western Great Plains area has proven to be unsatisfactory. Evaluation of plant materials at Manhattan cannot adequately test for extremes of climate encountered in the High Plains of western Kansas, Nebraska, and Oklahoma. For this reason, initial evaluation will need to be conducted off-Center in areas for which the plant material is intended for eventual use.

Objectives: Select a superior accession or accessions of oriental arborvitae for use in windbreak and wildlife plantings in western Kansas, Nebraska, and Oklahoma.

Initial evaluation must be conducted off-Center in MLRAs for which the plant has been selected. Planting, evaluation, and plot maintenance should be conducted in a precise and controlled manner as outlined by the study plan.

Procedure: Fifty-five accessions were assembled from seed collections in Kansas, Nebraska, Oklahoma, and 27 foreign countries. Insufficient seedling numbers caused by low germination narrowed the field to 35 accessions to be evaluated. Accessions (N) were planted at the Manhattan PMC (35); Southern Plains Range Research Station (18), Woodward, Oklahoma; Mead (16), Nebraska; Alliance (22), Nebraska; Sheridan Wildlife Area (26), Quinter (26), Kansas; and Knox City (15), Texas, PMC. All plantings were made in 1983, using 2-0 stock in a randomized complete block design. With the exception of the Manhattan PMC and Knox City PMC, plantings contained 3 replications with 3 trees per plot on a 3- x 4.6-m (10- x 15-ft) spacing. The Manhattan and Knox City plantings were non-replicated plots consisting of 6 trees per plot and 5 trees per plot, respectively. Refer to Appendix Figure 3.1 for plot locations at Manhattan.

Evaluation Factors: Factors for evaluation include survival, rate of growth, vigor, plant size, uniformity, foliage density, and stress due to climatic factors, insects, and disease. Special attention will be given to winter hardiness in northern plantings.

Potential Products: Cultivar Release

Progress or Status: It is desirable to archive some seed of each tree before it is removed from the plantation. Seed was collected from each individual tree that produced seed again this year at Manhattan. The amount of fruit was rated for each tree before collecting cones. A representative sample of cones was collected from each tree. The collection process began once cones had begun to open exposing the mature seeds. Collecting continued until enough cones were collected from each tree to fill up to a 11.5- x 12-cm (4.5- x 5-in) cloth bag. The cones were dried down and placed in the seed storage building until the collections can be processed. One more year of seed collecting is planned.

Literature Cited:

Schopmeyer, C. S., Technical Coordinator, 1974. Seeds of Woody Plant in the United States. Agriculture Handbook No. 450. USDA Forest Service, Washington, D.C. 883 p.

5. Study No. 20I037K - Evaluation of selected common hackberry.

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 four 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 nine 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 very 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 accession 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 PMC, 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 sil soil, March 21, 1988, in Field D-1 at the PMC.

Evaluating Factors: Plant vigor; growth rate and uniformity; and 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:

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.

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

6. Study No. 20I038K - Bur oak seed source study.

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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-ft). 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.

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 region.

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 germ plasm 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 PMC 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, two local collections were included in the study at Manhattan, 'Lippert', accession 9004392 and accession 9050065. Accession 9050065, a collection that was made on the Center, was also entered in the GP13 assembly for planting out at other trial sites. Acorns were planted in a soil-less mix in 102 cm^3 (40 in^3) deep pots in the spring of 1991. The "cone-tainers" were placed in the greenhouse for grow out. Only enough trees from 16 accessions were available for the planting. The plot layout consisted of five replications with two 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 June 14. There were enough seedlings to establish a 68.6- x 91.4-m (225- x 300-ft) field plot consisting of 26 accessions, Appendix Figure 4.1. 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*), accession 9050077or by green ash, (*Fraxinus pennsylvania*), accession 9050087, to provide adequate competition for the remaining trees. A complete list of sources established at Manhattan is listed in Table 6.1.

Potential Products: Cultivar Release

Progress or Status: Thirteen-year plant growth data was collected this year. Measurements of all accessions are listed in Table 6.1. Overall survival was 89.6 percent with a range of 70 to 100 percent for all sources. Growth measurements consisted of plant height and DBH. The mean height for all sources was 603.1 cm and DBH was 13.7 cm. Source differences were significant at the $P < 0.0001$ level for both height and DBH [PROC GLM by Statistical Analysis System (SAS), SAS Institute, 2002]. The range of growth measurements for 235 trees was 206 – 821 cm for height and 3.0 – 18.0 cm for DBH. The three best sources came from Missouri and the three worst sources came from the northern limits of the sample range, North Dakota, Minnesota, and Iowa. Accession 9050170, a Lafayette Co., Missouri source, had the greatest mean height of 749.4 and accession 9050169, Platte Co., Missouri, had the greatest mean DBH of 18.0 cm. The tallest individual tree from accession 9050170, Lafayette Co., Missouri, measured 821 cm and the tree with the greatest DBH was from accession 9050168, Holt Co., Missouri, with a DBH of 27.9 cm.

Table 6.1 Means for bur oak accessions planted at Manhattan PMC, Manhattan, Kansas.

Source ID	County	State	Accession Number	Percent Survival	Height (cm)	DBH (cm)
122	Bottineau	N. Dak.	9050153	90	430.1 h	8.7 ghi
125	Shelby	Iowa	9050154	90	441.7 h	8.4 hi
132	Pennington	Minn.	9050155	80	422.5 h	6.7 I
137	Allamakee	Iowa	9050156	90	582.3 efg	11.6 fgh
225	Doniphan	Kans.	9050157	100	636.8 cdef	14.1 bcdef
241	Thayer	Nebr.	9050164	100	590.2 efg	12.5 def
245	Gage	Nebr.	9050158	100	587.8 efg	14.0 bcdef
246	Jefferson	Nebr.	9050163	100	581.4 fg	13.9 bcdef
249	Douglas	Nebr.	9050169	80	578.6 fg	12.7 cdef
253	Nance	Nebr.	9050160	100	572.9 fg	11.7 efg
262	Dickinson	Kans.	9050159	90	658.4 bcdef	16.1 abcd
265	Johnson	Nebr.	9050161	100	528.0 g	10.8 fgh
267	Richardson	Nebr.	9050162	100	657.2 bcdef	15.8 abcd
269	Nemaha	Kans.	9050165	100	589.8 efg	12.7 cdef
271	Miami	Kans.	9050166	100	682.0 abcd	15.8 abcd
274	Harvey	Kans.	9050167	80	605.1 defg	15.2 abcde
275	Riley	Kans.	9050065	80	640.5 bcdef	15.4 abcd
501	Holt	Mo.	9050168	100	578.0 fg	12.6 cdef
510	Platte	Mo.	9050169	80	725.4 ab	18.0 a
520	Lafayette	Mo.	9050170	100	749.4 a	17.4 ab
521	Howard	Mo.	9050171	90	693.4 abc	16.2 abc
523	Cherokee	Okla.	9050172	70	670.1 abcde	15.9 abcd
554	Creek	Okla.	9050173	90	587.6 efg	15.4 abcd
556	Sequoyah	Okla.	9050174	100	640.5 bcdef	15.5 abcd
567	Woodward	Okla.	9050175	90	690.0 abcd	15.9 abcd
KSPMC	Payne	Okla.	9004392	100	537.4 g	12.7 cdef
C.V. %					**13.0**	**23.2**

Values followed by the same letter in each column are significantly different at P<0.0001

Literature Cited:

Dickie, S. G. and W. T. Bagley 1980. Variability of *Quercus macrocarpa* Michx. in an eastern Nebraska provenance study. Silvae Genet. 29(5/6):171-176.

SAS Institute. 2002. Release 9.1 Ed. SAS Institute Inc., Cary, NC.

7. Study No. 20I039E - Evaluation of switchgrass germ plasm for rhizomatous characteristics.

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. Their studies indicated that a significant proportion of the total variation is due to genetic differences.

Objective: Use recurrent selection techniques to develop a highly rhizomatous switchgrass selection from sources of germ plasm suspected to be rhizomatous in nature.

Procedure: Seed from two sources (9049968, Roger Mills Co., Oklahoma, and 422003 (PMT-785) from Halletsville, Texas) was used to produce switchgrass seedlings in the spring of 1992. Seedlings were removed from the greenhouse approximately a week prior to transplanting in June. Seedling vegetative leaf mass was reduced prior to planting to reduce the risk of transplant shock. The seedlings were transplanted to a 2.1- x 2.1-m (7- x 7-ft) spaced plant evaluation nursery. Generally, the Texas transplants were more robust and vigorous than the Oklahoma source. Initial screening and performance will be observed through 1996.

Evaluation Factors: Plants will be evaluated for rhizome production, rate of spread, vigor, coarseness, flowering date, seed production, and seed size. A grid-type evaluation system will be used to select plants.

Potential Products: Cultivar Release

Progress or Status: Seed was collected from the cross-pollinating nursery which will be tested against standard switchgrass varieties for rhizomatous characteristics and plant morphology.

Literature Cited:

Eberhart, S.A. and L.C. Newell. 1959. Variation in domestic collections of switchgrass, *Panicum virgatum* L. Agronomy Journal 51:613-616.

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.

8. Study No. 20I041K - Evaluation of Siberian elm.

Contributed by: Iriarte, L. And W.A. Geyer. Polytechnic University of Madrid, Madrid, Spain and Kansas State University, Manhattan KS.

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 used 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 germ plasm 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 PMC were lifted on March 25, 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 limited number of seedlings by some accessions cause 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 three-replication, randomized evaluation plot containing 15 accessions and three seedlings per plot (Appendix Figure 5.1) was established on April 15, 1999, in Akron, Colorado. The plot was established in a recently tilled area on the USDA/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 May 19, 1999.

The Akron Site is located in Logan County, Colorado. The planting was established in cooperation with the USDA ARS Central Great Plains Research Station at Akron, Colorado. The site is located within MLRA 72. Average annual precipitation is 40.6-cm (16 in). The soils are classified as a Rago silt loam (sil).

A three-replication, randomized evaluation plot containing 11 accessions and three seedlings per plot (Appendix Figure 5.2) was established on May 18, 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 utilized to apply 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 with MLRA 72. Average annual precipitation is 40.6-cm (16 in). The soils are classified as Goshen sil.

Evaluating Factors: Factors for evaluation include survival, plant growth, vigor, winter injury, disease, and insect resistance.

Potential Products: Cultivar Release

Progress or Status: Evaluations were performed at the Akron and Sidney sites on October 18, 2005 with 90% survival and 94% survival, respectively. Heights ranged from 100- to 455-cm at Akron and 158-to 464-cm at Sidney with means of 346 and 320-cm respectively, Table 8.1. Height differences among accessions were not significant. Refer to Appendix Tables 3.1 and 3.2 for data on individual accessions.

Mean diameters were 11.9 and 12.1-cm at the Akron and Sidney sites. Accession differences for ground-line mean trunk diameters were significant ($P \leq 0.05$) at only the Sidney site,

Foliage density was high at this late date – 87 and 69 percent. Early leaf loss is more desirable as the study was to determine branch breakage due to ice storms; which was not noticeable after 5 years growth.

Table 8.1 Plant growth data and percent foliage density ratings for Siberian elm at Akron, Colo. and Sydney, Nebr.

Accession Number	Akron (Colo.)				Sydney (Nebr.)			
	HGT 03 (cm)	HGT 05 (cm)	DIAM 05 (cm)	FOL DEN 05 (%)	HGT 03 (cm)	HGT 05 (cm)	DIAM 05 (cm)	FOL DEN 05 (%)
9050184	282	353	10.4	94	312	326	11.4	67
9050213	289	341	10.6	67	271	315	10.9	29
9050214	276	342	12.0	78	315	365	11.9	93
9050216	304	345	12.0	83	-	-	-	-
9050217	298	308	11.2	72	272	323	11.9	50
9050219	310	359	11.5	75	279	289	13.1	67
9050222	301	342	11.1	100	278	318	11.5	56
9050224	319	381	11.6	100	272	315	10.6	78
9050225	278	359	11.5	100	-	-	-	-
9050226	290	337	11.5	100	291	345	13.4	78
9050228	297	359	11.9	94	247	292	13.2	81
9050233	264	312	10.9	83	251	290	12.3	75
9050235	317	370	11.2	83	-	-	-	-
9050240	267	354	11.9	94	276	351	12.5	79
9050241	278	328	10.5	94	-	-	-	-
Mean	**291**	**346**	**11.3**	**87**	**279**	**320**	**12.1**	**69**

9. Study No. 20I042E - Evaluation of false indigo for use in streambank stabilization, shoreline protection, and wetland restoration and enhancement.

Introduction: False indigo (*Amorpha fruticosa* L.) is a native legume, deciduous, medium-to-tall growing shrub native to North America. Its range is from New Hampshire west to Saskatchewan, south to Texas, New Mexico, Arizona, California, east to Florida, and north to New England. False indigo has application for erosion control along shorelines and streambanks, for wildlife food and cover, and for ornamental purposes.

Problem: The Manhattan PMC Long-Range Plan has listed four program objectives that pertain to developing and using plant materials to address: improving water quality, riparian vegetation, streambank and shoreline protection, and wetland restoration and enhancement. The need exists for plant species of known origin and adaptability that are not currently available for conservation work in the Central Great Plains Region.

Objective: Assemble, test, and release adapted false indigo selections for streambank stabilization and shoreline protection, wetland restoration and enhancement plantings, and for the improvement of wildlife habitat.

Procedure: Seeds from 84 accessions were planted to 25.4-cm^3 Ray Leach Single Cell "Cone-tainers" in the spring of 2001. Seeds of accessions with poor quality seed had to be replanted but establishment of most accessions was successful. Enough seedlings were established from 76 of the accessions to support an initial evaluation planting. The plants were transplanted to a spaced plant evaluation nursery in Field C-3-D-3, May 29, 2002, on a Stonehouse-Eudora complex soil. Appendix Figure 6.1. The plot layout consisted of 3 plants per plot with 3 replications in a RCB design. In-row spacing was 0.9-m (3-ft) and the between row spacing was 4.57-m (15-ft). The plots were irrigated throughout the growing season of the establishment year. Maintenance consists of mowing, disking, and hand weeding between the rows.

Potential Products: Information Technology and Cultivar Release.

Progress or Status: Most of the plants suffered some degree of tip dieback due to less than ideal moisture conditions for false indigo again this year. Plant height measurements indicated increased growth for all accessions, refer to Appendix Tables 4.1a. The height ranges are presented in Table 9.1.

Table 9.1 Height ranges for false indigo at Manhattan PMC, Manhattan, Kansas.

Range of Mean Heights (cm)	Accession	Origin
163	9050309	Sioux Co., Nebr.
339	9050343	Cleveland Co., Okla.
Range of Indivdiual Heights (cm)		
95	9050309	Sioux Co., Nebr.
369	9050307	Colfax Co., Nebr.

10. Study No. 20I043E - Evaluation of common buttonbush (*Cephalanthus occidentalis* L.).

Introduction: Common buttonbush (*Cephalanthus occidentalis* L.) is a deciduous wetland shrub 1-3 m tall, usually with several stems from the base or rarely a small tree to 5-m tall (Barkley 1986; Bonner 1974). It is locally common along ponds or lakeshores, stream banks, low swamps, woods, and prairie marshes (Barkley 1986). The seeds are eaten by many bird species and the shrub has some value as a honey plant (Bonner 1974).

Objectives: Select superior plants for streambank stabilization, shoreline protection, and for use in wetland areas for restoration, and for wildlife habitat improvement.

Procedure: Thirty-six seed collections were made in Kansas and Oklahoma. The seeds were planted in 2000 to 25.4-cm^3 Ray Leach Single Cell “Cone-tainers” in a greenhouse to establish plants. In 2001, the plants were transplanted to a spaced plant evaluation nursery in Field B-1 on a Belvue sil soil. The plot layout consisted of 3 plants per plot with 3 replications spaced on a 4.3- x 4.3-m (14- x 14-ft) spacing in a RCB design (Appendix Figure 6.1). The plots were irrigated throughout the initial growing season.

Progress or Status: Twenty plants were selected from 12 of the 36 accessions that were under evaluation at the Manhattan PMC. The plants were lifted with a tree spade and moved to a Breeder’s Block in Field B-1, on April 20, 2005. The composite was assigned accession number 9050496. Refer to Table 10.1, for a complete list of composite members.

Table 10.1 Common buttonbush plants selected for composite Breeder's Block, 9050496, located in Field B-1, Manhattan, PMC.

Accession Number	No. of Plants Selected	Origin	Collector
9050287	3	Hodgeman Co., Kans.	Shaun Vickers and Robert Schiffner
9050296	2	Miami Co., Kans.	Robert L. Allen
9050311	1	Douglas Co., Kans.	Fran Collins and Coleen Davison
9050323	1	Harvey Co., Kans.	Mark Religa
9050340	1	Cleveland Co., Okla.	Wayne Fjeseth
9050359	1	Reno/Harvey Co., Kans.	Joyce Wade
9050360	1	Osage Co., Kans.	Art Hastert
9050371	1	Butler Co., Kans.	Charles G. Jones
9050375	4	Montgomery Co., Kans.	Jodi L. Cushenberry
9050389	2	Douglas Co., Kans.	Larry Kichler
9050392	1	Johnston Co., Okla.	William R. Hall
9050395	2	Logan Co., Okla.	Dale Poindexter

Literature Cited:

Barkley, T.M. Ed. 1986. Flora of the Great Plains. Univ. Press of Kansas. Great Plains Flora Assoc.

Bonner, F. T. 1974. Seeds of Woody Plants in the United States. Forest Service, USDA, Washington, DC.

11. Study No. KSPMS-T-0201-CR – Plant species for revegetation of natural and man-induced saline areas.

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: Eighteen different species/selections will be seeded at four different locations; Perry, Oklahoma (1 site), Okmulgee, Oklahoma (2 sites), El Dorado, Kansas (1 site), and Eureka, Kansas (1 site). Sixteen different soil amendment treatments will be applied at the Eureka and El Dorado sites. Soil salinity analysis will be performed on all sites prior to and following species establishment. Plant species to be used are provided in Table 11.1. Treatments for the Kansas locations are provided in Figure 11.1. Okmulgee and Perry locations will be seeded in the spring of 2002. Evaluations will be completed annually through 2006. Locations will be evaluated for plant species establishment, growth, and persistence.

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.

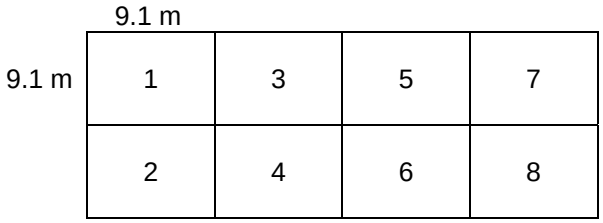
Progress or Status: No evaluation was completed at the Okmulgee Site. The Eureka and El Dorado Sites were seeded May 2, and May 3, 2003, respectively, based on critical area seeding rates. Evaluations were completed at both sites on October 28, 2003. Minimal germination was observed at the

Eureka site with alkali sacaton and blue panicum being the only two species present in any abundance. There were no observable differences in germination across the treatments. The El Dorado Site had overall better germination with four-wing saltbush, alkali-grass, blue panicum, inland saltgrass, and tall wheatgrass being the most abundant species. The plants on this site appeared to be more vigorous than the Eureka Site. There were no observable differences in germination across the treatments. Evaluations will continue in 2006.

Table 11.1 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
Side-oats 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	X		X	X
Tall wheatgrass, 'Jose'	X	X	X	X
Russian wildrye, 'Bozoiski-Select'	X	X	X	X
Western indigo / Knox City	X		X	X
Illinois bundleflower, Reno Germplasm	X		X	X
Showy partridge pea, Riley Germplasm	X		X	X

Figure 11.1 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.

Table 1.1 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs, Manhattan, KS PMC 2005.

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., Okla.
B1 18 1-25	1964			*Taxodium distichum*	baldcypress	/Commercial/KSU Ext. Forestry
				Block 2		
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., Mich. /MIPMC
B1 E 36-48	1990	478000	Midwest	*Malus baccata mandshurica*	Manchurian crab apple	Manchuria /NDPMC
B1 2 1-10	1984	9012932		*Cotoneaster zabelli*	cotoneaster	France
B1 3 1-10	1989	421620		*Alnus serrulata*	hazel alder	Knox Co., KY /KYPMC
B2 1 1	19	566824	Boomer	*Quercus macrocarpa*	bur oak	Custer Co., Okla. /KCPMC, Tex.
B2 2 1	19	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., Okla. /KSPMC
B2 S	1930's	20-1303		*Syringa vulgaris*	common lilac	
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., Mich. /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., Kans.
C1 21 A-E	1961	9004304		*Fraxinus pennsylvanica*	green ash	Franklin Co., Kans.
C1 W 1-23	1973	40-57		*Juniperus scopulorum columnaris*	Rky. Mtn. Columnar juniper	Okla. Panhandle/SW Kans. /ARS, Woodward, Okla.
C2 W 1-65	1973	40-57		*Juniperus scopulorum columnaris*	Rky. Mtn. Columnar juniper	Okla. Panhandle/SW Kans. /ARS, Woodward, Okla.
C3 W1 6-42	1967	20-1068		*Juniperus chinensis phitzeriana*	Phitzer juniper	/Riley Co., Kans.
C3 W2	1968	9001209		*Picea pungens*	Colorado blue spruce	Forrest Keeling Nursery, Elsberry, Mo.
E3 21 0-4	2001	9050411		*Fraxinus manshurica*	Manchurian ash	Primorye, Russian Fed /PI Sta. Ames, Iowa
E3 21 5-7	2001	9050416		*Quercus prinoides*	dwarf chinkapin oak	Salem, Nebr. /PI Sta., Ames, Iowa
E3 21 8-10	1990	9050023		*Sorbaria sorbifolia*	Ural false-spirea	Czechoslovakia /PI Sta., Ames, Iowa
				Block 1		
F1 1 1-2	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, Nebr. /UNL
F1 1 10-19	1966	107630		*Ligustrum vulgare*	Cheyenne European privet	/PI Sta., Ames, Iowa
F1 2 1	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, Nebr. /UNL
F1 2 2-3	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., Nebr. /UNL
F1 2 4	1985	9049957		*Platanus occidentalis*	sycamore	Brownville, Nebr. /UNL
F1 2 5	1985	9049955		*Platanus occidentalis*	sycamore	Marysville, Kans. /UNL
F1 3 1	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., Nebr. /UNL
F1 3 2-3	1985	9049955		*Platanus occidentalis*	sycamore	Marysville, Kans. /UNL
F1 3 4-5	1985	9049956		*Platanus occidentalis*	sycamore	Burt Co., Nebr. /UNL
F1 4 3-5	1997	9050263		*Celtis laevigata*	sugarberry	Newark, Ohio /PI Sta., Ames, Iowa
F1 5 1-10	1997	9050268		*Sorbaria tomentosa*	Lindley false spirea	Lublin, Poland /PI Sta., Ames, Iowa
F1 6 1-10	1997	9050265		*Sorbaria sorbifolia*	Ural false spirea	North Korea /PI Sta., Ames, Iowa
F1 7 1-10	1997	9050267		*Sorbaria* sp	false spirea	P R China /PI Sta., Ames, Iowa

Table 1.1 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs, Manhattan, KS PMC 2005 (continued).

Location (F	R	No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
F1	8	1-10	1997	9050264		*Sorbaria sorbifolia*	Ural false spirea	Lublin, Poland /PI Sta., Ames, Iowa
F1	9	1-10	1997	9050266		*Sorbaria sorbifolia* var. *stellipila*	Ural false spirea	South Korea /PI Sta., Ames, Iowa
F1	11	2-11	1989	9055585	Redstone	*Cornus mas*	Cornelian cherry dogwood	Cen Europe /N.Y. /MOPMC
F1	12	1-2	1984	325270		*Cotoneaster lucida*	cotoneaster	USSR /MDPMC
F1	18	1-5	1990	477010		*Ligustrum obtusifolium*	border privet	/MIPMC /PI Sta., Ames, Iowa
F1	19	1-5	2001	9050413		*Genista tinctoria*	common woadwaxen	Okhtyrka, Ukraine /PI Sta., Ames, Iowa
F1	19	6-10	2001	9050412		*Genista tinctoria*	common woadwaxen	Klishchevka, Ukraine /PI Sta., Ames, Iowa
F1	20	1-5	2003	9050482		*Viburnum rufidulum*	southern blackhaw	Holden Arboretum /PI Sta., Ames, Iowa
F1	20	6-10	2003	9050483		*Viburnum rufidulum*	southern blackhaw	ISU Hort. Farm /PI Sta., Ames, Iowa
F1	21	1-5	2001	9050417		*Spiraea flexuosa*		Northern Mongolia /PI Sta., Ames, Iowa
F1	21	6-10	2001	9050418		*Xanthoceras sorbilolium*	yellowhorn	Northern China/PI Sta., Ames, Iowa
F1	22	1-5	2002	9050425		*Cornus sanguinea*	bloodtwig dogwood	Iowa /PI Sta., Ames, Iowa
F1	22	6-10	2002	9050426		*Cornus sanguinea*	bloodtwig dogwood	Iowa /PI Sta., Ames, Iowa
F1	23	1-5	2002	9050427		*Cotinus coggygria*	smokebush	Iowa /PI Sta., Ames, Iowa
F1	23	6-10	2002	9050428		*Deutzia glabrata*	smooth Deutzia	Iowa /PI Sta., Ames, Iowa
F1	24	1-5	2002	9050429		*Sorbus aucuparia*	mountain ash	Iowa /PI Sta., Ames, Iowa
F1	24	6-10	2002	9050430		*Sorbus torminalis*	wild service tree	Iowa /PI Sta., Ames, Iowa
F1	25	1-5	2002	9050431		*Shepherdia argentea*	silver buffaloberry	Iowa /PI Sta., Ames, Iowa
F1	25	6-10	2002	9050432		*Sorbus torminalis*	wild service tree	Iowa /PI Sta., Ames, Iowa
F1	26	1-6	1985	9050007		*Syringa vulgaris*	common lilac	Phillips Co., Kans.
						Block 2		
F2	4	1-10	1967	9006095	McDermand	*Pyrus ussuriensis*	Harbin pear	Morden, Manitoba, Can. /NDPMC
F2	7	1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2	8	1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2	9	1-6	1998	various		*Castanea mollissima*	Chinese chestnut	/MDPMC
F2	10	1-4	1989	9050011		*Diospyros virginiana*	common persimmon	Iowa /PI Sta., Ames, Iowa
F2	23	1-5	1973	9006225		*Syringa reticulata* ssp *reticulata*	Japanese tree lilac	/NDPMC
F2	23	6-10	1973	9034667		*Forsythia europaea* X *ovata*	early forsythia hybrid	/PI Sta., Ames, Iowa
						Block 3		
F3	2	1-11	1967	9001069		*Quercus palustris*	pin oak	/Manhattan Nurs., Manhattan, Kans.
F3	3	1-5	2002	486339	Dynasty	*Ulmus parvifolia*	lace-bark elm	Iowa /PI Sta., Ames, Iowa
F3	5	1-5	1969	9004305		*Fraxinus pennsylvanica*	green ash	Butler Co., Kans.
F3	7	1-5	2003	9050478	Varen	*Betula papyrifera*	paper birch	NDSU /PI Sta., Ames, Iowa
F3	7	6-10	2003	9050481		*Tilia cordata*	littleleaf linden	Ukraine /PI Sta., Ames, Iowa
F3	8	1-5	2003	9050479		*Carpinus betulus*	European hornbeam	Ukraine /PI Sta., Ames, Iowa
F3	8	6-10	2003	9050480		*Carpinus betulus*	European hornbeam	Ukraine /PI Sta., Ames, Iowa
F3	10	1-10	1971	9034682		*Betula nigra*	river birch	Houston Co., MN /PI Sta., Ames, Iowa
F3	18	1-10	1971	9004302		*Fraxinus pennsylvanica*	green ash	Butler Co., Kans.
F3	19	1-5	1971	341756	Groeneveld	*Ulmus* 5 *hollandica*	Holland elm hybrid	/PI Sta., Ames, Iowa
F3	19	6-10	1973	265620	Hessei	*Fraxinus excelsior*	European ash	W. Germany /PI Sta., Ames, Iowa
F3	20	1-5	1972	9034674		*Quercus* sp	Swedish hybrid oak	/UNL /PI Sta., Ames, Iowa
F3	20	6-10	1972	9017646		*Quercus robur*	English oak	/ISU Hort Farm /PI Sta., Ames, Iowa

Table 1.1 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs, Manhattan, KS PMC 2005 (continued).

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
F3 21 6-10	1990	9050022		*Quercus phellos*	willow oak	TN /PI Sta., Ames, Iowa
F3 22 6-10	1972	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., Okla.
F3 24 1-10	1973	434253	Athens	*Quercus acutissima*	sawtooth oak	/GAPMC
				Block 4		
F4 1 9-10	1968	9004461	Woodward	*Platycladus orientalis*	Oriental arborvitae	/Okla. State Nurs., Norman, Okla.
F4 3 6-10	1972	9004434		*Platycladus orientalis*	Oriental arborvitae	/Deuel Co., Nebr. /PI Sta., Cheyenne, Wyo.
F4 5 10-11	1973	323932	Emerald Sea	*Juniperus conferta*	shore juniper	/MDPMC
F4 10 1-7	2005	9050495		*Cupressus arizonica*	Arizona cypress	/Lawyer Nurs., Plains, Mont.
F4 10 9-13	1975	9004334		*Juniperus* sp	columnar juniper	Custer Co., Nebr. /PI Sta., Cheyenne, Wyo.
F4 17 1-10	1982	477011	Affinity	*Thuja occidentalis*	northern white cedar	/MIPMC
F4 18 1-6	1976	343949		*Pinus sylvestris*	Scotch pine	Ankara, Turkey /MDPMC
F4 19 7-9	1976	343948		*Pinus sylvestris*	Scotch pine	Ankara, Turkey /MDPMC
F4 20 1-10	1974	9034668		*Picea abies*	Norway spruce	/Griffith St. Nurs., Wisconsin Rapids, Wis.
F4 21 1-9	1973	9004363		*Pinus strobiformis*	Mexican white pine	Lincoln Co., NM /Rky Mtn Exp Sta., Nebr.
F4 22 1-10	1973	9004364		*Pinus nigra*	Austrian pine	N. Turkey /Rky Mtn Exp Sta., Nebr.
F4 24 1-10	1973	9004365		*Pinus sylvestris*	Scotch pine	/Holt Co., Nebr. /Rky Mtn Exp Sta., Nebr.
F4 25 8-17	1973	9034669		*Pinus heldreichii*	Heldreich pine	Yugoslavia /Rky Mtn Exp Sta., Nebr.
				Block 1		
G 1 W'-B	1991	250278	Elsmo	*Ulmus parvifolia*	Lace-bark elm	Rochester, N.Y. /MOPMC
G 1 C-E	1974	9004437		*Ulmus parvifolia*	Lace-bark elm	Woodward /SO, Okla.
G 2 W'-Z'	1991	250278	Elsmo	*Ulmus parvifolia*	Lace-bark elm	Rochester, N.Y. /MOPMC
G 2 A-E	1963	9004439		*Ulmus* species	Offerle elm	Edwards Co., Kans.
G 3 B-E	1963	9013711		*Ulmus parvifolia*	Chinese elm	/ARS, Woodward, Okla.
G 3 F-J	1963	9004256		*Celtis occidentalis*	common hackberry	Pottawatamie Co., Kans.
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, Kans.
G 10 F-J	1963	9034680		*Carya illinoensis*	pecan	/KSU Forestry, Kans.
G 2 K-O	1963	9004329		*Juniperus virginiana*	eastern red cedar	/KSU Forestry, Kans.
G 4 K-O	1963	9004333		*Juniperus virginiana*	eastern red cedar	Harper Co., Okla.
G 6 K-O	1963	9004332		*Juniperus virginiana glauca*	silver eastern red cedar	/USDA-ARS, Woodward, Okla.
G 8 K-O	1963	9034671		*Pinus ponderosa*	ponderosa pine	/KSU Forestry, Kans.
G 9 K-O	1963	9013469		*Pinus nigra*	Austrian pine	/KSU Forestry, Kans.
G 15 U-Y	1964	9034673		*Quercus acutissima*	sawtooth oak	/GAPMC, Americus
				Block 2		
G2 16 1-8	1976	9004462	Sapporo Autumn Gold	*Ulmus* species	elm	/U. of Wis./PI Sta. Ames, Iowa
G2 17 1-3	1977	9004312		*Juglans nigra*	black walnut	Doniphan Co., Kans.
G2 23 6-8	1981	9030309		*Aesculus glabra*	Ohio buckeye	/PI Sta. Ames, Iowa
G2 24 6-7	1981	9030308	Royal Red	*Acer plantanoides*	Norway maple	/PI Sta. Ames, Iowa

Table 1.1 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs, Manhattan, KS PMC 2005 (continued).

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
				Block 3		
G3 16 1-8	1976	9008245		*Quercus acutissima*	sawtooth oak	/KCPMC, Tex.
G3 18 1-8	1976	9004392		*Quercus macrocarpa*	bur oak	City Park, Stillwater, Okla.
G3 19 7	1976	9034858		*Castanea crenata*	chestnut hybrid	MOPMC
				Block 1		
HQ1 1 1	1966	20-385		*Nyssa sylvatica*	black gum	/Forrest Keeling Nursery, Elsberry, Mo.
HQ1 1 2				*Carya illinoensis*	pecan	
HQ1 1 3	1963	20-382		*Pseudotsuga taxifolia*	Douglas fir	MOPMC
HQ1 1 4-12	1968	20-1209		*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., Mich. /MIPMC;
HQ1 2 3	1964	40-125		*Pinus edulis*	pinyon	/ARS, Woodward, Okla.
HQ1 2 4-5	1968	20-1209		*Picea pungens*	Colorado blue spruce	/Forest Keeling Nursery, Elsberry, Mo.
HQ1 3 1	1966	20-400		*Tilia euchlora*	Redmon Crimean linden	/Plumfield Nursery, Fremont, Nebr.
HQ1 4 1,3	1982	9030989		*Forsythia ovata*	early forsythia	
HQ1 4 2	1988	9049784		*Ribes odoratum*	buffalo currant	Dickinson Co., Kans.
HQ1 5 1-4	1982	9030990	Blue Star	*Juniperus squamata*	blue star juniper	Holland /PI Sta., Ames, Iowa
HQ1 5 1-4				*Yucca glauca*	soapweed	
HQ1 7 1	1984	20-1846		*Picea abies*	Norway spruce	/Griffith State Nursery, Wisconsin Rapids, Wis.
HQ1 7 2	1964	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., OK
HQ1 8 1		A-38398		*Caragana boisi*	Siberian pea shrub	/ARS Hort. Sta., Cheyenne, Wyo.
HQ1 8 2		483442	Flame	*Acer ginnala*	Amur maple	Eastern Asia /MOPMC
HQ1 8 3	1977	9004363		*Pinus ayacahuite*	Mexican white pine	Lincoln Co., NM /Rky Mtn Exp Sta., Nebr.
HQ1 9 1	1988			*Cerus canadensis*	red bud	Riley Co., Kans.
HQ1 9 2				*Quercus palustris*	pin oak	/Manhattan Nursery, Manhattan, Kans.
				Block 2		
HQ2 1 1-15				*Crataegus phaenopyrum*	Washington hawthorn	/Lawyer Nursery, Plains, Mont.
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	A-31705		*Syringa oblata dilatate*	Korean early lilac	/ARS Hort. Sta., Cheyenne, Wyo.
HQ2 3 1	1977	421614		*Ulmus wilsoniana*		/ARS Nursery Crops Res. Lab., Delware, Ohio
HQ2 3 2				*Pinus ponderosa*	ponderosa pine	
HQ2 3 3		516476	Redstone	*Cornus mas*	Cornelian cherry dogwood	Asia /MOPMC
HQ2 3 4-15				*Syringa vulgaris*	common lilac	
HQ2 3 16	1976	A-341179		*Spirea sargentiana*	Sargent spirea	/ARS Hort. Sta., Cheyenne, Wyo.
HQ2 3 17	1992			*Quercus robur*	English oak	Ill. /McKendree College
HQ2 3 18	1992	9004392	Lippert	*Quercus macrocarpa*	bur oak	Payne Co., Okla. /KSPMC
HQ2 3 19	1977	514275	Magenta	*Malus* sp.	hybrid crab apple	Clinton Co., Mich. /MIPMC
HQ2 4 1-6	1992			*Pyracantha*	firethorn	Blueville Nursery, Manhattan, Kans.
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., Kans.

Table 1.1 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs, Manhattan, KS PMC 2005 (continued).

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin /Source
P W 1	1966	20-386		*Liquidambar styraciflua*	American sweetgum	/Forest Keeling Nursery, Elsberry, Mo.
P W 2	1965	40-141		*Juniperus virginiana canaerti*	Canert juniper	/Nelson Nursery, Enid, Okla.
P W 3	1966	20-380		*Juniperus horizontalis glauca*	blue creeping juniper	/MIPMC
P W 4	1966	9000399		*Quercus rubra*	northern red oak	Eureka, Kans.
P W 5-6	1971	9001455	Emerald	Fraxinus *sp.*	ash	Marshall Nursery, Arlington, Nebr.
P 21 1-6	2001	9050416		*Quercus prinoides*	dwarf chinkapin oak	Salem, Nebr. /PI Sta. Ames, Iowa
P 22 1-5	2001	566597	Patriot	*Ulmus* hybrid	elm	US Nat'l Arboretum /PI Sta., Ames, Iowa
P S 1-6, 8-10	1977	399400		*Pinus nigra*	Austrian pine	Yugoslavia /PI Sta., Ames, Iowa
P S 7, 11-30	1981	9034670		*Pinus nigra*	Austrian pine	/KSU Forestry
PQ S 31-50	1977	399402		*Pinus sylvestris*	scotch pine	Yugoslavia /PI Sta., Ames, Iowa
Q S 51-70	1977	399403		*Pinus sylvestris*	scotch pine	Yugoslavia /PI Sta., Ames, Iowa
Q S 71-90	1977	399404		*Pinus sylvestris*	scotch pine	Yugoslavia /PI Sta., Ames, Iowa

Table 1.2 Study No. 20I010K Initial Evaluation: List of Miscellaneous Trees and Shrubs Removed, Manhattan, KS PMC 2005.

Location (F R No.)	Yr Pltd	Accn. No. or PI No.	Cultivar	Genus/ Species	Common Name	Origin/ Source
B1 3 1-10	1989	421620		*Alnus serrulata*	Hazel alder	Knox Co., KY /KYPMC
E3 21 0-4	2001	9050411		*Fraxinus manshurica*	Manchurian ash	Primorye, Russian Fed /PI Sta., Ames, Iowa
E3 21 8-10	1990	9050023		*Sorbaria sorbifolia*	Ural false-spirea	Czechoslovakia /PI Sta., Ames, Iowa
F4 23 1-10	1973	9004365		*Pinus sylvestris*	Scotch pine	/Holt Co., Nebr. /Rky Mtn Exp Sta., Nebr.

Refer to page 100, legend for woody plant evaluations.

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas.

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
B1 1-11	ALSE2	421620	hazel alder	91	91	9	9	100				31	58		
			Alnus serrulata		92	(11)	9	100				78	92		
			Knox Co., Ky./KYPMC		93		9	100				106	110		
					94		9	100	6			86	108		Winter injury
					95		9	100	6				154		
					03										Severe mechanical damage
					04										Removed
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., Kans.		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		
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., Kans.		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		
E3 21 0-4	FRMA5	9050411	Manchurian ash	01	01	5	5	100					150		
			Fraxinus mandshurica		02		5	100	9	6	3	20	103		Die back
			/PI Sta., Ames, Iowa		03		5	100	9						Dropped leaves early
					04		5	100	9						Dropped leaves early
					05		5	100	9	5	4	30	73		
E3 21 5-7 /P21 1-6	QUPR	9050416	dwarf chinkapin oak	01	01	9	9	100					23		
			Quercus prinoides		02		8	89	6	7	5	26	31		Leaf cutter bee damage
			/PI Sta., Ames, Iowa		03		8	89				42	41		
					04		8	89				67	66		Some deer browse
					05		8	89				93	83		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 8-10	SOSO2	9050023	Ural false-spirea	90	90	3	3	100	1			48	58		Deer browse
			Sorbaria sorbifolia		91		3	100				101	107		
			Czechoslovakia /PI Sta.,		92		3	100				212	135		Stem breakage
			Ames, Iowa		93		3	100					162		
					94		3	100					171		
					99		3	100	6			333	146		1-3 – dead branches
					04		3	100				274	131		
F1 1 1-2	PLOC	9049957	*Platanus occidentalis*	85	85	4	4	100	3		2	89	178		
2 1,4			Brownville, Nebr./ UNL		86	4	4	100	4	4		260	240		
					87	4	4	100	5			442	487	6	
					88	4	4	100	3	3	3	553	615	10	
					89	4	4	100	5	5		587	714	13	
					95	4	4	100					1213	27	
					04	4	4	100					1786	36	
F1 1 10-19	LIVU	107630	Cheyenne European privet	66	70	10	5	50	1			290	320		
			Ligustrum vulgare		71		5	50	1			320	396		
			PMC, Bismarck, N. Dak.		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		
F1 2 2-3	PLOC	9049956	*Platanus occidentalis*	85	85	5	5	100	3		2	93	189		
3 1, 4-5			Burt Co., Nebr./ UNL		86	5	5	100	2	4		176	290		
					87	5	5	100	3			401	492	6	
					88	5	5	100	2	3	2	505	607	10	
					89	5	5	100	4	5		545	707	12	
					95	5	5	100					1225	25	
					04	5	5	100					1625	31	
F1 2 5	PLOC	9049955	*Platanus occidentalis*	85	85	3	3	100	2		2	102	183		
3 2-3			Marysville, Kans. /UNL		86	3	3	100	1	4		200	310		
					87	3	3	100	3			453	512	7	
					88	3	3	100	2	3	2	557	615	11	
					89	3	3	100	4	5		608	723	14	
					95	3	3	100					1304	30	
					04	3	3	100					1787	39	

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 4 3-5	CELA	9050263	sugarberry	97	97	3	3	100	5				107		
			Celtis laevigata		99		3	100					337		
			/PI Sta., Ames, Iowa		00		3	100					465		
					01		3	100	1				558		
					02		3	100	4	1	3	509	593		
F1 5 1-10	SOTO7	9050268	Lindley false spiraea	97	97	10	10	100	2						
			Sorbaria tomentosa		99		10	100	7				145		
			Poland/PI Sta., Ames,		00		10	100				228	148		
			Iowa		01		10	100	9				153		
					02		10	100	5			216	147		20% die back; few flowers
F1 6 1-10	SOSO2	9050265	Ural false spiraea	97	97	10	10	100	3						
			Sorbaria sorbifolia		99		10	100	2				153		
			North Korea/PI Sta., Ames,		00		10	100				185	155		
			Iowa		01		10	100	3				171		
					02		10	100	6			228	150		40% die back; heavy flowering
F1 7 1-10	SOSO2	9050267	Ural false spiraea	97	97	10	10	100	5						Insect damage
			Sorbaria sorbifolia		99		10	100	4	9			143		
			China/PI Sta., Ames, Iowa		00		10	100				179	158		
					01		10	100	7				177		
					02		10	100	7			215	171		50% die back; heavy flowering
F1 8 1-10	SORBA	9050264	false spiraea	97	97	10	10	100	1						Wind damage
			Sorbaria sp.		99		10	100	1				211		
			Poland/PI Sta., Ames,		00		10	100				254	218		
			Iowa		01		10	100	1				213		No. 3 – winter injury
					02		10	100	3			275	215		15% die back; mod. flowering
F1 9 1-10	SOSOS	9050266	Ural false spiraea	97	97	10	10	100	9						
			Sorbaria sorbifolia var.		99		10	100	2				144		
			stellipila		00		10	100				216	153		
			South Korea/PI Sta.,		01		10	100	5				169		
			Ames, Iowa		02		10	100	5			244	157		30% die back; mod. flowering
F1 11 1-11	COMA21	9055585	Cornelian cherry dogwood	89	89	11	11	100	2	5		3	8		
			Cornus mas		90		11	100	2	4	2	31	78		1,4-5 – frost damage, some die back
			C. Europe /N.Y. /MOPMC		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 – herbicide damage
					03	10	10	100					353		All but 2 with good fruit production

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 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 /PI Sta., Ames,		92		5	100				111	102		
			Iowa		93		5	100				190	137		
					94		5	100	2			235	164		
					99		5	100				386	288		Excellent fruit production
					05		5	100					296		
F1 19 1-5	GETI	9050413	common woadwaxen	01	01	5	5	100	9			30	21		Weed comp; deer browse
			Genista tinctoria		02		5	100	9	6	5	39	28		Heavy deer browse
			/PI Sta., Ames, Iowa		03		4	80	9			39	25		Heavy rabbit browse
					04		2	40	9			42	45		
					05		1	20	9			41	43		
F1 19 6-10	GETI	9050412	common woadwaxen	01	01	5	5	100	1			40	63		Weed comp; deer browse
			Genista tinctoria		02		5	100	2	6	6	43	64		Heavy deer browse
			/PI Sta., Ames, Iowa		03		5	100	1			71	87		Rabbit browse
					04		2	40	3			106	120		
					05		0	0							
F1 20 1-5	VIRU	9050482	southern blackhaw	03	03	5	4	80	7			51	39		
			Viburnum rufidulum		04		3	60	6			30	34		
			/PI Sta., Ames, Iowa		05		3	60				38	62		
F1 20 6-10	VIRU	9050483	southern blackhaw	03	03	5	5	100	6			36	44		
			Viburnum rufidulum		04		5	100	5			33	46		
			/PI Sta., Ames, Iowa		05		5	100				47	69		
F1 21 1-5	SPFL9	9050417	*Spiraea flexuosa*	01	01	5	5	100	2			56	78		Weed comp; leaf cutter bee damage
			/PI Sta., Ames, Iowa		02		5	100	6	6	2	42	49		Heavy deer browse
					03		5	100	5			49	64		Fall flowers – 3 plants
					04		5	100	6			44	58		
					05		4	80				48	53		No. 5 - gone
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		Medium deer browse
			/PI Sta., Ames, Iowa		03		5	100	4			81	89		5 – die back; recovered summer
					04		5	100	5			93	105		
					05		5	100				117	134		
F1 22 1-5	COSA81	9050425	bloodtwig dogwood	02	02	5	5	100	4	4	4	27	80		Heavy browse
			Cornus sanguinea		03		5	100	3			69	106		3 – tip breakage – boring insect
			/PI Sta., Ames, Iowa		04		5	100	6		7	170	148		
					05		5	100				260	198		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 22 6-10	COSA81	9050426	bloodtwig dogwood	02	02	5	5	100	3	6	5	42	57		Medium browse
			Cornus sanguinea		03		5	100	6			74	81		
			/PI Sta., Ames, Iowa		04		5	100	3		4	181	169		
					05		5	100				241	212		
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		
			/PI Sta., Ames, Iowa		04		5	100	4			137	219		
					05		5	100				185	258		
F1 23 6-10	DEGL11	9050428	smooth Deutzia	02	02	5	5	100	7	5	4	21	29		
			Deutzia glabrata		03		5	100	9			23	33		
			/PI Sta., Ames, Iowa		04		1	20	9			12	33		Not adapted
					05		0	0							
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		
			/PI Sta., Ames, Iowa		04		2	40	3			53	120		
					05		2	40				88	180		
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		
			/PI Sta., Ames, Iowa		04		5	100	3	6	6	17	92		2 – girdled by deer
					05		5	100				28	139		
F1 25 1-3	SHAR	9050431	silver buffaloberry	02	02	2	2	100	6	6	7	14	61		Browse
			Shepherdia argentea		03		2	100	3			31	104		
			/PI Sta., Ames, Iowa		04		2	100	5			82	176		Mechanical damage
					05	1 (2)	1	100				117	211		No. 1 – Disked out.
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
			/PI Sta., Ames, Iowa		04		3	60	5	5	5	17	60		3 – deer damage
					05										
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., Kans.		93		6	100				152	150		No. 6 – leaves dried up early
					94		6	100							Mildew
					95		5	83					186		
					05		5	83					252		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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						
			/PMC, ND		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 – wind
					96		9	90	1				1119		damage
					01		8	80	4				974	24	
F2 10 1-4	DIVI5	9050011	common persimmon	89	89	4	4	100	9	3		3	13		
			Diospyros virginiana		90		4	100	1			22	45		
			/PI Sta., Ames, Iowa		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		No. 1-2 – herbicide damage
					03		4	100					605		No. 1 – a resprout; fruit amount - 5
F2 23 1-5	SYRER2	9006225	Japanese tree lilac	73	73	5	5	100	3			78	70		
			Syringa reticulata ssp		74		5	100	3			157	130		
			reticulata		75		5	100	3			210	230		
			/PMC, ND		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		
F2 23 6-10	FORSY	9034667	early forsythia hybrid	73	73	5	5	100	1			88	73		
			Forsythia europaea 5		74		5	100	1			116	143		
			ovata		75		5	100	3			142	189		
			/PI Sta., Ames, Iowa		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		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 Nurs.,		74		9	82	5			457	518		
			Manhattan, Kans.		75		9	82				488	700		
					76		9	82				670	762		
					78		8	73				800	960		
					01		8	73					1334	37	
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
			/PI Sta., Ames, Iowa		04		5	100	2	2	2	73	163		Good clean foliage
					05		5	100				123	250		
F3 5 1-5	FRPE	9004305	green ash	69	69	5	5	100	1						
			Fraxinus pennsylvania		71		5	100	2			213	271		
			Butler Co., Kans.		72		5	100	1			335	355		
					73		5	100	1			259	419		
					74		5	100	1			335	518		
					75		5	100	1			365	580		Abundant fruiting
					76		5	100	1			488	610		Moderate fruiting
					80		5	100	1			730	950		
					82		5	100	2			800	1100		
					83		5	100	2	4	5	900	1075		
					89		5	100	2	4			1099		No. 1 – blown down 6/03 - rot
					90		4	80	2	5					
					03		4	80					1178	33	
F3 7 1-5	BEPA	9050478	paper birch	03	03	5	5	100					147		
			Betula papyrifera		04		1	20	6	5	3	86	173		
			W. North Dakota /PI Sta., Ames, Iowa		05		1	20				82	188		
F3 7 6-10	TICO2	9050481	littleleaf linden	03	03	2	2	100				20	40		
			Tilia cordata		04		1	50	5	4	5	51	67		
			Ukraine /PI Sta., Ames, Iowa		05		1	50				83	110		
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 /PI Sta., Ames, Iowa		05		4	80				58	104		
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 /PI Sta., Ames, Iowa		05		3	100				43	73		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 18 1-10	FRPE	9004302	green ash	71	75	10	10	100	1			305	457		
			Fraxinus pennsylvanica		76		10	100	1			396	518		
			Butler Co., Kans.		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		N0. 1 - dead
					05		8	80					1236		
F3 19 1-5	ULMUS	341756	Holland elm hybrid	71	75	5	4	80	5			225	430		
			Ulmus X *hollandica*		76		4	80	5			290	470		
			/PI Sta., Ames, Iowa		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		
F3 19 6-10	FREX80	265620	European ash	73	73	5	5	100				30	174		
			Fraxinus excelsior		74		5	100				61	226		
			W. Germany /PI Sta.,		75		5	100	5			104	310		
			Ames, Iowa		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 – A sucker
F3 20 1-5	QUERC	9034674	Swedish hybrid oak	72	72	5	5	100	3			9	37		
			Quercus sp.		73		5	100	3			27	61		
			UNL /PI Sta., Ames, Iowa		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	

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 20 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 /PI Sta.,		74		4	100	3			94	183		
			Ames, Iowa		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		
F3 21 6-10	QUPH	9050022	willow oak	90	90	5	5	100		2	3	22	32		
			Quercus phellos		91		4	80				21	34		Severe deer browse
			TN /PI Sta., Ames, Iowa		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		
F3 22 6-10	QUMA2	9004392	bur oak	72	72	5	5	100	5			17	26		
			Quercus macrocarpa		73		5	100	3			82	125		
			Payne Co., Okla.		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	

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 1-10	QUAC80	434253	sawtooth oak	73	73		10	100	3			64	66		
			Quercus acutissima		74		10	100	3			111	137		
			/PMC, GA		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	
F4 1 6-10	PLOR80	9004461	Oriental arborvitae	68	75	5	5	100	3			396	427		
			Platycladus orientalis		76		5	100	3			396	457		
			Okla. State Nurs., Norman,		78		5	100	3			600	550		
			Okla.		79		5	100	5			600	640		
					83		5	100	3	3	4	700	620		
					93		5	100					820		
					96										Removed all but No. 10
F4 3 6-10	PLOR80	9004434	Oriental arborvitae	72	75		5	100	5			115	175		
			Platycladus orientalis		76		5	100	5			180	250		
			Deuel Co., Nebr. /PI Sta.,		78		4		5			270	400		
			Cheyenne, Wyo.		79		4		5			320	470		
					83		4		4	5	4	550	575		
					96		4						796		
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		
			NPMC, Beltsville, Md.		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		
F4 10 1-7	CUAR	9050495	Arizona cypress	05	05	7	7	100					84		
			Cupressus arizonica												
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., Nebr. /PI Sta.,		83		5	100	3	5	3	160	430		Cedar-Apple rust
			Cheyenne, Wyo.		99		5	100					963		
					04		5	100					1060		
F4 17 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, E. Lansing, Mich.												

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 18 1-6	PISY	343949	scotch pine	76	76	(9)	4		7			20	15		
			Pinus sylvestris		77	6	6	100	5			40	30		
			NPMC, Beltsville, Md.		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							
F4 19 7-9	PISY	343948	scotch pine	76	76	(9)	1		7			30	15		
			Pinus sylvestris		77	3	3	100	7			20	20		
			NPMC, Beltsville, Md.		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
F4 20/ 1-10	PIAB	9034668	Norway spruce	74	74	10	10	100	5			23	27		
			Picea abies		75		10	100	5			25	40		
			Griffith State Nurs.,		76		10	100	5			40	60		
			Wisconsin Rapids,		77		10	100	3			60	75		
			Wis.		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		
F4 21/ 1-10	PIST3	9004363	Mexican white pine	73	74	10	10	100	5						
			Pinus strobiformis		75		10	100	3			50	60		
			Lincoln Co. NM /Rky Mtn		76		10	100	3			75	95		
			Exp Sta., Nebr.		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		
F4 22/ 1-10	PINI	9004364	Austrian pine	73	75	10	10	100	3			70	75		
			Pinus nigra		76		10	100	3			120	110		
			N. Turkey /Rky Mtn Exp		78		10	100	3			190	195		
			Sta., Nebr.		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		

Table 1.3A Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 23/ 1-10	PISY	9004365	scotch	73	75	10	10	100	3			70	75		
			Pinus sylvestris		76		10	100	3			120	120		
			Holt Co., Nebr. /Rky Mtn		78		10	100	3			180	185		
			Exp Sta., Nebr.		79		10	100	3			200	200		
					83		10	100	2			425	400	13	
					93		10	100					717		
					02		2	20					1050		
F4 24/ 8-20		9034669	Heldreich pine	73	73	13	13	100	7						
			Pinus heldreichii		74	(20)	10	77	7						
			Yugoslavia /Rky Mtn Exp		75		8	61	7			10	15		
			Sta., Nebr.		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	

Refer to page 100, legend for woody plant evaluations.

Table 1.3B Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas.

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, N.Y./MOPMC		93		10	100				60	96		
					94		10	100	2			84	113		Deer browse
					95		10	100					138		1 destroyed by deer, heavy browse
					05		10	100					742	11	
G 1/ B-E	ULPA	9004437	Chinese elm	74	77	4	3	75	3			130	175		
			Ulmus parvifolia		78		3	75	3			185	215		
			SO, Woodard, Okla.		79		3	75	3			220	300		
					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		
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., Kans.		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	
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	
			ARS, Woodard, Okla.		78		4	80	3			500	1500		
					79		4	80	3			650	1450	28	
					83		4	80	3			600	1300	35	
					93		4	80							
					97		4	80					1574	39	
					02		4	80					1699		
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., Kans.		74		5	100	3			615	927	20	
					78		5	100	5			500	850		
					93		2	40						45	
					97		2	40					1387	55	
					02		2	40					1433		

Table 1.3B Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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		
					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	
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		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	
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, Kans.		83		5	100	3			450	1150	16	
					93		5	100						23	
					97		5	100					1747		
					02		5	100					1823	26	
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, Kans.		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	
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, Kans.		78		5	100	3			500	750		
					79		5	100	1			500	750		
					02		5	100					1055		
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., Okla.		78		4	100	1			500	700		
					02		4						1126		

Table 1.3B Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 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	
			USDA-ARS, Woodward,		78		5	100	3			550	700		
			Okla.		02		5	100					1256		
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, Kans.		78		3	60	5			300	550		
					02		3	60					1530		
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, Kans.		78		5	100	3			500	600		
					79		5	100	5			500	670		
					97		5	100					1311		
					02		3	60							
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	
			PMC, Americus, Ga.		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		
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., Kans.		79		3	100	1			250	240		
					83		3	100		1		550	575	9	
					93		3	100					1155	18	
					01		3	100					1329	24	
G2 16 1-8	ULMUS	9004462	elm	76	76	8	8	100	3			110	130		
			Ulmus sp.		77		8	100	3			270	174		
			PI Station, Ames, Iowa		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		

Table 1.3B Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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
G2 23	6-8	AEGL	9030309	Ohio buckeye	81	81	3	3	100				15	52		
				Aesculus glabra		82		3	100				15	58		
				PI Station, Ames, Iowa		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		
G2 24	6-7	ACPL	9030308	Norway maple	81	81	3	3	100				21	118		
				Acer plantanoides		82		3	100				30	104		
				PI Station, Ames, Iowa		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		
G3 16	1-8	QUAC80	9008245	sawtooth oak	76	76	8	8	100	5			25	40		
				Quercus acutissima		77		8	100	5			90	70		
				PMC, Knox City, Tex.		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	
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, Okla.		78		8	100	3			100	180		
						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	

Table 1.3B Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas (continued).

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 19 7	CACR27	9034858	chestnut hybrid	76	76	1	1	100	5			5	15		
			Castanea crenata		77	(8)	1	100	3			25	45		
			PMC, Elsberry, Mo.		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		
HQ1 5/1-10	JUSQ2	9030990	blue star juniper	82	82	4	4	100				10	5		Plants not hardened off; failed to
			Juniperus squamata		83	(10)	4	100				12	6		establish.
					91		4	100				43	18		
					96		4	100	3			53	24		
					98		4	100				63	27		

Refer to page 100, legend for woody plant evaluations.

Table 1.3C Study No. - 20I010K Initial Evaluation: Misc. Woody Plant Materials Manhattan, Kansas.

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
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
			PI Station, Ames, Iowa		03		5	100				81	109		Severe rubbing and browse damage
					04		5	100			7	104	156		Heavy deer browse
					05		5	100				154	225		
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		
			PI Station, Ames, Iowa		79		9	100	5			47	48		
					83		9	100	3			205	210	3	
					86		9	100	5			296	380		No. 9 produced seed
					96		9	100					668		
					01		9	100					817		
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 produced seed
			/Kans.U Forestry		95		21	84					337		
					01		21	84					615	20	
					05		21	84							
PQ/S 31-35, 37-50	PISY	399402	scotch pine	77	77	20	20	100	3			14	21		
			Pinus sylvestris		78		20	100	3			33	36		
			PI Station, Ames, Iowa		79		20	100	3			52	56		
					83		19	95	2		3	230	225	4	
					86		19	95	5			345	342		No. 48 & 50 produced seed
					96		19	95					728		
					01								844	25	
Q/S 51-54, 56, 58-70	PISY	399403	scotch pine	77	77	18	18	100	3			18	24		
			Pinus sylvestris		78	(20)	18	100	3			35	36		
			PI Station, Ames, Iowa		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 prod. seed
					96		18	100					819		
					01			100					945	28	
Q/S 71-82, 84, 86-90	PISY	399404	scotch pine	77	77	18	18	100	5			12	16		
			Pinus sylvestris		78	(20)	18	100	5			26	21		
			PI Station, Ames, Iowa		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			100					832	31	

Refer to Page 100, legend for woody plant evaluations.

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas.

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 1 1	CELTI	9011670	Libelta, Poland	81	82	1	1	100				8			40	30		rodent damage
					83		1	100				8	3	4	80	60		
					85		1	100				-	1	3	234	240		
					87		1	100	1	9	2	9	6	7	395	455	5	
					88		1	100	1	7	1	9	2	2				
					89		1	100	1	2		9						
					90		1	100				8				535	9	
					95		1	100								619	13	
					00		1	100	0	0						703	16	
					05		1	100								725	17	
B3 1 2-7	CEOC	9013446	Phillips Co., Kans.	81	82	6	6	100				1			275	275		4, 5 - galls
					83		6	100				1	4	6	355	400		galls
					85		6	100				2	1	4	522	589		good uniformity
					87		6	100	0	0	0	2	7	4	567	697	13	7 - witches'-broom
					88		6	100	0	0	0	2	5	5				
					89		6	100	0	0		1						2 - top broken
					90		6	100				2				894	20	3, 7 - witches'-broom
					95		6	100								1068	27	
					00		6	100	6	3	1					1166	32	
					05		6	100								1232	34	
B3 1 8	CEOC	9013422	Valley Co., Nebr.	81	82	1	1	100				1			340	370		many galls
					83		1	100				1	4	6	420	500		
					85		1	100				1	1	7	550	655		
					87		1	100	0	0	0	1	6	7	640	754	16	
					88		1	100	1	7	1	1	4	9				
					89		1	100	0	0		2						
					90		1	100				4				936	21	
					95		1	100								1067	26	
					00		1	100	0	0						1044	28	
					05		1	100								964	30	
B3 1 9-14	CEOC	9013415	Greeley Co., Nebr.	81	82	5	5	100				5			140	90		13 - top half dead, 14 - replant
					83		5	100				5	4	6	145	250		galls
					85		5	100				4	1	7	380	445		galls
					87		5	100	0	0	0	6	7	6	440	537	10	10 - chlorosis
					88		5	100	3	8	1	7	6	4				
					89		5	100	0	0		7						
					90		5	100				6				711	11	witches'-broom
					95		5	100								847	19	
					00		5	100	3	6	1					837	20	1 runty
					05		5	100								858	21	

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 1 15-20	CELTI	9004262	Cheyenne Co., Kans.	81	82	6	6	100				2			360	310		16, 19, 20 - some galls
					83		6	100				1	3	5	370	475		galls
					85		6	100				1	1	6	568	716		galls
					87		6	100	0	0	0	1	4	6	658	777	18	
					88		6	100	5	5	1	1	4	7				witches'-broom
					89		6	100	0	0		1						
					90		6	100				1				938	22	17,18, 20 - witches'-broom
					95		6	100								1072	30	
					00		6	100	5	3	1					1187	32	
					05		6	100								1238	35	
B3 1 21-26	CELTI	9004263	Cheyenne Co., Kans.	81	82	6	6	100				3			270	220		23 - limbs broken, 25 - leader
					83		6	100				2	5	5	360	365		broken
					85		6	100				3	2	6	450	510		
					87		6	100	0	0	0	3	5	6	619	662	12	24 - heavy insect & disease
					88		6	100	1	9	1	3	4	6				21, 24 - chlorosis: 21 - sap flow
					89		6	100	0	0		4						23 - chlorosis
					90		6	100				4				883	18	
					95		6	100								1090	26	
					00		6	100	5	4	1					1181	30	
					05		6	100								1429	33	24 - runty
B3 1 27-32	CELTI	9004264	Sherman Co., Kans.	81	82	6	6	100				4			230	220		29-32 - some galls
					83		6	100				2	3	5	340	410		
					85		6	100				1	1	3	448	718		
					87		6	100	0	0	0	2	4	7	596	762	13	
					88		6	100	3	8	1	4	3	8				
					89		6	100	0	0		3						
					90		6	100				3				941	19	
					95		6	100								1131	26	
					00		6	100	5	3	1					1264	29	
					05		6	100								1431	33	
B3 1 33-38	CEOC	9004265	Sherman Co., Kans.	81	82	6	6	100				5			190	180		34,35,37,39 - some galls
					83		6	100				3	3	5	265	325		
					85		6	100				4	1	3	450	566		
					87		6	100	0	0	0	7	6	3	407	552	9	36 - witches'-broom
					88		6	100	0	0	0	5	7	2				
					89		6	100	0	0		5						
					90		6	100				5				770	12	witches'-broom
					95		6	100								865	17	
					00		6	100	5	2	1					1016	20	
					05		6	100								1024	22	

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 1 39-41	CEOC	9013416	Wallace Co., Kans.	81	82	3	3	100				4			180	205		41 - top died, 39,40 - many galls
					83		3	100				3	3	4	245	320		
					85		3	100				3	1	4	390	584		heavy leaf gall infestation
					87		3	100	0	0	0	5	7	6	508	624	10	
					88		3	100	1	9	1	4	5	9				40,41 - witches'-broom
					89		3	100	0	0		4						
					90		3	100				6				754	16	
					95		3	100								963	21	
					00		3	100	3	6	n.o.					1155	26	
					05		3	100								1169	30	
B3 2 1-6	CEOC	9013417	Wallace Co., Kans.	81	82	6	6	100				3			150	170		2 - rodent damage
					83		6	100				4	3	4	210	285		
					85		6	100				3	1	7	438	630		heavy leaf gall infestation
					87		6	100	0	0	0	5	9	5	471	631	11	
					88		6	100	5	6	1	5	5	6				
					89		6	100	0	0		6						
					90		6	100				6				754	15	
					95		6	100								829	18	
					00		6	100	6	2	1					1024	21	
					05		5	67								1130	24	1 - dead
B3 2 7-12	CELTI	9013424	Ellis Co., Kans.	81	82	6	6	100				2			255	235		
					83		6	100				3	6	5	285	335		12 - broken leader
					85		6	100				3	1	4	487	531		12 - main stem broken at fork
					87		6	100	2	9	1	5	7	1	591	577	10	
					88		6	100	5	1	1	5	3	4				7 - frost damage
					89		6	100	0	0		5						
					90		6	100				6				750	11	
					95		6	100								756	14	
					00		6	100	5	3	5					915	18	12 – canker
					05		6	100								786	18	9 – two stems dead
B3 2 13-18	CEOC	9004266	Dickinson Co., Kans.	81	82	6	6	100				1			225	250		14,18 - broken off
					83		5	83				3	4	5	360	400		18 - broken limb
					85		5	83				2	1	3	517	576		15 - base of bole split
					87		5	83	0	0	0	7	7	6	650	723	11	13 - sap flow; 18 - wind damage
					88		5	83	2	8	1	8	4	5				
					89		5	83	0	0		6						
					90		5	83				6				839	17	
					95		5	83								934	20	
					00		5	83	1	8	1					1183	23	
					05		5	83								1340	28	

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 2 19-24	CELA	9013434	Tulsa Co., Okla.	81	82	6	5	83				4			160	225		20 - dead, replanted 12-2
					83		6	100				2	4	3	290	330		
					85		6	100				4	1	2	446	452		20, 23 - top broken out (TBO)
					87		6	100	0	0	0	7	6	2	548	611	11	wind damage; 19 - TBO
					88		6	100	2	9	1	7	3	2				22 - winter injury
					89		6	100	0	0		4						
					90		6	100				5				783	15	
					95		6	100								1006	21	
					00		6	100	3	7	1					1329	29	
					05		6	100								1446	37	24 – large stem broken
B3 2 25-27	CELA	9007333	New Castle Co., Del.	81	82	3	3	100				3			185	140		Leaves different
					83		3	100				2	4	4	290	350		
					85		3	100	3	8	7	4	1	3	490	427		3 produced fruit
					87		3	100	3	1	1	5	6	8	612	526	9	19 - top broken
					88		3	100	3	9	2	7	1	1				
					89		3	100	3	1	1	6						
					90		3	100				7				614	11	few blooms
					95		3	100								729	14	
					00		2	67	2	5	1					964	17	
					05		2	67								985	20	
B3 2 28-33	CELA	9013436	Kingfisher Co., Okla.	81	82	6	6	100				5			150	160		Looks different
					83		6	100				4	4	4	275	285		
					85		6	100				5	1	4	420	394		29 - top broken out
					87		6	100	0	0	0	6	6	2	553	546	6	not leafy, leaves small
					88		6	100	6	2	1	7	1	1				few blooms
					89		6	100	1	0		7						
					90		6	100				7				671	10	
					95		6	100								855	16	
					00		6	100	6	6	1					1074	21	
					05		6	100								1222	28	30 – limb breakage
B3 2 34-39	CEOC	9013437	Gove Co., Kans.	81	82	6	6	100				3			215	255		37 - some galls
					83		6	100				2	3	5	270	395		
					85		6	100	3	7	7	4	1	4	455	503		3 produced fruit
					87		6	100	0	0	0	5	7	3	460	594	9	39 - crooked trunk
					88		6	100	2	9	1	5	7	4				
					89		6	100	1	0		5						witches'-broom
					90		6	100				5				679	12	
					95		6	100								850	16	
					00		6	100	1	7	1					1126	23	
					05		6	100								1301	30	

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 2 40-42	CEAU7	9010081	Italy	81	82	3	3	100							140	100		
					83		3	100				4	4	5	230	195		
					85		3	100										
					87		3	100	3	2	1	6	5	8	539	436	7	
					88		3	100	3	6	1	6	2	5				
					89		3	100	3	1		6						
					90		3	100	3	7		6				558	9	
					95		3	100								670	12	
					00		3	100								796	15	
					05		3	100								836	17	
B3 W 3-8	CELTI	9013438	Gove Co., Kans.	81	82	6	6	100				6			90	95		
					83		6	100				5	3	7	120	140		
					85		6	100				5	1	5	364	287		
					87		6	100	1	8	1	7	7	7	457	417	5	
					88		6	100	6	3	1	8	2	4				
					89		6	100	4	7		6						
					90		6	100				5				554	7	
					95		6	100								648	10	
					00		6	100	6	1	1					726	13	
					05		6	100								748	17	
B3 W 9-13	CELA	9013439	Harmon Co., Okla.	81	82	5	5	100				6			115	90		
					83		5	100				5	4	6	160	130		
					85		5	100				7	1	2	418	282		good foliage persistance
					87		5	100	3	8	1	7	2	4	569	413	6	10 - weak trunk
					88		5	100	6	5	1	7	1	1				frost damage
					89		5	100	0	0		7						
					90		5	100				7				612	10	9 - winter injury
					95		5	100								759	15	
					00		5	100	5	3	1					814	17	9 - only 1 side branch remains
					05		5	100								845	20	
B3 W 14-19	CEOC	9013440	Sheridan Co., Kans.	81	82	6	6	100				3			145	160		
					83		6	100				4	3	6	180	220		
					85		6	100				3	1	6	458	526		galls
					87		6	100	0	0	0	6	8	7	605	563	13	
					88		6	100	6	6	1	6	6	2				19 - mildew, witches'-broom
					89		6	100	0	0		5						main trunk remained
					90		6	100				5				724	16	
					95		6	100								904	25	
					00		6	100	6	2	2					1102	29	
					05		6	100								1160	38	

Table 2.3B Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location	PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 W 20-25	CEOC	9030313	KSU Forestry	81	82	6	6	100				3			160	165		
					83		6	100				2	32	6	185	260		
					85		6	100				2	9	8	462	589		galls
					87		6	100	0	0	0	6	7	5	592	651	15	
					88		6	100	6	5	1	5		4				
					89		6	100	0	0		5						
					90		6	100				4				807	20	
					95		6	100								1000	28	
					00		6	100	6	5	2					1088	32	
					05		5	67								1096	37	25 - dead
B3 W 26-31	CEOC	9030314	Nebraska	81	82	6	6	100				3			135	160		
					83		6	100				4	3	7	135	235		
					85		6	100				5	2	8	302	406		heavy insect damage
					87		6	100	0	0	0	7	9	6	449	526	13	29 - Short, bark split
					88		6	100	3	7	1	7	8	3				frost damage; 26-28 - witches'-brm
					89		6	100	0	0		5						
					90		6	100				5				639	15	some yellowing - 6/08
					95		6	100								924	25	
					00		6	100	5	4	1					1047	28	
					05		6	100								1017	33	29 – half dead
B3 W 32	CELTI	9015678	Hungary	82	82	1	1	100				6			60	45		
					83		1	100				4	4	6	90	70		
					85		1	100				7	1	2	286	210		
					87		1	100	1	4	1	7	2	7	497	411	5	
					88		1	100	1	2	1	6	3	1				mildew
					89		1	100	1	4		7						
					90		1	100				6				573	9	
					95		1	100								837	14	
					00		1	100	1	1	1					897	15	
					05		1	100								775	16	
B3 W 33	CELTI	9021223	USSR	82	82	1	1	100										
					83		1	100				6	4	5	65	30		
					85		1	100				7	1	2	220	204		forked
					87		1	100	1	8	1	7	3	3	500	488	6	
					88		1	100	1	3	1	6	2	1				chlorosis
					89		1	100	1	7		6						
					90		1	100				5				588	8	
					95		1	100								990	16	
					00		1	100	1	1	1					960	15	
					05		1	100								925	18	

Table 2.1A Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location		PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 W	34	CELA	9022741	Anne Arundel	82	82	1	1	100										
				Co., Md.		83		1	100				5	4	6	60	55		
						85		1	100				7	1	4	273	248		
						87		1	100	1	9	0	7	6	7	658	514	7	forked
						88		1	100	1	2	1	6	7	2				mildew, chlorosis
						89		1	100	0	0		5						
						90		1	100				6				618	10	
						95		1	100								964	15	
						00		1	100	1	2	2					1022	18	
						05		1	100								925	21	
B3 W	35	CELTI	9026427	Romania	82	82	1	1	100										
						83		1	100				7	3	5	25	30		
						85		1	100				9	2	2	126	123		
						87		1	100	0	0	0	8	5	6	463	458	4	
						88		1	100	1	6	1	9	6	1				chlorosis
						89		1	100	1	0		8						
						90		1	100				7				598	7	
						95		1	100								882	13	top dead
						00		1	100	1	2	5	9				762	12	
						05		1	100								651	11	dieback
B3 W	36-38	CELTI	9017884	USSR	82	82	3	3	100				7			38	27		
						83		3	100				3	4	6	85	65		
						85		3	100				7	1	2	214	183		
						87		3	100	2	3	1	8	4	4	490	384	8	36, 38 - forked
						88		3	100	3	4	1	6	3	3				
						89		3	100	3	5		6						
						90		3	100				6				538	10	
						95		3	100								805	13	
						00		3	100	3	1	4					808	17	36 - many dead stems
						05		3	100								799	20	36, 37 – tops dead
B3 W	39	CELA	9026672	Edgecombe Co.,	82	82	1												
				N.C.		83		1	100				5	4	4	40	65		
						85		1	100				9	1	6	182	144	ms	deer browse
						87		1	100	0	0	0	8	2	2	433	455		main stem dead - respouts
						88		1	100	0	0	0	8	9	2				
						89		1	100	0	0		8						
						90		1	100				9				578	10	
						95		1	100								817	14	
						00		1	100	0	0	0					914	16	
						05		1	100								919	19	

Table 2.3B Study No. - 20I026K Initial Evaluation: Hackberry (*Celtis* sp.), Manhattan, Kansas (continued).

Plot Location		PLT SYM	Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	NUM FRT	SD AMT	SD FILL	VI	DI	IN	CAN COV	PLT HGT	PLT DBH	Plot Remarks
B3 W	40-41	CELTI	9023017	France	82	82	2												
						83		2	100				6	4	6	50	45		
						85		2	100				8	2	4	187	175		
						87		2	100	1	7	1	8	4	3	479	411	6	41 - missing leader
						88		2	100	2	4	1	8	2	1				
						89		2	100	2	6		7						
						90		2	100				9				465	7	
						95		2	100								591	10	
						00		2	100	2	8	1					740	12	
						05		2	100								795	17	
B3 W	42	CELTI	9026641	Champaign Co., ILL.	82	82													
						83		1	100				4	4	7	45	70		
						85		1	100				9	68	4	160	141		
						87		1	100	0	0	0	8	9	7	467	445	5	
						88		1	100	0	0	0	8		1				chlorosis
						89		1	100	0	0		8						
						90		1	100				8				542	8	
						95		1	100								651	11	
						00		1	100	0	0						771	13	
						05		1	100								759	14	
B3 W	43	CEOC	9026643	Champaign Co., ILL.	82	82	1												
						83		1	100				4	4	6	20	70		
						85		1	100				8	6	4	220	135		
						87		1	100	0	0	0	7	6	5	422	483	4	
						88		1	100	0	0	0	8	6	2				chlorosis
						89		1	100	0	0		8						
						90		1	100				8				540	7	
						95		1	100								699	9	
						00		1	100	1	4	2					948	17	
						05		1	100								956	21	
B3 W	44	CELTI	9026646	Gove Co., Kans.	82	82	1												
						83		1	100				4	4	5	25	40		
						85		1	100				8	4	5	225	174		
						87		1	100	0	0	0	8	5	6	370	347	6	
						88		1	100	1	9	1	9	2	4				
						89		1	100	1	5		9						
						90		1	100				9				404	5	
						95		1	100								554	8	
						00		1	100	1	1	1					662	11	
						05		1	100								673	13	

Refer to page 100, Legend for woody plant evaluations.

Table 3.1 Study No. – 20I041K Initial Evaluation: Siberian elm (*Ulmus pumila*), Akron, Colorado.

Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	FOL DEN	PLT HGT	BAS DIA	Remarks
9050184	Roger Mills Co., Okla.	99	00	9	9	100		173		
			01		9	100		244		
			02		9	100		245		
			03		9	100		282		
			05		9	100	94	353	10.4	
9050213	Woodward Co., Okla.	99	00	9	9	100		157		
			01		9	100		238		
			02		9	100		241		
			03		9	100		289		
			05		9	100	67	341	10.6	
9050214	Beaver Co., Okla.	99	00	9	9	100		180		
			01		9	100		262		
			02		9	100		262		
			03		9	100		276		2-214-1 - dieback
			05		9	100	78	342	12.0	
9050216	Ellis Co., Okla.	99	00	9	9	100		171		
			01		9	100		257		
			02		9	100		261		
			03		9	100		304		
			05		9	100	83	345	12.0	
9050217	Ellis Co., Okla.	99	00	9	9	100		173		
			01		9	100		253		
			02		9	100		254		
			03		9	100		298		
			05		9	100	72	308	11.2	
9050219	Stevens Co., Kans.	99	00	9	9	100		185		
			01		9	100		268		
			02		9	100		273		
			03		8	89		310		
			05		8	89	75	359	11.5	
9050222	Custer Co., Okla.	99	00	9	9	100		180		
			01		9	100		269		
			02		9	100		267		
			03		9	100		301		
			05		9	100	100	342	11.1	

Table 3.1 Study No. – 20I041K Initial Evaluation: Siberian elm (*Ulmus pumila*), Akron, Colorado (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	FOL DEN	PLT HGT	BAS DIA	Remarks
9050224	Custer Co., Okla.	99	00	9	9	100		180		
			01		9	100		271		
			02		9	100		278		
			03		9	100		319		
			05		9	100	100	381	11.6	
9050225	Custer Co., Okla.	99	00	9	9	100		164		
			01		9	100		248		
			02		9	100		251		
			03		9	100		278		3-225-1 - dieback
			05		7	78	100	359	11.5	
9050226	Custer Co., Okla.	99	00	9	9	100		173		
			01		9	100		258		
			02		8	89		260		
			03		8	89		290		
			05		8	89	100	337	11.5	
9050228	Custer Co., Okla.	99	00	9	9	100		167		
			01		9	100		252		
			02		9	100		256		
			03		9	100		297		
			05		9	100	94	359	10.9	
9050233	Harper Co., Okla.	99	00	9	9	100		154		
			01		9	100		237		
			02		9	100		245		
			03		9	100		264		3-233-3 dieback
			05		9	100	83	312	10.9	
9050235	Garfield Co., Okla.	99	00	9	9	100		169		
			01		9	100		261		
			02		9	100		262		
			03		9	100		317		
			05		9	100	83	370	11.2	
9050240	Cotton Co., Okla.	99	00	9	9	100		163		
			01		9	100		245		
			02		9	100		249		
			03		9	100		267		1-240-2 - dieback
			05		8	89	94	354	11.9	
9050241	Cotton Co., Okla.	99	00	9	9	100		178		
			01		9	100		252		
			02		9	100		255		
			03		9	100		278		1-241-2 - dieback
			05		9	100	94	328	10.5	

Table 3.2 Study No. – 20I041K Initial Evaluation: Siberian elm (*Ulmus pumila*), Sidney, Nebraska.

Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	FOL DEN	PLT HGT	BAS DIA	Remarks
9050184	Roger Mills Co., Okla.	99	00	9	9	100		186		
			01		9	100		232		
			02		9	100		285		
			03		9	100		312		
			05		9	100	67	326	11.4	
9050213	Woodward Co., Okla.	99	00	9	9	100		139		
			01		8	89		176		
			02		8	89		242		
			03		8	89		271		
			05		8	89	29	315	10.9	
9050214	Beaver Co., Okla.	99	00	9	9	100		197		
			01		9	100		243		
			02		9	100		290		
			03		8	89		315		
			05		7	78	93	365	11.9	
9050217	Ellis Co., Okla.	99	00	9	9	100		178		
			01		9	100		215		
			02		9	100		255		
			03		7	78		272		
			05		8	89	50	323	11.9	
9050219	Stevens Co., Kans.	99	00	9	9	100		165		
			01		9	100		193		1-219-3 – resprout from base
			02		9	100		261		
			03		8	89		279		
			05		7	78	67	289	13.1	
9050222	Custer Co., Okla.	99	00	9	9	100		155		
			01		9	100		193		
			02		9	100		256		
			03		9	100		278		
			05		9	100	56	318	11.5	
9050224	Custer Co., Okla.	99	00	9	9	100		175		
			01		9	100		207		
			02		9	100		249		
			03		9	100		272		
			05		9	100	78	315	10.6	
9050226	Custer Co., Okla.	99	00	9	9	100		165		
			01		9	100		200		
			02		9	100		257		
			03		8	89		291		
			05		9	100	78	345	13.4	

Table 3.2 Study No. – 20I041K Initial Evaluation: Siberian elm (*Ulmus pumila*), Sidney, Nebraska (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO PLT	NO SRV	PCT SRV	FOL DEN	PLT HGT	BAS DIA	Remarks
9050228	Custer Co., Okla.	99	00	9	9	100		172		
			01		9	100		206		
			02		9	100		230		
			03		8	89		247		
			05		8	89	81	292	13.2	
9050233	Harper Co., Okla.	99	00	9	9	100		150		
			01		9	100		190		
			02		9	100		226		
			03		9	100		251		
			05		9	100	75	290	12.3	
9050240	Cotton Co., Okla.	99	00	9	9	100		165		
			01		9	100		211		
			02		9	100		254		3-240-2 - dieback
			03		8	89		276		
			05		8	89	99	351	12.5	

Refer to page 100, legend for woody plant evaluations.

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas.

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9008041	no. plains /NDPMC	02	02	9	9	100						3.1		106	89	1.0	5.2
			03		9	100	4/14	9		8	9.0		7.0		142		10.9
			04		9	100		9	3.0	8	7.7						
			05		9	100									175		
9050188	Lyon Co., Kans.	02	02	9	9	100						1.8		80	77	1.0	4.6
			03		9	100	4/15	7		5	7.4		3.2		149		6.4
			04		9	100		9	4.6	9	5.0						
			05		9	100									216		
9050250	Johnson Co., Nebr.	02	02	9	9	100						2.4		105	114	1.6	4.8
			03		9	100	4/14	9		8	5.9		1.9		192		8.9
			04		9	100		9	3.1	9	4.0						
			05		9	100									253		
9050251	Pawnee Co., Nebr.	02	02	9	9	100						3.0		72	109	1.0	4.3
			03		9	100	4/15	3		3	7.8		3.1		186		6.2
			04		9	100		9	4.4	9	3.7						
			05		9	100									257		
9050253	Lincoln Co., Nebr.	02	02	9	9	100						3.4		67	102	1.0	5.2
			03		9	100	4/15	3		3	8.7		4.8		180		8.8
			04		9	100		9	3.8	8	6.2						
			05		9	100									279		
9050261	Douglas Co., Kans.	02	02	9	9	100						1.8		112	110	1.0	4.8
			03		9	100	4/15	8		7	6.2		3.3		195		9.2
			04		9	100		9	3.2	9	3.1						
			05		9	100									267		
9050262	Wheeler Co., Nebr.	02	02	9	9	100						2.2		98	101	1.0	8.1
			03		9	100	4/14	9		9	6.9		3.2		166		10.8
			04		9	100		9	2.6	9	2.8						
			05		9	100									240		
9050269	Holt Co., Nebr.	02	02	9	9	100						3.6		102	102	1.6	6.4
			03		9	100	4/14	9		9	8.2		3.4		167		9.2
			04		9	100		9	2.8	9	4.4						
			05		9	100									216		
9050271	Neosho Co., Kans.	02	02	9	7	78						2.1		69	84	1.0	3.1
			03		7	78	4/16	6		6	5.6		3.1		153		6.3
			04		7	78		6	3.2	7	3.2						
			05		7	78									238		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050272	Crawford Co., Kans.	02	02	9	9	100						1.6		106	116	1.0	5.6
			03		9	100	4/14	9		9	2.9		2.8		194		7.1
			04		9	100		9	3.0	9	3.0						
			05		9	100									263		
9050273	Anderson Co., Kans.	02	02	9	8	89						1.9		91	82	1.0	4.5
			03		8	89	4/14	5		5	5.6		3.3		159		8.8
			04		8	89		8	2.6	8	3.0						
			05		8	89									224		
9050274	Dickinson Co., Kans.	02	02	9	9	100						1.7		106	105	1.0	7.4
			03		9	100	4/15	9		9	5.4		2.0		186		8.4
			04		9	100		9	3.1	9	3.0						
			05		9	100									265		
9050275	Shawnee Co., Kans.	02	02	9	8	89						2.3		105	101	1.0	5.8
			03		8	89	4/14	6		5	8.8		2.9		170		9.8
			04		8	89		7	3.9	7	4.5						
			05		8	89									239		
9050277	Holt Co., Nebr.	02	02	9	9	100						3.6		109	115	2.3	6.1
			03		9	100	4/14	8		6	7.2		4.7		182		8.6
			04		9	100		9	2.3	9	5.2						
			05		9	100									253		
9050279	Wheeler Co., Nebr.	02	02	9	9	100						2.8		103	135	1.4	7.7
			03		9	100	4/13	9		6	8.7		2.8		220		10.8
			04		9	100		9	2.3	9	3.7						
			05		9	100									286		
9050280	Dickinson Co., Kans.	02	02	9	9	100						1.4		102	114	1.0	4.6
			03		9	100	4/14	6		5	6.9		1.7		196		8.8
			04		9	100		9	3.2	9	3.2						
			05		9	100									274		
9050284	Reno Co., Kans.	02	02	9	8	89						1.9		73	129	1.0	4.5
			03		8	89	4/15	3		1	7.9		2.8		222		8.4
			04		8	89		8	2.9	8	2.4						
			05		8	89									305		
9050285	Hodgeman Co., Kans.	02	02	9	9	100						2.4		79	113	1.2	5.4
			03		9	100	4/15	1		1	8.3		2.9		206		8.7
			04		9	100		9	3.7	9	3.3						
			05		9	100									295		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050292	Nuckolls Co., Nebr.	02	02	9	9	100						2.3		112	122	1.1	6.3
			03		9	100	4/15	7		7	5.0		2.9		205		12.6
			04		9	100		9	2.2	9	3.2						
			05		9	100									276		
9050293	Buffalo Co., Nebr.	02	02	9	9	100						2.0		81	104	1.0	5.6
			03		9	100	4/14	5		5	7.2		3.3		186		7.1
			04		9	100		9	3.1	9	3.0						
			05		9	100									267		
9050294	Greeley Co., Nebr.	02	02	9	9	100						2.0		95	126	1.6	5.4
			03		9	100	4/14	8		7	5.6		3.6		200		8.4
			04		9	100		9	2.3	9	3.3						
			05		9	100									272		
9050295	Miami Co., Kans.	02	02	9	9	100						1.9		115	89	1.4	6.1
			03		9	100	4/14	8		6	6.4		2.7		156		12.1
			04		9	100		9	3.1	9	4.3						
			05		9	100									228		
9050297	Pawnee Co., Nebr.	02	02	9	9	100						2.8		81	100	1.0	3.7
			03		9	100	4/15	1		1	8.2		3.9		182		5.6
			04		9	100		9	2.9	9	2.3						
			05		9	100									250		
9050298	Cuming Co., Nebr.	02	02	9	9	100						3.3		111	119	1.9	4.7
			03		9	100	4/14	7		4	7.2		3.6		215		11.7
			04		9	100		9	3.3	9	3.1						
			05		9	100									277		
9050299	Pratt Co., Kans.	02	02	9	9	100						2.1		90	105	1.2	6.8
			03		9	100	4/15	6		5	7.4		3.3		177		13.3
			04		9	100		9	2.8	9	3.2						
			05		9	100									261		
9050300	Russell Co., Kans.	02	02	9	9	100						1.4		70	111	1.0	5.3
			03		9	100	4/16	4		2	8.7		1.6		191		8.9
			04		9	100		9	3.2	9	5.4						
			05		9	100									277		
9050307	Colfax Co., Nebr.	02	02	9	9	100						2.1		128	116	1.0	8.2
			03		9	100	4/15	7		7	5.3		3.1		208		14.4
			04		9	100		9	3.2	9	3.6						
			05		9	100									293		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050308	Cheyenne Co., Kans.	02	02	9	9	100						2.9		110	127	1.2	6.2
			03		9	100	4/14	5		3	8.4		2.4		212		13.9
			04		9	100		9	4.1	9	3.9						
			05		9	100									301		
9050309	Sioux Co., Nebr.	02	02	9	9	100						4.2		64	73	1.0	6.2
			03		9	100	4/15	2		0	9.0		6.3		109		11.8
			04		9	100		9	6.2	5	8.0						
			05		9	100									163		
9050310	Douglas Co., Kans.	02	02	9	9	100						1.8		99	104	1.0	3.9
			03		9	100	4/16	5		3	8.7		3.4		200		8.2
			04		9	100		9	3.0	9	4.0						
			05		9	100									276		
9050312	Knox Co., Nebr.	02	02	9	9	100						3.9		111	119	1.3	7.3
			03		9	100	4/14	8		8	5.9		3.1		200		11.8
			04		9	100		9	1.9	9	3.8						
			05		9	100									279		
9050313	Knox Co., Nebr.	02	02	9	9	100						3.8		105	126	1.8	6.6
			03		9	100	4/14	7		7	7.4		4.4		221		10.3
			04		9	100		9	2.4	9	3.4						
			05		9	100									282		
9050314	Dodge Co., Nebr.	02	02	9	9	100						1.9		110	125	1.3	6.3
			03		9	100	4/14	8		8	6.3		2.1		239		7.7
			04		9	100		9	2.8	9	3.2						
			05		9	100									319		
9050316	Kiowa Co., Kans.	02	02	9	9	100						1.7		79	130	1.3	6.0
			03		9	100	4/15	3		1	8.1		2.8		218		9.4
			04		9	100		9	3.0	9	3.0						
			05		9	100									309		
9050315	Trego Co., Kans.	02	02	9	9	100						3.0		92	105	1.6	6.9
			03		9	100	4/15	5		4	8.0		3.1		180		10.8
			04		9	100		8	4.1	7	5.7						
			05		9	100									264		
9050317	Smith Co., Kans.	02	02	9	9	100						1.7		108	114	1.3	4.9
			03		9	100	4/15	7		4	8.4		2.8		195		12.1
			04		9	100		9	2.2	9	3.8						
			05		9	100									278		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050318	Kingman Co., Kans.	02	02	9	9	100						2.2		94	100	1.2	6.7
			03		9	100	4/15	5		4	7.6		2.0		195		11.1
			04		9	100		9	2.3	9	3.8						
			05		9	100									275		
9050319	Keith Co., Nebr.	02	02	9	9	100						3.2		75	92	1.0	5.9
			03		9	100	4/15	4		1	9.0		4.4		152		8.7
			04		9	100		9	3.4	9	6.1						
			05		9	100									221		
9050321	Howard Co., Nebr.	02	02	9	9	100						2.5		102	122	1.8	8.3
			03		9	100	4/14	9		8	8.4		3.0		205		14.0
			04		9	100		9	3.1	9	4.1						
			05		9	100									277		
9050324	Harvey Co., Kans.	02	02	9	9	100						1.6		102	110	1.0	4.7
			03		9	100	4/15	8		7	6.4		3.6		201		7.7
			04		9	100		9	2.7	9	3.4						
			05		9	100									287		
9050325	Neosho Co., Kans.	02	02	9	9	100						2.0		103	114	1.0	5.7
			03		9	100	4/16	6		5	6.6		2.4		189		11.1
			04		9	100		9	3.0	9	3.1						
			05		9	100									250		
9050327	Graham Co., Kans.	02	02	9	9	100						2.0		86	105	1.3	7.1
			03		9	100	4/15	5		5	7.4		3.4		199		13.2
			04		9	100		9	3.2	9	4.9						
			05		9	100									277		
9050328	Cherokee Co., Kans.	02	02	9	9	100						1.3		93	91	1.0	5.2
			03		9	100	4/16	6		6	5.6		2.6		160		8.0
			04		9	100		9	3.4	9	3.2						
			05		9	100									231		
9050329	Cherokee Co., Kans.	02	02	9	9	100						1.2		80	93	1.3	4.8
			03		9	100	4/14	6		6	6.1		3.1		177		8.2
			04		9	100		9	2.7	9	2.6						
			05		9	100									237		
9050334	Cotton Co., Okla.	02	02	9	9	100						2.8		82	117	1.0	7.3
			03		9	100	4/19	2		2	8.4		2.8		185		13.0
			04		9	100		8	4.8	8	4.0						
			05		9	100									266		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050335	Cotton Co., Okla.	02	02	9	9	100						1.9		94	115	1.0	5.8
			03		9	100	4/18	3		3	8.1		3.1		187		10.6
			04		9	100		9	2.7	9	2.4						
			05		9	100									263		
9050336	Johnson Co., Nebr.	02	02	9	9	100						2.4		116	102	1.6	6.2
			03		9	100	4/15	5		4	7.4		3.1		212		9.7
			04		9	100		9	3.8	9	4.4						
			05		9	100									273		
9050337	Linn Co., Kans.	02	02	9	9	100						2.6		110	113	1.0	4.2
			03		9	100	4/15	7		7	5.6		3.1		185		7.8
			04		9	100		9	2.9	9	3.6						
			05		9	100									253		
9050342	Cleveland Co., Okla.	02	02	9	9	100						1.1		70	86	1.0	6.1
			03		9	100	4/17	2		0	9.0		2.3		190		8.7
			04		9	100		9	3.9	8	4.2						
			05		9	100									250		
9050343	Cleveland Co., Okla.	02	02	9	9	100						2.3		80	119	1.0	4.6
			03		9	100	4/18	3		3	6.7		2.2		234		6.8
			04		9	100		9	3.4	9	3.6						
			05		9	100									339		
9050344	Harper Co., Kans.	02	02	9	9	100						1.2		102	115	1.0	7.0
			03		9	100	4/16	4		3	7.9		3.0		215		9.9
			04		9	100		9	2.7	9	4.3						
			05		9	100									304		
9050345	Elk Co., Kans.	02	02	9	9	100						1.8		107	101	1.0	7.0
			03		9	100	4/14	6		6	5.6		2.9		184		11.2
			04		9	100		9	2.3	9	2.0						
			05		9	100									244		
9050346	Greenwood Co., Kans.	02	02	9	9	100						1.2		108	102	1.1	6.0
			03		9	100	4/13	9		9	2.8		2.8		171		7.9
			04		9	100		9	2.4	9	3.1						
			05		9	100									231		
9050348	Greenwood Co., Okla.	02	02	9	8	89						2.8		103	118	1.4	6.5
			03		8	89	4/19	5		4	7.1		2.6		219		13.8
			04		8	89		8	2.1	8	3.0						
			05		8	89									291		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050349	Haskell Co., Okla.	02	02	9	9	100						1.9		87	97	1.0	6.2
			03		9	100	4/15	4		3	7.7		2.0		197		8.0
			04		9	100		9	3.8	9	1.4						
			05		9	100									267		
9050353	Nance Co., Nebr.	02	02	9	9	100						3.2		117	115	1.4	6.0
			03		9	100	4/15	8		7	7.8		2.8		203		13.6
			04		9	100		9	2.7	9	3.9						
			05		9	100									270		
9050354	Reno Co., Kans.	02	02	9	9	100						1.2		116	135	1.0	8.3
			03		9	100	4/16	5		5	6.9		4.0		225		12.3
			04		9	100		9	1.3	9	1.6						
			05		9	100									306		
9050355	Reno Co., Kans.	02	02	9	9	100						1.6		75	139	1.0	3.7
			03		9	100	4/15	2		2	8.0		2.6		216		8.7
			04		9	100		9	3.0	9	3.6						
			05		9	100									293		
9050356	Jefferson Co., Okla.	02	02	9	9	100						1.3		88	104	1.0	6.4
			03		9	100	4/18	1		1	8.7		3.2		205		10.2
			04		9	100		9	2.8	9	2.3						
			05		9	100									276		
9050361	Chautauqua Co., Kans.	02	02	9	9	100						2.8		97	103	1.0	5.8
			03		9	100	4/18	4		3	8.0		3.0		186		9.3
			04		9	100		9	3.4	9	2.3						
			05		9	100									234		
9050362	Alfalfa Co., Okla.	02	02	9	9	100						1.4		73	124	1.0	5.7
			03		9	100	4/18	0		0	9.0		2.3		214		7.3
			04		9	100		9	3.1	9	2.8						
			05		9	100									298		
9050365	McIntosh Co., Okla.	02	02	6	6	100						1.7		47	71	1.0	2.2
			03		6	100	4/16	3		2	7.8		2.3		141		7.2
			04		6	100		6	2.3	6	2.5						
			05		6	100									219		
9050366	Dodge Co., Nebr.	02	02	9	9	100						2.0		88	108	1.0	2.6
			03		9	100	4/15	8		7	7.9		3.2		186		5.1
			04		9	100		9	2.7	9	4.0						
			05		9	100									263		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050367	Thomas Co., Nebr.	02	02	9	9	100						4.2		90	90	1.0	7.9
			03		9	100	4/14	4		3	9.0		4.6		149		13.4
			04		9	100		9	4.1	9	5.0						
			05		9	100									235		
9050372	McPherson Co., Kans.	02	02	9	9	100						1.8		112	96	1.4	7.2
			03		9	100	4/15	6		6	6.1		2.9		182		12.7
			04		9	100		9	2.8	9	3.2						
			05		9	100									256		
9050373	Butler Co., Kans.	02	02	9	8	89						3.5		96	102	1.0	6.1
			03		8	89	4/15	4		4	6.9		2.5		171		11.0
			04		8	89		8	2.6	8	3.8						
			05		8	89									236		
9050374	Montgomery Co., Kans.	02	02	9	8	89						2.3		121	103	1.3	5.9
			03		8	89	4/15	6		5	7.3		2.4		191		14.9
			04		8	89		8	4.6	8	4.1						
			05		8	89									257		
9050377	Woodson Co., Kans.	02	02	9	9	100						2.2		91	92	1.1	6.0
			03		9	100	4/14	8		8	5.0		2.7		148		8.2
			04		9	100		9	1.6	9	3.8						
			05		9	100									212		
9050378	Republic Co., Kans.	02	02	9	9	100						3.1		109	124	1.2	5.3
			03		9	100	4/15	3		3	8.0		4.2		220		10.9
			04		9	100		9	3.4	9	3.8						
			05		9	100									291		
9050379	Richardson Co., Nebr.	02	02	9	9	100						2.4		99	120	2.2	5.8
			03		9	100	4/15	5		5	6.4		2.2		211		7.7
			04		9	100		9	2.1	9	2.8						
			05		9	100									283		
9050383	Norton Co., Kans.	02	02	9	9	100						2.9		62	114	1.0	5.9
			03		9	100	4/15	6		4	9.0		4.6		191		11.9
			04		9	100		9	3.6	9	5.4						
			05		9	100									275		
9050384	Sumner Co., Kans.	02	02	9	9	100						1.0		93	125	1.0	5.7
			03		9	100	4/16	9		8	3.9		2.3		202		9.1
			04		9	100		9	2.6	9	2.7						
			05		9	100									288		

Table 4.1a Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	NO. PLT	NO. SRV	PCT SRV	SPR REC DAT	NO. BLM	BLM AMT	NO. FRT	FRT AMT	DI*	HEA STR	CAN COV	PLT HGT	STM BRK†	NO. BAS STM/PLT
9050388	Antelope Co., Nebr.	02	02	9	9	100						3.1		96	111	1.0	4.6
			03		9	100	4/14	7		5	7.7		4.2		183		7.1
			04		9	100		9	4.1	9	4.4						
			05		9	100									253		
9050391	Washington Co., Kans.	02	02	9	9	100						2.6		92	87	1.0	5.4
			03		9	100	4/15	7		7	5.7		1.4		154		8.4
			04		9	100		9	2.6	9	4.8						
			05		9	100									225		
9050394	Pottawatomie Co., Kans.	02	02	9	8	89						2.9		97	105	1.5	6.3
			03		8	89	4/16	2		1	8.4		3.1		188		7.9
			04		8	89		8	3.8	8	3.4						
			05		8	89									271		
9050400	Clay Co., Kans.	02	02	9	9	100						1.4		88	101	1.0	6.6
			03		9	100	4/16	7		5	7.4		3.0		167		13.0
			04		9	100		9	2.8	9	3.7						
			05		9	100									240		

1-9, † 1-5 Rating = (Best-Worst); DNE=did not establish; HB= Heavy browsing; MD=mechanical damage; no. = northern; RP=replant; SB=stem breakage; SH=Sprawling Habit; Refer to page 100, legend for woody plant evaluations for additional legend information.

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas.

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9008041	no. plains /NDPMC	02	02			
			03			
			04	3.0	7.8	
9050188	Lyon Co., Kans.	02	02			
			03			
			04	2.9	4.1	
9050250	Johnson Co., Nebr.	02	02			
			03			
			04	3.9	2.3	
9050251	Pawnee Co., Nebr.	02	02			
			03			
			04	2.6	3.9	
9050253	Lincoln Co., Nebr.	02	02			
			03			
			04	2.0	4.0	
9050261	Douglas Co., Kans.	02	02			
			03			
			04	4.2	2.7	
9050262	Wheeler Co., Nebr.	02	02			
			03			
			04	2.6	4.2	
9050269	Holt Co., Nebr.	02	02			
			03			
			04	2.7	3.9	
9050271	Neosho Co., Kans.	02	02			2-262-3; 3-331-1 DNE
			03			2-262-3; 3-331-1 RP
			04	3.8	4.5	
9050272	Crawford Co., Kans.	02	02			
			03			
			04	4.6	3.1	
9050273	Anderson Co., Kans.	02	02			2-263-3 DNE
			03			2-263-3 RP
			04	3.0	4.6	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050274	Dickinson Co., Kans.	02	02			
			03			
			04	2.4	2.4	
9050275	Shawnee Co., Kans.	02	02			2-275-2 HB; 3-327-1 DNE
			03			3-327-1 RP
			04	3.4	3.8	
9050277	Holt Co., Nebr.	02	02			
			03			
			04	2.4	4.4	
9050279	Wheeler Co., Nebr.	02	02			
			03			
			04	2.6	2.3	
9050280	Dickinson Co., Kans.	02	02			
			03			
			04	3.4	1.8	
9050284	Reno Co., Kans.	02	02			3-352-3 DNE
			03			3-352-3 RP
			04	2.3	2.3	
9050285	Hodgeman Co., Kans.	02	02			
			03			
			04	2.3	3.6	
9050292	Nuckolls Co., Nebr.	02	02			
			03			
			04	2.4	2.2	
9050293	Buffalo Co., Nebr.	02	02			
			03			
			04	2.3	3.6	
9050294	Greeley Co., Nebr.	02	02			
			03			
			04	2.6	2.9	
9050295	Miami Co., Kans.	02	02			
			03			
			04	4.4	3.7	
9050297	Pawnee Co., Nebr.	02	02			
			03			
			04	3.2	3.8	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050298	Cuming Co., Nebr.	02	02			
			03			
			04	3.4	2.1	
9050299	Pratt Co., Kans.	02	02			
			03			
			04	2.7	3.2	
9050300	Russell Co., Kans.	02	02			
			03			
			04	2.8	3.2	
9050307	Colfax Co., Nebr.	02	02			
			03			
			04	2.7	1.8	
9050308	Cheyenne Co., Kans.	02	02			
			03			
			04	2.4	2.2	
9050309	Sioux Co., Nebr.	02	02			
			03			
			04	1.6	7.3	
9050310	Douglas Co., Kans.	02	02			
			03			
			04	4.3	2.2	
9050312	Knox Co., Nebr.	02	02			1-172-1 SB
			03			
			04	2.0	2.2	
9050313	Knox Co., Nebr.	02	02			
			03			
			04	1.8	3.3	
9050314	Dodge Co., Nebr.	02	02			
			03			
			04	2.7	2.2	
9050316	Kiowa Co., Kans.	02	02			
			03			
			04	2.7	2.4	
9050315	Trego Co., Kans.	02	02			
			03			
			04	2.9	3.3	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050317	Smith Co., Kans.	02	02			
			03			
			04	1.8	2.9	
9050318	Kingman Co., Kans.	02	02			
			03			
			04	2.9	3.6	
9050319	Keith Co., Nebr.	02	02			
			03			
			04	1.7	5.2	
9050321	Howard Co., Nebr.	02	02			
			03			
			04	2.1	2.3	
9050324	Harvey Co., Kans.	02	02			
			03			
			04	2.9	3.7	
9050325	Neosho Co., Kans.	02	02			
			03			
			04	3.6	2.8	
9050327	Graham Co., Kans.	02	02			
			03			1-129-1 SH
			04	2.4	2.4	
9050328	Cherokee Co., Kans.	02	02			
			03			
			04	4.0	3.7	
9050329	Cherokee Co., Kans.	02	02			
			03			
			04	4.6	3.6	
9050334	Cotton Co., Okla.	02	02			
			03			
			04	2.8	3.3	
9050335	Cotton Co., Okla.	02	02			
			03			
			04	4.0	3.8	
9050336	Johnson Co., Nebr.	02	02			
			03			
			04	3.3	2.8	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050337	Linn Co., Kans.	02	02			
			03			
			04	3.9	3.1	
9050342	Cleveland Co., Okla.	02	02			1-342-2 HB
			03			
			04	2.7	3.8	
9050343	Cleveland Co., Okla.	02	02			1-115-2 MD
			03			
			04	4.2	2.3	
9050344	Harper Co., Kans.	02	02			
			03			
			04	2.6	2.6	
9050345	Elk Co., Kans.	02	02			
			03			
			04	3.4	3.7	
9050346	Greenwood Co., Kans.	02	02			
			03			
			04	3.3	3.6	
9050348	Greenwood Co., Okla.	02	02			3-355-2 DNE
			03			3-355-2 RP
			04	4.0	2.9	
9050349	Haskell Co., Okla.	02	02			
			03			
			04	2.9	2.4	
9050353	Nance Co., Nebr.	02	02			
			03			
			04	2.2	2.3	
9050354	Reno Co., Kans.	02	02			
			03			
			04	2.3	2.2	
9050355	Reno Co., Kans.	02	02			
			03			
			04	3.4	2.6	
9050356	Jefferson Co., Okla.	02	02			
			03			
			04	3.0	1.6	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050361	Chautauqua Co., Kans.	02	02			
			03			
			04	4.2	3.1	
9050362	Alfalfa Co., Okla.	02	02			
			03			
			04	2.8	3.1	
9050365	McIntosh Co., Okla.	02	02			3-347-1; 3-359-1; 3-359-2 DNE
			03			3-347-1; 3-359-1; 3-359-2 RP
			04	3.5	5.2	
9050366	Dodge Co., Nebr.	02	02			
			03			
			04	2.8	2.8	
9050367	Thomas Co., Nebr.	02	02			
			03			
			04	2.0	5.0	
9050372	McPherson Co., Kans.	02	02			
			03			
			04	2.8	2.4	
9050373	Butler Co., Kans.	02	02			1-105-3 DNE
			03			
			04	3.5	2.9	
9050374	Montgomery Co., Kans.	02	02			3-309-3 DNE
			03			3-309-3 RP
			04	3.4	2.4	
9050377	Woodson Co., Kans.	02	02			
			03			
			04	3.3	3.9	
9050378	Republic Co., Kans.	02	02			
			03			
			04	2.8	1.4	
9050379	Richardson Co., Nebr.	02	02			3-320-1 SB
			03			
			04	4.2	2.1	
9050383	Norton Co., Kans.	02	02			
			03			
			04	2.6	4.0	

Table 4.1b Study No. – 20I042E Initial Evaluation: False indigobush (*Amorpha fruticosa*), Manhattan, Kansas (continued).

Accession Number	Origin/Source	YR PLT	YR REC	DBK	VIG	Remarks
9050384	Sumner Co., Kans.	02	02			2-268-1 MD
			03			
			04	3.4	2.6	
9050388	Antelope Co., Nebr.	02	02			
			03			
			04	2.1	3.8	
9050391	Washington Co., Kans.	02	02			
			03			
			04	3.0	4.3	
9050394	Pottawatomie Co., Kans.	02	02			2-246-2 DNE
			03			2-246-2 RP
			04	3.3	3.0	
9050400	Clay Co., Kans.	02	02			
			03			
			04	3.4	3.4	

1-9, † 1-5 Rating = (Best-Worst); DNE=did not establish; HB= Heavy browsing; MD=mechanical damage; no. = northern; RP=replant; SB=stem breakage; SH=Sprawling Habit; Refer to page 100, legend for woody plant evaluations for additional legend information.

Legend for woody plant evaluations:

Plot Location: Field number, row number, and plot (numbered spaces in the row).
Eg. B3 1 9-14, Field B3 Row 1 Plot numbers 9-14.

BAS DIA: Trunk diameter 10 cm above the ground.
CAN COV: Crown width or ground cover as measured in centimeters.
CT: Cold Tolerance, rating 1-9 (best-worst).
DBK: Die back
DI: Disease Resistance, rating 1-9.
FOL ABU: Foliage Abundance, rating 1-9.
FOL DEN: Foliage Density, rating 1-9.
FOL DIS: Foliage Distribution
FRT AMT: Fruit Amount, rating 1-9.
FLW AMT: Amount of Flowers, rating 1-9.
HEA STR: Heat Stress
IN: Insect Resistance, rating 1-9.
ms: multiple stem.
MAT DAT: Maturity Date
NO. BAS STM /PLT: Number of basal stem per plant.
NO. EST: Number Established
NO. FLW: Number Flowering
NO. FRT: Number of trees producing fruit.
NO. PLT: Number of trees planted. *
n. o.: not observed
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
SD AMT: Seed Amount, rating 1-9.
SD Fill: Seed Fill, rating 1-9.
SPR REC: Spring Recovery Date
STM BRK: Stem Breakage, rating 1-9.
UN: Uniformity, rating 1-9.
VI: Plant Vigor, rating 1-9.
YR PLT: Year Planted.
YR REC: Year of Record

* May not agree with current plot number designations in miscellaneous woody plant materials.

Figure 1.2 Plot Map: Study No. 20I010K – Trees and shrubs - Field G. ▲ North ▲

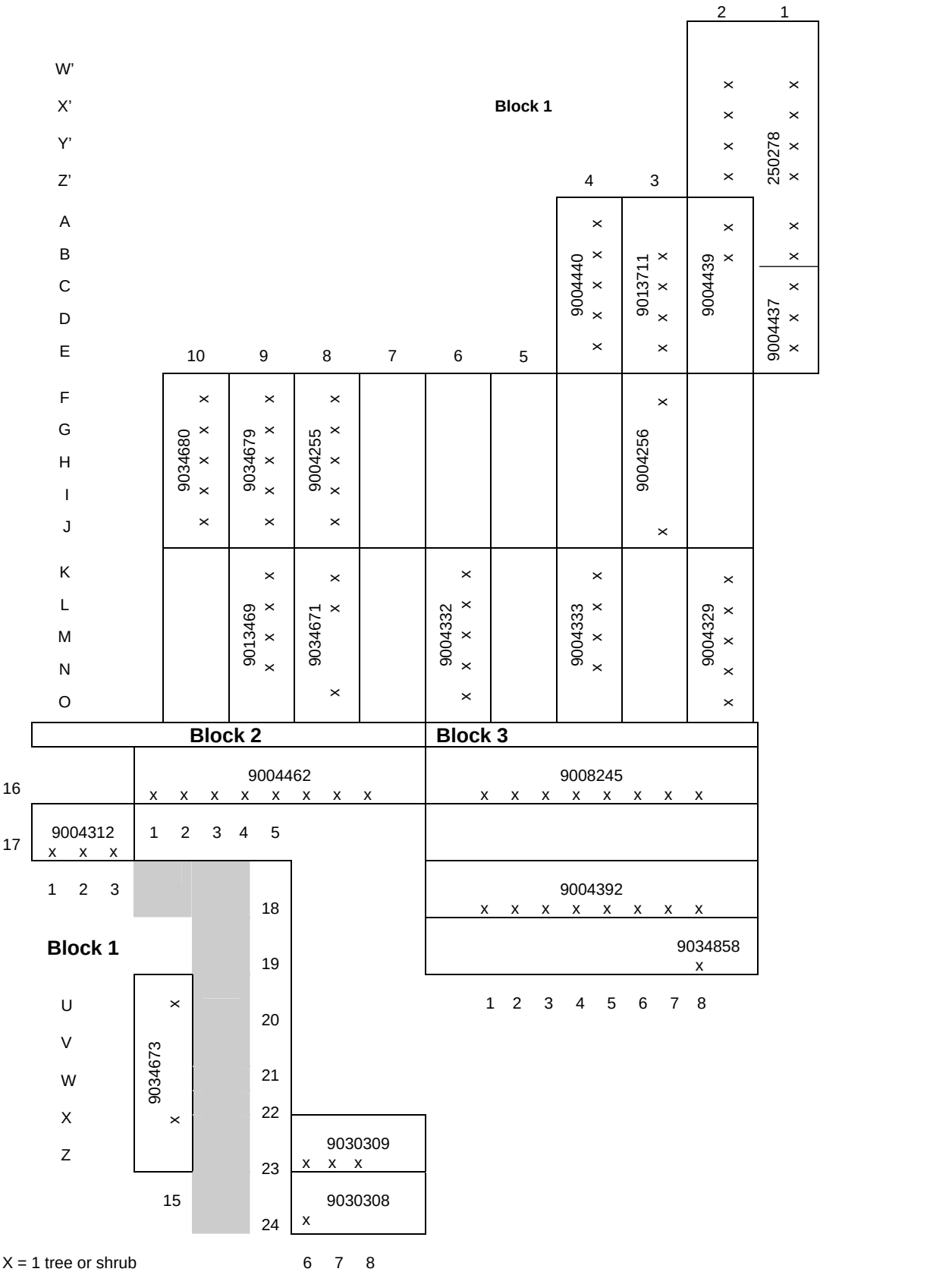


Figure 2.1 Plot Map. Study No. 20I026K, Hackberry, *Celtis* sp., IEP, Manhattan, PMC.

Row W

■	9026646
■	9026643
■	9026641
■ ■	9023017
■	9026672
■ ■ ■	9017884
■	9026427
■	9022741
■	9021223
■	9015678
9030314 ■■■■■■■	
9030313 ■■■■■■■	
9013440 ■■■■■■■	
9013439 ■■■■■■■	
9013438 ■■■■■■■	

■ = 1 tree

Figure 2.1 Plot Map. Study No. 20I026K, Hackberry, *Celtis* sp., IEP, Manhattan, PMC.

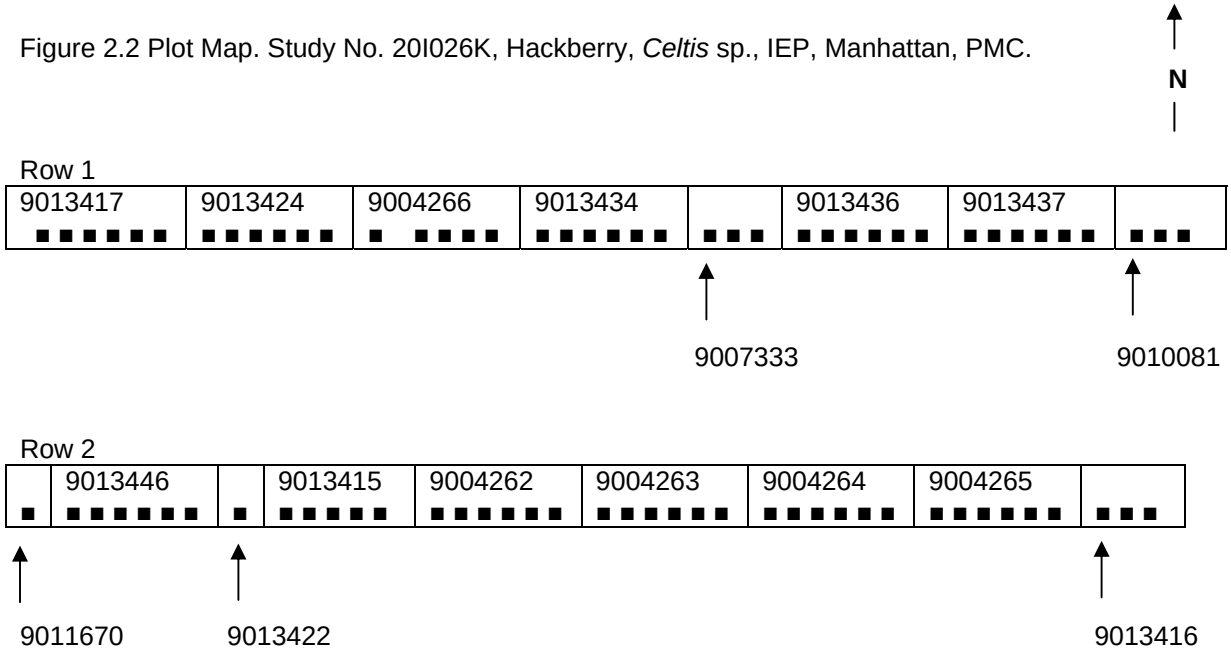
N

Row W

■	9026646
■	9026643
■	9026641
■ ■	9023017
■	9026672
■ ■ ■	9017884
■	9026427
■	9022741
■	9021223
■	9015678
9030314 ■■■■■■■	
9030313 ■■■■■■■	
9013440 ■■■■■■■	
9013439 ■■■■■■■	
9013438 ■■■■■■■	

■ = 1 tree

Figure 2.2 Plot Map. Study No. 20I026K, Hackberry, *Celtis* sp., IEP, Manhattan, PMC.



■ = 1 tree

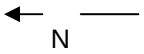


Figure 3.1 Plot Map. Study No. 20I031K - Oriental arborvitae, *Platycladus orientalis,* IEP, Manhattan PMC.

Field J

Col. 2	9017764 X X 0 0 X 0	9017879 0 X X 0 0 X	9018973 0 0 0 0 0 0	9019848 X X X X X X	9019849 X X X X X X	9019850 X X 0 0 0 0	9019853 0 X X X X X	9019854 0 0 0 X 0 0	9020979 0 0 0 0 0 0	9021012 0 X 0 0 0
Col. 1	9010076 0 0 0 0 0 0	9010077 0 X 0 X 0 0	9011202 0 0 0 0 0 0	9012467 X X X X X X	9013567 X X X X X X	9013568 0 0 0 0 0 0	9013569 0 0 0 0 0 0	9013570 X X X X X X	9013571 0 0 X 0 0 X	9013572 X 0 0 0 0 0

Field L

Col. 2	9023359 X X X X X X	9026610 X X X X X X	PMK-2925 X X X X X X	9026780 X 0 X 0 X 0	Blank	9013566 X	9019852 0 0	9026780 X X 0	9019852 X X	
Col. 1	9013573 0 0 0 0 X 0	9013574 X X X X X X	9013575 X X X X X X	9013576 X 0 X X X X	9013577 X X 0 0 X X	9013578 X X X X X X	9013579 X X X X 0 0	9013580 0 0 X 0 0 0	9014890 X 0 X X X X	9015329 0 0 X 0 0

Legend: X – existing tree; 0 – missing tree

Figure 4.1 Plot Map Field E-2. Study No. 20I038K - Bur Oak Seed Source Study - Manhattan PMC. N

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

Figure 5.1 Plot Map. Study No. 20I041K - Siberian Elm, *Ulmus pumila*, FEP - Akron, Colorado.

N

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 5.2 Plot Map. Study No. 20I041K - Siberian Elm, *Ulmus pumila*, FEP - Sidney, Nebraska.

N

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

Figure 6.1 Plot Map Part 1, Field C-3. Study No. 20I042E - false indigo, *Amorpha fruticosa,* IEP, Manhattan PMC.

N

Rep 1	101 9050384	102 9008041	103 9050345	104 9050285	105 9050373	106 9050355	107 9050361	108 9050262	109 9050310	110 9050253
	120 9050324	121 9050277	122 9050313	123 9050336	124 9050327	125 9050309	126 9050362	127 9050294	128 9050366	129 9050327
	139 9050335	140 9050348	141 9050251	142 9050354	143 9050292	144 9050367	145 9050316	146 9050353	147 9050337	148 9050271
	158 9050317	159 9050269	160 9050379	161 9050344	162 9050307	163 9050308	164 9050378	165 9050394	166 9050329	167 9050391
Rep 2	201 9050292	202 9050334	203 9050284	204 9050312	205 9050319	206 9050324	207 9050272	208 9050294	209 9050373	210 9050349
	220 9050279	221 9050313	222 9050354	223 9050378	224 9050251	225 9050299	226 9050356	227 9050325	228 9050188	229 9050374
	239 9050297	240 9050309	241 9050253	242 9050348	243 9050337	244 9050277	245 9050372	246 9050394	247 9050383	248 9050343
	258 9008041	259 9050321	260 9050345	261 9050280	262 9050271	263 9050273	264 9050261	265 9050379	266 9050342	267 9050355
Rep 3	301 9050345	302 9050355	303 9050354	304 9050391	305 9050384	306 9050344	307 9050280	308 9050310	309 9050374	310 9050321
	320 9050379	321 9050300	322 9050343	323 9050325	324 9050346	325 9050317	326 9050298	327 9050275	328 9050295	329 9050388
	339 9050342	340 9050293	341 9050314	342 9050377	343 9050361	344 9050188	345 9050319	346 9050378	347 9050365	348 9050269
	358 9050356	359 9050365	360 9050307	361 9050372	362 9050373	363 9050297	364 9050400	365 9050277	366 9050251	367 9050299

Part 2 →

Figure 6.1 Plot Map Part 2, Field D-3. Study No. 20I042E - false indigo, *Amorpha fruticosa,* IEP, Manhattan PMC (continued).

N

Part 1 ←

Rep 1	111 9050329	112 9050299	113 9050377	114 9050366	115 9050343	116 9050372	117 9050328	118 9050318	119 9050400
	130 9050293	131 9050383	132 9050346	133 9050388	134 9050250	135 9050298	136 9050188	137 9050284	138 9050342
	149 9050275	150 9050300	151 9050280	152 9050314	153 9050279	154 9050325	155 9050356	156 9050274	157 9050319
	168 9050272	169 9050334	170 9050315	171 9050297	172 9050312	173 9050349	174 9050261	175 9050273	176 9050295
Rep 2	211 9050328	212 9050269	213 9050275	214 9050388	215 9050310	216 9050307	217 9050308	218 9050391	219 9050317
	230 9050300	231 9050377	232 9050285	233 9050336	234 9050344	235 9050316	236 9050365	237 9050293	238 9050367
	249 9050327	250 9050362	251 9050262	252 9050361	253 9050400	254 9050298	255 9050315	256 9050314	257 9050329
	268 9050384	269 9050366	270 9050318	271 9050346	272 9050335	273 9050274	274 9050353	275 9050295	276 9050250
Rep 3	311 9050394	312 9050279	313 9050313	314 9050294	315 9050312	316 9050328	317 9050292	318 9050272	319 9050353
	330 9008041	331 9050271	332 9050285	333 9050250	334 9050274	335 9050334	336 9050335	337 9050321	338 9050309
	349 9050315	350 9050316	351 9050383	352 9050284	353 9050253	354 9050374	355 9050348	356 9050318	357 9050362
	368 9050261	369 9050349	370 9050308	371 9050273	372 9050367	373 9050262	374 9050336	375 9050324	376 9050337