LEGUME ADAPTATION STUDIES IN NORTH CENTRAL OKLAHOMA

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CONTENTS

Legume Adaptation Studies in North Central Oklahoma

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There is a need for suitable legumes in north-central Oklahoma for use in range and pasture improvement and for maintenance of soil fertility on farm crop lands. Many desirable native legumes exist in the area but not in sufficient quantity to be of real value and to date only limited success has been experienced in establishing them. Very few exotic legumes have been found that are adapted to local conditions.

Methods Used in the Study

In 1951, a very extensive program was initiated to obtain samples of the legumes of the world that might prove of value for local conditions. The first plantings of winter or cool season type species were made in the fall of 1951 and of warm season species the spring of 1952 on the Agronomy Farm at the Stillwater Station. The soil (Kirkland Clay Loam) was liberally limed and treated with superphosphate.

Seeds planted in the nursery were obtained from the New Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture, State Agricultural Experiment Stations, and other agricultural agencies in this country and abroad. When sufficient quantities of seed were available, the entries were seeded directly in the field. In instances when only small quantities of seeds were available, they were germinated on blotters, transferred to plant bands in the greenhouse and subsequently transplanted to the nursery.

In the summer of 1952, the area was fenced with chicken wire to exclude rabbits since many entries were being grazed by these pests to the extent that stands of many of the species could not be maintained.

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Observations were made on vigor, persistence, disease susceptibility, seedling and growth habit, and other agronomic factors. Seed of all entries was harvested and replanted for further evaluation whenever possible. Original seed supplies were quite limited for most entries and failure of germination or survival of plants eliminated such accessions from the nursery.

Many of the winter growing legumes were severely attacked during dry spring seasons by plant aphids and had to be sprayed with insecticides to maintain stands. The alfalfa entries were heavily attacked in the 1955-1956 seasons by the spotted alfalfa aphid as well as the pea aphid and there were mild to serious outbreaks of the pea aphid other years on alfalfa as well as on many other legumes. During the summer season, blister beetles often fed heavily on alfalfa and other entries and had to be controlled to maintain stands.

The observation period, 1951 through 1959, was somewhat typical weatherwise. Severe drought was experienced in 1954 (16.91 total inches of rainfall) and again in 1956 (15.65 total inches of rainfall). Other years total rainfall ranged from 21 to 38 inches, with 55.17 inches being recorded in the exceptional year of 1959.

Results Obtained

Most entries failed to survive the winter cold or summer heat and drought. Of those that did survive, very few produced enough vegetative growth to be of value for pasture and range use or for soil maintenance purposes. The alfalfas and vetches proved most promising of all accessions entered in the test. (See Table 1). Annual *Lespedeza* species such as *striata* and *stipulacea* showed promise but were not outstanding in quantity of herbage produced. *Cassia, Crotalaria, Melilotus, Psoralea, Sesbania,* and *Tephrosia* species made abundant growth but at present are of questionable value because most of them are not suited for hay or grazing. They may, however, have real value for bringing shallow eroded lands back into condition for pasture seeding to adapted grasses and legumes.

The *Trifolium* species were particularly disappointing in that very few of them were able to survive the summer season while some did not survive the winter. Evaluations for adaptation and forage potential of all species tested can be found in Table 1.

Summary

Of the 54 genera, 216 species, and 1,366 entries of legumes checked for adaptation at the Stillwater Agronomy Farm from 1951 through 1959 only alfalfa and some of the vetches showed real promise for use as forage legumes. Lespedeza, birdsfoot trefoil, and sanfoin were fairly well adapted but vegetative growth was somewhat limited most years. Practically all of the *Trifolium* species were eliminated by summer heat or drought or both.

Some of the sweet clovers, *Cassia, Crotalaria, Psoralea, Sesbania,* and *Tephrosia* species made good growth and may be of value for maintaining soil fertility or in reclaiming abandoned lands.

TABLE 1

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
Alysicarpus	*rugosus,* DC.	2			X			X
"	*vaginalis,* Wall.	1			X			X
Amorpha	*brachycarpa,* Palmer	1	X					X
"	*fruticosa,* L.	1	X					X
Amphicarpa	*bracteata,* (L) Fern.	1			X			X
Astragalus	*cicer,* L.	16		X			X	
"	*flexuosus,* Dougl.	4			X			X
"	*galegiformis,* Pall.	3			X			X
"	*globifera,* E. Mey.	1			X			X
"	*mortoni,* Nutt	1			X			X
"	*onobrychis,* L.	1			X			X
Baptisia	*australis,* (L.) R. Br.	1		X				X
Canavalia	*ensiformis,* DC.	3			X			X
Cassia	*hebecarpa,* Fern.	1			X			X
"	*marilandica,* L.	3	X					X
Centrosema	*pubescens,* Benth.	1			X			X
Cladrastis	*lutea,* (Michx.) Koch.	1			X			X
Clitoria	*ternatea,* L.	1			X			X
Colutea	*arborescens,* L.	1			X			X
Coronilla	*cretica,* L.	1			X			X
"	*scorpioides,* (L.) Koch.	1			X			X
"	*varia,* L.	14	X					X
Crotalaria	*incana, L.*	4	X					X
"	*intermedia,* Kotschy.	3		X				X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
"	*lanceolata,* L.	4	X					X
"	*mucronata,* Desv.	5	X					X
"	*sericea,* Willd.	1		X				X
"	*spectabilis,* Roth.	4	X					X
"	*usaramoensis,* Baker	1		X				X
"	*verrucosa,* L.	1		X				X
Cyamopsis	*tetragonaloba,* (L.) Taub.	12	X				X	
Dalea	*frutescens,* (Gray) Vail.	1		X				X
Daubentonia	*drummondii,* Rydb.	3	X					X
Desmanthus	*illinoensis,* (Michx.) MacM.	1	X					X
Desmodium	*canadense,* (L.) DC.	1		X				X
"	*canescens,* DC.	1			X			X
"	*glutinosum,* (Muhl.) Willd.	1			X			X
"	*illinoense,* Gray	1			X			X
"	*paniculatum,* (L.) DC.	1			X			X
"	*rotundifolium,* (Michx.) DC.	1			X			X
"	*uncinatum,* DC.	6			X			X
Dolichos	*biflorus,* L.	1			X			X
Dunbaria	*villosa,* Makino	1			X			X
Galactia	*texana,* (Scheele) Gray	1			X			X
"	*volubilis,* (L.) Britton	1			X			X
Galega	*officinalis,* L.	1			X			X
Genista	*tinctoria,* L.	1			X			X
Glycine	*javanica,* L. Thumb.	1			X			X
"	*max, Merrill*	1	X				X	
"	*ussuriensis,* Regel & Maack	1			X			X
Glycyrrhiza	*echinata,* L.	1		X				X
Hedysarium	*coronarium,* L.	1			X			X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
Indigofera	*glandulosa,* Roxb.	1			X			X
"	*hirsuta,* Harv.	3			X			X
"	*hochstetteri,* Baker	1			X			X
"	*pseudo-tinctora* Matsum.	1			X			X
"	*subulata,* Vahl.	1			X			X
"	*suffruticosa,* Mill.	2			X			X
"	*sumatrana,* Gaertn.	1			X			X
Lathyrus	*aphaca,* L.	3			X			X
"	*cicera,* L.	20			X			X
"	*clymenum,* L.	1			X			X
"	*gorgoni,* Parl.	1			X			X
"	*hirsutus,* L.	1		X			X	
"	*ochrus,* DC.	1			X			X
"	*sativus,* L.	10			X			X
"	*sylvestris,* L.	2		X			X	
"	*tuberosus,* L.	2			X			X
Lens	*esculenta,* Moench.	108			X			X
Lespedeza	*capitata,* Michx.	1		X				X
"	*cuneata,* G. Don.	3		X			X	
"	*cyrtobotrya,* Miq.	1			X			X
"	*latissima,* Nakai	1			X			X
"	*stipulacea,* Maxim.	2		X			X	
"	*striata,* (Thumb.) H. & A.	7		X			X	
"	*stuvei,* Nutt.	1			X			X
"	*virginica,* (L.) Britton	1			X			X
Lessertia	*brachystachya,* DC.	1			X			X
Lotononis	*Bainesii,* Baker	3			X			X
Lotus	*corniculatus,* L.	55	X				X	
"	*palustris,* Ledeb.	1			X			X
"	*peregrinus,* L.	1			X			X
"	*scoparius,* Ottley.	1			X			X
"	*uliginosus,* Schkuhr.	4		X			X	
Lupinus L.	*elegans,* H .B. & K.	1			X			X
"	*Hartwegii,* Lindl.	1			X			X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
"	*luteus,* L.	4			X			X
"	*polyphyllus,* Lindl.	1			X			X
Medicago	*arabica,* (L.) All.	6			X			X
"	*arborea,* (L.) Aubl.	3			X			X
"	*ciliaris,* (L.) Willd.	1			X			X
"	*falcata,* Lam.	15	X				X	
"	*hispida,* Gaertn.	15			X		X	
"	*lupulina,* L.	4		X			X	
"	*murex,* Willd.	1			X			X
"	*orbicularis,* (L.) Bartalina	11		X			X	
"	*rugosa,* Desr.	1			X			X
"	*sativa,* L.	117	X			X		
"	*scutellata,* Mill.	6			X			X
"	*tribuloides,* Desr.	11			X			X
"	*trunculata,* Gaertn.	33			X			X
Melilotus	*alba,* Desr.	65	X				X	
"	*altissima,* Thuill.	2			X			X
"	*indica,* (L.) All.	16		X			X	
"	*infesta,* Guss.	3			X			X
"	*leucantha,* Koch.	2			X			X
"	*neapolitana,* Tenore	6			X			X
"	*officinalis,* (L.) Lam.	24	X				X	
"	*parviflora,* Desf.	1			X			X
"	*ruthenica,* Ser.	1			X			X
"	*segetalis,* Ser.	7		X				X
"	*sicula,* Vitm.	1			X			X
"	*suaveolens,* Ledeb.	3			X			X
"	*sulcatas,* Desf.	7			X			X
"	*taurica,* Ser.	14			X			X
"	*wolgica,* Poir.	1			X			X
Onobrychis	*arenaria,* DC.	3			X			X
"	*chorassanica,* Bunge	1			X			X
"	*transcaucasica,* Grossh.	1			X			X
"	*viciaefolia,* Scop.	20		X			X	
"	*vulgaris,* Gueld.	10			X			X
Ononis	*spinosa,* L.	1			X			X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
Ornithopus	*sativus,* Brot.	7			X			X
Petalostemum	*purpureum,* (Vent.) Rydb.	1	X				X	
"	*villosum,* Nutt.	1	X				X	
Phaseolus	*acutifolius,* Gray	2	X				X	
"	*aureous,* Roxb.	2		X			X	
"	*calcaratus,* Roxb.	1		X			X	
"	*coccineus,* L.	1			X		X	
"	*lathyroides,* L.	2	X				X	
"	*lunatus,* L.	1		X			X	
"	*metcalfei,* W. & S.	1			X		X	
"	*trilobatus,* Baill.	1		X			X	
"	*vulgaris,* L.	2		X			X	
"	*wrightii,* Gray	2		X			X	
Pisum	*arvense,* L.	2			X			X
"	*maritimum,* L.	1			X			X
"	*sativum,* L.	2		X			X	
Psoralea	*americana,* L.	1	X				X	
Robinia	*hispida,* L.	1			X			X
Scorpiurus	*subvillosa,* L.	1			X			X
"	*sulcata,* L.	1			X			X
Securigera	*coronilla,* DC.	5	X				X	
Sesbania	*aegyptiaca,* Poir.	2	X					X
"	*cannabina,* Poir.	1		X				X
"	*sesban,* (L.) Merrill	1		X				X
Stylosanthes	*gracilis,* H. B. & K.	1			X			X
"	*juncea,* Micheli	1			X			X
Tephrosia	*candida,* DC.	2		X				X
"	*glomeruliflora,* Meissn.	1		X				X
"	*purpurea,* (L.) Pers.	1	X					X
"	*remotiflora,* F. Muell.	1		X				X
"	*toxicaria,* Pers.	1		X				X
"	*villosa,* Pers.	1		X				X
"	*virginiana,* (L.) Pers.	1		X				X
"	*vogelii,* Hook.	2		X				X
Thermopsis	*caroliniana* M.A. Curt.	1		X				X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
Trifolium	*agarium,* L.	2		X				X
"	*alexandrinum,* L.	6		X				X
"	*ambiguum,* Bieb.	1	X			X		
"	*campestre,* Schreb.	9		X				X
"	*carolinianum,* Michx.	1		X				X
"	*cernuum,* Brot.	2		X				X
"	*cherleri,* L.	2		X				X
"	*ciliolatum,* Benth.	1		X				X
"	*dubium,* Sibth.	16	X			X		
"	*echinatum,* Bieb.	1		X				X
"	*fimbriatum,* Lindl.	1		X				X
"	*fragiferum,* L.	5	X			X		
"	*glomeratum,* L.	2		X				X
"	*hirsutum,* Thunb.	4	X			X		
"	*hirtum,* All.	1		X				X
"	*hybridum,* L.	3	X			X		
"	*incarnatum,* L.	14	X			X		
"	*lappaceum,* L.	7		X				X
"	*medium,* (L.) Huds.	2		X				X
"	*michelianum,* Koch.	1		X				X
"	*nigrescens,* Viv.	5		X				X
"	*pratense,* L.	83	X			X		
"	*procumbens,* L.	9	X			X		
"	*repens,* L.	41	X			X		
"	*resupinatum,* L.	12	X			X		
"	*spinulosum,* Dougl.	2		X				X
"	*subrotundum,* (L.) Steud. & Mochit	1		X				X
"	*subterraneum,* L.	28	X					X
"	*tembense,* Fresen.	1		X				X
"	*tomentosum,* (L.) Willk.	5		X				X
"	*wormskioldii,* Lehm.	1		X				X
"	*xerocephalum,* Fenzl.	2		X				X
Trigonella	*foenum-graecum,* L.	2	X			X		
Vicia	*angustifolia,* (L.) Reichard.	6	X					X

TABLE 1 (Continued)

GENUS	SPECIES	ENTRIES	ADAPTATION GOOD	ADAPTATION FAIR	ADAPTATION POOR	FORAGE POTENTIAL GOOD	FORAGE POTENTIAL FAIR	FORAGE POTENTIAL POOR
"	*articulata,* Horn.	4		X				X
"	*atropurpurea,* Desf.	8		X			X	
"	*calcarata,* Desf.	5		X				X
"	*dasycarpa,* Tenore	5	X			X		
"	*disperma,* DC.	2			X			X
"	*ervilia,* (L.) Willd.	65		X				X
"	*galeata,* Boiss.	1		X				X
"	*gracilis,* Loisel.	1			X			X
"	*grandiflora,* Scop.	1			X			X
"	*hirsuta,* (L.) S. F. Gray	5			X			X
"	*hybrida,* Huds.	1		X			X	
"	*lathyroides,* L.	4			X			X
"	*leavenworthii,* Torr. & Gray	1			X			X
"	*lutea,* L.	1			X			X
"	*macrocarpa,* Bertol.	1			X			X
"	*monantha,* Retz.	3		X			X	
"	*narbonensis,* L.	8		X				X
"	*pannonica,* Crantz	6		X				X
"	*sativa,* L.	96		X			X	
"	*serratifolia,* Jacq.	3			X			X
"	*tetrasperma,* (L.) Schreb.	1			X			X
"	*varia,* Host.	2	X			X		
"	*villosa,* Roth.	20	X			X		
Vigna	*cylindrica,* Merr.	1	X				X	
"	*sesquipedalis,* W. F. Wight	1	X				X	