

COOPERATIVE EVALUATION ON NORTHERN HEMISPHERE GRASSLAND
GERMPLASM IN INNER MONGOLIA AND THE WESTERN UNITED STATES

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ABSTRACT

Replicated studies were established jointly in central Inner Mongolia and in the USA northern intermountain west by Chinese and American scientists. Both Asian and North American plant materials were included. Results of the Chinese plots show USA saline tolerant species have potential to assist the Chinese with saline soil reclamation. Results of Chinese accessions planted in the northern Great Plains show the introduced dryland legumes have promise for USA range improvement, reclamation and sustainable agriculture.

INTRODUCTION

The semi-arid and arid grasslands of Inner Mongolia and the western United States are ecologically similar in structure and function (Dewey, 1983). A cooperative project was initiated between the Grassland Research Institute, Inner Mongolia, People's Republic of China and the USDA Natural Resources Conservation Service, Bridger Plant Materials Center (PMC), Bridger, Montana USA in 1988. The major objective of the cooperative program was to evaluate and select plant materials to restore steppe, shrub-steppe, saline bottomlands, and open woodland sites in the arid and semi-arid zones of the two countries.

METHODS

China

Seven hundred and five plots were planted with a Planet Jr. single row hand planter at four locations within the Desert Steppe ecosystem of Inner Mongolia in June 1991 and 1992. Each of the eighty five Chinese and USA accessions and cultivars were planted in four rows, six meters (19.7 ft) long and were replicated three times. Row spacing widths were 30 cm (11.8 in) for grasses, 60 cm (23.6 in) for legumes and 120 cm (47.2 in) for shrubs. All plantings were planted into dryland plots and relied on the natural environmental conditions for establishment and survival. The planting sites range from sand to clayey textured soils and from saline to non-saline in 300 - 400mm (11.8 - 16 in) precipitation zones.

USA

The Bridger, Montana PMC received twenty three Chinese accessions in 1989 and they were planted March 2, 1989. Sixteen additional Chinese accessions were received in 1990 and were out-planted in plots April 27, 1990. These collections were planted in single six meter (19.7 ft) long rows with one meter (39.37 in) or 2 meter (72 in) row spacing. The plots were irrigated to maintain field capacity throughout the summer. The plots were not replicated due to the small seed supplies. Seed was eventually harvested from these plots to establish additional studies.

In the spring of 1994 replicated plots featuring Asian plant materials were established at Bridger, MT, Pullman WA, and Aberdeen, ID. The plot designs were identical to the ones described in the Chinese materials and methods. The Bridger plots consist of 44 Asian accessions while Aberdeen and Pullman sites feature 31. Eighteen USA cultivars are included at each location for standards of comparison. The Bridger site receives 280mm (11.2 in) of mean annual precipitation and has clay loam soils. Pullman receives 400mm (16 in) and Aberdeen receives 300mm (12 in) of rainfall.

All the plant entries have been evaluated for vigor, percent stand and foliage height since planting. The Chinese plots have been sampled for forage yield beginning the year after establishment.

RESULTS AND DISCUSSION

The Chinese plant performance results are based on the mean of three replications evaluated during 1994. The USA multi-state PMC plant performance results are based on 1994 qualitative stand and vigor data. Only the top five ranked plant entries at each location will be discussed.

China

Huhehot

Due to below average 1991 growing season precipitation, a severe weed infestation within the plots and rodent grazing most of the 85 plant entries did not establish good stands. *Astragalus adsurgens* Pall., *Melissitus ruthenicus*, *Agropyron mongolicum* Keng and *Agropyron sibiricum* (Willd.) Beauv were the highest ranked species and established greater than 23.3% stands and produced more than 674 air dry kg/ha (601.2 lbs/ac) of forage. *Astragalus adsurgens* had the best yield, 2182 kg/ha (1946.3 lbs/ac), while *Agropyron mongolicum* had the best stands at 58.3%.

The replant in 1992 established a high percentage of the 85 plant entries. *Astragalus adsurgens*, *Agropyron Mongolicum*, *Lespedeza davurica*, *Milissitus ruthenicus* accessions had the highest yield, more than 1431.7 kg/ha (1277.1 lbs/ac) with *Astragalus adsurgens* yielding the most at 3669.3 kg/ha (3273 lbs/ac) *Astragalus adsurgens*, *Caragana microphylla* Lam., 'Lakak' *Medicago sativa* ssp. *falcata* (L.) Arcang., 'Hycrest' *Agropyron cristatum* (L.) Gaertn. X *desertorum* (Fisch. ex Link) J.A. Schultes and 'Ranger' *Medicago sativa* X *falcata* all rated 51.7% or greater stands.

Dalad Qi

Twenty of twenty eight plant entries established plants on this saline site. *Achnatherum splendens* (Trin.) Nevski, *Psathyrostachys juncea* (Fisch.) Nevski, *Hordeum brevisubulatum* (Trin.) Link, and 'Rodan' and 'Arriba' *Pascopyrum smithii* (Rydb.) A.Love established the best stands with *Achnatherum splendens* rating the highest, a 18.33% stand.

Linhe

'Largo', 'Tyrell', 'Jose' and 'Alkar' *Thinopyrum ponticum* (Podp.) Barkworth & Dewey established the best stands and had the highest yield on this saline site. 'Prairieland' *Leymus angustus* (Trin.) Pilger and *Hordeum brevisubulatum* were also ranked in the top six entries. *Hordeum brevisubulatum* rated the best stand, 80%, while Largo had the highest yield at 6925 kg/ha (6177.1 lbs/ac).

Zhaohe

Caragana microphylla, *Agropyron mongolicum*, *Astragalus adsurgens*, *Agropyron desertorum*, *Melissitus ruthenicus* and *Agropyron Sibiricum* were ranked highest in yield and stands on this dryland site. *Caragana microphylla* rated the best stand of 75% while *Agropyron mongolicum* had the best yield of 713 kg/ha (636 lbs/ac).

USA

Overall, *Agropyron cristatum*, *Astragalus adsurgens*, *Caragana korshinshii*, *Caragana microphylla* and *Ceratoides arborescens* maintained the best stands of the 1989 plantings, 80-100%. *Agropyron cristatum*, *Agropyron desertorum*, *Agropyron sibiricum*, *Elymus dahuricus* Turcz., *Elymus nutans* Griseb. and *Hordeum brevisubulatum* rated the highest stand ratings for the 1990 Bridger planting and the 1994 multi-state plantings, 80-95%.

CONCLUSION

Overall, the Chinese grasses and legumes out-performed the USA plant materials in Inner Mongolia. However, early results indicate USA species/cultivars have potential to assist the Chinese with saline soil reclamation.

Preliminary results of the Chinese accessions planted at the three USA locations show several Asian species have potential for range improvement, reclamation and sustainable cropping systems in the USA.

These studies are scheduled for evaluation through 1995. The summarization of the study results at that time will validate plant performance and begin seed production for additional large scale plantings in both countries.

LITERATURE SITED

Dewey, D.R. 1983. Range forage germplasm resources in China. pp. 37-58. In Proc. International Symposium: Range Livestock Production in the People's Republic of China, Las Cruces, NM.

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