PLANT GERMPLASM COLLECTION REPORT

USDA-ARS
FORAGE AND RANGE RESEARCH LABORATORY
LOGAN, UTAH

Foreign Travel to:
China
August 1-September 2, 1993

TITLE: Collection and Evaluation of Forage Germplasm from the Northern Area of the Xinjiang Autonomous Region of the People's Republic of China

U.S. Participants

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GERMPLASM ACCESSIONS

SUMMARY: The objective of our trip was to make joint seed collections of forage grass and legume germplasm in northern Xinjiang for improving deteriorated rangelands in the western U.S. and PRC. Our collection trip to the northern areas of the Tien Shan Mountains was an unqualified success. We were joined by scientists with the Xinjiang Grassland Research Institute in Urumqi. Our collecting route traversed along the southern edge of the Junggar Basin through the counties and towns of Wenchuan, Bole, Usu, Shihezi, Hutubi, Fukang, Jimsar, and Chitai. After returning to Urumqi, we threshed, cleaned, weighed, and equally divided the seed. A list containing the Latin name, Chinese-character name, and seed weight was prepared. Government officials allowed us to take 243 collections out of Xinjiang, including 85 forage legumes and 158 forage and turf grasses representing 65 species. We delivered our seed to officials at the Ministry of Agriculture in Beijing who obtained the necessary approvals from the Institute of Crop Germplasm Resources and Ministry of Agriculture. The seed collections were given to the Beijing Animal and Plant Quarantine Service for obtaining a phytosanitary certificate. Seed was sent to the USDA Plant Germplasm Quarantine Center and Plant Introduction Office in B

RECOMMENDATIONS: The rangelands that we visited in northern Xinjiang were typically severely overgrazed, and the only productive collecting sites were in areas saved for winter forage harvesting. These protected sites held an incredible diversity of forage grass and legume germplasm. These areas generally were fenced and were in the process of being hand-harvested by scythes and rakes for subsequent transport to animal-wintering sheds. We were told that these winter forage areas are being gradually reduced in size because of increasing numbers of animals and the need for additional summer grazing pastures. Consequently, timely collection and evaluation of this diverse germplasm is required before these important germplasm resources disappear. Collaborative efforts should be established with scientists in Xinjiang to systematically collect and evaluate this important germplasm. Without immediate efforts this unique germplasm will be lost and unavailable for future breeding programs for crop improvement. It is recommended that a longer-term collaborative project be established with scientists in Xinjiang to initiate this important research. Also, grazing pressure must be reduced on Xinjiang rangelands to allow plant recovery. With the severe overgrazing taking place, forage species diversity certainly must be decreasing on these lands; however, no vegetation monitoring for either productivity or species composition is currently being done. Consequently, enclosures need to be established on Xinjiang rangelands to monitor changes in vegetation composition and plant production.

Benefits of Trip: The collected forage germplasm will make an important addition to the germplasm banks of both the U.S. and PRC. These collected materials will be an important source of germplasm for the conservation and improvement of productivity on semiarid rangelands of both countries. The U.S. collections will be incorporated into the National Plant Germplasm System where they will be available to all qualified scientists and organizations, both domestic and foreign, for use in their ongoing work. Similarly, the Xinjiang Grassland Research Institute in Urumqi will make the collections available to forage scientists in PRC.

This trip report will be sent to cooperating scientists in PRC and to interested parties in the U.S. Slide presentations by U.S. participants at Crop Advisory Committee meetings, Regional Research Committee meetings, and various seminars will inform scientists of the collection trip and opportunities for collaboration. Because of the excellent cooperation received on our trip, a proposal for the visit of two forage scientists from Xinjiang to visit the U.S. in 1994 has been submitted for funding. Plans have been discussed for a subsequent germplasm collection trip to west-central Xinjiang for 1995 or 1996.

Acknowledgements: We feel fortunate that our scientific exchange was successful. Our success can be directly attributed to the hard work, cooperation, and dedication of a number of people involved with the exchange. We particularly wish to thank Mr. Li Bao Jun of the Xinjiang Grassland Research Institute, Ms. Lucia Claster of the USDA-OICD Research and Scientific Exchange Division, and Mr. Zhuang Renan of the Department of International Cooperation in the Ministry of Agriculture who is now working in the Agricultural Affairs Office in the U.S. Embassy in Beijing. Thanks also to the numerous others, both in the U.S. and PRC, who helped in various ways before, during, and after our trip.

TECHNICAL REPORT AND TRIP DETAILS

1-2 August Team members departed Logan, Utah and traveled to Beijing where we were met by Mr. Zhuang Renan of the Ministry of Agriculture. We were transported to the Zhaolong Hotel located on Workers' Stadium Road near the Ministry of Agriculture.

3 August We visited staff and facilities at the Institute of Crop Germplasm Resources at the Chinese Academy of Agricultural Sciences. We met with Mr. Liu Xu, Deputy Director of the Institute, and Mrs. Wei Li Qing from the Foreign Affairs Office. The Institute was founded in 1978 and is the national center for crop genetic resources research. The main functions of the Institute are to collect, conserve, characterize, evaluate, document, enhance, and utilize crop germplasm resources throughout China. The Institute has a staff of 253 of which 70 are senior scientists and is divided into 12 laboratories including: Rice; Wheat; Corn, Sorghum, and Millet; Food Legumes; Stress Resistance Evaluation; Disease and Pest Resistance Evaluation; Germplasm Conservation; Quality Analysis; Exploration and Collection; Germplasm Introduction and Exchange; Information Management; and Special Germplasm Conservation.

We were taken on a tour of the National Genebank, which was established in 1986, and is attached to the Institute of Crop Germplasm Resources. The Genebank covers an area of 3,200 m^2, which includes space for seed processing, seed storage, and research. The processing area is used for seed drying, cleaning, weighing, fumigation, germination, and record computerization. The seed storage area has 650 m^2 with a total capacity for cold storage (-8 to -18C) of 400,000 seed accessions. Total accessions currently stored in the Genebank number 245,127. The area for germplasm research includes space for laboratories, conference room, and library.

We also discussed current permit requirements for processing our seed collections. Procedures require that the seed be threshed, cleaned, weighed, and a duplicate sample maintained in PRC. A species list with the Latin name, Chinese-character name, and seed weight of each accession is required by local officials in Xinjiang. The Institute of Crop Germplasm Resources then must approve the list of species followed by final approval by the Department of Science and Technology in the Ministry of Agriculture. After these approvals, seed must be delivered to the Beijing Animal and Plant Quarantine Service for issuance of a Phytosanitary Certificate.

4-5 August We took a 3.5 hour flight from Beijing to Urumqi, where we were met by Mr. Onerhan Bayan (Director of the Xinjiang Grassland Institute) and Mr. Li Bao Jun (Leader of the Xinjiang Forage Germplasm Project). We were taken to the Hotel World Plaza, one of two four-star hotels now open in Urumqi.

We met with President Guo Zhiqin, President of the Xinjiang Academy of Animal Sciences, and toured new laboratory facilities of the China-Australia Fine-Wool Sheep Research Project. A new multi-story building has recently been completed and laboratories are being furnished with new instrumentation. Laboratories included: Embryo Engineering, Radio Immunoassay, Nuclear Analysis, Electrophoresis, Analytical, and Protein Purification. Staff of the Grassland Research

Institute may be moving into this building later this year. The Academy was established in 1982 and currently has a 400 person staff. A total of 262 projects has been completed by various research units under the Academy, and 65% of these have resulted in improvements in animal husbandry practices. Particularly successful research projects have included: fine-wool sheep production, embryo transfer, pasture resource inventory with satellite imaging, sheep nutrition, caracul sheep production, and *Kochia prostrata* establishment.

We discussed the finalized plans of our collection trip (see attached map) with President Guo and the importance of collecting and preserving forage germplasm resources of Xinjiang. There are a total of 3,000 plant species in Xinjiang of which 500 are commonly used for forage. The Xinjiang Forage Germplasm Project, which is directed by Mr. Li Bao Jun, is in its last year of funding from the PRC Central Government. This project has been very productive and needs to be continued to fully evaluate the most promising forage germplasm accessions for use in improving forage production and conservation on Xinjiang's rangelands. We then presented seminars on our research to staff of the Xinjiang Academy of Animal Sciences and the Grassland Research Institute.

6-8 August We traveled to Hutubi County where we were shown the Hutubi Dairy Farm, one of the most productive dairy operations in PRC. It is the largest milk producer in Xinjiang, providing more than 62,000 tons of milk to Urumqi, and also is one of the key dairy bull farms in China. The Farm has established the Xinjiang Domestic Animal Biological Experiment Center in cooperation with the Xinjiang Academy of Animal Sciences. In addition, the Farm has established the Junggar Grassland Ecological Experiment Station in cooperation with August 1st Agricultural College and the Chinese Academy of Sciences. The main purpose of this station is to conduct research on the reclamation and utilization of salt-effected lands of the Junggar Basin area. The station includes 10 to 12 laboratory rooms, accommodations for researchers, animal care facilities, and land for research plots.

We made collections in the lowland desert pastures and along irrigated field margins of Hutubi Dairy Farm. In addition, we traveled to the foothills of the Tian Shan Mountains where the Kazakh and Mongul minorities were grazing their sheep, cattle, horses, and goats. We were accompanied by county leaders who introduced us to the herdsmen, who along with their families lived in traditional tents or yurts.

9-12 August We drove to Shihezi and then on to Usu. Enroute we visited Zinichuan Stud Farm, which is one of the most famous fine-wool sheep breeding stations in PRC. While there, we made collections in two winter-pasture enclosures. We also saw indigenous deer that are being domesticated for antler production. At Usu we collected in the Tien Shan Mountains. Enroute to the mountains we visited pastures that had been sown to *Kochia prostrata*. These *K. prostrata* plots were established both by traditional plowing and seeding as well as by aerial seeding. Both treatments were successful, but there was considerably greater species diversity in the aerial seeding. Both areas were protected from grazing by fences. We also collected in semidesert pastures on Gultu Farm, the largest farm in the area with more than 70,000 grazing animals.

13-15 August We collected in areas in the vicinity of Bole, Lake Salimu, and Wenchuan. This is the first area where we collected *Agropyron cristatum*. Even though the Lake Salimu area was

extremely overgrazed, we made more than 20 collections of important forage grass and legume species in pastures reserved for winter forage harvesting. Based on the diversity of forage germplasm collected in this area, a future collection trip to the Yili Valley in the Central Tien Shan Mountains would probably be very productive. Scientists with the Grassland Research Institute are interested in cooperating on such a collection in 1995 or 1996.

16-18 August We returned to Urumqi via Shihezi.

19-22 August We collected in the foothills to the east of Urumqi near the towns of Fukang, Chitai, and Jimsar. We visited the Fukang Agricultural Ecology Station, which is located 28 km east of Fukang. The Station is jointly funded by the Xinjiang Animal Husbandry Bureau, the Grassland Research Institute of the Xinjiang Academy of Animal Sciences, and the Fukang Animal Husbandry Bureau. The Station has a climate characterized by hot-dry summers, long-cold winters, and low rainfall. The average January temperature is -17C with a minimum of -37C; the average July temperature is 26C with a maximum of 42C. Annual precipitation at the Station is 188 mm. The Station has two main experimental plot areas, one is where a wide range of forage introductions are being evaluated, and another where the indigenous genetic resources of Xinjiang are being tested for their establishment and adaptation. The soils at the Station are highly saline so that species doing well in the evaluations have considerable tolerance to salinity.

23-29 August We made final collections at South Mountain located about 90 km southeast of Urumqi on the Xiejago and Gango Stud Farms. Seed from our field collections was threshed, cleaned, weighed, and equally divided. A list containing the species Latin name, Chinese-character name, and weight of each seed accessions was prepared to obtain approval to transport our seed out of Xinjiang. Twelve accessions were not allowed out of Xinjiang including: *Leymus multicaulis* (8 accessions), *Glycyrrhiza uralensis* (1 accession), *Glycyrrhiza glabra* (1 accession), *Allium oreoprasum* (1 accession), and *Leymus unispiculus* (1 accession). We received approval to transport 243 seed accessions from Xinjiang (Table 1). During our stay in Urumqi, we also prepared and signed a "Letter of Intention to Cooperate" (see attached). This letter documents our interest and desire to establish cooperative forage research with scientists at the Xinjiang Grassland Research Institute in Urumqi. Areas of mutual interest include: germplasm exchange, germplasm evaluation, breeding and selection, cytogenetics, tissue culture and biotechnology, and joint research projects.

30 August - 1 September We delivered our seed to Mrs. Sun Li Ping of the Department of International Cooperation at the Ministry of Agriculture in Beijing. She obtained the necessary permits from the Institute of Crop Germplasm Resources in the Chinese Academy of Agricutural Sciences and the Department of Sciences and Technology in the Ministry of Agriculture. Mrs. Sun then delivered our seed to the Beijing Animal and Plant Quarantine Service for issuance of a Phytosanitary Certificate. The seed collections were then delivered to Mrs. Diana L. Sedney of the Agricultural Affairs Office of the U.S. Embassy for subsequent mailing to the USDA Plant Germplasm Quarantine Center and Plant Introduction Office in Beltsville, MD.

2 September Team members departed Beijing and returned to Logan, Utah.

Table 1. Seed Accessions collected in northern Xinjiang in 1993 by D. A. Johnson and K. B. Jensen.

Achnatherum inebrains	2	Lotus corniculatus	3
Achnatherum splendens	6	Medicago falcata	4
Agropyron cristatum	5	Medicago lupulina	7
Aeluropus pungens	1	Medicago sativa (Xinunu No. 1)	1
Alopecurus pratensis	1	Medicago varia	8
Astragalus alpinus	3	Melilotus albus	4
Astragalus macroceras	2	Melilotus officinalis	8
Astragalus tibetanus	10	Onobrychis viciifolia	4
Bromus inermis	11	Oxytropis glabra	1
Bromus japonicus	1	Phleum phleoides	4
Carex songorica	1	Piptatherum songorica	1
Carex turkestanica	1	Poa angustifolia	12
Dactylis glomerata	3	Poa attenuata	1
Elymus caninus	1	Poa pratense	1
Elymus cylindricus	2	Psathyrostachys juncea	13
Elymus fedschenkoi	1	Roegneria canina	1
Elymus gmelinii	4	Roegneria mutabilis	1
Elymus sibiricus	7	Roegneria precaespitosa	1
Elymus tangutorum	18	Roegneria stricta	1
Elymus tschimgamicus	1	Roegneria tschimgamica	1
Elytrigia aegilopoides	3	Roegneria ugamicus	2
Elytrigia elongata	1	Setaria italica	1
Elytrigia repens	9	Sorghum bicolor	1
Festuca ovina	11	Stipa capillata	1
Hedysarum ferganense	1	Trifolium fragiferum	4
Hedysarum gmelinii	2	Trifolium pratense	1
Helictotrichon tibeticum	2	Trifolium repens	11
Hordeum bogdanii	5	Trifolium rubens	1
Hordeum brevisubulatum	2	Trigonella cancelata	1
Koeleria cristata	1	Vicia costata	5
Lathyrus pratensis	1		
Lathyrus tuberosus	2	**TOTAL**	**243**

Leymus angustus	7			
Leymus chinensis	1			
Leymus karelinii	6			
Leymus ovatus	1			
Leymus secalinus	2			

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