**PLANT GERMPLASM EXCHANGE REPORT**

**USDA-ARS**

**FORAGE AND RANGE RESEARCH LABORATORY**

**LOGAN, UTAH**

***Foreign Travel to:***

**Uzbekistan**

**October 20 - October 28, 2002**

**TITLE:** EXPEDITION IN UZBEKISTAN TO EXCHANGE FORAGE KOCHIA (*Kochia prostrata*) GERMPLASM FOR CROP AND RANGELAND IMPROVEMENT


***U.S. Participants***

Dr.Blair L. Waldron - Research Geneticist

USDA - Agricultural Research Service

Logan, UtahU.S.A.

Mr. R. Deane Harrison - USDA-NRCSEmeritusRange Scientist

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***PrimaryUzbekistan Participants***

Dr. Tolib Mukimov - Head of Laboratory for Desert Forage Production and Plant Physiology

Dr. Abdullo Rabbimov - Specialist for Introduction and Selection of Plants

Dr. S. Yusupovich Yusupov - General Director

Gulya Tursunova - Librarian, interpreter, and translator

Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts

47, M. Ulugbek, 703000

Samarkand, Uzbekistan

**GERMPLASM EXCHANGE ITINERARY:**

Traveled from Logan, UT to Tashkent, Uzbekistan (via Frankfort, Germany) ... Oct. 20-21.
Met with ICARDA Central Asia and Caucasus Regional Program Representative, Tashkent ... Oct 22.
Traveled to Samarkand, Uzbekistan ... Oct 22.
Toured divisions of the Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts ... Oct 23.
Visited and met with scientists from the Samarkand Department of the Uzbekistan Academy of Sciences and the Biology department of SamarkandStateUniversity ... Oct 23.
Traveled to and from Karnab Experiment Station - Harvested forage kochia seed ... Oct 24.
Met with Uzbek Research Institute director - Prepare receipts and documentation to export seed ... Oct 25.
Traveled to and from Nurata Experiment Station - Harvested forage kochia seed ... Oct 26.
Traveled from Samarkand to Tashkent, Uzbekistan - Collected wild forage kochia seed en route ... Oct 27.
Traveled from Tashkent, Uzbekistan to Logan, UT (via Frankfort, Germany)... Oct 28

**INSTITUTIONS VISITED:**

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Dr. Botir Bekchanov, Halophyte Specialist and Head of Plant Introduction Lab
Dr. Uzak Egamnazarov, Pasture Phytomelioration and Karnab Exp. Station Director
Ms. Elina Tumshaevna Suzaeva, Seed Production and Seed Science Specialist
Dr. Nasrullo A. Bobokulov, Head of Feeding and Maintenance of Karakul Sheep Lab
Dr. Rakhmatullo Khaitboev, Head of Pasture Utilization Lab
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Scientific Contact(s):
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InternationalCenter for Agricultural Research in the Dry Areas (ICARDA), Central Asia and Caucasus Regional Program, Tashkent, Uzbekistan

Scientific Contact(s):
Dr. Luis Iniguez

**PURPOSE OF TRIP:**

1. To exchange seed of the U.S. cultivar ‘ Immigrant’ forage kochia for Uzbek varieties of forage kochia representing subspecies *villosissima*, *canescens*, and *virescens*.
2. To arrange for cooperative studies comparing the performance of Immigrant and the Uzbek forage kochia varieties.
3. To continue to develop contacts and to expand upon interactions for germplasm exchange and

related agricultural research with scientists and administrators associated with the Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts at Samarkand, Uzbekistan.

## SUMMARY:

We consider the expedition to have been very successful.In exchange for ‘ Immigrant’ forage kochia, we obtained bulk seed of six types of Uzbek forage kochia and arranged for collaborative research between ARS and the Uzbek Research Institute.Much of the forage kochia seed was still immature, but we were able to obtain some with good viability.The Uzbekistan personnel at the Uzbek Karakul Sheep Breeding Institute were excellent hosts.T. Mukimov and A Rabbimov were wonderful guides, while G. Tursunova was very effective as the interpreter.We were able to initiate a good coordinated program which should benefit both the U.S. and Uzbekistan.We are pleased with the expedition and feel its purpose was successfully accomplished.

In addition to the germplasm, we obtained useful information about forage kochia.We were told that forage kochia is a preferred forage for sheep, goats, and cattle in the semiarid desert area, and often referred to as “ the alfalfa of the desert” .Two unpublished Uzbek Research Institute reports on the ecology, biology, and breeding and ploidy level of forage kochia were translated into English.We learned from Dr. Rabbimov that their Institute classifies forage kochia into three types or subspecies: (1) Sandy ecotype - spp. *villosissima,* originating from Kazakhstan and characterized as being more gray and pubescent and the least preferred by livestock; (2) Stony ecotype - spp. *canescens,* originating from Kirghizia and characterized as being highly variable; and (3) Clay ecotype - spp. *virescens,* originating from Uzbekistan and characterized as being the most glabrous and preferred by livestock.However, we discovered that Dr. Toderich of the Uzbek Academy of Sciences, agrees with Balyan’ s classification in combining spp. *villosissima* and *canescens* into the spp. *grisea*.

## TECHNICAL REPORT AND DETAILS:

### Background

The use of forage kochia (*Kochia prostrata)* has accelerated on Western U.S. rangeland restoration projects in recent years.This valuable semi-shrub is being used for soil erosion control, wildlife and livestock forage, green striping and fire prevention, upland game bird habitat, and to suppress invasive annual weeds such as cheatgrass (*Bromus tectorum*) and halogeton (*Halogeton glomeratus).* Harrison et al. (2000) conducted a 3-year study to investigate the adaptability and the potential invasiveness of forage kochiaThey reported that forage kochia was widely adapted to the semi-desert and desert ecosystems of the western rangelands and was not an aggressive invader of perennial closed plant communities [*Harrison,et al. 2000. Forage Kochia - Its compatibility and potential aggressiveness on Intermountain rangelands. Utah Ag. Exp. Sta. Res. Rpt. 162. (Available on-line at http://www.agx.usu.edu/agx/ResearchReports/KOCHIA/kochia.html)*].

In 1998, under the direction of Dr. Blair L. Waldron, the United States Department of Agriculture, Agriculture Research Service (USDA-ARS), Forage and Range Research Laboratory (FRRL) in Logan, UT, initiated a forage kochia breeding and genetics program. This was in response to requests from private ranchers and others who desired a taller upright plant for improved livestock and wildlife winter grazing and better gamebird and small mammal habitat.Immigrant forage kochia, which is relatively low growing, is the only released cultivar in the U.S.In view of the little variation in the stature and height of Immigrant, FRRL scientists organized a forage kochia germplasm collection trip to the Aral Sea region of Kazakhstan.This trip was made in 1999, in cooperation with the N.I. Vavilov Institute of Plant Industry (St. Petersburg, Russia), the NationalAcademicCenter for Agricultural Research of the Ministry of Science and Higher Education of the Republic of Kazakhstan, and USDA-ARS International Programs, and resulted in over 200 forage kochia collections.

Literature review and reports indicated that scientists in Uzbekistan had released several forage

kochia cultivars.Scientists from the Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts visited the USDA-ARS-FRRL in Logan, UT in June 2002 and described forage kochia types that stood 1.8-m tall and yielded 1600 kg $ha^{-1}$ on less than 300 mm ppt. $year^{-1}$.Subsequent contacts were made with the Uzbek Research Institute, and funding for a germplasm exchange trip was applied for and obtained from the USDA-ARS National Germplasm Resources Laboratory.The purpose of the forage kochia germplasm exchange expedition was clearly defined prior to trip and included the following: (1) Exchange of forage kochia germplasm - The USDA-ARS would provide Immigrant forage kochia seed and the Uzbek scientists would provides seed of, or opportunity to collect seed of, Uzbek forage kochia varieties; (2) Cooperative field evaluation and molecular genetic studies would be initiated; and (3) translation of key forage kochia papers (to English) would be arranged.

**Expedition Details**

**October 20-21.**U.S. team members left Logan, Utah and traveled to Tashkent, Uzbekistan (via Salt Lake City, Utah;Atlanta, Georgia, and Frankfurt, Germany).We were met at the airport by Dr. Tolib Mukimov and taken to the Diphotel in Tashkent.

**October 22.** Accompanied by Dr. T. Mukimov, we met with Dr. Luis Iniguez of the InternationalCenter for Agricultural Research in the Dry Areas (ICARDA), Central Asia and Caucuses program, headquartered in Tashkent.The goals of ICARDA, their cooperative research with the Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts, and the purpose of our trip were reviewed. We then registered with the U.S. Embassy in Tashkent and traveled to Samarkand, Uzbekistan.

**October 23.** We toured the Uzbek Research Institute□s main building in Samarkand and the goals and objectives of the institute were presented by its scientists, and we reviewed the purpose of our trip. The following Institute scientists were at the meeting Director S. Yusupov, and Drs. T. Mukimov, A. Rabbimov, M. Makhmudov, B. Bekchanov, N. Bobokulov, R. Khaitboev, and K. Sindarov.We then had the opportunity to meet with Drs. B. Mardanov and C. Toderich of the Samarkand Department of Academy of Sciences of Uzbekistan, and Dr. M. Nasirov of SamarkandStateUniversity.

**October 24.**The expedition continued with discussion and forage kochia seed collection at the Karnab Experiment Station.We were accompanied by Drs. T. Mukimov and A. Rabbimov.

**Karnab Experiment Station**

Dr. U. Egamnazarov head of the Karnab Experiment Station directed our tour and activities.The station is located at the town of Karnab in the territory of the agricultural enterprise □Razzok Jahangirov,□ Nurabad providence, Samarkand Region, and 150 km NW from Samarkand (39'40"N, 65'47"E).The station represents the Sagebrush-EphemeroidalDesert rangelands of the foothills of Uzbekistan. The altitude is 487 m and the site is characterized by an annual air temperature of 14.6☜C and annual precipitation of 166 mm.The majority of the precipitation is received during November-May and is basically dry from June-October.The current dominant native species in the ecosystem include: sagebrush (*Artemisia diffusa*), camel thorn (*Alhagy pseudoalhagi),* and bulbous blue grass *( Poa bulbosa)*.Other plants found in the area included cheatgrass *(Bromus tectorum),* sedge *(Carex pachystachya),* foxtail barley *(Hordeum leporinum),* spring grass *(Eremopyrum orientale),* and loco weed *(Astragalus alocepius)*. The soil is classified as gray brown loamy serozem with an occasional gypsum horizon in the soil profile. The surface texture is silty clay loam.Grazing of livestock in the area, mainly karakul sheep, is uncontrolled and unsystematically used. The majority of the rangeland is in a low state of health.In especially heavily-grazed areas near villages, many of the desirable species are being replaced by the poisonous plant peganum

*(Peganum hazmala)*.
Rangeland species, that we observed being investigated at the experiment station include the following: "Otavny" variety of forage kochia (*Kochia prostrata* spp. *canescens)*, Haloxylon (*Haloxylon aphyllum*), four-winged saltbush (*Atriplex canescens)*, camphoromosa (*Camphoromosia spp),* Salsola *(Salsola orientalis),* calligonum (*Calligonum microcarpium*) and halothamus *(Halothamus sybaphylla)*.
Seed was collected from individual plants within test plots of Otavny forage kochia.
Following the germplasm collection at Karnab we observed haloxylon (*Haloxylon aphyllum)* planted in strips about 15-m wide and 250-m apart.Later we visited a 1000 ha area that had been planted to forage kochia (spp. *canescens)* for seed production.However, the area had been heavily grazed and was not currently used for seed harvest.
**October 25.** The team toured the Institute"s Karakul sheep breeding museum in Samarkand and learned more about the Karakul sheep culture.We prepared trip receipts, prepared kochia seed for export, and made arrangements for phytosanitary inspection and certificate.
**October 26.** The expedition continued with discussion and forage kochia seed collection at the Nurata Experiment Station.We were accompanied by Drs. T. Mukimov, A. Rabbimov, N. Bobokulov, and Prof. M. Makhmudov.Prof. Makhmudov provided Deane Harrison with detailed ecological descriptions of the experiment stations.
**Nurata Experiment Station**
The experiment station is located near the city of Nurata, where Alexander the Great had a major fortress.It is in the Navoi Region about 300 km NW from Samarkand (40'28", 65'42").The station represents the semidesert foothill rangelands of Uzbekistan.The altitude is 650 m with an average annual air temperature of 15.4☜C and annual precipitation of 225 mm.The majority of the precipitation occurs during November-May.The soil is classified as a serozem with a fine sandy loam to a sandy textured surface soil.Native species in the ecosystem were similar to those found in the area around the Karnab experiment station.The current major species were sagebrush and bulbous blue grass.Research plots were old (established in 1986) and included many similar species to those at Karnab.Originally, they were used for seed production of improved forage types.

2' Sahro' forage kochia

Bulk and individual seed collections were made from "Sahro" variety forage kochia *(K. prostrata* spp. *villosissima*), and "Karnabchulsky" variety forage kochia (*K. prostrata* spp. *canescens*).A third seed collection was made at this site, prior to our arrival, from an early maturing forage kochia variety ("Pustinny" variety *K. prostrata* spp. *virescens*). Seed was also collected from winterfat (*Krascheninnikovia erwinsmannia*).
A Cooperative ICARDA research project was reviewed at a irrigated farm near Nurata. The suitability of several different varieties of mulberry trees and corn were being tested.Another cooperative ICARDA project investigating animal husbandry-rangeland utilization was visited approximately 100 km east of Nurata.Overall performance of 400 sheep and 24 cows along with range condition and trend were being evaluated.This study is replicated at two other locations.We were able to observe a Sandy Desert Ecological Site near this farm which had the following species: *Artemisia scoparia, calligonum microcarpium, Astragalus unifalalatus, Carex phisodes*, *Haloxylon persicum, Salsola paletshiama, and S. richteri* and other minor species.

1' Otavny' forage kochia

**October 27.** The team traveled from Samarkand to Tashkent.We were accompanied by Drs.

A. Rabbimov and T. Mukimov.En route, we stopped at the Jazzah region and collected seed from forage kochia believed to be native to the area.

**Jizzah Native Forage Kochia Area**

3Wild/native forage kochia protected from grazing by camel thorn. The native germplasm collection area was along the main highway between Samarkand and Tashkent, near Shzud - Amigdalis in the Jizzah region (Dzhizak city, 40'07"N, 66'08"E).It is in a semidesert foothill area. The soil surface texture is silt loam and is a typical serozem.It receives an estimate of 500 mm of annual precipitation.The average temperature 14.0 C and the elevation is about 850 m.The rangeland was over grazed and the few unprotected forage kochia plants were heavily utilized.The plant community was comprised mainly of sagebrush (*A. fogiana),* bulbous bluegrass, and camel thorn.Tall wheatgrass (*Elytrigia elongatia)* was found in a protected area.

**October 28.** We traveled from Tashkent to JFK airport in New York (via Frankfort, Germany). The seed was turned over to APHIS for quarantine inspection.We then flew to Salt Lake City, Utah.

**November 6.** Forage kochia seed arrived in Logan, UT (from APHIS).Viability of seed was checked and found to be low, but sufficient to start plants of most collections.

**Catalog of Accessions.** Forage kochia types (varieties) obtained in germplasm exchange between USDA-ARS and the Uzbek Research Institute of Karakul Sheep Breeding and Ecology of Deserts.

| Species[1] | Subspecies | Variety/type | Description[2] |
|---|---|---|---|
| *Kochia prostrata* | *canescens* | Otavny | Developed using mass selection in stony-type populations collected from foothill regions of Kirgizia.Characterized by having both upright and semi-upright forms, and its regrowth ability after harvest. Yields of 1680 kg $ha^{-1}$ (protein levels of 12-16%) have been reported. It is adapted to semi-saline soils in areas receiving 160-200 mm annual ppt. |
| *Kochia prostrata* | *canescens* | Karnabchulsky | Deep rooted, very palatable type with reported yields of 1240 - 1510 kg $ha^{-1}$ and protein levels of 13-15%. Adapted to desert regions with mean annual ppt. of 100-200 mm. It is reported to be mainly tetraploid (4x=36) with some hexaploid off-types (6x=54). |
| *Kochia prostrata* | *villosissima* | Sahro | Developed using mass selection within a Kizilkum population of sandy ecotype. Shoots and leaves are very pubescent, and it is known for its prolonged vegetative period and semi-upright stature. Yields of 1500 - 1700 kg $ha^{-1}$ (13-15% protein) have been reported. Adapted to regions receiving 80-120 mm annual ppt, including sandy deserts. |
| *Kochia prostrata* | *virescens* | Malguzarsky | Also known as Malguzarsky-88, it was an original type used in Uzbekistan before 1972. From the Malguzarski region. It is a diploid (2x=18). |

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|---|---|---|---|
| *Kochia prostrata* | *virescens* | Pustinny | Leafy, disease and pest resistant type developed using repeated mass selection. Reportedly yields 1170 - 1420 kg $ha^{-1}$, with protein levels of 11-13%.Adapted to desert and semidesert areas receiving 160-350 mm annual ppt.It is diploid with a large number of tetraploid off-types. |
| *Kochia prostrata* | *virescens* | native-wild | Collected along the main highway between Samarkand and Tashkent, near the cities Shzud and Amigdalis, in the Jizzah region. Seed was obtained from plants protected from grazing. Predominantly yellow-stemmed, but also contained red-stemmed plants. |

[1]NPGS system classifies *Kochia prostrata* as *Bassia prostrata*, however this classification has not been recognized in Uzbekistan.

[2]Variety descriptions taken from unpublished report by Dr. A. Rabbimov entitled, "Ecological and biological peculiarities and achievements in the selection of *Kochia prostrata* (L.) Schrad in Uzbekistan".