PLANT GERMPLASM COLLECTION REPORT

USDA-ARS
FORAGE AND RANGE RESEARCH LABORATORY
LOGAN, UTAH

Foreign Travel to:
Northern Pakistan and Nepal
August 20 - September 21, 1986

U.S. Participants

***Douglas A. Johnson*, Plant Physiologist**
USDA-Agricultural Research Service
Logan, Utah U.S.A.

GERMPLASM ACCESSIONS

3. Purpose of trip:

1) To collect seed and nodule samples of perennial Medicago species

2) Discuss progress and future plans of cooperative research involved in USDA/CSRS Project #85-CRSR-2-2773 entitled "Biological Nitrogen Fixation in Co-Evolved Rhizobium and Medicago falcata Ecotypes"

3) To collect seed of promising range forage species

4. Summary:

Research progress of our cooperative research project was discussed and future research plans were made with scientists of the Pakistan Agricultural Research Council at Islamabad, Pakistan. Arrangements were finalized for Mr. Athar Anees Tariq's arrival in Logan, Utah to start a Ph.D. program in the Range Science Department. A total of 30 seed collections and 23 nodule collections were made of Medicago sativa and of hybrids between M. sativa and M. falcata in the Hindu Kush Mountains of northern Pakistan. Another 104 seed collections were made of various forage species in northern Pakistan that may hold potential for agronomic use. Nine seed collections of M. falcata and one of M. sativa were obtained along with 10 corresponding nodule collections from the cold, dry Himalayan Mountain Region in Nepal. An additional 16 seed collections of various perennial forage species were made in Nepal. M. falcata holds considerable promise as a valuable forage resource for the Hindu Kush-Himalayan Mountain Region and the International Region in the western U.S. Additional seed and nodule collections of M. falcata throughout the Hindu Kush-Himalayan Mountain Region should be made to adequately sample variability for forage production and biological nitrogen fixation potential. A great opportunity exists for mutually beneficial cooperative forage and range management research projects between the U.S. and countries in the Hindu Kush-Himalayan Mountain

Region. Cooperative forage and range management projects between the U.S. and countries in the Hindu Kush-Himalayan Mountain Region are almost non-existent and should be expanded.

5. Travel details:

20-24 August; Logan to Islamabad, Pakistan

I traveled from Logan, UT via London, England to Islamabad, Pakistan. Similar to last year's trip, we interacted with cooperating scientists of the Pakistan Agricultural Research Council (PARC). I will not repeat the background information concerning agricultural research in Pakistan. Individual interested in this background information should consult our last year's foreign travel report (D. A. Johnson and M. D. Rumbaugh, 2-22 October 1985). The new PARC office is very near completion and relocation should be taking place within the next few months. The address of PARC is:

Pakistan Agricultural Research Council
L-13, Almarkaz F-7
Post Box 1031
Islamabad, PAKISTAN

While in Islamabad, I consulted with PARC administrators. This included visits with Dr. G. R. Sandhu (PARC Member, Natural Resources) and Dr. Muhammad Iqbal (PARC Director of Land and Water Resources.) We discussed the research results and ongoing experimentation of our cooperative research project, and the details of Mr. Athar Anees Tariq's Ph.D. program with our project. Mr. Tariq is scheduled to arrive in Logan in September 1986 to begin his graduate program in the Range Science Department. Mr. Iqbal made final arrangements for securing a Toyota four-wheel drive vehicle and driver for our collecting trip to the Northern Area of Pakistan.

While in Islamabad, Dr. Noor Mohammad, Co-Principal Investigator of our project who is Director of Range and Watershed Management at PARC, and I discussed our cooperative research project. His address is:

Dr. Noor Mohammad
National Agricultural Research Centre
P.O. NARC, Park Road
Islamabad, PAKISTAN

We reviewed progress of our cooperative experimentation and made detailed plans of future research activities. The Pakistan portion of the research has involved utilizing the soil sample collected during our 1985 trip to the Northern Area of Pakistan. These soil samples were sown with Spredor 2 (cultivar of Medicago sativa from the U.S.), Anik (cultivar of M. falcata from Canada), and Punyal (local type of M. sativa from northern Pakistan). Seedlings of each of the three perennial Medicago species were grown in each of the soil samples. After 18 weeks, plant growth and nodulation by indigenous rhizobia in each of the soil samples were evaluated. Growth of plants that were not nodulated was poor in most soils indicating that symbiotic

nitrogen fixation is important in most of the soil sampled in the Northern Area of Pakistan. All soil contained rhizobia capable of nodulating at least one of the three alfalfas; however, many could not nodulate all three. Even when all three alfalfas were nodulated, their growth was variable, indicating that some rhizobia may be better able to fix nitrogen with some host alfalfas than others. Consequently, matching of host alfalfas with effective Rhizobium appears to be of value in northern Pakistan.

Dr. Noor Mohammad also indicated that the alfalfa adaptation trials have been initiated in Pakistan. The 52 accessions that we sent from the U.S. plus an additional 8 accessions were successfully sown with and without Rhizobium inoculation at Muzaffarabad in Azad Kashmir and at Mustang in Baluchistan. An additional planting was sown at Islamabad, but had failed. Fall plantings of these same 60 accessions will be sown in October at the Korakoram Agricultural Research Station at Juglote near Gilgit and at Islamabad. Preliminary indications are that significant variation exists among alfalfa accessions for dry matter production. Preliminary results also indicated that inoculation with commercial Rhizobium inoculum appears to result in greater plant growth than no inoculation. More definitive information concerning forage yield comparisons among the 60 alfalfa accessions will be available next growing season.

Plans of our collection trip to the Northern Area were also discussed with Dr. Noor Mohammad. A recent wheat germplasm collection trip to northern Pakistan had been conducted by Dr. Rashid Anwar from the National Agricultural Research Center (NARC) at Islamabad, Dr. Bob Metzger from Corvallis, Oregon, and Dr. Buddie Somaroo from the International Center for Agricultural Research in Dry Areas (ICARDA) in Aleppo, Syria. We discussed the collecting efforts of this team with Dr. Rashid Anwar, and he indicated that they had seen cream-flowered alfalfa growing in the Skardu area in northern Pakistan. Based upon Dr. Anwar's report, we decided to make a repeat collection to the Gilgit and Hunza Valley areas and then to drive to Skardu for collection.

25-29 August; Islamabad to Gilgit and Hunza Valley, Pakistan

I was accompanied on my trip to the Northern Area of Pakistan by Mr. Athar Anees Tariq who accompanied us on our trip last year and by Mr. Shabaz from the biological nitrogen fixation project at the National Agricultural Research Center at Islamabad. We traveled north to Gilgit via Haripur, Abbottabad, Mansehra, Balakot, Battagram, Besham, Patan, Kamila, Dasu, and Chilas on the Korakoram Highway. We located Mr. Ali Gohar in Gilgit who had accompanied us during our trip last year, and he agreed to accompany us on our current trip. Mr. Gohar was not presently working at the Korakoram Agricultural Research Station at Juglote, but rather is working with the Aga Khan Rural Support Program (AKRSP) at Gilgit where he is in charge of training local villagers for agricultural extension positions. Because most of the trainees are illiterate, this represents a tremendous challenge. They have had excellent success in their training program. We also met with the Pakistan Agricultural Research Council at Islamabad. He was most impressive and explained the extremely beneficial program of AKRSP. They are presently working on village land use plans with eventual incorporation into a Hunza Valley Master Plan. They work closely with the villagers in all aspects of agricultural improvement. There are four main land forms in northern Pakistan, including; 1) river terraces, 2) alluvial fans, 3) moraines, and skree slopes. The AKRSP is actively involved with the formation of village agricultural commodities. The AKRSP staff members are Pakistanis and have been very

successful in forming these village cooperatives and in motivating villagers to improve their farming situation. A major effort in this area has been fruit dehydration programs and in organizing crop and tree adaptation trials. Mr. Alam's address is:

Dr. Zahur Alam
Aga Khan Rural Support Program
Babar Road
Gilgit, Northern Area, PAKISTAN

Mr. Ali Gohar accompanied us on our trip throughout the Gilgit and Hunza Valley areas. His capable assistance was invaluable in locating previously sampled sites form our 1985 trip for repeat sampling. Mr. Gohar is from the village of Chaprote near Chalt. He knows the Gilgit and Hunza Valley areas extremely well and is knowledgeable of the local dialects. With Mr. Ali's help we obtained additional seed and nodule collections to supplement our 1985 sampling. The timing of the present trip for late-August and early-September was better than our 1985 trip because considerable more seeds were available. Future germplasm collection trips for perennial forage grasses and legumes in this area of Pakistan should be conducted during late-August and early-September. A total of 48 seed collections (see attached species listing) was obtained in the Gilgit and Hunza Valley areas with 13 of these representing perennial Medicago seed and nodule collections.

30 August to 4 September; Gilgit to Skardu, Pakistan

We traveled from Gilgit to Skardu via Rhondu. Mr. Gohar recommended contacting Mr. Mohammad Afzal Kahn, Divisional Forest Officer at Skardu. We were fortunate to locate Mr. Khan upon our arrival in Skardu. We discussed our collection interests with Mr. Khan, and he advised us on possible collection locations and seconded one of his forestry assistants to accompany us. Mr. Khan also arranged accommodations for us at the NWFP Rest House in Skardu. Mr. Khan's address is:

Mr. Afzal Khan
Divisional Forest Officer
Skardu, Baltistan
PAKISTAN

We were successful in obtaining 83 seed collections of various perennial forage grasses and legume species in the Skardu area (see attached species listing). This included 16 collections of seed and nodules from perennial Medicago species of which 5 were cream-flowered hybrids between M. sativa and M. falcata. No pure M. falcata plants were located in the Skardu area.

We had particularly good success in collecting a wide range of perennial forage species on the Deosai Plateau located south of Skardu. We rented a jeep and driver in Skardu to get to the Deosai Plateau. After the first 30 miles, the road to Deosai becomes extremely narrow, very

steep, and accessible only by a few very experienced drivers. We were very fortunate to hire one of the few driver-mechanics who is capable of making the trip to Deosai. His name is

Mr. Hakeem Shah
Hakeem Engineering Works
New Bazaar, Skardu
Baltistan, PAKISTAN

Dr. Yasin Nasir and Miss Rubina Akhter at the National herbarium taxonomically verified our collected specimens. The seed collections were packaged for shipment by Diplomatic Pouch Mail to the Plant Germplasm Quarantine Center in Beltsville, MD. Although I did not have an opportunity to meet the newly appointed Agricultural Officer at the Islamabad AID Office, his name and address are:

Mr. Harry Dickherber
USAID/Islamabad, Pakistan
Agency for International Development
Washington, DC 20523

7-8 September; Islamabad, Pakistan to Kathmandu, Nepal

I flew form Islamabad, Pakistan to Kathmandu, Nepal with an overnight stop in Karachi. I was met at the Kathmandu Airport by Mr. M. B. Thapa, Assistant Livestock Development Officer with the Coordinated Livestock Development Programme, and by Mr. Madhukar Upadhya, a recent M.S. graduate of the Range Science Department at Utah State University, both of whom accompanied me for the duration of my visit in Nepal. Their addresses are:

Mr. M. B. Thapa Mr. Madhukar Upadhya
Coordinated Livestock 78 Gha
Development Programme Gyaneshwar
Kha-2-111 Kathmandu, NEPAL
Putlisadak, Kathmandu
NEPAL

After checking into my hotel, Mr. Thapa and Mr. Upadhya assisted me in making the necessary arrangements for our trip to the Mustang District of Nepal. This necessitated obtaining a government-issued Trekking Permit, which required extra passport photos. The issuance of my Trekking Permit was greatly expedited by Mr. Upadhya. Having a Nepali assist in obtaining the numerous approval signatures, stamps, etc., shortened the required time, and in a matter of about 30 minutes I had been issued my required Trekking permit. We then make the necessary flight reservation and obtained tickets for our Royal Nepal Airlines flight from Kathmandu to Pokhara.

9-14 September; Kathmandu to Jomsom, Nepal

This time of the year is near the end of the monsoon season in Nepal. Consequently, air travel in Nepal at this time is very subject o the uncertain weather conditions. During our trip, Nepal

received the hardest rains of the monsoon season. However, travel to the cold, dry Mustang District at this time was necessary to ensure seed collection before all available forage was harvested and before winter snows arrived. Others going to Nepal and not needing to make seed collections at high elevations would be well advised to schedule their trip during October or November to avoid travel scheduling uncertainties associated with the monsoon rains.

We flew to Jomsom in the Mustang District of Nepal via an overnight stop at Okhara. The regularly scheduled Royal Nepal Airline flights from Pokhara to Jomsom and return operate only once or twice a week, and sometimes do not operate at all because of the weather. Sometimes Nepali businessmen charter Royal Nepal Airlines flights between Pokhara and Jomsom and return so it is possible to obtain seats on these chartered flights to and from Jomsom. However, usually these are primarily used for transporting cargo rather than passengers. Consequently, seats to and from Jomsom can be extremely difficult to obtain. The 8 or 9 passenger seats are often allocated first to friend or relatives of the businessmen. Fortunately Mr. Thapa and Mr. Upadhya knew the business men who chartered these flights. The weather can cause flight cancellations during the monsoons or other times of the year so that an additional 7 to 10 days is not an unreasonable dely for travel to the Mustang District. The alternative to flying is to hike to Jomsom, which would typically take 3 to 4 days of walking.

The trip from Pokhara to Jomsom is spectacular. The plane follows mountain valleys between the peaks of Annapurna and Dhawalagiri (both over 7,900 m of 26,000 feet elevation). Jomsom is located at an elevation of 2,682 m (8,800 ft.) and is characterized as a dry, windy, cold mountain valley environment. There are not roads in this area of Nepal so that transportation is by horse, mule, or walking.

We found Medicago falcata growing abundantly in the field margins of the cropping areas in the Jomsom area. M. falcata is being used by the farmers in this area for fall and winter forage and is commonly known as kote. It would undoubtedly be widespread throughout the rangeland areas as well, if the overgrazing were not so severe. One progressive farmer at Kagbeni (north of Jomsom) was growing M. falcata on about 3 acres of his land. By protecting the area form overgrazing the providing supplemental watering, the farmer was able to effectively convert the area to a dense stand of of M. falcata. He harvested the kote using a two-cut system and used the forage to mainly feed his horses. He sold extra M. falcata to other farmers at quite a high price (30 rupees for small bundle). Because of the value of this forage, the farmer was in the process of expanding M. falcata to additional field areas. In addition, this farmer was trying M. falcata as a cover crop in this fruit orchards.

The rapidly expanding population in the Hindu Kush-Himalayan Region is placing severe constraints on the natural resources of this Region. This population pressure is causing expansion of subsistence agriculture on steep slopes, destruction of forest resources, and overgrazing of rangelands in the Hindu Kush-Himalayan Region. In many areas this situation is leading to soil erosion, flooding, and loss of productive agricultural lands. This is resulting in decreased agricultural productivity and environmental degradation. In conjunction with proper rangeland management the use of native forage species may help in alleviating some of the problems associated with this degradation. Because of their nitrogen fixing capability, native forage

legumes such as M. falcata may hold considerable potential for helping the forage situation in the Hindu Kush-Himalayan Region.

M. falcata is apparently found throughout the Hindu Kush-Himalayan Mountain Region between elevations of about 2,400 to 3,700 m (7,800 to 12,100 ft.) and is well adapted to this cold, dry climate of this area. Because of the acute shortage of forage in this Region and the success that the progressive farmer at Kagbeni was having with M. falcata, the forage potential of M. falcata should be carefully evaluated. M. falcata likely has potential in many of the cold, dry mountainous areas of the Hindu Kush-Himalayan Region.

Twenty-five seed collections of perennial forage species were made in the Mustang District in the villages of Chairo, Jomsom, Kagbeni, Khinga, Jarkot, and Muktinath (see attached listing). Of these, 9 were collection of M. falcata. Nodules were also collected for each M. falcata collections. Although some plants were profusely nodulated, M. falcata plants exhibited considerable variability for nodulation. Arrangements were made with local extension personnel to make additional seed and nodule collections of M. falcata. These collections will be important in addressing our co-evolution hypothesis concerning the matching of rhizobial strains with specific plant ecotypes. They will also serve as valuable material for selecting the most effective combinations of M. falcata and R. meliloti for maximum biological nitrogen fixation. However, a greater diversity of seed and nodule collections of M. falcata is needed to more adequately sample the variability present within the Hindu Kush-Himalayan Mountain Region.

South of Jomsom in the village of Marpha, we visited with Mr. Madan Rai, Assistant Vegetable Development Officer with the National Temperate Horticultural Research Station. The research station conducted research concerning fruit tree and vegetable adaptation and cultivation for the cold, mountainous regions of Nepal. The station is also evaluating various fruit and vegetable processing techniques for preserving the villagers' horticultural crops. Specific work involves fruit and vegetable drying, brand making, storage processing, and marketing. Presently there is a staff of 65 working at the research station, but the research station is slated for a budget increase for next year so that an additional 40 staff may be added. The address of the research station is:

National Temperate Horticultural Research Station.
Marpha, Mustang, NEPAL

At Marpha we also visited the Livestock Development Subcenter. The Subcenter functions primarily as an extension service center. It provides advice and consultation concerning veterinary services, forage and fodder production and agronomy. The Subcenter is staffed by four persons. The address of the Subcenter is:

Livestock Development Subcenter, Marpha, Mustang, NEPAL

15-17 September; Jomsom to Kathmandu, Nepal

We returned to Katmandu by plane via a short stopover in Pokhara. After air-drying the seed samples, the seed was package for shipment by Diplomatic Mail Pouch through the US AID office to the Plant Germplasm Quarantine Center in Beltsville, MD. I discussed our trip to the

Jomsom area and forage production research in Nepal with agricultural officers at the US AID mission including Drs. Charlie Hash, George Taylor, and Gary Alex. Their address is:

USAID/Kathmandu, Nepal
Agency for International Development
Washington, DC 20523

While in Kathmandu, I also discussed our trip to Jomsom and learned of agricultural research currently being conducted in Nepal in conversations with Dr. A. John DeBoer. Dr. DeBoer is Chief of Party of a large US AID sponsored project being conducted jointly with his Majesty's Government of Nepal and entitled "Agricultural Research and Production Project", referred to as the ARP Project. His address is:

Dr. A. John DeBoer
Winrock International USAIR/HMG ARP Project
P.O. Box 1336
Kathmandu, NEPAL

Dr. DeBoer is on staff with the Winrock International Institute for Agricultural Development, which was established in 1985 with the merging of the Agricultural Development Council, the International Agricultural Development Service, and Winrock International Livestock Research and Training Center. Winrock International is an autonomous, nonprofit corporation that contracts projects involved with providing technical assistance and professional expertise to international agricultural development. Winrock International currently had projects in more than 20 countries around the world and has a senior staff that numbers about 120 scientists and technical specialists with expertise in the plant, animal, and social sciences. Its main headquarters address is:

Winrock International
Route 3
Morrilton, AR 72110

The overall goal of the ARP Project is to increase the agricultural productivity of small farmers in Nepal including livestock, agro-forestry, and important food crops. To achieve this goal, the project is strengthening Nepal's institutional capabilities to plant, coordinate, and evaluate agricultural research; supporting research stations more effectively; assisting in the development of new technologies for small farmers; developing methodologies for conducting comprehensive production programs in the hill country of Nepal; and improving hill farmer's access to improved seed varieties. Main funding of the ARP Project is being provided by an AID grant ($10 million) and the Government of Nepal ($3.8 million). The project was initiated in 1985 and will continue through 1990.

While in Kathmandu, I visited with Dr. Colin Rosser, Director of the International Center for Integrated Mountain Development (ICIMOD). ICIMOD's overall objective is to promote integrated mountain development in the Hindu Kush-Himalayan Mountain Region. This Region is the largest mountain area in the world and directly sustains more than 100 million people.

ICIMOD was established to provide a coordinated, systematic international effort to design and implement effective measures to help alleviate environmental degradation of these mountainous areas. ICIMOD began its professional activities in September 1984 and has been successful in promoting exchange of technical information and regional cooperation of its member countries including: Nepal, Pakistan, Bhutan, China, India, Afghanistan, Bangladesh, and Burma. ICIMOD's funding and support is being provided by the Governments of Nepal, Switzerland, the Federal Republic of Germany, and the People's Republic of China; the United Nations Educational, Scientific, and Cultural Organization (UNESCO); and the Ford Foundation.

Under the able directorship of Dr. Colin Rosser, ICIMOD has been successful in completing the equipping an effective and attractive seven-building campus complex in Kathmandu, assembling a professional staff of 26 persons, holding a series of international workshops in the Hindu Kush-Himalayan Region, implementing a major publication series on mountain development and environmental management, establishing professional linkages with national and international agencies and institutions concerned with mountain development, and initiating a Ford Foundation-sponsored Senior Research Fellowship Program. Dr. Rosser is a most helpful person, and anyone interested in research related to mountain development in the Hindu Kush-Himalayan Mountain Region would be well advised to be placed on ICIMOD's newsletter mailing list. Dr. Rosser's address is:

Dr. Colin Rosser
ICIMOD
G.P.O. Box 3226
Kathmandu, NEPAL

While visiting with Dr. Rosser, he informed me of a recently initiated regional project entitled "Himalayan Pasture and Fodder Research Network." This project is jointly funded by the Food and Agricultural Organization (FAO) and the United Nations Development Program (UNDP). This project is headquartered in Kathmandu and will service the countries of Nepal, Bhutan, Pakistan, and India. This long-term objective of this project is to improve the hill farming systems in the Himalayan Mountain Region for the enhancement of the socio-economic well-being of the people in this Region and conservation of the Himalayan natural resources. The main focus of this project will be to strengthen the critical balance between crops, livestock, and forestry by improving the productivity and use of pasture and fodder species in small subsistence farms. The four main priority areas will be: 1) fodder tree development, 2) use of forage legumes in crop rotations, 3) use of fodder grasses, legumes, and trees for soil conservation, and 4) management of native pastures. The National Coordinator for this project is Dr. L. P. Sharma and the FAO Specialist is Dr. C. Samuel. Both Drs. Sharma and Samuel were out of the office during my visit.

This apparently is one of the few multi-country funded projects that deals specifically with applied forage and fodder research in the Himalayan Mountain Region.

18-21 September; Kathmandu, Nepal to Logan, UT

I returned to Logan, UT with an overnight stop in Frankfurt, West Germany.

1986 Pakistan Seed and Nodule Collections

(*denotes nodule collection)

I.D. Number	Species	Location
J-1	Medicago sativa	Jalalabad (1,463 m)
J-2*	Medicago sativa	Upper Basin (1,676 m)
J-3*	Medicago sativa	Gilgit (1,524 m)
J-4*	Medicago sativa	Rahimabad (1,615 m)
J-5*	Medicago sativa	Jafarabad (2,134 m)
J-6	Elymus semicostatus	"
J-7	Elymus russellii	"
J-8	Medicago sativa	Karimabad (2,134 m)
J-9	Melilotus officinalis	"
J-10	Elymus dahuricus	"
J-11	Pennisetum orientale	"
J-12	Elymus caninus	"
J-13	Elymus semicostatus	"
J-14*	Medicago sativa	Shishket (2,377 m)
J-15	Elymus dahuricus	"
J-16	Calamagrostis pseudophragmites	"
J-17	Bothriochloa ischaemum	"
J-18	Calamagrostis pseudophragmites	"
J-19	Elymus nutans	"
J-20	Calamagrostis pseudophragmites	"
J-21	Medicago sativa	Hussanini (2,499 m)
J-22	Elymus dahuricus	"
J-23	Pennisetum orientale	"
J-24	Agrostis gigantea	"
J-25*	Medicago sativa	Passu (2,469 m)
J-26	Elymus dahuricus	"
J-27	Melilotus officianlis	"
J-28*	Medicago sativa	Ganish (2,164 m)
J-29	Elymus semicostatus	"

J-30	Melilotus alba + officianlis	"
J-31	Elymus dahuricus	Aliabad (2,195 m)
J-32	Medicago sativa	Murtazabad (2,164 m)
J-33	Elymus dahuricus + semicostatus	"
J-34*	Medicago sativa	Lower Naltar Valley (1,920 m)
J-35	Pennisetum orientale	"
J-36	Trifolium pratense	"
J-37	Elymus semicostatus	"
J-38	Elymus dahuricus	Mid Naltar Valley (2,377 m)
J-39	Elymus nutans	"
J-40	Elymus dahuricus	"
J-41	Elymus semicostatus	"
J-42	Trifolium pratense	"
J-43	Dactylis glomerata	"
J-44	Elymus semicostatus	"
J-45	Melilotus officinalis	"
J-46*	Medicago sativa	Pari (1,463 m)
J-47	Aristida adscensionis	"
J-48	Melilotus officinalis	"
J-49	Elymus dahuricus	Lake Sadpara (2,530 m)
J-50	Medicago sativa	Skardu-DFO (2,195 m)
J-51	Medicago hybrid	"
J-52	Melilotus officinalis	"
J-53*	Medicago sativa	Skardu-Hoto Farm (2,225 m)
J-54	Phragmites karka	"
J-55	Elymus semicostatus	"
J-56*	Medicago sativa	Lake Kachura Turnoff (2,225 m)
J-57	Indigofera spp.	"
J-58	Lotus corniculatus	"
J-59	Melilotus alba	"
J-60	Trifolium pratense	"
J-61*	Medicago hybrid	"
J-62*	Medicago sativa	Lake kachura Bridge (2,377 m)
J-63	Dactylis glomerata	"
J-64	Pseudoroegneria spp.	"
J-65	Chrusopogon gryllus	"

J-66	Elymus semicostatus	"
J-67	Medicago sativa	Kachura Power Station (2,408 m)
J-68	Medicago sativa	"
J-69	Melilotus officinalis	"
J-70	Elymus semicostatus	"
J-71*	Medicago sativa	Ispecho (2,256 m)
J-72*	Medicago hybrid	"
J-73	Melilotus officinalis	"
J-74*	Medicago sativa	Senkhore (2,256 m)
J-75	Lotus corniculatus	"
J-76	Indigofera spp.	"
J-77	Elymus repens	"
J-78	Elymus dahuricus	"
J-79	Critesion bogdanii	"
J-80*	Medicago hybrid	Skardu (A.K.) (2,195 m)
J-81	Elymus semicostatus	Sadpara Nullah (2,256 m)
J-82	Melica persica	″
J-83	Medicago sativa	Sadpara Rest House (2,530 m)
J-84	Medicago hybrid	"
J-85	Melilotus officinalis	"
J-86	Elymus repens	"
J-87*	Medicago sativa	Thorgu (2,225 m)
J-88	Capillipedium assimile	"
J-89	Iris ensata	"
J-90	Cucurbitae (melon)	Skardu (2,195 m)
J-91	Pseudoroegneria	Deosai (2,987 m)
J-92	Piptatherum gracile	"
J-93	Scrophularia spp.	Deosai (3,353 m)
J-94	Pseudoroegneria	"
J-95	Ranunculaceae	"
J-96	Elymus lange-aristatus	"
J-97	Astragalus spp.	"
J-98	Piptatherum gracile	"
J-99	Oxyria digyna	"
J-100	Polygonum spp.	Deosai (3,353 m)
J-101	Hedysarum cachemirianum	Deosai (3,414 m)

J-102	Pseudoroegneria	"
J-103	Elymus repens	Deosai (3,444 m)
J-104	Bromus pectinatus	Deosai (3,505 m)
J-105	Elymus dentatus	Deosai (3,566 m)
J-106	Aquilegia spp.	"
J-107	Achillea millefolium	Deosai (3,719 m)
J-108	Cicer microphyllum	Deosai (3,749 m)
J-109	Elymus lange-aristatus	Deosai (3,871 m)
J-110	Koeleria macrantha	"
J-111	Tritsetum alneum	"
J-112	Elymus dentatus	"
J-113	Elymus lange-aristatus	"
J-114	Piptatherum munroi	"
J-115	Festuca valesiaca	"
J-116	Koeleria macrantha	"
J-117	Draba spp.	Deosai (3,901 m)
J-118	Geum spp.	"
J-119	Polygonum spp.	"
J-120	Astragalus spp.	Deosai (3,901 m)
J-121	Deschampsia caepitosa	"
J-122	Rostraria cristata	Deosai (3,993 m)
J-123	Sedum spp.	"
J-124	Potentilla spp.	"
J-125	Unknown forb	"
J-126	Silene spp.	"
J-127	Festuca valesiaca	"
J-128*	Medicago sativa	Rhondu (1,920 m)
J-129	Brachypodium sylvaticum	"
J-130	Elymus semicostatus	"
J-131	Elymus dahuricus	"
J-132	Medicago sativa	Juglote (1,463 m)
J-133	Medicago sativa	Jallipur (1,311 m)
J-134	Unknown grass	Aliabad (2,195 m)
Other Nodule Collections		
JR-32	Medicago sativa	Mid Naltar Valley (2,377 m)
(repeat 1985)		

JR-37	Medicago sativa	Danyore (1,463 m)
(repeat 1985)		
Soil #24	Medicago sativa	Gilgit (1,524 m)
(repeat 1985)		
	Medicago hybrid	Thorgu (2,255 m)