PLANT GERMPLASM COLLECTION REPORT

USDA-ARS
FORAGE AND RANGE RESEARCH LABORATORY
LOGAN, UTAH

Foreign Travel to:
Spain
May 21 to June 9, 1985

U.S. Participants

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GERMPLASM COLLECTIONS

Purpose of Trip:

1) To review the U.S.-Spain Binational Project CA 83-142, "Selection and Evaluation of Trifolium Germplasm and Rhizobium Strains."

2) To interview candidates for research positions with the U.S. counterpart Project USDA/OICD #58-319R-5-017.

3) To measure acetylene reduction of indigenous legumes in their native habitats.

4) To collect forage legume germplasm.

Madrid	May 23-24
Jarandilla	May 25
Badajoz	May 26-28
Granada	May 29-31
Sevilla	June 1-4
Gredos	June 5-6
Madrid	Jun e 7-8

SUMMARY

Nitrogen fixation research and the selection of legumes and Rhizobium for enhanced nitrogen fixation in Spain parallels such activity in the United States. There appears to be many opportunities for cooperative research and scientific exchange between the two countries. Candidates for research positions with the U.S. counterpart project at Logan, Utah, were interviewed. Nodules and acetylene reduction activity measurements of 13 legume species were obtained to provide baseline comparison data for the work to be conducted at Logan. A total of 50 seed samples were acquired to provide germplasm of 21 legume species indigenous to southen Spain.

TRAVEL DETAILS

May 21-24:

We traveled from Logan, Utah to Madrid where we rented a car and made preparations for our travel in Spain. Mr. Frank Kinnelly, the Scientific and Technological Attache at the U.S. Embassy, was very helpful and made appointments for us with Dr. Fernado Medina of INIA and with Dr. Tomas Ruiz-Argüeso at the University. Their addresses are as follows:

Dr. Fernando Medina Lopez
Drieccion Tecnica de Relaciones Cientificos
Instituto Nacioanl de Investigaciones Agrarias
Jose Abascal 56
28003 Madrid, SPAIN
Telephone: 442-3199
442-6599

Dr. Tomas Ruiz-Argüeso
Universidad Politecnica de Madrid
Departmento de Microbioligia
Escuela Tecnica Superior de Ingenieros Agronomos
28040 Madrid
Telephone: 244-4807 ext. 264

Dr. Medina speaks English well and is knowledgeable about a wide range of agricultural research activities in Spain. He is an important contact for any USDA-ARS personnel visiting that country. Dr. Medina called the experiment station at Badajoz and verified our itinerary. Arrangements also were made for us to attend the second "Reunion Nacional de Fijacion de Nitrogeno" at Granada because nearly all of the Spanish scientists working in the area of nitrogen fixation were participating in that meeting.

Dr. Tomas Ruiz-Argüeso was the host country organizer of an NSF funded bilateral workshop held in Granada immediately prior to the reunion mentioned above. He obtained a Ph.D. with Harold Evans at Corvallis and later worked in San Diego. His primary research interests currently relate to the genetic control of nitrogen fixation processes. He also conducts some applied investigations of cross-inoculation within the genus Hedysarum. Dr. Ruiz-Argüeso assisted us in obtaining acetylene gas and miscellaneous supplies for our sampling in Spain.

May 25-26:

We traveled a route from Madrid to Toledo, Torrijos, San Martin de Valdieglesias, Arenas de San Pedro and stayed over night in Jarandilla. The crops south of Madrid primarily consisted of small grain. Grape and olive culture was emphasized between Toledo and the Sierra de Gredos Mountains. Considerable irrigated tobacco is grown west of Jarandilla. Trifolium arvense, T. campestre, T. pratense, T. repens, and Vicia sativa were growing in the pine forest near Arenas de San Pedro. All species were in bloom and were well nodulated. Gas samples were obtained to measure acetylene reduction activities. The following day were traveled through Plasencia and Caceres to Badajoz. Much of the province of Extremadura is Mediterranean woodland used for pasture.

May 27-28:

During these two days we met the personnel of the experiment station near Badajoz and reviewed their research projects. The Director of the station is:

Dr. Mariano Mora Seco de Herrera
Servicio de Investigacion Agraria
Finca "La Orden"
Guadajira (Badajoz)
Telephone: 4402 11
Telex: 28738 INIA E

The Subdirector is Dr. Joaquin Jimenez Mozo

Both are fluent in English. The research farm was established in 1968-1970 by the Instituto Nacional Investigaciones Agrarias as an FAO-World Bank project on forage and animal production. In 1979 research was initiated on legume breeding, conservation of forage, fertilizer, and animal grazing trials. Projects on horticulture and the production of pulse crops for human and animal consumption were added recently. Cooperative research on wheat with scientists at CYMIT is also being conducted and they would like to initiate similar research with barley since the latter crop is more important than wheat in Extremadura. The laboratory, field, and office facilities at "La Orden" appeared to be in excellent condition and adequate for most kinds of agronomic research.

Dr. Carlos Gomez Piteras is leader of Subproject 5810-G "Trebol Subterraneo." He initiated the subclover research project in 1975 and has collected more than 2,100 accessions. About 10% of these have been lost. The late-maturing accessions are now included in the USDA germplasm collection as PI 493149 through PT 493308. Dr. Gomez would like to place the documentation for the collection on computer files. There also is a need to expand the collection to represent all of the Iberian Peninsula. Research objectives include selection for the following traits:

1) Seed production above the soil
2) Hard seededness
3) Early maturity
4) Low estrogen levels
5) Increased seed yield
6) Morphological markers for cultivar identification

Dr. Gomez is fluent in English.

Dr. Victor Moreno Cruz is in charge of Subproject 5810-M "Otras Leguminosas Anuales." The research with annual medics was initiated in 1980 and a germplasm collection of 400 accessions is maintained. Major problems are soil acidity and inoculation failure. Medicago polymorpha grows very well if it is nodulated. However, subclover produces more than the medics in areas where the clover is adapted. Breeding objectives for medic include spineless pods, more hard seeds, and increased seed yield.

Trifolium glomeratum is common in Extremadura and dominates pastures if superphosphate is applied. Forage production by this species is concentrated in early spring. Dr. Moreno has seeded 80 ha to this species for experimental grazing. Dr. Moreno understand and speak English fairly well. He was on a study leave in the Range Science Department at Utah State University in 1976. Dr. Moreno is an excellent botanist and is familiar with a large number of Mediterranean legume species.

Subproject 5810-0"Ensayos Regionales" is directed by Dr. Leopoldo Olea Marquez de Prado who also is the Principal Investigator of the binational project "Evaluacion de Germoplasma de Leguminosas y Rhizobium de Pastos Mediterraneos." Much of this research is conducted at a large experimental farm "Valdesquera" which is well suited for animal grazing trials. Dr. Olea

has tested 27 legumes and legume mixtures under grazing. He has initiated new experiments with 7 to 12 legumes to be grazed at 5 locations for 5 years with 2 replications per location. The objective it to identify the more important climatic, soil, and management factors contributing to the success or failure of subclover in Mediterranean woodland pastures. These pastures have approximately 29 Querus ilex trees per hectare. As is traditional agricultural practice in this area, the trees are pruned so that they do not shade the forage. The acorns from the oak trees are valued as food for swine.

Pasture renovation is done by plowing in October and seeding with subclover. Sometimes they are lightly grazed the following winter. A stand of as many as 1,200 subclover plants per hectare can be achieved with production as much as 400 kg seed/ha. Drs. Gomez and Moreno generously provided us with seeds of the better accessions of a number of legume species.

May 29-31:

We attended the second biennial meeting of the Sociedad Espanola de Fijacion de Nitrogeno in Granada. There were 97 scientists registered. Papers were presented on basic and applied nitrogen fixation research topics and the subject matter and techniques seemed to parallel those of the United States. A copy of the program in included as an appendix to this report. We discussed the USDA-ARS research program at Logan, Utah, with many of the scientists at the meeting and informed them of the opportunities for Spanish citizens to do research at Logan under the auspices of the binational project.

June 1-4:

While at Sevilla, we conferred with the two scientists responsible for legume inoculum production in Spain. They are:

Dr. Rafael Orive Echevarrietaand
Dr. Francisco Temprano Vera
Servicio de Investigacion Agraria
Apartado 13
San Jose de la Rinconada
Sevilla, SPAIN

The Rhizobium work was initiated at the station in 1975. It currently is the sole commercial production facility in Spain for legume inoculants and also is responsible for identifying superior

strains of bacteria and for improved production technology. The best carrier discovered to date is a peat mined at Padul near Granada. The peat is not sterilized prior to use. The station maintains a collection of 600 pure-culture Rhizobium strains.

Rhizobium inoculum produced in 1984 included the following:

Legume	Inoculum (kg)
Hedysarum coronarium	611
Medicago sativa	39
Trifolium subterraneum	112
Trifolium repens	50
Trifolium violeta	31
Trifolium glomeratum	2

A total of 1,793 kg of other Rhizobium inoculum for legume crop species was produced in1984 with the largest of that being for soybeans (1,761 kg). They also produced 1,852 kg of Agrobacterium tumefaciens strain K-4 for horticultural crops.

Seeds of Hedysarum humilis were collected south of Sevilla. A search at four locations near Cadiz for Medicago marina failed although the species is known to occur on the beaches of southern Portugal and further east in Spain.

June 5-6:

In traveling form Sevilla to Madrid, we sampled a number of legumes for nitrogen fixation activity and nodulation. Sampling was centered in mountains near Gredos. Seeds were immature.

June 7-9:

We visited Mr. Kinnelly, Dr. Medina, and Dr. Ruiz-Argüeso again to discuss our experiences and conclusions. We mailed our seed and nodule samples to quarantine in the United States, completed our business arrangements, and returned to our duty station at Logan, Utah.

APPENDIX C

Seed samples obtained in Spain.

Species	Number

Hedysarum	flexuosum	1
	glomeratum	1
	humilis	2
Lotus	arenarius	2
Medicago	arabica	2
	blancheana	2
	disciformis	2
	doliata	2
	minima	2
	murex	2
	orbicularis	2
	polymorpha	4
	rigidula	2
	scutellata	2
	tornata	2
	turbinata	2
	turbinata	2
Trifolium	brachycalcinium	4
	cherleri	1
	stellatum	1
	subterraneum	10
	TOTAL	50

APPENDIX

Legume species from which nodules and acetylene reduction gas samples were obtained while in Spain.

Lotus	spp.
Medicago	polymorpha
Medicago	tornata
Ornithopus	compressus
Trifolium	arvense
Trifolium	campestre

Trifolium	fragiferum
Trifolium	repens
Trifolium	subterraneum
subspecies:	brachycalycinum
subspecies:	subterraneum
Trigonella	monspeliaca
Vicia	lutea
Vicia	sativa
Vicia	villosa