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PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

(Contract AID/NE-C-1701)

REPORT ON
SHORT-TERM STAFF ASSIGNMENT

Submitted by
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Department of Crop Science
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Corvallis, Oregon

October 14 through November 19, 1983

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at the

UNIVERSIDADE DE EVORA

EVORA, PORTUGAL

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PORTUGAL UNIVERSITY INSTITUTES
DEVELOPMENT PROJECT

Report on
Short-Term Assignment

submitted by
W.S. McGuire
Oregon State University

I. Area of Consultancy. The main problem to be addressed, as stated by the Project, is as follows: "Limited water and soil conditions in the Alentejo complicate the establishment of pastures and forages. Sowing techniques may improve the best establishment." It was further stated that the consultant should have pasture experience in similar Mediterranean climate.

In regard to similarity of climate, western Oregon is not completely Mediterranean. It is better classified as West Coast climate because of cooler winters and absence of warmer, sunny days in winter. Information was presented (Fig. 1) to show similarities and differences. Both areas have very similar temperatures in spring and autumn, but the Alentejo has slightly higher temperatures in winter and is more favorable for winter pasture growth.

Oregon's Willamette Valley has 1000 mm rainfall and the large pasture areas south of the Valley have 500-750 mm, compared with average 700 mm over much of the Alentejo. The distribution is nearly identical, with no effective rainfall during 3 summer months, equal rainfall in spring and autumn, and more rainfall in the winter season in Willamette Valley. Most of the mid-winter rainfall (nearly one-third of total) is lost to runoff. Rainfall is less intense in western Oregon, so there is an advantage in effectiveness of rainfall with the more porous and deeper soils of western Oregon.

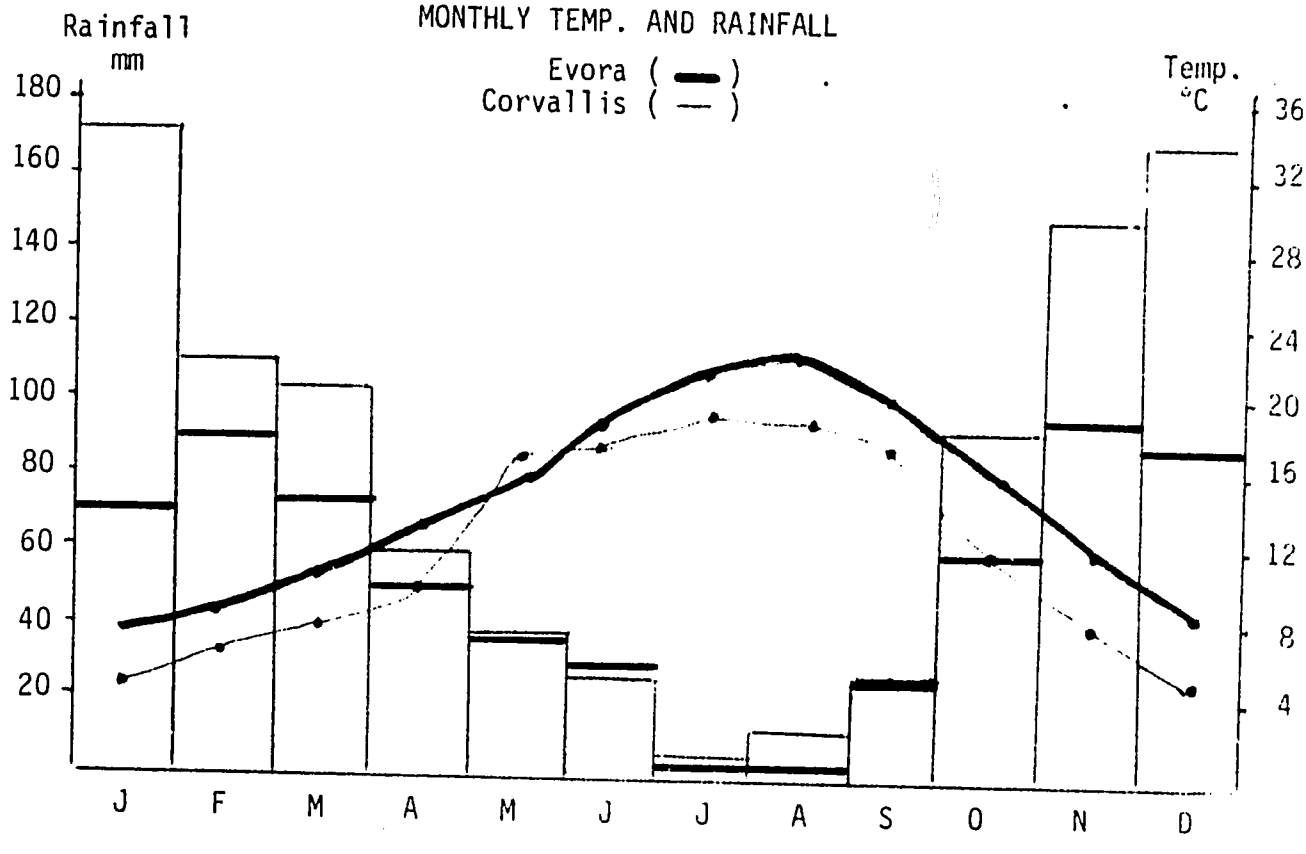
MONTHLY TEMP. AND RAINFALL
Evora ( )
Corvallis ( )
Rainfall
mm
Temp.
°C
180
160
140
120
100
80
60
40
20
36
32
28
24
20
16
12
8
4
J
F
M
A
M
J
J
A
S
O
N
D

Fig. 1

Pasture species used are very similar. Rainfed pastures are based on annual legumes -- subclover in Oregon, and subclover, medics and serradella in Alentejo, with similar grass species of Lolium, Festuca, and Dactylis and annual grasses in shallow soils. Western Oregon is able to use the later-maturing Mt. Barker and Nangeela subclovers because of advantage in soil depth and water-holding capacity.

Irrigated pastures in both areas are based on Huia white clover, Festuca and Dactylis. Thus, pasture production in the two areas is similar as are most of the problems encountered in establishment and fertilization. Western Oregon has very similar problems in legume nutrition in regard to phosphorus, sulfur and minor elements, particularly molybedenum.

II. Specific Objectives of the Consultancy

1. Evaluation of the establishment of temporary pasture (subterranean and crimson clovers, phalaris, dactylis, medics, etc.) and forage (vetch and oats, persian clover, etc.).
2. Analysis of the establishment of temporary irrigated pasture and forages (tall fescue, ryegrasses, bluegrasses, timothy, white and red clovers, alfalfa, etc.).
3. Discussion of sod-seeding and direct drilling techniques.
4. Improvement on the use of brassicas (kale, rape, and turnips) for winter feed for livestock.
5. Discuss possible coordination of AID, PROCALFER and GTZ research to maximize benefits.
6. Give one or more seminars on the similarity and fiferences between environmental conditions for pasture and forage production in Oregon and Alentejo.

III. Identification of Portugese Counterparts. The chief counterpart was Pedro Silveiro, Plant Science Department, who was responsible for preparation and execution of the schedule shown in Appendix. I am very grateful for the excellent cooperation

and support in that regard, and in seeing that all the necessary contacts, visits and observations were accomplished. Time was spent with all staff and faculty in Departments of Plant Science, Animal Science and Soils.

IV. Accomplishments with Respect to Objective of the Assignment.

1. Establishment of temporary pastures (rainfed) -- On stony, shallow or rough land (permanent type pasture) where annual medics or serradella are usually present, and where subclover had been introduced, regneration was good after the first fall rains in late October. Production of the pastures, according to observed data and stocking rate results, appear favorable where pastures had been fertilized properly with phosphate, sulfur and minor elements. There appears to be no problems in sowing pasture with conventional drilling techniques. The problem and challenge is in direct drilling and sod-seeding for economy and soil protection (increased infiltration and reduced runoff).

   On better land where wheat is produced, there is the urgent need for legume-based pasture in support of the wheat crop and for livestock production. Legumes have not been sown, or the native medics and serradella have been lost from the customary deep plowing, tillage after fall rains or from lack of fertility and from severe overgrazing. The legumes must be sown or re-introduced. The temporary pasture, to be effective in its contribution to the wheat crop and increased livestock production, must have good density in stand, fertilized with necessary nutrients for feed and seed production, and utilized properly to insure a large reserve of seeds and hard seeds for succeeding years. Again, the challenge and need is for direct drilling and mininum tillage.

2. Establishment of irrigated pastures -- Methods and techniques appear to be satisfactory. Similar to western Oregon, use of expensive irrigated land, typically for dairy production, requires more attention to seedbed preparation, drilling, sowing rates and fertilizer.

   Irrigated pastures are similar to those in Oregon, using Huia white clover and either *Festuca* or *Dactylis* or both. To some extent, sudangrass or sudan-sorghum hybrids are sown for summer grazing. In Oregon, sudan pasture is often sown as a companion crop with white clover and grass in order to provide pasture in a short or long rotation, with sudan being used in pasture renovation or in sowing of new pastures. It is not economical to use irrigated land to support only the summer-grown feed. An alternative, if sudangrass is highly desirable each summer, is to sow annual ryegrass and suitable legume with the sudan or immediately after final use of the sudan. For economy, this should be accomplished with direct drilling. The John Deere Power Drill should be ideal for all direct drilling.

3. Sod-seeding and direct drilling -- Colored slides showing sod-seeders and results were presented in seminar. There appeared to be good interest for experiment and demonstration. A new pasture drill, Tye Pasture Pleaser minimum till machine, was calibrated by José Peca and put to use in direct drilling of pasture. It likely will be suitable for drilling wheat, using high-analysis fertilizers. It applies insufficient superphosphate fertilizer in pasture drilling. Other machines from Australia and U.S. may be more suitable in regard to rate adjustments. The Tye drill does penetrate the soil and cover the seeds. Two

recent developments in drills for direct sowing are (a) the John Deere Power Drill and (b) a set of disk openers attached to a conventional drill and provided with downward pressure. Both are used successfully in western Oregon in seed production drilling and for pasture drilling. Information on the drills has been forwarded to Evora University.

Minimum tillage and direct drilling should be successful in the Alentejo. Weather conditions in late October and early November were ideal for the practice. Timing is important. Drilling should be done before or immediately after first fall rain to provide equal start for sown seeds and reduce interspecific competition.

4. Use of Brassica species -- The species, sowing dates and utilization were illustrated with slides and discussed in seminar presentation. Additional information was provided for the Rector Ario L. Azevedo who is particularly interested in the production. All the Brassicas can be grown in the Alentejo (many are already grown in gardens). They can be direct-drilled or with minimum tillage at most, providing firmer soil for winter grazing. Some nitrogen fertilization will be required until fertility levels are increased.

Time of sowing is very important in rainfed situations. My experience is that vegetative growth continues to the shortest days in late December, with reproductive growth commencing with first suitable temperatures and daylength. When rain does not come until late October or November, there would be greatly reduced production. relative to September establishment. In this regard,

the fodder radish may be more useful. Varieties are available which make very rapid growth for grazing in 8-10 weeks. A good cover of winter rape, radish or kale should greatly depress weed growth.

Seeds of Brassica species will be forwarded for experimental trials.

5. Possible coordination of AID, PROCALFER and GTZ research -- Lack of familiarity with Procalfer and GTZ may not allow proper evaluation. There appears to be facilities, expertise, good research and qualified researchers at E.A.N., Lisbon, and at E.N.M.P., Elvas. There is potential for support of expanded research, particularly in soils and fertilizers, plant nutrition, rhizobia microbiology and plant pathology, all of which are deficient at Evora. Objectives in pasture work common to all the organizations include drilling and establishment, fertilization, nodulation, weed control and utilization.

Continued training of staff at Evora, and staff increases, particularly in Plant Science and Soils, should significantly influence pasture research, and need for coordination will be even more evident.

All persons involved in research in pasture, forage and the wheat-pasture rotation should be brought together, perhaps semi-annually, for discussion of problems, planning of research, comparison of results, observation of trials, equipment performance, etc. Some of this may be accomplished through meetings of the Grassland Society, but the need is for informal or lower level meetings. Planning and direction is needed for graduate students and less experienced staff. Leadership should be provided by the experience at Procalfer or E.N.M.P.

Coordination of pasture research in Oregon, among branch stations and main station, is accomplished by this means, and likely it is similar to other areas.

6. Seminars -- Presented at Mitra: (a) Comparison of pasture and forage production in Alentejo and Oregon, (b) establishment and nutrition of pasture legumes. Presented at E.A.N., Lisbon: (a) legume establishment and nutrition, and (b) seed production of pasture grasses and legumes.

V. Identification and Analysis of Problems Encountered.

1. There is a great need for improvement of the volunteer pasture on the rougher or permanent pasture lands and on better lands devoted to wheat-pasture rotation. Most of the staff are aware of this. The main priority is, or should be, in that direction. Land capable of good legume-grass production is not being developed to any extent. Many reasons are offered, the main being that farmers cannot afford it. Experience during the last 25 years in western Oregon in pasture development showed a similar situation. Additional reasons for lack of development included lack of technical information, absentee ownership or lack of tenure, attachment to traditional systems, etc.

   The need is for demonstrations on station and on farmers' fields, but before the agronomists and extension personnel can perform demonstrations with confidence of success, research is needed. Research should be on smaller plots involving time of drilling, influence of soil pH, nodulation, placement of fertilizers and selection of drills or modifications necessary to achieve direct drilling with success.

There is good support in regard to pelleted seeds and quality control of rhizobia inoculum. Seed houses have good equipment for seed pelleting, keep fresh inoculum at the proper temperature, and pellet seeds on order, just before sowing. Support in this regard is better than in Oregon, where few seed companies pellet seeds, and the seeds prepared by a few larger companies are distributed for retail to farmers months before sowing time. Reportedly, there are still some nodulation problems, possibly from acid soil conditions, desiccation of rhizobia or other causes.

The need then is agronomic research to define, understand and correct any problems in order to move to demonstration and farmer use with confidence of success.

2. Rainfed pastures may decline in production and may fail to regenerate from seed in fall. Reference is often made to erratic or reduced rainfall for lack of seed production and regeneration. After autumn rains in October-November, pastures were observed with near failure; yet, other improved, fertilized pastures had dense stands of annual legumes. Inclusion of earlier maturing subclover varieties in the mixture and removal of extreme grazing pressure during seed production during the first year of production, will help to provide a good seed supply for succeeding years.

   Production decline likely is related to soil fertility. Often, minor elements are not used or used only in the year of sowing. It is known that both molybdenum and boron may be deficient, probably depending on soil pH. Information is lacking in regard to relation of soil

type and pH to deficiencies, fixation of the nutrients in the soil, time and amount of repeated application, and need for any other minor elements. The result is a mixture of several minor elements applied indiscriminately and likely only once. In western Oregon, the use of large quantities of lime (releasing molybdenum) and indiscriminant use of molybdenum resulted in cases of molybdenosis in livestock. This resulted in delayed or no use of the element, already known to be deficient, but essential for nitrogen fixation and favorable pasture establishment and production. The same will occur, if not already, in the Alentejo. Little information is available on phosphorus fixation, increased levels of soil phosphorus with grazing and continued application, and the fate of sulfate in the soil.

3. Wheat yields can be very significantly increased. There is sufficient moisture for much higher yields. Emphasis should be on minimum tillage, sowing time and fertilization. An excellent test incorporating these variables is underway with good results to date (Mario de Carvalho). Continued similar work, and incorporating the improved legume pasture rotation, will provide the information for the total system. Information on relative water infiltration, organic matter content and water-holding capacity with the improved system would be desirable.
4. A problem in livestock production and nutrition, in addition to pasture establishment and production, is the seasonal distribution of production, with surplus in spring and shortage in late summer and fall. Research should include investigation of species to help match the nutritive requirements of sheep, beef and dairy cattle. Deep-rooted legumes (lucerne and trefoil) could provide

feed later into the season, or managed with early grazing to delay haying until favorable weather in June. Use of brassica species, autumn-saved pasture and over-sowing with annual ryegrass for winter feed should be researched. Hay quality is part of the problem. To avoid rain damage, it is left to maturity.

It was found in Oregon that hay cut immature in early May and rained on was still of better nutritive value than hay cured without rain in June. Improvement of distribution and availability would provide basis for improved nutrition and increased stocking rates. This should be a cooperative project for Plant and Animal Science Departments.

5. Most of the research is done by graduate students, or staff working for advanced degrees. They have heavy teaching loads and insufficient time for their own study and research. In addition, there is insufficient direction of research of graduate students. The situation should improve with time as more staff are added and the younger workers gain experience and confidence.
6. There is conflict among staff in regard to results of other researchers and disagreement on ideas, problems and concepts. For example, there is no agreement which annual legumes-medics, serradella or subclover are more productive for pasture, or, in fact, if the native pasture can even be improved to any extent. The E.I.P.O. intensive sheep production trial, in my opinion, is a sound and well-organized research and demonstration trial with very significant results. Yet, there is a discounting by some in regard to reliability and application or results. Apparently there is a serious lack of confidence and cooperation, and researchers tend to work independently.

VI. Future Requirements and Proposed Action

1. There should be increased support and emphasis on pasture establishment and production, involving soil, plant and animal. This is the basis for the total effort in increased livestock production, land development, and soil management for the Alentejo. It is related to the potential increased wheat yields. Even minimum tillage of wheat, and weed control, are part of the total objective, although related more indirectly.

   There should be a continued search and purchase of drills for sod-seeding and direct drilling. An agricultural engineer should be involved in the research effort and in selection, use and modification of equipment. Dr. Peca is well qualified in this respect. There must be close cooperation and teamwork to provide a common understanding of what is required of the equipment. Support for increased staff in Plant Science is needed to provide more research effort.

2. A weak portion of the effort toward the main research objective is in regard to soil fertility and plant nutrition. A large thesis research project was being initiated by the soils group. In addition to looking for nutrient responses, it involves sowing, botanical studies, and calculation of carrying capacities. To my knowledge, no staff in Plant or Animal Science is involved in cooperation or advising. The complex project will provide a suitable thesis project, but information promoting pasture development in the Alentejo should be obtained by looking for nutrient responses at several locations and soil types. Much of that can be done in simple pot tests. The soils staff should be concerned with soil and plant analyses, location of minor element

deficiencies, fixation of nutrients in the soil, potential of increased phosphate availability in pasture soils, use of reverted super, use and effects of lime, correlation of soil tests with field results, etc. Cooperation and direction should be obtained from E.A.N. and E.N.M.P., where there is considerable information on soil fertility and nutrient needs.

An experienced staff member should be added to the group. In addition, it is highly recommended that Dr. Milton Jones, University of California, be obtained on short-term assignment.

3. There is need for more organization, cooperation and direction. One solution could be the provision of a director of research, assuming responsibility for the total research program. An alternative approach would be the organization of a pasture and forage team, comprised of certain staff from Plant Science, Animal Science and Soils, and including an agricultural engineer. The team would be responsible directly to the Rector. This would provide the team approach, but until staff is increased or graduate students complete theses, team members would have little time for additional research.

   There should be increased meetings of department staff and staff of all departments to discuss objectives, problems and planning of research. Coordination of research with other organizations and stations should be encouraged as indicated above (coordination of AID, Procalfer and GTZ).

4. There is a problem in getting results and new methods into farm use. Field days for extension workers and farmers would provide on-site results of field tests and new methods and techniques put to use in field-sized demonstrations.

Visits should include private farms with new or improved production practices. The tours and visits should be organized and conducted by extension, otherwise by the University.

Cooperative and off-station efforts might be directed to the more progressive farmers. Progress in pasture development, production and increased stocking rates from 2 ewes/ha to 7 ewes/ha gained momentum in Oregon, mainly after farmers reviewed the results on other farms.

5. A main objective of the project is concerned with production, based primarily on practical agronomic research, a very suitable rule for Evora agricultural staff. The project would have benefitted, and still could, with an on-site agronomist for the purpose of helping in defining the specific problems, planning research, assisting in direction of theses, selecting equipment and machinery for small plot and field use, and initiating tests and projects. This does not imply long-term assignment, but the agronomist should be on the job well before autumn in time for full preparation for fall planting on schedule. The same agronomist, or another with similar background and advised of the program and details of work underway, should be available during the spring growing season for growth appraisal, harvesting, interpretation of results and planning of further work. The real need is to get on with the program of development and production.

APPENDIX

Itinerary

Oct. 14	-	Departed Corvallis, Oregon 5 a.m., Limo to Eugene, departed Eugene 6:30 a.m.
Oct. 15	-	Arrived Lisbon 12 noon. Met by Pedro Silveira. Stayed at Rex Hotel
Oct. 16	-	Sunday
Oct. 17	-	Met with AID Mission. Travel to Evora with Pedro Silveira, booked into Mitra Inn.
Oct. 18	-	With pasture and forage staff, Mitra, discussed research underway.
Oct. 19	-	Visit Herdade Experimental da Mitra, including sheep grazing trial. Visited University and Rector Ario Lobo Azevedo in afternoon.
Oct. 20	-	At University to discuss proposed research with Geo Physical Science (Soils) staff.
Oct. 21	-	Visit Animal Science staff on research underway.
Oct. 22-23	-	Weekend
Oct. 24	-	To Elvas with Pedro Silveira for excellent discussion with Eng. David Crespo on problems, potential and present status of research.
Oct. 25	-	Look over farm machinery, arrange to set up new tye drill, visit Afonso de Almeida on Animal Nutrition.
Oct. 26	-	Visit private farm for dairy production.
Oct. 27	-	Prepare remainder of schedule. Work at Mitra.
Oct. 28	-	Visited University Farms Outeiro and Almocreva at Beja.
Oct. 29-30	-	Weekend. Travel to Algarve with D. Sims (FAO).
Oct. 31	-	Visit Extension Service, Evora. P.M. met with Andre Barros Mendes Dordio to arrange schedule for PROCALFER work.

Nov. 1	-	Holiday. Prepare seminar
Nov. 2	-	A.M. at University; P.M. prepare seminars
Nov. 3	-	Observed sowing operations for oats-vetch with broadcast. P.M. visit with Jose Pedro Almeida
Nov. 4	-	Visit with Dr. Gunter, Universities AID Project. Presented seminar, "Comparison of Pasture Production of the Alentejo and Western Oregon." Presented second seminar, "Establishment and Nutrition of Legumes." Visited private farm (Dutch) to see pasture and hay production.
Nov. 5-6	-	Weekend
Nov. 7	-	Observed clover establishment on grazing trial, worked on sod-seeder drill.
Nov. 8	-	Calibrated sod-seeder. Final visits and recommendation in Plant Science and Animal Science departments.
Nov. 9	-	Visit and recommendations to Geo Physical Science.
Nov. 10	-	Visit Ministry of Agriculture irrigated farm at Pegoes.
Nov. 11	-	Final Report. Visit with Rector Ario L. Azevedo. Complete details for leaving Evora.
Nov. 12	-	Saturday, travel to Lisbon.
Nov. 13	-	Sunday
Nov. 14	-	With PROCALFER. Present seminar. Visit with Plant Science and Microbiology.
Nov. 15	-	With PROCALFER. Present seminar. Visit with Soils staff.
Nov. 16	-	Attend Agronomy Field Day.
Nov. 17	-	Depart Lisbon TAP 312
Nov. 18	-	Overnight Denver, Colorado, USA
Nov. 19	-	Arrive Eugene, Oregon 12 noon, Corvallis 1 P.M.