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- Proceedings -

# M O R O C C O

## PARTNERSHIP PROGRAM ON INSTITUTION BUILDING
## THE MID-PROGRAM CONFERENCE

MAY 6 AND 7, 1985

UNIVERSITY OF MINNESOTA

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Proceedings

# MOROCCO

PARTNERSHIP PROGRAM ON INSTITUTION BUILDING
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Editors

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James C. Sentz
Roy D. Wilcoxson

A Cooperative Program of:

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
INSTITUT AGRONOMIQUE ET VETERINAIRE and
UNIVERSITY OF MINNESOTA

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## Preface

The need for this conference had been discussed for some time both in Morocco and at the University of Minnesota. It was recommended in the Project Review of 1983. Many justifications could be cited for its development, but a few seem to be obvious: 1) to review the problems and progress with institution building experienced by the Project, 2) to provide more information in order to foster better communication among universities collaborating in the Project, 3) to more fully inform participants about the Project so they might understand how the development of their own careers is related to institution building, 4) to identify accomplishments and impacts of the Project in Morocco, 5) to identify potential modifications in Project procedures so that its goals and objectives might be more efficiently achieved.

The content of the papers grouped together in this volume was presented in the conference. The many discussions that occurred when the papers were presented were not recorded but many ideas were gathered by Project personnel and these ideas will be used in the formulation of future work plans.

The historical data presented is essentially correct, but it is presented as understood by the speakers. This data as well as the ideas and suggestions presented are those of the speakers and do not necessarily constitute the view of the Project, the Institut Agronomique et Veterinaire Hassan II, the University of Minnesota, or the United States Agency for International Development.

Abbreviations commonly used throughout the proceedings are:

| | |
|---|---|
| U of M | University of Minnesota |
| IAV | Institut Agronomique et Veterinaire Hassan II |
| USAID or AID | United States Agency for International Development |

| | |
|---|---|
| ENA | Ecole Nationale d'Agriculture |
| ENFI | Ecole Nationale Forestière d'Ingenieurs, Salé |
| BIFAD | Board for International Food and Agricultural Development |
| FAO | Food and Agriculture Organization |
| INRA | Institut Nationale de la Recherche Agronomique |

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# ORIGINS OF THE PROJECT

# INTRODUCTION

Dr. Roy D. Wilcoxson

Thank you President Keller for the warm welcome you have given our conference participants who are from out of town as well as from our own Campus.

This conference is important for it marks the 15th year of our ongoing association with the Institute of Agronomy and Veterinary Medicine Hassan II and the mid-point of our present Contract funded by the United States Agency for International Development.

I should like to say a public "thank you" to all of the people who will speak to us during the next day and a half, to out of town visitors who have come to learn more about the Morocco Project, and to the administrators, faculty and students of the University of Minnesota who are and will be present throughout the conference. I extend special recognition to Mr. Larbi Firdawcy, Secretary General of the Institute of Agronomy and Veterinary Medicine Hassan II, Rabat, Morocco; to Dr. Malcolm Purvis, Agriculture Officer of USAID-Morocco; to Dr. Fred Hutchinson, Executive Secretary of BIFAD, Washington D.C.; and to Dr. Richard Sauer, Deputy Vice President for Agriculture and the University of Minnesota Title XII Officer.

I hope you learn some new things about international cooperation from your attendance at this conference. We shall attempt to review the progress and problems of our cooperative effort with the USAID and the Institute of Agronomy and Veterinary Medicine Hassan II to establish an institution of higher learning in agriculture in Morocco. When I speak of "our" cooperative effort, I am, of course, referring to the University of Minnesota as well as to the 29 other universities that have given staff and facilities to the task. The universities involved can be seen by referring to the Appendix.

The cooperation of so many universities is often referred to in USAID circles as "The Partnership." The Partnership, because many American universities have joined with the University of Minnesota in the

development of the Agronomy and Veterinary Medicine Institute in Morocco and to help Moroccan citizens to continue their education in Agriculture.

The effort officially began in 1970 after several years of preliminary consultations by Dr. John Blackmore of the University of Minnesota with interested parties in Morocco, Belgium and the United States. The purposes and goals of the cooperative work that was started in 1970 were: "to assist with faculty training and related institution building activities of the Institute of Agronomy and Veterinary Medicine Hassan II (later the National School of Agriculture at Meknes and the National School of Forestry Engineers at Sale were also included) to provide scientists, managers and technicians needed for Morocco's agriculture development and to develop the linkages between education, research and extension to improve the lot of low income farmers and herders." These goals and purposes still guide the Project towards its conclusion in 1990.

These clearly stated purposes and goals have, over the years, permitted all concerned to maintain their focus to avoid the temptation to pursue peripheral issues that dilute the resources available, and that create confusion.

One of the major means for assisting the growth of the Institute and the other schools in Morocco was to provide a resident team of American scientists to teach, advise and carry out research programs. Since 1970, 15 resident team members have served in Morocco. The longest tenure for an individual has been about 10 years and the shortest has been 2 years. The average term of service has been about 6 years. The team members have stayed long enough to accomplish worthwhile work. These resident team members have been soil scientists, plant breeders, plant pathologists, horticulturalists, foresters, veterinarians, and animal scientists.

The resident team has taken a lead in development of curriculum, individual courses and seminars, and in advising Moroccan students in program development and thesis research. They have also developed research programs in the field of their professional specialization. These research programs have addressed Moroccan problems, provided problems for students

to solve in their thesis research, and have begun to build a resource of facilities for research in Morocco. When results of the research began to appear in the published literature of the world a tremendous stimulus to scholarly activity was produced throughout the Institute. Today Moroccan scholars publish their manuscripts and present information at international scientific meetings.

The resident team members also work toward the development of linkages between the Institute and other Moroccan institutions for research, extension and education, with growers and with agribusiness organizations. They developed cooperation with other USAID projects in Morocco and with assistance projects sponsored by European governments. Thus the resource of the Institute began to be appreciated and recognized in and, to an extent, outside of Morocco.

The resident team members have given special stimulation to their particular specialized departments but they have also extended themselves and their resources to departments and individuals in other professional areas. The result has been growth across the Institute.

I do not wish to create the impression that all of the success of the Institute has been due to the resident team. However, I do want you to understand that for a project to succeed, a capable dedicated resident team is essential to success. The teams and the individuals we have had in Morocco have been outstanding and the lessons to be learned from their mode of operation should be carefully studied.

In addition to clearly articulated goals and purposes and a capable resident team of scientists there are four other important ingredients for success in a project like ours. I shall touch on these only briefly because they are topics for special consideration.

The institution to be assisted must be committed to change and growth. In our case this has clearly been the case. Mr. Abdallah Bekkali, former Director of the Institute, Dr. M'Hamed Sedrati, present Director of the Institute; and Mr. Larbi Firdawcy, their associate and the Secretary

General of the Institute, have clearly understood this. Over the years they have encouraged the creation of an outstanding program of undergraduate education to prepare students for graduate studies. They hired only outstanding Moroccans to be faculty members at the Institute. They provided physical facilities for teaching and research. They also provided financial resources to foster participation by the Moroccan faculty members. All of this has been consistently done since 1970. These Moroccan leaders have made a sustained effort to be involved in the Project.

The principal financial resource for the Project must be committed to a long term investment in the Project. USAID in Washington D.C. and in Morocco made that commitment in 1970. Over the years, even though USAID officials have come and gone, the commitment has remained. Throughout the life of the Project the officials of USAID have avoided the temptation to interfere in the Project. They have provided advice, council and friendly support. Once the work plans have been agreed upon USAID has left the work to the Institute and the University of Minnesota. At present the commitment of USAID to the Project seems to be as well sustained as ever.

The University of Minnesota also needed to make a long term commitment; to provide resident team members and other staff members in Morocco, to receive Moroccan students at its Twin Cities Campus, and to expand its curriculum and research programs in order to more adequately serve international students. This commitment has evolved over time and I believe the University now has the commitment, philosophy and policies in place to permit it to continue to make long term commitments to international activities in general and to Morocco in particular.

Finally, I should like to say a few words about the need for a training and education program in the United States. The basis for this program is the university system of the United States, but access to this system must be accomplished on an individual university basis. Over the years Dr. James Sentz has developed the necessary personal contacts in many of the land grant institutions and in a few other universities to develop a relatively smooth administration of the training aspects of the Project.

On the whole we have found the people of most universities to be supportive of the Project once they have understood what the Project seeks to achieve.

One recurring problem concerns the time frame for the individual education programs. Every program that is ongoing operates with a schedule for bringing new persons into activity. For our Project this has meant that persons in Doctoral programs or Master of Science programs must complete their studies, examinations and research experiences in about 24 months. Third cycle students have completed their studies in the U.S. in 12-15 months. If serious problems arise in meeting these time frames the adviser can request a deviation. However, it should be understood that all requests cannot be granted. The decision is based on several factors: budget considerations at the Institute, the need for the person to return home, the need for others in a department at the Institute to begin their programs, evaluation of the request in terms of Project and Institute programs.

We do our best to place participants in the schools they wish to attend and to help them to develop and maintain first class quality programs. Our success is recorded in the success of 174 people in the Third Cycle and Masters programs and by the 79 people in Doctoral programs.

In concluding this speech please permit some repetitions.

1. You are welcome to the conference. If you need something please contact me, Dr. Sentz, Dr. Wardlow, or the office staff and we will do our best to help you.

2. The purpose of the conference is to review the ongoing progress made in the development of the Institute and its professional departments, and to consider some of the impact that the Project has had in Morocco.

There is a temptation to speak only of successes and to neglect problems. Let us try to speak of our successes, but we can profit as well from an examination of problems.

# THE ORIGINS OF THE MOROCCO PROJECT

Edwin L. Schmidt

What has come to be referred to as the Morocco Project is an obviously large, obviously diverse, and an obviously successful venture. The very fact of this conference and the nature of this program attest to the remarkable success of the Morocco Project. I was fortunate to have been in on the origins of the Project and I feel privileged to have the opportunity now to reflect on those origins, and especially to call attention to the individuals who laid the framework for the success so apparent in the structure today. My recollections are necessarily incomplete. I am a microbiologist and not given to history or archives, in fact some of you who have seen my office may marvel that I could find any records at all. I do claim accuracy for points cited, however, I was not privy to many negotiations and sat through some others with very little interest.

I intend to consider the origins of the Project in three stages: the conceptual period, 1964-1967; the planning period, 1968-1969; and the activation period 1970-1971.

## The Conceptual Period

The earliest beginnings of the Morocco Project took place neither in Minnesota nor Morocco, but in Belgium, and the central figure was neither a Minnesotan nor a Moroccan, but a Belgian by the name of Henri Laudelout, a Professor in the Faculty of Agriculture at the University of Louvain. I applied for a sabbatical leave in 1964 and was fortunate to have been awarded a Guggenheim fellowship to work in the laboratory of Professor Laudelout in Louvain, Belgium. Laudelout and I had been together for a year in Selman Waksman's laboratory at Rutgers University some fifteen years earlier, he as a postdoctoral scholar, I as a graduate student. During my stay in Louvain, Laudelout was serving as a consultant to the government of Morocco as the Hassan II Institute was being planned and constructed. During this period he also was formulating a proposal to the Belgian government for an assistance program in soil sciences at Hassan II Institute. Laudelout and I had common interests in the microbiology and

biochemistry of certain nitrogen transformations and on numerous occasions we discussed how we might develop a collaborative research effort in soil nitrogen at the Institute to complement the Belgian program. I returned to Minnesota in September 1965 but maintained close contact with my colleagues in Louvain.

John Blackmore and the University of Minnesota Office of International Agricultural Programs initiated a major seminar series in world food problems in 1966, with world-class seminar speakers. I suggested Laudelout as a speaker in that series and Blackmore readily agreed since he and Laudelout were already acquainted through FAO activities when John was with that organization in Rome. Thus Laudelout came to the University of Minnesota in the spring of 1967 to lecture in the seminar series. During this visit Laudelout and I again discussed collaboration in Morocco, and we set up an appointment with John to get his reaction and possible suggestions. I remember very clearly how he sat quietly as we described our idea about having a Minnesota participation in the by now newly formed Belgian assistance program. In effect we proposed the idea of an international consortium with a Belgian university and a United States university developing a mutual cooperation to build a soils department in Rabat. After hearing us out, he straightened up in his chair, clasped his hands, smiled his pixy smile and said, "What an interesting idea!" The international consortium aspect obviously intrigued him. By the next day John had set up an appointment for the three of us with Dean S.O. "Woody" Berg to discuss the "consortium" with him. Dean Berg was strongly supportive and Blackmore followed up promptly in USAID circles. The planning stage was underway.

## The Planning Period

The plan developing in Blackmore's mind went much beyond that suggested by Laudelout and me. From the outset Blackmore was thinking of soil science as a starting point in a program that would also encompass a number of other disciplines. He also saw Laudelout as a key emissary who would be invaluable in presenting Minnesota's objectives and capabilities to Director Bekkali and Government of Morocco officials. Consequently when Laudelout was enroute on a polar flight from Belgium to Australia in August

of 1968 and had a few hours in transit in Los Angeles, Blackmore met him there for a lengthy discussion of the Minnesota strategy.

At this stage the plan was to propose that Minnesota undertake work in the area of soil microbiology, and perhaps also undertake work in agricultural economics, general agronomy and some assistance for library development and teaching of English. All of these aspects were incorporated in the preliminary proposal drafted and reviewed on campus during the fall of 1968.

A major development took place in November 1968 with the fruition of plans to bring Monsieur Bekkali, Director of IAV, to Minnesota to view this American university that was proposing an assistance program with his institute. The beginning of Bekkali's visit was not auspicious. He was scheduled to arrive on Monday, November 4 with an interpreter from Washington. Something happened to change the schedule and Blackmore was advised that Bekkali would arrive a day earlier. Blackmore tried to meet him at the airport, but missed him and assumed the schedule had been changed again. Perhaps it had been changed, but in any case Bekkali did arrive on Sunday, unmet, and without his interpreter! The interpreter was called Monday morning, arrived that evening, and the schedule got back on track.

On the first of January 1969 the Minnesota proposal was submitted to AID, and arrangements were set up through the Mission Director of AID Rabat, Philip Birnbaum, for a Minnesota team visit to Rabat later in January. The objective of the visit by the Minnesota Survey team was to work out amongst GOM, Minnesota, and AID personnel details of the proposed technical assistance. The Minnesota team led by Blackmore included in addition to myself, M.F. Kernkamp from Plant Pathology, L. Martin of Agricultural Economics, and E.B. Savage, English and Library. The general recommendations of the Survey Team report stated that USAID, the Government of Morocco, and the University of Minnesota should proceed immediately to arrange for a program of technical cooperation between the University and the Hassan II Institute of Agronomy, and that cooperation should be within the framework of a consortium arrangement with the University of Louvain.

The Minnesota-USAID contract was signed June 2nd, 1969 and the Morocco Project was underway.

## The Activation Period

Of the many critical periods that the Morocco Project has encountered since its inception, I would strongly contend that the greatest challenge was the very first one, the inception itself. The Institute was small, struggling and completely dominated by the French presence and the French educational tradition. The financial promise of USA assistance was attractive, but the American system as an educational force was unknown and uninteresting.

There was, in fact, a prejudice against USA education evident in the experiences of the few Moroccan students that AID had sent to the USA for university training in the 60's. Those students found that their USA degrees penalized them in an employment market based on French or Belgian degrees. The challenge to the Project then was how to break into the French-language, French-dominated system to demonstrate how Morocco might draw from American educational philosophy and American approaches to evolve a Moroccan solution to Moroccan needs in agricultural technology.

In Soil Science, the first of the programs to be activated, we had the fortunate capability to deal with the initial challenge of language and educational philosophy. On the one hand we had the strong affiliation with the Belgian cooperation in our consortium, and Laudelout as our minister sans portfolio. On the other hand we had the capability to staff our program quickly with individuals ideally equipped for the challenges by way of language, culture and educational background. Our first staff member in Morocco was Pierre Antoine. Pierre was a fifth year student at Louvain during my sabbatical, when he expressed an interest in graduate study at Minnesota. He arrived in Minnesota within a few days of my return to start Ph.D. studies with Professor Rust in soil genesis. With the Minnesota Ph.D. in hand Pierre joined the Soil Science group at Rabat in July 1970. When I visited Rabat in October as program director for the soils component, I found Antoine already heavily endowed with departmental and institutional responsibilities.

The Soils complement was completed about six months later with the arrival of Jean Molina in Rabat to handle soil microbiology. Jean was a native of France, a product of the University of Paris, and a holder of M.S. and Ph.D. degrees from Cornell. Again an excellent pedigree for the tenuous times. Considerable recognition should be given to W.P. Martin, Head of the Department of Soil Science, for his patience and skill in attracting Molina to Minnesota from his Assistant Professor position at the University of Illinois.

The Minnesota presence at the Institute was thus consolidated at the outset with two staff members easily integrated into the Institute pattern: both native French speakers and both supported by our consortium with the large and influential Belgian group. The soils consortium with Belgium worked beautifully in these early stages. When it became apparent that none of our AID contract funds could be used for equipment and instrumentation needs, this desperate situation was resolved by Laudelout with the purchase of about $10,000 worth of instrumentation for the programs of Antoine and Molina. The consortium concept was expanded still further with inclusion of a French University represented by Professor J. Boulaine of Paris-Grignon. Professor Boulaine was the world authority on the soils of North Africa and a long time consultant and teacher at the Institute. Antoine quickly won the support of Boulaine and engaged in a long and productive research and teaching cooperation that was visibly good for Morocco, good for the Institute and good for the Minnesota Project.

Expansion of the Minnesota program to a plant science effort was formally explored in October 1970 with the arrival in Rabat of Professors Blackmore, Kernkamp, and Rasmusson for discussions with AID and Director Bekkali. Although the discussions hit upon a little rough water when Bekkali stated that he did not need or want a plant pathologist, the Blackmore plan prevailed. John Caddell was the first of the plant sciences component to be recruited. He completed French language training and arrived in Rabat during the summer of 1971 to initiate a plant breeding program. Ben Lockhart arrived in Rabat at the end of 1971 to undertake a program in plant virology. The subsequent duration, productivity, and

practical consequences of Lockhart's program in Morocco forcefully belied the early reservations referred to above.

Clearly without strong success in the critical and tenuous activation phase of the Project, the impressive subsequent successes of the Morocco Project that we note today could not have occurred. I've emphasized the crucial contributions of Antoine and Molina in this early stage and their abilities to integrate as regular Institute staff with Belgian and French support. The services that they rendered at this stage won the confidence of Institute administration and Institute staff and quickly gained acceptance for the Minnesota Project. Moreover, their positions brought them into contact with students and provided an institutional stature from which educational policy could be influenced. I have mentioned as well the vision, skill and dedication of John Blackmore, the seminal role of Laudelout, the contributions of Boulaine, and the wisdom of Director Bekkali. There are others who contributed notably through critical support from well placed positions. I probably do not know all of them, and for this I apologize. I do know however that the Morocco Project benefitted greatly in its origins from the support of USAID Mission Director Donald Brown and USAID Agricultural Officer Carl Ferguson.

I have tried to present some sense of the origins of the Morocco Project and the backdrop of items and personalities involved in those origins. The development, size, and impact of the effort that grew out of such modest beginnings are somewhat overwhelming to me as I look back from my vantage point. Hopefully this summary will stimulate some interest on the part of an archivist to reconstruct these beginnings in greater historical detail. The Morocco Project deserves this.

Table 1. Timetable of the Origins of the Morocco Project

| | |
|---|---|
| **Conception 1964 - 1979** | |
| September 1964 | E.L. Schmidt, sabbatical year 1964-1965 at University of Louvain, Belgium |
| | H. Laudelout, Professor, University of Louvain, Consultant to G.O.M. |
| March 1967 | Laudelout to University of Minnesota, Discussions: Laudelout, Schmidt, John Blackmore and Dean S.O. Berg. |
| **Planning 1968 - 1969** | |
| August 1968 | Blackmore, Laudelout meeting, Los Angeles |
| September 1968 | Drafting and review of Minnesota proposal initiated. |
| November 1968 | Director A. Bekkali, Institut Agronomique et Veterinaire Hassan II, to Minnesota. |
| January 1969 | Minnesota proposal submitted to USAID, Minnesota Survey Team to Rabat. |
| June 1969 | Minnesota-USAID Contract approved. |
| **Activation 1970 - 1971** | |
| July 1970 | P. Antoine arrival at IAV, Soil Science Department |
| October 1970 | Blackmore, M.F. Kernkamp, D.C. Rasmusson to Rabat to discuss Plant Science phase. |
| January 1971 | J.A.E. Molina arrival at IAV, Soil Science Department. |
| August 1971 | J. Caddell arrival at IAV, Plant Breeding compound. |
| December 1971 | B. Lockhart arrival at IAV, Plant Virology compound. |

# THE COMMITMENT OF MOROCCO

Larbi Firdawcy

Mr. Chairman, Honorable Professors, Dear Friends:

The Institute has lost, at the end of last month, one of its major professors and Director of Development, Paul Pascon, as well as his assistant, the young and active Arrif. I ask you to have a thought for them and to associate them in your memory with those others who have disappeared during the life of our Project: Dr. John Blackmore, the American initiator of the Project, Mr. Najib Bencheqroun, our faculty participant, Mr. Saoud Boulmene, the third-cycle student, and Professor E.R. De Prospo, the advisor of a faculty participant at Rutgers University.

I want also to express my great appreciation for those who have greatly contributed to the development and the success of our Project, and here I mean Abdullah Bekkali, the first Director of the Institute, the Moroccan initiator of the Project, and Dr. Magrath, Dr. Hueg and Dr. Tammen, former President, Vice President and Dean of the Institute of Agriculture, Forestry and Home Economics and Dean of the College of Agriculture of the University of Minnesota, respectively.

I want also to express on behalf of the Direction of the Institute, and of the Moroccan scientific community, our best wishes to President Keller, Dr. Sauer and Dr. Allen, the new authorities of the University of Minnesota, as well as to the authorities of the other American universities that participate in the Project, and to the new USAID officials in Washington and Rabat, and to the American scientific community, and to assure them of the feeling of friendship in continuity of the two hundred years of peaceful and amicable relationships between the U.S. and Morocco.

It is a tremendous occasion that is given to us today and tomorrow to meet together and to exchange ideas about the accomplishments, the impact and the future of the Project. Some among us may ask why this is only the first meeting of this kind. Maybe scarce resources or administrative procedures can explain this. Anyway, this meeting comes at a good time

since we are, after fifteen years, just in the middle of the river, a river that is one generation wide.

Our Project has been designed and is to be executed as a Host Country Contract, but within the spirit and intent of the collaborative assistance method. The contract, by its long-term nature, its institution-building purpose, its professional collaboration between educational institutions, and its commitment to joint research and development (including training) most appropriately uses the collaborative assistance method. Consequently, the contract is designed to provide for flexible and implementation authority.

We started our cooperation at the beginning of the Project by sending students with bachelors degrees to spend fifteen months in the U.S. to improve their English and to be taught courses at the Master's level, and return to the Institute to do their research theses and to complete their degrees. This important phase is nearly finished. This October, the Institute will offer locally ninety percent of the Masters programs. The obligation of carrying out the Masters research in Morocco was important for the creation of research programs in the Departments. We send our young faculty members--and the Project will be concerned with only 140 out of 400 young faculty members to be trained at the doctoral level, to develop necessary scientific skills, and also skills needed to participate in institutional development of a modern college of agriculture and veterinary medicine. We really are at the mid-point of this phase. What do we expect from this:

At the individual level, the dissertation research will provide the opportunity to young faculty to pursue their interests in Moroccan agricultural development and provide a base for faculty programs essential to teaching, research and extension, as well as gaining needed applied scientific research skills under Moroccan conditions of scarce resources and daily material and even moral difficulties.

At the departmental and institutional level, a more integrative approach toward departmental duties in teaching, in research planning,

outreach activities and administration, as well as an increase in local capacity to tackle these duties with less dependency, but with permanent scientific linkages with the American and international communities, so as to maintain an external quality evaluation and to permit an original contribution to the progress of science.

In this respect, we really are at the very beginning. Some tentative experiences are just emerging, maybe in Animal Science, Plant Protection and Agricultural Engineering, and also under the collaborative research support program formula of the Small Ruminant CRSP.

We really need more, and that will be my message to the American scientific community, whom I ask to go beyond a personal commitment to the personal accomplishment of a single research exercise, and to try to help us in building a Moroccan capacity in teaching, research, extension and management.

Thank you for your attention.

# THE USAID COMMITMENT TO THE MOROCCO PROJECT

Malcolm J. Purvis

The Agronomic Institute has developed very rapidly from its early beginning in 1968 when it had twelve (12) students and no buildings. It now has over 2,000 students, fifteen (15) programs of specialization on two (2) campuses (ENA and ENFI). The Institute annually produces some 30 BS, 100 MS and 45 DVM laureats and has now awarded its first 3 doctorates. It has 313 faculty of which 229 are Moroccan. Above all the Institute has created an intellectual and pedagogical tradition which is firmly anchored in Moroccan agriculture. Its program of "Stages" is unique and one of the late Professor Paul Pascon's major contributions to the Institute.

As you are all aware, USAID has been supporting the Agronomic Institute since 1970. The commitment of the United States Agency for International Development to the development of the Agronomic Institute can be summed up in a few statistics: fifteen (15) years of continuous assistance from 1970 to 1985 and expected to continue until 1990; 389 participants sent or to be sent to the U.S. (Table 1); and $33.3 million dollars obligated or projected to be obligated ($42.8 million in constant 1983 dollars, Table 2). These numbers are indeed impressive. They are measures of one of the most extraordinary sustained commitments by USAID to an institution of higher agricultural education anywhere in the developing world. These statistics give unarguable meaning to the Agency's declared support for long term institution building and science and technology transfer. They are proof that long term projects <u>can</u> be made to work with USAID despite the fact that for much of the last fifteen (15) years USAID has been not just funded by annual appropriations but through continuing resolutions!

However, these statistics also and inevitably fail to capture the full complexity of USAID's assistance and commitment to the Institute. Over the past fifteen (15) years there have been three (3) Project Papers and two (2) major revisions of them; there have been three (3) separate contracts and more than fifteen (15) amendments. There has been input from dozens of USAID agricultural officers, program specialists and senior administrators

who have worked with literally hundreds of IAV and U.S. university faculty, and their administrators on more than 20 U.S. campuses! Over the years there have been moments of euphoria and of occasional tragedy; there have been moments of conflict as well as periods of harmony; there have been fifteen (15) years of hard work but the job is still not finished. These fifteen years of history and of this USAID commitment can hardly be given full justice in 20 minutes! However, this morning I want to high-light two aspects of USAID's commitment to the Agronomic Institute: Its differences from other USAID projects of this kind and the unique features of the Project which have created its success. To do this I must first quickly review with you the broader history of USAID's support to agricultural university institution building as the necessary backdrop to understanding USAID's past, present and future support of the Agronomic Institute.

AID and support of Agricultural Universities 1949-1985

Let me read you the following quotation (1, 252):

> "I am convinced that one of the soundest ways we can help in the long run is to assist the other countries to develop institutions like our Land Grant Colleges, Experiment Stations, Extension Service and credit and marketing systems. We should not try to transport our institutions intact to foreign soil but rather to help other people develop the kind of institutions that suit their own particular needs."

This is a wise and far-seeing statement. A quotation from Administrator Peter McPherson's recent speech at Michigan State University? Or from E.T. York's Seaman A. Knapp memorial lecture last November? Or a pronouncement by Dr. Fred Hutchinson at the last BIFAD meeting?

No. But Henry G. Bennett, former President of Oklahoma State University speaking in 1952 as Administrator of the Technical Cooperation Administration! Another great American (and Minnesotan) Harold Stassen, who became director in 1953 of the Foreign Operations Administration (the first unified U.S. AID agency and predecessor of AID) said (2, p. 158):

"There were 3 main reasons why I supported the University contract idea. First, I felt that there was an important potential in the long term relationships between an American university and a university of another country. Second, I felt that given the educational nature of technical assistance, a university was a most natural institution for carrying it out. Third, universities were important repositories of excellent personnel which had to be tapped if an acceptable program were to be carried out."

The point I am trying to make is that support for building of agricultural universities has been at the heart of USAID programs since the launching of formal U.S. technical assistance and cooperation with developing countries by President Truman's Point Four program in 1949.

There have been multiple examples of success - Oklahoma State in Ethiopia, Cornell at Los Banos, Arizona in Iraq, Arkansas in Panama. Above all there was the India experiment in which USAID and six Land Grant Universities assisted in building nine Indian agricultural universities between 1952 and 1972. I can assure you that in the early 1960's many people considered India a "basket case", perhaps far worse than the situation we now see in Africa. This involvement was abruptly ended, in 1972, as a result of foreign policy differences with India. However, the foundations had been laid. Illinois, Ohio State, Tennessee, Missouri, Kansas State and Penn State played key roles in the development of Indian agricultural universities and in the subsequent miracle of India's green revolution. I recommend to this conference Hadley Read's measured history of this USAID-Indian institution building experience (3).

Similar experiments were launched in Nigeria with Michigan State at Nsukka, Wisconsin at Ife and Kansas State at Ahmadu Bello.

The USAID experience of the 1950's and 1960's showed that long term, sustained commitment was essential, that there was no cookbook mode to follow, that pay off was very long term, that patience was required.

Oddly enough in the 1970's USAID managed to forget much of the lessons it had learned in institution building. A number of USAID funded studies on the theory and practice of institution building were initiated in the late 1960's (4, 5, 6, 7). However, by the time they were published institution building and USAID-university relationships were out of vogue (see 8, Appendix 13).

It took Senator Hubert H. Humphrey's championing of the Title XII legislation and the creation of BIFAD (on which Peter McPherson was a charter member) to reenergize USAID's interest in institution building. Under Administrator McPherson USAID once again reaffirmed its commitment to US Land Grant University involvement and the implementation of long term institution building (9, 10).

The Evolution of the Project

The original USAID project with the Agronomic Institute was very different from the projects that had taken place in the 1950 and the 1960's in India, Nigeria and other countries. For example:

- The original Project was designed to provide assistance only to the disciplines of Soil Sciences and Plant Sciences. Horticulture, Range Management and Watershed Management were added 4-6 years later. It was not until 1980 that USAID made a commitment to support the development of the entire Institute (including Veterinary Medicine).
- It was, to my knowledge, the first such USAID project in Francophone Africa.
- The Project was originally staffed with Junior, French speaking faculty in a tripartite arrangement with the University of Louvain, Belgium. (A tenured faculty member from the University of Minnesota was not assigned to the Project until ten years later).
- No senior administrator from the University was sent out on resident assignment (in India and Nigeria Americans had frequently served as the first President or Vice Chancellor).
- The Project was originally designed to develop a graduate MS (third cycle) program - not an undergraduate program, even though the Institute in 1970 had yet to graduate its first undergraduate!

Thus the original Project was very different from the Los Banos, Punjab or Ife models. Equally important the Project today is very different from its original 1970 design. The Project has always had innovative and, perhaps by consequence, sometimes unsuccessful features. It has been frequently redesigned (in 1972, 1976, 1979 and to a lesser extent in 1984) and has evolved from a narrowly focused assistance to an institution-wide activity. These redesigns and fine tunings have at times created strains on the USAID-IAV-University of Minnesota relationship. Nevertheless the ability to redesign in a responsible way has, in my view, been a major element in the Project's current success. The Agronomic Institute Project proves that U.S. universities and USAID can be flexible!

A major reason for this evolving, and expanding Project design was that the capability of U.S. land grant universities was almost completely unknown in Morocco in 1970. One of the great accomplishments of the first ten (10) years of the Project was the gradual acceptance by the Institute of the value of U.S. agricultural science, graduate education and of the Land Grant approach to integrated teaching, research and outreach - not as things to be lavishly emulated but to be folded into the development of a truly Moroccan institutional philosophy. Exactly as suggested by Administrator Bennett thirty five years ago!

Some of Its Unique Features

The Project that exists today was designed in a Collaborative Assistance Mode in 1979. It is a far cry from the original, tentative efforts of 1969. The current Project was designed above all as an Institute-wide faculty development project. The Project has some original, if not unique, features. The most important of these in my views are:

- The Development of Faculty through a wide range of the best land grant universities from all across the USA (The Partnership).
- In-Country Research and granting of Doctoral Degrees from the Institute.

Let me say a few words about each of these.

## The Partnership

This conference is the first formal meeting of the Partnership even though many of you have been involved with the Project as individuals and institutions for six or more years. The idea behind the Partnership was to seek a low cost, informal association of kindred spirits reaching out across the United States into your programs and laboratories. Through this process the Institute has not been limited to the resources of one university (or of a regionally similar grouping of Universities in a Consortium). This has broadened and deepened the contacts between Morocco and the United States. It has also created an extraordinary cadre of U.S. advisors who have been (or are now) substantively engaged with their Moroccan student in research in Morocco. This is real Title XII Strengthening! Of course, there have also been some problems: including arriving at an understanding of the philosophy and procedures of the Project. I hope we will thoroughly discuss these at this Conference. This Partnership meeting today offers an exciting new opportunity for the strengthening of lasting professional, scientific and academic ties between the Agronomic Institute and U.S. agricultural science. These ties must grow and flourish: Of the three Partners in the Partnership - the Institute, U.S. universities and USAID - two should remain for the long run. One, USAID, should disappear. In this sense you should be thinking not of working yourselves out of a job but working USAID out of one!

## In-Country Research

The Project in which you are all participating is an institution building project. The conducting of research and granting of degrees, - of the highest, international quality - is a fundamental part of institution building. Apart from the usual benefit of providing "flight training" of young scientists, dissertation research in Morocco will:

- Permit the development of a Moroccan knowledge base (140 Doctoral dissertations is going to be a national asset).
- Lay foundations of on-going research/training programs in Morocco.
- Establish in the eyes of the world (and of Moroccans) that front line, world class research can be done in Morocco.

° Establish the capability of the Agronomic Institute to train the needed future Moroccan scientists to the Doctorate level.

These parts of the design are now being tested by today's and tomorrow's accomplishments of the Agronomic Institute. So I now turn to the future.

Opportunities for the Future

In any project there are always problems or, as I learned from Bill Hueg "Opportunities." The opportunity is always there to do better, to do more. There are two particular opportunities I want to lay on the table for discussion by this Conference.

One, the faculty participants from the Institute have done an extraordinary job in working on research in Morocco. There are a dozen or more faculty nearing completion. However their research has, inevitably, taken longer to do in Morocco than it would have in the United States.

There is a sense of frustration amongst some of the faculty that they are not getting all the help they need and that their concerns are not being listened to. These are real issues for them. Does this mean that additional assistance, at a cost for sure, needs to be given these faculty participants as they make the last push to complete their dissertations?

Two, the question of the Institute's Doctorate and/or the Ph.D. is still unresolved in the minds of many U.S. advisors and Graduate Schools. The USAID Project is unequivocally designed to assist in the creation of the institutional capacity of IAV to grant Moroccan doctoral degrees. Can we do more to build with the Institute the policies, procedures and traditions of its own graduate school and to make the partnership more aware of the issues in question? Are there issues on the subsequent awarding of the Ph.D. which need to be clarified at this Conference and on your campuses?

The Real Heroes

If the Agronomic Institute (and USAID's support to it) has been successful the overwhelming credit has to go to a large group of people most of whom are not at this conference - the past and present third cycle

students and faculty of the Institute. They have learned English, come to a strange land, competed in the toughest graduate programs in the United States - and performed brilliantly. The academic record of Moroccans has been outstanding. The achievement of Morocco's young faculty in U.S. Ph.D. level course work has been truly astonishing. They have completed prelims in an average of 27 months of course work - a feat of which an American student could be justifiably proud! The same faculty have returned home, resumed their teaching loads, started their research programs and struggled with all the daily and mundane problems of putting together laboratories, field plots, data collection and analysis. By their enthusiasm, effort and commitment they have been the real institution builders.

There have been many individuals on both sides of the Atlantic whose contribution has been critical to the development of the Institute - John Blackmore and Abdallah Bekkali to name but two - but the success of the Institute is truly the success of a talented group of young men and women: the Faculty of the Institut Agronomique et Veterinaire Hassan II. It has been their success which has made the Project supportable by USAID. They have earned our respect and our continued support. I take this opportunity to publicly salute them.

Conclusion

Much has been done, much is being done, much remains to be done. The present and future problems of feeding Morocco's growing population, of coping with a limited and degrading resource base and of bringing about the modernization of Moroccan agriculture are formidable. The ultimate success of the Agronomic Institute can only be measured by Morocco's success in confronting these challenges. USAID's commitment to the Agronomic Institute is programmed to end in 1990. However, institution building never ends - not here in Minnesota or in Morocco. The challenge of the future, ladies and gentlemen, is whether you - not USAID - can sustain the quality of your cooperation and scientific exchange into the 21st century to enable both the Agronomic Institute and your institutions to continue to grow and adapt to a changing world. This conference, the reenforcing of the Partnership and the improved networking which is now taking place amongst Moroccan and American agricultural scientists gives one great confidence that together you will succeed.

Table 1. Agronomic Institute: USAID Obligations
1970-1990 (Actual and Estimated)

| Fiscal Year | Obligations ('000 $) | Project Implementation |
|---|---|---|
| 1970 | 340 | Higher Agricultural Education |
| 1971 | 240 | Phase I |
| 1972 | 300 | 608-088 |
| 1973 | 285 | (December 1969-June 1976) |
| 1974 | 335 | |
| 1973 | 150 | |
| 1976 | 510 | Higher Agricultural Education |
| 1977 | 715 | Phase II |
| 1978 | 500 | 608-0184 |
| 1979 | 1,175 | (July 1976 - June 1980) |
| 1980 | 1,800 | |
| 1981 | 1,400 | Agronomic Institute |
| 1982 | 3,100 | 608-0160 |
| 1983 | 3,421 | First Tranche |
| 1984 | 2,255 | (April 1980 - June 1985) |
| 1985 | 4,000 | Agronomic Institute |
| 1986 | (est)4,000 | 608-0160 |
| 1987 | (est)4,000 | Second Tranche |
| 1988 | (est)4,000 | (July 1984 - April 1990) |
| 1989 | (est)4,000 | |
| 1990 | (est)1,332 | |
| Total | 33,308 | |

Source: USAID, Rabat

Table 2. Agronomic Institute: Participant Training Arrivals in the United States, 1970-1990

| Year | FACULTY | | |
|---|---|---|---|
| | Third Cycle | Doctoral | M.S. |
| 1970 | - | - | - |
| 1971 | - | - | - |
| 1972 | 1 | - | - |
| 1973 | 4 | - | - |
| 1974 | 6 | - | - |
| 1975 | 8 | - | - |
| 1979 | 9 | - | 1 |
| 1977 | 11 | - | - |
| 1978 | 14 | 4 | - |
| 1979 | 19 | 10 | 4 |
| 1980 | 20 | 7 | 2 |
| 1981 | 25 | 12 | 3 |
| 1982 | 25 | 13 | 2 |
| 1983 | 27 | 19 | 6 |
| 1984 | 24 | 18 | 5 |
| 1985 (est) | 15 | 17 | 2 |
| 1986 (est) | 10 | 15 | 1 |
| 1987 (est) | - | 15 | 1 |
| 1988 (est) | - | 10 | - |
| 1989 | - | - | - |
| 1990 | - | - | - |
| Total | 223 | 140 | 26 |

Source: USAID, Rabat

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# THE UNIVERSITY OF MINNESOTA COMMITMENT TO THE MOROCCO PROJECT

Richard J. Sauer

The administration, faculty and staff of the University of Minnesota are committed, without qualification, to the continuation and successful completion of this unique cooperative Project. From President Keller and our Board of Regents to the individual faculty and staff who have made specific professional contributions, the Morocco Project is an integral part of our mission and goals - as integral as teaching undergraduate students in our College of Agriculture, as integral as training professionals in Agriculture and Veterinary Medicine on this campus, as integral as solving problems and providing technological, economic and social advances for Minnesota farmers.

I would make this statement of commitment before any audience at any time. My visit to Morocco a year ago only reaffirmed and strengthened that commitment. It became very clear to me what has been accomplished to date, what enormous potential for further accomplishment remains during the rest of the decade, and why the Project is so critical and necessary for the future vitality and success of the University of Minnesota - as much as for the future of Morocco.

Why is the University of Minnesota involved in international education, research and development to the extent we are, and committed to the Morocco Project as I have just stated? Because we live in an international society and economy, with growing mutual interdependencies. Sometimes our own country has been slow to recognize this fact, but the University of Minnesota has been a pioneer in trying to understand and play a key role in this changing world.

Today we are part of a new era. Communication systems have erased distances and technological development has hastened our global interdependence. We have become acutely aware of the shared problems of the human family and, even more important, we are learning to appreciate

the different cultural and social foundations that govern the solution to these problems.

First, I must emphasize the international nature of science and technology, including agricultural science. The international transfer of ideas and new knowledge in the biological, physical and social aspects of agriculture and the exchange between individuals and institutions across national boundaries is absolutely essential to maintaining and enhancing the quality, productivity and impact of research. teaching and extension activities in our own economy and society.

Second, the health and future of Minnesota's agriculture and the quality of life for our citizens is very directly linked to and dependent upon the development and improved prosperity of other countries' economies and societies. Minnesota's farmers and foresters, food and fiber processors, and businesses in agricultural and forestry industries, as well as all of our consumers, are participants in a global economy and society of growing size and complexity. The University is a principal source of education and information for Minnesotans engaged in these international industries in their professional and personal lives. And the future competitive productivity of Minnesota's agriculture is dependent upon agricultural science, <u>international</u> agricultural science.

Third, I emphasize broadly the growing international nature of our world in which agriculture and natural resource policy and use are central issues. Problems such as world hunger, global dependencies and interdependencies, trans-national business dealings and distributive justice and morality are creating an increased public awareness not only of the social and economic importance of agriculture and related industries in Minnesota and abroad, but also of the ethical, political and ecological importance of these industries in an international setting. Agriculture and food production will remain central to these major issues in the future and thus of vital interest and concern to the people of Minnesota and to the University. Faculty whose research, teaching and service activities include international perspectives are essential to the University's ability to prepare Minnesotans for life in a century that has already

experienced huge changes in national roles, changes that will only accelerate as we move into the future.

The products of the University of Minnesota are two - knowledge and people. And it is the latter that assures continuity in generating the former as well as in applying the knowledge and training to solve the world's problems. The human intellect is the ultimate resource creating all others, including energy. It is the infinite, renewable resource. Consider by way of example, one human intellect educated at the University of Minnesota and his subsequent contribution to agriculture and world hunger. That person is Dr. Norman Borlaug, father of the "Green Revolution" and a recipient of the Nobel Peace Prize. He brought about significant and fundamental change in international agriculture and helped alleviate the world hunger problem in many countries. Norman Borlaug could not gain admittance to our College of Forestry as an undergraduate because his high school grades were too poor. Thus, he began his studies in our General College, then transferred into Forestry. His graduate work was in Plant Pathology in our College of Agriculture and the rest is well documented history. In September we are dedicating a major new building on this campus in his honor.

I am convinced that there are future Norman Borlaugs among our current students - and among the Moroccan faculty who are graduate students in our special Cooperative Project with Morocco and USAID. Just imagine the potential for changing the world for the better!

The current Agronomic Institute Cooperative Project follows two previous projects, the first of which dates back to 1970. Thus, the University of Minnesota has been actively involved in a cooperative effort with Morocco and USAID for 15 years. During 1979 the present Project was designed to deal with one of the major pieces of IAV's (Institut Agronomique et Veterinaire) drive to institutional maturity - the development of its own Moroccan faculty. During the 1970's IAV had experienced a phenomenal growth of students, programs, budget and institutional philosophy. For the institutional growth of IAV, and of ENA (Ecole Nationale d'Agriculture de Meknes) and ENFI (Ecole Nationale

Forestiere d'Ingenieurs de Sale) to continue and to permit them to become self-supporting and capable of generating the human capital, so badly needed to manage and support Morocco's agricultural development, it was apparent that the creation of a well trained Moroccan faculty was a critical element in this process.

The Project is unique in that, subordinate to its institution building goals, the faculty development activities are planned within the framework and goals of the institutional growth of IAV, ENA and ENFI. It is important to realize that the University of Minnesota and USAID have been successful in Morocco in making a long term commitment to institutional development. The rapid development of the Moroccan institutions is now being appreciated as a necessary condition for the development of Moroccan agriculture.

The initiation of the present Project marked more than just a major renewed commitment by the University of Minnesota and USAID to Moroccan agricultural development. It was a milestone in the institutional history of IAV, ENA and ENFI and the beginning of their emergence as independent, national institutions, taking their place in the international community of agricultural science and capable of their own sustained contribution to Moroccan agricultural development. The job is not yet a completed one - but the goal is a realizable one, with the strong joint commitments of Morocco, USAID and the University of Minnesota. I assure you that the University of Minnesota remains committed to achieving the goal.

# THE PARTICIPANT TRAINING PROGRAM

James C. Sentz

## Introduction

Institution Building is a widely used term generally referring to those processes and procurements planned to establish the physical facilities, human resources and organizational structure necessary to the performance, perpetuation and evaluation of a given set of functions. It is certainly applicable to the development of the Institute Agronomique et Veterinaire-Hassan II (IAV) created in 1968. Participant training is a cornerstone, if not the foundation itself, in providing the human resources essential to the initiation and establishment of an educational institution. The classrooms and laboratories at IAV, the research plots and sophisticated scientific apparatus, and the most elaborate administrative and academic organizations will become deteriorating halls, corroding hardward and paper exercises without faculty educated and trained in their respective disciplines to advance their science and its application to enhance Moroccan agriculture, and particularly to teaching a new generation of Moroccan scientists and educators to follow in their footsteps. In the "final" evaluation of this program, the success of this partnership effort will rest upon our combined successes in participant training to establish this human resource foundation for the Institute's development and perpetuation. It is appropriate that more than one-half of the project resources are expended for training activities.

Although this topic is listed as part of the Project Origins session in our program, my presentation will provide a transition between our origins and accomplishments sessions this afternoon which will include considerable detail about participant training in the various disciplinary areas.

## The Beginning: Phase I 1970-1979

Participant training was initiated with Third-Cycle IAV students coming for one year of MS level courses, research and experience. The first student came in 1972, and students now total 198 in the continuing program. Malcolm Purvis has already shown our training numbers in some

detail. I will make some additional observations one these as given in Table 1

The gradual increase in numbers of students from 1972 to 1979 was not only due to an increase in IAV graduates, but also reflects a developing integration of U.S. graduate education into the Moroccan IAV system. While the first students came to study in plant and soil sciences only, the number of disciplines gradually expanded to include water, engineering, nutrition and the animal sciences in general. This early program helped establish our Minnesota training and experience base for the Doctoral program initiated in 1978. More than one-third of the 72 students who came during 1972-79 have returned for Doctoral programs as IAV faculty members. To date 31 of the 198 third-cycle students have returned to participate in the Doctoral program, and recent student participants joining the IAV faculty are not yet eligible to return.

Third-Cycle MS level training in the U.S. has continued with 25 students per year since 1980. Beginning this year, it is scheduled to decrease as the IAV departments assume this function. Approximately 50% of these recent students have studied at other universities and some 25 universities have been partners in Third-Cycle training.

The Doctoral Program: Phase II

The first four Doctoral participants came to the U.S. in 1979 and this phase of the program was formally initiated in April 1980 as part of a ten-year cooperative effort with IAV and USAID. The major elements of this program will be important to our following sessions.

Participant Doctoral Program Plan

- IAV Nominations
- US Graduate Admission
- Coursework and Comprehensive Program in U.S.
- Research in Morocco
- Dissertation in Morocco and IAV Doctorate
- Post-Doctoral U.S. Study Tour

The details and support provided for the components of this plan are given in our Moroccan Participant Handbook, with which most of you are familiar, and I will review certain aspects only briefly.

The Institute first nominates its faculty for study in the U.S. Nominees then prepare and submit applications to selected U.S. universities for graduate admission. Upon acceptance nominees become Faculty Participants and complete all requirements for the Ph.D. degree through the comprehensive examinations and admission to candidacy, including dissertation research planning and methodology training. A basic two year leave is granted faculty by the Institute to complete this coursework phase.

Participants then return to Morocco to complete their research and dissertation preparation under direction of their U.S. advisor and local supervision by the Minnesota resident faculty coordinator. Following acceptance of the dissertation by an international jury appointed by IAV, with the U.S. advisor as president, participants will defend their work for the Doctorate es Science.* A significant aspect of this procedure is completion of the U.S. university degree requirements through candidacy, and the dissertation in Morocco under direction and acceptance of the U.S. advisor to assure a standard of quality achievement at least equivalent to U.S. degree standards. Defense of the dissertation before a heterogenous international expert committee is expected to be equally (and perhaps more) demanding as the defense before an appropriate U.S. university committee.

Provision is made for successful IAV Doctorate awardees to return to the U.S. for journal publication of their research, to attend professional and scientific meetings, for library research, and related academic and professional activities in support of their IAV teaching and research responsibilities. At this time participants may independently defend their research and fulfill the final requirements for the Ph.D. degree, which will be their option at most universities.

The operational plan of the 1985 project amendment covering the

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*Guidelines for dissertation preparation and committee structure and appointments are available.

1985-1990 period provides for training 140 faculty at the Doctoral level, and 25 to the Masters degree in the U.S. The distribution of these among IAV departments is given in Table 2.

Present Status

At this date there are 90 doctoral programs in progress or completed, and 18 identified for initiation during the remainder of 1985 for a total of 108. Among the 90 programs already initiated, five participants have completed their doctoral degree, 41 are pursuing research and dissertation writing in Morocco, and 44 are doing resident coursework in the U.S. Master of Science programs now number 17, with six completed, and six additional identified for initiation in 1985 for a total of 23 (Table 2).

Reaching the Target

To achieve the program training target we need to identify and initiate 32 doctoral and 2 MS programs for completion by April 1990. (Tables 2 and 3). The MS program target is clearly attainable. For completion by 1990 the remaining 32 doctoral programs should be identified and initiated no later than September 1986. This timetable however, provides only 3½ years to the scheduled completion of the Project. Currently programs are taking significantly more time, including more than 3 years for the research and dissertation, for completion.

It is apparent therefore that some modification of the plan will be necessary to achieve the IAV doctoral training target, and perhaps including the program plans of many of those who will initiate doctoral studies this year.

The distribution of training was not programmed uniformly among all disciplines and consequently there are a larger number of programs remaining to be initiated in the Veterinary Sciences, Socio-Economics, and Environmental Sciences. The current number of MS programs targeted may be an underestimate of the Institute needs.

The 46 doctoral participants who have returned to Morocco have completed their US studies, including English language requirements in an

average of 28 months with the extremes ranging from 21 to 33 months. This time frame is certainly minimal given consideration of the program requirements and the urgency of faculty to return to their duties at the Institute.

Completion of research and dissertations at IAV has lagged appreciably and several are taking more than five years to complete this phase of their programs. These delays can be excused by a variety of reasons. Although there may be valid delays in program completion, I suggest that the underlying causes be identified and effectively addressed so that this final phase of doctoral program completion will keep pace with progress in other stages of the doctoral program. I expect some of these issues will be identified and discussed in the remaining sessions of our program.

## Program Linkages

Approximately 45% of the 90 doctoral participants who have entered the program have studied at 20 universities other than Minnesota and these are well represented at this conference. This is most significant for the Institute in providing its faculty a broad and diverse academic exposure, and in establishing a wide base of institutional and departmental linkages significant to future academic interchanges. The continuation and benefits to be derived from these linkages in the future will depend in large part upon availability of financial support, which we will need to exploit in order to maintain and continue the growth and stature of IAV into the 21st century.

## Conclusion

We are well into a significant institutional project with IAV. The Project draws upon the academic strengths of many U.S. universities and is structured to provide maximum benefits to the Institute and Moroccan agriculture in the process. The ultimate success in this effort depends upon many factors, most of which are under our combined control. If we will all continue to work together, we can succeed.

Table 1. Third-Cycle Student Participants

| Year | Arrivals | Returned for Doctoral Studies | Comments |
|---|---|---|---|
| 1972-79 | | | |
| 72 | 1 | - | Plant & Soil |
| 73 | 4 | 2 | Sciences, Range, |
| 74 | 6 | 3 | Irrigation, and |
| 75 | 8 | 5 | Nutrition |
| 76 | 9 | 2 | |
| 77 | 11 | 3 | |
| 78 | 14 | 2 | |
| 79 | 19 | 8 | First students in Animal Science |
| Sub-Total | 72 | 25 | |
| 1980-84 | 126 | 6 | All Areas |
| TOTAL | 198 | 31 | |

Table 2. Faculty Participant Training Plan and Status

| Area | Total Planned | In-Program 1974-84 Doctoral | In-Program 1974-84 MS | Planned 1985 Doctoral | Planned 1985 MS | Remaining |
|---|---|---|---|---|---|---|
| Basic Sciences | 7 | 59 | | | 1 | 1 |
| Environmental Sciences | 14 | 69 | | 1 | | 7 |
| Marine Food Sciences | 6 | 1 | | | | 5 |
| Crop Sciences | 20 | 14 | 1 | | | 5 |
| Horticulture Sciences | 13 | 9 | 2 | 3 | 1 | (-2) |
| Animal Sciences | 8 | 10 | | 3 | | (-5) |
| Engineering & Irrigation | 15 | 7 | 4 | 1 | 2 | 1 |
| Food & Nutrition Sciences | 20 | 9 | 6 | 2 | | 12 |
| Veterinary Sciences | 30 | 15 | 1 | 2 | | |
| Socio-Economic Sciences | 9 | 2 | | 1 | | 6 |
| English Language | 3 | | 2 | | 1 | 0 |
| ENA-Meknes | 15 | 8 | 1 | 3 | 1 | 2 |
| ENFI-Sale | 5 | 4 | | 2 | | (-1) |
| TOTAL | 165 | 90 | 17 | 18 | 6 | 34 |

Target 1978-90: Doctoral 140 MS - 25

Total 1978-85: Doctoral 108 MS - 23

*1985 Project Amendment

Table 3. Doctoral Program Status, May 1985

| Stage of Program | | Numbers | |
|---|---|---|---|
| Completed | | 8 | |
| IAV and US | 2 | | |
| IAV only | 2 | | |
| US only | 4 | | |
| Research/Dissertation | | 38 | |
| U.S. Resident Program | | 44 | |
| TOTAL PROGRAMS INITIATED | | | 90 |
| Planned for 1985 | | 18 | |
| Remainder 1986 | | 32 | |
| TOTAL 1985-90 | | | 50 |
| TOTAL | | | 140 |

# ACCOMPLISHMENTS OF THE PROJECT

# PLANT BREEDING

Lynn W. Gallagher

This discussion should be read with that by Dr. Steve R. Simmons to obtain a complete knowledge of contributions in agronomy and plant breeding.

The role of seven centuries of Moorish rule in Spain in the introduction of North African germplasm into the U.S. remains obscure. A history of the flow of plant germplasm from North Africa and Iberia into the Pacific Southwest of the United States has been partially documented. Alfalfa was probably brought into California from Mexico by early spanish missionaries, although written records trace introductions to California back to Chile in the 1850's. Spanish missionaries are believed to have introduced red oats into California. Also introduced into California by the Spanish were North African barley land races from which the variety Coast was selected. Reselection within Coast resulted in the release and distribution of Atlas barley in 1924. A series of cultivars was developed in the Atlas background in the years '46, '54, '57, and '68. Early California researchers realized the ecological importance of North Africa. Club Mariout barley was introduced in 1903 and California Mariout in 1905, both from Egypt. California Mariout was modified through breeding to create CM67 and CM72, both of which were resistant to barley yellow dwarf virus (BYDV).

The introduction of new germplasm into Morocco is playing a crucial role in the development of new varieties for several plant species. California developed barley genotypes having resistance to BYDV have been high yielding in Morocco, where BYDV is one of the most important diseases. Adaptation of cereals bred in California to conditions in Morocco is also understandable because both have a Mediterranean climate characterized by cool, wet winters and hot, dry summers. Spring cereals are fall and winter sown. The Moroccan barley growing area covers the same latitude found from the Yaqui Valley of Mexico, north to the Sacramento Valley of California. The majority of the parents now being used to create new six-row segregating populations in Morocco are from California breeding programs.

Two outstanding experimental barley lines, UC76252 and NK1272, have Numar, which traces back to California Mariout, in their pedigree. Coincidentally the Moroccan cultivar Arig 8 had the California cultivar Arivat as one parent. The current six-row Moroccan barley improvement program owes its outstanding potential to the generous cooperation of cereal breeders in California.

The Moroccan barley breeding program also has benefited from the introduction of two-row and to a lesser extent six-row barleys from western Europe. Scandinavian, French, Dutch, and British barleys have many good characteristics, but they need earlier maturity and BYDV resistance for Moroccan growing conditions. Two high-yielding two-rowed Moroccan cultivars, INRA 1703 and Orge 1, have been developed previously from European germplasm. They are early in maturity but only now is BYDV resistance being incorporated. Other cereal improvement programs have benefited from germplasm evaluation.

Besides soil moisture, Hessian fly (*Mayetiola destructor*) damage severely limits wheat yields in Morocco. From 1981 through 1983 Hessian fly resistant durum wheat and breadwheat germplasm from the USDA small grains collection at Beltsville, Maryland, was evaluated in Morocco. The genes $H_5$ and $H_{13}$ were determined to be useful, and their deployment was recommended separately in durum wheat and breadwheat, respectively. With the exception of the untested $H_{12}$ and the two above, the other genes numbering $H_1$ through $H_{16}$ were found to be of little value, although there was some evidence that the fitness of natural *Mayetiola* populations was being reduced. Many of the genes identified as conditioning resistance to *Mayetiola* in the USA, such as $H_5$, are of Portuguese origin. Useful sources of resistance were not found among the USDA collection of Hessian fly resistant durum wheats. Only 12 breadwheat lines, some of which probably have $H_5$, appeared to be useful in Morocco; the majority of these 12 are of Portuguese origin. Breadwheat genotypes having $H_{13}$ were developed from *T. tauchii* at Kansas State University.

The data collected so far suggests that more virulence genes are found in natural fly populations in Morocco than normally encountered in the USA. The larvae in Morocco frequently provoke the formation of a gall on barley and this observation led to speculation about the existence of a new species by early French scientists. Experiments designed to demonstrate reproductive isolation of populations on barley and wheat have not been successful; evidence for speciation is lacking.

Oat introductions from California were found to be similar in maturity to the Moroccan cultivar created by early French workers. California oats were also very disease susceptible. Slightly later, but more productive and disease-and lodging-resistant are the red oats from the Missouri and Coker Seed Co. programs. Selections from these programs have been hybridized inter se and with Moroccan oats to form segregating populations from which higher yielding BYDV resistant oat varieties should emerge.

Durum wheat and rice experimental lines also have been introduced into Morocco from California. Hybridization of these materials with Moroccan varieties has already been carried out in each instance because of the superior grain quality of the introductions.

In 1924 the non-hardy, non-dormant alfalfa variety African was introduced into the American Pacific Southwest from Egypt. Further breeding using African produced Moapa, Sonora, Moapa 69 and Sonora 69. Moapa, Sonora, and African have been distributed in Morocco, although seed is produced from subsequent generations rather than original clones. A recent evaluation of modern cultivars from the Waterman-Loomis Co. of Bakersfield, California, and the University of California suggest that Morocco can benefit from increased germplasm exchange and evaluation. Morocco itself remains rich in local alfalfa ecotypes which might be important for further cultivar development in the U.S. No active program of alfalfa improvement exists in Morocco.

In conclusion, ecological similarity between Morocco and the Pacific Southwest of the U.S. has led to the successful bidirectional introduction of germplasm of several cultivated species. Until very recently this flow

of germplasm had been primarily unidirectional. The importance of new introductions to Moroccan agricuture should be judged 10 to 20 years from now. It remains to be seen whether or not Moroccan scientists will be able to establish and maintain increased scientific contacts with California or revert to their previous isolation. Other examples mentioned above suggest that Moroccan scientists must be ready to reach out to other crop improvement programs where scientific advances have taken place to resolve some of their problems and increase agricultural productivity.

# AGRONOMY

Steve R. Simmons

## Introduction

The agronomy component of the Agronomic Institute Project has contributed to educating faculty in agronomy for the Institut Agronomique et Veterinaire Hassan II (IAV) and the Ecole Nationale d'Agriculture (ENA). It has also provided third cycle education for IAV students who have or will become the crop scientists and other professionals important for improving Morocco's agriculture. Agronomy doctoral and third cycle students from Morocco have been advised by faculty from the Department of Agronomy and Plant Genetics at St. Paul. For purposes of this report I will include among the agronomy students those specializing in plant breeding, weed science, crop physiology and crop production. Dr. Lynn Gallagher has summarized some of the contributions in plant breeding in a separate report in this conference.

Dr. Kent Crookston, a crop production and physiology specialist from Minnesota, recently assumed the position of resident staff in agronomy at IAV. Plant breeders, Dr. Lynn Gallagher and Dr. John Caddel, each served as resident staff in agronomy before Dr. Crookston.

## Third Cycle Education

By next fall twenty-five students will have completed the one year third cycle study program in the Department of Agronomy and Plant Genetics as part of their requirements for the Master of Science level program at IAV (Table 1). Three of these students had specializations in weed science, four were in crop production or physiology, and eighteen specialized in plant breeding. These students took an academic year of graduate level coursework in St. Paul while participating in various research activities. In some cases this research experience related directly to the memoire (thesis) topic that they pursued upon returning to Morocco, and in other cases the experience was more supplemental. Students utilized the University of Minnesota library facilities to conduct an in-depth literature search for their memoire topic. Four former third cycle participants at St. Paul (one in crop physiology and three in plant

breeding) have since gone on to work toward doctorates at other institutions in the U.S. Participants in the agronomy program who have studied at other universities are shown in Table 3.

I would like to use Mr. Ahmed Bamouh, a student that I advised who is now at University of California-Davis working on his doctorate, as an example of how this third cycle education worked in agronomy. Mr. Bamouh arrived in the U.S. in August of 1979 to begin his third cycle studies. He had not yet established a defined memoire topic before leaving Morocco. However, it had been decided before he arrived that he should work on some aspect of water stress physiology in cereals, possibly related to photosynthesis. One of the difficulties I faced was how to mesh these specific research needs with the peculiar Minnesota growing conditions and other constraints of my ongoing research program. For example, field water stress studies are difficult to conduct with reliability in St. Paul because of our climate. Furthermore, my research project had not conducted photosynthetic studies before Mr. Bamouh came, nor was it equipped to do so.

It was decided that Mr. Bamouh would not conduct research in Minnesota that directly applied to his memoire in Morocco, but he would be provided with an intensive research experience that would be beneficial to his overall understanding of cereal physiology. During his time in Minnesota he completed graduate coursework in statistics, plant physiology and agronomy, and conducted independent studies that permitted him to gain experience with various water relations laboratory techniques. He also conducted an in-depth field research study with me that considered the importance of temporarily stored photosynthates in barley stems for grain yield. This temporary carbohydrate storage is recognized as an extremely important water stress adaptation mechanism in barley. The research involved radiocarbon labelling procedures in plants, providing Mr. Bamouh with an experience that is not readily available in Morocco. Although this research was not directly applied to his memoire when he returned to Morocco, Mr. Bamouh's overall understanding of water stress physiology and associated methodology was greatly enhanced by his experiences in Minnesota.

Faculty Education

Four individuals have pursued doctoral degrees in agronomy with advisors from the Department of Agronomy and Plant Genetics (Table 2). One of them, Dr. Ahmed Zahour, was the first Project participant to complete his doctoral degree through the program in September 1984. His specialization was plant breeding. The three other faculty participants in the Project have completed their coursework, passed their preliminary exams, and are at different stages in their dissertation research in Morocco. Two of these faculty (Mr. Ouatter and Mr. Oussible) are projected to complete their doctorates this summer or fall and the third (Mr. Chafai) will likely complete his program sometime in 1986. Each of these faculty participants is actively teaching, advising students, conducting research, and carrying various administrative responsibilities within their respective institutions.

The relationship with doctoral participants is more intense and of longer duration than with the third cycle students. Our experience with these doctoral participants has been very positive and their record of academic achievement has been excellent. The greatest challenge for me in working at this level of the Project is to effectively advise the participant now that he has returned to Morocco. This is facilitated considerably by the presence of the resident staff in Morocco. Dr. Gallagher served this important role for the recently completed degree of Dr. Zahour. Since he arrived, Dr. Crookston has served as an effective resource person and on-site advisor to Mr. Oussible, Mr. Ouattar and Mr. Chafai. I have been to Morocco only once (last December) and anticipate making my next visit when my participant, Mr. Chafai, begins writing his thesis next winter. Thus, the importance of having a resident staff person working to assure the timely and successful completion of a thesis is clear.

Resident staff and faculty advisor activities go beyond merely equipping participants to complete their dissertation research, however. Within the "institution building" concept it is important to recognize other contributions that these individuals make. For example, discussions between students and faculty often occur concerning subjects other than

research. My students and I have many philosophical discussions about topics such as how universities should function, what constitutes a quality agronomy curriculum, teaching improvement issues, and how to establish a career in science. These interactions were seldom one-sided. I gained much from them. I was impressed, for example, by innovative aspects of the Moroccan agronomy education system, such as the field training, that conceptually have much to offer an agronomy education program in the U.S. My doctoral participant also served as a student teacher in my small grains management course when he was in Minnesota. This provided us a focus for useful discussions of classroom teaching issues. When I was in Morocco I met with the faculty in agronomy at Meknes for the express purpose of reviewing their curriculum, discussing course review and revision procedures, and considering other issues of importance in establishing an outstanding agronomy education program. Most faculty in agronomy have presented seminars at IAV when they have visited Morocco to advise their students.

Resident staff

I highlighted above the critical role that the resident staff member plays in assuring timely and successful completion of the doctoral research in Morocco. This individual also contributes much through daily interactions with the faculty and students at IAV. Both Dr. Gallagher and Dr. Caddel provided valuable guidance to the barley breeding programs in Morocco. Dr. Crookston, a former Director of Graduate Studies in the Department of Agronomy and Plant Genetics at St. Paul, is well equipped to consult with the IAV faculty on development of its graduate curriculum and other resources.

Areas for emphasis

As we review accomplishments of the Project in agronomy we can be pleased, but not complacent. Many difficulties have been solved and the Project is succeeding in its primary goals of facilitating the education of students at both the M.S. and Doctoral levels. Let me now suggest some areas for future emphasis in this or similar projects.

Two agronomic discipline areas appear to be very critical to improving overall Moroccan agriculture. These are weed control and forage management. These areas are ripe for future emphasis.

More can be done with doctoral level participants while they are in the U.S. Effort should be made to acquaint them with faculty procedures for establishing research and educational policies and standards, methods for maintaining or enhancing course and instructional quality, and other issues of importance to a faculty member at a teaching and research institution. During my visit to Morocco I was impressed that these doctoral level "students" of ours should be involved more as "visiting faculty" during their time with us in St. Paul. I wish now that the agronomy participants had been encouraged to attend faculty meetings, observe curriculum sessions and course reviews, and monitor other faculty policy making meetings. This would have permitted them to observe first-hand how educational issues are resolved at Minnesota. I am sure that they would not always have observed "model" examples of issue resolution, but the experience would have been useful none the less. Some attention has been paid in the past to discussion of instructional improvement issues with the agronomy project participants, but more can be done. Faculty of IAV and the other schools in Morocco have major responsibilities for teaching courses and administering programs, advising students, and conducting research upon returning to Morocco. They could benefit from any assistance we can provide in honing their skills in these areas while they are with us in the U.S.

Summary

In the years since the University of Minnesota became involved in the Partnership Institution Building Program in Morocco much has been accomplished in agronomy. Today we have completed the doctoral program for two faculty participants and are nearing completion of the programs for several others. In addition the Project has assisted in educating many who are today making important contributions to the development of the agronomic industry in Morocco. Resident staff in agronomy have already assisted in many aspects of building the research and teaching programs in Morocco. The current resident staff member in agronomy has considerable

administrative experience in graduate education and research and is uniquely qualified to continue assisting in the day to day aspects of building institutions of graduate excellence in agronomy. We in agronomy enthusiastically point toward completion of the task that is before us.

Table 1. Third cycle participants in agronomy

| Name | Dates in MN | MN Advisor | Specialization |
|---|---|---|---|
| Bani-Aameur, Fuzia | 1974-75 | D. Rasmusson | Plant Breeding |
| Ibnelmouata, Azzouz | 1975-76 | D. Rasmusson | Plant Breeding |
| Zahour, Ahmed | 1975-76 | J. Geadelmann | Plant Breeding |
| *Jlibene, Mohamed | 1977-78 | D. Rasmusson | Plant Breeding |
| *Amri, Ahmed | 1978-79 | R. Busch | Plant Breeding |
| *Bamouh, Ahmed | 1979-80 | S. Simmons | Crop Physiology |
| Oubaha, Lahcen | 1979-81 | B. Gengenbach/ J. Geadelmann | Plant Genetics |
| El Brahli, Azzedine | 1980-81 | R. Behrens | Weed Science |
| Mergoum, Mohamed | 1980-81 | D. Rasmusson | Plant Breeding |
| Nsarellah, Nasser | 1980-81 | R. Phillips | Plant Genetics |
| *Obanni, Mohamed | 1980-81 | R. Busch | Plant Breeding |
| Sabik, Mohammed | 1980-81 | R. Stucker | Plant Breeding |
| Selmani, Abdellaziz | 1980-82 | J. Geadelmann | Plant Breeding |
| Bari, Abdallah | 1981-82 | J. Lambert | Plant Breeding |
| Benyassine, Abderrahim | 1981-82 | D. Barnes | Plant Breeding |
| Belhadri, Mohammed | 1982-83 | D. Rasmusson | Plant Breeding |
| Benahnia, Khadija | 1982-83 | D. Wyse | Weed Science |
| Hachen, Jamal | 1982-83 | D. Behrens/ R. Crookston | Weed Science |
| Msikine, Driss | 1982-83 | C. Sheaffer | Agronomy |
| El Behri, Abdelfattah | 1983-84 | C. Sheaffer | Agronomy |
| El Himdy, Badre | 1983-84 | R. Jones | Agronomy |
| Ez-Zarzari, Abdelfdil | 1983-84 | D. Stuthman | Plant Breeding |
| Fatemi, Zain El Abidine | 1983-84 | D. Rasmusson | Plant Breeding |
| Tahiri, Amar | 1983-84 | J. Orf | Plant Breeding |
| Belmokhtar, Lamya | 1984-85 | D. Rasmusson | Plant Breeding |

*Currently pursuing doctorate through institution other than Minnesota.

Table 2. Faculty Participants in Project from Agronomy.

| Name | Dates in U.S. | U.S. Advisor(s) | Current Position |
|---|---|---|---|
| *Zahour, Ahmed | 1979-81 | D.C. Rasmusson | Assoc. Professor, IAV |
| *Ouattar, Said | 1979-81 | R.K. Crookston/ R.J. Jones | Assoc. Professor, IAV |
| Oussible, Mohammed | 1979-81 | R.D. Wych, R.K. Crookston | Asst. Professor, IAV |
| Chafai, Alaoui | 1981-83 | S.R. Simmons | Asst. Professor, ENA |

*Has received IAV Doctorate.

Table 3. Participants in Agronomy at Cooperating Universities.

| Name | Date | University |
|---|---|---|
| Doctoral Participants: | | |
| BEN BELLA, Mohamed | 1983 | Kansas State University |
| BOUHACHE, Mohamed | 1984 | Univ. of California-Davis |
| MOSSEDDAQ, Fatima | 1984 | Colorado State University |
| MOUGHLI, Lhoussaine | 1984 | Colorado State University |
| BAMOUH, Ahmed | 1984 | Univ. of California-Davis |
| Third Cycle Students: | | |
| GOURIMATE, Mohamed | 1978 | Kansas State University |
| LAAOUANE, Lahib | 1980 | Univ. of California-Davis |
| ZAID, Abdelouahhab | 1981 | Univ. of California-Riverside |
| ABIEDI, El Hassan | 1981 | University of Nebraska |
| AIT OUBAHOU, Ahmed | 1981 | University of Nebraska |
| BOUSRAREF, Abdelaziz | 1984 | Kansas State University |
| RACHIDI, Faouad | 1984 | Kansas State University |
| SOUAF, Mohamed | 1984 | Oregon State University |
| ABIDI, Mohamed | 1985 | Kansas State University |
| EZEKARI, Mohamed | 1985 | University of Nebraska |
| NASSIR, Abderrahim | 1985 | Kansas State University |
| ZAHIR, Hamid | 1985 | Oregon State University |

# PLANT PATHOLOGY

Roy D. Wilcoxson

In 1971 I first visited Morocco as the leader of the Plant Science Project of the cooperative program between the University of Minnesota, USAID and The Institute of Agronomy and Veterinary Medicine Hassan II in Rabat, Morocco. At that time there were no Moroccan plant pathologists but a few Canadian, French and Belgium plant pathologists were active as teachers and researchers of plant diseases in Morocco. They were Dr. Joseph Meyers, Dr. M. Goetals, both from Belgium, Dr. Paul Reuif and Professor Viennot Bourgin from France, and Dr. R.L. Pelletier from Canada. Dr. Reuif lived and worked in Morocco most of his career. He was primarily interested in diseases caused by fungi and he published on many that occur in Morocco. In addition to the work of the scholars I have mentioned, the diseases of citrus were evaluated by various persons interested in this very important crop.

On this trip in 1971 I learned of Mohamed Besri who was studying plant pathology at the University in Nancy, France. In due course Dr. Besri returned to Morocco to teach plant pathology and to research plant diseases of Morocco. During the last 10 years Besri has been primarily interested in diseases caused by the fungus Fusarium, and the diseases of the tomato. Under Dr. Besri's leadership there has been a rich outpouring of students, of research recorded in Third Cycle theses, published in the international journals of Europe, and in presentations at scientific meetings in Europe and the Mediterranean basin.

In 1971 Dr. Ben Lockhart was hired by the Department of Plant Pathology to serve in Morocco. Dr. Lockhart has worked in Morocco for about 10 years as a leader in studies on plant virus diseases of Morocco. His work has demonstrated several important points that are essential in an institution building project. I shall list them:

1. He has demonstrated that first class research laboratories can be built on a small budget in developing institutions. He built two such laboratories for studying plant virology.

2. He systematically studied a certain class of diseases using available facilities. He has identified the virus disease problems of important crop species, especially vegetable crops. These studies have yielded 40 publications in internationally recognized journals. Most of these studies were produced in cooperation with other professional virologists working in Morocco for projects financed by other countries and with Moroccan students who studied under his direction. He has also lead out in the development of international cooperation with scientists in the U.S., Brazil, England, Germany, Belgium and France.

3. His research was done not only to discover the virus disease problems of Morocco but to provide a model for his students to follow and to provide them with materials and facilities for their thesis research.

4. He lead out in the development of a plant disease diagnosis clinic to teach students the art and science of diagnosis, and to serve the growers who needed the service. He was aided with this clinic by Mr. Nick Verstegen but the clinic has been operated by Moroccans for the last two years.

In December Dr. Lockhart will leave Morocco. In addition to the general contributions I have mentioned, Ben has helped educate his successor. This man earned his masters degree in our program and his doctorate in the Belgium program.

In 1978 Dr. James Burleigh was hired by the department to develop a cereal pathology program in Morocco. Cereals are an important crop in Morocco and plant disease is an important constraint to maximum production. Dr. Burleigh's efforts have centered in teaching courses on epidemiology of plant diseases and on the methodology for estimating losses due to disease. His research has been almost entirely in the field where he has studied epidemiology of rusts, powdery mildew, Septoria and net Blotch of wheat and barley. He and his students have also published their findings in the international journals.

Dr. Burleigh organized a workshop on crop disease losses that was held in April 1985. This work shop attracted some 70 scholars from Morocco as well as teachers from the U.S., England and Syria.

Though the contributions of Drs. Besri, Lockhart, and Burleigh have been of great significance, perhaps their greatest contribution is yet to be made when the work of their students begins to come to fruition.

Remember, I said there were no Moroccan plant pathologists in Morocco in 1971. There are now 16 who have completed the equivalent of the Master of Science degree in what is called the Third Cycle program. Three more persons will complete the degree this year and the remaining two will complete it next year. The people in the Third Cycle program have studied at 5 American universities including the University of Minnesota, the University of California at Riverside, Iowa State University, and the Universities of Illinois and Wisconsin. Thus they have been exposed to a rather wide range of current thought in Plant Pathology.

The thesis topics for Third Cycle students have been as follows: five have studied diseases of wheat and barley, eight the virus diseases of vegetables, two have studied fungal diseases of potato, one the bacterial diseases of bean, one citrus pathology, one seed pathology, two have studied nematode diseases of vegetables, and one has worked on the legal regulation of pesticides especially fungicides.

Two Third Cycle candidates have gone on to complete doctoral degrees in West Germany and Belgium.

All of the students in the Third Cycle program who have completed their experience in the U.S. universities returned to Morocco. Their research has been of high quality and their thesis defense presentations have been among the best at the Institute. According to my latest information, all who have completed the program are employed in Morocco except for one who only recently completed his degree and is looking for a position.

Six persons have studied plant pathology in the doctoral program of the Institute. Unfortunately one of these doctoral candidates was killed several years ago in a car accident. Five of the participants earned masters degrees through our cooperative Project and the remaining two earned their masters degrees in the French program.

The American universities cooperating with the Institute in the doctoral program in plant pathology are: three persons at the University of Minnesota, two at the University of California at Riverside and one each at the University of Idaho and North Carolina State University. All but two of the participants have returned to Morocco and these two are expected to complete their U.S. experiences and return home during 1986. We plan on two participants completing their doctoral programs in plant pathology during the fall term of 1985.

The thesis topics being studied by the doctoral candidates relate to important plant disease problems of Moroccan crop production. The topics are: occurrence of mychorizal fungi on Moroccan crop species, resistance of tomato to nematodes, control of seed transmission of bacterial canker of tomato, leaf rust of wheat, and stripe disease of barley, and on the taxonomy and populations of root-knot-nematode.

Those doctoral participants who have returned to Morocco are all engaged in teaching undergraduates, in supervising thesis research by undergraduates and Third Cycle degree candidates, in departmental administration, in committee work in their departments and the Institute, and on National committees where their expertise has been needed.

The doctoral participants have developed laboratory and field research facilities to supplement those developed by Drs. Besri, Lockhart and Burleigh. Therefore, the interested new students in Morocco can now find the support system for effective studies in plant pathology.

Finally, I should mention that library facilities for plant pathology have been built up over the years so that nearly complete collections of American journals on plant diseases are now available at the Meknes

School of Agriculture and at the Institute in Rabat. Most of the books published on plant diseases during the last 10 years are also available. This collection is somewhat scattered because portions of it belong to individuals as well as to the institutions where they work, but the information is available to an interested student. Hopefully there will be an integration of the available material so it will be more readily available.

In conclusion I should like to claim that plant pathology has grown since 1970 from a situation where most work was being done by visitors to Morocco to one where (1) most undergraduate instruction is being done by Moroccans who are well qualified to instruct, (2) most thesis research by undergraduates and Third Cycle candidates is being supervised by Moroccans, (3) publications are appearing in the world literature based on work done by Moroccans. (4) Facilities are now in place for studying most plant disease problems in Morocco. (5) A corps of well trained Moroccans has been prepared. (6) Finally this corps of professional people hopes to offer the entire Third Cycle program in Plant Pathology without foreign assistance beginning in 1986.

## SOIL SCIENCE

Jean-Alex Molina

Along the Atlantic coast of Morocco, late in spring and during the summer months, waters from the ocean rise in tenuous white shrouds to condense, almost at eye level in thick clouds. Pushed inland over a few kilometers by the winds, this wet, damp air gives crops enough moisture to grow when the rainy season is long past. Honeydew, watermelon in early summer, replete with water collected by leaves spread over the soil surface to gather the morning dew. This climatic phenomenon which has the beautiful name of "hidden precipitation", is also at the origin of an expression of vernacular wisdom which advises owners of newly built houses, not to move in immediately, but rather, to rent their property for 3 to 4 years. In this damp summer climate, it takes 3 to 4 years of winter heating to dry the walls and to avoid rheumatism, allergies and fungal growth on skin, boots and books.

Do I need to tell you that, in 1970, when the resident staff from the Department of Soil Science of the University of Minnesota moved to IAV, the walls were still wet?

Dr. Schmidt and Dr. Blackmore initiated the Project. Soil Science offered academic and technical expertise, when dollars were expected.

Soil Science was first to propose an original Project staffing based on the tandem made of young, untenured resident staffs in Morocco, backed up by senior faculty members from the University of Minnesota, when this was viewed in Morocco as evidence of the low quality of the human material shipped to Rabat.

Soil Science received the first Third Cycle student, Mr. Mohamed Lahlou, when the routine called for training in France or Belgium.

Soil Science was the first to break away from the Third Cycle - Ph.D. exclusive involvement called for by the original Project to teach for the Second Cycle not only at Rabat but also at Meknes.

The resident staff members sent to Morocco by the Soil Science Department, Drs. P. Antoine, J. Vavra, and me, from 1970 to 1978, had the responsibility for the Project's on-site leadership in addition to our teaching and research activities, when it was essential to maintain a low profile and to limit our administrative expenditures and support to a level compatible with IAV's resources.

Soil Science identified and trained the first Ph.D. candidate, Mr. Abdelali Hilali, when the best Institut graduates were still lured away from teaching and research by rewarding administrative and technical positions in other services of the Ministry of Agriculture.

Dr. P. Antoine, back in the Department of Soil Science of the University of Minnesota, became Project Director and negotiated Phase II of the Project when Phase I was judged harshly for not having been able to produce one complete, full-blooded Ph.D.

Soil Science first introduced in Morocco the US and FAO soil classification systems.

Soil Science was first to suggest that substantial savings could be made by decreasing the rate of potassium fertilizer application to cereals in some soils of the Tadla.

Soil Science broadened the soil curriculum by introducing soil physics, soil conservation and watershed management in the general teaching, instead of restricting these topics to students specializing in irrigation or forestry.

Soil Science first demonstrated the feasibility of growing soybean crops in the Tadla irrigated perimeter, and identified the need for soil inoculation by *Rhizobium japonicum*.

There is however something wrong, with listing the achievements in Morocco of the Soil Science Department from the University of Minnesota.

The achievements made were the result of the cooperative efforts of all who worked at the Institute.

Morocco, the land of the international technical experts, with a legacy of unfinished projects, a legacy of achieved goals, and forgotten results. Upon our arrival at IAV, in 1970, the Director, Mr. Abdallah Bekkali, could have given us a room in one corner of the Institute, and some students. He could have asked us to teach and develop the Moroccan agriculture. In short, to do our thing, drink mint tea, and leave him alone. Under these circumstances, we would have achieved, perhaps more than what we did; but we would have failed, because we would not have shared, participated in the life of IAV.

What has been achieved is institutional buildup, which is important. However, sharing technically and humanly in the act of achieving has been the critical element in the Project's success: This is Institutional participation. Of course, this presumes the existence of a lively, healthy host institution. It has been our privilege and to our advantage to have found at the Institut a leadership, personalized then by Messrs. Bekkali and Firdawcy, and now by Messrs. Sedrati and Firdawcy, which has fiercely fought to maintain the integrity of the Institut's identity, even at the expense of consciously slowing down the so-called concrete, quantifiable achievements. This was a necessity which, to our credit, we have recognized and respected with the understanding and support of Drs. C. Ferguson and D. Brown and other leaders in USAID-Rabat.

I would hope that this is appreciated by Moroccan Ph.D. candidates who find it hard to understand why they should acquire a "Doctorat en Agronomie" at Rabat, before a Ph.D. at a U.S. University. For the Institut, their Ph.D. degree represents an end which translates in Institutional buildup; their "Doctorat en Agronomie" however, is a process of institutional participation which has to be performed up to and including the final act.

From 1970 to 1979, many students affiliated with "Le Departement des Sciences du Sol" went to the USA for Third Cycle training. In 1979, for

the first time in the history of the Institute, a department, "Le Department des Sciences du Sol", was judged sufficiently staffed and matured to teach their Third Cycle students without sending them abroad. This was also the year when the Department of Soil Science of the University of Minnesota stopped fielding a resident staff member in Morocco. Instead, faculty advisors, Drs. G. Blake, P. Bloom, and W. Larson visited Morocco to guide Ph.D. candidates. A cooperative research program funded by USDA-USAID was initiated with the participation of Mr. A. Hilali, Dr. E. Schmidt and myself. This 3-year program involved not only Morocco but also Senegal.

In 1985, of the 9 Moroccan faculty members of "Le Department des Sciences du Sol", 5 will have received doctoral training in the USA. Hopefully, 5 will win a "Doctorat en Agronomie" and a Ph.D. degree. All but one, have visited the USA and established professional contacts with the United States (Table 1). For the Department of Soil Science, the stage has been set for the future: To shift from institutional participation to institutional cooperation.

Table 2. Faculty of the "Department des Sciences du Sol" (1985)

| NAME | SPECIALIZATION |
|---|---|
| *BADRAOUI, Mohamed | Soil Mineralogy and Fertility |
| FASSI, Driss | Geomorphology |
| *HILALI, Abdelali | Soil Microbiology |
| *MERZOUK, Abdelaziz | Soil Conservation<br>Soil Physics |
| MOUGHLI, Housine | Soil Chemistry |
| NAIMI, Mustapha | Pedology |
| SOUDI, Brahim | Soil Fertility |
| *STITOU, Mohmed | Pedology |
| *TAYAA, M'Mammed | Watershed Management<br>Hydrology |

* Doctoral participants in the Project.
(All others are Third Cycle participants)

# HORTICULTURAL SCIENCE

David W. Davis

## Historical Aspects

The University of Minnesota involvement in the horticultural program began, essentially, in 1973. In February of that year, Duncan[1], in a report to USAID Morocco, evaluated the characteristics of horticulture in Morocco, and described the technical support base and the educational system as it applied to horticulture. In concert with academic, government and industry leadership, the degree of need for a strengthened support base was established. With particular reference to the Third Cycle (MS) level, it was concluded that there was urgent need for at least 90 to 120 trained personnel by a 1990 target date. By May of 1973 recommendation was made that the Minnesota Project be amended to include two University of Minnesota horticultural faculty and Ph.D. level training for eight Moroccan faculty.

In 1973 there were 10 Third Cycle graduates employed in the system in Morocco. These 10 were graduates of European schools and there was in Morocco no university program for advanced training in horticulture. Only two schools, one at Meknes and one at Marrakech, offered horticultural programs, with the former offering a 4-year undergraduate degree and the latter a 2-year degree. The Meknes program began in 1971 and by 1973 about 15 students a year were entering.

Regarding opportunity for advanced study, the policy was that graduates of Meknes with three years of experience could, upon successful completion of an examination, enter the graduate (i.e. Third Cycle) program at Institute Hassan II, Rabat. However, at that time the Third Cycle program at Rabat was just beginning and there were no horticultural faculty.

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[1]A.A. Duncan. 1983. Some background information and suggestions for development of horticultural science and research at Hassan II Institut et Veterinaire, Rabat. A report prepared for USAID Morocco.

The initiation of participatory training in the horticultural phase of the program at Hassan II Institute began in 1974 with four 6th year Third Cycle students who had spent four undergraduate (Second Cycle) years at the Institute and their 5th year in France. Their research and thesis writing took place in Morocco during their 6th year. These students had received general training in science and agriculture at Institute Hassan II and their horticultural instruction in France. By 1978, however, 17 undergraduates were majoring in horticulture at Rabat.

By the mid-1970's the government of Morocco had decided to establish at Agadir, in the southeastern part of the country, a separate institute or "Complexe Horticole" for horticulture. This facility, designed to address the need for professionally trained people as recommended by the Duncan Report of 1973, opened in September, 1981. Horticultural faculty, including those at Meknes, were moved to Agadir and the horticultural program at Meknes was closed. Currently there are about 170 students in a 4-year program of horticulture and plant protection at Agadir and a small number of Third Cycle students. The faculty consists primarily of Moroccan graduates of the participant training program with the University of Minnesota. All of these faculty currently are in one phase or another of graduate study or have aspirations of such continuation. In addition, there are two Minnesota faculty, Drs. Lasheen (horticulture) and Lockhart (plant pathology), at Agadir. Other expatriate faculty also have during its early years played an important role in the instruction at Agadir, as well as in the earlier program at Meknes, with the largest single group coming from Belgium.

Approximately 40 Moroccan students have now either graduated from the program in horticulture or are still in graduate study (Table 1). Most of the graduates have been employed by the Institute or by the Government of Morocco Agricultural Research (INRA) or Extension (DMV) Service (Table 2a and b). Most of the participatory students have spent at least a part of their stay in the U.S. at the University of Minnesota. For several reasons cooperating universities in the U.S. assisted in horticultural education, i.e., 1) to spread the advising load, 2) to provide instruction in sectors not provided at the University of Minnesota, and 3) to provide a Moroccan

faculty having a more diverse academic background of training and viewpoint. Important assistance has been provided by the University of Florida, University of California (Davis and Riverside), Fresno State University, Chico State University, Oregon State University, and Michigan State University (Table 1).

The Ph.D. phase of the horticultural program began in 1978 when two Moroccan faculty began coursework study at the University of Minnesota. There are now five Ph.D. candidates involved in thesis completion at Agadir. The first doctorate was completed in late May, 1985. Two others may complete the degree requirements in 1985. There is good reason to be pleased with the caliber of students that have entered the graduate program.

Duncan in 1973 had estimated that of the 90 to 120 professionals needed by 1990, 30 to 35 should be in citrus and subtropical fruits, 15 to 20 in deciduous fruits and nuts, 20 to 25 in vegetable crops, 12 to 17 in small fruits and grapes, 8 to 13 in ornamentals, and 5 to 10 in seed technology. Table 1 shows that in a general way this program has been followed. Areas in which there has been surprisingly little emphasis thus far, however, are seed technology, plant breeding, ornamentals and weed control. High quality, inexpensive seed and improved crop varieties through breeding are basic to agricultural improvement. Weed control also continues to be one of the more serious constraints to crop production throughout the world.

Current Concerns

It should be noted also that completion of the Ph.D. program in Morocco has been slower than expected, even though completion of the oral preliminary examination occurred at or near the two-year deadline. There are several probable reasons for this, as follows. While any one of these reasons alone might be overcome, it is highly unlikely that the students can overcome all of them and adhere to our expected schedule.

1. The new faculty at Agadir have, in addition to their thesis research, all of the disruptive tasks and challenges inherent in the start-up of

a new teaching and research institution at a new location in an undeveloped nation, and with only a skeletal senior resident faculty for guidance.

2. The research program has in some cases been slowed due to lack of facilities, delayed arrival of equipment and supplies, and equipment maintenance problems.

3. The time/distance separation from library, data processing and advisor resources, as well as from various other useful resources normally found on the campus of a major university, is an important factor.

4. There is a debilitating real fear as to what the future holds for the Complexe Horticole at Agadir.

5. There is a strong, self-imposed desire to achieve and contribute. The new faculty is well aware that they are setting standards for the others who will follow them in the program. They see a need to develop truly strong theses.

6. A somewhat accelerated completion of coursework and the oral preliminary examination has given little time for a maturing process in their field and for preliminary research.

Hence the new faculty at Agadir is in a high-pressure environment much of which is inherent in the situation and some of which is of their own making. It is highly important that the Ph.D. programs be brought to completion so that other goals can be emphasized. However, the initial Ph.D.s must feel that they have achieved and that they have earned recognition in the eyes of their peers at Agadir. At this moment in their professional career this achievement seems embodied in the American Ph.D. With it they will feel more comfortable about guiding their own graduate students and in awarding their own doctoral degrees in the future. In order to solve unforeseen problems which are certain to arise from time to time in undertakings of the kind we are involved in with Morocco and USAID, flexibility rather than rigidity must be permitted in contract

interpretation. Guidelines are more useful than rules. Timely completion of the theses can more likely be achieved if changes, such as the following, are adopted.

1. Release time needs to be (and is being) provided so that faculty on M.S. and Ph.D. programs can be expected to spend time on their graduate work each week.

2. The concept of the "mini-sabbatical" needs to be put into practice at Agadir. A short leave of a few weeks or months research, writing, or travel for consultation could be arranged.

3. Short term goals need to be defined in research and in writing. Long term goal achievement will follow.

4. A spirit of collegiality must be developed. There must be developed the practice of review and challenge in good faith for the common good. Mutual support is needed. Skillful leadership in developing discussion groups for scrutinizing data and criticizing ideas and interpretation is essential.

5. Research project goals must be realistic and achievable within the framework of available resources.

## The Complexe Horticole and its Future

The wisdom of the creation of a specialty institute such as the Complexe Horticole can be and has been debated at length. Certainly the creation of such institutes after World War II in the United Kingdom resulted in some excellent breakthroughs in applied agricultural research, but there was always some tie-in with the universities via teaching, research and graduate education. Just as importantly, the directed focus of these institutes provided improved liaison with farmers and commodity organizations that recognized, through institute names and the makeup of advisory boards, that these were research arms organized to investigate farm-related problems. In this respect, the Complexe Horticole at Agadir has outstanding potential. The three services -- research, teaching and

extension -- for the most part remain as separate entities in Morocco. A more narrowly based institute such as the Complexe Horticole may tend to draw the three together. At the same time the horticulturists at Agadir will need to have at hand colleagues in other agricultural sciences, particularly in the plant and soil sciences, crop protection, economics and engineering. Research needs to be oriented such that a major portion of the results can be utilized in the short to intermediate term in Morocco, not in some distant time frame, if the Complexe Horticole is to develop the strongest possible liaison with the research and extension services.

If the faculty does not aggressively seek research funding and opportunities relevant to farm and commodity problems their teaching very likely will become oriented toward, as an example, the botanical rather than the agricultural. Orientation toward the agricultural, with its complexity and the need to integrate components is more difficult, and consequently, tempting to avoid, especially if scientific peer recognition is a factor.

There is good opportunity in horticulture for cooperative work with the commercial sector, which at some levels is well developed, consisting of such elements as:

1. The agricultural holdings of the Monarchy
2. Government operated farms (SODEA)
3. The Office of Commercialization and Exportation

All three employ well-trained people from various academic backgrounds. There is a high degree of skill. Standards are high and there is a genuine desire for performance. Solutions to horticultural problems which these organizations confront would provide credibility for the faculty of Agadir. Much of what might be learned also could be put into context for application to small-farm holders either directly or through cooperatives.

The new faculty, as noted earlier, needs to develop a mutually cooperative and mutually supportive approach. From the top down they need

assurances that this is their best hope of achieving the aspirations that they have for their institution. The spirit of competition is high.

Finally, there are of course many other tangible needs of the Complexe Horticole, including library resources, equipment, and equipment maintenance, to name only a few.

In closing, it should be noted that the need for emphasis on horticulture in Morocco is great. The potential return on investment is high. Many have written about the diversity of horticulture in Morocco and about the contribution which this sector makes to the nation. Malo[2], in describing generalized fruit production environments in Morocco, pointed out that the harsh environment, i.e. soil and suitability, salt, high evapotranspiration rates, water shortage, and winds require high farmer skill levels for success. Relatively little, however, has been said about the adaptation of numerous woody horticultural crops, such as almonds olives, and argan, to arid mountainous agriculture. As high energy and high protein crops they play a role as staple food items for rural people or livestock.

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[2]S. E. Malo. 1977. Possibilities for tropical and subtropical horticulture in Morocco. A report to University of Minnesota International Agricultural Programs on Development and Manpower Training.

Table 1. Horticultural Specialization -- Participatory Students from Morocco, 1975-1985.

| | MS or 3rd Cycle | Ph.D. Track | Total | Universities Other Than U. of M. |
|---|---|---|---|---|
| Vegetable Crops | | | | |
| General Production and Physiology | 9 | | 9 | UC (2)* |
| Plant Nutrition | 1 | 1 | 2 | |
| Seed Technology | 1 | | 1 | Ore. St. (1) |
| Stress Physiology | | 1 | 1 | |
| Breeding | 1 | 1 | 2 | |
| Fruit Crops | | | | |
| General Production and Physiology | 6 | | 6 | Fresno St. (1); Chico St. (1) |
| Plant Nutrition | 2 | | 2 | Ore. St. (1) |
| Propagation | | 2 | 2 | UC (1) |
| Citrus Propagation and Physiology | 2 | 1 | 3 | UC (1); UF (1) |
| Plant Physiology | 3 | 1 | 4 | Mich. St. (1) |
| Weed Control | 2 | | 2 | |
| Post-Harvest | 2 | | 2 | Mich. St. (1) |
| Floriculture | 2 | | 2 | Chico St. (1) |
| Turf | 1 | | 1 | |
| Landscape | 1 | | 1 | Chico St. (1) |
| TOTALS | 33 | 7 | 40 | |

* Numbers in parentheses indicate number of students at these institutions.

Table 2a. Source of Employment -- Horticultural Participatory Students from Morocco, 1975-1985.

| MS | | | 3rd Cycle | | | Ph.D. Track | | |
|---|---|---|---|---|---|---|---|---|
| Faculty | INRA | DMV | Faculty | INRA | DMV | Faculty | INRA | DMV |
| 3 | 2 | | 5 | 8 | 5 | 7 | | |

Table 2b. Employment of Graduates -- Horticultural Participatory Students from Morocco, 1975-1985.

| | |
|---|---|
| Faculty | 15 |
| INRA | 10 |
| DMV | 5 |
| Still in School | 6 |
| Unknown | 3 |
| Emigrated | 1 |

# WATERSHED MANAGEMENT

Kenneth N. Brooks

## Introduction

Appropriate management of Morocco's upland watersheds is critically important for the production of food and fiber for the country's expanding population. Most upland watersheds are grazed by livestock. Steep and fragile areas are subjected to cultivation for sometimes meager but sorely needed crop production. The resulting land abuse is costly to downstream agricultural and urban areas that are dependent upon upland watersheds for usable and dependable water supplies. If present trends continue, upland soil erosion will diminish the productivity of watersheds to an almost irreversible state. Further, the resulting sedimentation of downstream reservoirs will reduce irrigation and hydropower capabilities of downstream agricultural areas that are essential to Morocco's development. Credit must be given to those involved with the Minnesota-Morocco Project for making watershed management an integral part of the institution building program.

The Watershed Management program became part of the Project in 1977. It was designed to provide technical assistance to Morocco's Institute of Agronomy and Veterinary Medicine Hassan II (IAV) in developing courses of instruction and research expertise in watershed management. Prior to this phase of the Project, watershed management was only taught to the forestry students at the Ecole Nationale Forestiere d'Ingenieurs de Sale (ENFI). The existing program has provided a linkage between ENFI and IAV which in turn will help students and graduates better understand the interdependency of upland forest management-range management-watershed management and downstream agricultural development.

The watershed program has accomplished much in these few years. The purpose of this paper is to highlight those accomplishments and to consider future needs and opportunities. The material and intellectual accomplishments of Dr. Erwin Berglund must be recognized as the real beginning of the

watershed management program at IAV. The following discussion summarizes much of Dr. Berglund's achievements along with those of the resident instructor of watershed management at IAV, Mr. M. Tayaa.

## CURRICULUM DEVELOPMENT

### Formal Instruction

The development of a graduate-level curriculum in watershed management is dependent upon having: i) a core of specialized courses that deal specifically with watershed management, and ii) a number of strong supporting courses from other disciplines including engineering, soils, plant sciences and renewable natural resources. The early phase of program development at IAV targeted four courses of instruction for watershed management: climatology, soils and water seminar, hydrology, and advanced wildland hydrology. Each targeted course of formal instruction is described below.

1) Title: Climatology
   Duration: 20 lecture hours, 6 laboratory hours
   Beginning Date: December 1977
   Justification: A service effort for the Department of Soils
   Objective: Prepare and present a basic climatology course emphasizing physical parameters and their interrelationships.
   Procedure: Lecture and three laboratory periods are given for each offering.
   Inputs: Erwin R. Berglund, University of Minnesota Project: M'Hammed Tayaa, L'Institut Agronomique et Veterinaire Hassan II (INAV)

2) Title: Seminar on soils and water
   Duration: Ongoing series
   Date: Winter 1977-78
   Objective: To provide an open seminar series to students and faculty stressing current knowledge and problems in soil and water resources management in Morocco.

Justification: Numerous nationally and internationally prominent soil-related scientists and administrators visit INAV. Furthermore, many faculty and student research programs contain results of interest to many. This seminar series provides an informal opportunity to share ideas.

Procedure: Faculty and graduate students are solicited for their inputs in conjunction with administrators and field staff persons from governmental organizations. Presentations and discussions ensue

Inputs: Erwin R. Berglund, University of Minnesota Project
Joseph P. Vavra, University of Minnesota Project
M'Hammed Tayaa, L'insitut Agronomique et Veterinaire Hassan II
Aziz Merzouk, L'Institute Agronomique et Veterinaire Hassan II

3) Title: Hydrology

Duration: 30 lecture hours, 10 laboratory hours

Beginning Date: Fall 1978

Objective: To develop a basic hydrology course for third cycle students

Justification: Hydrology was not offered at IAV. Introduction to terminology and methodology enhances knowledge of land and streamflow processes and thus serves as a prerequisite to Advanced Wildland Watershed Management.

Procedure: The water delivery mechanisms and instream flow characteristics are presented. Basic data tabulation and analysis in the laboratory will be supplemented with visits to nearby installations.

Inputs: Erwin Berglund, University of Minnesota Project
M'Hammed Tayaa, L'Institut Agronomique et Veterinaire Hassan II

4) Title: Advanced Wildland Watershed Management

Duration: 20 lecture hours, 10 laboratory hours

Planned Beginning Date: Winter 1978-79

Objective: To develop a specific advanced wildland watershed management course for third cycle students.

Justification: At present there is no coursework specifically for third cycle students in wildland watershed management. Students will gain expertise in problem identification and solution development.

Procedure: Detailed analyses of water transport soil-plant relationships will be investigated. Fundamental processes will be correlated with various land uses in Morocco. Observational techniques, models and their application must be stressed. Field laboratories will emphasize problem solving methodology.

Inputs: Erwin R. Berglund, University of Minnesota Project
M'Hammed Tayaa, Institut Agronomique et Veterinaire Hassan II

All courses except Advanced Wildland Watershed Management have been offered. A course titled "Watershed Hydrology" has subsequently been taught (24 contact hours) for third cycle students. A course titled "Principles of Soil and Water Conservation" has also been developed and has been taught by A. Merzouk and M. Tayaa. The lack of adequate staffing in watershed management is the reason for not developing the advanced course.

Informal Instruction

Graduate-level instruction requires a substantial commitment by faculty for advising students on curriculum and research project activities. This not only means a dedicated period of time in the office and in laboratories, but in the case of the watershed projects, a considerable amount of time must be spent traveling and working with students in remote field sites.

Because of common teaching and research interests, M. Tayaa and A. Merzouk have worked closely together in advising students and in the above

course. In the combined program of watershed and soil conservation, six students have completed their third cycle; two more are planning to complete their work by July, 1985. These numbers are impressive considering the fact that both staff members have been working on their own doctorate research while advising other students.

## RESEARCH

An active and well-supported research program is essential to an effective graduate program in watershed management. The focus should be on applied research that is targeted to resolving problems of national significance. Such research should provide students with fundamental skills in hydrometeorological instrumentation, experimental design and statistical methods, computer simulation modeling, and a strong orientation towards solving the problems of today and in the future.

Problems of watershed degradation are complex, and are not simply a matter of applying western technology. Intensive land use is the result of resource needs of a rapidly growing population. Before long-term solutions can be implemented, the social and economic aspects of land use on watersheds need to be appropriately dealt with. Therefore, the watershed research to date has examined both the technical hydrology-erosion-sedimentation components as well as some of the socio-economic aspects. The following section briefly describes completed and on-going research.

### Technical Field-Oriented Research

Developing an understanding of the hydrologic treatments requires a: i) knowledge of fundamental processes and quantitative relationships between land use activities and hydrologic outputs, and ii) knowledge of long-term meteorological and hydrological characteristics of each distinctive region. Technical field studies including a long-term watershed monitoring project have been established to achieve the above.

The Tleta basin in northern Morocco, halfway between Tangiers and Tetowan, has been the focal point for IAV's watershed management research program. Located on the north edge of the Rif mountain region, the basin

represents an area that has many of the problems of the Rif region. The region is plagued by spectacular erosion of upland areas and sedimentation of downstream reservoirs, channels and irrigation facilities. Heush (1970) estimated that 60 percent of all sediment leaving Morocco originated in the Rif region, which is only about 6 percent of the land area in the country. Intensive cultivation, grazing and deforestation in fragile mountain watersheds by a dense population has caused these problems.

The 334 hectare Sidi Salah watershed is a "permanent" installation that has, and will continue, to provide a site and foundation for long-term field studies of precipitation, streamflow, erosion and sedimentation. This watershed was selected because it was reasonably accessible and is representative of much of the land use observed in the larger Tleta basin. Dr. Berglund, M. Tayaa, and A. Merzouk were the key individuals responsible for setting up this remote research site.

Several memoirs and refereed publications have resulted from the work completed at Sidi Salah. These include the following:

Ahyoud, Abdelaziz. 1978. Etude de l'infiltration relative dans le bassin versant du Tleta. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire Hassan II, Rabat, Maroc. 168 p.

Barhmi, Kouider. 1980. Etude de l'erodibilite relative et ses relations avec les proprietes physiques et chemiques des sols. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire Hassan II, Rabat, Maroc. 124 p.

Berglund, Erwin R., Abdelaziz Ahyoud, and M'Hammed Tayaa. 1981. Comparison of soil and infiltration properties of range and afforested sites in northern Morocco. Forest Ecology and Management 3:295-306.

El Haiba, Mostapha. 1979. Precipitations et Ruissellement dans le bassin de Sidi Salah - Region Tangerois. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire Hassan II, Rabat, Maroc. 164 p.

Lahlou, Mohamed. 1979. Etude du regime des sediments en suspension dans les eaux de ruissellement au niveau du bassin versant de Sidi Salah - Region Tangerois. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire Hassan II, Rabat, Maroc. 208 p.

Lahlou, Mohamed and Erwin R. Berglund. 1981. Variations temporelles de sediment en suspension dans le sous-bassin versant de Sidi Salah de Tleta - Region Tangerois. Draft copy. 36 p.

Upon returning from Minnesota after completing his Ph.D. preliminary examination, M. Tayaa began his field research for his thesis. Tayaa's project is titled "Modeling storm induced erosion and sedimentation in northern Morocco." Based on field data collected from the Sidi Salah watershed and elsewhere, this model is to provide estimates of erosion and sedimentation from first order watersheds. The model is to be physically-based, to the extent possible, and will be designed to predict erosion/sedimentation rates associated with different land use activities that result in soil disturbance. Such models are sorely needed so that reasonable estimates can be obtained for watersheds that feed the high investment, capital intensive reservoir and irrigation projects in downstream areas. This work has not progressed as fast as originally anticipated largely because M. Tayaa has been heavily involved with advising and teaching responsibilities.

Collaboration with Utah State University has resulted in substantive contributions to the overall watershed management program. Dr. O. Aboulabbes of ENFI recently completed his Ph.D. thesis at Utah State and will be able to make significant contributions in both the research and teaching program in Watershed Management. Publications resulting from this work include:

Aboulabbes, O. 1984. Infiltration characteristics of a small watershed. Ph.D. Dissertation. Utah State University, 168 pp.

Aboulabbes, O., D.J. Kotansky and R.H. Hawkins. 1985. Interrelating infiltration measurements. In: Watershed Management in the eighties. ASCE Symp. Proc., Denver, Colorado. 168 pp.

Socio-economic Oriented Research

Recognizing that technical field solutions to watershed problems of streamflow extremes, erosion and sedimentation are but the first step in reaching long-term solutions, social and economic related work has proceeded coincident with the field studies. Many of the erosion and sedimentation problems in northern Morocco are the result of traditional

land-use practices that can no longer be supported under present-day populations. To correct these problems, projects and programs must be developed that are not only technically correct but are economically feasible and socially acceptable. Only then will we see sustainable, long-term watershed management solutions. With these ideas in mind, the following studies were completed:

Brooks, K.N., H.M. Gregersen, E.R. Berglund, and M. Tayaa. 1982. Evaluation of watershed projects - Methodology and Application. Water Resources Bulletin 18(2):245-250. (Note: Reprinted in the Water Resources Journal, ESCAP, September, 1984, pp, 50-55).

Tayaa, M. and K.N. Brooks. 1984. Erosion and sedimentation in the Rif mountains of northern Morocco. In: Symp. Effects of Forest Land Use on Erosion and Slope Stability. IUFRO and the East-West Center, Honolulu, Hawaii, pp. 23-39.

The former publication has been widely accepted and promoted by many in the World Bank and FAO as representing a practical approach for economic evaluation of watershed projects in developing countries. The latter paper was presented by M. Tayaa and has been published as a symposium proceedings. This paper described the erosion and sedimentation situation in the Rif Mountain region and also: i) examined the societal factors that influence erosion problems, and ii) considered several of the key societal factors that must be dealt with in order to have sustainable erosion control programs. These two projects represent the type of interdisciplinary research that needs to continue along with the technical studies. Such activities cannot continue, however, unless watershed staffing is increased above the present one-man level at IAV.

## CONCLUSIONS

The accomplishments of the watershed management program have been many and the efforts of Dr. E. Berglund, M. Tayaa, A. Merzouk, and O. Aboulabbes are to be commended. The level of activity was at its peak during the latter phase of Dr. Berglund's tour in Rabat. Subsequent to his return to the U.S., the Project has suffered somewhat because of the lack of a natural resource specialist on the resident team in Rabat and because of only one watershed faculty member being present on the staff (M. Tayaa). M. Tayaa has been trying to complete his doctorate research and, at the same time, teaching courses and advising students at IAV. This has prolonged his research. Once he completes his doctorate program and the staffing is increased to at least 2 or 3 faculty members, the true success of this Project should be felt. The long-term success is dependent upon a adequate staff that can and will continue to expand the teaching and research program in watershed management. Opportunities for funding from outside the Project can then be explored and a truly "stand alone" program should emerge.

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Brooks, K.N., H.M. Gregersen, E.R. Berglund and M. Tayaa. 1982. Evaluation of watershed projects - Methodology and Application. Water Resources Bulletin 18(2): 245-250.

El Haiba, Mostapha. 1979. Precipitations et Ruissellement dans le bassin de Sidi Salah - Region Tangerois. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire HASSAN II, Rabat, Maroc. 164 p.

Heusch, B. 1970. L'erosion dans le prerif. Annales Rech. Fores. Maroc. 12:1-176.

Lahlou, Mohamed. 1979. Etude de regime des sediments en suspension dans les eaux de ruissellement au niveau du bassin versant de Sidi Salah - Region Tangerois. Memoire de 3 eme Cycle Agronomie, L'Institut Agronomique et Veterinaire Hassan II, Rabat, Maroc. 208 p.

Lahlou, Mohamed and Erwin R. Berglund. 1981. Variations temporelles de sediment en suspension dans le sous-bassin versant de Sidi Salah de Tleta - Region Tangerois. Draft copy. 36 p.

Tayaa, M. and K.N. Brooks. 1984. Erosion and sedimentation in the Rif mountains of northern Morocco. In: Symp. on Effects of Forest Land Use on Erosion and Slope Stability. Environment and Policy Institute, East-West Center, Honolulu, Hawaii, pp. 23-29.

# RANGE MANAGEMENT

James T. O'Rourke, Omar Berkat (IAV) and Hamid Narjisse (ENA)

## Training Needs

The first range management project in Morocco (Fagouri and Gray 1984) pointed out the need for training trainers at all levels, i.e., Doctoral (Ph.D.), Ingenieur d'Etat (M.S.), Ingenieur d'Application (B.S.), Adjoint Technique (Associate Degree), as well as shortcourse training for administrators of range science programs who are not trained range managers or scientists. Initial attempts to improve range management practices in Morocco met with difficulties in large part due to the shortage of qualified Moroccan range management personnel and the problems that available specialists had in involving pastoralists in decision-making processes on range perimeters. This experience has been repeated over and over again in range livestock development projects in developing countries.

Fortunately for the rangelands and the people of Morocco, the country has realized the importance of building and strengthening its agricultural education, research, and extension systems. Although too late for the initial range management project in the late sixties, this has been the key to the rapid development of a "range science industry" in Morocco.

## In-Country Training

Degree and non-degree programs organized by personnel from developing countries and conducted in a developing world setting is most certainly an important goal. Until such programs exist, however, the personnel who will eventually develop these programs must be trained where there are adequate facilities. Countries which have recognized this have developed their own extension, formal education, and research organizations by ensuring that they have adequately trained personnel to maintain these institutions.

In 1968 when the building and strengthening of agricultural education facilities entered a new era in Morocco, neither the personnel nor the facilities existed to train range scientists in Morocco. It was found to be necessary, therefore, to train personnel outside the country while these facilities were being developed.

Out-of-Country Training

In order to establish sufficient numbers of high caliber persons in key positions, effective training requires a mutual long-term commitment which anticipates high attrition rates. However, whether the movement is to other projects, to private industry, or to administrative governmental positions, rangelands will benefit from these persons.

Until range scientists become linguists, until first class range science professors are attracted to institutions in developing countries, and until foreign training sites and facilities are developed adequately, it appears that the most feasible method of improving our training for foreign students is to adapt our materials and presentations to the needs of foreign students and to use examples both good and bad in the rangelands of the U.S. as our classroom. This approach was taken in Morocco bearing in mind that the goal was to allow Morocco to be self-sufficient in its training of range scientists in the shortest time possible, realizing that in-country training and development is the ideal.

The Moroccan educational system in agriculture in the late sixties had three institutions offering advanced degrees within which to develop range management training. Two four-year schools offered Ingenieur d'Application degrees, one in forestry and one in agronomy or animal science, these being the National School of Forestry (ENFI) and the National School of Agriculture (ENA), respectively. A newly created school was the Institute of Agronomy and Veterinary Medicine, Hassan II (IAV) which was designed to offer a four year degree in general agriculture (Ingenieur d'Application) or veterinary medicine, but with those graduates going straight on into a specialized graduate program which would result in the Ingenieur d'Etat degree (M.S. level) and eventually a Doctorate degree (Ph.D. level). Since four-year degrees were being offered in Morocco, it was not appropriate to send Moroccans out of the country for a B.S. degree in range science, but more desirable to develop the existing institutions such that a four-year degree, and eventually graduate degrees, could be offered in range management in Morocco.

Training in range management in Morocco began with the first AID range project. Six Adjoint Techniques from the Service d'Elevage were given five months range management training in the U.S. between March and August 1968. One Ingenieur d'Application attended the two month U.S.D.A. shortcourse in range management in the U.S. in 1974. Only one Ingenieur d'Application was sent to the U.S. for an M.S. in range science, which was completed in 1972. Upon their return to Morocco, these people were assigned to the Project as counterparts to IVS (International Voluntary Services) Volunteers, or as Project Manager in the case of the M.S. participant. Due to the fact that the Project terminated in 1972, these latter two trainees had very little overlap with their U.S. counterparts. Partly due to the small cadre of range managers and therefore their slight political influence, range management activity was not a high priority of the government and by 1975 only one of these people remained active in range management.

The FAO program at the Ecole Nationale Forestiere d'Ingenieurs (ENFI) from 1968-73 resulted in only one person being trained in range management to an M.S. level in the U.S. in 1977. The FAO Project des Parcours did not include any formal training.

USAID has provided support to IAV, ENA and ENFI by means of a contract with the University of Minnesota. Under this program, participants do course work, attend professional meetings and are exposed to research and management activities in the U.S., but do research in Morocco, defend their graduate thesis in Morocco and receive a Moroccan degree, either Ingenieur d'Etat (M.S. level) or Doctorat (Ph.D. level). The objective is to develop a faculty at these schools to enable Morocco to be self-sufficient in training in Morocco. In 1973 the first participants under this program were sent to the U.S. to study range science. Since 1973 this Project has trained 18 Moroccans to an M.S. level (4 presently in training) and 6 to a Doctorate level (5 presently in training) in range management.

The USAID Dryland Farming Project, with the University of Nebraska and the national Institute for Agricultural Research (INRA), has a training program similar to the University of Minnesota Project. This Project presently has one Moroccan in training in range science at the Doctorate level.

The USAID Small Ruminant CRSP and two World Bank Projects have been involved in range management activities but have not been involved in out-of-country training of Moroccans.

On-the-Job Training

One school of thought concerning where and how training might be accomplished is on-the-job training (OJT) in the trainee's own country where the trainee is attached as a counterpart to a foreign "expert." Supporters of this method have grown out of dissatisfaction with U.S. classroom training in range science for foreign students because of the realization that presently the U.S. professor of range science has little opportunity to teach in another language, to understand another culture or to attempt to modify western technology to another setting. Proponents of this method of training, however, must recognize that a sound background in the basic sciences is necessary for a person to appreciate the principles of range science, and that a thorough understanding of range science principles is essential before a person should attempt to manage arid or semi-arid ecosystems.

The reliance upon on-the-job training for counterparts has proven to be inadequate, as shown in the Moroccan example and repetitive elsewhere. The average foreign "expert," on the production-oriented projects which dominate foreign assistance, has seldom had teaching experience. The amount of time spent on training in basic principles is nearly nonexistent. Most of the effort is aimed at achieving a certain goal -- a fence built or a stock pond dug. Why and how these jobs are done is seldom explained in detail and, if at all, only to accomplish the immediate task. The underlying principles of plant physiology or animal nutrition, or other options open to accomplish the objective, are seldom thoroughly explained. OJT is normally limited to one trainer per trainee, as opposed to an entire

faculty from whom one could receive these explanations in a formal training setting. A one-to-one training experience is very demanding, requiring long hours and patience. Both trainer and the trainee are prone to take advantage of distractions. These distractions too often result in the trainer and trainee spending little time together, the trainee being expected to have gained more than was possible.

On-the-job training is also extremely expensive. Current costs of $100,000 to maintain this "expert" in a developing country for one year while he "trains" one or two counterparts is a questionable economic strategy when six to eight people could be trained in a formal education mode at the same cost.

No formal training was provided by the FAO Project des Parcours, the USAID Small Ruminants CRSP, or the two World Bank projects. As a result, these projects have relied on personnel trained under other projects to achieve their objectives. Of these four projects only FAO and USAID included any significant numbers of on-the-job training of personnel. All other projects have involved on-the-job training in addition to formal degree and non-degree training outside Morocco. It is important to realize, however, that of the 31 people receiving OJT, 16 of these had already received formal training at an M.S. or Ph.D. level in range science and likely would have benefited more from shorter consultancy visits, as opposed to the expensive full-time "expert." Only 15 Moroccans, then, were reached with some amount of range management training for the first time in their careers through OJT. The cost of this first and extremely inadequate exposure to range management is estimated very conservatively at approximately $1.7 million, or approximately $113,000 per trainee. Formal training for two years outside Morocco to an M.S. or Ph.D. level has cost from $36,000 to a maximum of $50,000 per trainee. Non-degree training in specialized programs outside Morocco has ranged from $8,000 to $25,000 per trainee.

## The Base Provided for In-Country Training, Research, Extension, and Production

Under the various projects mentioned there will be 27 people trained to an M.S. level, in addition to 7 to a Ph.D. level, by 1985 in most aspects of range sciences: range ecology, range nutrition, range hydrology, range sociology, range extension, forest-range management, and range seed production. These people have received training at 16 U.S. universities, in France, and in Morocco. In addition there are 21 Moroccans, either field technicians or ministerial level administrators, who have completed short-term training in range management. An additional 15 people have received on-the-job training in range management. This cadre of 70 professionals is the base upon which Moroccans can conduct their own programs of education, research, extension, and production, programs which must develop together and support one another.

## Education

The reorganization of agricultural education allowed: 1) a significant increase in the number of graduates (700 college graduates and 2798 technicians) for the 1973-77 period according to Bekkali (1976 and Guermoudi(1979); 2) most of the training to take place in Morocco, i.e., within the ecological and socio-economic conditions of the country; and 3) a build up of research and development activities and experience gained by student and teaching staff.

A range management course was first taught after the establishment of ENFI in 1968 as a joint Morocco/FAO project. This trend was continued with the creation of a course both at IAV and ENA in 1973, and strengthened in 1975 when IAV started granting the "Diplome d'Ingenieur d'Etat" (M.S. equivalent) with a specialty in range science.

The entire college level training in agriculture starts with a common preparatory year at IAV. After this year, training continues at IAV, ENA or ENFI for three to five, three, or three more years, respectively.

Training at IAV concerns all aspects of agriculture (agronomy and related sciences, veterinary medicine, topography, horticulture, landscape

architecture, food science and technology, and agricultural machinery). Range management training is offered within the "Agronomy Section," the equivalent of an Agricultural College, which receives 100 students annually from the preparatory year. During the 2nd, 3rd, and 4th year, these students receive a broad background in basic sciences, agriculture, social sciences, and a good exposure to field work.

A range management course is offered during the 4th year (20 hours in class plus a 4-day field trip). A brief course outline follows:

1) Definitions of range ecosystems, range science, rangeland management,
2) Rangeland types in Morocco,
3) Structure and functions of a range ecosystem,
4) Responses of plants to defoliation,
5) Responses of vegetation to use by animals,
6) The animal as a part of the range ecosystem,
7) Systems of range use,
8) Vegetation measurement techniques,
9) Range improvement techniques,
10) Important range plants in Morocco, and
11) Range development projects in Morocco.

This course has exposed some 700 graduates to range management which is helping create a national awareness of rangeland resources management.

The students who elect to specialize in range science after the 4th year are sent for one academic year to a U.S. university within the IAV/University of Minnesota/USAID training Project. The thesis research is conducted in Morocco and presented at IAV.

Each year about 100 students are received by ENA from the IAV preparatory year. There, they receive more basic science, agricultural, and social science coursework, as well as field work training, during the 2nd and 3rd year before specializing in one of two options: 1) animal husbandry or 2) agricultural techniques and development. A range

management course is offered within the first option. A brief course outline is as follows:

1) Introduction to ecological analysis of vegetation and its environment,
2) Data collection and treatment,
3) Structure and functioning of present range livestock production systems,
4) Livestock and vegetation types,
5) Range-livestock interrelationships,
6) Relationships of livestock operators to rangelands,
7) Range use by animals, and
8) Possible evolution of present systems of livestock production on rangelands.

During the 4th (final) year, a number of students elect to conduct their research on range related topics. With this system, ENA has been able to offer a course to nearly 500 students and have about 30 students conduct research on range related subjects.

Approximately 20 students to be trained in forestry are received annually by ENFI from the IAV preparatory year. There they receive, in addition to forest science, three courses in range management. Brief outlines follow:

I. Range plants course (3rd year, 40 hours), 1) Range ecosystems and range forage production; 2) Ecology of range plants; 3) Toxic plants; 4) Range grasses; 5) Range legumes and other families; and 6) Range improvements.

II. Range management course (4th year, 75 hours + 10 day field trip) 1) Importance of livestock industry in North Africa and the forest areas; 2) Range ecosystems in Morocco; 3) Responses of plants to defoliation; 4) Responses of vegetation to defoliation; 5) Range-animal interrelationships; 6) Vegetation measurement techniques; and 7) Grazing systems.

III. Range sociology course (4th year, 20 hours) 1) Geographical and social organization of range use; 2) Forest and range use analysis; 3) Decision-making in forest and rangeland management; and 4) Studies in pastoral life.

During the 4th year, students work in groups on a range development project in forested land. With this system, ENFI has been able to offer courses to about 100 graduates.

Other range management training takes place as 1) thesis research presented at Universities in Morocco or France and conducted on range related problems by people with a forestry, plant ecology, animal science, and social science background; and 2) training of graduates and technicians within development projects.

Progress has been made during the last ten years. However, more needs to be done in terms of number of range specialists trained and in terms of improving programs that best fit country needs and keep pace with technological innovations.

The entire specialization in range science at IAV will soon take place entirely within Morocco. This should allow more students to be trained both at the M.S. and the doctoral level.

An option in range management is under consideration at ENA. This will allow students to attend six range science courses and thus have a stronger background in range management.

The establishment of the Missour Center for Arid Land Research and Development is in the planning stages. The objectives for the center are: 1) involve a multidisciplinary team in research and education efforts, and 2) train 60 range technicians to an Associate Degree level each year. The institutions involved would be IAV, ENA, ENFI, Mohamed V University, Eaux et Forets, Direction de l'Elevage, and UNESCO through the MAB program.

## Research

The establishment of range management research in Morocco is quite recent. Before 1968 rangelands attracted primarily foresters and European plant ecologists. Most of these scientists were active researchers in Moroccan institutions such as the Phytoecological Station of INRA, the Cherifien Institute of Science (ISC) and the Forest Experiment Station of the Direction des Eaux et Forets. During this period, attention was focused exclusively on the plant component of rangelands, while grazing activity was not investigated. Research performed within this period consisted primarily of vegetation inventory, mapping, and the examination of plant community/environment interactions. This work led to the establishment of a large scale vegetation map of Morocco complemented by smaller scale maps for some Moroccan regions. Investigations on relationships between environmental variables, such as climate and soil, and plant communities were also published.

Despite the magnitude of the rangeland problems and the tremendous opportunities for research needed to solve these problems, research and funding are still in their early stages. At present, research results related to management of range resources come mostly from investigators in educational institutions, as shown in Table 1, mainly IAV, ENA, and ENFI. A few other scientists concerned with research on plant physiology, ecology and taxonomy hold positions in various colleges of science located in Marrakech, Rabat, Fes, and Oujda, in ISC, and in INRA. Most of these scientists are nationals educated in Morocco, Europe, and the United States in animal production, plant synecology, ecophysiology, taxonomy, and range management.

Research accomplished so far in the field of range management was implemented primarily at four experiment stations. These stations are located in the semi-arid climate in the Middle Atlas region (Sidi Aissa and Timahdite Stations), in the arid high plateau (Ain Beni Mathar Station), and in the desert region east of the High Atlas Mountains (Talsinnt Station).

Some research undertaken is associated with projects of final year students completing their B.S. and M.S. equivalent degrees. Others, implemented primarily by faculty members, are in partial fulfillment of the requirements for a newly established Moroccan Doctorate degree. The topics covered by this student research include vegetation inventory, determination of productivity and carrying capacity of different range sites, studies on feeding behavior of sheep and goats, and on the feasibility of different management practices.

Data on seasonal and yearly variations of productivity and nutritive value of Artemisia herba-alba, Stipa tenacissima and various grassland sites of the Middle Atlas Mountains have been collected over the last six years at the Timahdite, Sidi Aissa, Talsinnt, and Ain Beni Mathar Stations. Diet composition and diet quality of sheep and goats as affected by season of use and stocking rate have been examined at the Timahdite, Sidi Aissa, and Ain Beni Mathar Stations. Vegetation response to different grazing intensities was also investigated at Timahdite and Ain Beni Mathar Stations. The performance of introduced forage species and the effects of fertilizer applications were tested at the Timahdite and Sidi Aissa Stations as well as at other sites throughout the country. Basic synecological and ecophysiological studies, including a study of the physiognomy, structure, and distribution of the flora in the southern slopes of the High Atlas Mountains and an investigation on Artemisia herbaalba population dynamics as affected by environment and management, are also being implemented.

Studies concerning revegetation of forested grazing lands, the effect of thinning of oak-woodland tree cover on production of wood and forage products, the response of native vegetation to grazing treatments, and the effect of various land use treatments on watershed values have been conducted on forested lands.

Forage selection work is continuing for both pasture and rangeland situations.

Sociological studies, both of an applied and basic nature, have accompanied rangeland development efforts in Morocco.

Despite the critical importance of rangeland to the people and the economy of the country, range management research is still a long way from reaching its goals. Constraints facing research development are managerial and financial.

All experiment stations mentioned above are fully administered by the Livestock Service or by INRA, while the majority of the scientists involved in range research are at IAV, ENA, and ENFI (Table 1). Under these conditions, those who perform the research have no authority to make field decisions and no control over the budget. Consequently, the difficulties encountered by researchers are sometimes insurmountable and the chances for coordination and planning are very limited. A further obstacle to mounting a solid research program is the lack of adequate financial support which would provide basic facilities at the experiment stations as well as onsite technicians to carry on routine measurements and observations at these stations.

A major breakthrough would come by transferring the administration of the experiment stations to those institutions having the personnel and facilities to perform research, namely educational and research organizations such as IAV, ENA, and ENFI. Once such reform is achieved, a technical advisory committee needs to be established for each station. The responsibilities of these committees would be to allocate funding and to coordinate and select research projects to be implemented. These committees would be made up of scientists from different institutions and representatives of the extension organizations (Direction of Extension, Direction of Livestock Production, and Direction of Water and Forest and Soil Conservation). This would assure a system of communication between the academic community and extension personnel. Another necessary measure would be the appointment of a foreman at each experimental station. The foreman should live on the station and be responsible for routine activities and coordination of the station's resource allocation (animals, labor, machinery, etc.).

To broaden the knowledge and the experience of the individual scientists involved in range research, it is recommended that formal contacts between Moroccan professionals and foreign students be promoted which will lead to collaborative research work beneficial to range science worldwide.

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Table 1. Number and speciality of research staff of Moroccan governmental organizations with training related to the field of range science.

| Organization | Number of Individuals | Research Specialty |
|---|---|---|
| Institute of Agronomy and Veterinary Medicine, Hassan II (IAV) | 2 | Range Ecophysiology |
| | 1 | Range Synecology |
| | 1 | Range Nutrition |
| | 1 | Range Wildlife |
| | 1 | Poisonous Plants |
| | 2 | Botany |
| | 2 | Forages |
| National School of Agriculture (ENA) | 1 | Range Ecophysiology |
| | 1 | Range Nutrition |
| | 1 | Botany |
| | 1 | Forages |
| National School of Forestry (ENFI) | 1 | Range Science |
| | 1 | Range Watershed |
| | 1 | Botany |
| National Institute of Agricultural Research (INRA) | 3 | Forages |

# IRRIGATION ENGINEERING

Jack Keller

The Departement de l'Equipment et de l'Hydraulique (DEH) at the Institut Agronomique et Veterinaire Hassan II groups the Agricultural and Civil engineering disciplines related to:

- Water resources and management: hydraulics, hydrology, irrigation, drainage, land reclamation, ground and surface water management;
- Civil engineering and rural structures: reinforced concrete design, soil mechanics, farm and storage buildings, steel design, small earth dams; and
- Farmstead: water supply, rural roads, sewage systems

The Department is organized in three cells:

- Hydraulics and Irrigation Engineering;
- Civil Engineering; and
- Farmstead

The Department is in charge of the U.S. equivalent of Agricultural Engineering B.S. curriculum (Section des Travaux Ruraux, with 120 students), the M.S. and Hydrology curriculum, and provides courses to other sections in the Institute. As of now, this represents about 1,340 hours of teaching activities.

## The Professional Staff

On the staff there are 11 Moroccans and two French cooperants. Most of the Moroccans on the staff are involved in the University of Minnesota Partnership Project, as shown in Table 1.

## Evolution of the Program

Since 1983 the DEH has implemented its Agricultural Engineering M.S. program in collaboration with the Civil Engineering Department of Ecole Mohammedia Des Ingenieurs (EMI). Six students are involved in this program.

Before 1982 most of the Third Cycle students in Agricultural Engineering and Hydrology graduated from France or Belgium. Because of the increasing interest in specialized training in irrigation, in 1983 four students (see Table 2) were sent to the Agricultural and Irrigation Engineering (AIE) Department at Utah State University and the Agricultural and Civil Engineering Departments at the University of Minnesota. These students are involved either in a non-degree program (to complete the course work in the U.S.A. and undertake the M.S. research in Morocco) or a regular M.S. program.

The experience acquired by the staff participants after their stay in the U.S. and the research environment created by their doctorate research led them to introduce more research activities in the curriculum of the M.S. program. Now the DEH is planning to implement a complete Moroccan M.S. program in Agricultural Engineering and Hydrology in the next academic year.

Lessons Learned

The Partnership Program has been successful in developing reasonable capacity at the Institute to provide B.S. and M.S. training in Irrigation Engineering. This is evident from the current level of activities and the emerging qualifications of the DEH's professional staff. Once the staff complete their own degree programs, they will perhaps be the best qualified training center for academic Irrigation Engineering training in Africa. (Two or three staff members will be completing the Ph.D. programs within the next six months). However, this level of development is not surprising, given the excellent support (both financial and technical) which has been made available through the Partnership Program.

What has been an unexpected bonus (at least from my viewpoint) has been the emerging collaborative relationship which is developing between the DEH at the Institut and the AIE Department at Utah State University. Before commenting on this further, however, I would like to mention that all four of the DEH staff who have received training with us have been excellent. They all rank among our top Ph.D. candidates and have come with excellent backgrounds and qualifications for their graduate studies.

Having four excellent Ph.D. candidates more or less simultaneously studying in our Department, plus the liberal research visitation programs for their Committee Chairmen, has stimulated this collaboration. I believe our faculty's visits to Morocco have been important in terms of research guidance and developing an understanding of Moroccan irrigation training and research needs. But perhaps the personal friendship and understanding that is fostered by these visits is even more important for, after all, the chemistry of successful collaboration requires good human relationships as well as technical rapport. I do not know whether having a critical mass of students study at Utah State was done by design in an effort to generate this emerging collaboration, or whether it "happened by accident."

In addition to the above mentioned collaboration between our two Departments, I believe the backgrounds and understandings that these four students have in common provide another positive side effect. They give the DEH a sense of community in the area of Irrigation Engineering which, for a developing Department, is an essential element for success.

Community versus Diversity

It can be argued that each Partnership student should attend a different university in the U.S.A. in order to maximize diversity. This argument might have been made against having or allowing so many students to attend Utah State. However, our experience suggests the following:

- If each student obtains an entirely different background, then how does a new developing department bring itself together to find a common direction and consensus? Who provides the leadership, and where is the role model?

- If a group of students all receive training at the same outstanding department, would they necessarily be narrowly focused? I believe an excellent department like ours represents a sufficiently broad set of viewpoints and skills.

- As a beginning point, for a newly forming group a role model and spirit of common interest is essential. Otherwise, how can a group of individuals with diverse backgrounds develop appropriate goals and a sense of community and direction for achieving them, even with strong leadership?

The Emerging Collaborative Relationships

Besides the desire and will to collaborate, such relationships require energy and financial resources to continue. The Partnership Program has stimulated the desire and will, and through the liberal visitation program, has also provided significant financial support. But beyond the Program's limits, what are the future possibilities? In answer to this question, there are two emerging possibilities. Both of these are dependent on our mutual understanding and confidence in each other as well as personal friendships.

Research Activities

During my most recent visit to the Institute in late March, we discussed two potential research activities. Both activities will be carried out in Morocco and involve rather extensive field work there. One activity involves investigation of center pivot irrigation in an effort to analyze its potential for expanded use in the country. The other topic involves computerized assisted system management of the country's large irrigation systems.

There is widespread interest in center pivot irrigation in Morocco. A number of center pivots have been installed on the King's various farms and have been successfully operating for the last two or three years. They have had very little problem with mechanical failures, while production has been high and water consumption quite low. In fact, it appears that approximately three times as much small grain per unit of water is being produced under the center pivots as compared with traditional surface irrigation systems. The collaborative research we envision is to fully investigate the performance of the current center pivot systems and set up a demonstration wherein a center pivot serves a number of small farmers.

What we have in mind is to not disturb the current farm boundaries, but rather than supplying water to each farm, supply artificial rain or irrigation.

The center pivot study will not only involve the physical and mechanical features of the system, but the social and economic aspects as well. To carry out this research, we are hopeful of obtaining some assistance from USAID for technical support through the Water Management Synthesis Project and some assistance from within the country to cover the cost of the water supply and hardware required.

The DEH already has an evaluation study under way on the 60 hectare center pivot adjacent to the King's farm at Tedla. This particular center pivot is operated by the King's farm managers, but serves several indigenous farmers. While this is not the model we have in mind, it is a step in the right direction.

The other research activity which we envision involves computer assisted management of large canal and pipe irrigation systems. This activity will involve an extension of the Water Management Synthesis II Project's Special Study research in this area which has been under way at Utah State University for the past three years. What we envision is collaborating with the DEH and setting up a demonstration program in Morocco. Two of the Partnership students have already been involved with the analytical framework for the computer assisted management program. We anticipate that this activity will be carried out using technical support assistance from USAID's Water Management Synthesis Project. We are hopeful of having these studies under way this summer.

Training Activities

We are now in the process of collaborating and setting up a satellite extension of our International Irrigation Center (IIC). Our IIC now offers nine short courses (two to seven weeks in duration) involving various aspects of irrigation system design, management and operation. The courses have been developed to address the needs of in service training for professionals involved in irrigation development and operation and are

presented in both English and Spanish on the Utah State University campus and numerous field locations in the Western U.S.A. and Mexico.

In view of the current high level of interest in irrigation development throughout Africa, we have had a considerable number of requests for presenting the various short courses in French. However, we have been unable to honor these requests because we have so few French speaking experts on campus. After pondering this dilemma, it occurred to us that through our close ties with the DEH and high esteem for the professional competence for the staff at the Institut, that it would be interesting to consider setting up a collaborative arrangement and developing a satellite IIC there.

During my recent visit to the Institut we discussed the needs for irrigation management training in the French language, the advantages of having an institute of this sort on the West Coast of Africa, the mutual understanding between our two departments, and the confidence we have in each other. We concluded that a satellite IIC would be an interesting undertaking for both of us, and set up a schedule for putting such a program in place. The basic time frame for this undertaking will be to begin this summer and have a satellite IIC at the Institut in full operation in approximately two years. We will provide some financing of this operation, but we are hopeful of obtaining some assistance from USAID to cover travel, management and per diem costs associated with the necessary movement of technical staff between the two locations.

Our schedule for initiating this effort is as follows. During 1985 four Moroccan trainers would participate with USU trainers in conducting the course "On-Farm Water Management" at Logan, Utah, from July 28-August 31, 1985. These trainers would remain in Logan for two to three weeks afterwards reviewing the course and planning the modifications to the course materials. The USU International Irrigation Center staff will take the primary responsibility for translating and publishing the course materials in French, with the Moroccan trainers serving as editors. The only funds or cost reimbursements being requested for 1985 are those associated with having the four Moroccan trainers (Agronomist, Agricultural

Engineer, Agricultural Economist and Rural Sociologist) in the U.S.A. for two months.

During 1986 the "On-Farm Water Management" course will be conducted over a six-week period at the International Irrigation Center/Morocco using the French language. Participants will be from Morocco and the African francophone countries. To assist in this effort for purposes of backstopping and further adapting the course materials to African conditions, two USU staff members (a Physical Scientist and a Social Scientist) will work with the four Moroccan trainers.

Any further modifications for the French course materials will be completed by the USU International Irrigation Center, but again in a collaborative mode with IIC/Morocco.

The OCID Congress will be held in Rabat during 1987. The "On-Farm Water Management" course would be given in both French and English preceding this Congress. Afterwards, the participants can attend the OCID meetings.

Conclusions

Our experience with the Participantion Program has been excellent. We feel fortunate in having had so many of the DEW's staff study with us. It appears that the DEH has a strong direction and sense of purpose and will emerge as one of the outstanding Agricultural and Irrigation Engineering Departments in the developing world.

Through our extensive relationships together I am certain that our collaborative activities will continue well beyond the life of the Partnership program. I feel confident that the International Irrigation Center/Morocco will be a success and that this alone will assure a continuing tie between our two departments. We will continue taking the leadership role in developing new video, audio and written training materials, the DEH will be charged with translating them into French and adapting them for African use.

Providing sufficient funding can be found and maintained, I am also confident that we will have continuing collaborative research activities. Our mutual confidence and understanding should assure good rapport between our Departments. This, coupled with the rather extensive needs for adaptive irrigation and water management research in Morocco, should assure an interesting and continuing collaborative relationship.

TABLE 1

PROFESSIONAL STAFF IN THE DEPARTEMENT DE L'EQUIPEMENT ET DE L'HYDRAULIQUE

| Name | Area of Interest | U.S.A. University | Dates Departure | Dates Return |
|---|---|---|---|---|
| ABABOU Rachid | Hydrology and water resources | M.I.T | 9/1983 | 9/1985 |
| ABDELLAOUI, Rachid | Irrigation-Management | Utah State | 9/1982 | 1/1982 |
| AIT KADI, Mohamed | Optimization-irrigation and systems analysis | Utah State | | |
| BARTALI, Houssine | Storage structures | Michigan State | 1/1982 | 1/1984 |
| BAZZA, Mohamed | Soil Physics-spatial variability | California Davis | 9/1982 | 9/1984 |
| DEBBARH Abdelhafif | Soil Mechanics and groundwater flow | Minnesota | 7/1980 | 12/1982 |
| EDDEBAGH, Abdelaziz | Drainage | Colorado State | 1/1985 | 1/198 |
| ESSAFI, Boubker | Surface irrigation | Utah State | 9/1985 | 9/1987 |
| OULHAJ, Ahmed | Hydraulics | Utah State | 7/1983 | 7/1985 |
| GUENNOUNI, Abdellah* | Agricultural structures | -- | -- | -- |
| BELAABES, Kamal* | Hydraulics | -- | -- | -- |

*Hired recently

TABLE 2

THIRD LEVEL STUDENTS IN THE U.S.A.

| Name | M.S. Thesis | University | Advisor |
|---|---|---|---|
| TARIB | Evaluation of center pivot | U of M | AIT KADI |
| LAHRAOUI | Irrigation scheduling | U of M | ABDELLAOUI |
| TOUIL | Drainage | U S U | WILLARDSON |
| LAHRAFI | Soil Mechanics | U of M | DEBBARH LARSON |

# FOOD SCIENCE AND NUTRITION

Frank F. Busta

The program in Morocco that relates to food science, food technology, food engineering and human nutrition was initiated in 1979. Consequently, it has a relatively short but successful and productive six year period on which to draw conclusions and make predictions. Although not exclusively, the program has been concentrated in the Section de Technologie et Economie Alimentaires et Nutrition Humaine (STEANH) (Food Technology and Economics and Human Nutrition Section) of the Institut Agronomique et Veterinaire - Hassan II (IAV). Actual specializations of graduate research have included Nutrition, Nutrition Planning, Food Science, Food Technology, Food Microbiology, Food Engineering, and Food Processing. Commodity specializations or emphases have included grain science, vegetable oils, red meats, fruit, vegetables, and marine products. Nutritional status and assessment also have been addressed.

The distribution of participant representation reflects the diversity and needs of this program (Figure 1). Eleven third-cycle students have participated to date. Ten have completed their study in the U.S. Six was the greatest number present in the U.S. at any period of time and there has been at least one third-cycle student studying in the U.S. since 1979. Two have recently returned to the U.S. to pursue Ph.D. programs at Cornell University and the University of Wisconsin. All but one of the eleven were studying nutrition.

Nine individuals have pursued the M.S. degree in the U.S. Two have studied nutrition and the remainder have concentrated on some phase of food science including food chemistry, food engineering, food microbiology, and food processing and technology. Since 1979, there have been from two to four students working on their M.S. degree at any given time in the U.S. Five completed their M.S. degree and returned to Morocco. Of these, three have returned to the U.S. to pursue Ph.D. programs; two at the University of Minnesota and one at the University of Illinois.

A total of ten faculty have embarked on Ph.D. programs in the U.S. since 1979. One participant entered the Ph.D. track each year until the end of 1984 or start of 1985 when the five U.S.-based M.S. or third-cycle faculty returned to the U.S. for Ph.D. activities. The first and one of the last in the doctorate program are concentrating on human nutrition at Minnesota and Illinois, respectively. Another is studying nutrition policy at Wisconsin. Most of the remainder have started their Ph.D. activities at Minnesota in food microbiology, food chemistry, and food engineering. One participant is in a Ph.D. track at Kansas State University majoring in Grain Science.

Four of the participants in the doctorate program have returned to IAV in Rabat to conduct their thesis research while functioning as full-time faculty. To date, none have completed their research and defended their thesis. All four are actively pursuing their research and are writing manuscripts for publication with various degrees of intensity.

The selection of faculty for participation in the program has been judicious and representative. This Food Technology and Economics and Human Nutrition Section (STEANH) has five departments: Engineering Technology; Food Chemistry and Biochemistry; Food Microbiology and Biotechnology; Human Nutrition and Policy; and Food Technology. Several of the experienced faculty hold doctorates from France. The participants in the U.S. program have been drawn from all five departments. Two of the participants that have returned to Morocco to work on their doctorate thesis research now head the Department of Human Nutrition and Policy and the Department of Food Microbiology and Biotechnology. These administrative duties have placed additional burdens on these two participants who are in the process of conducting research.

The first doctorate participant (Essatara) emphasized nutrition and has been back in Rabat for just over three years. He completed the course work and other necessary requirements at Minnesota. He has written and submitted manuscripts for publication on his research and has participated in international meetings. The level of involvement of his U.S. advisor is

difficult to measure but has been complicated by unanticipated relocation etc. The conclusion of the thesis and defense should be imminent.

The second doctorate participant (Ababouch) emphasized food microbiology and has been back at IAV for just over two years. He, of course, also successfully finished his extensive course work, written examination, oral examination, and initial research at Minnesota before his return. He has set up a new laboratory with isolation controls for hazardous research and has produced a reasonably significant amount of research to date. He has prepared four manuscripts for submission to refereed journals. Two are under review and two are in their final stage of preparation. He has participated in an international meeting and has directed third-cycle students and laboratory assistants effectively and has weathered the numerous frustrations of laboratory research at IAV, a long distance from special supplies and advisor and sometimes without key infrastructure (e.g. electricity). He is diligently and enthusiastically pursuing good science. He has written proposals for funds to support his research. Nevertheless, he has a considerable way to go and will probably take in excess of three years to complete his research if he does not encounter unanticipated setbacks.

The third doctorate participant (Rahmani) emphasized food chemistry and returned to IAV at the beginning of 1984 after successfully completing requirements at Minnesota. He has set up his analytical instruments in his laboratory and has initiated his research on Moroccan fats and oils. His research program appears to be progressing satisfactorily.

The fourth doctorate participant (Achkari) emphasized food engineering and has been back in Morocco only a few months. It is anticipated that he will be initiating a successful research activity.

It should be emphasized that this broad spectrum of disciplines represented by the faculty participants in STEANH reflects programs and needs that are critical to Morocco's future. Each of these participants is conducting research and answering questions on Moroccan subjects and materials. Essatara is surveying nutritional status of key Moroccan

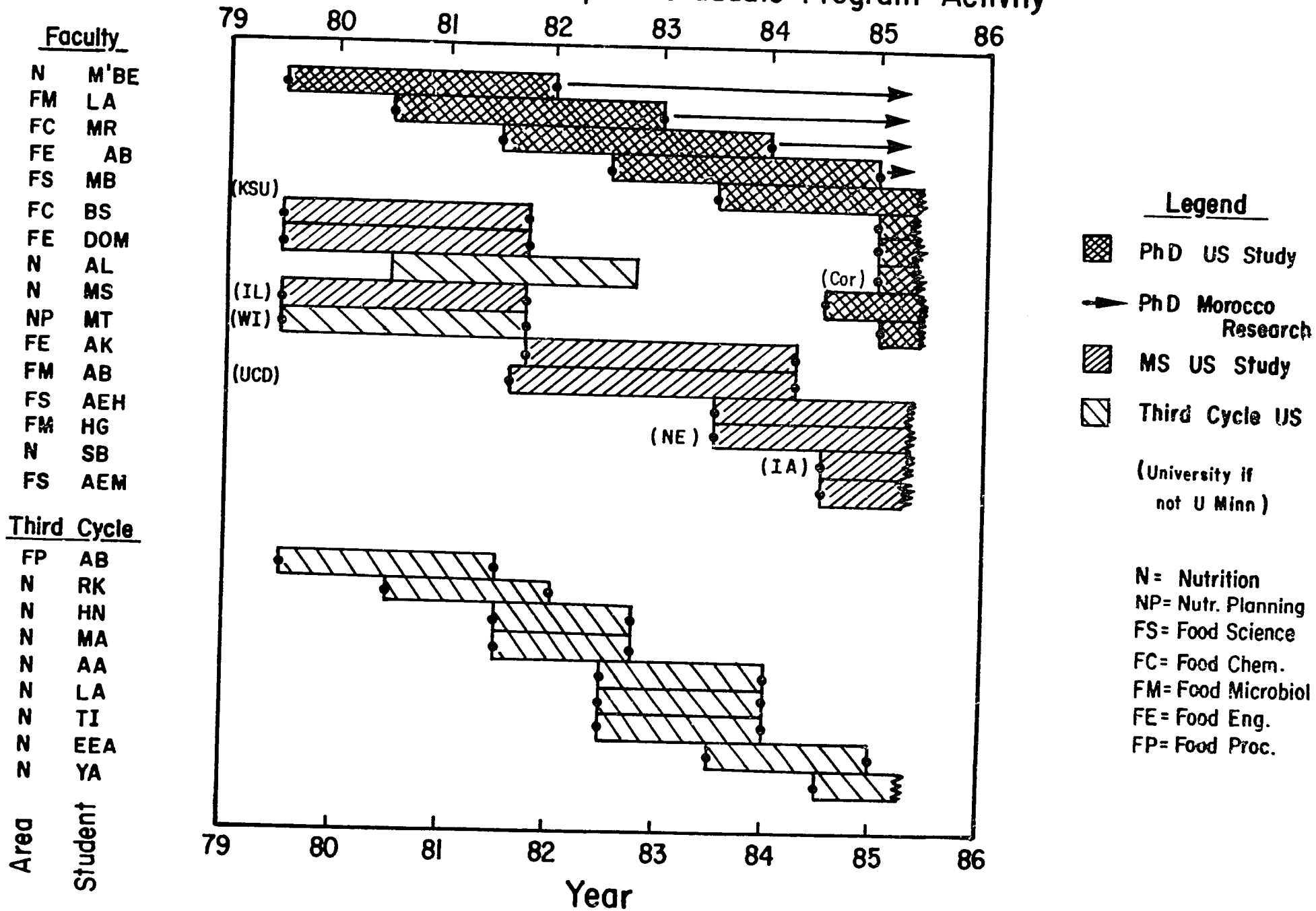
groups. Ababouch is evaluating the safety of Moroccan fishery canning and evaluating the influence of the olive, peanut, and soybean oils used in the processing. Rahmani is studying stability of major fats and oils used in Moroccan food processing. Achkari's project in engineering, whether biogas production from food wastes or food dehydration or process modeling will have a similar critical orientation to long-term Moroccan needs.

Involvement by advisors has been significant; also a number of other University of Minnesota faculty have visited IAV to indirectly participate in the program. Hegarty, initially, was involved in the nutrition area. Busta has spent about six weeks on two occasions and is tentatively scheduled for a third visit to work with Ababouch. Csallany has worked with Rahmani on one occasion. These visits have been extremely useful to the participant by working together with their advisors in the laboratory. Also the visits have been invaluable for the advisor by offering an opportunity to understand Moroccan culture, food products, food processing, distribution systems, IAV procedures and organization, and other significant environmental components. Seminars benefit the IAV faculty and students, and visits to government laboratories and food industries benefit IAV and the clientele in the field. In addition to the advisors, Goodrich, Thompson, Labuza, and Allen have paid visits to IAV and interacted with the STEANH faculty participants. The resident advisor for this group, and especially for Ababouch, is D. Johnson whose veterinary microbiology background is truly useful for the food science activities. The senior faculty in STEANH such as Senhaji, Tantaoui-Elaraki, Hachimi, Benjilali, Berrada, and others also contribute significantly to the guidance and interaction with the participants.

Financial support of research and time to conduct the research and writing remain significant constraints. The initial prediction of two years in Morocco to complete the doctorate is not realistic for the research activities in STEANH, especially if instruments and laboratories have to be set up from scratch. The funding also is spartan for research activities that are to be competitive on the international level. Accumulating funding to support research also takes time.

In summary, 25 participants have been or are involved in the Food Science and Nutrition area since 1979. Ten have completed their Third Cycle Program and one is currently in the U.S. Five have completed their M.S. program and another four are currently pursuing their studies in the U.S. A total of ten are now actively pursuing the doctorate program with four conducting research in Morocco. The program should continue to be a benchmark in institution building that results in teaching and research directly applicable to the problems and needs of the country, Morocco.

Figure-1 Moroccan Participant Graduate Program Activity



# ANIMAL PRODUCTION

Richard D. Goodrich

A productive animal industry is essential if Morocco is to produce adequate amounts of food for its growing population (currently about 22 million). The major reason for this statement is the fact that only 11.2% of the 69 million hectares of land in Morocco is cultivated. The remaining land area is in forest (7.4%), alfa grass (3.8%), range land (30.3%) or unutilized land (47.3%). Thus, even if productivity of the cultivated land were to increase dramatically and if limited quantities of land now used for range were diverted to crop production, a large animal industry will exist in Morocco. Cattle and sheep not only graze range and forest lands, but fully utilize crop residues. Therefore, cattle and sheep offer little competition for cereals that could be consumed by the people of Morocco.

In addition to the efficient use of land resources that result because of cattle and sheep production, the people of Morocco prize animal products in their diet. Although meat is a key ingredient in Moroccan diets, annual production is not large. In 1982, amounts of meat (live weight basis) produced were: beef, 105,000 tonnes; lamb and goat, 70,000 tonnes; poultry, 110,000 tonnes; abats (specialty-foods), 33,000 tonnes; and other, 7,000 tonnes. Thus, the average Moroccan consumes yearly about 2.9 kg of carcass beef, 1.6 kg of carcass lamb and goat, 3.8 kg of poultry (carcass weight), 1.5 kg of specialty foods and .3 kg of other. Milk consumption is (1978-1979) about 32 liters per person yearly (about 86 milliliters per day). In addition, an average of 30 eggs are consumed per person yearly.

Numbers of animals in Morocco have declined in recent years because of the drought that has plagued the country. Cattle numbers have declined from 3.7 million in 1971 to 2.5 million in 1982. Sheep numbers declined from 16.7 million to 10.2 million, and goats declined from 7.0 million to 4.1 million during this period. In addition, large numbers (1981 statistics) of horses (.28 million), asses (.96 million), mules (.45 million), and camels (.064 million) exist in Morocco.

Moroccan Animal Production Departments

Animal Production Departments exist at IAV at Rabat, and at ENA at Meknes. Names and area of specialization of faculty at these institutions are presented in Table 1.

Many of these faculty have received graduate training as a result of the Morocco - USAID - University of Minnesota project. Listed in Table 2 is a description of the graduate education of faculty members at IAV and ENA.

Thus, "the Project" has had a major influence on the graduate education of faculty at Rabat and Meknes. The research that these faculty members are conducting as a part of their graduate education and research being conducted by third cycle students who are working under their direction will do much to improve livestock production in Morocco.

Students in Animal Production

Third cycle, masters (noted with *) and doctorate students (noted with **) who have studied animal production (Animal Science) as a part of the project are listed in Table 3.

Other Accomplishments

Laura McCann. Laura McCann completed her B.S. and M.S. course work at the University of Minnesota and is conducting her research in Morocco under the joint advisorship of Fouad Guessous and Richard Goodrich. She will obtain a Third Cycle degree from IAV and a M.S. degree from the University of Minnesota. Her research involves collection of samples of 12 feeds from five regions in Morocco. Complete analyses will be conducted on the feeds -- 10 minerals, protein, fiber and in vitro digestibility. In addition, soil samples were taken from the farms from which feeds were sampled. Results from this study will be used to model typical diets fed in Morocco and to predict nutrients that should be supplemented.

Steve Cornelius. Steve Cornelius, an Associate Professor in the Department of Animal Science left for Morocco on May 5 to assist in computer data analyses. He will provide faculty in Morocco a least squares

program and a regression-correlation program that have been down-loaded from our main frame computer and adapted for the IBM-PC. These programs will be used to instruct scientists in Morocco on data analyses using the IBM-PC. Dr. Cornelius will also offer instruction on the use of data base management, spread sheet, and word processing programs.

William Boylan, Charles Young, Robert Touchberry, Gene Allen and Richard Goodrich. These faculty members from the University of Minnesota have visited Morocco to assist in graduate student programs and to present seminars at IAV and the School of Agriculture at Meknes.

## Needs in Animal Research

Research facilities. Improved research facilities at both Moghran and Meknes are a must if continued, useful animal production research is to be conducted. Current facilities are fully used and frequently limit the type of studies that can be conducted.

Extension -- Applied Research. Doctorate programs in Animal Production should emphasize research that furthers our knowledge of livestock growth, nutrition, genetics or reproduction. Thus, this research must have a "basic" research component. However, Moroccan faculty members must maintain a commitment to the improvement of livestock production in Morocco.

They must be familiar with proper animal management, and be committed to the solution of applied problems and to dissemination of this information to livestock producers in Morocco. Closer ties with extension and active involvement in extension education should be encouraged.

Research cooperation. Doctorate students should be encouraged to meet to share research ideas and solutions to problems. Sharing of ideas and assisting each other in the conduct of research must be fostered if the Moroccan institutions are to fully address livestock production in Morocco.

Long-term funding to support research in Morocco. If IAV and the School of Agriculture at Meknes are to develop and maintain an excellent reputation as educational and research institutions, increased long-term funding to support research and teaching must be obtained.

Communications and exchanges. Efforts must continue to improve communications and exchanges between U.S. and Moroccan institutions. A philosophy of working as sister institutions would allow accomplishment of faculty-faculty exchanges of information and assistance. In addition, many U.S. students who are interested in a career in international agriculture could be coadvised by faculty in Moroccan institutions.

Table 1. Faculty Members at Rabat and Meknes.

| Location | Name | Area of specialization |
|---|---|---|
| Rabat | | |
| | K. Benabdelijelil | Poultry nutrition |
| | I. Boujenane | Animal breeding - sheep |
| | M. Bourfia | Animal breeding - sheep |
| | A. Eddebbarh | Dairy production and management |
| | A. El Aich | Range Management |
| | F. Guessous (Head) | Forages and ruminant nutrition |
| | N. Rihani | Ruminant nutrition and by-product utilization |
| Meknes | | |
| | A. Ait Boulahsen | Poultry production |
| | B. Charaani | Animal health |
| | A. Ilham | Ruminant Nutrition |
| | A. Kabbali | Animal breeding and meats |
| | M. Mouncif | Range management |
| | H. Narjisse (Head) | Range management and ruminant nutrition |
| | M. El Youssoufi | Range Management |

Table 2. Graduate Education of Faculty at Rabat and Meknes.

| Location | Name | Graduate education |
|---|---|---|
| Rabat | | |
| | K. Benabdelijelil | - M.S., University of Minnesota<br>- Currently on doctorate program, University of Georgia |
| | I. Boujenane | - M.S., Paris (INA) and IAV<br>- Currently on doctorate program, University of California |
| | M. Bourfia | - M.S., Paris (INA) and IAV<br>- Doctorate program, Univ. of Minnesota |
| | A. Eddebbarh | - M.S., Paris (INA) and IAV<br>- Doctorate program, Univ. of Minnesota |
| | A. El Aich | - M.S., Paris (INA) and IAV<br>- Doctorate program, Colorado State University |
| | F. Guessous (Head) | - M.S. Paris (INA)<br>- Doctorate, Paris (INA) |
| | N. Rihani | - M.S., University of Minnesota |
| Meknes | | |
| | A. Ait Boulahsen | - M.S., Paris (INA) and IAV |
| | B. Charaani | - M.S., IAV<br>- Doctorate program, Univ. of Minnesota |
| | A. Ilham | - M.S., Paris (INA) and IAV<br>- Currently on doctorate program, University of Minnesota |
| | A. Kabbali | - M.S. Paris (INA) and IAV<br>- Doctorate program, Univ. of Minnesota |
| | M. Mouncif | - M.S., possibly Texas A&M |
| | H. Narjisse (Head) | - M.S., Paris (INA) and IAV<br>Ph.D., Utah State University |
| | M. El Youssoufi | - M.S. Degree, Oregon State |

Table 3. Animal Production Students

| Year | Name | Advisor |
|---|---|---|
| 1979 | S. Bara* | C. Young |
| | K. Benabdelijelil* | M. Hamre and R. Shoffner |
| | M. Mejjati* | R. Goodrich |
| | D. Maachouk | M. Hamre and R. Shoffner |
| 1980 | M. Bourfia** | R. Touchberry |
| | A. Kabbali** | C. Allen |
| | M. Lazaar* | J. Meiske |
| | N. Rihani* | R. Goodrich |
| | K. Sabeur* | J. Wheaton |
| | A. Souleimani* | J. Donker |
| | M. Tadlaoui* | J. Donker |
| 1981 | M. Battar | W. Boylan |
| | A. Boualil | M. Stern |
| | H. Chafai | R. Goodrich |
| | A. Choulli | C. Allen |
| | A. Eddebbarh** | C. Young |
| | C. Jerrari | R. Shoffner |
| | A. Zemrani** | G. Mitchell (Kentucky) |
| 1982 | M. El Aich** | L. Rittenhouse (Colorado) |
| | M. El Housni | F. Ehle |
| | A. Gaizi | W. Burke (Georgia) |
| | N. Kssili | C. Allen |
| | F. Moussaif | E. Graham |
| | A. Mallah | W. Burke (Georgia) |
| 1983 | I. Boujenane | E. Bradford (California) |
| | J. El Harti | C. Young |
| | M. El Hmamsi | W. Boylan |
| | M. El Kabbaj | F. Ehle |
| | M. Falaki | C. Allen and D. Otterby |
| | A. Ilham** | R. Goodrich |
| 1984 | A. Araba | J. Meiske |
| | K. Benabdelijelil* | (Georgia) |
| | M. Bakali | C. Young |
| | A. Hilali | D. Otterby |
| | M. Laidouni | W. Boylan |

Totals

Third Cycle 19
M.S. 8
Doctorate 8

* M.S.
** Doctorate
Others have been on a third cycle program

# ANIMAL HEALTH

Donald W. Johnson

## Introduction

The level of animal health is one of the critical factors affecting livestock production which is often overlooked unless catastrophic disease problems are affecting the herds and flocks of a livestock industry. Catastrophic disease problems have contributed to decreased animal production in Morocco. In 1977 there was a serious foot and mouth disease outbreak and it caused serious losses in both cattle and sheep. Another dramatic and serious infectious disease problem, sheep pox, caused heavy losses to the Moroccan sheep flock. Important to consider is that death loss, although very dramatic and readily accountable, is frequently the minor loss; with the less dramatic changes of loss of weight, decreased weight gain, treatment and nursing expenses actually resulting in greater financial loss. However, it is not these disease problems which cause the most serious reduction in the output of meat, meat products, milk and other animal products.

The diseases causing the most significant economic losses and decreased productivity are the more insidious ones, e.g. nutritional deficiencies, management errors, parasitic diseases, and reproductive problems. It is these disease problems which cause significant inefficiencies in production and reduced supply of animal protein in Morocco. These diseases are shown in table 1.

Because of the recognized impact of Animal Health Management on the livestock industry the government of Morocco and the administration of IAV recognized the need to develop a trained core of veterinarians who could deal with these problems and attempt to reduce their impact on animal

production. They also decided to combine this program with that of the other fields of agriculture to bring about savings in the costs of educational programs and to initiate cooperation among specialists to work together to increase animal production. The goal of the training program was to develop a veterinarian who could function in administration, education and private industry in Morocco to deal with the major production limiting disease problems; to develop and function in a program which would insure a safe and nutritious food supply; to administer and control a long list of zoonotic diseases; and to serve the draft and companion animal (horse and small animal) needs of Morocco and other North African countries.

I will attempt in this paper to point out the progress which has been made in the training of veterinarians at IAV and to indicate how they are being utilized in the country to work toward the goals of reducing the impact of disease on livestock production and to prevent the spread of diseases from animals and animal products to man. In addition, I will present the progress made in providing advanced training for the veterinarians to serve as educators and researchers at IAV. Finally I will deal briefly with the problems and challenges which lie ahead and make some recommendations to deal with these problems.

## Organization of the Veterinary Section

The Veterinary Section has 9 separate departments. These include:

- Anatomy
- Physiology
- Pharmacology, Biochemistry and Toxicology
- Microbiology and Contagious Diseases
- Parasitology
- Pathology
- Public Health and Food Hygiene
- Reproduction

Medicine and Surgery -- this department has 3 divisions:

- Avian Diseases
- Equine and Small Animal Medicine and Surgery
- Ruminant Medicine and Surgery

## Undergraduate Training

The IAV did not start its veterinary program until 1970, thus it was 1976 before there were graduates in this field. For the first few years the numbers of incoming students was at 25 per year, with there being less than 20 graduates per year. In 1977 the number of incoming students was increased to 50 per year. Thus there has been only one year with approximately 40 graduates. In the first 10 years 250 doctors of Veterinary Medicine have graduated from IAV. Two hundred of the graduates have been Moroccan and are now filling positions in the various fields of Veterinary Medicine (table 2). The other 50 graduates have been students from other African countries. They have returned to their home countries to fulfill the needs there, in the area of animal health.

The veterinary students begin their training with the students in agriculture and have the same basic science curriculum in the first year. The second year students in agriculture and veterinary medicine have many courses in common, but the veterinary students start their specialized curriculum in veterinary medicine. In the third through sixth year the students in veterinary medicine have a curriculum which is totally devoted to veterinary training. In the last half of their fifth year and early part of the sixth year they receive their clinical training. In the sixth year each student has to do a research study and prepare a thesis. Thus each department has to supervise approximately five students each year.

The clinical program and the supervision of students during their research studies require large amounts of faculty time and also require that there be a low faculty-student ratio of approximately 3 to 1 in order for the student to be closely supervised and actually get hands on clinical experience in the diagnosis and treatment of a variety of disease problems.

A major difference between the veterinary section and the sections in agriculture is that the veterinary students remain in Morocco during their fifth year rather than having training outside of Morocco. Thus the veterinary faculty have had increased teaching responsibility through the years. Some relief was provided by German, French and Belgium assistance either on short term basis, or with long term faculty to assist in the clinical teaching.

## Faculty Development in Veterinary Medicine

As presented in Table 3 the Veterinary faculty is making progress in developing a faculty with advanced training. Prior to 1980 advanced training for Veterinary faculty was only available in countries other than the U.S. The Minnesota project now has 16 Veterinary faculty in the early stages of training. Three are back in Morocco initiating their research studies. Thirteen are in the U.S. at various universities.

Some faculty being supported by other countries have completed their advanced degrees. Two have received their doctorates from IAV and four have received their doctorates from France.

In the field of veterinary medicine the IAV is the only institute or governmental division which has a research program on animal diseases and is the only institute which has offered scholarships for students to study outside of Morocco to receive advanced training toward the doctorate degree. In the other fields of agriculture there is advanced training and research being conducted at the National Agriculture Research Institute and Ministry of Agriculture.

## Research Studies by Department

Veterinary Anatomy -- The research emphasis in this department is on the anatomy of the camel. Each of the faculty members is working on a particular body system to better understand the anatomy of the camel in a comparative sense.

Veterinary Physiology -- The research emphasis in this department is in the area of environmental physiology in sheep and camels. One faculty member is working on ruminant physiology.

Veterinary Pathology -- The research emphasis in this department is directed toward a better understanding of the pathology induced by the blood parasites e.g. thielaria.

Veterinary Parasitology -- The research emphasis in this department has three aspects: 1) The pathophysiology of gastro-intestinal parasites, 2) The epidemiology and the pathogenesis of liver fluke infection, 3) The pathogenesis of thielaria in infection.

Veterinary Microbiology and Infectious Diseases -- The research emphasis in this department currently has four aspects: 1) The role of K-99 E. coli, Rota-virus and corona-virus in diarrheal disease in neo-natal calves and lambs, 2) The role of mycoplasma infections in sheep, goats and cattle, 3) The role of reduced dose strain 19 vaccination and the supplemental serologic tests for diagnosis and control of Brucellosis in infected herds, 4) The role of gram positive anaerobes in digestive disease of small ruminants.

Veterinary Public Health and Food Inspection -- There are three areas of research emphasis in this department. These include: 1) Development of sausage made from poultry, 2) Studies on controlling bacterial growth which influence milk quality, 3) Detection and control of Salmonella induced food intoxication.

Veterinary Toxicology, Biochemistry and Pharmacology -- The areas of research which are being developed in this department are: 1) Diagnosis and Control of flouride intoxication, a serious problem in the areas of Morocco which are rich in phosphates, 2) Epidemiology, diagnosis and prevention of selenium deficiency induced white muscle disease in lambs and calves, 3) Pathogenesis and determination of the toxic principal of fennel, 4) Developing diagnostic procedures to detect antibiotic and chemical residue in food products.

Veterinary Reproduction -- This department has a very well developed program of reproductive disease research. It has research support from several sources including the CRSP-SR, AID funded project and support from the International Atomic Energy Agency. The areas of research are: 1) Studies on the endocrine system to determine the hormones associated with prolificity and non-seasonal reproduction in sheep, 2) Studies on the male reproductive system to improve the fertility of the male and develop techniques for cryogenetic semen storage, 3) Studies on reproduction management in dairy cattle as part of a program of herd health management, 4) Studies on the etiology and control of mastitis.

Veterinary Medicine and Surgery -- This department has 3 major divisions and research is oriented according to the responsibility of each division. Division of Avian Disease has three areas of research: 1) Studies on diagnosis and control of infectious bronchitis infections, 2) Studies on diagnosis and control of Newcastle disease, 3) Studies on diagnosis and control of Salmonella infections in poultry breeding flocks.

Division of Ruminant Medicine -- This section has studies aimed primarily at understanding the biochemical and metabolic changes which occur in animals in a state of undernutrition and how to best deal with this problem to reduce losses as much as possible.

Division of Companion Animal Medicine -- This section has studies in two areas. First, there are studies on orthopedic surgery in the equine. Secondly, there are studies in micro-surgical techniques for vascular surgery. The latter of these studies are in cooperation with faculty from the Medical School.

## Problems and Challenges

Animal disease problems are resulting in a significant reduction in the level of production of Moroccan herds and flocks.

The level of production of Moroccan herds and flocks needs to be improved to provide the necessary animal protein to feed the expanding

Moroccan population. Many factors are contributing to a low level of productivity of livestock. A major factor is animal disease problems. Some of these problems are straight forward and may be solved by control procedures, testing and vaccination programs. Others are more complex involving all aspects of production and therefore will require a more complicated health management approach. This approach will require that certain optimal production targets be determined and the total management of the herds or flocks be modified in order to meet these targets. Important in this approach will be the necessity to choose procedures and techniques which are cost-effective and accepted by the Moroccan farmer.

Areas requiring further development in animal health are: 1) A need for additional training for those graduates who are involved in diagnostic and epidemiologic studies of animal diseases on the national level, and 2) An extension service which will reach the average Moroccan farmer and help him understand good herd health management to allow him to achieve optimal herd or flock production.

Finally, to achieve the goals of improved productivity, cooperation will be needed by all disciplines involved, not only animal health but animal science, range science, agronomy, and agricultural economics, and only working as a team will advancement and improvement be made. As we well know, working together presents new problems and new challenges but I hope that there can be cooperation in guiding the Moroccans in facing these problems and I am certain we will experience new rewards.

TABLE 1

Significant Production Limiting Animal Health Problems of Morocco

WATER-PROTEIN - ENERGY - TRACE ELEMENT DEFICIENCY DISEASE

MANAGEMENT INDUCED DISEASES
- MARKED VARIATION IN FOOD SUPPLY
- CLIMATIC STRESS
- OVERCROWDING

PARASITIC DISEASE
- EXTERNAL PARASITES
- PULMONARY, DIGESTIVE SYSTEM AND BLOOD PARASITES

INFECTIOUS DISEASES (BACTERIAL, VIRAL, AND MYOTIC)

REPRODUCTIVE DISORDERS
- MANAGEMENT
- INFECTIOUS

TABLE 2

Faculty Development in Section of Veterinary Medicine

| DEPARTMENTS | TEACHING ASSISTANTS | Countries Providing Advanced Training | | | | |
|---|---|---|---|---|---|---|
| | | FRANCE | GERMANY | SWEDEN | U.K. | U.S.A. |
| Anatomy | 2 | 1 | | | | 2 |
| Physiology | 1 | | | 1 | | 2 |
| Pharmacology Toxicology Biochemistry | 1 | 1 | | | | 3 |
| Pathology | 3 | 1 | | | | 1 |
| Microbiology | 1 | 1 | 1 | | | 1 |
| Public Health | 2 | 2 | | | | 1 |
| Reproduction | 2 | | 2 | | | 2 |
| Medicine + Surgery | 5 | | 2 | | 1 | 3 |
| Parasitology | 1 | 1 | 1 | | | 1 |
| TOTAL | 17 | 7 | 6 | 1 | 1 | 16 |
| Vet. Science at ENA MEKNES | | | | | | 1 |
| T O T A L | 17 | 7 | 6 | 1 | 1 | 17 |

TABLE 3

Current Organizations that Provide Employment of Veterinary Graduates in Morocco

FEDERAL AND PROVINCIAL ANIMAL HEALTH AND PPODUCTION OFFICES
- MINISTRY OF AGRICULTURE
- 27 PROVINCIAL OFFICES
- 9 REGIONAL IRRIGATION DISTRICT OFFICES

PRIVATE PRACTICES
- NEW PRACTICE ACT, 1984

IAV-HASSAN II AND OTHER FACULTIES

PARASTATAL FARMS

6 REGIONAL DIAGNOSTIC LABORATORIES

INDUSTRIAL EMPLOYMENT

# IMPACT OF THE PROJECT

# IN MOROCCO

1274

# APPLIED DRYLAND RESEARCH PROJECT

Daniel Bigbee

The functional linkage being established between the INRA-Aridoculture Center and IAV is important to the development of agricultural manpower and technology in Morocco. In particular, it can unify the efforts of the two institutions as they strive to train scientists and improve the production capacity of Moroccan agriculture. Successful cooperation has been achieved in the areas of socio-economic research, graduate degree programs, agronomic research and faculty interaction. Future activities in the areas of seminars, symposia, colloquia, workshops and faculty exchanges would strengthen and expand this functional linkage between these two institutions. This presentation will describe the Dryland Research Project and its present and future linkages with IAV.

The Aridoculture Center had its beginnings in 1980 when the Midamerica International Agricultural Consortium (MIAC) and the Moroccan Institut National de la Recherche Agronomique (INRA) were designated by their respective governments as the cooperating organizations for its development. The University of Nebraska-Lincoln was assigned the role of lead institution for MIAC. In 1984 the project was extended to 1988 with a $19 million budget and a field staff of 13 professionals. Its mission is to assist Morocco in the establishment of an Aridoculture Research Center. Its purpose is to improve farmer incomes through the creation of appropriate technology for efficient increased production of cereals, food legumes and forages in the low rainfall areas of Morocco.

The Center is a specialized unit within INRA, a part of the Moroccan Ministry of Agriculture and Agrarian Development. It is located in Settat with substations at Sidi el Aydi, Tessaout, Annaceur and Jemaa Shaim. These additional stations give the capacity for experimental replication under the varied climatic and soil conditions found in the semi-arid zone of Morocco.

The research program concentrates on two areas of investigation. First is production technology dealing with (1) germplasm selection and

testing for drought and pest resistance, (2) cropping systems for optimum economic yield and soil water conservation and utilization, (3) development of tillage practices and equipment for efficient soil water storage and utilization, and soil conservation, (4) soil structure-fertility-water interactions that affect plant growth, (5) weed control to enhance soil water utilization, (6) pest control to reduce crop losses in the field and in storage, and (7) forages for animal feed.

The second research thrust deals with socio-economic patterns of farm economics and family behavior patterns. These investigations are important for development of technology transfer strategies. For transfer to occur it must be determined if a recommended practice will be culturally acceptable as well as profitable. A technical reference center is being established at Settat to assist this program activity. There is a direct link with the Rural Development Program of IAV for the conduct of some socio-economic research.

Our two-country agreement calls for direct MIAC participation in the Aridoculture Center program through 1988. UNL/MIAC/USAID are responsible for a field staff of eleven scientists, laboratory and field plot equipment, research instrumentation, greenhouses and academic training for thirty-two scientists. In addition some 132 Moroccan station managers and technicians will receive short term technical training.

As the Aridoculture Center program grows, its outreach and relationships with other institutions in and outside Morocco will become an important part of its ability to fulfill its mission. MIAC/UNL will play a significant role in developing these relationships with Moroccan institutions, international dryland research centers and universities around the world. This will be facilitated in part by the academic training program which involves Aridoculture Center scientists in training in cooperative research efforts with scientists at these institutions. This helps establish ongoing personal collaboration and relationships for scientific dialogue, experimentation and exchange of current technology.

Institutional cooperation has developed primarily in the area of research and scientist training. The process began with the contractural agreement between USAID and MIAC for a socio-economic study of Moroccan agriculture in the Aridoculture Center project area. The purpose of this socio-economic research program is to develop a better understanding of farmers' attitudes regarding the high risks implicit under rainfed agriculture conditions. It calls for a collaborative effort between the Aridoculture Center and IAV to meet the following goals:

1. Accomplish a baseline study of agriculture in the area sufficient to describe production systems in a way which is useful to researchers. This includes assembling and evaluating existing data from IAV, INRA and other agencies, and collection of additional data when necessary. The baseline study includes, but is not limited to, regional information on total resources, number of farms, soil and climatic information, animal populations, production systems, education, family size and roles of individuals.

2. Identify major production regions and soils, and describe typical farming systems and their characterizing components.

3. Identify a cross-sectional group of farmers that can be used to determine what factors are important in decision making, sources of labor, education, land tenure or leasing, and the role of individual family members on the farm.

4. Identify farm production costs to the extent necessary for economic analysis of alternative technologies.

5. Introduce a systematic approach for evaluating crop and animal production on the farm in order to have scientists better understand the total system and also provide a useful basis for encouraging farmers to adopt new technology.

6. Identify social and cultural factors which influence the adoption of technology.

7. Increase the awareness among researchers and administrators of the social and economic parameters in current systems and the consequences of technological changes in the system.

8. Contribute to the socio-economic programs in IAV through collaborative development of research methodology, analysis and interpretation of data, and field studies when appropriate.

Presently there are two contract sociologists working on this research. One is staticned in Rabat working directly with IAV faculty in the summarization and analysis of existing rural sociological data, and planning of future studies. Another is developing a sociological survey in the Jemaa Shaim area. An agricultural economist will join the team in June, 1985. These social scientists, with those of IAV, will comprise a significant intellectual resource for the study of rural risk and decision making. The result will be better designed technology transfer systems for Moroccan agriculture.

Agronomic research is another area where there is broad cooperation between the two institutions. One notable accomplishment is the use of Center facilities and scientists by IAV degree candidates for their field studies. This has been most stimulating as regards the intellectual and professional growth of the people involved. At this stage we see much of this activity between the IAV graduate students and MIAC technical assistance staff. As more Center graduate students return to begin their research this interaction will evolve into a wholly Moroccan context. At least a foundation has been laid on which to build solid cooperative research collaboration between the Moroccan faculties of IAV and the Dryland Research Center.

A more concrete linkage of the two institutions is evidenced in the participant training programs of the Minnesota and MIAC contracts. The MIAC universities are actively engaged in degree or field training for thirteen IAV participants. In like turn, nineteen Center scientists will receive doctoral training under the auspices of IAV. The involvement of the respective technical assistance staffs in the supervision of graduate

research that integrates the future Moroccan faculties is essential. The resulting professional bonds between Moroccan scientists can insure future collaboration on common problems.

Coming to mid-term in the Maroc/Minnesota Project we can see much to be proud of in establishing a solid linkage between the Aridoculture Center and IAV. There is much yet to be done. As we in the Maroc/MIAC contract look ahead we anticipate strengthening the linkage in the following ways:

1. The use of Aridoculture faculty in an appropriate way to contribute to the teaching mission of IAV.

2. Establishment of collaborative research programs in plant breeding, soil science and agricultural mechanization.

3. Development of criteria and procedures for courtesy status of Center scientists with the faculty of IAV.

4. Development of some integrated extracurricular education experiences for our respective participants while they are studying in the U.S.

The Aridoculture Center and IAV are new unique entities in the agricultural research and teaching programs of Morocco. As such, they bring together the intellectual resources of the dryland areas of the world to help solve the problems of aridoculture. Their work should lead to a more economically productive agriculture, and most important, a people that are better nourished.

# THE RANGE MANAGEMENT PROJECT

James T. O'Rourke

## The Beginning of Range Management in Morocco

A summary of initial efforts in range extension by GOM/USAID centers around a 1966 feasibility study conducted by Meril G. Carter of the Soil Conservation Service of USDA. Faced with the problems of over-grazing on the collective lands and the lack of technically qualified personnel, the GOM requested assistance from USAID in 1966 to set up range management perimeters, perform forage adaptability trials and provide technical assistance and some participant training. The project was initiated in 1968 and one half million dollars had been expended by its completion in 1974. It was initially planned to develop twelve range management perimeters covering an area of 325,000 hectares over a period of three years. After eighteen months of operation, however, the project scope was reduced to two areas covering some 70,000 hectares at the perimeters of l'Arid and Tafrata.

An evaluation of the project by Haney (1973) determined that its primary problem was the failure to obtain the understanding, consensus and participation of the local herders and leaders at the provincial level. The project was reduced in scope primarily because of its failure to involve the herders in the decision-making process. Nor were qualified Moroccans available to negotiate with the local herders and direct project activities in the perimeters. Consequently, attempts to set aside land for improvement by the Livestock Service of the Ministry of Agriculture were in some cases met with resistance. Because their needs were ignored, herders failed to perceive the benefits which could be expected to accrue from the project. This situation continued to plague the project even after its scope was reduced to two perimeters.

In spite of these difficulties, the project resulted in a number of notable accomplishments. Assistance and impetus was provided for the formulation of Dahir No. 1-69-61, which the GOM passed in 1969. This law provided for the local establishment of grazing perimeters and thus gave a legal basis for the management and development of communal grazing lands.

In the Midelt area, the project quite clearly demonstrated the feasibility of range seeding and deferred grazing with the resultant increases in production and carrying capacity. It also gave a concrete introduction of range management potential to the GOM, which set up the Service of Feeds and Ranges within the Livestock Service by the time the project was terminated in 1972.

The Service of Feeds and Ranges is a middle-level administrative unit within the Livestock Service which provides technical and administrative support to the range perimeters in the country. It has continued the range management program initiated by the former project.

The main activity of the Service of Feeds and Ranges initially was the distribution of forage to the provinces for emergency livestock feed purposes and the allocation of Morocco's agro-industrial by-products. With increases in its field personnel and program budget, the Service of Feeds and Range in 1980 attempted to increase its field activities in perimeter development. However, it lacked a strategy for a comprehensive extension and demonstration program, as well as qualified extension personnel to carry the program forward.

The availability of trained personnel was the limiting factor in perimeter developed by 1980. The result was that, in the period 1968-1972, only about 10 percent of the funds allocated by GOM for range management were expended and less than 20 percent were expended in the period 1973-77. The function, however, continued to receive strong support in terms of budget from the GOM with a 1980 annual budget of about 1.3 million dollars. The lack of a well-defined GOM policy for rangeland development was not due to ignorance of the country's range and livestock resource policies by the Moroccan range staff, but was due to a shortage of qualified personnel to implement programs. Also, the National Rangeland Commissions were quite effective in implementation of recommendations for grazing cooperative if someone was available to give them recommendations and technical guidance.

The Service of Feeds and Ranges, until 1975, was never composed of more than five people, due to trained personnel leaving the activity nearly

as quickly as they were trained. From 1975 to 1980 the Service of Feeds and Ranges was growing steadily but it was still lacking trained staff.

New Thrust in Range Management in Morocco

With personnel available as a result of the University of Minnesota/IAV/USAID Project, USAID began a five year, five million dollar project in Range Management Improvement in 1981. In response to the critical human, economic and ecological problems facing Morocco, USAID's support attempted to provide the vehicle for achieving the following goals:

1. Increase the number of Moroccan personnel in various range management specialities for employment at the provincial and perimeter levels through both degree-oriented training in the U.S. and short-term training in the U.S. and Morocco;

2. Reduce the social cleavage between GOM administrators and herders by training GOM counterparts in the social and economic customs of target groups whereby GOM personnel can recognize and utilize traditional systems and change agents in future innovations and decision-making; and

3. Develop extension programs for target groups demonstrating the benefits to pastoralists of making needed changes in traditional or nontraditional range practices which damage the rangelands and lower productivity.

At the time the contract was signed with Utah State University in 1981, three of the five perimeters to be involved were supervised by graduates of the University of Minnesota/IAV/USAID Project. In addition, the central directorship position of all range management projects with the Bureau of Feeds and Ranges within the Ministry of Agriculture was filled with a graduate of the Project. The Plant Materials Center of the new project was also being run by a graduate of the Project. None of the other world donor/GOM projects which were involved in range management in Morocco contributed trained personnel to this new project, since only two

individuals had been trained to a degree level by six such projects over the 13 year period of their activity.

Training Needs Not Addressed by University of Minnesota Project

Even though five M.S. level graduates of the Minnesota Project were available to staff this new USAID range management project, none of the individuals had received training in extension methodologies, since the purpose of the Minnesota Project was to train personnel in teaching and research so as to select faculty for the Institute of Agronomy and Veterinary Medicine, Hassan II. Since the new USAID range project was to address extension needs, it was necessary to expend a large part of project resources on training. This training involved three major levels: M.S. degree, technician level, and administrator awareness.

The M.S. level training involved training eight graduates of the Meknes Agricultural School in Plan B type programs in range management and extension methodologies, one Meknes graduate in seed production and extension methodologies, 1 Meknes graduate in agricultural education, and 1 Meknes graduate in rural sociology.

The Administrator's Shortcourse offered by the Range Science Department at Utah State University (USU) was designed to teach the fundamentals of range management to people who are unable to find the time required for formal courses in an academic program. It is a condensation of concepts and principles that form the core of a basic degree program, presented in the context of various biogeographical regions, and pastoral cultures. Special attention is given to the problems of range/livestock development projects in LDCs.

The shortcourse was provided for six GOM Ministry of Agriculture administrators and government officials responsible for introducing, implementing, and evaluating range management programs. The shortcourse assumes that the participants have not had prior formal education in range science and it is taught in a number of classroom units, with a three-day field trip halfway through the session.

The need for practical, hands-on training both at a degree level and for non-degree technicians is obvious. Individuals slotted for this type of training, however, typically descend upon a range science department or a government agency, with little advance notice and no well-defined goals for their program. The result has been very inefficient and incomplete training received while competing with an already full schedule of a professional employee.

In order to fill the need for training technicians working in range management, Utah State University has developed a six-month, practical experience type shortcourse in range management and extension principles. The ultimate objective is that this type of training eventually be offered in Morocco, conducted by graduates of the University of Minnesota Project.

The shortcourse is designed for technicians and extension agents who have a background in agriculture and/or animal science but have had a limited amount or no training and experience in the field of range management and extension. The philosophy of this short-term training is that, in appropriate instances, learning through "hands-on" experience is the best training method. This experience is gained by working individually with a rancher, a county agent, an experiment station technician, etc. The participants receive additional technical training from visits to research stations and attendance at other range management shortcourses and workshops. Fourteen field level technicians of the Bureau of Feeds and Ranges attended this shortcourse.

The following is a summary of the objectives of this shortcourse:

1. To provide on-the-job training for each participant on a sheep ranch operation in all important aspects of livestock production, from management strategies to daily activities.

2. To teach extension techniques and program organization by working with extension specialists and county agents and participation in field days, county fairs, shortcourses, and other extension activities.

3. To provide technical training in range livestock management through visits to research stations and attendance at associated shortcourses and workshops.

4. To offer a coherent overview of range and ranch management in the context of developing country problems in such a way that participants obtain a perspective of the components of range management extension they might apply in their home country.

As suggested by the objectives, the program of this shortcourse can be broken down into three categories: practical ranching experience, extension training, and technical training.

Ranching Phase

The ranching experience is a vital component as it allows the participants to gain firsthand experience of a management system. The schedule is such that the trainees are able to actively participate in the major operations of sheep ranching in the western United States. At the beginning of the shortcourse, each participant is assigned to a sheep ranch at which he works during predetermined and intermittent periods throughout the shortcourse training period.

Shearing is the first activity in which the trainees participate. Each participant assists the rancher in setup and maintenance of shearing equipment and facilities. The actual shearing is done by professional shearers but the participant is active in gathering, wrangling, branding, and dusting the sheep. The participants are also exposed to most aspects of wool marketing during this period.

The next activity in which the trainees participate is lambing. Open range lambing is generally practiced in which the trainees, like the rancher and herders, do not actively participate, but mostly observe.

Towards the end of the lambing period, sheep are gathered and sorted. Participants take an active role in docking, branding, and castrating lambs. Sheep are then trucked or trailed to the summer ranges.

During the summer months, the herds are concentrated on high elevation rangelands of relatively abundant forage. The trainees work with herders and ranchers, gaining exposure to herd movements and grazing management schemes. Marketing lambs and culling of the breeding herds are the last ranching activities in which the trainees participate. They assist in all aspects of gathering, sorting, culling, and marketing. They gain exposure to the marketing system, including buyer-seller negotiations and price determination.

Trainees are exposed to the legal, financial, and managerial aspects of corporate ranching operations, as well as the concept of multiple use management, on an operation which manages its rangeland for the production of beef cattle, sheep, wildlife, and minerals.

As most ranchers borrow money for annual operating expenses, the trainees spend some time with a loan analyst who reviews the financial aspects of the livestock industry.

As a result of the ranching phase of the shortcourse, trainees gain experience with sheep ranching operations, exposure to multiple purpose management of rangelands, and exposure to financial management and loan sources for ranchers.

Extension phase

Extension services dealing with range management in third world countries are commonly poorly supported and developed or nonexistent. Unfortunately, most training programs in the area of range management usually only briefly mention extension or omit it entirely. Extension is emphasized in this shortcourse with the participants receiving a broad and comprehensive view of extension principles, planning, techniques, activities, and organization.

The first part of the extension training involves classroom discussions of extension principles and planning. The participants are then given numerous opportunities to experience the application of extension principles and planning.

Two to three days are spent in the field with USU extension specialists. During this time, the participants have the opportunity to view the overall program as well as some of the specific projects and activities of the USU Cooperative Extension Service.

The participants spend four to five days with rural county extension agents. In terms of scope of work, the county agent position is probably very similar to the position for which many of the participants are being trained. Therefore, the participants' detailed exposure to the daily routine and activities of the county agent is of utmost importance. This experience should allow the participants the opportunity to better understand, and possibly explore, their own roles as extension agents.

A vital component of extension services is youth programs (i.e. 4-H and FFA). In most extension programs of third world countries, youth is an extremely important audience that is ignored. Throughout their training, the participants are made aware of the success and importance of youth programs in the agricultural sector of the U.S. Several shortcourse activities are conducted solely for the purpose of providing a detailed understanding of youth programs, such as: 1) participants attend 4-H and FFA club meetings; 2) they discuss and view 4-H and FFA members' projects; 3) they accompany youth to various 4/H and FFA activities and competition; 4) they attend a week-long 4-H Conservation Camp and/or a week-long Range Youth Camp; and 5) they spend a significant amount of time with extension agents discussing the philosophy and organization of youth programs.

The culmination of much of the extension agents' efforts, especially in terms of youth programs, is expressed during the few days of the County Fair. The participants attend at least one County Fair, viewing the various exhibits and judging events. Following the County Fair, they also attend the Utah State Fair.

Technical Phase

The technical training is aimed at improving the participants' knowledge and understanding of range ecology and management. Without this basic training, much of what they observe in the field would not be

understood. The technical training is divided into three parts: 1) an introduction to range management and ecology in a classroom atmosphere; 2) more advanced training consisting of visiting and working on experimental stations in California, Idaho, Utah, Arizona, New Mexico, and Texas; and 3) enrollment in USDA's Range Management and Forage Production Shortcourse.

The introduction to range management and ecology is conducted at Utah State University by personnel of the Range Science Department. It takes place during the first 20 days of the shortcourse and involves a series of classroom lectures and discussions as well as field trips in northern Utah.

Experimental stations that represent various ecosystems in the western U.S. (arid and semi-arid shrublands, plains grasslands, annual grasslands, mountain grasslands, oak woodlands) are visited. Appropriate range management and improvement practices are illustrated and discussed for each ecosystem. The participants are also given the opportunity to work at USU's Tintic Research Site, applying vegetation sampling methods in the field under the supervision of experienced plant ecologists.

USDA's Range Management and Forage Production Shortcourse provides a framework for range development and planning, emphasizing extensive range production. It provides the detailed technical instruction that the participants need. Therefore, this two month shortcourse is not duplicated by USU but simply incorporated into the shortcourse's schedule.

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# THE SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

W.C. Weir and D.W. Robinson

Following the Congressional passage of the Famine Prevention and Freedom from Hunger act known as Title XII in 1975, one of the means chosen for implementation was the Collaborative Research Support Programs called CRSPs. The first of these was the Small Ruminant CRSP (SR-CRSP) now operating through ten United States institutions and in five countries. The most recent collaborator to join the SR-CRSP is the Institut Agronomique et Veterinaire, Hassan II through a Memorandum of Understanding.

The SR-CRSP is truly a collaborative effort. The Management entity at the University of California, Davis, is the grantee but operates through sub-grants to the United States institutions who in turn designate Principal Investigators who collaborate with their co-investigators in the host country; in this case Morocco.

After consultation with the collaborators at Hassan II, four disciplinary areas were selected as most appropriate to support the objectives of the SR-CRSP to increase the efficiency and product offtake by the sheep and goat producers in Morocco. The original projects and current leaders are:

| Project | U.S. Principal Investigator | Moroccan Co-Investigator |
|---|---|---|
| Animal Genetics | G.E. Bradford<br>Univ. of Cal.-Davis | A. Lahlou Kassi<br>IAV |
| Nutrition and Feeding | W.L. Johnson<br>N. Carolina State | F. Guessous<br>IAV |
| Sociology | M.F. Nolan<br>Univ. of Missouri | A. Hammoudi<br>IAV |
| Range Management | F. Bryant<br>Texas Tech Univ. | H. Narjisse<br>ENA |
| | | A. El Aich<br>IAV |
| | | O. Berkat<br>IAV |

The development of these projects has provided a productive interaction with the U of M - IAV training Project. The Principal Investigators have been favorably impressed with the level of training of the Moroccan personnel who are either alumni of the training Project or are currently involved.

In the Range Program, each of the Co-investigators; Berkat, El Aich and Narjisse, have been in your program.

The Sociology Program which is working with the Range Program on a deferred grazing custom called "Agdals" includes Ahmed Debagh from your program. A. Eddebahr is doing some system work with them. Further collaboration is evident with Lloyd Mendes, a graduate student from Utah State University supported by the University of Missouri Sociology Project.

The Animal Genetics Program includes Mohamed Bourfia whose advisor is Professor Robert Touchberry of the U.C. Department of Animal Science. Ahmed Tibary from your program is active in Morocco while Ismael Boujenane and Lahsen Derqaoui are currently at U.C. Davis in Animal Genetics and Reproduction respectively.

In the Nutrition Area, Ahmed Kebbali whose advisor is Dean Allen is also working with Don Johnson from your program and Bill Johnson from North Carolina. We are expecting Nacif Rihani to come to U.C. Davis to work with W.N. Garret as part of your program. He will be the eighth student to come to U.C. Davis under your program.

The SR-CRSP projects have also benefited from the thesis research of the second and third cycle students who have provided useful information through research directed by their Moroccan professors at IAV and ENA.

The SR-CRSP is happy to facilitate the research projects of the investigators at IAV which are in support of the SR-CRSP program to increase the productivity of small ruminants in Morocco. The Principal Investigators are responsible for insuring that expenditures must be in accordance with the work plans which are considered and approved annually

by the SR-CRSP Technical Committee and the Board of Institutional Representatives. Dr. Firdawcy is a member of the latter body which essentially controls the SR-CRSP budget as funded by the United States Agency for International Development and partially matched by the participating United States Institutions. With the contributions of the Moroccan participants we really have a tripartite collaboration. We appreciate the added contribution of the University of Minnesota IAV/Hassan II to the training component. Dr. Don Johnson has been particularly helpful. One example was his assistance in diagnosing and treating the white muscle disease at Tadla which responded to selenium.

The SR-CRSP looks forward to continued collaboration with the Minnesota-IAV programs and hopes to increase its interaction with the Utah Range Extension Program and the Cereals program of MIAC at Settat.

# POINTS OF VIEW OF THE MOROCCAN PARTICIPANTS

Abdelhafid Debbarh

## Introduction

Education is one of the major keys to the development of Morocco, especially in the sector of agriculture. In fact, this sector plays a major role in helping the Moroccan economy to achieve selfsufficiency in the country's food supply, and to improve the well-being of the rural population which represents more than 54% of the total population.

From the beginning of the independence of the country from French colonization, Morocco has planned for higher training to respond to its needs for educated people in the fields of agriculture. The first college of agriculture was the "Ecole Nationale d'Agriculture" in Meknes which was involved in the education of Moroccan engineers at the bachelor level. In 1966, the Institute of Agronomy and Veterinary Medicine-Hassan II became responsible for the education of "Ingenieurs Agronomes et Docteurs Veterinaires" at the level of the M.S. degree. The program later was enlarged to include several other needed engineers at the B.S. level in areas such as irrigation and drainage, topography, food technology, horticulture, fisheries and green parcs. The third important Moroccan college in agricultural education is "L'Ecole Nationale des Eaux et Forets" at Sale. All of these colleges, in addition to training Moroccan students, participate in the higher education of other African engineers in all domains of agriculture.

Among the many missions of these colleges is their participation in the research effort, within the country, to serve the development of Moroccan agriculture. This activity requires 1) the development of scientific and research skills by Moroccans at a high level, 2) the procurement of a minimum of equipment for different laboratories, and 3) the development of a network for technical and scientific support with experienced institutions such as the University of Minnesota and other American Universities. These are the purposes of this partnership program as perceived by most of the Moroccan participants.

In the following sections we will try to comment on the experience of the first term of the ongoing Project. Although most of the ideas and comments herein presented are shared by most (if not all) of the participants, the author is solely responsible for what is written in this paper.

## Objectives of the Project

The main objectives of this program are outlined in the following points:

1. Institution building through the training of about 150 faculty members of IAV, ENA and ENFI at the Ph.D. level and the strengthening of the doctorate of "sciences agronomiques" at the IAV.
2. Enhancement of the research activity in the Moroccan environment with the support of American universities and research institutions.
3. Access to the new facilities and American technology which are suitable to help solve scientific or technical problems related to the development of our agriculture.

## The Training Program

The training program of the Moroccan faculty member in the U.S. is very heavy and limited to a two year period of time. The steps of the program are as follows:

1. The satisfaction of admission requirements by obtaining satisfactory TOEFL and GRE scores (when required).
2. The fulfillment of all the conditions of the departments and colleges of graduate schools of the American universities.
3. The satisfactory accomplishment of the heavy course work, and both the written and oral preliminary examinations within the two years.
4. Discussion with the American advisor of the dissertation research topic to be done in Morocco, and preparation of the literature review. The participant has to also think about the needed equipment for his research and order it before going back home.
5. Dissertation research in Morocco while carrying out daily duties such as teaching, advising third cycle students, departmental and

administrative responsibilities. This period of time is the most critical stage for the success of this important and original project.

6. Defense of the doctorate thesis at the Institute before a highly qualified international committee, and the defense of the Ph.D. in the American university with which the participant is working, if he is willing to do this.
7. Post doctorate training at the American universities for a period of up to three months. During this time the participant writes jointly with his advisor some papers to be published in international journals and does other activities to provide for his professional improvement.

Brief Evaluation of the First Phase of this Partnership Program

A. This is a very successful project with respect to the following points:

1. High quality Moroccan faculty members training in outstanding American universities.
2. Stimulation of research activity within all departments of the Institute and other colleges of agriculture. Creation of an environment for scientific achievement within these institutions. These successes are an important part of institutional building.
3. Easy access to scientific literature and facilities within the United States.
4. Real and effective impact on the education level of both undergraduate and graduate studies at the Moroccan colleges of agriculture.
5. Building of strong direct ties between the departments of the Moroccan colleges of agriculture and their homologous American departments at different universities in the U.S.
6. Large cooperation at the institutional level and most importantly between people of the United States and Morocco.

B. There are great challenges to the young participant who is struggling, most of the time alone, with multiple problems. These problems are summarized as follows:

1. Isolation of the participant from ready access to the broad scientific community.
2. Difficulty of communication with the advisor and other members of the research committee of the Moroccan participant.
3. Long delays in the progress of the program of research to be done in Morocco.
4. Strong rigidity of the project "everybody must fit the same mold." The lack of flexibility has created a lot of obstacles of different kinds to most of the participants (some face insufficient financial resources, others need more contacts with their advisors and the scientific community to build up the needed scientific environment...etc.).
5. As a result of the problems outlined above there is a great deal of frustration and sometimes self-doubt among the participants to the extent that some may give up this project.

<u>A few ammendments may have a positive effect on this Project and improve its outcome</u>

The following suggestions are made to improve the overall success of the Project:

1. Inclusion of more flexibility in dealing with participant problems. This flexibility has to be justified and agreed upon by the advisor, the IAV or school where the participant is employed and the Project.
2. Improvement of the communication facilities and all other facilities needed for the accomplishment of the research work in Morocco.
3. Multiplication of scientific contacts between the participant and his advisor or other professors to help solve the scientific problems that confront the participants.
4. Possibility of attending a professional meeting in the field of interest of the participant or a visit to a scientific institution in the U.S., if needed and strongly justified for the continuity of his research process in Morocco.

## Conclusion

In conclusion I will emphasize the commitment of the Moroccan faculty members who are participants in this partnership program, and also our commitment to its improvement:

1. The Moroccan faculty members, including both the participants in this project as well as their other colleagues of the Institute, have been, are, and will continue to be strongly committed to the effort of the institution building at IAV.
2. They are looking forward to the success of the ongoing project and the achievement of its goals.
3. They strongly support the establishment of a graduate program at the doctorate level at IAV which is part of the institutional building, and in the framework of which they are conducting their research work. However, those who are willing to get, in addition to the Moroccan doctorate, their Ph.D. for which they fulfill all the conditions of the American universities, should have the right to do so.
4. They are proud, more than ever, of what they have achieved with this project, but they are hoping that their suggestions will be taken into consideration for the real improvement of this unique program in order to make it more successful.

# APPENDIX

*Joseph Verner Reed*
*Ambassador of the United States of America*

April 29, 1985

Greetings! As the personal representative of the President of the United States to the Kingdom of Morocco I want to thank each of you for the important contribution you are making to Morocco's agricultural development. The University of Minnesota and its Partner Universities, the Agency for International Development and the Institut Agronomique et Veterinaire Hassan II have successfully sustained - for 15 years - a truly extraordinary institution building program in Morocco which is shaping the future of Moroccan agriculture.

President George Washington wrote to Mohammed III in 1789: "Our soil is bountiful and our people industrious and we have reason to flatter ourselves that we shall gradually become useful to our friends". By sharing the traditions, the science and the technology of our finest Land Grant Universities you are indeed being useful to America's oldest friend - the Kingdom of Morocco. You are also realising the vision of Minnesota's Senator Hubert H. Humphrey who championed the Title XII program of the Agency for International Development.

For these achievements I salute you. I send you my personal best wishes for the success of this conference and for your continued success in Morocco.

Participants at the Partnership Conference
University of Minnesota, St. Paul
St. Paul, Minnesota 55108

Partnership Program on Institution Building
at the Institut Agronomique et Vétérinaire - Hassan II

The Mid-Program Conference

May 6 and 7, 1985
University of Minnesota, St. Paul

Monday, May 6 - 135AC Earle Brown Center

ORIGINS OF THE PROJECT

Chair: Dr. C. Eugene Allen, Dean College of Agriculture
University of Minnesota

| | | |
|---|---|---|
| 8:15-8:30 | WELCOME | President Kenneth Keller<br>University of Minnesota |
| 8:30-9:00 | INTRODUCTORY REMARKS | Dr. Roy D. Wilcoxson,<br>Project Director |
| 9:00-9:20 | THE EARLY BEGINNINGS | Dr. Edwin L. Schmidt,<br>University of Minnesota |
| 9:35-10:00 | MOROCCO COMMITMENT | L. Firdawcy, Secretary General<br>Institut Agronomique et<br>Vétérinaire Hassan II, Morocco |
| 10:05-10:30 | USAID COMMITMENT | Dr. Malcolm Purvis,<br>USAID Agriculture Officer,<br>Rabat, Morocco |
| 10:30-11:00 | Break | |
| 11:00-11:20 | U of M COMMITMENT | Dr. Richard J. Sauer,<br>Deputy Vice President, Institute<br>of Agriculture Forestry and Home<br>Economics, University of<br>Minnesota |
| 11:25-12:00 | THE TRAINING PROGRAM | Dr. James Sentz, Training<br>Officer, Univ. of Minnesota |
| 12:00-1:30 | Lunch - (on your own) | |

Monday, May 6 (afternoon)

## ACCOMPLISHMENTS OF THE PROJECT

Concurrent Session A - 135A Earle Brown Center

Chair: Dr. James F. Bartz, Head Horticultural Science and Landscape Architecture, University of Minnesota

| | | |
|---|---|---|
| 1:30-1:55 | PLANT BREEDING | Dr. Lynn Gallagher, U. of Minnesota |
| 2:00-2:25 | AGRONOMY | Dr. Steve Simmons, U. of Minnesota |
| 2:30-2:55 | PLANT PATHOLOGY | Dr. Roy D. Wilcoxson, U of Minnesota |
| 2:55-3:15 | Break | |
| 3:15-3:40 | SOIL SCIENCE | Dr. Jean-Alex Molina, U of Minnesota |
| 3:45-4:10 | HORTICULTURE | Dr. David Davis, U of Minnesota |

Concurrent Session B - 135C Earle Brown Center

Chair: Dr. William C. Larson, Head, Soil Science University of Minnesota

| | | |
|---|---|---|
| 1:30-1:55 | WATERSHED MANAGEMENT | Dr. Kenneth Brooks, U of Minn. |
| 2:00-2:25 | RANGE MANAGEMENT | Dr. James O'Rourke, Utah State |
| 2:30-2:55 | IRRIGATION ENGINEERING | Dr. Jack Keller, Utah State |
| 2:55-3:15 | Break | |

Chair: Dr. Roger S. Morris, Head, Large Animal Clinical Science, University of Minnesota

| | | |
|---|---|---|
| 3:15-3:40 | FOOD SCIENCE AND NUTRITION | Dr. Frank Busta, U of Florida |
| 3:45-4:10 | ANIMAL PRODUCTION | Dr. Richard Goodrich, University of Minnesota |
| 4:15-4:45 | ANIMAL HEALTH | Dr. Donald Johnson, Institut Agronomique et Vétérinaire Hassan II |

Monday, May 6 - 135AC Earle Brown Center

EVENING PROGRAM

| | | |
|---|---|---|
| 5:30 | WINE & CHEESE RECEPTION | |
| 7:00 | DINNER, Speaker | Dr. Fred Hutchinson, Exec. Director BIFAD 1985: The Tenth Anniversary |
| | Master Ceremonies | Dr. Richard J. Sauer, Deputy Vice President and Title 12 Officer, University of Minnesota |

Tuesday, May 7 - 135AC Earle Brown Center

IMPACT OF THE PROJECT IN MOROCCO

Chair: Dr. Robert H. Dunlop, Dean, Veterinary Medicine, University of Minnesota

| | | |
|---|---|---|
| 9:00-9:30 | THE DRYLAND AGRICULTURE PROJECT | Dr. Dan Bigbee, University of Nebraska |
| 9:35-10:05 | THE RANGE MANAGEMENT PROJECT | Dr. James T. O'Rourke Utah State University |
| 10:10-10:30 | Break | |
| 10:30-11:00 | THE CRSP-SR PROJECT | Dr. David Robinson, Univ. of California-Davis |
| 11:05-11:35 | POINTS OF VIEW OF MOROCCAN PARTICIPANTS | Mr. Abdelhafid Debbarh Institut Agronomique et Vétérinaire Hassan II |
| 11:40-12:10 | CLOSING REMARKS | Dr. C. Eugene Allen, University of Minnesota |

COOPERATING UNIVERSITIES

| Universities | Doctoral | Mastors and/or Third Cycle |
|---|---|---|
| Western U.S.A. | | |
| Utah State University | * | * |
| University of California | | |
| Fresno | | * |
| Humboldt | * | |
| Riverside | * | * |
| Davis | * | * |
| Oregon State University | * | * |
| Colorado State University | * | * |
| New Mexico State University | * | |
| University of Idaho | * | |
| Montana State University | | * |
| University of Nevada | | * |
| Washington State University | | * |
| University of Arizona | | * |
| Mid-Western U.S.A. | | |
| Kansas State University | * | * |
| University of Nebraska | | * |
| Michigan State University | * | * |
| University of Michigan | * | |
| University of Minnesota | * | * |
| University of Southern Illinois | | * |
| University of Illinois | * | |
| University of Kentucky | * | |
| Iowa State University | * | * |
| Southern U.S.A. | | |
| Texas A & M | * | * |
| North Carolina State University | * | * |
| Auburn University | | * |
| University of Georgia | | * |
| University of Louisiana | | * |
| University of Florida | | * |
| Eastern U.S.A. | | |
| Rutgers University | * | |
| Syracuse University | | * |

## INSTITUTIONS REPRESENTED AT CONFERENCE

| Institution | Location |
|---|---|
| California, University of | Davis, California |
| Colorado State University | Ft. Collins, Colorado |
| Florida, University of | Gainesville, Florida |
| Idaho, University of | Moscow, Idaho |
| Iowa State University | Ames, Iowa |
| Kansas State University | Manhattan, Kansas |
| Kentucky, University of | Lexington, Kentucky |
| Minnesota, University of | St. Paul, Minnesota |
| Michigan State University | East Lansing, Michigan |
| Nebraska, University of | Lincoln, Nebraska |
| Oregon State University | Corvallis, Oregon |
| Utah State University | Logan, Utah |
| Wisconsin, University of | Madison, Wisconsin |
| Ecole Nationale D'Agriculture de Meknes | Meknes, Morocco |
| Institut Agronomique et Veterinaire Hassan II | Rabat, Morocco |
| BIFAD, Board for International Food and Agricultural Development | Washington, D.C. |
| USAID-Rabat, United States Agency for International Development | Rabat, Morocco |
| USAID-Washington, United States Agency for International Development | Washington, D.C. |