PDAAQ-433

ISN 37653

PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

(Contract AID/NE-C-1701)

REPORT ON

SHORT-TERM STAFF ASSIGNMENT

AT THE

INSTITUTO UNIVERSITARIO DE TRAS-OS-MONTES E ALTO DOURO (IUTAD)

VILA REAL, PORTUGAL

August 29 through November 1, 1984

Submitted by

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I. Assignment:

The general assignment was to assist in the area of soil and crop research and teaching at IUTAD.

The specific assignments were to:

1. Help with the doctoral degree research of Engr^{o} Joao Coutinho including to arrange contact with the Spanish work done by Dr. F. Mombiela of CRIDA in La Coruna.

2. Help with the doctoral research of Engr^{a} Ester Portela, Engr^{o} Afonso Martins and others in the Geoscience and Plant Science departments.

3. Help with the teaching organization in Soils and Soil Fertility.

4. Give two seminars on pedagogic topics concerning Improvement of University Teaching and Experience with a Teaching Learning Center in Soil Science.

5. Give a seminar to students on the application of techniques in x-ray and infrared to the study of soil.

6. Consult on the research projects on fertilization of cereals.

7. Consult on the development of a soils map of Tras-os-Montes.

8. Help in the research and service aspect of the running of the routine Soil Analysis Lab.

II. The Portuguese Counterparts:

The Portuguese Counterparts included

Engr^{o} Joao Coutinho
Engr^{a} Ester Portela
Engr^{o} Afonso Martins
Engr^{o} Rui Vale
Engr^{o} Manuel Teles Oliveira
Engr^{o} Vincente Seixo Sousa
and others to a lesser degree

III. The Itinerary:

I left Lafayette at 8 am Wednesday, August 29, 1984 and arrived in Lisbon at 4 am Thursday, August 30. I visited with the AID mission at the Embassy that day. Friday, August 31 was spent at Oeiras talking with Engr° Almeida Alves, director of the Procalfer program. I went to Vila Real on Monday, September 3 by train.

During the stay I made one trip to La Coruna, Spain with Engr° Coutinho to discuss related research on soil acidity, soil fertility and forage production being done at the CRIDA station by Dr. Francisco Mombiela (Oct. 22 and 23). We also visited at the University of Santiago with Dr. Filipe Macias, head of pedology and expert in survey and mapping of soils to get information on the Spanish soils maps available adjacent to the Portuguese border for use by Engr° Afonso Martins.

I returned to Lisbon on October 29 and visited at the Procalfer offices for conferences with Engr° Almeida Alves, Dr. Phillip Warnken, Mr. James Black and Ms. Linda Lynch. I also spent one evening of October 30 in discussion with Dr. Roger Hansen of the team that had just arrived for Procalfer Project evaluation.

IV. Accomplishments:

1. Helping with the doctoral program of Joao Coutinho.

Engr° Coutinho is part of a team conducting a major field research program with the support of J.N.I.C.T. (National Scientific Research and Technology Council) and of World Bank funding. However, he freed himself for September and some of October to concentrate on thesis research.

We had previously developed a general doctoral plan and discussed it with his orienting professor, Prof. Quelhas dos Santos of the Instituto Superior de Agronomia in Lisbon. He had begun some work on it during his short visit to Purdue on a Procalfer bolsa in 1983.

The thesis attacks the problem of an appropriate lime requirement test for northern Portuguese soils and is designed also to clarify the problem of aluminum

toxicity and lime response for the cultures of the region. The literature shows that many cultures, excepting some legumes, give little response to liming after pH's near 5.5. Yet most liming programs are designed for pH's of 6.0-6.5. Removal of aluminum toxicity appears to be the main advantage of liming and this may require only a pH of 5.5 or less. Bioassay studies based on short term root elongation can verify the aluminum toxicity level. Coutinho and I have developed the procedures for this assay during his visit to Purdue. He will now apply it to a cross-section of 30 soils he has selected to represent the region.

The lime requirement of soils is determined in Portugal by either the method of Tabodela (Spanish) or of Quelhas dos Santos (Portuguese). The Tabodela method gives very high values on many soils and the Quelhas dos Santos method also is quite high on some soils. Engr° Coutinho has started limestone incubation studies and $Ca(OH)_2$ titrations of soils to ascertain true lime requirements. This will be done on 30 well selected soils and on a much larger group of acid soils passing through the routine soil testing lab.

The major research in September and early October was to do this on a large group of soils from the routine testing laboratory. All were also tested using seven of the most used lime requirement methods. While we expected some differences between methods the amazing results showed a range which at times was from near zero to 10 or 20 tons of lime/ha for the same soil depending on the method used. From this work we expect to be able to choose or adapt a method which will enable us to predict lime requirements to attain a desired pH on a regional soil with greater accuracy.

He also has detailed chemical data on all aspects of acidity and aluminum for each soil so we also expect to be able to characterize what the acidity-aluminum parameters should be to permit normal or near normal plant growth. He'd like to be able to lime to the best soil chemical balance rather than to a generalized "best" pH level. He completed his first statistical correlations while I was there.

All chemically determined "best" parameters will be checked by 48 hr. bioassays, greenhouse pot experiments and with some field experiments.

The end result should be a much improved lime requirement test for Portugal and a much clearer picture of the level of liming most apt to give response on Portuguese soils with Portuguese cultures.

Careless use of lime can create serious problems in these fragile soils. Boron is already very low, and any liming will accentuate the boron problem.

Coutinho, Pires and I have already demonstrated the very low Mg levels of soils and plants and the general prevalence of Mg deficiency symptoms. This has led Coutinho to general recommendation of dolomitic lime for much of the region rather than the often used calcitic lime.

We completed a file of the pertinent literature from all over the world on liming and aluminum toxicity which we have both studied in detail. The "AIDCOPY" service of the National Agricultural Library of the USDA and Purdue's International Program in Agriculture helped us greatly in accumulating the literature.

In summary, Engr° Coutinho knows the literature on the subject and his research is well started. He needs to complete his soil collection and has a lot of hard research left to do. He will ask for freedom from some of his responsibilities so he can put a concentrated effort into thesis research as soon as his colleague, Ana Pires, returns from Purdue where she is completing an M.S. on a soils and forage research problem. Engr° Coutinho impresses me as one of the most competent of young research scientists. He has a natural ability in science, a good science background, a great efficiency in accomplishing research and an excellent ability to interpret data. I consider him one of the best scientists in the Instituto especially in applied research.

In connection with his program I went with him to La Coruna, Spain for two days to introduce him to Dr. Francisco Mombiela at the CRIDA station. Dr. Mombiela is an excellent young Spanish soil scientist, a graduate of North Carolina State University, with research experience on acidity problems. He has excellent research going on acidity, phosphorus and potassium fertility on seeded ryegrass and clover pastures on reclaimed brush land of Galicia. We got excellent ideas from him on acidity and liming. He is developing a method for rapid routine assessment of aluminum concentration of soil solutions as a lime

requirement method to complement his observation that small lime additions (i.e. 2T/ha) give the main response to be expected on ryegrass-clover pastures. We observed some good experimental design to get information on phosphorus build-up from residual accumulation and on the rapid potassium depletion by harvested forage. All of these are pertinent problems for us.

2. Helping with the doctoral program of Engr^{a} Ester Portela and other docentes.

A. Engr^{a} Portela

Engr^{a} Portela must begin her doctoral research. She is interested in potassium fertility problems. I brought considerable literature for her area of interest with me from Purdue including the new book "Soil Nutrient Bioavailability, A Mechanistic Approach" by S.A. Barber, a renown expert on nutrient availability. We spent considerable time discussing the literature and the problem during my first weeks there and I outlined with her what I thought could make an excellent general thesis plan. She is committed to spending time in Lisbon in January visiting with the three Portuguese soil scientists with the most ability to help her; Quelhas dos Santos who would be her orienting professor, Vasco da Gama who has done research in the past on K availability, and Almeida Alves who has conducted a great deal of applied soil fertility research and is director of Procalfer.

The general K level in Portuguese soils is medium to high yet there are low and occasional very low testing soils. However, these tests have never been well correlated to crop response. There is reason to believe that there is a great range in the K supplying power of soils with similar K tests and that some soils deplete of bio-available K very rapidly when adequate N and P are present, especially when the foliage as well as grain is removed. The soil factors and the plant root elongation factors in the Barber-Cushman model enable one, from a few measurement, to predict the ability of the plant to get adequate K from the soil at the moment and over time.

The attached research outline (Appendix I) would give her a good opportunity (1) to try the new model with regional soils, (2) to develop a practical insight into which regional soils should need K fertilizer, (3) to improve the K response tables used in the routine

soil testing lab, and (4) to complete a good thesis study. She had submitted her plan to the Scientific Council before I left with her request for permission to begin her doctoral program and we had begun our first attempts to displace true soil solutions.

B. Engr° Rui Vale

Engr° Vale got his M.S. degree in Soil Chemistry at the University of Wisconsin in 1982 under our Purdue-IUTAD program. He is in the chemistry department where he has made a positive contribution to the Ag program by helping teach the Ag chemistry classes. Unfortunately, he has not been incorporated into the regular Ag research activities via the World Bank projects etc. I feel he could make a real contribution. He impresses me as an excellent chemist with interest in micronutrient chemistry which is a problem in much of Portugal. I think he should be a part of all liming research since liming has micronutrient side affects. A serious effort is needed to incorporate him into the ongoing research. He could be a really fine scientist and after getting his doctorate, an excellent orienting professor in the chemistry aspect of future doctoral programs.

Engr° Vale began research on boron deficiency with soil and plant analyses from the Vila Pouca valley last summer and with a greenhouse experiment with a sensitive species, radish. Generally inadequate boron levels were found with liming accentuating the problem. Vineyard and olive people have known of this problem and they add some boron fertilizer once in 10 years or less. However, no concern has been expressed about forage needs for boron even though legumes are sensitive. Seed production is especially diminished by boron deficiency thus it could be especially critical for stand maintenance in annual, self-reseeding legumes like subterranean clover, annual alfalfa, etc.

I have discussed research plans with Engr° Vale and provided some literature which I'd brought from Purdue, ordered other reprints and a new chemical for an improved boron procedure (We rely on colorimetric wet chemistry analysis which is tedious so an improved method is important). I've encouraged a boron study which would more carefully determine the extent of the liming-pH effect on boron availability, especially to determine what the pH vs. depression-in-uptake curve is like so we can predict the effect that various levels of liming might have on boron uptake. Also a

greenhouse study of boron level vs. seed set on sub clover and other annual legumes would be valuable to our forage program.

He is drafting his thesis research proposal but his hospitalization and surgery delayed getting it completed. Conversations with Procalfer leaders indicates that they would consider support for such a project. I have pushed him to collaborate with Nuno Moreira and Joao Coutinho to produce a project for Procalfer consideration. This would serve a triple purpose of 1) to get needed fertility and forage production information, 2) to get Engr° Vale active in agricultural research and 3) to give him a viable and useful Ph.D. thesis program.

C. Engr° Manuel Teles Oliveira

Engr° Teles Oliveira is a case of a very intelligent young man who has not gotten started in research after an M.S. degree at the University of Wisconsin under our program. His original interest areas of tillage systems and erosion are not areas which are easy to develop as first research studies because they require long periods of time, lots of equipment and supplies and expenses support. They are better for study by a team of several researchers under a longer term research project which has major financial support.

However, it would seem to me that problems of water supply for plant growth are so fundamental in the region that he might readily do a fine study on some aspect of this. It would require only modest financial support and would provide an opportunity to prove himself as a research scientist. It also could help incorporate him into team work with colleagues Vincente Seixo Sousa, Lurdes Rego, Fernando Bianci and Nuno Magalhaes.

I think we now have a good plan which interests him and would be an important support for the Viticulture program. We have gotten the new neutron soil moisture probe from the German Project operational. I have worked with Teles and with Vincente on operation of the probe, on obtaining inexpensive access tubes and on methods of putting the one to two meter long access tubes into local soils.

He is planning a program of study of the water content of Douro vineyard soils under various terrace

types, vertically planted vineyards, and various slopes and exposures. This is an extension of an interesting German thesis done on German vineyards, and is important to our understanding of how to renovate Douro vineyards. I think that support of Teles Oliveira at this time is important to his developing as a useful scientist. I expect Bianci, Magalhaes and Vincente Seixo Sousa to cooperate with him. This work would relate closely to the German project and Dr. Herbert Albrecht has expressed an interest in adding it to the projects of Fernando Bianci and Vincente Seixo Sousa. I've attached the first draft of the research idea, as Teles has summarized it, to this letter. I strongly urge its support and that he be put under pressure to produce data on this beginning this season.

3. Other activities.

A. I consulted only briefly with Afonso Martins on his soil classification and genesis work. We discussed an appropriate organization for publishing his accumulated profile description data, and also discussed the World Bank Soil Mapping project on which he seems to handle IUTAD's involvement very well. Because of this he has made no progress on his thesis work. Since his thesis study would be a climo-sequence study over a wide moisture range I've encouraged him to include soil moisture access tubes at all sites so he can monitor soil moisture for several years with the neutron moisture probe. I discussed very little of the Soils Mapping Project with Afonso Martins as he was not present most of the time and as that is not one of my areas of expertise.

B. We hosted Procalfer administrators, Almeida Alves and Phillip Warnken on their visit to IUTAD and discussed the soils program in detail with them. We also hosted James Black and Terry Cooper when they brought the new computer for soil testing.

C. I did little on teaching organization outside of the two seminars on teaching and the teaching of one two hour session of Soils since classes just started as I left. I feel that the soils teaching is quite well done but it needs more space so that laboratory activity can be developed.

D. I edited and redrafted a Portuguese research article based on the cereal-fertility research to expidite its publication. I also edited a number of articles and abstracts in English by the Plant Breeding group.

E. The Soils & Plant Analysis lab is running well. There is a problem of space for the work which will be solved by the winter move to the new building. The time needed for making recommendations should reduce this year as we received the computer terminal and printer from Procalfer in October and Engrº Coutinho has the program scheme already outlined and ready for the programer to begin inserting the program. This should become experimental this winter and operational by next summer.

F. At the request of Vice-Reitor Lima Pereira, I and Prof. Larry Peters have begun writing a paper on Ag Education and Vocational Agriculture for publication in Portugal.

In summary, while I interacted with many at IUTAD my main activity in this visit was to develop and/or activate thesis research programs for the four soil science faculty discussed in my opening to this section.

V. Problems and Proposed Action

1. The lack of continual on-site leadership and advice in the form of experienced older scientists makes it difficult for some young, new faculty to start and maintain viable research programs. Our visiting US scientists and others from Europe have filled some of this role. A number of young staff have been floundering. The Scientific Council should concern itself with the continual need of each young staff person in developing their teaching, research and thesis work. The newly graduated "Doctoral" people need to be sensitized to the importance of their also accepting responsibility in this role; the role of building young scientists.

2. I see a problem for the coming generation of graduate degree candidates. If we are going to have young people with doctoral degrees by their early 30's, then they will be neither adequately nor broadly enough trained scientifically unless we include some formal course work into their degree program. IUTAD soon should be able to do some of this as persons like Torres

Pereira, Antonio Nazeri Pereira and others are returning with their Ph.D.'s. These persons could each prepare to offer a formal graduate level course for a semester or two every few years for the small group of younger staff. It could be done by lecture-lab teaching but with so few students a formal tutoring approach would probably be better. Chemistry, Biology, and Statistics, and Physiology are all fundamental areas that all persons in Soil Fertility, Biology, Plant Sciences and Animal Science need.

3. Without in situ "orienting professors" many of the young people currently working on degree programs will need opportunity to spend time with experts in their field in other countries. Other European countries will serve some of this need. The U.S.A. may be less accessable now that our Purdue Program is closing. Future assistance of AID-Lisbon on this need will be valuable. Reitor Real has prepared a draft copy of a proposed "agreement" for general cooperation between Purdue and IUTAD. I hope Purdue will be able to agree on such a document and that some funding will be available for it. I hope Procalfer will be able to continue to help in finishing the training of Ester Portela, Ana Luisa Pires, Artur Cristavao and perhaps Rui Vale and Joao Coutinho.

   The Reitor and the Scientific and Pedogogic Councils are to be commended for having the courage to permit so many of their faculty to be absent for training when a university needs to continue to function in Vila Real. Considerable need for this will continue for some years, and, because Portugal is a small country with few scientists, this need will always be present to some degree for all IUTAD faculty. Good contact with Europe will certainly continue. I hope it can continue with the U.S.A.

4. The "project" basis for the World Bank related work is a big help to the staff in planning their work since they have a specific budget. I would think that staff without these projects could benefit from operating on a similar basis if they could obtain approval of specific projects with the administration and then have an assigned budget even if it was only a small budget.

5. While I'm not knowledgeable on the details of current regulations, it appears that the Ministry

of Education needs to develop or get approval for a new flexibility. It appears to me that those who are only teaching (not running research or extension or major administrative programs) and especially the chair professors, are not teaching enough while those with major research, service lab administration, and similar responsibilities are worked very hard.

6. Some research papers and abstracts or summaries in English have been going to journal editors without editing by a native English speaking person. While the staff reads, speaks and understands English very well in general, they can not write English well enough to publish without embarrassing themselves and the university. I recommend that they be reminded that all English for publication must be finally checked by someone whose native language is English. When no technical person is available, David Underwood could do it with the author present to clarify technical details.

   However, no roadblocks should be put in the way of rapid publication of either research papers or extension fliers. Engr° Afonso Martins, the Soil Fertility group and I'm sure others have data that would make either good research papers or publications in the new Extension series and they should be encouraged to get these published.

7. The organization for teaching disturbs me. Classes cannot begin when the semester starts. It takes a week to two weeks before both students and professors are fully functioning in the classroom. Mid-week holidays and "bridges" produce many missed classes. On weekends the university is locked. The library is only open after 2 pm on week days and closed weekends. There is not much student housing close to the campus. All of these items need some attention in order to develop a true scholarly environment.

8. There is a serious lack of laboratory space in chemistry and in soils for both teaching and research. They need space both for teaching and for their own research. The new building should solve most of the problem.

9. The genetics and plant breeding group lacks the common journals, especially from past years. Prof. Erickson and I have solicited back issues of

"Genetics" (1964-75); Journal of Heredity (1961-84); Canadian Journal of Genetics and Cytology (1966-80) which are being sent to IUTAD. We will continue to solicit additional issues and journals.

10. The university badly needs access to more computers for both students and faculty. The Procalfer computer doubled the computer capacity but Reitor Real is developing major plans for computerization. He should be supported in this effort.

VI. Closing:

IUTAD has made great progress in its few years of existence because of a strong leader and a group of dedicated faculty. I enjoyed working at IUTAD and have developed a great interest in the progress of the institution and especially that of the young faculty working on their degree programs. I hope to keep contact with some of them as an aid to their work.

Appendix 1
Thesis Proposal of
Ester Portela

INSTITUTO UNIVERSITÁRIO
DE
TRAS-OS MONTES E ALTO DOURO
VILA REAL PORTUGAL

PROPOSTA PARA A TESE DE DOUTORAMENTO EM:

"Disponibilidade em Potássio dos Solos de Trás-os-Montes"

1. INTRODUÇÃO

Os métodos actualmente utilizados entre nós para avaliar a disponibilidade dos solos em potássio não têm dado uma indicação adequada da fertilização potássica a efectuar. Os métodos utilizados baseiam-se na extracção do potássio por processos químicos sem que a maioria das propriedades dos solos que regulam o fornecimento de potássio à planta sejam considerados. Deste modo na maioria dos ensaios de fertilização potássica realizados em Portugal por *Almeida Alves*, este verificou que não só solos mal providos em potássio não dão resposta à adubação potássica, como solos bem providos naquele nutriente têm respondido positivamente à sua aplicação.

Reconhecemos pois a necessidade dum estudo mais aprofundado nesta matéria, nomeadamente sobre os factores do solo que mais influência têm no fornecimento do potássio às plantas, no sentido de se encontrar uma metodologia mais apropriada à avaliação da disponibilidade de potássio nos solos.

2. OBJECTIVOS

- Encontrar correlações entre alguns constituintes do solo nomeadamente, teor em argila e/ou limo e tipo de mineral de argila e o poder de fornecimento de K dos solos mais representativos de Trás-os-Montes
- Verificar o contributo do potássio não imediatamente disponível às plantas no fornecimento de potássio ao longo do tempo

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- Encontrar correlações mais estreitas entre vários métodos de extracção do potássio e as respostas das plantas à adubação potássica
- Prever e testar através do modelo mecanicista de Barber e Cushman a quantidade de potássio absorvido pelas plantas nos solos de Trás-os--Montes e correlacionar estes valores com as respostas das plantas ao potássio.

Através deste estudo, espera-se obter melhor compreensão dos mecanismos envolvidos na absorção do potássio pelas plantas e responder a algumas interrogações existentes relativamente aos métodos correntemente utilizados na avaliação do potássio disponível. Pretende-se ainda sugerir as necessárias alterações aos métodos actualmente utilizados ou propor uma metodologia mais apropriada às condições de Trás-os-Montes. Deste modo será possível recomendar as adubações potássicas de forma mais adequada e menos contingente.

3. ESTUDOS A REALIZAR

Os estudos que se pretendem realizar incidirão fundamentalmente em solos representativos das unidades pedológicas de Trás-os-Montes.

3.1. Análise mineralógica - análise semiquantitativa das fracções argila e limo para identificação dos minerais dominantes

3.2. Métodos químicos - para determinação do potássio biodisponível

- potássio solúvel
- potássio trocável
- potencial do potássio lábil (pAR_o)
- relações Q/I
- Outros métodos (Egner-Riehm, HNO_3 1N etc)

O potássio extraído por estes métodos será posteriormente comparado com o potássio extraído pelas plantas e/ou a resposta das plantas à adubação potássica.

3.3. Métodos biológicos

3.3.1. Ensaios em vasos com soluções nutritivas sob condições controladas de luz, temperatura e humidade. Esta metodologia é necessária na obtenção de parâmetros ligados às plantas para utilização do modelo de Barber e Cushman

3.3.2. Ensaios em vaso em diversos solos sob condições controladas de luz, temperatura e humidade para pedição de parâmetros ligados ao sistema solo-planta também necessários à aplicação do modelo de Barber e Cushman

3.3.3. Ensaios em vaso em diversos solos como uma planta teste com vista à exaustão do potássio através de cortes sucessivos da cultura com e sem adubação potássica.

4. CALENDÁRIO PROVISÓRIO

	1985	1986	1987
	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Colecta de amostras			
Análise mineralógica			
Análise química			
Ensaios em vaso			
Modelo de Barber			
Interpretação de resultados			

Parte dos estudos a realizar não tem viabilidade técnica em Portugal. Para tanto o proponente pretende deslocar-se aos Estados Unidos no sentido de adquirir a técnica necessária à aplicação do modelo de Barber e Cushman.

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5. CONDIÇÕES

5.1. Deslocações

5.1.1. Na região de Trás-os-Montes para colheita de várias amostras de terra destinadas aos ensaios em vaso e laboratoriais

5.1.2. Universidade de Braga e/ou Instituto Superior de Agronomia (ISA) e Estação Agronómica Nacional (E.A.N.) para:

- Pesquisa bibliográfica
- Realização de análise mineralógica das argilas
- Discussão com o supervisor do doutoramento Snr. Professor *Quelhas dos Santos* e com um especialista em estudos de potássio Snr. Engº *Vasco da Gama* (EAN).

5.1.3. Universidade de Purdue - Estados Unidos

A deslocação aos Estados Unidos deverá fazer-se por dois períodos de 2 meses compreendidos entre Julho e Setembro de 1986 e 1987. Os contactos com o Prof. *Barber* da Universidade de Purdue estão a ser já realizados através do Prof. *James Ahlrichs*. A proponente irá tentar a aquisição duma bolsa de estudo para suportar a sua estadia nos USA através de vários organismos e para a qual conta os bons ofícios do Reitor e Conselho Científico do IUTAD.

5.2. Material necessário

- Diverso material de vidro, suportes em madeira e reagentes
- Câmara de crescimento de plantas

5.3. Dispensa de serviço docente durante os anos de 1986 e 1987. O restante período de dispensa de serviço docente fica ainda em aberto (A partir de 1986 conta-se já com a presença da Engª Ana Luísa Tires recém-vinda dos Estados Unidos para assegurar a docência das disciplinas de Solos e Fertilidade e Fertilidade do Solo)

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Appendix 2
Research proposal of
Manuel Teles Oliveira

INSTITUTO UNIVERSITÁRIO
DE
TRÁS-OS-MONTES E ALTO DOURO
VILA REAL – PORTUGAL

EVOLUÇÃO DE HUMIDADE E TEMPERATURA EM SOLOS VITIVINÍCOLAS

O objectivo da medição da humidade e temperatura do solo sob vinha da região do Douro e cujo terreno é sujeito a diversos tipos de armação é determinar a influência das referidas armações no meio edáfico e consequentemente na evolução e produção da vinha. Os resultados obtidos serão, eventualmente, de ter em consideração quando da escolha da armação do terreno para instalação da vinha.

Os solos da região Duriense ocidental são muito delgados e rochosos e situam-se em terrenos com declives médios bastante acentuados. A seca sasonal na região e o pequeno armazenamento possível de água no solo obriga as plantas a procurarem água em zonas profundas já no estrato rochoso. Os tipos de armação do terreno modificam o meio físico edáfico assim como as características de intercepção da precipitação e radiação solar e também a escorrência superficial. Assim, é de esperar que as condições de temperatura de humidade e temperatura do solo sejam diferentes em cada uma das armações.

Para concretizar o objectivo enunciado seguir-se-á a evolução anual das temperaturas e humidades nos perfis verticais dos terrenos armados em socalco, em patamares e nos terrenos de vinha ao alto. No primeiro caso (socalco) os dados serão recolhidos em duas verticais: uma situada entre o muro de suporte e a linha interior de vinha, outra situada para além da linha exterior de vinha; admite-se que a meio do terreno existe uma situação intermediária. Nos terrenos armados em patamares serão escolhidas 3 verticais em espaçamento dependente da largura do patamar, mas situadas sempre perto do ponto mais elevado, do ponto inferior e a meio. No terceiro caso (vinha ao alto), a localização das verticais será semelhante ao dos patamares.

Numa primeira aproximaçao escolher-se-ão vinhas em terrenos de declive médio para a area considerada a armados pelos 3 processos indicados e com a mesma orientação geográfica (Norte ou Sul). Seguir-se-ão medições em declives superior e inferior no inicialmente escolhido e também uma orientação oposta à primeira.

... / ...

... / ...

Dadas as características edáficas e a necessidade de seguir a evolução dos parâmetros pontualmente, o processo de medição da humidade será o da sonda de neutrões; a medição da temperatura será indirecto usando a variação da corrente electrica em células de nylon enterradas a diversas profundidades.

A influência dos parâmetros considerados nas plantas deverá ser avaliada por uma (ou mais) variável. Deixo a escolha desta variável à vossa consideração.

Qualquer que seja a escolha, esta variável (P) reflete a influância dos parâmetros considerados. Assim, dentro de cada tipo de armação, P será função da humidade (h), da temperatura (t), do declive (d), e da exposição (y) e de várias interacções entre eles. De entre as interacções julgo que serão de considerar apenas as seguintes:

humidade x temperatura x declive
humidade x temperatura x exposição
humidade x temperatura x declive x exposição

Admitindo que P é função linear das variáveis consideradas pode-se estabalecer a relação

$$P = h + t + d + y + htd + hty + htdy + e$$

onde e é o erro experimental.

Três problemas devem desde já ser considerados.

Há necessidade de encontrar um processo de enterrar tubos de aço galvanizado em terreno muito rochoso por onde será baixado o elemento radioactivo da sonda de neutrões. Cada tubo deverá atingir pelo menos a profundidade de 1,20 m e deixar uma extremidade à superfície com cerca de 10 cm. O número de tubos necessário estará dependente do número de locais disponíveis para instalação das experiências, mas não podem ser inferior a 64.

As células de nylon ficam permanentemente no terreno e após o fim da experiência é de esperar que muitas delas estejam irreparavelmente deterioradas, e também algumas terão de ser substituídas ao longo da experiência. Admitindo medições de temperatura a 3 níveis em cada vertical, são necessárias cerca de 250 células cujo preço unitário rondará os 2,50 dólares americanos.

Por fim, há que considerar o volume de dados obtidos. A análise de dezenas de milhares de dados só será possível com recurso ao processamento automático.

Appendix 3
Hand-outs used in 1st
Seminar given 17 Oct. '84

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PARA UM MELHOR ENSINO UNIVERSITÁRIO

por:

Professor J.L. Ahlrichs,
Purdue University

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A qualidade do ensino universitário no mundo é bastante baixa. Normalmente os professores universitários não têm qualquer treino na arte e ciência de ensinar. Raramente lêem revistas ou livros sobre a teoria e prática de ensinar. Só os nossos estudantes, que se têm de sentar nas salas de aula por muitas horas, certamente sabem como eficazes ou ineficazes nós somos.

Felizmente não é difícil ser um bom professor!

Vamos primeiro analisar alguns papéis do professor e então sugerir algumas práticas simples para melhorar o ensino. No processo mencionaremos vários "princípios de aprendizagem". Finalmente teremos que discutir como construir um sistema de melhoramento no nosso ensino de modo que cada ano nós sejamos melhores professores, embora este último item tenha de esperar por outro artigo.

Três dos papéis do professor são:

1. Perito
2. Autoridade Formal
3. Auxiliador

Nós somos os "Peritos" nas nossas disciplinas. Pode haver outros mais hábeis, mas quase todos os professores universitários são suficientemente hábeis para os estudantes que eles ensinam. Certamente que devemos continuar a nossa formação profissional, lendo e investigando. Porém é característico dos novos professores preocuparem-se por serem insuficientemente hábeis quando, de facto, a sua maior fraqueza normalmente está no papel da "Autoridade Formal" e no papel de "Facilitador". Os estudantes criticarão alguns professores ineficazes por saberem demasiado do assunto. Na realidade não é que eles saibam demasiado (sejam demasiado "Peritos"). É que eles não desempenham bem os papéis 2 e 3.

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Papel 2. " Autoridade Formal" significa que o professor decide. Neste papel revêm-se pesquisas passadas e todos os livros e artigos de revistas escritos acerca do assunto e então decide-se qual a pequena porção que é importante para os estudantes no seu primeiro, segundo ou subsequentes semestres dessa disciplina.

Neste papel de "Autoridade Formal" nós professores também standardizamos os graus e fazemos os testes.

Muitos de nós falhamos em vários aspectos do papel 2. Segundo a "Autoridade Formal" nós fazemos uma certa selecção do que é importante, mas depois não partilhamos as nossas decisões com os estudantes ou se partilhamos as nossas decisões elas são vagas e gerais. Por exemplo, um professor de solos , biologia ou química que diz que um dos seus objectivos para os estudantes é "compreender as reacções redox" não se está a ajudar muito a si próprio nem aos seus estudantes porque os cientistas estão ainda a dispender muitos anos de trabalho para compreender os sistemas redox. O que dizemos deve ser mais definido do que isso!

Outro falhanço no papel de "Autoridade Formal" é o de ensinar uma coisa e examinar sobre outra. Podemos não pensar que o estamos a fazer, mas muitas vezes fazê-mo-lo. Assim nós adicionamos o título de "desonesto" ao nosso título de "ineficaz".

Papel 3. "Auxiliador", é o papel de ajudar os alunos na sua aprendizagem. Se nós na verdade desejamos ajudar os alunos e se na verdade sabemos alguma coisa sobre os "Princípios da Aprendizagem" então nós podemos realmente facilitar o sucesso que os estudantes têm com a nossa disciplina.

A maior parte dos professores universitários falam demais. O provérbio Chinês que diz "Diz-me e eu esquecerei" também diz "Mostra-me e eu talvez me lembre" e "Envolve-me e eu perceberei". Este provérbio deve-nos dar algumas

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indicações porque falhamos como "Auxiliador"

MELHORAMENTOS:

Vejamos os melhoramentos que se podem fazer. Você é um "Perito" na sua disciplina e eu sou um "Perito" na minha, portanto não precisamos de ir mais longe na discussão do papel 1. Faremos os nossos melhoramentos no papel 2 e 3.

No papel 2, o da"Autoridade Formal" devemos decidir primeiro o que é que os estudantes devem estar aptos a poder:... (esboçar, explicar, resolver, identificar, recitar, construir, comparar, acertar, etc.) e também as condições segundo as quais se espera que eles façam isso. Por exemplo não lhes podemos pedir que "compreendam as reacções redox". Compreensão é uma coisa ainda inacabada, nebulosa sobre a qual não se deve, de modo algum, testar. Em vez disso nós devemos pedir-lhes que: dados os produtos da oxidação do sulfato ferroso pelo ácido crómico, os alunos sejam capazes de apresentar a equação e acertá-la". Agora temos alguma coisa específico para ensinar e eles tem algo específico para aprender [1].

Talvez nós queiramos mais conhecimentos acerca das reacções redox. Neste caso escreveremos seis ou oito ou mais objectivos. Outro exemplo pode ser "dando os estados de oxidação dos reagentes e dos produtos, deve ser capaz de acertar qualquer reacção redox". Nós dizemos-lhes o que eles precisam de saber fazer e as condições segundo as quais eles devem poder fazê-las.

Qualquer pequena unidade de trabalho, tal como reacções redox, deve provavelmente ter de 5 a 15 objectivos expressos daquele modo. Digamos que temos 10 objectivos em reacções redox. Nós professores precisamos desses objectivos antes de começarmos a preparar as nossas aulas, e os estudantes pre-

(1) - *Para mais informações leia o pequeno livro de R.F. Mager "Preparing Instructional Objectives", ed 2, Fearon Publishers Inc., Belmont, CA, USA.*

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cisam da sua copia antes da liçao ser dada. Agora estamos organizados! Temos os objectivos claramente situados para os estudantes. Devemos ensinar-lhes a fazer essas 10 coisas. Eles sabem agora o que é que têm de ser capazes de fazer, e podem decidir o que podem fazer e o que não podem. Sabem o que devem estudar e em que tópicos precisam de ajuda.

Finalmente escrever o exame é agora muito simples. Escreveremos cautelosamente perguntas que caibam nesses 10 objectivos. Cautelosamente significa que, se dissermos nos nossos objectivos que daríamos os produtos e os reagentes, e os alunos teriam de acertar a equação, então a pergunta do nosso teste tem de dar os produtos e os reagentes, e os alunos têm de a acertar. Escreveremos o teste directamente dos objectivos escritos. Nós sabemos que somos mais hábeis do que os jovens estudantes a fazer equações redox, não precisamos pois de provar a nossa superioridade,destruindo os seus frágeis egos com perguntas "desonestas". Perguntas honestas são aquelas escritas para testar os objectivos estabelecidos.

Escrever bons objectivos nao e fácil mas vale a pena. Organiza-nos . Para os estudantes um professor organizado tem mais valor. Com os nossos objectivos dactilografados e nas mãos, os estudantes têm um bom guia para o nosso ensino e consequentemente damos exames justos e honestos. Tudo isto é bom para a moral dos estudantes, e a credibilidade do nosso programa de ensino melhora. Objectivos bem escritos têm outros aspectos positivos, mas não temos aqui espaço para o discutir.

Para o papel 3 o de "Auxiliador" precisamos de procurar maneiras de ajudar o estudante a aprender. Há alguns princípios de aprendizagem que podem ser-nos úteis no nosso ensino? Penso que sim.

O PRINCÍPIO DA "PARTICIPAÇÃO ACTIVA": Lembre-se do provérbio Chinês "Envolve-me e eu compreenderei". Um estudante que apenas junta qualitativamente sulfato ferroso e ácido crómico, para ver mudar o ião crómico laranja para o ião cromoso verde durante a redução em que foi envolvido. Este princípio

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"Participação Activa", é a justificação para as aulas práticas, mas eu creio que o envolvimento deve também estar presente nas aulas teóricas.

O PRINCÍPIO DA "PRÁTICA": qualquer coisa experimentada muitas vezes é lembrada por mais tempo e evocada mais fácilmente. Então no nosso ensino devemos dar oportunidade aos nossos estudantes de usar coisas repetidamente depois de as terem estudado primeiro.

O PRINCÍPIO DO"CONTRASTE": trabalhar primeiro com o mais elevado contraste tal como um solo novo e pouco evoluído contra um solo velho e muito evoluído, o que lhes realça as diferenças. Mais tarde será mais fácil detectar menos diferenças em solos com evolução mais semelhantes.

O PRINCÍPIO DE "DIFERENÇAS INDIVIDUAIS": alguns estudantes aprendem através da explicação na aula, alguns preferem ou precisam de diferentes explicações em livros de texto, e alguns podem precisar ou querer ajuda particular. Tomaram a precaução de ensinar o mesmo material de diferentes maneiras? Lembrem-se que não é importante qual o método que os estudantes usam para aprender. O importante é que aprendam.

O PRINCÍPIO DE "ESTAR PRONTO A CONTINUAR": o estudante pode não estar pronto para aprender o próximo degrau em cálculo, hoje, quando nós lho tentamos ensianr, porque ainda está confuso acerca de um pormenor em trigonometria do qual precisa para o seu próximo degrau em cálculo. Amanhã quando ele tiver aprendido o pormenor em trigonometria de que ele precisava, ele estará pronto. Estará então alguém do nosso grupo de professores disponível para ajudar? Isto implica que nós devemos arranjar no nosso grupo de professores alguém sempre disponível para esses estudantes fora das aulas normais.

Estes poucos princípios (há outros) podem-nos dar ideias como ajudar os alunos a aprender. Cada um dos nossos objectivos (lembrem-se do papel 2) deve ter a melhor maneira de ser ensinado (com experiências, demonstrações,

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slides, filmes, esquemas no quadro, conversação etc.) mas se achamos que a nossa melhor maneira em cada objectivo é somente falar acerca dele, então quase de certeza que nós somos fracos "Auxiliadores". Boas espécimes, de - monstrações, ilustrações, figuras etc., dão um forte suporte às nossas palavras.

— CONCLUSÕES —

Os estudantes esperam que o professor seja um perito e nós somos. Eles esperam do professor que:

1. seleccione o que é importante
2. os ajude a aprender isso
3. e os examine honestamente para determinar se eles aprenderam ou não.

Para os ajudar a aprender esperam boa assistência (baseada em princípios de aprendizagem) de professores simpáticos que arranjam tempo para ajudar os estudantes. Estas sao aspiraçoes razoaveis.

Como professores estamos empregados para ajudar gente jovem a aprender. Se seleccionarmos e escrevermos boas objectivas para cada dia de trabalho, compartilharmos esses objectivos com os estudantes, procurarmos as melhores maneiras de ensinar cada objectivo, e examinarmos por esses mesmos objectivos, então teremos um melhor ensino universitário .

Effecting pre-class study[1]

J. L. Ahlrichs[2]

ABSTRACT

A method of effecting pre-class study by all students in a course is based on a weekly study package. The package includes a study guide listing instructional objectives to guide the student's study, and the reading and homework assignments. Attached to the study guide are figures, equations, and data from sources not readily available to the students, reprints of journal articles, and problem sets. The package also includes a brief audio-tape. The tape and the study guide, with its attached material, are taken home with the student to direct the pre-class study. Use of this material produces class meetings which are exciting discussions among knowledgable people, rather than periods of lecturing at students.

THE knowledge which we expect our students to gain does not all require explanation by the instructor. Therefore, class time can be used most efficiently if students have studied the subject matter in advance and already understand much of what we would like them to know. We can then truly have an intelligent discussion among a group of knowledgable people.

Establishing a pattern of studying a subject in advance of class lecture or discussion has typically been attempted with reading assignments or problem sets. It has been difficult to get serious preclass study with either of these techniques. Reading assignments, unless very carefully selected and delineated, do not clarify to student what we, as teachers, deem important; so, students typically wait until after lecture to do their reading. Thus, reading assignments become directed reading after the lecture rather than pre-class reading. Likewise, problem sets often need prior class discussion to make them meaningful or even solvable; they are not a good tool to implement study prior to class.

If students consistently study prior to class meetings, the meetings can become exciting with much efficiently used discussion. The difficult and the complex aspects of topics can be the focus of concentration because students have already learned the routine and obvious. Lecture periods then become animated with discussion.

A versatile system for stimulating pre-class study has been successfully used in a senior-graduate level course in Soil and Plant Analysis. The class meets twice each week for lecture with a 3-hour laboratory following the second lecture. The course is organized into weekly topics. Each topic receives 5 hours of class attention.

A package, which I have at times called the "Take-Home Teacher," is given to each student 1 week in advance of each topic. The package always has a "Study Guide" which opens with 6 to 12 instructional objectives, written mostly in the cognitive domain and in the manner of Mager (2), or Kibler et al. (1). The objectives tell the students what I expect them to learn. The first page of the study guide also contains carefully selected paragraphs, pages, and chapters which the students should read. Keeping the required reading pertinent and sufficiently brief encourages all students to read it. The second and subsequent pages of the study guide contain equations, graphs, flow diagrams, tables, and sample problems which are neither in their reading material nor readily available to them.

The package may also include journal reprints or mimeographed and photocopied procedures, problem solutions, or problem sets. Finally, the package usually includes a cassette audio-tape with 15 to 45 minutes of the professor's comments designed to direct students in their study and to explain complicated equations or other difficult items in the study guide.

The packages for pre-class study vary from extremes of a one page study guide with a 25 minute, directive, audio-tape, to a three page study guide with two attached journal article reprints, a problem set and a 40 minute audio-tape, to a five page guide with no tape or reprints. Audio-tapes are not necessary to the system. Study guides can be made more complete and eliminate the necessity for the tape. However, written evaluative comments at the end of the semester always include many voluntary statements about the value of the tapes for the pre-class study and many students ask for tapes to be developed for the weeks currently handled without them.

Directive comments for a second week are on the reverse side of the tape making tape exchange necessary only biweekly. Most students have personal cassette players, but several players are available in a small study room adjacent to the laboratory. This room also contains reference books belonging to the professor and a folder of auxillary materials for students to use as they study.

The system operates as follows: when the first meeting of the week convenes the students have already had the study materials for one complete week. Class typically opens with student questions. Intense discussion follows, mixed with occasional mini-lectures by the professor. The hour typically closes with a short quiz to help assure that students do study in advance. The second meeting continues the open discussion and often includes special short lectures based on difficulties ex-

[1] Educational Journal Paper No. 3, School of Agric., Purdue Univ., W. Lafayette, IN 47907.

[2] Professor of agronomy.

posed by the students in the previous discussion. This second meeting is the hour directly preceeding the 3-hour laboratory on the topic under discussion. Therefore, there is flexibility to expand or shorten the various types of teaching activities over the span of 4 hours.

Effective tapes are short and designed to direct study. They are not complete lectures. After explaining or simplifying a difficult equation or relationship it may be best to direct students to well-written paragraphs in their text for the next topic rather than to discuss the simpler or well-presented topics on the tape. Listening is slower than reading.

This format works well for small enrollment courses we commonly have at the senior or graduate level. We have used it in a course which has 15 to 30 students. When enrollment gets large, then open discussion becomes more difficult and the logistics of tape exchange and providing the study packages gets more complicated.

Successful use of the pre-class study system, the Take-Home Teacher, has made the classroom an exciting time to discuss the substantive aspects of the course. It has permitted deeper probing of subjects because time is not wasted on the routine and easier material. The classroom is much more stimulating to the teacher, as well as to the students. It is exciting to have knowledgable students discussing and challenging the literature and the professor's comments. It certainly makes classroom activities a more professional experience for both students and professors.

LITERATURE CITED

1. Kibler, R. J., L. L. Barber, and D. T. Miles. 1970. Behavioral objectives and instruction. Allyn and Bacon Inc., Boston, MA.
2. Mager, R. F. 1975. Preparing instructional objectives, 2nd edition. Fearon Publ. Inc., Belmont, CA.

Appendix 4
Outline for 2nd Seminar
given 19 Oct. '84

TEACHING

A Seminar for Both Students and Teachers

James L. Ahlrichs, Professor of Agronomy, Purdue University

Objectives:

To analyze how well we are serving our IUTAD students and to discuss what is good and what we might change.

To analyze how our graduate training is progressing and how it should evolve in the future.

To discuss how we can best function as a faculty for our own benefit and for the students benefit.

How are we doing as a teaching university?

1. Undergraduate:

   Helping students develop

   - Advisors
   - Seminars
   - Teaching Aids
   - Program Flexibility

2. Graduate Training:

   a. Where

   b. How

   c. Evolving Graduate Training at IUTAD

   d. Libraries, labs

3. Faculty

   a. Interaction and attitude

   b. Division of labor