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**PORTUGAL UNIVERSITY  
INSTITUTES  
DEVELOPMENT PROJECT**

(Contract AID/NE-C-1701) 1500001

**REPORT ON  
SHORT-TERM STAFF ASSIGNMENT**

Submitted by  
**DR. DANIEL GIANOLA**  
Department of Animal Sciences  
University of Illinois  
Urbana, Illinois

**June 21 through July 12, 1985**

PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT  
(Contract AID/NE-C-1701)

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REPORT ON  
SHORT-TERM STAFF ASSIGNMENT  
AT THE  
INSTITUTO UNIVERSITARIO DE TRAS-OS-MONTES E ALTO DOURO  
VILA REAL, PORTUGAL

June 21 - July 12, 1985

Submitted by

DR. DANIEL GIANOLA  
Department of Animal Sciences  
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PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

Report on Short-term Staff Assignment

AREA OF CONSULTANCY

Quantitative genetics and statistics, Instituto Universitario de  
Tras-os-Montes e Alto Douro (IUTAD), Vila Real, Portugal.

SPECIFIC OBJECTIVES

Supervision and follow-up of research programs of Drs. J. A. Cola  
and F. A. Macedo, in connection with their plans of "Doutoramento." The  
above research programs, in animal breeding and biometrics, respectively,  
were developed in August - October 1984 during the first visit of the  
consultant to IUTAD.

COUNTERPARTS

Work was with Drs. Jorge A. Colaco (Department of Animal Science)  
and Fernando Anibal Wolfango de Macedo (Department of Mathematics).  
These people provided scientific and logistic support during the assignment.

ACCOMPLISHMENTS

A detailed itinerary and work schedule is given in Annex A. Because  
the assignment was essentially one of follow-up and supervision, most of  
the time was spent in reviewing the accomplishments of Drs. Colaco and  
Macedo during the period October 1984 - June 1985. The expectations that

the consultant had regarding these accomplishments are outlined in the report pertaining to the 1984 assignment.

#### Dr. Colaco's Work

Dr. Colaco's teaching duties during the period October 1984 - June 1985 were considerably decreased by IUTAD authorities, as the consultant had requested in 1984.

He was sent to INIA, Spain, to conduct the bibliographic search necessary to support his research. During this visit to Spain, Dr. Colaco collected a number of papers, books and scientific materials not available in Portugal. This component of the program was highly successful and, in addition, excellent relationships have been developed with the INIA group working in genetic improvement of animals. This can have an impact on potential future cooperation in teaching and research programs between IUTAD and INIA.

Virtually no progress was made during the above period concerning the transcription of milk production records from raw form to a computer readable medium. The reasons for this are several and are discussed in this report in the section "IDENTIFICATION AND ANALYSIS OF PROBLEMS ENCOUNTERED." This situation prompted the consultant to write a memorandum to the Rector of IUTAD in which the problem was discussed and solutions suggested. This memorandum is in Annex B and an English translation in Annex C.

The consultant had recommended that Dr. Colaco take a short course in FORTRAN programming at some institution in Portugal so as to obtain the necessary foundation to undertake the data processing component of his research. Unfortunately, this did not occur and the apparent reasons for that are discussed in the subsequent section.

Dr. Colaco made very significant progress in his understanding of modern techniques of genetic evaluation of animals. He studied a large number of relevant papers and demonstrated that he had absorbed effectively the materials taught by the consultant in the two courses offered at Vila Real in 1984.

We discussed in detail seven chapters (Chapters 22-28) of the book by C. R. Henderson "Applications of Linear Models of Animal Breeding," University of Guelph. This material represents the most advanced account of techniques of genetic evaluation currently available in textbook form. Thus, Dr. Colaco has now the theoretical background to undertake advanced research in sire and cow evaluation with a sharp focus on Portuguese milk recording data.

Dr. Colaco's research proposal was sharply focused during the visit of the consultant to Vila Real. Some possible areas of attack in his research are now:

- Assessment of the effectiveness of age correction factors developed in other countries under Portuguese conditions.
- Development of national age correction factors using local data.
- Study of potential differences in degrees of maturity between commercial and registered cows and development, if necessary, of separate age correction factors for the above categories of animals.
- Estimation of variance-covariance components among herds, cows within herds, and within cows.
- Assessment of possible heterogeneity in dispersion structure across strata of management or production as measured perhaps through level of fat test.
- Evaluation of producing ability of cows by BLUP techniques.
- Estimation of genetic parameters and sire evaluation from pedigreed data kindly offered by Prof. L. S. Monteiro, Universidade do Porto. Prof. Monteiro agreed to make available

a few thousand pedigreed records for Dr. Colaco's research. In a letter to Prof. Monteiro dated July 22, 1985 (Annex D), the consultant sent the requirements for a magnetic tape to be readable by the Cyber 175 or IBM 4341 computers available at the University of Illinois, where a large part of the data processing will be conducted.

#### Dr. Macedo's Work

IUTAD considerably reduced Dr. Macedo's teaching load, as recommended in the report submitted by the consultant in 1984. Unfortunately, (from the viewpoint of the activities envisaged in this specific component of the project) Dr. Macedo became actively involved in the final preparation of a book on forest fires, work which had begun a few years ago. Hence, the amount of time available to Dr. Macedo for critical study of Bayesian statistics was less than that originally anticipated.

Dr. Macedo spent approximately one month in INIA, Spain, collecting bibliography on Bayesian statistics and, more specifically, on estimation of variance and covariance components. The material he obtained is highly pertinent to the outline of the thesis described in the 1984 report and should be very useful for conducting the research planned.

Dr. Macedo participated in all discussions on Chapters 22 - 28 of C. R. Henderson's book as described above, and this should be of great value to develop the interphase between his work and that of Dr. Colaco's, as it had been planned originally.

#### Potential Liaisons With Other Groups

Discussions were held with Prof. L. S. Monteiro so as to coordinate research work in dairy cattle breeding and to minimize possible overlaps. Prof. Monteiro has prepared a data set consisting of approximately

5000 cows, daughters of 230 sires in 14 herds. This data set overlaps somewhat with Dr. Colaco's, but it contains the feature that the sires of the cows are identified, which is an essential requirement for sire evaluation and for estimation of genetic parameters. This is the result of a titanic effort done by Prof. Monteiro attempting to coordinate information from two Ministry of Agriculture sections (milk recording and herdbook), which at present seem to function independently and with some degree of "territoriality." Unless a more fluid liaison is established between these two units, it will prove to be very difficult to implement dairy sire genetic evaluation on a national scale and, more importantly, to design optimal young sire testing programs.

The consultant was pleased to have an opportunity to visit the "Unidade de Investigacao e Servicos de Epidemiologia Economica" (UISEE), coordinated by Prof. F. J. Tilak Viegas at the Escola Superior de Medicina Veterinaria, Lisbon. This unit is working closely with Prof. Monteiro in planning a future implementation of best linear unbiased prediction in Portugal. It appears that this group has a very clear picture of the current constraints to dairy cattle breeding in the country, and they have access to excellent computing equipment.

The consultant gave a conference at the Excola Superior de Medicina Veterinaria in Lisbon on sire evaluation and its feasibility in Portugal including: 1) objectives, 2) methodologies, 3) selection biases, 4) computability, and 5) minimal requirements. The presentation was followed by a lively discussion involving about 30 persons working in different aspects of dairy production in Portugal.

## IDENTIFICATION AND ANALYSIS OF PROBLEMS ENCOUNTERED

The main problems encountered include: a) the inability of Dr. Colaco to transcribe the milk recording data into a computer readable form so that they could be processed at the University of Illinois or elsewhere; b) the apparent non-availability of short-courses (1 month or so) so that Dr. Colaco could rapidly learn the basis of FORTRAN programming, and c) the fact the Dr. Macedo devoted considerable time to activities (e.g., book on forest fires) that had not been anticipated during the 1984 assignment.

The first problem seemed to be largely beyond Dr. Colaco's control. Incompatibility of equipment, diskette sizes and other reasons involving inadequate data processing equipment and limited coordination between services, made this task exceedingly difficult. Retrospectively, it would appear that this could have been done at Lisbon or Porto. However, it is not clear whether this alternative was available at the appropriate time. Further, it appears that neither Dr. Colaco nor IUTAD could have afforded to provide the 1000-1500 man-hours of work required to complete this task extramurally and its associated costs, monetary and institutional.

Regarding the short course in FORTRAN programming, Dr. Colaco made inquiries with the Universidade do Minho (Braga), but apparently the available courses would have required that he stay outside of Vila Real for much longer than 1 month, thus creating professional and personal difficulties for Dr. Colaco.

Dr. Macedo stated that it was imperative for him to finish a book on forest fires, an endeavor which he had started with a colleague a few years ago. Clearly this was a factor competing for the limited time

available for study and reflection. Thus, Dr. Macedo did not progress sufficiently in his research program.

#### FUTURE REQUIREMENTS AND PROPOSED ACTION

1. It is recommended that Drs. Colaco and Macedo each spend a total of 16 months (August 20, 1985 - December 20, 1986) at the University of Illinois, as opposed to the 12 - 14 months recommended in the 1984 report. This would enable them to make up for the time lost and to work directly under the supervision of the consultant. Further, this would be done against the background of an excellent "critical mass" as available at the University of Illinois.

2. The project should provide support to contract student help at the University of Illinois to enter the approximately 70,000 records (13 variables per record) that Dr. Colaco would use in his research. We estimate that this would require about 1000-1500 hours of work at a cost of about \$4,000 - \$6,000 (\$4 per hour of student help). Clearly, it would be unwise that Dr. Colaco spend such a large portion of his time during his stay at the University of Illinois engaged in a largely mechanical activity.

3. I recommend that the project purchases a powerful small computer, e.g., an IBM-PC-AT with 370 enhancement, allocated as part of the research budget customarily available to USAID sponsored trainees. This computer and the peripherals (at a total cost of about \$6,000) would be purchased at the University of Illinois during the stay of Drs. Colaco and Macedo and then brought to Portugal at their return. This would give them considerable flexibility and computing power, and the item

would be in lieu of the approximately \$6,000 that the project would have to pay the University of Illinois computing center in the event that the data processing were undertaken here. Also, this computer could be used to upgrade the computing facilities of IUTAD, and would provide backup to a future Biometrics Unit, which I proposed to develop within IUTAD's Department of Animal Production (see the 1984 report, page 11). The funds to purchase the computer should be made available to Drs. Colaco and Macedo as soon as possible after their arrival to the University of Illinois. IUTAD's authorities are in agreement with this proposal.

4. It is recommended that while in the United States, Drs. Colaco and Macedo be permitted and supported to attend the Third World Congress of Genetics Applied to Livestock Production which would take place at the University of Nebraska, Lincoln, July 17-22, 1986. This would be an important opportunity to interact with world leaders in this field.

5. It is essential that IUTAD's Department of Animal Production develops a stronger liaison with the groups of Prof. Tilak Viegas and Monteiro in Lisbon and Porto, respectively. Portugal cannot afford duplication in research efforts in the domain of animal production.

6. Upon the return of Drs. Colaco and Macedo to Portugal, a 3-4 week supervision mission should take place in June - August 1987. The final supervision should occur at the time that their "theses de doutoramento" are drafted and ready for evaluation before distribution to the respective committees.

**ANNEX A**

**Itinerary and Work Schedule**

ANNEX A: ITINERARY AND WORK SCHEDULE

- June 21: Departure from Champaign airport
- June 22-23: Lisbon
- June 24: Lisbon to Vila Real, by automobile
- June 25: a) Discussion of Dr. Colaco's data set and identification of problems encountered during the period October, 1984 - June, 1985.  
b) Review of reading program assigned to Drs. Colaco and Macedo in October 1984.
- June 26: a) Meeting with Prof. Torres Pereira to discuss technical and financial aspects of project. b) General discussion on methods of cow evaluation, statistical models and computing procedures. c) Attendance at examination of candidate for admission as Assistant in IUTAD.
- June 27: a) Continuation of discussion on cow evaluation models. b) Analysis of Chapter 22 of "Application of linear models to animal breeding", by C. R. Henderson, University of Guelph Press. c) Beginning of preparation of handout on inversion of additive relationship matrices using the algorithm of Quaas.
- June 28: Visit to Prof. L.S. Monteiro, Instituto de Ciências Biológicas "Abel Salazar", Porto, to discuss the research project of Dr. J. A. Colaco, and to coordinate efforts in dairy cattle breeding research.
- June 29-July 11: Vila Real. a) Discussion and analysis of Chapters 23-28 of C. R. Henderson's book including the following problems: sire evaluation models, "animal" and repeatability models, sire

evaluation with repeated records, multiple trait analysis with "animal" and sire models, and multiple traits. b) Preparation of handout on Quaas' algorithm. c) Discussions with Rector and vice-Rector regarding the forthcoming trip of Drs. Macedo and Colaco to the United States. d) Study of genetic evaluation with heterogeneous variance and relationships between best linear unbiased prediction and translation invariance functions. e) Analysis of canonical transformations as a computational device, and of restricted maximum likelihood when the variance-covariance structure is unknown. f) Review of the design and analysis of a feeding experiment with trout.

July 12:

Lisbon. a) Visit to "Unidade de Investigacao e Servicos de Epidemiologia Economica" (UISEE), at Escola Superior de Medicina Veterinaria, led by Prof. F. J. Tilak Viegas. b) Presentation of a conference on "Sire evaluation and its feasibility in Portugal" at the Escola Superior de Medicina Veterinaria. End of Assignment.

July 17:

Lisbon-New York, New York-Champaign.

ANNEX B

Letter to Reitor Fernando Nunes Real



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

Exmo. Senhor  
Reitor, Prof. Dr. Fernando Nunes Real,  
Instituto Universitário de Trás-os-Montes  
e Alto Douro - IUTAD  
VILA REAL

Destina-se este memorando a apresentar a V. Exa. certos aspectos relacionados com a projectada estadia dos *Drs. Jorge Colaço e Fernando Wolgango de Macedo* na Universidade de Illinois, com início previsto para 20 de Agosto de 1985, no âmbito dos seus projectos de doutoramento a executar, pelo menos parcialmente, ao abrigo do contrato AID/NE - C - 1701 "*Projecto de Desenvolvimento dos Institutos Universitários de Portugal*", com a Universidade de Purdue.

Como consultante desse projecto e na qualidade de co-orientador científico das investigações a levar a efeito pelos colegas acima referidos, gostaria de apresentar à consideração de V. Exa. algumas sugestões relativas às suas actividades na Universidade de Illinois, Urbana - Champaign. Embora a minha presente estadia se tenha iniciado apenas há dois dias, penso que alguns dos seguintes aspectos merecem atenção imediata, com vista a maximizar os resultados desejados dessas investigações, que terão impacto a curto prazo e longo prazo nas actividades do próprio IUTAD.

1º) *Duração da estadia em Illinois*

Nas páginas 9 e 11 do meu relatório sobre as actividades realizadas no ano passado no IUTAD, no período de 10 a 31 de

Agosto e de 17 de Setembro a 16 de Outubro, recomendava-se que o *Dr. Colaço* deveria permanecer cerca de 12-14 meses na Universidade de Illinois, tendo sido recomendada para o *Dr. Macedo* uma estadia de 12 meses.

Os *Drs. Colaço* e *Macedo* trabalharam diligentemente para cumprir os requisitos por mim estabelecidos como necessários para que pudessem aproveitar de uma estadia prolongada na Universidade de Illinois. No entanto, o *Dr. Colaço* não pode encontrar em Portugal uma instituição que lhe facultasse treino de programação em linguagem FORTRAN (ver pag. 6 de meu relatório), e não pode ultrapassar as dificuldades encontradas para a digitalização dos registos de lactações, indispensáveis para a sua investigação, totalizando cerca de 70 000 registos, contendo cada um 13 variáveis. Penso que estes dois aspectos do seu projecto são essenciais e, em virtude das dificuldades locais, sugiro que sejam realizados na Universidade de Illinois.

Assim, recomendo que o *Dr. Colaço* possa permanecer na Universidade de Illinois durante 16 meses (desde 20 AGO 85 a 20 DEZ 86) em vez dos 12-14 meses inicialmente previstos. Visto que a actividade do *Dr. Macedo* se interliga com a do *Dr. Colaço*, recomendo também para ele uma estadia de 16 meses, o que lhe permitirá obter maior preparação em *Biometria* e *Estatística* e, o que é importante, progredir mais rapidamente na redacção da sua tese sob a minha orientação directa. Penso que deste modo estará numa fase mais avançada da preparação da sua tese, em Dezembro de 1986, do que estaria se regressasse a Vila Real em Agosto de

1986, e tivesse que trabalhar isolado, sem apoio de uma massa crítica,

Devo ainda referir que o *Prof. C.R. Henderson*, a maior autoridade mundial nas aplicações da estatística ao melhoramento genético animal deverá estar em Illinois de Julho a Dezembro de 1986. Assim, cinco meses de contacto entre os *Drs. Macedo e Colaço* e o *Prof. Henderson* seriam um importante factor do seu desenvolvimento profissional.

29) *Aquisição de um micro-computador*

Como me foi comunicado pela Universidade de Purdue, é costume, quando investigadores subsidiados pelo USAID visitam Universidades americanas, a elaboração de um orçamento para investigação. Dado que o trabalho dos *Drs. Macedo e Colaço* não é experimental, os custos das suas actividades de investigação referem-se essencialmente ao acesso a computadores e tempo de sua utilização. Fiz portanto uma estimativa aproximada de US\$ 3 000 para cada um, de modo a cobrir essas despesas com computação. Mas julgo agora que seria mais útil para o IUTAD se esses 6 000 dólares fossem antes usados para adquirir um micro-computador, por exemplo, um IBM PC-AT/370 ou IBM PC-XT/370, que seria posteriormente trazido para o IUTAD, facultando aos *Drs. Macedo e Colaço* facilidade e potência de cálculo, e melhorando substancialmente a capacidade do IUTAD nesse domínio, actualmente ultrapassada e não compatível com a sua dimensão e prestígio. Esse computador seria posto ao serviço da Unidade de Biometria, que propôs se deveria criar no Departamento de Zootecnia (ver págs. 11 e 12 do meu relatório do ano passado).

Devo notar que a compra desse micro-computador se deveria fazer logo após a chegada aos Estados Unidos. Tentar-se-á reduzir o custo de aquisição, aproveitando a oferta da IBM, de grandes descontos a alunos e professores da Universidade de Illinois, de que estes beneficiam desde há pouco tempo. No caso de haver saldo nessa aquisição, seria dispensado na compra de um conjunto de programas de estatística, por exemplo SAS (Statistical Analysis System), que seria posto posteriormente à disposição dos investigadores do IUTAD.

3º) *Registo de dados do "Contraste Lático-manteigreiro"*

No meu relatório do ano passado (págs.6 e 9), sugeri que o *Dr. Colaço* utilizasse na elaboração da sua tese os dados dos registos leiteiros. Supunha-se então que durante o período de Outubro de 1984 a Junho de 1985 seria possível digitalizar cerca de 70 000 registos (13 variáveis por registo) em formato utilizável por computador, de modo a estarem prontos para análise na Universidade de Illinois. Devido a gralhas e informação incompleta supõe-se que apenas 10-20% desses dados se prestarão a processamento final. Infelizmente, e por motivos que parecem não ser imputáveis ao *Dr. Colaço*, não se procedeu ao registo em diskettes, como previsto, devido a incompatibilidade de equipamentos dimensões das diskettes e outros factores, que complicaram sobre maneira essa tarefa rotineira. E sem dados não se poderá elaborar a tese. Além disso, tal ficheiro de lactações constitui talvez o mais volumoso conjunto de dados disponível em Portugal para fins de investigação aplicada no do

mínio da genética e da produção leiteira, e julgo que seria do interesse do IUTAD a iniciativa de criação (e actualização) de tal ficheiro para investigação, que facilitaria futuros estudos e daria ao IUTAD a liderança em Portugal no que se refere a investigações no domínio da produção leiteira.

Visto que não se pode esperar que uma tarefa que não foi realizada em 8 meses venha a ser executada nos dois meses que faltam para a partida do *Dr. Colaço* para os Estados Unidos, proponho que tal digitalização se faça nos Estados Unidos, o que tem a vantagem de eliminar qualquer risco de incompatibilidade entre suportes magnéticos e equipamentos a serem usados. Estima-se que é necessário 1 minuto para digitalizar cada registo com 13 variáveis, o que daria 1 500 hora x operador, isto é, o que daria trabalho de um operador de registo de dados.

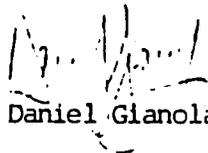
Evidentemente que o *Dr. Colaço* terá outras tarefas a realizar durante a sua estadia em Illinois, e não seria sensato, em termos de higiene mental, que ele dedicasse esse tempo à digitalização de dados. Assim, proponho que se inclua no orçamento para investigação, o pagamento de estudantes, tarefeiros para digitalizarem o ficheiro para processamento por computador. De acordo com as tarifas actuais, tal tarefa é paga a US\$ 4,00/hora, sendo portanto o custo total de criação do ficheiro digital de US\$ 6000. Se fossem contratados 8 estudantes poderia executar-se essa tarefa em cerca de 2 meses, isto é, na altura em que terminará o 1º semestre de estadia do *Dr. Colaço* (basica

mente para adaptação). Sobrariam assim 12 meses para processamento e análise dos dados. Assim, proponho empenhadamente que tal custo seja incluído no orçamento destinado a actividades de investigação.

49) *Assistência a conferências, reuniões e congressos*

Proponho ainda que, durante as suas estadias nos Estados Unidos, os *Drs. Colaço e Macedo* possam assistir (sendo para tal subsidiados) ao Terceiro Congresso Mundial de Genética Aplicada à Produção Animal, que se realizará na Universidade de Nebraska, Lincoln, em Julho de 1986. Haveria ainda interesse que participassem nas reuniões da Associação Americana de Produtores de Leite (Universidade da Califórnia) e da Sociedade Americana de Zootecnia (Universidade Estadual do Kansas).

Finalmente, peço respeitosamente a V. Exa. que seja tomada uma decisão sobre os assuntos acima expostos, antes do meu regresso aos Estados Unidos (12 de Julho), de modo que possa elaborar um orçamento realista destinado a encargos com a investigação, a ser submetida à Universidade de Purdue. Grato pela atenção dispensada, e com os melhores cumprimentos,

  
Daniel Gianola,

Prof. Associado de Genética e Melhoramento Animal, Universidade de Illinois.

Vila Real, IUTAD, 26 de Junho de 1985.

ANNEX C

English Translation of  
Letter to Reitor Fernando Nunes Real

## ANNEX C

Vila Real, June 26, 1985

Prof. Dr. Fernando Nunes Real  
Reitur  
Instituto Universitario de Tras-os-Montes e Alto Douro  
I.U.T.A.D.  
Vila Real, Portugal

Dear Prof. Dr. Nunes Real:

The objective of this letter is to raise some issues in connection with the proposed visit of Drs. Jorge Colaco and Fernando Wolfango de Macedo to the University of Illinois. Their visit, starting on or about August 20, 1985, is in the context of their projects of Doutoramento, and carried out (at least partially) under the auspices of Contract AID/NE-C-1701 "Portugal University Institutes Development Project" executed by Purdue University.

As a consultant to the above project and in my capacity as scientific co-supervisor of the research conducted by the colleagues mentioned previously, I would like to take this opportunity to offer my suggestions regarding their visit to the University of Illinois at Urbana-Champaign. Although my current supervision started only two days ago, I feel that some of the following issues deserve immediate attention, so as to maximize the research accomplishments envisaged, and the short and long term input on the activities of IUTAD.

1) Length of their stay in Illinois

On pages 9 and 11 of the report vis a vis the assignment I undertook last year in Vila Real (August 10-31 and September 17-October 16, 1984), I had recommended that Dr. Colaco should stay approximately 12-14 months at the University of Illinois; the corresponding recommendation for Dr. Macedo's length of stay was 12 months.

Drs. Colaco and Macedo have worked diligently towards fulfilling the requirements which I established should be met prior to determining whether or not they would profit from an extended visit to the University of Illinois. However, Dr. Colaco was unable to find an institution in Portugal where he could take a short course of instruction in FORTRAN programming (see page 9 of the report), and has had insurmountable problems to transcribe the milk recording data to be used for his research (13 variables on each of about 70,000 records), as discussed below. I believe that these two components of the program are essential, and in view of difficulties encountered locally, I recommend that they be implemented at the University of Illinois. Therefore, I recommend that Dr. Colaco be permitted to stay at the University of Illinois for a total of 16 months (August 20, 1985-December 20 1986) instead of the 12-14 months initially anticipated.

Because Dr. Macedo's work liases well with Dr. Colaco's, I also recommend a visit of 16 months for him. This would enable him to obtain further strength in biometrics and statistics, and, importantly, to make additional progress in writing his thesis under my direct supervision. I anticipate that in this manner he would be at a more advanced stage of his thesis by December 1986 than if he were to return to Vila Real by August 1986, and then work by himself, in isolation from a critical mass.

Prof. Dr. Fernando Nunes Real --2  
June 26, 1985

Finally, I wish to point out that Prof. C. R. Henderson, the world's leading authority on applications of statistical-genetic improvement of animals, is expected to be in Illinois between July and December 1986. Hence, 5 months of interaction between Drs. Macedo and Colaco and Prof. Henderson would be an important asset to their professional development.

## 2) Acquisition of a micro-computer

As I was instructed by Purdue University, it is customary when USAID sponsors an individual's visit to an American University that a research budget be prepared. Because Drs. Colaco and Macedo's work is not experimental, their research costs relate primarily to access to computing time and facilities. I had estimated that they would need approximately \$3,000 (U.S. dollars) each in order to defray their computing costs. In retrospect, it appears to me that it would be in the best interest of IUTAD that these \$6,000 be used instead to acquire a microcomputer, e.g., an IBM-PC-AT or IBM-PC-XT with 370 enhancement which would eventually be brought to Portugal. This would give Drs. Colaco and Macedo considerable flexibility and computing power, and would permit an essential up-grading of the current computing facilities of IUTAD, which at present are somewhat outmoded and not consistent with the size and strength of the institution. Essentially, this computer could be put at the service of the Biometrics Unit which I proposed to develop within the Department of Animal Production (see pages 11 and 12 of my report of last year).

It is important to stress that the purchase of this computer should be done immediately after their arrival in the U.S.A. Also, I would try to explore ways to reduce the cost of acquisition, because I.B.M. offers important discounts to faculty and students of the University of Illinois, and it is quite likely that my counterparts could benefit from such price reductions. If this is the case, the balance of the money could be used by them to acquire statistical software such as S.A.S. (Statistical Analysis System), which would then be available to the whole community of IUTAD.

## 3) Transcription of the data from the "Contraste lacto-manteigreiro"

In my report of last year (pages 6 and 9), I suggested that milk recording data should be used for Dr. Colaco's thesis. In the period between October, 1984 and June 1985, about 70,000 records (13 variables per record) were supposed to be entered into a computer-readable form so that the data would be available for analysis at the University of Illinois. Because of errors and incomplete information, about 10-20% of the data are expected to be available for final evaluation.

Unfortunately, and for reasons which seem to be beyond Dr. Colaco's control, the records have not been entered onto diskettes. Incompatibility of equipment, disk size, and other factors have exceedingly complicated this routine task. Without data, there is no thesis. Furthermore, these milk production records provide perhaps the largest body of data available in Portugal for genetic and management research, and I believe that it would be in the best interest of IUTAD to take leadership in the development (and continuous update) of such a research file. This would

Prof. Dr. Fernando Nunes Real--3  
June 26, 1985

facilitate research and developmental studies and would give IUTAD leadership in Portugal vis a vis dairy cattle breeding research.

Because it is unreasonable to expect that what was not accomplished in 8 months would be feasible in the 2 months that are left before Dr. Colaco leaves for the U.S., I recommend that these records be entered in the U.S.A. This would eliminate any danger of incompatibility between the medium of storage and the computing facilities that would eventually be used. We estimate that about 1 minute of labor is required to enter 13 variables for each cow. With 70,000 records, this would represent about 1500 manhours or about 37.5 weeks of work. Clearly, Dr. Colaco has other endeavors to accomplish while at Illinois, and it would be unwise (on health grounds) to propose that he spend the above time entering records. Hence, I recommend that a provision be made in the research budget to hire student help to enter records into computer readable form. At current rates of about \$4/hour for student help, the total cost of transcription would be approximately \$6000. If 8 students were hired, all records could be entered in about 2 months, i.e., they would be ready at the time Dr. Colaco's first semester (mostly adaptational) is winding down. This would give us about 12 months for research on the data. I strongly recommend that this be allowed in the context of the research budget.

4) Attendance at conferences

It is recommended that while in the United States, Drs. Colaco and Macedo be permitted (and supported) to attend the Third World Congress of Genetics Applied to Livestock Production, which will take place at the University of Nebraska, Lincoln in July 1986. Also, it would be of value that they participate in the meetings of the American Dairy Science Association (University of California), and American Society of Animal Science (Kansas State University).

Finally, I would like to respectfully request that a decision concerning the above items be made before my departure to the United States (July 12), so that I can prepare a realistic research budget for final submission to Purdue University.

Thanking you for your attention, and wishing you the best, I remain

Sincerely yours,

Daniel Gianola  
Associate Professor  
Of Animal Breeding  
and Genetics  
University of Illinois

ANNEX D

Letter to Prof. L. S. Monteiro

ANNEX D

University of Illinois  
at Urbana-Champaign

Department of Animal Science  
126 Animal Sciences Laboratory  
1207 West Gregory Drive  
Urbana  
Illinois 61801

College of Agriculture  
217 333-3131

July 22, 1985

Prof. L. S. Monteiro  
Instituto de Ciencias Biomedicas "Abel Salazar"  
Universidade do Porto  
4000 Porto, Portugal

Dear Prof. Monteiro:

I spoke with Dr. Colaco immediately after my return to the U.S.A., and he informed me that you kindly agreed to make available to him the data we had discussed during my visit to Porto and Lisboa.

For the tape to be readable by either our Cyber 175 or IBM 4341 computers, the following requirements would need to be met:

- 1) unlabeled tape;
- 2) 9-track of 1600 b.p.i. or 6250 b.p.i.;
- 3) E.B.C.D.I.C. characters, and
- 4) fixed block characters tape:
  - a) each record in a file is of the same length
  - b) integral number of records in a block (for Cyber, block length is  $\leq 8000$ )

I hope the above information is sufficient but if this is not the case, please advise. Dr. Colaco has already left Vila Real so it would be better that you send the tape directly to us.

Thank you very much for your hospitality during my visit to Porto, as well as for the invitation to speak at the School of Veterinary Medicine in Lisboa.

Best regards.

Sincerely,

Daniel Gianola  
Associate Professor  
of Animal Breeding  
and Genetics

DGafh

cc: F. A. Wolfango de Macedo  
Computing Centre  
I.U.T.A.D., 5000 Vila Real  
Portugal