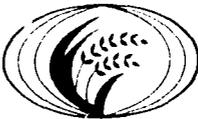


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**PORTUGAL UNIVERSITY
INSTITUTES
DEVELOPMENT PROJECT**

(Contract AID/NE-C-1701)

**REPORT ON
SHORT-TERM STAFF ASSIGNMENT**

Submitted by
DR. HOMER T. ERICKSON
Department of Horticulture
Purdue University

August 29 through September 28, 1984

PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

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

August 29 through September 28, 1984

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Potato Research at Vila Real, Portugal
End of Tour Report - Activities and Observations
August 29 - September 28, 1984
H.T. Erickson

STATUS OF THE POTATO IN PORTUGAL

The potato is the most important annual crop in Portugal. Per capita consumption of nearly 100 kg per year is among the highest in Europe. Nearly all of Portugal's production is used for human consumption.

Northern Portugal is the main production area, because of cooler temperatures and a more satisfactory rainfall pattern. The north accounts for nearly 70 percent of the total and potatoes are grown along the coast as well as in the inland mountain valleys.

Potatoes are produced in small fields, usually in association with dairy farming. Rotation is characteristically corn and potatoes, with forage crops or pasture sometimes involved.

Portugal grows about 100,000 Ha of potatoes, with a national average yield of 10 tons/Ha. The crop is grown with the aid of animal traction and some tractor power, with a large component of hand labor, especially during harvest.

Certified seed is imported from Canada, Holland and Germany for the most part although some 25 percent of certified seed is produced in Portugal. Kennebec and Desireé are the most widely grown varieties.

OBJECTIVES

The scope of work to be carried out with Fernando Martins of IUTAD as counterpart included the following:

- 1) Analysis and discussion of the work at IUTAD on:
 - a) true potato seed
 - b) evaluation of growth rate curves of potato
- 2) Analysis and discussion of potato nematodes project
 - a) visit to field experiments concerning this project (Chaves and Braganca)
 - b) visit to seed potato areas (Boticas, Montalegre, Chaves and Braganca)
- 3) Discussion of future projects
 - a) potato storage
 - b) breeding potatoes, mainly techniques of seed production
 - c) potato tissue culture
- 4) Meet with IUTAD staff working on vegetable production and visit to vegetable crop production areas.

AREAS OF RESEARCH

Potato seed source

Twenty five percent of the seed potatoes sold in Portugal are produced in a relatively small area north of Vila Real, the rest being imported from northern Europe, the U.K. and Canada. Much Portuguese seed is grown and marketed under certification. The merits of locally grown, compared with imported seed is a matter of considerable controversy. We encountered some growers who always use the Portuguese product with obvious good results, and others who stated that yields from such seed wouldn't pay for the fertilizer applied.

These statements reflect the emotional nature of the subject, and are likely justified by personal experiences. The value of potato seed depends on many factors, not all directly related to certification, which deals with varietal purity and freedom from disease. The

physiological state of the seed tuber is vitally important. This can be modified by storage conditions, both before and after sale, by transportation and handling, and even by post-planting soil and climatic variables.

We tested 24 plants from different seed lots for viruses. These were grown from imported seed and were sampled at the end of the growing season at Vila Real. Tests were run on viruses M, S, X, Y and Leaf Roll. Nearly all were totally free of all five. Two lines, both of the same variety, were positive for leaf roll. There was no evidence of X or Y, two of the principle viruses tested for in certification programs. A couple of lines had viruses S or M. The generally negative results using the highly sensitive ELISA test is especially encouraging since this was near the end of the growing season and a region considered unsuitable for seed production. Areas north of Vila Real above 800 meters in elevation are recommended for certified seed.

While the data are very preliminary they do raise the possibility that virus infestation is negligible in first year high quality imported seed. This should provide good planting stock for locally produced certified seed the following season. It is a line of research which needs to be pursued in greater depth. ELISA test kits are now available commercially, at relatively reasonable prices, which is one testing option. There are others, but trained virologists might be required for some of them. In any event virus diseases can be monitored much more effectively now than in the past, and this should be done with seed produced in Portugal.

The physiological condition of seed following storage, and its effect on yield, also needs to be studied. This should be done on virus-free stock to avoid confounding the variables. Such comprehensive research will go far to resolving the present seed source controversy and permit rational decisions on long range plans for the local seed industry.

Returning to potato virus, the green peach aphid is a major vector in virus transmission. More information is needed on the incidence of this insect in the production regions. Services of a qualified entomologist would be most helpful.

Potato Varieties

The two most widely grown varieties are Kennebec from North America, and Desireé from Europe. They appear to yield quite well, at least better than other varieties, and both have good consumer acceptance. The latter point is significant because the two differ greatly in qualitative aspects. Kennebec is white skinned and white fleshed. Desireé is red skinned and yellow fleshed.

In many regions or countries strong consumer preferences exist for skin color and, or, flesh color, especially the latter. The fact that the Portuguese consumer has slight discrimination for these variables increases the array of potential varieties from which to choose.

Fernando had a variety trial at Chaves consisting mainly of golden nematode resistant entries from northern Europe. This nematode is a serious problem in some parts of Europe. It has recently become established in the old potato growing region of Long Island in the U.S., and it will probably soon spread to states beyond New York.

Recent genetic advances have led to the development of a sizeable number of resistant clones which is the best, and probably the only, practical approach to the problem. The Chaves trial included about ten of these clones.

The plots were harvested while I was there. Yield and quality data were collected, and dry matter content determined from specific gravity values using a special hydrometer designed for this purpose. Dry matter content is a useful statistic for processing potatoes, an increasingly important market for local producers. Clones which show some commercial potential will be re-tested next year. It would be desirable to include several of those which have recently been developed in New York, to widen the genetic base being evaluated.

Variety testing might be modified somewhat to permit evaluation of more entries with little or no increase in expense. Rather than planting four 25-hill rows per plot, replicated four times, a single row with four replications of each entry could be grown as this is normally considered adequate, and it would give a 75% reduction of field space and of effort. The difference could be made up by evaluating additional clones. In fact the first year an entry is tested it might be grown in a single row, non-replicated, to evaluate its quality. Most decisions to retain or discard a variety are based on qualitative rather than quantitation characteristics. Replicated trials could then be restricted to those for which quantitative (yield) data are needed, having already met the qualitative requirements. By such an approach it may be possible to screen a hundred or more clones yearly, most of which could be nematode resistant selections.

Additional Golden Nematode Work

An excellent team exists at Vila Real to work on the nematode problem. Plant Pathology personnel are working with Fernando in surveying intensity of infestation in selected producing regions of northern Portugal. It will be particularly important to evaluate the certified seed producing regions. A long term crop rotation experiment has been established at Chaves to monitor nematode populations under different cropping systems. The severity of the nematode problem remains to be determined and this cooperative work should provide answers.

The nematode research, in summary, involves evaluation of resistant varieties, effects of crop rotations, and field surveys of levels of infestation. These well-directed efforts should define the magnitude of the problem in the near future and provide information on how it can be resolved.

True Potato Seed

The past decade has seen unprecedented interest in the use of true (botanical) potato seed as a means of propagating the commercial crop, as opposed to the traditional use of clones, where tuber pieces are used as "seed." Except for a few notable exceptions, mainland China is one, this interest has not extended beyond the promotional or research phase.

True seed has certain clear advantages, such as freedom from viruses, low volume (handful vs tons), and ease of storage. It also has serious inheritent problems. These include levels of plant to plant

variability which the more sophisticated markets could probably not tolerate, difficulty of direct seeding or of transplant production, and the likelihood of lower yields. As of now it seems that use of true seed is more appropriate for tropical third world countries than for Europe, for example, but even in developing countries the future is not at all clear. Cytogenetic studies now underway elsewhere could lead to breeding systems that might conceivably overcome some of the problems.

Preliminary work is underway at Vila Real in the use of true potato seed in commercial production. Plant growth, from transplants, was very good this year but the crop was late and not ready for harvest by the end of September. It had been planted in June.

This research should continue, because there might be situations where true seed can be used advantageously. Perhaps the most fruitful line of investigation for Portugal, and one which would provide needed information, involves transplant production and stand establishment. Many questions remain to be answered. They include optimum planting time, effect of supplementary light before transplanting to prevent premature tuberizing, plant populations, use of single or multiple plants per hill, fertilization and fertilizer placement, to mention a few of the more obvious.

Variety studies at this time would probably not be very useful because varieties are apt to change rapidly over the next few years. In fact the current open-pollinated seed may be replaced by hybrids if some basic research now underway is successful. We did, however, collect a large amount of open-pollinated Desireé seed from some commercial

fields. Performance data on crops grown from seed of this well adapted variety would be interesting to have. If open-pollinated Desireé performs reasonably well, an available source of seed is assured. Furthermore, true seed of a locally productive variety is, statistically speaking, likely to out perform that from other sources. It might be appropriate to use this Desireé seed for the cultural studies suggested earlier.

SUMMARY OF RECOMMENDATIONS

1. Conduct comparative performance studies of the locally produced certified seed and that which is imported, on varieties Desireé and Kennebec.
2. Survey the green peach aphid populations in certified production areas.
3. Use the ELISA method for making spot tests for virus in certified fields. Test for viruses X, Y and leaf roll, and possibly for M and S.
4. Monitor storage and post-storage handling of certified seed and determine their effects on subsequent productivity.
5. Continue a comprehensive variety testing program. Make a small planting of each new entry the first year, and retain only those which appear to have promise for subsequent replicated tests.
6. Emphasize golden nematode resistant clones, but not to the exclusion of others.
7. Continue studies on cultural techniques for nematode control.

8. Determine the best methods of establishing productive field stands using "true" potato seed, emphasizing transplant production techniques, plant populations, and planting dates.
9. Use open-pollinated seed of Desireé for the above studies.
10. Study growth patterns of the two important commercial varieties now being produced in Portugal, Kennebec and Desireé.
11. Have as a goal an increase in the average national yield to 15 tons/ha from the current 10.

ACKNOWLEDGEMENTS

Fernando Martins spent a great deal of time and effort to make this consultantship meaningful and very enjoyable. His enthusiasm for his work is impressive. The Reitor's concern for our comfort is appreciated. Housing arrangements were excellent and cars were usually available for our use. Arrangements made by IPIA were thorough and flawless, thanks to Vivian Rider's efficient attention to detail.

SUMMARY OF ITINERARY

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| August 30 | Arrived in Lisbon with Jim and Kristina Ahlrichs. Went to the U.S. Embassy and conferred with USAID people. Carolyn arrived from London. |
| August 31 | Drove to Vila Real with Fernando Martins and his family. Stopped at Batalha and Bucaco Forest en route. Arrived in Vila Real about dark. |
| September 1 | Saturday. Bought provisions for the Guest house and rested. |
| September 2 | Sunday. Drove north to Chaves and the Spanish frontier, to become familiar with the region and its agriculture. Bill Friday arrived at Guest Home. |
| September 3 | Orientation and introductions at the University with Fernando. Went over his research program in some detail. |

Inspected field plots of potatoes grown from true seed. They appeared healthy and vigorous, but late maturing. Invited to the Reitor's home in the evening. The Ahlrichs arrived from Lisbon.

- September 4 Went to Chaves with Fernando to harvest plots of Golden Nematode resistant potato varieties. His research there is on a state run farm. The plot was well designed and cared for. In addition to this research he has elaborate crop rotation trials which are also designed for controlling the nematode. Plots were hand harvested using local labor.
- September 5 Worked at the university with Fernando on collecting data and evaluating the material harvested yesterday.
- September 6 Terminated yesterdays work. Visited briefly with Sr. Rosa, the vegetable specialist, on his program. A researcher from Rutgers will spend next February with him.
- September 7 Looked over university departments and facilities that I hadn't had an opportunity to see earlier. This was a major market day in Vila Real and we spent considerable time observing the fruits and vegetables being offered. The potato harvest is just getting underway.
- September 8 Saturday. Took a trip to the little town of Sabrosa and then down to Pinhão on the Rio Douro, in the heart of the Port wine producing area. Went with the Ahlrichs who know the region well. Grapes not yet being harvested, but appear to be nearly ripe.
- September 9 Sunday. Again went with the Ahlrichs, this time to a remote village in the high lands just west of Vila Real. Livestock production is prevalent in such locations, with land devoted to grain and pasture, and little if any fruit or vegetables.
- September 10 Conferred with Fernando about his Doctors research and studied related research programs and facilities. Set up a small greenhouse experiment.
- September 11 Spent most of the day in the office going over documents related to potato production and research in Portugal.
- September 12 A representative from a Holland certified seed producer spent the day with us. A large proportion of certified potatoes planted in Portugal comes from Holland.
- September 13 Fernando and I tested 24 lines of potatoes for five viruses, using an ELISA test kit purchased by

International Programs prior to my departure. It was done in the Plant Pathology laboratory and occupied most of the day.

- September 14 Went to Sabrosa with Fernando and Carlos Abreu, the Pathologist, to collect soil samples in a field suspected of heavy Golden Nematode infestation.
- September 15 Saturday. Carolyn and I left on a weekend trip to the northwest, to Braga, Barcellos and as far as Spain on the Rio Minho.
- September 16 Sunday. Returned to Vila Real.
- September 17 Spent the day in the office, reading and discussing research plans and programs with Fernando.
- September 18 Fernando and I spent a long day at Chaves and in highlands to the west, in the vicinity of Montealegre. In the latter region much of the local certified seed is produced. We visited producers and co-ops where the crop is stored and marketed. Harvest appeared to be at its peak. Also collected a large amount of fruit in a commercial field of the variety Desireé.
- September 19 Worked in the office. At noon several of us visited the Mateus Palace nearby with its very interesting formal gardens and fruit plantings.
- September 20 Went to Chaves with Fernando to harvest the rest of the variety trial plot. These were the late-maturing types.
- September 21 Evaluated yesterdays samples. Visited at length with the plant breeding group. They are heavily committed to working on cereals, especially Triticale.
- September 22 Saturday. Went with the Ahlrichs on a brief train trip south of town, through the grape and olive production areas between Vila Real and Regua on the Douro.
- September 23 Sunday. In Vila Real.
- September 24 Fernando had a death in the family and went to Lisbon for several days. Visited with the fruit specialist and toured his research plots. They just began apple harvest, on a young planting of dwarf trees.
- September 25 The annual Onion Festival was held in Vila Pouca, just north of Vila Real, which a group of us attended in the morning.

- September 26 Carolyn and I left for Lisbon, stopping along the way to visit the ancient university of Coimbra.
- September 27 Carolyn left for London. Fernando came over in the evening for a final conference.
- September 28 Returned to Purdue.