PURDUE UNIVERSITY INSTITUTE
DEVELOPMENT PROGRAM

Report of
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Purdue University
September 10 - October 10, 1981

INTRODUCTION

This report covers a one month assignment (September 10 - October 10, 1981) as advisor in the horticulture area under the Portugal University Institute Development Program. The itinerary (enclosed as appendix A) was established by Dr. Carlos Alberto Martins Portas, University of Évora whose help and guidance are acknowledged and appreciated. The program involved the following:

1. Extensive travel throughout the horticultural and agricultural regions of Portugal including a one-half day visit in Spain (Badajoz project).
2. Tours of technical projects, research stations, universities and schools, private farms, food processing, plants and cooperatives.
3. Contacts and conferences with agricultural technicians, students, professors, and administrators.
4. Presentation of a series of seminars (in Portuguese).
5. Accumulation of Documents and Reports (presented in appendix B).

SUMMARY OF CONTACTS & VISITS

U.S. Agency Personnel

Charles A. Buchanan	USAID
James Black	USAID - USDA
Donald Finberg	USAID
Richard Mc Donald	U.S. Agr. Attache
John H. Sanders	Purdue - Évora
John Foley	Purdue - Vila Real
James L. Ahlrichs	Purdue - Vila Real
Julian H. Atkinson	Purdue - Covilhã

Universities and Technical Schools

Évora	(University)
Vila Real	(University)
Lisbon	(University)
Coimbra	(Escola Superior)
Santarém	(Escola Superior)
Faro - Algarve	(President, planning stage only)

Irrigation Projects

Badajoz (Spain)
Mondego

Processing Plants & Cooperatives

Heinz (Benavente)
Tocan (Canha)
Cachão (Mirandela)
Cooperative (Bombarral)
Lourefruta Cooperative (Lourinhã)

Seminars

September 17	-	Évora	History of Horticulture
September 22	-	Vila Real	History of Horticulture
			Genetic Improvement of Fruit Crop
			Tissue Culture
September 23	-	Porto (Vairão)	History of Horticulture
September 25	-	Coimbra	Genetic Improvement in Horticulture
September 29	-	Santarém	Tissue Culture
September 30	-	Santarém	History of Horticulture
October 6	-	Faro	Tissue Culture
October 7	-	Évora	Tissue Culture
October 8	-	Lisbon	History of Horticulture

GENERAL OBSERVATIONS

Portugal, although a small country, is characterized by great diversity of agricultural climates and areas. The general agricultural situation is well documented in the 1979 MASI report. My impression of the general agricultural and economic situation was in substantial agreement with the conclusion contained therein. I recommend that the MASI report be required reading for all advisors.

I agree that a substantial problem exists in order to accelerate

the pace of agricultural development. The present problems of "stagnation" in the agricultural sector have been exacerbated by confusion and instability in the political arena following the revolution of 1974 and land reform of 1975; present political attempts to decentralize agricultural institutions including the expansion and transformation of various educational institutions; accelerating inflation in Europe and the United States; uncertainties concerning the prepared entry into the European Economic Community (Common Market); and severe drought conditions in 1980-1981 covering practically all of Portugal.

It seems clear that Portugal will enter the EEC and attempt to tie its future to Europe. For Portugal to compete in the EEC difficult decisions and shrewd bargaining will be required. At present Portugal's agriculture is not in the same league with Northern Europe, much less that of Spain. However, in my estimation, great improvement in Portugal's productive capacity is possible. What is needed is solid commitment to increase efficiency in agricultural production and export rather than to restrain agricultural prices for consumers. The key is optimum utilization of resources. For example, the best land in Portugal - the Ribatejo - is poorly utilized. Much of the land is in grapes yet this is not the home of the best wines. This area needs to be intensively farmed with a combination of high-yielding feed grains and forage, and especially high value, intensively cultivated processing crops. Increased investment in irrigation is required.

The "vast" area of the Alentejo needs to be better utilized with increased emphasis on permanent pastures and small animals. Small-scale irrigation, presently planned, should be completed. However, the ecological approach for efficient use of much of this land may be the best use. Sheep production should be emphasized because lamb carcass quality is acceptable to Europe. Production of wool fits into the Portuguese textile industry and milk production for cheese offers a third alternative.

The Northern littoral regions are well suited for high intensity horticulture including grapes for wine, production of temperate tree fruits (particularly apple, pear, peach) as well as protected cultivation in plastic greenhouses and truck gardening.

The Algarve, where water is limited but where soils in the littoral

are good, and climate ideal for out-of-season production, should be promoted for intensive production of export fruits and vegetables particularly greenhouse production of tomatoes, peppers, beans, cucumbers, melons, table grapes, as well as open field production of subtropical fruit crops such as citrus, figs, avocados, apricots and peaches. The Algarve contains about 350,000 ha of tillable land in the mountains (Serra), 50,000 in the piedmont (Barrocal), and 100,000 in the coast (litoral). The litoral is an extremely intensive area of horticulture in Portugal's southern "tropics" with heavy but excellent soils (about 7.0 pH), and level areas. The limiting factor is water. Shallow wells provide irrigation from a fresh water lens. Irrigation is from private wells with a general irrigation program only in the preliminary planning stages.

The traditional crops of the region were figs, almonds, and carob but only figs are now considered viable. Nonirrigated almonds cannot compete and carob has little future. There are new plantings of irrigated citrus, grapes, and peaches in open fields. There are about 500 - 600 ha of non-heated greenhouses of wide "pale" construction, mostly in tomatoes but also beans, peppers, and some very promising table grapes. The industry desperately needs assistance in marketing. Production is generally too small for export. The most exciting development is in table grapes under protected culture scheduled for May harvest.

Assistance from a German Technical Aid Program is well funded and showing enormous progress for the first year. Various farmers are aggressively pursuing new crops and techniques. The largest demand is for a better credit and marketing systems. A combination of growing tourism and the potential of a strong agriculture geared to export could transform this area, traditionally one of the poorest in Portugal, into the most dynamic in the country.

INTENSIVE HORTICULTURE

Intensive systems of horticulture production of food and ornamental crops for export offer an exciting alternative for small farmers. Various levels of technology are possible. The simplest involves greenhouses without heaters made of treated Eucalyptus or pine trunks, covered with plastic film,

and irrigated by trickle (drip) systems. These greenhouses are presently used by carnation growers close to Setúbal, by tomato growers in the area North of Lisbon, and by various vegetable and fruit (table grapes) growers in the Algarve, principally east of Faro. Other systems are being tried by private farmers (including a modern glasshouse and plastic operation, Stapoflor, near Setúbal geared to export of pot plants, bulbs, and tubers to Holland). The greatest opportunity exists in the Algarve where about 500 - 600 ha of protected cultivation are now found. The limiting factors appears to be marketing. I suggest that effort be extended to establish a marketing organization for export of protected cultivation so that the growers can concentrate on production. The technology required is available at every level but applied research is needed - coupled with economic assessment of markets - to determine the appropriate technology required, to determine optimum combination of crops, and to encourage sufficient production to export. Development in this area is particularly attractive to younger farmers, entrepreneurs, as well as large companies. It is important that technical advice, credit, and marketing organizations be developed to make these systems available to small growers and younger farmers who lack capital and experience. This is especially important because of the aging of the productive agricultural sector.

Protected culture takes full advantages of Portugal's abundant resources - light and favorable temperatures. Technology can substitute for poor soils and maximum use of limited water can be achieved with trickle systems. Capital expenditures can be relatively moderate but credit is essential. Most important is the development of a critical mass of production and an organized marketing system. This is a sensitive problem because of the high level of independance of the present greenhouse growers.

IRRIGATION

The Mediterranean climate of Portugal is characterized by dry summers. This area requires only water to be transformed into an extremely productive agriculture. Portugal has its share of agricultural impediments such as poor drainage, problem soils, salinity, and unsuitable terrain but none is as limiting to increased production as the lack of water. The best

investment for the long term future of Portugal's agriculture will be the expansion of irrigation. One major problem for Portugal is the source of all the great rivers are in Spain. Spain has already preempted a large part of the Guadiana with the Badajoz project where 195,000 ha are being developed. The Mondego project between Coimbra and Figueira da Foz is much smaller but should be used as a prototype for Portugal with multiple uses planned: flood control, power, and irrigation.

Various irrigation projects are underway in the Alentejo but appear to be stalled. Although these projects are small in area the cummulative effort of new areas under irrigation could be important to regional development. The Government should seriously plan for the Algarve irrigation project to better exploit the potential of good agriculture lands east of Faro.

Where water is limiting more effective use could be otained with drip (trickle) irrigation systems. Except for the Algarve, the area of drip irrigation is low in Portugal. The results obtained with drip systems have been impressive. In the Algarve, farmers, who use it, consider it the only feasible alternative. Drip irrigation is suitable for protected cultivation such as greenhouses or plastic tunnels and for fruit crops on hilly terrain. Advantages of drip irrigation include low water use, low power requirements, and lack of salt accumulation because of the leaching effect. The disadvantages beside initial cost (which can be ameliorated when growers complete their own system) are the necessity of clean water. An Israeli filter system used in the Algarve was highly regarded. Research is needed to determine appropriate systems for Portuguese horticulture. Other systems that need to be considered are portable sprinklers and micro-sprinklers.

POMOLOGY AND VITICULTURE

Temperate fruit although extensively planted in Portugal is generally confined to small plantings in multi-crop systems. As a result fruit often receives marginal attention. Although quality is sufficient for local conditions, it is unsuitable for export. The limiting factor appears to the lack of marketing systems and grading standards. Lack of demand for higher quality fruit within the country has stifled development of a modern

fruit industry. An infrastructure does exist to control grading, cold storage, and export (e.g. Cooperative Agricola de Bombarral; Sourifruta, Lourinhã) but more aggressive export marketing is needed. I suggest research be first expanded in the export of fresh pear. The local "Rocha" (Rock) pear has excellent quality and a distinctive appearance and flavor. It is a semi-russett type but grading by amount of russett in addition to size would improve appearance. The pears with high amounts of russett are attractive if properly sorted. About 85% of Portugal's pear production consists of this variety, which means that sufficient quantity now exists for export. Presently the only exports go to Brazil (large size, low russett fruit) but markets could be developed in Canada and the U.S. (eastern markets) in the winter because the fruit is superior in quality to "Anjou" in my judgement. Presently Brazil takes only low russett fruit so a market is required for russett types. The "Rocha" pear has high eating quality and is attractive when properly sorted. Selection of superior clones needs to be carried out. "Roche" appears to include various strains. The canned pear nectar in quick-opening cans is a superior product. This product (along with the apple and peach nectars) should be promoted in airliner and prepackaged meal markets. Improved production practices - fruit thining to increase size, better control of pear scab-are needed to improve percentage pack out of export-quality fruit.

Apple marketing potential is discouraging because most Portuguese fruit does not now seem competitive in appearance and quality with international standards. Further the root disease Rosalinia seems to be a serious problem. The country is overplanted with "Golden Delicious" with which the European market is already flooded. The russett apple "Reinette du Canada" is of excellent quality and of distinctive appearance as grown in Portugal. I suggest aggressive marketing of this apple so that a unique sector of the crowded apple markets can be made for Portuguese apples.

Peach is very adapted to Portugal but present production is based on a combination of clingstone and freestone varieties. The peach processing industry has not developed because of a lack of internal market. Although climate seems very suitable for peach, trials are needed to determine a suitable series of cultivars. Aromatic nectarines are needed. Nematode-resistant rootstocks should be tested including "Nemaguard" and a new

selection from Wayne Sherman's program at the University of Florida. The clingstones peaches which are consumed fresh are not suitable for export.

There are various new fruits that need to be tested to diversify Portuguese pomology:

Kiwi or Chinese Grooseberry (Actinidia Chinensis) appears to be well suited to Portugal. Production research needs to be aggressively pursued to anticipate European export. Marginal grape production in the Porto area could be replanted with Kiwi. Here many farms are surrounded by high trellises where kiwi would be expanded. Studies are needed to determine the areas of adaptation for this crop.

Blueberries (vaccinium SP) are well suited for acid soils of which northern Portugal is richly endowed. There is a complete lack of information on blueberries and I could not find a proper Portuguese name. A series of adaptation trials should be made. This would make a suitable thesis problem.

AVOCADOS (PERSEA AMERICANA)

Avocados (persea americana) appear to be well adapted to the Algarve; testing of 4 varieties and 2 rootstocks by the Ministry will begin this spring. "Haas" is thought to be most suitable for the region. More aggressive trials of cultivars and rootstocks are needed.

Nut crops need to be expanded in the Trás-os-Montes area where terrain is unsuitable for extensive cropping of annual row crops. In the Northeast poor roads and marginal soils make extensive tree-horticulture a suitable alternative crop. Suggested crops include chestnuts, Persian walnuts, and filberts. Studies should be expanded on improved propagation systems and more adapted rootstocks.

Table grapes geared to the May harvest appear to be an excellent crop for the Algarve because a gap in the market exists. "Cardinal" has produced up to 35 MT/ha under protected cultivation (uncooled greenhouses). Production needs to be expanded in order to market effectively.

Portuguese wine is of good-to-excellent although quality does vary with season and location. A good export market has been developed for some regional wines (Port wines) and for wines blended for the unsophisticated

U. S. market (e.g. Lancers, Mateus) but production of many regional wines is too small for mass marketing (as Vinho Verde). The increasing consumption of wine in the U. S. and the growing preferences for white wine should be exploited. I suggest the government consider a new type of marketing scheme. Each year an export grade would be established and local regional wines that meet quality standards would be doubled-labeled as "Wines of Portugal - Export Grade". Aggressive marketing needs to be pursued to establish the identity of such Portuguese wines. Wine production of the Alentejo has been curtailed for centuries to promote Port Wines. The full-bodied red wines of the Alentejo could be promoted if jointly market under such a program.

Dried fruit would seem a possibility but the fig industry, the main dried fruit, is waning. I could find no reason why raisins are not produced in Portugal. The abundance of sun and the adaptedness of Prunus (peach, apricot, plum) suggest sun-dried fruit as a future possibility.

PROCESSING CROPS

The tomato processing industry is a bright spot in Portuguese agriculture. Increased development can be achieved by expanding processing of vegetables to include canning, freezing, and drying. Many processing factories are under-utilized. Suitable crops with increasing European demand include blanched (white) asparagus and artichokes. Others include various brassicars including cauliflower, various green beans, peas, cowpeas (vigna sinensis), dried beans, pearl onions and small whole carrots, beets, and various chilis and pepers. A pickling vegetable industry should be investigated.

SEED IMPROVEMENT

It is axiomatic that much of the present agricultural progress is contingent on genetic-improvement. Portugal is particularly weak in this area. One exception is the cereal program in Elvas, particularly triticale improvement. Little agronomic or horticultural breeding is underway except for some cereal breeding. Use of hybrid corn is very low, about 15%. The reason for this is obscure but it may be that many hybrids under test are inadapted. Increased corn productivity with the use of good hybrids should be substantial. The poor results with hybrid corn may be due to lack of insert resistance (corn

borer). It may that inadapted hybrids do poorly under stress conditions of dryland agriculture. Corn production needs a technological study.

In horticulture crops Portugal is fortunate that varieties adapted to California do very well in Portugal. Under these circunstances extensive selection program rather than breeding is essential. It is important that local adapted varieties not be lost in the shuffle and local germplasm collection should be preserved and maintained before this genetic variation is lost forever.

PLANT NUTRITION

The low pH (4.5 - 5.0) of many soils in Portugal suggest that inadequate mineral nutrition may be a limiting factor to increase agricultural productivity. The PROCALFUR program is based on expanding liming principally in the Northeast of Portugal. I was unable to get any good data on lime. Various bits of information through word-of-mouth suggest that lime requirements may be less than expected on the basis of U.S. experience. Research on plant nutrition is essential to investigate the inter-action of lime, soil management, and crop response. Plant nutrition might be best investigated through a foliar analysis survey. This is essential in order to maximize the effectiveness of any program aimed at lime distirbution.

AGRICULTURAL EDUCATION AND RESEARCH

The decentralization policy following the revolution of 1975 has resulted in the expansion of agricultural universities. Before 1975, the University of Lisboa provided the only training at the "Engenheiro Agrónomo" level, probably equivalent to a BS-MS level education. Regente Agrícola, a sub-BS, vocational agricultural program has been phased out. The present expansion oh higher agricultural education to Évora and Vila Real is now underway. A program at the Algarve is in the planning stage. The upgrading of the "Regente" level schools to "Superior" level (a higher level but still sub BS) is to be phased in at Coimbra and Santarém this year with an entering class to be initiated with 30 students at each school. It must be remembered that Agricultural Education is under the Ministry of Education with research

and extension under the Ministry of Agriculture. Thus the "land-grant" concept of the U.S. is not the model of Portugal.

The present expansion of educational institutions may be premature because human resources do not seem sufficient to expand the 4 Universities (Évora, Vila Real, Coimbra, and Santarém) at the same time. In my opinion it would have been wiser to concentrate expansion on 2 institutions only, perhaps Évora for the higher level and Coimbra for the lower level - but it appears that the die is cast. Hopefully, the excitement of institution building may be sufficient to push the institutions past the trauma of birth. The physical plants at Santarém and Coimbra are substantial but the faculty is very short. Vila Real is in an active growth stage. Physical facilities at Évora are very good and I believe that Évora has achieved the "take-off" stage. In my judgement the University of Évora should be increased in size with increased participation by the Purdue Project. Active participation of other international agencies should be sought. Location and physical facilities are good and with sufficient human resources Évora could be transformed in 5 years to a University of real stature.

Portuguese Universities do not follow the U.S. land grant system. The Purdue/USAID program should accept this difference and work to develop a "Portuguese" model. The prototype that may be more appropriate for Portugal is the International Center where emphasis is placed on technology adapted for regional conditions. Such a concept may indeed be well suited to the Portuguese situation which requires a concentration of effort but is hampered by limited resources and yet requires regional decentralization as a political necessity.

In this context Évora could be organized around research on dryland pastures and small animals (sheep, goats, swine) industry.
My proposal for research areas would be:

1) Improved dryland pasture management. Techniques must be found to replace fallow techniques by more permanent pastures.
2) Improved sheep production systems (lamb may be especially important as an export crop with entry into the EEC).
3) Swine production. The restriction on swine production by the African diseases (swine fever, hog cholera) has prevented

foraging of the local breed (Alentejano) on acorns of the Azinheira tree (Ilex rotundifalei). It may be that this disease may be approached with new immunological techniques if so swine production techniques may change.

4) Improved management of natural flora. This includes the cork oak (Ilex suberosa), holly oak (Ilex rotundifolei), olive and pasture crop such as subterranean clover. For example development of a small harvesting machine could increase use of native acorn (bolota) previously harvested by swine. This acorn crop is found on approximately 994,000 ha. including both the holly oak and the cork oak.
5) Improved production of dryland crops such as sorghum to replace corn where production is marginal when grown on residual soil moisture; cowpeas; garbanzo; winter production of oat-legume mixtures for forages.

HUMAN RESOURCES AND PROFESSIONAL DEVELOPMENT

Portugal is fortunate in having a cadre of educated technicians. Recently the "retornados" from Mozambique and Angola have increased the available resources. Many young technicians are in the private sector. I was able to identify many young men and women in their twenties and thirties who were running large commercial entreprises and processing plants.

In contrast many of the Ministry field stations seemed moribund in paper, overstaffed, and out-of-touch with developments of other stations. Experimental plots at substations seemed pedestrian and unimaginative. Portugal seems to generate a tremendous quantity of paper which requires large staff to move around. The productive program appeared to be dominated by strong personalities. I was particularly impressed by the program of the German Technical Assistance Program at Mondego and Algarve.

It is imperative that the best talent be searched out for more training - particularly at the U.S. and at the Ph. D. level. I suggest training in the Agricultural disciplines be stressed. This includes nutrition, plant breeding, pest control, soils, agronomy, horticulture, postharvest technology, physiology, and marketing economics.

Although there appear to be a great deal of report writing in Portugal - many of enormous length - there is only one journal in agriculture. It is difficult to find research information in horticulture. I suggest that a journal devoted to Crop Science to include all crops including forestry, agronomic crops, horticultural crops be developed. The main source of articles will be the Universities and Ministry of Agriculture. This type of journal is essential to build up a solid source of hard information.