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TROPICAL HORTICULTURE

A Study of Tropical Research and Production
in Pakistan

by

Dr. Richard A. Hamilton
November, 1987

PARC - USAID - Winrock

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Sponsored by PARC, USAID, and the MART Project

A Report to Winrock International

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INTRODUCTION

The consultant was invited to Pakistan to examine the tropical horticultural research and production and to make suggestions for improvement. This request stemmed mainly from the interest of the Secretary Agriculture, Punjab, in strengthening this sector of the agricultural industry in Punjab. A copy of the terms of reference for this study is attached as Appendix 1.

The consultant arrived in Pakistan on 20 October 1987 and departed on 17 November 1987. His itinerary (Appendix 2) included consultation with PARC and NARC officers and scientists, and travel to Punjab, Sind, and NWFP to examine horticultural research and production and to confer with researchers and producers. The consultant also brought with him to Pakistan a generous supply of new, improved germplasm of several tropical horticultural species.

The consultant has over 40 years experience in tropical horticultural research and production and has traveled and consulted widely throughout the tropical regions of the world. His biodata are attached as Appendix 3.

The following paragraphs describe the current situation with respect to the important tropical horticultural crops in Pakistan and make recommendations for research or other actions to improve that industry.

GUAVAS

Guavas for processing:

Although guavas are grown on a fairly large scale in the Punjab and in Sind province, the type of fruit produced is not of the type and quality needed for processing. The guavas now grown in Pakistan are small, sweet, seedy, white-fleshed fruits used primarily as dessert fruits. Guavas preferred for processing into puree, canned guava halves, jam, and jelly are large, acid-flavored deep pink or red-fleshed fruits weighing from 200 to 500 G. This type of guava is grown from budded or layered trees rather than seedlings, and is not presently found in seedling guava orchards in Pakistan. Suitable processing type guava varieties should be imported and planted commercially in Pakistan to provide a source of guavas for commercial processing, before a guava processing industry can be seriously considered feasible.

Budwood of 3 processing guava clones: 'Beaumont', 'Kahua Kula', and 'Waiakea' were brought from Hawaii and budded at 4 locations in Sind and Punjab provinces. Additional processing type clones including outstanding cultivars from Florida and South Africa can be readily obtained through budwood imported via air-mail.

Dessert Guavas

The present type of guavas grown in Pakistan produce small fruited, seedy, white fruits, variable in shape, size, and quality. They are not comparable in quality or flavor to the large-fruited, thick-fleshed, clonal varieties grown in Malaysia, Thailand, Taiwan, and Singapore. These improved varieties should be imported and propagated by budding or cuttings to gradually replace the inferior type of seedling guavas now grown. Budwood and air-layered plants of these varieties are readily obtainable from commercial nurseries in Thailand, Malaysia and Singapore. One of the best commercial varieties in Malaysia comes relatively true from seed, so seed could be imported and seedlings grown.

If red-fleshed dessert guavas are desired, there are several very good red-fleshed dessert guava varieties available from Hawaii. These could be obtained as budwood or cuttings. The fruits of improved clonal varieties of guavas range in weight from 300 to 800 G compared to less than 200 G for most seedling guavas now grown in the country. It is recommended that improved red and white-fleshed guava clones be imported to gradually replace the poor and variable types of white seedling guavas now grown in Pakistan.

Guava propagation:

Contrary to general opinion in Pakistan, guavas are comparatively easy to propagate clonally. Both patch budding and cuttings are successful methods of clonal propagation if carried out carefully by experienced, capable propagators. If patch budding is done, it should be carried out during the spring months when rootstocks are growing actively and the bark slips easily. This facilitates patch budding operations. It is also recommended that one or more propagators be given special training in patch-budding, in Malaysia, Singapore, or some other country where rubber, cacao or guavas are routinely patch-budded.

Rapid and efficient rooting of guava cuttings is also possible. Recent experiments by Dr. Hafiz-ur-Rehman have shown that leafy tip cuttings of guava treated with paclobutrazole can be successfully rooted in about 6 weeks. This is a promising new method of propagating guavas which merits testing on a large scale for commercial plantings.

MANGOS

Seven good, well adapted mango varieties are presently grown commercially in warm tropical and subtropical areas of Pakistan. These are mostly mid-season varieties from the sub-continent and apparently well accepted in Pakistan. Some improvement is possible and it is suggested that 'Keitt' and 'Brooks late' from Florida and 'Rapoza' from Hawaii could extend the harvest season for at least an additional month. 'Keitt' is already present and 'Brooks late' can be obtained from Hawaii on request. 'Rapoza' was included in scion wood of 7 varieties brought from Hawaii in October by the consultant.

All of the mango varieties presently grown commercially in the country originated in the sub-continent, which is logical. There are however several outstanding mango varieties from the western hemisphere, the Philippines, and elsewhere, which are not well known, or if known, not adequately tested in Pakistan. These varieties are listed in Table 1.

Table 1: Mango varieties worth testing in Pakistan.

Variety	Origin	Season of maturity
1. Rapoza	Hawaii	Late
2. Paris No.1	Hawaii	Mid season
3. Ah Ping	Hawaii	Mid season
4. Brooks late	Florida	Late
5. Van Dyke	Florida	Mid season
6. Cambodiana	Florida	Mid season
7. Tete Nene	Puerto Rico	Mid season
8. Julie	-do-	Mid season
9. Malindi apple	Kenya	Mid season
10. Carabao (syn. Manila)	Philippines	Mid season
11. OK Rong	Thailand	Mid season
12. Aroonanis	Indonesia	Mid season
13. Manalagi	Indonesia	Mid season
14. Fairchild	Panama	Mid season

These clones can be made available on request as scions or budwood from the University of Hawaii, with the exception, of 'Manalagi' and 'Cambodiana.' 'Rapoza' and 'Carabao' were both introduced in October by the consultant. Mango propagation is adequate and fairly advanced in Pakistan so new mango varieties can be introduced as scions sent via air-mail and grafted within 2 weeks of mailing date.

Mango bark malformation

A previously unreported mango bark disease or disorder was observed on the rootstock section of grafted mangos in the Punjab and Sind provinces. The main symptom of this mango bark malformation condition is very thick bark, deeply furrowed and cracked, on the trunk of the tree below the graft union. This symptom was found in several orchards in the Punjab. Some affected trees appeared to be growing satisfactorily, while others appeared to be weakend and in a state of decline. The cause of this disorder has not been determined but it is probably soil borne, since the symptoms usually appear only on the rootstock portion of grafted trees. However both grafted and seedling trees can show symptoms. Seedlings of clonal varieties often develop these bark malformation symptoms when used as rootstocks. It is, therefore, recommended that rootstocks be grown only from seed of certain selected ungrafted wild or native trees which appear immune to mango bark malformation. Such trees have been located and the seedlings used for mango rootstocks in the Punjab. This practice is recommended to minimize damage caused by this mysterious bark disorder. A similar condition has also been observed on mango trees in Mexico, Colombia, the Philippines and Hawaii.

CITRUS FRUIT

Tangerines: 'Kinnow' is by far the most successful and widely grown dessert citrus variety in the country. It is a type of mandarin, rather than a true orange. It is so prolific and widely planted that juice exports to nearby countries are planned. There are several other promising tangerines and tangors well worth trying because of the outstanding performance and acceptance of 'Kinnow.' Some promising tangerine varieties recommended for test planting include: 'Lee,' 'Bowers,' 'Ladu,' 'Clementine,' 'Khasi Hill orange,' 'Ortanique,' 'Honey,' 'Page,' and 'Nova.' In view of the success of 'Kinnow' in Pakistan, one or more of these varieties might also become a successful commercial variety in Pakistan.

Oranges: True oranges, Citrus sinensis, are also well adapted to tropical and subtropical areas of the country. 'Musumbi' orange is popular and 'Washington navel' orange develops good quality in Soan valley. Blood oranges are also adapted to growing in Pakistan and develop good quality and juice color. In view of the success of these varieties, it is recommended that other selected oranges with desirable characteristics be imported for test planting in appropriate areas. 'Bibile seedless,' 'Raratonga seedless,' 'Pera,' 'Joppa' and 'Panama criolla' are desirable varieties worth testing in areas of the country suitable for growing oranges. These orange varieties could be imported and established from seed, thus avoiding introduction of Tristeza and other virus diseases. It is recommended that this be done.

Grapefruit: The 'Shambar' grapefruit is already grown successfully on a small scale in Pakistan. It is an excellent variety and plantings should be increased. 'Oroblanco' from California and 'Puma' from Hawaii are new grapefruit varieties with fruit of exceptionally good quality. Both are worth testing and should be imported for test planting.

Lime: 'Kagzi' lime is the most important and widely grown lime variety in the world. It is also the most important acid citrus variety in Pakistan. The seedless 'Persian' or 'Tahitian' lime is attracting some attention and is sometimes grown but on a smaller

scale than 'Kagzi' lime. The 'Persian' lime is not a true lime but the fruits are large and attractive although the flavor and aroma are not as good as 'Kagzi' lime. Perhaps there is a place in the Pakistan market for both the 'Kagzi' and 'Persian' seedless limes.

Pummelo (Citrus grandis), also known as shaddock and jabong is the most tropical of all dessert citrus. Pummelos are tolerant to salinity and have the longest shelf life of any dessert citrus. Although not well known in Europe or the Americas, those who have had experience with and access to all types of dessert citrus, usually prefer pummelos to other dessert citrus. Pummelo seeds are monoembryonic and the embryos gametic. Therefore they do not come true from seed like most other citrus, and seedling trees seldom produce acceptable fruit. The best clones are from China and Thailand. The best Thai varieties are 'Kao Pan' 'Kao Phuong,' 'Kao Yai,' 'Kao Hom' and 'Thong Dee.' 'Leslie' and 'Haiku B' are the best clones from Hawaii and 'Chandler' is an excellent variety developed in California. A few pummelos are now grown in southern Pakistan but there are no large plantings of improved clones. Pummelos are probably better adapted to saline soils, high water tables and high pH than other citrus species. Because of this they may grow and produce well in areas of the country where other citrus would fail. It is recommended that the best pummelo clones from Thailand be imported and test grown in warm tropical areas of the country. Pummelos should not be grown from seed but must be introduced and grown by means of scions, budwood or marcotts. Extreme caution must always be taken never to introduce clonal material from trees affected with virus diseases, especially tristeza which is readily transmitted to other citrus species by aphids.

Citrus Rootstocks: Citrus varieties grown in Pakistan are usually budded on either rough lemon or sour orange rootstocks. Both have serious shortcomings as rootstocks. The quality of fruit produced on trees budded on rough lemon is marginal and the trees are subject to Phytophthora foot rot and gummosis. Trees budded on sour orange are

very susceptible to tristeza virus and often die prematurely. These widely used citrus rootstocks in Pakistan have serious drawbacks and are of doubtful value. They need to be replaced when viable alternatives can be found. Fortunately there are several promising new rootstocks available which may provide alternatives. These include:

1. 'Heen Naran,' Citrus crenatifolia, a small native type of mandarin orange, native to Sri Lanka. This promising rootstock for oranges and tangerines is immune to Phytophthora foot rot and tolerant to Tristeza.
2. Citrus sunki: This is a dwarfing rootstock, tolerant to Tristeza, and resistant to Phytophthora foot rot. It is the most important rootstock for tangerines in China.
3. 'Swingle', a hybrid rootstock developed in Texas specifically for use on saline soils with high pH.

Any of these three rootstocks could provide a viable alternative to the questionable citrus rootstocks now used in Pakistan. It is recommended that these promising rootstocks be imported and tested in citrus growing areas of Pakistan as soon as possible. Replacement for present rootstocks is needed because of fruit quality and disease considerations.

BANANAS

'Basrai' and 'Williams Hybrid', banana varieties now widely grown under irrigation in Pakistan are considered well suited to growing conditions in the country. In addition to these well accepted varieties, it is recommended that the 'Santa Catarina Prata' (silver) variety from Brasil be imported and tested as soon as possible. 'S.C. Prata' is a recently developed variety originally as mutant form of 'Virupakshi,' syn. 'Sirumalai,' a hill banana from India. 'S.C. Prata' has excellent plant and fruit characteristics with sturdy plants which are strong and vigorous with adequate suckering and only about half as tall as 'Virupakshi.' The bunch size and fruit are the same as 'Virupakshi.' The fruit quality and flavor of 'S.C. Prata' are good and in Brasil and Hawaii the fruit is preferred to that of 'Basrai.' Fruit of 'Prata' always sells at a higher price than that of 'Basrai' because of preferred flavor and longer keeping quality. It is recommended that plants of 'S.C. Prata' be imported from Hawaii as soon as possible for testing in banana producing areas of Pakistan.

There is also an improved type of 'Basrai' from New Guinea which has stronger, more vigorous plants and larger bunches than original 'Basrai.' Fruit quality and flavor are the same as 'Basrai.' This new variety is gaining importance as a commercial variety in Australia. It is recommended that the 'New Guinea Basrai' variety be imported and tested in Pakistan because of its vigorous growth and high productivity.

PAPAYAS

Although there is considerable commercial production of papayas in Sind province, environmental conditions are considered marginal for production of high quality dessert papayas. Cool night temperatures below 15°C, during the winter months from December to March, adversely affect quality and yield of papayas set during this period of the year.

Only female plants are used for fruit production and the seed used is from open pollinated female fruits. Pollination is from unknown random sources, so the seedling plants are heterozygous and the fruit produced, variable in size shape, shape, flavor, and sugar content (TSS). Improvement in fruit quality is not possible without hand pollination and this is seldom done. Until true breeding inbred lines are obtained and maintained by controlled pollination, little if any improvement can be expected in the type and quality of papayas produced. Unfortunately however there are no outstanding dioecious papaya varieties in existence. Any papaya improvement program, although possible, would be a difficult, long-time proposition. Most of the world papaya production and all of the export papayas are based on hermaphrodite varieties with perfect flowers. A good quality uniform papaya variety with fruit averaging more than 12% sugar (TSS) is urgently needed before papayas can become a popular commercial fruit in Pakistan. It is recommended that a serious effort be made by breeding and/or introduction from other countries to develop such a variety. It is strongly recommended that seed for commercial plantings be from hand pollinated fruits. Three inbred hermaphrodite varieties bearing fruit with high sugar content were introduced by the consultant in October. These may be of some value in genetic improvement and/or fruit production. However because of deformed flowers and fruit which occur on hermaphrodite plants at temperatures below 15°C, female plants are probably better than hermaphrodite plants for fruit production in Pakistan.

PERSIMMONS

All persimmons presently grown for market in Pakistan appear to be of the astringent type, which must be ripened and eaten after they soften and become nonastringent. If persimmons are to become widely accepted as a popular fruit in the country, it is recommended that improved nonastringent varieties such as 'goshō' fuyugaki and fuyu be introduced and popularised. Fruit of these and other non-astringent varieties are eaten like apples while they are firm and crisp. Nonastringent persimmons are generally more acceptable to the consumer than the astringent type presently grown and marketed in Pakistan.

BER (JUJUBE)

The so-called Indian jujube Zizyphus mauritania, native to the sub-continent, is widely grown in Pakistan. The fresh fruit of improved varieties is generally eaten fresh, out-of-hand, as a dessert fruit. The trees are tough, productive, easily grown and well adapted to saline soils with a high pH. Improved clones have been selected and are grafted and budded on wild native jujube seedlings.

The Chinese jujube, Zizyphus jujuba, on the other hand, is not well known and not grown commercially in Pakistan. Improved clonal varieties of Chinese jujube are grown and much appreciated in China and Thailand. Ripe fruit of these improved varieties is widely used as a dessert fruit in China and elsewhere. Fruits of certain varieties when properly prepared and dried are acceptable substitutes for dates and are sometimes called 'Chinese dates.' Fruit of other selected varieties is sometimes packed, labeled, and sold as "prunes" because they so closely resemble European prunes. It would be worthwhile to import and test Chinese jujubes in warm, dry areas of Pakistan, where they could probably be grown successfully. Southern China would probably be the best source of planting material of improved clones of Zizyphus jujuba.

AVOCADOS

Improved clonal varieties of the 3 major types or races of avocados should be imported and test grown, particularly in cool, frost free locations in the hilly and mountainous areas of the northern and western sections of the country. A few avocado trees of the Mexican race were observed growing well and producing crops in Tret valley at about (2000) ft. elevation near Murree. There appears to be little interest, knowledge, or understanding in Pakistan, of the excellent nutritional qualities and potential value of avocados as a food crop. Of all tree fruits in the world, avocados are the most nutritious with the highest food value. They are much appreciated and sold at high prices in all countries where they are well known. It is therefore recommended that several selected clones of avocado be introduced and test grown in well drained frost free areas above 1000 ft. elevation in Pakistan. Scions of suitable avocado varieties for test planting could be obtained from Hawaii, Florida, Puerto Rico, and California. 'Hass,' 'Sharwil,' 'Semil 34' and 'Simmonds' would be good varieties for test plantings in suitable locations in Pakistan.

SPECULATIVE TREE CROPS

Pakistan is presently deficient in production of edible oil and must import cooking oil to make up the deficit. Two promising oil crops for dry, hot areas should be imported and test grown in the country. These are 'Tacay,' Caryodendron orinocense, and 'Aceituna,' Simaruba Glauca. Both can be imported and propagated without difficulty from seed.

Tacay is an oil producing tree native to Venezuela, Colombia, Northern Brasil, and Ecuador. It is tough, vigorous, highly productive tree of the Euphorbiaceae family. It produces heavy crops of edible nuts which contain more than 60 per cent of a high grade edible oil. Tacay is presently being planted commercially as an oil crop in Colombia and could probably be grown successfully under irrigation in frost free zones of Pakistan.

Aceituna is an extremely robust, drouth resistant oil bearing tree, native to tropical America from Southern Mexico to Ecuador. It grows well on poor, dry, alakaline soils in hot semi-arid regions. The kernels of the seeds contain a premium grade edible oil which solidifies without hydrogenation at approximately 30°C. Aceituna is an easy tree to grow. In arid regions during protracted drouth periods, aceituna is often the only tree which retains its leaves and continues to grow well.

Imbu, Spondias Tuberosa, is the only important native fruit tree which thrives on saline soils in the hot, dry, inland areas of North-eastern Brasil. Wild imbu trees produce an abundance of a good fruit, well liked by Brazilians. Fresh imbu fruit has good keeping quality and is trucked hundreds of miles to be sold in major cities of central Brasil. Imbu trees are easily propagated by seed or by means of hardwood cuttings which root easily. Because of its tolerance to drouth and salinity, Imbu should be imported and tested in Pakistan.

Ramon, Brosimum alicastrum, is a good food and fodder tree, native to the Yucatan peninsula of Mexico. Yucatan has a hot, semi-arid climate, high soil pH, saline soils, and variable but relatively high salt content in the ground water. Mesquite and henequen will grow under these conditions but most other tree crops are marginal or fail. Ramon is an important native tree of this area which thrives under difficult soil and climatic conditions in this area. It is a useful fodder tree for cattle and horses. The leaves, and branches with leaves provide a palatable and nutritious feed for livestock. The seeds are also eaten by livestock and in the past have been made into flour for human consumption. Because it is a good food for livestock and humans and thrives in saline soils in warm semi-arid locations, Ramon should be well adapted to similar soil and climatic conditions in Pakistan. It is recommended that seeds be imported from Mexico for adaptation trials in Pakistan.

Suggested Locations for
University Degree Training in Tropical Agriculture:
(Horticulture, Plant Pathology, Soils, Agronomy and Entomology)

B.S. & M.S. levels only:

1. National Agricultural University Chapingo, Mexico
D.F. (in spanish)
2. University of Nuevo Leon, Monterey, Mexico, N.L. (in spanish)
3. University of the Philippines at Los Banos, College, Laguna
Philippines.
4. California Polytechnic University, San Luis Obispo,
California
5. California Polytechnic University, Pomona, California
6. University of Puerto Rico, Rio Piedras,
Puerto Rico
7. University of the West Indies, Port au Prince, Trinidad, W.I.

PH. D. & M.S. levels:

1. University of Hawaii at Manoa, College of Agriculture,
Gilmore Hall, Honolulu, Hawaii, U.S.A. 96822
2. University of Florida, College of Agriculture
Gainesville, Florida
3. University of California at Riverside, Riverside,
California
4. Netherlands Institute of Tropical Agriculture, Wageningen.
The Netherlands

Suggested procedure for handling requests for plant material.

Plant material requests: Seeds, scions, and budwood of fruit varieties mentioned in this report can for the most part be obtained from the University of Hawaii Horticulture department and/or the USDA tropical fruit germplasm facility in Hawaii. Specific requests for limited amounts of seed and scions of desired fruit varieties can be made through the University of Hawaii Horticulture Department. For specific requests contact:

Dr. Richard A. Hamilton
Professor of Horticulture (Emeritus)
Department of Horticulture
University of Hawaii, 3190 Maile
Way, Honolulu 96822 USA

For further information and assistance in locating and procuring propagating material of desirable fruit varieties discussed in the report, the consultant will be able to assist on request. Details on procurement, shipping, and packing charges for seed and scions vary and will need to be worked out. For small shipments charges will be minimal. Charges will be mostly for time spent in collecting, packing, and shipping the scions or seeds requested.

TERMS OF REFERENCE

A Study of Horticultural Research and Production in Punjab

The purpose of this consultancy is to study the existing fruit and nut production in Punjab with a view of promoting an improvement in both research and production. This consultancy is viewed as the first of several in the horticulture area and as such, the consultant is expected to describe the current research and production situation in a broad sense, pointing out areas for further study by other consultants as well as recommending improvements in research and production for implementation in the immediate future. The consultant will concentrate on tropical and subtropical species but should not neglect the important temperate species in this assignment. Also he should provide suggestions for other consultants who, at later dates, will concentrate on specific horticultural research issues. He should also recommend for importation exotic germplasm of plant material of tropical and subtropical fruit and nuts which would have traits useful to Pakistan but which is currently lacking in Pakistan.

The consultant will visit research and production locations in Punjab, and other parts of Pakistan to get an understanding of the level of research and the problems of production. He will be guided in developing an agenda by the Secretary of Agriculture, Punjab, and his staff, Member (C.S.) of the PARC and by the MART Provincial Research and Operations specialist. The length of this consultancy will be about four weeks in early 1988.

The consultant final report (a draft must be prepared before he leaves Pakistan) should consist of his findings and observations together with a set of recommendations to improve research and production of fruit and nuts in Punjab and similar areas elsewhere in Pakistan. Some of the recommendations may be research problems that need to be addressed with suggestions of research methodology to be followed.

The following are some key points the consultant should include in his report:

1. A description of the current research being done on fruit and nut crops with an indication of where research is being conducted, the number of scientists involved, their level of training, and if possible the current level of funding.
2. An evaluation of research programs in progress with respect to the potential usefulness of the research findings. Any areas of research critical to increased horticultural production that are not being addressed by the current research program should be noted, and suggestions made for a research methodology to tackle the problem.
3. A discussion of the export possibilities for any fruit and nut crops grown in Pakistan, including those not now grown but potentially valuable in this country.

For all the points above the consultant should analyze the current situation and make suggestions for improvements. He should point out weaknesses in the current research program and recommend ways to improve research on fruit and nuts. Centers of excellence around the world for research on these topics and names of individuals who are research leaders on various pertinent topics should be given. Two research problems which have long vexed Pakistan are mango malformation and quick decline of citrus. Suggestions for a research program on these two problems that could be implemented immediately should be given.

The consultant will, as part of his report, draft the terms of reference for future horticultural consultants (approximately 4-6) who will investigate specific horticultural research and production problems over the next 18 months.

The consultant should also suggest types of training and locations overseas where horticulturalists may be trained for tropical, subtropical, and temperate pomology applicable to Pakistan

Assistance will be required in obtaining budwood for any important plants that are currently deficient in the national inventory. If possible, the consultant should bring with him budwood of superior processing varieties of guava and scionwood of colorful dessert mango varieties.

ITINERARY FOR DR. RICHARD A. HAMILTON
HORTICULTURE CONSULTANT

October

20	Tue	Arrive Islamabad from Karachi PK 324 1250 Bud guava at NARC and rest
21	Wed	PARC - Meet Member Crop Sciences and Dr. Daud NARC - Visit horticulture plantings. To Lahore PK 313 - 1630 - 1720
22	Thu	Lahore - Bud guava - Meet Secretary of Agriculture. See private farmers near Lahore.
23	Fri	Visit private farmers.
24	Sat	Lahore - Faisalabad by road. Meet Dr. M.A. Bajwa and staff of Horticulture Institute.
25	Sun	To Sahiwal and stay overnight.
26	Mon	To Shujabad, Bahawalpur and back to Multan.
27	Tue	To Jhang and Faisalabad
28	Wed	To Soan Valley and stay overnight.
29	Thu	Return to Faisalabad. Visit with D.G. and return to Lahore.
30	Fri	Proceed to Karachi PK 303 1120 - 1305. Proceed to Hyderabad
31	Sat	To Mirpurkhas, Horticulture Research Institute MJD - HYD PK 567 1655 - 1755

November

1	Sun	Thatta - Sujawal - Badin - Husri research stations.
2	Mon	Nawabshah area.
3	Tue	Miani Forest research area.
4	Wed	SAU Horticulture
5	Thu	Private farmers in Mirpurkhas area
6	Fri	Private farmers in Tando Jam.
7	Sat	Coconut research station and PIA horticulture farm
8	Sun	Visit PARC Plant Introduction Station. KHI - LHE PK 306 1830 - 2010
9	Mon	Lahore - Check on guava and see Secretary of Agriculture. Proceed to Islamabad
10	Tue	Visit NWFP - AU and Tarnab and return to ISB by road. Work on report.
17	Tue	Departure

BIOGRAPHICAL SUMMARY SHEET

NAME: Richard A. Hamilton

ACADEMIC QUALIFICATIONS (Degrees, Specialization, Institution, Year -- most recent first)

Tropical Fruits Consultant

YEAR OF BIRTH: 1915

YEAR BEGAN PROFESSIONAL WORK EXPERIENCE: 1946

NATIONALITY: U.S. Citizen

LANGUAGE CAPABILITY (rate per definitions on previous sheet--limited, fair, good, excellent, or native/bilingual)

- English: Excellent
- Spanish: Good
- Portuguese: Fair

COUNTRIES OF WORK EXPERIENCE:

AFRICA: Kenya, Malawi, South Africa, Zambia, Zimbabwe

ASIA: Bangladesh, Indonesia, Malaysia, Philippines, Thailand, Taiwan

LATIN AMERICA: Brasil, Colombia, Ecuador, Peru, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Montserrat

CARIBBEAN:

MIDDLE EAST:

EUROPE:

NORTH AMERICA:

CHRONOLOGICAL WORK EXPERIENCE (Organization, Position, Dates--most recent first, all inclusive):

- 1938-39 Asst. Co. Agent, Grant Rapids, MN
- 1940-41 Co. Agent, Carrington, ND
- 1945-47 Asst. Prof. Horticulture, Grand Rapids, MN
- 1954-1984 Various short time consulting assignments on tropical fruit research and development with the following countries and sponsors.

1. El Salvador/AID
2. Guatemala/AID
3. Panama/AID
4. Nicaragua/AID
Costa Rica/FAO & IICA

WORK EXPERIENCE (Cont'd)

- | | |
|-----------------------------------|-------------------------|
| 5. Mexico/INIA | 24. Panama |
| 6. Colombia/AID | 25. El Salvador |
| 7. Peru | 26. Nicaragua |
| 8. Brasil/IICA/EMBRAPA | 27. Costa Rica |
| 9. Ecuador/NSF | 28. Venezuela |
| 10. Montserrat/Barclays Bank | 29. Australia |
| 11. Republic of S. Africa/Private | 30. New Zealand |
| 12. Zambia/FAO | 31. US/Hawaii (Private) |
| 13. Kenya/FAO | |
| 14. Malawi/Private | |
| 15. Zimbabwe/Private | |
| 16. Philippines/FMC | |
| 17. Malaysia/FAO | |
| 18. Thailand/Rockefeller Found. | |
| 19. Indonesia/FAO | |
| 20. Bangla Desh/AID | |
| 21. Hawaii/Private | |
| 22. Marianas/USDA | |
| 23. Costa Rica/AID | |

I have made 53 consulting missions to 32 countries from 1955 to date. All of these consultantships have been research and development oriented advisory missions dealing with tropical and subtropical fruit and nut crops. Twenty of these consulting missions were return or follow up missions to countries where I had worked previously. Five consulting missions each were made to Mexico, Brasil and the U.S. (Hawaii).

I have not kept detailed records on dates of these consulting missions carried out over the past 30 years. It would be difficult if not impossible to provide an accurate record of the exact dates involved. I can however provide on request, pertinent information including old reports from specific countries which may be of interest.

CHRONOLOGICAL LIST OF CONTACTS
MADE BY CONSULTANT

- Dr. Daud Ahmad Khan, Consultant on Horticulture, PARC
Dr. Abdul Rehman Khan, DDG NARC
Mr. Hafiz-ur-Rehman, SO Horticulture, NARC
Dr. Ashraf, PSO Horticulture, NARC
Syed Yawar Ali, Managing Director, Milk-Pak, Lahore
Mr. Khalid, Horticulturist, Ashrafiyah Nursery, Lahore
Malik Khuda Bakhsh Bucha, Mango Farm Owner, Marakka Farm, Lahore
Dr. Zafar Altaf, Secretary of Agriculture, Punjab, Lahore
Mr. M. Khurshid Chaudhry, Horticulturist, Lahore
Mr. Hameed Mazhar Sheikh, Acting Director, Horticulture Research
Institute, Faisalabad
Mr. Musahib-ud-Din Khan, Visiting Professor, University of
Agriculture, Faisalabad
Mr. Irshad-ul-Haque Mian, Horticulturist, AARI, Faisalabad
Mr. Ata-ur-Rehman Aslam, Horticulturist, Citrus Research Station,
Sahiwal
Ch. Abdul Haq, Horticulturist, Mango Research Station, Shujaabad
Mr. Muhammad Akram Nasir, Asstt. Horticulturist, Mango Research
Station, Shujabad
Mr. Niaz Ahmed, Assistant Horticulturist, Bahawalpur Sub-station
Malik Nazir, Horticulturist, Soan Valley
Mr. Inayat Ali Rizvi, Director, Horticultural Research Institute,
Mirpurkhas
Mr. Ehsanullah Baloch, Horticulturist, Citrus & Mango Station, Sakrand
Mr. Manzoor Ahmed, Horticulturist, Banana, Papaya & Chiku Station,
Sujjawal
Mr. Muhammad Umar Sial, Sugarcane Specialist, Sujjawal
Mr. Muhammad Sadiq Bhatti, Horticulturist, Coconut Research Station,
Karachi
Mr. S. Haq Memon, Conservative of Forest, Hyderabad
Mr. Lajpat Rai, Horticulturist, Jujube, Husri
Sh. Muhammad Ashfaq, Vegetable Specialist, Husri
Mr. Shewak S. Neuwani, Asstt. Horticulturist, Tomato, Badin
Mr. Barkat Ali Soomro, Director, Cotton Research Institute, Sakrand
Mr. Muhammad Hussain Panhwar, Consulting Engineer and Mango, Banana
and Jojoba Farm Owner, Tandojam

- Dr. Muhammad Iqbal, Director, Oilseeds, AARI and his staff on their visit to Hyderabad
- Dr. A.Q. Ansari, V.C., Sind Agriculture University, Tandojam
- Mr. Haji Khan, Chairman, Dept. of Horticulture, Sind Agriculture University, Tandojam
- Mr. Munir Ahmed Sheikh, Assistant Professor of Horticulture, Sind Agriculture University, Tandojam
- Dr. Kazi Suleman Memon, Associate Professor of Soils, Sind Agriculture University, Tandojam
- Mr. Noor Muhammad Miano, Assistant Professor of Horticulture, Sind Agriculture University, Tandojam
- Mr. Zafar Sheikh, Chief Horticulturist, PIA Nursery, Karachi Airport
- Dr. M.H. Baig, PSO, Pesticides, PARC at University of Karachi
- Dr. Ahsan Vahidy, Chairman, Dept. of Genetics, University of Karachi
- Dr. Kenneth McNabb, Research Advisor, Pakistan Forest Institute, Peshawar
- Mr. Muhammad Siddique Khan, Director General of Research, NWFP Agriculture University, Peshawar
- Mr. Rauf Khattak, Director General of Research NWFP Agriculture University, Peshawar
- Dr. Faridullah Khan Wazir, Associate Professor of Horticulture, NWFP Agriculture University, Peshawar
- Dr. Bill Seiders, Outreach Specialist, TIPAN Project, NWFP Agriculture University, Peshawar
- Syed Abdul Qadim, Director Tarnab ARI
- Mr. Saifullah Khan Khattak, Project Director, Horticulture, Tarnab
- Mr. Iftikhar-ul-Haq, Horticulturist, Tarnab
- Mr. Tasleem Jan, Horticulturist, Mingora
- Mr. Haleem Khan Kunch, Horticulturist, D.I. Khan
- Mr. Khalid Mahmood Chaudhry, SO Horticulture, NARC
- Mr. Harold Dickherber, Agricultural Development Officer
- Dr. Curtis Nissly, MART Project Officer
- Dr. Mohammad Saeed, Program Agronomist
- Mr. Ikramullah Khan, Member Board of Directors, ADBP, 20-Chinar Road, University Town, Peshawar