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**Queensland fresh market tomato breeding
- travel to USA and Europe, July 1994**

Des McGrath

**Queensland Department of Primary
Industries**



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Level 6
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Telephone: (02) 9418 2200
Fax: (02) 9418 1352

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Tomato Breeders Conference
Royal Sluis and Caillard Graines Seed Companies

Travel Report to Bowen District Growers Association and
Horticultural Research and Development Corporation

Executive Summary

D.J. McGrath

Department of Primary Industries
Bowen Horticultural Research Station
PO Box 538
Bowen Q 4805

(This report covers attendance at the 1994 North American Tomato Breeders Roundtable at Fletcher, NC, 25-27 July, and visits to Royal Sluis Seed Co, Nimes and Caillard Graines Seed Co, Sarrians, France from 31st July - 6th August.)

The travel was funded jointly by Bowen District Growers Association and Horticultural Research and Development Corporation.

INTRODUCTION AND OBJECTIVES

Mr D. McGrath attended the 1994 Tomato Breeders Conference in Fletcher, North Carolina. This meeting is a forum for North American tomato breeders to present the latest advances in their programs, to exchange information, germplasm and breeding lines.

He also visited the tomato breeding centres of Royal Sluis and Caillard Graines in southern France, where he inspected the research and development facilities at the companies' breeding stations.

The development of new tomato varieties addresses Departmental Goal 3 which is the promotion of competitive advantage of rural-based industries. By studying the best programs in the United States and Europe, Mr McGrath has sought to enhance the productivity, profitability and competitiveness of Queensland's tomato industry. His exposure to breeding lines of other programs and access to some of that material will support Queensland's advantage in tomato production.

Continuing improvements in crop productivity, especially through genetic resistance to pests and diseases are vital for the whole process of technological innovation. This is a key issue in the Industry Services Program. Particular attention was given to germplasm and breeding lines with Potato Tuber Moth resistance.

Interaction with tomato breeders from large companies is an excellent means of keeping abreast of current market trends. The company breeders are working very carefully to produce varieties for specific market segments and are sensitive to market requirements. Exposure to their knowledge and experience was an objective of the travel.

Interest by both Sluis and Groot and Royal Sluis in developing linkages with QDPI's tomato breeding program was also explored.

BENEFITS TO QUEENSLAND

General

This travel has strengthened the existing relationships between QDPI and significant tomato breeding programs in the United States and Europe. Information, new knowledge and new breeding lines have been obtained for the benefit of QDPI's program.

Contact with breeders and their managers from two large companies confirmed their interest in working cooperatively with QDPI in the development of particular types of varieties. Approaches are being made from the companies to QDPI, seeking negotiations for joint work and direct investment in our program.

Tomato Breeders Conference, North Carolina

Presentations from breeders and geneticists working in the areas of insect and disease resistance, tomato quality and molecular biology were given at this meeting. Discussions with two of the most experienced researchers working with insect resistance were directly

useful for the Potato Tuber Moth program in Queensland. Breeding material from Cornell University was requested.

A large number of hybrid varieties and breeding lines were on display in field plots at the University of North Carolina Fletcher Research Centre. Many of these lines were noted and the University breeder agreed to supply a number for our program. Early maturity, disease resistance, particular growth habits and fruit quality were the features of greatest interest.

Royal Sluis Seed Company, Nimes, France

Inspection of the Company's facilities and field plots was of interest here. Several extended shelf-life varieties were on trial.

Similar hybrids are now being marketed by several companies in Australia and these may offer the potential for expanding Queensland exports by sea freight. Their adaptation by industry has been limited by quality problems; although work by several companies may soon overcome these problems.

An offer of joint work with QDPI was made in 1993 and the possibility of implementing this proposal was discussed.

Caillard-Graines (Sluis & Groot), Sarrians, France

Field trials, breeding material and facilities were examined and their breeder discussed the various programs for which he is responsible.

I met with the company's senior manager of vegetable breeding, the marketing manager for Asia, and the tomato breeder. They discussed a plan for investment in QDPI's tomato breeding program, particularly for the development of varieties suitable for Asia. It was evident that they had given the proposal serious thought. The detail of the plan is to be presented to the Horticulture manager for consideration and the options presented to me are listed in the body of this report.

Recommendations on Cooperative Work

1. I strongly recommend that prompt attention be given to proposals from both Royal Sluis and Sluis & Groot seed companies for cooperative breeding work.
2. Given the material benefits which would follow from cooperative work, I strongly suggest that agreements be negotiated to ensure investment in the Department's tomato breeding program and to preserve the integrity of its relationships with all seed companies.

Breeding for Insect Resistance

John Snyder (University of Kentucky) and Martha Mutschler (Cornell University) presented work on insect resistance in two wild species of tomato. The major interest here was the mechanism of resistance to several mites and insects and the chemistry of toxic compounds in wild species. The use of these compounds as selection criteria in breeding programs was discussed.

Breeding for Disease Resistance

Dan Chellemi (University of Florida) reported several new tomato accessions with good levels of resistance to bacterial wilt. He also indicated crop management factors which reduced disease incidence in susceptible varieties.

J. Mercier (Clause Seed Co., France) discussed Tomato Yellow Leaf Curl Virus and sources of resistance in two wild species.

The details of a program to transfer *Alternaria* resistance to fresh market tomato were presented by Dina St. Clair (University of California). She emphasised the use of RFLP markers and QTL analysis which related one area of Chromosome 3 to the Asc locus controlling a disease of different aetiology.

Paul Shoemaker (University of North Carolina) gave an overview of *Phytophthora* problems in that State and the occurrence of Ridomil resistant strains. He discussed the development of horizontal resistance to control the use of fungicides for both *Alternaria solani* and *Phytophthora infestans*.

Mike Coffey (University of California) reported on the appearance of new mating types of the *Phytophthora* pathogen throughout the world and the potential for sexual variability and the evolution of new fungicide-resistant strains. He indicated three wild accessions with good horizontal resistance.

Use of Molecular Markers

Steve Tanksley (Cornell) introduced some applications of molecular markers in tomato breeding. He mentioned the usefulness of markers closely linked to major genes which have been introgressed from wild species. By judicious use of markers it was possible to identify segregants with a minimum of linkage drag around the introgressed gene.

Dina St. Clair (University of California) reviewed the current status of mapping minor genes (QTL) and mentioned the difficulties of a QTL analysis.

Improved Tomato Quality

The influence of fruit sugar concentration on quality was reported by John Stommel (USDA, Beltsville). He considered the relative sweetness of fructose, glucose and sucrose and the contribution of various acids to flavour. A major part of his work is the genetic control of sucrose accumulation in green-fruited tomato species.

William Howie (DNA Plant Technology Corporation) discussed the extension of shelf-life in transgenic lines (Transwitch™). This material has extended fruit firmness (more than 40 days after first colour), and will not colour until gassing after harvest. This operates by a genetic suppression of ACC synthesis. Harvest costs are reduced because only one harvest is necessary when all fruit have developed some colour on the vine. He indicated that this shelf-life was longer than that currently obtained with conventional Rin fruit.

Jay Scott (University of Florida), Jim Augustine (BHN Research), Bob Heisey (Asgrow Seed Co) and Allan Nash (DNA Plant Technology Corp.) gave presentations on the use of extended shelf-life (ESL) varieties for US production and participated in a panel discussion. The view of the panel was that ESL types would prevail in the future. Already 75% of the 1994 production area in Mexico comprises ESL varieties. Some speakers expressed the view that ESL types were pre-disposed to quality problems such as colour defects following gassing and that retailers could misuse the extra shelf-life in these varieties. More work was needed on the handling and distribution of ESL types.

The overview of this issue by the panel suggested that ESL tomatoes do not possess intrinsic superior flavour. Their potential value was the ability to retain acceptable fruit firmness for longer periods, and this allowed later harvest when colour development had been initiated on the vine.

PRODUCTION REPORTS

United States

Within the United States the largest production areas for fresh market tomatoes are the South East States (Georgia, Carolinas, Alabama, 28 000 acres), Florida (50 000 acres) and California (45 000 acres). California will produce about 10% more in 1994.

Florida is facing serious losses because of the rapid spread of Tomato Mottle Virus; Tomato Yellow Leaf Curl Virus is a very serious problem in neighbouring Caribbean Islands and is expected to appear in Florida soon.

A severe outbreak of Cucumber Mosaic Virus has been reported in two mountain areas of Alabama and 75% of production has been destroyed in these areas.

Europe

Jan Barten (de Ruiter Seed Co) reported that large increases in southern Europe (Spain, Canary Islands) and Moroccan production had flooded Dutch, German and French markets with larger fruited types and had ruined the market for northern European glasshouse producers. Hazera Seed Co had taken a large share of the market in all European markets with the variety *Daniella*. It was especially useful for Spanish producers because its longer shelf-life allowed for distribution into northern markets. The damage to the Dutch glasshouse industry was considerable and the Dutch growers were working hard to restore the image of their product.

A significant marketing trend in the northern European countries was the shift towards harvesting a single truss or cluster of uniformly ripe fruit and presenting these in cases. Truss tomatoes have been retailing for higher prices in Holland.

Tomato Trial Plots

Demonstration trial plots of 75 trellised and ground-crop tomato varieties were available for inspection at the University of North Carolina Experiment Station at Fletcher. These plots displayed seed company and university hybrids and breeding lines with a range of useful attributes. All varieties were evaluated, some were photographed and a request was made for four lines of particular interest for the Queensland industry. The characters sought include short-internode (brachytic gene), shortened fruit maturation period, hot set ability and resistance to *Alternaria solani*.

Royal Sluis Seed Co., Nimes, France

I spent two days inspecting facilities and tomato breeding programs at the company's Nimes Research Centre. The leader of the tomato program coordinates the activities of other breeders in Hungary, Thailand, Morocco and Italy. Breeding is directed towards markedly different objectives in various regions of the world. Resistance to Tomato Yellow Leaf Curl Virus is essential for the Middle East and Tomato Spotted Wilt Virus is becoming more important in Europe. A greater effort is being made towards better flavour so that the company can reclaim market share lost in France and Germany.

An area of comparative weakness is bacterial wilt resistance. The company has relatively few varieties with resistance for expansion into Asia. Because of QDPI's expertise in screening

for resistance and development of resistant varieties, Royal Sluis would like to undertake some joint work. An approach was made to QDPI in 1993 regarding this venture.

INRA - Montfavet

I visited the INRA plant breeding station at Montfavet with Sylvain Bontemps and Abbe Adema from Sluis & Groot. We meet Professor Henri Laterrot and Madame Filouze to discuss their work on tomato improvement. Their programs have produced fruit quality improvement, resistance to bacterial canker and bacterial wilt.

Breeding for higher solids in processing tomatoes is underway using interspecific crosses to *L. cheesmanii*.

An attachment describes the activities of the Department of Genetics and Plant Breeding at INRA.

Caillard Graines (Sluis & Groot), Sarrians, France

I visited Caillard Graines for three days with the company's marketing manager for Asia, Abbe Adema. The leader of the breeding unit and the tomato breeder explained the scope of their tomato programs.

The French research centre handles programs for four different markets in Asia - India, Japan, China and Australia. The company wants to expand business in Asia, particularly Japan and China, but is constrained by a lack of suitable lines. A program for sweet Momotaro-like tomatoes for Japan has been running in France for 10 years. As with Royal Sluis, bacterial wilt resistant lines are not available for China, Taiwan and South-east Asia and Sluis and Groot faces the prospect of developing research facilities for this and other purposes.

An attractive alternative to building facilities in Asia is a linkage with QDPI. Sluis and Groot are impressed by QDPI's expertise in disease resistance breeding, especially bacterial wilt, Fusarium wilt and nematode resistance. The criteria which they use in selecting research facilities are the closeness to market, facilities and expertise, the size of the project and ease of communication. In all categories, QDPI was regarded very favourably and the company is preparing a submission for a joint venture through its associate in Australia, Northrup King.

There options for cooperative work were outlined to me.

1. QDPI develop new disease resistant lines from its own germplasm and breeding line resources, which Sluis & Groot would purchase and royalties would be returned to QDPI.
2. QDPI would develop disease resistant lines from Sluis & Groot's own adapted breeding lines. This would be a conservative back crossing program, using QDPI's disease resistant lines as donor parents.

3. QDPI would screen breeding material from Sluis & Groot on a contract basis at Bowen or Bundaberg.

The details of ownership and revenues from breeding lines will be negotiated, but some options will be presented in the formal submission to be made shortly to the General Manager, Horticultural Industry Services.

Recommendation

I was impressed by the depth and scope of the proposals put to me by senior personnel of Sluis & Groot. It appeared that they were fully committed to substantial investment in QDPI's breeding program and to cooperate fully. Given the urgent need for external funding of the Department's tomato breeding work, this represents an excellent opportunity for continued development of its program. If the Department appears to lack resolve in its dealings with the company, the opportunity could be lost.

I suggest that negotiations with both Sluis & Groot and Royal Sluis be undertaken promptly, and in such a way as to preserve the Department's independence and integrity in its relationships with all companies.