PN-ABK-017

76331

# MAHAWELI ENTERPRISE DEVELOPMENT

## MED/EIED PROJECT

(USAID/Sri Lanka Project No. 383 - 0090)
(Contract No. C-00-0031-00)

# PROCESSING TOMATO TRIALS IN MAHAWELI SYSTEM H

A short-term consultancy report
by
Peter Florance

March, 1992

Report 3/1992


INTERNATIONAL SCIENCE AND TECHNOLOGY INSTITUTE, INC.

WITH :

ERNST & YOUNG CONSULTANTS (Sri Lanka)
DEVELOPMENT ALTERNATIVES, INC.
HIGH VALUE HORTICULTURE, PLC.
SPARKS COMMODITIES, INC.
AGROSKILLS, LTD


CONSULTANTS TO THE MAHAWELI AUTHORITY OF SRI LANKA

# The Mahaweli Enterprise Development Project

The Government of Sri Lanka and the international donor community have given high priority to the development of the natural and human resources of the Mahaweli river basin. The first phase of this development, the construction of dams, irrigation and power systems, roads and other physical infrastructure, is largely complete. The second phase, settling the land and forming an agricultural production base, is well under way. The third phase, the major challenge for the 1990's, is the building of a diverse and dynamic economy, improving employment and income prospects for Mahaweli settlers and their families. In this phase the private sector has a leading role to play.

The Mahaweli Enterprise Development Project (MED) is a USAID-supported initiative of the Mahaweli Authority of Sri Lanka to promote investment and business development in agribusiness, manufacturing, tourism, minerals and services. MED directly assists small, medium and large-scale investors with technical assistance, marketing support, training, business advisory services and credit. MED also provides policy assistance to improve access to resources, such as land, water and capital, and the legal and institutional framework for enterprise development.

The official MED implementing agency is the Employment, Investment and Enterprise Development Division of the Mahaweli Authority. The main MED technical consultancy is provided by a consortium led by the International Science and Technology Institute, Inc., a private consulting firm with head offices in Washington DC. Other firms in the consortium are Agroskills, Development Alternatives, Ernst and Young, High Value Horticulture and Sparks Commodities. Marketing services are provided by SRD Research and Development Group, Inc.

# PREFACE

Mr Peter Florance, a tomato production agronomist is a MED consultant who is assisting Mahaweli investors in the development of processing tomatoes. He was in the field in Mahaweli Systems H and C during January/February 1992.

# TABLE OF CONTENTS


Page

1.0 OBJECTIVES . . . . . 1

2.0 SEED PROCUREMENT . . . . . 1

a. Australian Lines . . . . . 1

3.0 VARIETY TRIAL WORK . . . . . 2

4.0 FUTURE TRIAL WORK . . . . . 3

5.0 BACTERIAL WILT. (Pseudomonas Solanacearum) . . . . . 4

Future research into the Bacterial Wilt problem . . . . . 5

6.0 OTHER DISEASES AND PESTS . . . . . 5

Pests - Heliothus . . . . . 5

Leaf miner (Liriomyza Sativae) . . . . . 6

Aphid, white fly thrips . . . . . 6

7.0 CHEMICALS AND RESIDUES IN PRODUCT . . . . . 6

8.0 IMPLEMENTS AND TOOLS . . . . . 6

9.0 WEED CONTROL . . . . . 7

10.0 IRRIGATION . . . . . 7

Page


11.0 AREAS VISITED . . . . . 7

a. System H. . . . . 7

b. Anuradhapura . . . . . 7

c Dambewatana Farm . . . . . 8

d. Malwanegama Farm . . . . . 8

12.0 MECHANIZATION . . . . . 8

a. Necessary machinery . . . . . 8

13.0 OUTGROWERS . . . . . 9

14.0 THE CLIMATE AND ITS EFFECT ON OUTGROWERS . . . . . 9

15.0 COMMUNICATIONS . . . . . 10

16.0 CONTAINERS AND COLLECTION POINTS . . . . . 10

17.0 NURSERY . . . . . 11

18.0 STAFF . . . . . 11

19.0 CONCLUSION . . . . . 11


ANNEXES


**Annex 1** . . . . . 13

**Annex 2** . . . . . 15

## 1.0 OBJECTIVES

To establish commercial trial plots of selected varieties of processing tomatoes. To procure seed varieties that can be grown in dry tropical areas. To instruct and assist in the development of tomato production including seed-bed preparation, transplanting practices and correct soil moisture management.

Other objectives, according to the terms of reference, were to grown tomato seedlings in plastic module trays with and without starter solution, and to practice soil and media sterilization techniques. Unfortunately, facilities were not available for either demonstration.

Because the duration of service has been curtailed, it is not possible to be present for the harvest or post-harvest periods.

## 2.0 SEED PROCUREMENT

During my stay in Sri Lanka I brought in both hybrid and open pollinated tomato seed from California and Australia for trial work. The four California lines are hybrid F1 varieties all with heat tolerance, and of the Australian lines, two were found to have the best tolerance of Pseudomonas solanacearum (Bacterial Wilt) in trials in Thailand and the other three are dual purpose varieties 1.2 for both processing and fresh market. Heinz lines from Dr. B. George, California:

| | |
|---|---|
| H.7038 ) | All determinate types. Medium to large vines. |
| H.1810 ) | Heat tolerant, high yielding, good field storage |
| H.3025 ) | varieties. All have V, F1 and II, nematode and |
| H.2710 ) | Bacterial Speck resistance. |

### a. Australian Lines

| | |
|---|---|
| A 422<br>V & F1 | Large, vigorous vine. Indeterminate type, with large round to flat-round fruit. Very firm, excellent flavour, for fresh market or processing |
| Bounty Gem<br>V & F1 | Small compact vine. Small round fruit with pleasant flavour. High yielding. Not so firm as A 422. For fresh market or processing. |
| Arcadia<br>V & FI | A new improved variety, round fruited. High yielding. Excellent shelf life - very firm. Fresh market or processing. |

| | |
|---|---|
| UC82B<br>V & F1 | Widely grown in Australia. Excellent, compact vine type. Determinate characteristics. Fruit shape - pear to long plum. Good shelf life. High yielding processing tomato. |
| UC134E<br>V & F1 | Very early tomatoes - 105/110 days from seed to harvest. Flat-round fruit, good size. Good keeping. Processing tomato. |

These seed lines have been supplied to Mr. Nagasinghe of Richard Pieris Agricultural Enterprises (RPAE) but have not been planted as yet.

## 3.0 VARIETY TRIAL WORK - Galkiriyagama RPAE administration office

The early variety trials were made using fifteen (15) Peto lines and four (4) from Taiwan supplied by V.V.L. (Petograb). One day prior to my visit Mr Nagasinghe had planted seeds of these nineteen (19) varieties in light plastic bags using sieved jungle litter without fertilizer as a medium. The following day I planted five(5) seeds of each variety (see list), using the same soil medium with the addition of a small quantity of Triple Superphosphate. These pots (bags) were staked, numbered and watered. Instructions were given to the nurserywoman that they were to be watered gently by cup in hand, rather than with the only available watering can which had large vents in the rose unsuitable for watering small seedlings. Some of Mr Nagasinghe's trial were emerging against the side of the pots.

Five days later there was patchy germination - some of the Peto lines appeared to be lacking in vigour. On the sixth day only Nos 5 and 7 had not germinated, but we replanted those varieties that were ailing. On 25th February, four to five weeks after planting, I returned to Galkiriyagama Mr. Nagasinghe was most disappointed in his trial in which there were few healthy survivors - most seedlings were miserable, dying or dead. In contrast, in the planting made with superphosphate, the seedlings were without exception, one foot high and healthy apart from minimal leaf miner damage. To control this, the plants were sprayed with Metasystox early the following morning.

Cardboard boxes were purchased in the village to transport the seedlings to the field and RPA's David Struys and I transplanted the varieties into beds that had been previously prepared with poultry manure and rice hulls and were in good condition.

Holes were dug two feet apart and filled with one handful of triple Superphosphate, plus a double handful of rice husks and a double handful of husk ash to each hole (there was no more poultry manure available at this stage).

Loose soil was dragged back into the hole and mixed with husks and ash. The plants were removed from the bags carefully, making sure that there was no root damage; placed in the hole, firmed in and watered. Unfortunately, I will not be present to evaluate varietal performance or harvest yield.

## 4.0 FUTURE TRIAL WORK

Future trial work should be carried out under Mr. Nagasinghe's guidance.

I recommended that the farmer, who has leased land to R.P.A.E. for the trial work, should work up the two adjoining beds to the transplants and apply poultry manure and rice hulls similar to our previous trial. Mr Nagasinghe would then direct seed 2/3 seeds per drop of the four (4) hybrid F1 lines, and the five lines from Australia. All these varieties might do much better direct seeded than as transplants. I suggest that he keeps the remainder of the seed of all lines to grow some transplants and for direct seeding on the four (4) acre property which is to be developed adjoining the R.P.A.E. rice mill at Anuradhapura. These trials might not fruit before the wet season, but should give some indication which varieties (if any) have tolerance of Pseudomonas solanacearum (Bacterial Wilt).

Peto tomato seed varieties

1. Spectrum 579
2. Hybrid 882
3. Nema 512
4. Nema 1401
5. Nema 1435
6. Sausalito
7. Hypeel 696
8. Narcal
9. Peto 9543
10. Peto 98
11. Peto 111
12. Peto 343
13. Rio Grande
14. Royal Chico
15. Elios

Taiwanese lines

16. Known You seed Co
17. Precious
18. Girl's Sweet
19. New King Kong
20. Lovely Red 383

**********

## 5.0 BACTERIAL WILT (Pseudomonas Solanacearum)

On my first visit to R.P.A.E's farm at Galkiriyagama it was apparent that bacterial wilt was present in the commercial crop of Roma VF tomatoes. In an experimental effort to control the disease, we instigated a new method of cultivation and bedforming with the co-operation of the farmer from whom R.P.A.E. is leasing the land.

The following steps were taken to prepare the bed:

a) Weeds were hoed off the bed, and it was dressed with (46%P) superphosphate.

b) On top of that rice hills (husks) were spread, and then a layer of decomposed poultry manure mixed with rice hulls.

c) Finally rice husk ash from the boilers at the mill which is said to be rich in potash, was applied.

d) The mixture was thoroughly incorporated into the soil, using hand hoes.

e) Holes were dug two (2) feet apart, and a mixture of poultry manure, husks and ash was placed in the holes.

f) Beds were then formed with a three feet top and a nine inch deep furrow. Using seedlings grown from Peto seed varieties "Caribe" and "Roma", I transplanted five (5) of each variety from planting bags. The seedlings were placed in the holes, firmed in and watered.

Work carried out in Thailand two years ago showed that poultry manure in the planting medium helped to control bacterial wilt because the pathogen tended to attack the manure rather than the plant root. We know that Roma VF variety is susceptible to the wilt and this trial was designed to test the efficacy of this method of control.

The remainder of the same bed was marked down the middle with a stick to give a line for direct seeding. Poultry manure and husk ash were placed in the shallow furrow. Roma tomato seed was dropped in the row, three(3) seeds per clump at nine inch intervals. These were covered with rice hulls compacted and watered.

Four weeks later the commercial crop had virtually collapsed, riddled with disease. The transplant trial was surviving, but not flourishing. (The fact that the only available transplants were past their optimum planting date might have been a factor here.) The direct seeded trial, however, had only one clump of three (3) seedlings affected by wilt. The soil, moreover, was in excellent condition indicating that this method of bed preparation is worth persevering with in future plantings.

I observed that the adjoining coriander crop was also affected by bacterial wilt. It would be interesting to repeat the experiment on other areas of land where the bacteria might be less virulent.

### a. Future research into the Bacterial Wilt problem

I have been told that some local tomato varieties have tolerance of B.W. but the fruit is undersized and of poor quality. If this is so, a long-term breeding programme should be begun, crossing these types with imported varieties to improve performance while retaining tolerance. When final assessment of the imported varieties is made those (if any) that show tolerance to Wilt should be used in the crossing program. Selections would be made in Sri Lanka, and then sent to the Southern Hemisphere for crossing, thus saving a season. The seed saved from this crossing would be returned to Sri Lanka for further trialing, and so on. This process has been going on in Thailand for six years and should show results in 1992. However, there are many strains of Pseudomonas, and seed that is tolerant or resistant there may not necessarily be so in other parts of the world. There are also many vectors for the spread of the disease. Teak, mulberries, anthuriums and bananas have all been named as host plants in tropical areas.

Soil temperature of 22°C is needed before the organism becomes active. Has anyone considered tomato culture in the more elevated areas of the Island?

## 6.0 OTHER DISEASES AND PESTS

At least two (2) strains of Tobacco Mosaic Virus (T.M.V) were present in the commercial crop of tomatoes, in addition to Curly top virus T.M.V. is spread by poor sanitation i.e. dirty hoes and implements, and by workers walking on beds and brushing the plants with trousers or sarongs. N.B. There should be no SMOKING and hands should be washed and implements sterilized daily with a solution of hypochlorite, where the disease is present. T.M.V. can also be seed or soil borne. Avoiding planting in soil which has grown a previous crop of tomatoes, eggplant, or peppers, clearing away and burning infected debris from a previous crop, and keeping crops free of weeds, can all help to control the virus. Direct seeding often helps to eliminate the problem, as does the use of resistant seed. The same measures apply to Curly Top Virus, particularly weed control.

### a. Pests - Heliothus

There is a surprising incidence of grub damage in the crop. This is impossible to control with pesticides using knapsack pumps because, when the operator refills his spray unit or spends time mixing chemicals and then returns to the tomato bed, he frequently becomes confused and misses some areas. These lapses allow the grubs to survive and multiply, reinfesting the crop.

Flag markers would help, but ideally a motorised misting spray unit to cover a wider area in a shorter time would be the method to consider in the future. Elimination of grubs is essential in a processing tomato operation.

b. Leaf miner (Liriomyza Sativae)

Damage was noted in the nursery plants. Tunnels in foliage caused by these insects leave plants open to infection by Powdery Mildew. Spraying with Rogor or Metasystox should control this.

c. Aphid, white fly thrips

There are so many host plants around the perimeter of the fields that these insects are virtually impossible to eradicate. Good husbandry is the only solution.

## 7.0 CHEMICALS AND RESIDUES IN PRODUCT

I have been shocked to find many brands of dangerous chemicals available in this country which have been taken off registration in other parts of the world e.g. Dieldrin, Aldrin, Lindane, D.D.T. to name a few. These chemicals can leave residues in the finished product which are not acceptable in the processing industry, so it is essential that the Company has control over the spray material used by its suppliers. In Australia, State departments of Agriculture perform frequent random checks on fruits and vegetables where insecticides are used. To enable out-growers and farmers to keep simple records of chemical applications, a Spray Program Record form is attached (see Annex 2).

Endosulfan is the safest insecticide available at present, but there are many new synthetic pyrethrum products coming on the market. In hot, tropical climates regular preventative sprays should be applied to control bacterial problems i.e. Bacterial Speck, Spot and Canker - copper hydroxide in recommended fungus diseases should be controlled with Dithane Sprays, but this is not usually needed until fruits sets. Wettable sulphur should be applied to prevent russet mite attacking tomato vines.

Spraying chemicals by knapsack leaves the operator vulnerable through his bare feet, legs and arms. As many dangerous chemicals are absorbed through the skin, protective clothing should be provided in a company project.

## 8.0 IMPLEMENTS AND TOOLS

Hand hoes are used for most horticultural procedures and are too large and cumbersome for successful vegetable culture, at times causing damage to plants and roots. For close weeding a small hoe would do a better job - these could be manufactured locally.
A few shovels and wheelbarrows would be useful for nursery work, and a bench for filling pots for trial work would be more efficient and hygienic than the present method of working on the ground.

## 9.0 WEED CONTROL

Weeds can be vectors for transmission of disease and hosts to insect populations. They also interfere with irrigation flow, and compete with tomato plants. In paddy, Nutsedge, a stubborn perennial weed that produces rhizomes at a depth of 8", is nearly impossible to eradicate by cultivation. In the future, thought should be given by the company to making application to import weedicides into the country. If direct seeding of tomatoes is employed, pre-emergent weedicides are a must to get a good start.

## 10.0 IRRIGATION

This is the most important part of a tomato growing operation and the most difficult to do successfully. It is essential to get water on the growing plants, and equally essential to get it off again. On a large farm e.g. Malwanegama, high head channels and irrigation syphons to get uniform water flow with good drainage are the recommended method. Our small holdings, growers should be trained to use raised beds with furrow irrigation. Good drainage is the key word. In previous reports, watering by overhead sprinklers has been mentioned. In a tomato crop this is disastrous for several reasons. People tramping through fields dragging pipes, spread T.M.V and other diseases and can cause damage to vines, and compaction of wet soil. Rotary sprinklers, unless they are very carefully positioned, leave dry spots - uneven watering. Also, sprinklers working during the day suppress pollination of the flowers, and keep bed tops wet when fruit has formed promoting botrytis and soil rots. Any crop susceptible to bacterial problems will suffer under sprinkler irrigation, especially in tropical conditions. This method of irrigation is not recommended. Once tomatoes have been grown successfully and it is desired to increase yields, trickle or drip irrigation is the way to go.

## 11.0 AREAS VISITED

### a. System H

Areas visited included RPAE's rice mill as Anuradhapura, and the four (4) acres adjacent which it is proposed to develop for tomato culture; Malwanegama (Chinese Farm) situated on the Talawa - Tambuttegama Road. H.4.; RPAE's Research farm at Galkiriyagama, and the area leased for trial work nearby; Dambewatana Farm 100 acres behind Galkiriyagama H.9; and R.P.A.E. Head Office in Colombo.

### b. Anuradhapura - (4 Acres adjacent to RPAE's Rice Mill).

When I visited this site, with Mr. Nagasinghe, he was expecting a bulldozer to remove old coconut palms preparatory to starting cultivation. Check banks were to be knocked down, and since this area has been in paddy for some years, deep ripping was recommended. Water had commenced to flow into the paddy. This field might take a month to prepare.

c. Dambewatana Farm

Dambewatana Farm is at least five (5) years away from tomato production. Clearing, levelling and fencing (electric?) irrigation channels and drainage need to be installed. Humus build up and fertilizing, then bed forming should take place. A legume crop, e.g. soya beans, should be grown before cultivating tomatoes.

d. Malwanegama Farm

As a vegetable farm, this probably has the greatest potential of all. However, to date no decision has been made by EIED as to its future.

If RPAE's bid is successful it would take at least twelve (12) months to bring the farm into tomato production. Firstly, trials would need to be carried out to find out if bacterial wilt would be a problem. Having done that the land, which has been in paddy for some time, would need deep ripping. It has been laid out and graded for long runs of irrigation giving better water distribution and easier control; and making it ideal for bed forming for horticulture. Drainage is excellent, running to one point so that recirculation of water is a possibility.

The property would lend itself ideally to a paste processing and packing plant. The shedding is adequate for ware-housing. There is plenty of room for a nursery structure, boiler house (coal, oil, gas) and auxiliary power unit.

There are office facilities, with space for a laboratory and testing facilities for quality control. There is three (3) phase power, good roads and machinery and implement sheds. The site is excellent for the plant itself, which would include an inspection area for outgrowers product prior to dumping, and swimming pool or dumping tanks for fruit.

## 12.0 MECHANIZATION

The bulk of machinery at present on the farm would appear to be either unserviceable or worn out. Modern agriculture demands minimum tillage. No disc ploughing should be done because it destroys the soil structure. Deep ripping and bedforming is sufficient.

a. Necessary machinery

It is recommended RPAE purchase 100 H.P 4 wheel drive tractor (60-85 h.p are not strong enough to pull a Chisel plough) if they are go ahead with commercial tomato farming. Tractor implements required would include the following:

- Triple length implement bar, measuring 17' wide with hillers, tynes and bean knives, and with land wheels attached.

- Clamps and wedges if possible (instead of spanners, nuts and bolts)
- Lely rotor cultivator with bed former attached.
- Spray unit with boom.
- Fertilizer spreader.
- Chisel plough.
- Seeder (3 off for direct seeding).
- Syphon hoses for irrigation.

Further details can be supplied if they are required.

## 13.0 OUTGROWERS

I have been told that many outgrowers are interested in growing tomatoes for processing, but to date have only met the farmer from whom R.P.A.E. is leasing land for trial work.

I have suggested that people with authority in the villages should be contracted by company representatives, and a more definite response should be sought. Hearsay is not a sufficient basis for a processing industry. A fifty acre company farm will not support a processing plant on its own . To train large numbers of outgrowers in techniques which will produce quality fruit will be a major undertaking. Example by demonstration is the best way. In Portugal, at the inception of tomato processing, the company provided two tractors and employed four drivers working in shifts to do the initial cultivation on all blocks, after that the growers were on their own. This set the standard for good practices. If only 100 outgrowers are relied upon to provide fruit in the first instance, an enlarged field staff will be necessary. In other countries tomato field officers live in the areas under their care and are constantly available to assist all growers who need help. Growers must be under no misapprehension regarding the quality of fruit required for export quality paste production - ***any old tomato will <u>not</u> do***. They must be of good colour and consistency and free from cracks, blemishes and grubs. This cannot be emphasized strongly enough.

## 14.0 THE CLIMATE AND ITS EFFECT ON OUTGROWERS

January to September has been the period cited for tomato production when estimating quantities to satisfy plant capacity. Quality is better and soluble solids higher early in the season, becoming less as time goes by. Tomatoes, being perishable, are not meant to be grown in the tropics. With so many potential bacterial problems it is highly inadvisable to rely on a continuous two season operation. Bacterial Canker, B. spot and B speck, botrytis, anthracnose and early and late blight, phytophthera root rot , can all develop under wet conditions in high

temperatures. Break down of vines and fruit, and cracking occur, and yields drop. It is not recommended that tomatoes are grown during the wet season - far better to increase the area under cultivation during the dry season and concentrate factory production in that period. A simple description of the processes involved might be in order.

Firstly, boilers must be fired to make steam to run the plant. Raw material is fed through the cutter boxes (electrical), through the scalders run by live steam, and finishers which remove skins, seeds and stems. At the thin pulp stage the tomato material goes into a holding tank which has an internal rotary coil supplied with steam to keep the pulp hot and in suspension. From there it goes through mono-pumps and a series of valves into the evaporator. After evaporation, it passes though a series of stainless steel pipes with valves to the aseptic filler. If there is a deficiency in the quantity of material in any of these processes the product can bake on to the internal structure of the equipment entailing a complete close down and massive cleaning operation, with loss of product.

The usual method is to run a plant for six (6) days per week, with one day for cleaning. A processing engineer will affirm size of plant and quantity of tomatoes required to keep it running.

## 15.0 COMMUNICATIONS

A telephone or two-way radio system is necessary to connect field officers with the factory. All personnel should be in a position to pass messages, and to know the current situation. On Malwanegama farm the road is in good condition, but the tracks on the farm need up-grading. Transporting tomatoes from Dambewatana or a collection point at Galkiriyagama would be difficult and time consuming.

## 16.0 CONTAINERS AND COLLECTION POINTS

Oblong plastic containers with lugs to hold about 20 kgs of fruit would stand on top for each other. This would prevent tomatoes being squashed or damaged in transit. When empty, two crates will enclose a third. The Company name should be stamped on the crate, and the grower should be charged a deposit. When the crates are returned, the deposit is refunded.

There should be receiving stations for growers fruit. The fruit is graded there for quality - two grades from a 4% sample taken at random, before proceeding to the factory. First quality fruit to be paid for at a higher rate than second grade. Grub damaged or grossly inferior fruit to be rejected.

## 17.0 NURSERY

I oppose an open rooted nursery system because the damage done to root systems when pulling plants, and the method of "puddling" into mud causes "transplant shock" which can set back transplants by days, and from which some do not recover. If a nursery is to be set up it should be in a modular form, which would need a manager brought in for the first season so train staff in an absolutely new aspect of seedling growing. High expectations should not be had for the first year when growing "seedlings" but if persevered with it is a most successful technique which helps to defeat weed and disease problems. I can supply further information if required.

## 18.0 STAFF

Staff were unfailingly helpful and co-operative. I suggest that Messrs Nagasinghe, Premasiri and Struys would all benefit greatly from a short visit to Australia in the October to March period.

They would gain a better understanding of the need for improved methods and the modern techniques that vegetable growers in Sri Lanka will eventually have to embrace if they are to complete on would markets.

I recommend Australia as a learning venue rather than California because the industry there is on a smaller scale, and has similar, sometimes difficult, soil types to those in Sri Lanka. Mr Premasiri, with his mechanical background, would be interested not only in the tomato industry, but also in rice production. There is a large rice industry in the Riverina, Southern N.S.W where I live, and I would be happy to escort and assist all or any of these people if they should visit Australia in the future.

## 19.0 CONCLUSION

Before any thought is given to establishing a processing plant, it must be demonstrated that tomatoes can be grown in sufficient quantities and of a quality that will meet world export standards for tomato paste.

The hypothetical figures for tomato production given in the RPAE project report seem to the consultant to be optimistic in view of the problems to be overcome. There are constraints imposed by traditional cultural methods with little mechanization, by water restrictions, by severe disease problems, and by climatic conditions.

There is the difficulty of finding and controlling 1,000 outgrowers and programming their planting schedules to provide consistency of supply to a factory.

The whole project depends on Malwanegama farm as a nucleus operation. If it is available, then a long term plan over, say five years, covering all aspects of improvement that have been discussed in this report, could be laid down. Once Malwanegama becomes a viable operation producing quality tomatoes, outgrowers and other areas could be considered. It will be a long hard haul to establish production to support a processing plant, and without Malwanegama the project does not appear to be feasible.

Annex 1

## SPRAY PROGRAM RECORD

CONTRACT NO: _____

GROWER: _____

MONTH: _____

_____

AREA: _____

| DATE | METHOD | CHEMICAL | RATE OF APPLICATION | PURPOSE OF SPRAY | COMMENTS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

_____ AREA: _____

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## SPRAY PROGRAM RECORD



| DATE NOTED | TYPE OF INSECT<br>DISEASE<br>WEED | EXTENT OF PROBLEM | INSECT COUNTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

## TERMS OF REFERENCE

**FOR:** Tomato Production Agronomist.

**DURATION OF SERVICES:** Four months

**COUNTERPARTS:** VVL field managers and extension agronomists.

**RESPONSIBILITIES:** This advisor will assist VVL in the establishment of commercial trial plots for selected varieties of processing tomatoes. The objective is to examine cultivation practices for selected varieties of processing tomatoes to establish that it can be done successfully. Also, it would aim to detail costs to produce processing tomatoes.

Specific responsibilities will include:

- o procurement of several seed varieties that can be successfully grown in dry tropical conditions;
- o instruction and assistance in the:
  - development of tomato production including seed bed preparation, growing tomato seedlings in plastic module trays both with and without starter solution, seedling soil or media sterilization versus none, transplanting practices, and correct soil moisture management;
  - harvesting of tomato including the proper practices for the removal from plants and selection of desired sized tomato for the market; and
  - post harvest handling and preparation for processing (cleaning, peeling, pulping, concentrating,) to enable commercialization of tomato on out-grower schemes in the Mahaweli regions.
- o conduct a workshop/seminar on tomato production practices;
- o prepare a manual on tomato production; and
- o participate in other industry activities as mutually agreed.

**Reports:**

- o prepare a report on work completed with VVL and accomplishments achieved during the assignment. The report is to be completed in full draft seven days prior to leaving Sri Lanka. The final report, taking into account comments in the draft report is to be submitted within 10 days of departure from Sri Lanka. The report is to be submitted in three hard copies and on diskette using Word Perfect or a Word Perfect convertible program.

- o conduct debriefing with Director General MASL, Director EIED, USAID, MED and associated Mahaweli parties.

**QUALIFICATIONS:**

The tomato production advisor will ideally have a Bachelor of Science degree in Agronomy or Horticulture. He (she) will have had between five and ten years of broad and direct experience with: (i) hands on experience producing processing tomatoes under sub-tropical and/or tropical conditions; (ii) nursery bed design and production of transplants; (iii) experience in transplanting for proper plant population in commercial plots; (iv) irrigation techniques required for successful tomato production; (v) knowledge of suitable tomato varieties and pre-knowledge of varietal behavior; (vi) knowledge of how to establish trial plots to assess plants performance against several production variables; (vii) access to commercial seed sources; (viii) a good knowledge of harvesting and post harvest product handling; and (ix) hands on experience in utilizing farm equipment and knowledge of spraying for disease and pests.