PPC/CDIE/DI REPORT PROCESSING FORM

PN-ABL-155
76907

ENTER INFORMATION ONLY IF NOT INCLUDED ON COVER OR TITLE PAGE OF DOCUMENT

1. Project/Subproject Number: 596-0108-3-60011

2. Contract/Grant Number: 596-0108-C-00-6060-00

3. Publication Date: April 16, 1991

4. Document Title/Translated Title: Assessment of the Nicaraguan Tomato Industry

5. Author(s)
1. William L. Sims
2.
3.

6. Contributing Organization(s)

7. Pagination: 8

8. Report Number:

9. Sponsoring A.I.D. Office: ROCAP Non-Traditional Agricultural Export Support Project

10. Abstract (optional - 250 word limit)

11. Subject Keywords (optional)
1. tomato processing
2. cultural practices
3. plant pests
4. posharvest handling
5. Nicaragua
6. Central America - tomato processing

12. Supplementary Notes

13. Submitting Official: Diane Bejerano

14. Telephone Number: (202) 466-5340

15. Today's Date: January 21, 1992

DO NOT write below this line

16. DOCID

17. Document Disposition: DOCRD [ ] INV [ ] DUPLICATE [ ]

AID 590- / (10/88)

PN-ABL-153

ASSESSMENT OF THE NICARAGUAN TOMATO INDUSTRY

ROCAP
Non-Traditional Agricultural Export Support Project

Presented by:

William L. Sims
Chemonics International Consulting Division
2000 M Street, Northwest
Suite 200
Washington, D.C. 20036

April 16, 1991

PREFACE

The consultant, William L. Sims, traveled to Nicaragua April 1-7, 1991. I visited the processing tomato area in the Sebaco Valley and the factory of the Sebaco Agro- Industrial Plant. The purpose was to assess present production practices, potential, and to make specific recommendations for processing tomatoes in that area. Particularly, to:

- Evaluate presently grown tomato varieties in regard to yield, fruit quality, and market preference in light of the soil and climatic conditions.
- Observe plant pests such as diseases, insects, and weeds and their effect on the growth and quality of processing tomatoes.
- Evaluate current cultural practices including fertilization, irrigation, plant populations, and bed preparation.
- Make recommendations regarding possible variety evaluations for trial in the 1991-1992 growing season.
- Observe postharvest methods of handling and processing at the Sebaco Agro-Industrial Plant.
- Visit the Sebaco Agricultural Experiment Station and hold discussions with research personnel on processing tomato research.

During the entire visit, the consultant had the pleasure of the assistance of Ricardo Frohmader, marketing specialist, PROEXAG, Guatemala City. His services and attention were invaluable for my visit. I am also grateful for the assistance given by Samuel Mansella and associates of the APENN offices in Managua, Nicaragua; Gustavo Acosta and Bayardo Conrado and others at the Sebaco Agro-Industrial Plant; Danilo Cortez, subdirector general, Ministry of Agriculture and Livestock; Julio Mediterrano, researcher at the Sebaco Agricultural Experiment Station; and Nazmy Elehwany and Leslie Savino, who were consultants for Hanover Foods. The services of the staff at Chemonics in Washington, D.C. were also deeply appreciated.

ASSESSMENT OF THE NICARAGUAN PROCESSING TOMATO INDUSTRY

A. Introduction and Background

Revitalization of the Nicaraguan economy will involve capitalizing upon efforts already in process, existing industrial capacity, existing knowledge and capabilities, as well as introducing new technologies, and capital resources. Nicaraguan agriculture has a history of tomato production, processing, and exporting. However, it is not an important exporter at the present time. This assignment is targeted at identifying the problems and making recommendations on production-related issues so that sufficient quantities of high-quality product may begin to flow through the Nicaraguan processing tomato industry. Current growing practices will be examined with particular attention being given to varieties, plant populations, soil and bed preparation, pest and diseases, fertilization, irrigation, and postharvest handling.

During the period April 1-7, 1991 a visit to the processing tomato area in the Sebaco Valley was made. Also visited was the Sebaco Agro-Industrial Plant which first operated in 1988. Processing tomatoes were presently being grown on 282 *manzanas* (485 acres), all under factory management. The fields visited were clay loams and heavy black clays. With good management these soils are capable of producing good tomato yields. Irrigation water was obtained from ground wells. The climate is suited to tomato production with average highs of 87-94° F and average lows of 69-75° F from November through April with an average of 28-31 days per month with no rain. The months of June and September have the heaviest rainfall. Annual rainfall is approximately 1,400 mm (55 inches).

The Sebaco Agro-Industrial Plant has a capacity of 300 MT per day of raw material but, at the time of our visit, was operating at 78 MT per day.

B. Varieties

Presently, only one variety of processing tomatoes, the UC 82, is being grown for the Sebaco Agro-Industrial Plant. This variety was developed by the University of California at Davis some 18 years ago. Even though it is a well-adapted growing variety to many areas around the world, it has less resistance to several diseases and less soluble solids (Brix) than a number of the newer more recently developed varieties. It is resistant only to *Verticillium* and *Fusarium* race one. Generally soluble solids are 4.5 to 5.5 percent, whereas the newer varieties have solids of 5.8 to 6.6 percent. The newer varieties also have a higher viscosity (Bostwick), better color, acidity and produce higher yields. It is also a bit risky to have only a single variety for processing. At least four or five others should be added, as diseases and insects could be a disaster with a single variety.

It is imperative that the new varieties of processing tomatoes be evaluated in Nicaragua and that the industry begin to adopt the best performing varieties as established through variety evaluation trials. In California over the past 15 years, we have doubled our yields from 35 tons per hectare to 68 tons per hectare in 1989 and have increased our solids on tomatoes from 4.8 to 6.0 percent. A great deal of this improvement can be attributed to the acceptance of new varieties. The varieties such as UC 82 that were standards ten years ago are no longer the standards of today. In 1990, some 60 percent of the varieties grown in California were new hybrids. The new hybrids are resistant to nematodes, bacterial speck, *Alternaria alternata*, *Verticillium* race one, and *Fusarium* (races one and two). Even though the new hybrids are more expensive than the traditional open-pollinated varieties, they are more than cost-effective. Some of the new hybrids such as ALTA are excellent yielders but do not carry nematode resistance. However, in soils where nematodes are not present, these new varieties with their improved solids and other quality factors are making strong inroads into the tomato variety picture. Also, we should not overlook the fact that several new open-pollinated varieties are moving upward in the variety picture because of better fruit quality and good yields. These are Harris-Moran 3075, Peelmuch, E6203, US204C, and P111B.

Seeds of some 19 different processing tomato varieties, consisting of both hybrids and open-pollinated varieties, were left with Ricardo Frohmader at the APENN office in Managua to be placed in observation trials for the 1991-1992 growing season. These should be planted in November 1991 in at least two different locations in different soil types. With improved financial assistance it is hoped that one of these trials can be located at the Sébaco Agricultural Experimental Station. Instructions for planting were also left with the seed.

C. Plant Pests (diseases, insects, and weeds)

Several pests were observed in the tomato fields visited. These included diseases such as *Phytophthora*, *Alternaria*, *Pseudomonas syringae* (bacterial speck), powdery mildew, and *Xanthomonas vesicatoria*. Insect problems at the tie of visit were mainly with worms (*Heliothis* and *Spodoptera*). The worms had been controlled in the earlier field visited with their recommended chemicals and also in California we use Dipel (*Bacillus Thuringiensis*), Guthion, Lannate, and Monitor for worm control. It is recommended that an integrated pest management program be used for pest control of tomatoes in Nicaragua. This management program required a good monitoring system and combines both biological and chemical control methods. Mites and beetles were also insect problems. Apparently money was not available for continuing treatment of the insect problem and the latter fields that were visited had a serious worm damage problem which will reduce yields significantly. A copy of the 1990 UC IPM Pest Management Guide was also left with Ricardo for copying and distribution. Several weed species were similar to those found in California and the herbicides used were Sencor and Dual. If the paste product from the factory is to be exported to the U.S., similar chemicals to those used in the U.S. (i.e., those registered with EPA for tomatoes) will have to be applied, as residue problems may occur.

It is believed that new molecular biology and genetic engineering methods used in plant breeding will go a long way in helping us to get away from chemicals and to protect the consumer. We are beginning to see this happen with the development of our new varieties.

D. Cultural Practices

1. Plant Populations

Increased yields can be obtained by increasing the plant populations per manzana. Presently, for the double-row plantings of the variety UC 82, some 40,000 plants/manzana are used. In California, we are using some 100,000 per hectare. In general, we can say that the newer larger-vine open-pollinated varieties use single rows per bed with 3 plants in clumps about 30 cms apart or single plants 10 cms apart in the row, with the exception of UC 82 which requires double rows with direct seeding. For the hybrids, we recommend single rows with 2 plants per clump some 45 cms apart or single plants 20-25 cms apart. The beds are 1.5 meters apart.

2. Fertilization

The rates and amounts of fertilizers (NPK) presently sued appear to be in order. This was 400 pounds per manzana of a mixture 12-30-10 banded before planting, and then an additional amount of 400 pounds/manzana applied in a split application of urea, the first 25 days after plant emergence, and the second some 15 days later. It is recommended that the last application of the nitrogen fertilizer (urea) be applied no later than the first flower cluster of bloom. It is believed that the application made at the first small fruits is too late and causes more vegetative growth and less fruit-set.

3. Irrigation

Irrigation in the fields was done by sprinklers, and the water was from ground wells. There was no problem with this method, but with more land planning and land leveling, it is believed that once the germination and seedlings have been established, furrow irrigation could be used with less cost. It is recommended, however, that the length of the water runs should be only 300 to 400 feet. The longer rows should be cut into shorter rows for more efficient irrigation to prevent over-irrigation at one end and running the water over the top of the beds.

It is also recommended that the cut-off of the last irrigation be made when 20 to 30 percent of the fruit on the plant is pink or red in color, some 60 to 70 percent of the fruit is mature green (with full gel and seed development) and the remaining 10 percent is an immature green. There should also be an ample supply of soil moisture present to a depth of 1 to 1.5 meters. These prerequisites, plus a healthy plant not under stress from root injury, disease, or insect injury, are essential for an irrigation cut-off some two or more weeks

before harvest. A split-set fruiting situation will require different management of the irrigation water.

During the soil preparation process it is also advisable to sub-soil with a type of chisel or knife to a depth of one meter to break up or fracture the soil. The soil must be dry during this operation. This will allow growth channels for the roots of the tomato plants and give a more uniform moisture and fertilizer availability for the growth of the plants.

4. Crop Rotation

It is advisable to have a crop rotation plan with tomatoes. Corn or a legume crops should be followed by tomatoes. This will also assist in lessening the disease, insect, and weed problems.

E. Gemini Virus Problem

The tomato yellow leaf curl virus has been a very serious problem in the Middle Eastern countries (Egypt, Israel, Turkey, Saudi Arabia, etc.) for many years. Recently this virus has also become a serious problem in the Dominican Republic, Honduras, and Guatemala, as well as on fresh market tomatoes in Florida. Research teams from the USDA, Texas, Florida, and California have only recently received funding to study the problem. During the past three years a number of workshops have been held on this subject. So far, there are no sure chemical or biological control measures for the virus, nor have any resistant commercial varieties been found to carry resistance to the virus. Dr. Maxwell, at the University of Wisconsin, is working on an ELISA test to separate the various Gemini viruses. When this is done, it will be easier to concentrate on each single virus. Recently, an OICD program got underway with Egypt and Israel and several U.S. universities, including the University of California at Davis. Dr. Frank Zalom, director of the IPM Project at UC Davis, is on this team and will keep us posted as to new developments on this subject.

No one seems to know for certain why the sweet potato whitefly (*Bemisia tabaci*) populations have exploded and why they have colonized other host crops so rapidly. Not only do they cause uneven ripening of the tomato fruits, but they are responsible for vectoring several serious viruses such as yellow virus on leaf and cucurbit crops, but also the tomato yellow leaf-curl virus found in the Middle East. Control efforts are hampered by reinfestation from weed hosts, as *B. tabaci* has a host range of more than 300 species. It appears that successful control of sweet potato whiteflies lies in close monitoring of crops and preventing colonization through timely applications of suitable control materials, including both biological and chemical. An IPM program will have to be carefully initiated. For example, it has been suggested that a possible control would be with fungi introduced to attack the adult stage during the first few hours as whiteflies start to exude an anti-fungal way and coat themselves with it. Monitoring of the instar nymphs and adult stages will be critical. Water cut-off is important, as populations cannot respond immediately to adverse

conditions in the tomato field such as serious plant deterioration. For example, it has been found in cotton when water is cut-off that two weeks later the plants are inhospitable to whiteflies, and females in the field deposit eggs which become migrators. Twenty-one days later these mature and fly out of the field.

The chemical Temik has been partially successful for control of whiteflies on cotton but this chemical cannot be used on tomatoes. More recently, a product called "Margo San" from the NIM tree seed has shown some success on tomatoes and other crops. We also know that several wild species of *Lycopersicon* and *Solanum* (tomato) have contributed sources of resistance. With new techniques in molecular biology, this resistance will be introduced into commercial varieties of tomatoes in another five years or so.

F. Postharvest Methods of Tomato Fruit Handling

I was quite pleased with the postharvest handling system observed at the Sebaco Agro-Industrial Plant. They were using four-wheel trailers to carry the fruit from the field to the factory and then washing the fruit out from the trailers into flumes and on into the cannery. The fruit was picked by hand and placed in plastic buckets and in turn these emptied into the trailers which held 3 tons of tomatoes. In the future, it may be that larger trailers will be used. In California, we machine-harvest into 10-12 ton load trailers.

The raw tomatoes were inspected for green fruit, rot, mold, dirt, and insects at the receiving station at the factory. The factory also had a quality-control laboratory for testing pH, acidity, mold, color, and solids.

The Sebaco Agro-Industrial Plant has a capacity of 300 metric tons per day of raw material, but at the time of our visit was operating at 78 MT per day. Three shifts are possible. It would require 10 manzanas of tomatoes averaging some 30 MT/manzana to operate one day. They indicated 48 MT of finished product (28-31° Brix) could be processed in a 24-hour day. Thus, during a 120-day operation of the factory approximately 6,000 MT of paste could be produced. This goal is possible with a more efficient field and factory production.

G. Visit to the Sebaco Agricultural Experiment Station

A discussion was held with Julio Mediterrano, a researcher at the Experiment Station. His work on tomatoes was mainly on chemical control for fruit worms, but he is interested in tomato variety evaluation. More money is needed by the station for field labor to control the weeds, etc.

CONCLUSIONS

- Processing tomatoes can be successfully grown in the Sebaco Valley in Nicaragua from November to mid-May under the climatic and soil conditions that exist there. Presently, the yields average some 15 MT per manzana, but some fields have obtained as high as 50 MT/manzana. It is believed that with improvement in bed preparation, higher plant populations, improved cultural practices including irrigation and pest management, along with selected newer higher-yielding and better fruit quality varieties, yields of 30 MT/manzana average can be obtained in a two-year period, and 50 to 55 MT/manzana average over a period of four to five years.

- It is imperative that the new varieties of processing tomatoes with disease resistance and better yields and fruit quality be evaluated in two locations in the Sebaco Valley. Some 19 different tomato varieties have been left there for evaluation during the 1991-1992 season.

- Diseases and insects can be a problem in tomato production in the Sebaco Valley and must be controlled through an integrated pest management program using chemical and biological means and resistant varieties.

- Plant populations need to be increased with the variety UC 82 to as high as 100,000 plants per hectare, using double rows with clumps of 3 plants 30 cms apart, or single plants 10 cms apart in the row. The beds should be 1.5 meters apart. Hybrids and the newer larger-vine, open-pollinated varieties should be planted in single rows with 2 plants per clump about 45 cms apart, or single plants 20-25 cms apart.

- Present rates of fertilizer being used on processing tomatoes are satisfactory, but the last application of side-dressed nitrogen should be made not later than the first flower cluster bloom stage.

- Irrigation management needs to be improved with shorter and more even water runs. Currently sprinkler irrigation is used, not furrow irrigation, some 300 to 400 feet in length. During the end of the growing season, irrigation cut-off should be around the 20-30 percent pink and red fruit stage, when a one-to-two meter profile of soil moisture exists and the plants are healthy.

- A good crop rotation pattern should be followed, not tomatoes following tomatoes.

- Control of the sweet potato whitefly is presently less than satisfactory, as no good control exists. However, research is progressing in this area. The virus was not a serious problem in the fields we visited.

- Postharvest handling procedures were encouraging in the field and at the Sebaco Agro-Industrial Plant.

It is advisable that the consultant make a return trip to Nicaragua during late March or early April of 1992 to assist in making decisions on the evaluation trials of the 19 different processing tomato varieties. The experience I have gained with these varieties in other countries will be helpful in making adaptable selections.

The entire visit was well-planned, and I appreciate the many acts of thoughtfulness and kindness shown me by all persons involved.