

Vegetable Crops
Extension Report
VEC 83-3

1983 Florida Tomato Institute

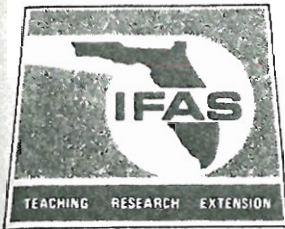


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INTRODUCTORY REMARKS

D. N. Maynard

Welcome to the Twenty-second Annual Florida Tomato Grower's Institute.

Tomatoes continue to be Florida's most important vegetable crop and Florida continues to be the most important fresh-market tomato producing state.

The vitality of the Florida tomato industry is related to numerous factors. A generally favorable climate, available land, knowledgeable and progressive growers, and effective coordination of the industry through the Florida Tomato Committee and Florida Tomato Exchange have all contributed to the industry. In addition, new varieties and improved production and postharvest handling procedures developed by IFAS research have greatly benefitted the Florida tomato industry.

The Florida Agriculture In The '80s Tomato Report that was prepared by industry leaders and research and extension faculty provides general guidelines for the future. Each IFAS unit is incorporating the priorities identified in the report into their research and educational programs. As these priorities are being implemented, it will be useful for the Industry: IFAS Tomato Committee to meet from time to time. We encourage this continuing interaction.

The Cooperative Extension Service interprets and disseminates research information. A team of state Specialists and County Agents work together in bringing current research information to growers and shippers through on-site demonstrations, mass media, grower meetings, and newsletters or other publications.

The Tomato Institute is one means of reporting IFAS research and educational activities to the Florida tomato industry.

AN OVERVIEW OF THE 1983 TOMATO MARKETING SEASON

Wayne Hawkins, Manager
Florida Tomato Committee

The Organizational Meeting of the Florida Tomato Committee was held on September 17, 1982, at the Marriott's Marco Beach Hotel & Villas, Marco Island, Florida. The initial regulations that were subsequently approved by the Secretary. The regulations were the same as those in effect for the 1981-82 season except that the minimum and maximum diameters for most sizes were changed. The size dimensions of tomatoes in each size category were different from those defined in the U. S. Standards for Grades of Fresh Tomatoes and a 2/32-inch overlap between sizes was allowed. This required that only numerical terms be used to indicate the size designations on containers. Due to the lateness of the crop in District 4, the regulations were extended through June 25, 1983.

The Committee's recommendation to eliminate Extra Small tomatoes which the Secretary approved met no opposition from the industry this season. This regulation also applied to imports; however, it is customary for Mexican producers to impose regulations on themselves during most of the season that are more restrictive than those required by the Marketing Order. This was also the case at times this season.

Again this season we had periods of adverse weather, but it was different from the preceeding two years. Growing conditions in the fall were anything but normal. We had more rain than usual and controlling disease in the fields was a real challenge. Instead of the usual January frost and freeze problem, we had continued rain and cold weather from January through April. All districts received from two to four feet of rain and cold, windy weather during their growing season. This affected quality and delayed crops in all areas, forcing the Committee to extend regulations for two weeks at the end of the season.

Total harvested acres in Florida were 43,386 compared to 39,095 the previous season and 44,801 harvested in 1980-81. Districts No. 1, 2 and 4 had increases of 1,994, 465 and 2,275, respectively. District No. 3 was down 443 acres, giving a net increase of 4,291 acres. There were 2,418 more acres of ground tomatoes and 1,463 more acres of staked tomatoes planted this season. The ratio remains about 1/3 ground and 2/3 staked. Total shipments were 45,703,529 25-lb. equivalents compared to 44,598,431 cartons last year. This established a new shipping record.

The increase in shipments is directly attributed to the increase in acreage since yields were down. Weather was very wet and windy at times which affected fruit set and quality. If Florida and Mexico had experienced good weather, there would have been bumper crops, glut conditions and disastrously low prices throughout most of the winter and early spring.

Harvesting of the fall crop began in District No. 4 in mid-October. Districts No. 2 and 3 started a couple of weeks later and total weekly shipments from all districts exceeded one million packages by the second week of November. District No. 1 started the last week of November. Fall acreage in District No. 4 was up 13 percent over the previous season, but shipments were down by more than 25 percent. This illustrates the growing problems encountered during the fall.

District No. 2 started harvesting the last week of October and continued shipping good volume through mid-May with just a little trickle through June 4. Acreage planted for harvest was up a little more than 18 percent, and total shipments were up 12.5 percent above last season. Weekly shipments from this District exceeded 100,000 25-lb. equivalents every week during the weeks ending December 4 through April 30 and many of these weekly shipments approached or exceeded 200,000 25-lb. equivalents.

District No. 1 started picking the first week of December and continued through early May. Weekly volume remained low throughout this period with only a couple of weeks approaching anything like a normal season. Total acreage planted for harvest was up about 18 percent, but shipments were up only three percent over the previous season. This is directly attributable to the very adverse conditions that prevailed during the season. The new hybrid varieties and improved cultural practices are the only things that saved this crop. Many old timers said the crop would have been a total loss in the "old days."

District No. 3 began shipping tomatoes the last week of October and continued throughout the balance of the season although total volume during the last half of February and March was severely curtailed by rain, wind and hail damage. Total acreage planted for harvest was down less than one percent but shipments were up nearly 25 percent over the previous season. This increase is attributed to heavy losses in the 1981082 freeze. Shipments would have been much higher, but weather conditions also affected yields severely in this area.

District No. 4 started harvesting in late April which was three weeks later than the previous season. Total acreage planted for harvest was up nearly 17 percent but shipments were down by nearly ten percent. During their 10-week spring season, shipments from District No. 4 totalled more than 11 million 25-lb equivalents. Basic quality was very good throughout most of

their season, but cat faces, wind scarring and misshapen fruit were terrible. Packouts and resulting yields were far below normal. The regulations terminated on June 25 but a lot of tomatoes were picked after that date.

The total 45,703,529 25-lb. equivalents were shipped over a 37-week period. Twenty-six of these weeks showed shipments exceeding one million packages with four of them showing more than two million and the week ending May 28 exceeded three million 25-lb equivalents. Florida's total tomato shipments for the fresh market exceeded one billion one hundred and forty-two million pounds. Placed in a single row, they would go around the world nearly two times at the equator.

The total value of the crop was about 344.7 million dollars, an increase of 87 million dollars over the previous season. The average price was \$7.54 per 25-lb. equivalent for the entire season, compared to \$5.77 per 25-lb. equivalent for the 1981-82 season. The less than normal supplies in January through March helped to bolster the total season's average price. Many tomatoes were sold for prices far below the average at various times during the season.

During the 1982-83 season, there were more than 14 different commercial varieties planted. Sunny, Duke and F.T.E. No. 12 accounted for 88 percent of the total acreage. Hayslip, Florida-Dade and 8212 make up another 9.5 percent. Therefore, size varieties accounted for 97.5 percent of the total commercial acreage. The Florida Tomato Exchange is continuing research efforts to find a new super variety for Florida. Several of the leading seed companies are working toward the same objective.

Mexican imports began early this year with the first report from Nogales appearing in the week ending December 18, 1982. In the past three years, Mexico has started earlier and continued shipments later. This has increased their season by several weeks. Shipments were relatively light through December and the first two weeks of January. In the week ending January 22, imports jumped to nearly 850,000 25-lb. equivalents. Cold, wet weather followed seriously affected their quality and shipments ranged from 600,000 to 900,000 25-lb. equivalents for the next seven weeks. The week ending March 19, imports exceeded 1.5 million packages and stayed at a level above one million per week through the month of April. Imports tapered off some in May, but stayed well above 1/2 million packages per week until the week ending June 4th. They were still shipping when our season ended.

Total shipments from Mexico were up about 18 percent from the previous season. This was a surprise since initial reports on the total acres planted were up nearly 50 percent and imports were expected to be higher. Total mature greens imported increased by 18.6 percent from the previous season while ripe

increased 18.5 percent and cherries increased 17.6 percent. Prices at Nogales, Arizona, were constantly cheaper than Florida prices which tended to depress the market for certain grades and sizes during some parts of the season. Members of the Florida Tomato Industry met with representatives of the Special Trade Representative's Office in Washington to document dumping of Mexican tomatoes in March and April. An investigation is still pending.

The Committee's activities in controlling container weights and designated diameters of tomato sizes have been profitable for the Florida Tomato Industry. It is also doubtful that Mexican producers would impose restrictions on themselves voluntarily if the Florida Tomato Marketing Order was not in effect. The need for continued use of these controls plus consideration of additional regulations on domestic shipments during periods of market glut are essential if profitable returns are to be expected by the Florida Tomato Industry.

A pilot television advertising project was approved this season. A 30-second commercial designed to educate the consumer on the proper handling and ripening of tomatoes was shown in the Metropolitan New York and Boston markets. This commercial ran three times a day, five days a week, for ten weeks during daytime television on the three major television networks. The commercials were spread out over the period of January 3 to May 20, 1983.

Additional funds were allocated to this firm for a retail promotion program that would tie-in with a new pilot television advertising campaign. Twenty-three chains representing 4,280 stores participated and distributed hundreds of thousands of the newly developed pamphlet, "Fresh Tomato Secrets." The object of the crusade was to get consumers to handle tomatoes properly.

The brochure outlining how Florida tomatoes are grown, harvested and marketed again received large scale distribution. A slide cassette program telling the Florida Tomato Industry story designed for use in public presentations was used by many groups. A 36-page cookbook featuring tomatoes for all meals, developed by Staff Secretary Marsha Crowder, was distributed to all states, the District of Columbia and four foreign countries. The cookbook and all other releases keep featuring the kitchen ripening theme and tips for consumers in selecting, ripening and preparing fresh Florida tomatoes.

CRITICAL RESEARCH NEEDS OF THE
FLORIDA TOMATO INDUSTRY

D. N. Maynard

Because of the importance of tomatoes in Florida, research is conducted on virtually every aspect of production and handling by an interdisciplinary team of scientists. Horticulturists constitute the core of this team with scientists from the Departments of Agricultural Engineering, Entomology and Nematology, Food and Resource Economics, Food Science and Human Nutrition, Plant Pathology and Soil Science contributing to their particular specialties.

Tomato research in Florida, in addition to being multidisciplinary, occurs at several locations; many in the heart of production areas. The research program is coordinated by the Chairman of the Vegetable Crops Department at Gainesville in concert with appropriate Center Directors and the Dean for Research. Other locations where tomato research is conducted include the Agricultural Research and Education Centers located at Bradenton, Homestead, and Quincy and the Agricultural Research Centers at Ft. Pierce and Immokalee.

Altogether, the Institute commits over 15 full-time equivalent scientists to tomato research. Since most faculty work on a variety of crops and problems, the actual number of contributing scientists is two or three times greater. This level of faculty input represents about a \$1.5 million annual research investment in the industry. Although this figure may seem large, it represents only 0.6% research investment which is significantly less than the research commitment of most major industries in the United States.

Research priorities for the remainder of this decade have been identified in the Florida Agriculture In The '80s Tomato Report. This report, prepared by industry leaders and IFAS research and extension faculty, characterizes the industry and serves as a guide for planning and implementing our research and educational activities.

For convenience, research priorities have been grouped under discreet headings even though specific characteristics may interact throughout the production-handling-marketing system. Accordingly, a research priority identified in one area may impinge on other research areas.

<u>RESEARCH AREA</u>	<u>RESEARCH PRIORITY</u>
I. Variety Improvement	Dependable Yields Disease Resistance Stress Tolerance Insect Tolerance Quality
II. Soil & Water Management	Irrigation Fertilization
III. Stand Establishment	Direct Precision Seeding Transplant Quality
IV. Cultural Systems	Plant Populations Double Cropping Systems
V. Pest Management	Tomato IPM Pesticide Evaluation Fusarium Race 3 Management Bacterial Spot & Wilt Leafminer (<u>L. trifolia</u>) Row-middle Weed Control
VI. Harvest & Postharvest Handling	Insect Management Physical Damage Reduction Fruit Ripening Retail Handling
VII. Consumer & Nutritional Quality	Nutritional Composition Fruit Quality
VIII. Transportation & Marketing	Project MUM Market Identification Product Identification Alternative Markets
IV. Management	Tomato Data Base Computer Programs

These research areas will be the focus of the IFAS tomato research in the future. The priorities within each research area may vary from time-to-time with immediate needs of the industry. Because of the complexity of some problems, they may never be solved completely. However, it is expected that at least a degree of improvement will be made at regular intervals. As sometimes happens in research, a major discovery may eliminate some industry problems.

We acknowledge and appreciate the monetary support of the Florida Tomato Exchange, the cooperation of industry in encouraging on-site research and demonstrations, and the constructive suggestions and interest that is shown in our research. We look forward to a continuing relationship that will result in further advances for the dynamic Florida tomato industry.

FAIR, Florida Agricultural Information Retrieval System

Ken Pohronezny and Jeanette Viola

In recent years university extension specialists have realized that the "computer age" has prompted a dramatic shift in our thinking about modes of information delivery. This information science revolution has come at a time of increasing manpower constraints and transportation costs, and tightening institutional budgets.

In response to this situation, Drs. Freddie Johnson and Jerry Stimac and Mr. Howard Beck, of the Department of Entomology and Nematology, University of Florida, Gainesville, wrote a successful proposal to the Kellogg Foundation to fund the development of a pilot "Florida Agricultural Information Retrieval System" (FAIR). Three crops were targeted for initial program development: soybeans, tomatoes, and citrus. The soybean database is complete and has been through one large test with excellent results. The tomato database has been in the development stage for about one year, and work is now beginning on the citrus database. We will describe briefly the tomato portion of the FAIR program.

Software and Hardware

The tomato section objectives center on development of an extension database for pest control and crop production. The end product is to serve as a pragmatic guide for diagnosis, consultation, planning, and management.

The database is menu-driven and friendly enough to overcome most of the reluctance associated with first contacts with the computer.

Some of the specific topics to be included in the tomato database are shown in Table 1.

The PASCAL database management software package is totally the design of the project systems analyst. It is currently unavailable to any outside agencies or individuals, pending resolution of copyright questions.

The database management package represents a significant advancement in the systematic storage of large volumes of textual data. Most of the database entry is being done by paraprofessional editorial assistants. Persons with particular editorial aptitudes can learn the system sufficiently well in two days of intensive training to begin database entry. Initial training with the data entry program on a one-to-one personal basis seems more successful than written autotutorial materials alone.

The hardware used for the database entry consists of the following:

1. Apple III with 128K
2. Monitor
3. Floppy Disk Drive

Information in final form is transferred to a 5 megabyte removable Winchester hard disk unit.

In the future, the database will be operable on the Apple III, Dec PC350, and, the Apple II with appropriate hardware upgrade.

The Program Audience and the Source of the Database

We envision that this information will be readily accessed electronically by county agents and IFAS faculty and staff. It should provide for efficient communication of new facts from state specialists to county agents, with edit capabilities providing for rapid information update. Perhaps others will gain access to the database in the future.

The bulk of the database is being entered from already published material. However, much of this written information requires extensive editing in order to fit the menu-driven format.

The impetus from this effort has also resulted in the publication of previously unpublished information, much of it "stored in the heads" of experts throughout the state.

The tomato database development has presented some unique problems in decentralization of the database entry. While the soybeans and citrus expertise is centralized in Gainesville and Lake Alfred, respectively, tomato production and the IFAS support personnel are scattered throughout the state, particularly in the southern half of the peninsula. The tomato effort, in essence, has become a test of the feasibility of decentralized program development, and, to date, has been highly successful. Most recently, the effort has been enhanced by the availability of electronic mail between local centers and Gainesville.

Table 1. Outline of Some Topics to be Included in Tomato Database

-
- A. The Florida Tomato Industry
 - B. Botany of the Modern Tomato Plant
 - C. Variety Selection*
 - D. Land Selection
 - E. Mulching
 - F. Nutrient Management
 - G. Soil Moisture Management
 - H. Diseases and Disease Control*
 - I. Insect Pests and Insect Control*
 - J. Nematode Pests and Nematode Control*
 - K. Weed Problems and Weed Control*
 - L. Post-Harvest Operations
-

*Section complete or, nearly so, as of 8 July 1983.

MAKING THE FREEZE FORECAST AVAILABLE TO THE PRIVATE SECTOR

FAST - Florida Agricultural Services and Technology, Inc.

John F. Gerber, Executive Director

"Helping Agriculture Utilize Computer Technology"

Have you ever wondered if it is going to freeze, if the rain is going to be as bad as forecast, or if the showers will be followed by clear weather so you could spray, spread fertilizer or plant? All these and many more questions may potentially be answered by a new service being instituted by FAST, an acronym for Florida Agricultural Services and Technology, Inc. FAST plans to help farmers use their on-farm microcomputers as a window on the world of high technology, for example, as a window on the weather. FAST plans to provide present weather conditions as seen from satellites, from radar estimates of rainfall, and from reporting weather stations. This service will be available to farmers 24 hours a day, 7 days a week for a nominal fee.

FAST is assembling a central computer system consisting of a large mainframe computer a satellite antenna, graphics processing and communication equipment. This system, worth several million dollars is being acquired partially as a gift and partially as a purchase. FAST is indebted to Control Data Corporation for the gift of the mainframe, a CYBER 170-730. FAST is based upon the assumption that the high technology needed for Florida agriculture will require the use of computers which are directly accessible to the Florida farmer and that the marketplace can set the important priorities for computer needs in a self sustaining way which does not require additional public taxes.

FAST is a private not-for-profit corporation developed to utilize the scientific and technological resources from the Institute of Food and Agricultural Sciences (IFAS) of the University of Florida and other land grant colleges with high technology equipment from Control Data Corporation for the benefit of Florida agriculture. It's purpose is to bridge the gap between research and its application by the use of a large mainframe computer and on-farm microcomputers. The FAST computer will acquire weather data directly from the Geostationary Orbiting Environmental Satellite (GOES), a weather satellite in synchronous orbit, from radar measurements of rainfall and forecasts supplied by the National Weather Service. All these data will be processed into graphic representations that can be displayed in color with on-farm microcomputers. The central FAST computer can service many users at the same time over telephone lines. Members of FAST will not have to wait for scheduled TV or radio weather broadcasts but will be able to obtain weather information when needed. Movement of rain clouds, development of local showers, development and movement of cold weather, and the movement of large scale weather patterns will be easily visible. The FAST computer will support Apple, IBM Personal, Zenith 100, and the Radio Shack on-farm computers. Only the Apple, IBM Personal and Zenith have color graphics capabilities. Presently, the Zenith 100 has the best color graphic capabilities because it can display eight colors in high resolution. It will probably be the computer chosen by many members of FAST.

FAST, will be operated to make weather information such as the Satellite Freeze Forecast System available to members in a cost effective way. Membership for most farm members will be \$50 per year. Monthly charges for weather information and other computer based programs will be on a monthly basis which will include communication costs. Farm members who do not have a microcomputer can obtain both a computer and services for about \$200 a month. This would include a second generation microcomputer with both a 16 bit and an 8 bit processor, two disk drives, a high resolution color display, a modem and a dot matrix printer. Of course, the microcomputer would be available to use for any purpose members might choose in addition to providing access to the FAST computer for acquiring weather information on a nearly automatic basis.

The development of FAST may be timely because many of the services which have been offered by the National Weather Service on a "free" basis may be modified or terminated in the future. For example, the Florida Fruit Forecast Service is being continued on a year-to-year basis. The inability to insure funding produces uncertainty within the National Weather Service, difficulty in retaining personnel, and an almost impossible task of significantly upgrading or improving the quality of service.

Over the past several years, IFAS of the University of Florida, National Aeronautics and Space Administration (NASA), and National Oceanic and Atmospheric Administration (NOAA) have jointly developed a system called the Satellite Freeze Forecast System (SFFS) to obtain information from the GOES Satellite on cold nights and used it to observe, measure, and forecast minimum temperatures. FAST will exploit this technology and make it available to individual farm users, with the full cooperation and assistance of the National Weather Service, augmenting, but not replacing their vital role. Furthermore, it is envisioned that FAST will do this in a self-sustaining way so that the farm members can decide the value of the services and the ways it might be developed and expanded to better fit their needs and improve their position in today's competitive marketplace.

As FAST develops, management information, technical information, access to major computing resources and data bases will be available to members. This will include information on pest management, irrigation, crop reports, pesticide labels, business accounting and analysis, farm records and other information identified by the industry as important. In the future, low cost mass storage devices will allow technical bulletins, circulars, data bases, technical papers, design information, and possibly even rules and regulations to be available to farm users for rapid retrieval from the FAST computer.

FAST's goals are to enhance the value, accessibility, and use of technology for the betterment of Florida agriculture and society. It will allow the user to have access to a full range of computer resources without the necessity of making massive investments in computing equipment.

Computers really allow individual farmers to expand their memory. They can recall, almost perfectly, any information in their own farm computer. The real excitement is the ability to link computers so that important information can be found and shared. These longer term goals will not be realized immediately, but a beginning has been made and you can help it become a reality by joining FAST for the future benefit of agriculture.

For further information on FAST, or to become a member, contact John F. Gerber, Executive Director, FAST, Inc., P.O. Box 13761, Gainesville, Florida 32604.

CHANGING INPUT COSTS ON TOMATOES

Jose Alvarez and Thomas H. Spreen

The effect of inflation on tomato production and marketing costs is a major cause of concern for Florida producers, who face stiff competition from their Mexican counterparts. The purpose of this study was to analyze the behavior of the cost items of tomato production and marketing in Florida during the 1968-69 to 1978-79 seasons to identify changing input costs.

Weighted costs for 18 different items were developed as follows: First, Florida tomato production was divided into five main areas. Second, per acre costs by item were taken from the annual surveys conducted by the Food and Resource Economics Department of the University of Florida for each area. Third, acreage statistics were obtained from the Florida Crop and Livestock Reporting Service and the corresponding percentages computed. Finally, the state weighted costs by item were arrived at by multiplying the cost of production in each area times the percentage acreage and adding the resulting costs in the five areas.

Since the data revealed that the different cost items had increased at varying rates over the period of analysis, the average annual rate of increase for each item was computed. The results represented the average rate compounded annually.

Trend analysis was used to analyze the effect of inflation on production and marketing costs and to forecast future cost trends. It involved estimating the effect of time on annual production and marketing costs. Trend models for each cost item were estimated using ordinary least squares regression. If the ratio of the estimated coefficient to the estimated standard error (the "t-ratio") was less than one for the squared term, it was deleted and the equation reestimated as a linear model.

The results of computing the average annual rate of increase ranged from a small decrease for machine hire to a 27.4% for miscellaneous expenses. Cultural labor, spray and dust, picking expense, and grading and packing expenses, which account for a large percentage of total costs and are often blamed as items whose costs are "out of control", did not show excessively large rates of increases relative to other items. The annual rates for all these items, except for picking expense, however, exceeded 12%, and as such have grown rapidly over the period of analysis.

The estimated trend models showed that, over the study period, the profile of costs for each item fell into one of three major categories. In the first category, the estimated trend model was linear in time, suggesting a steady, constant rate of increase over time. Items falling in this category included seed; gas, oil, and grease; repair and maintenance; depreciation; interest on production capital; interest on capital investment; miscellaneous expenses; and hauling expenses. In the second category, the coefficient of the quadratic term was negative, indicating that costs have been increasing at a decreasing rate. This category included fertilizer; spray and dust; cultural labor; machine hire; picking; grading and packing; containers; and selling expenses. In the third category, the quadratic term was positive, indicating increasing costs at an increasing rate over the range of the data. Only two items (land rent; and licenses and insurance) fell in this category.

A word of caution is in order. The data used was expressed in current dollars and did not take into account adjustments for the quantities and qualities of inputs. It could also be argued that the cost of some items may have declined in terms of real dollars. Thus, differential inflation rates could have benefited the tomato producers - particularly if tomato prices had increased at a faster rate. This did not seem to be the case. During the study period, tomato prices showed an average rate of increase, compounded annually in current dollars, of 5.17%. This figure is far below the 12% rate of increase for total costs. Therefore, Florida producers should be particularly concerned with those items which have risen most rapidly and with those which displayed similar trends.

FEDERAL CROP INSURANCE PILOT PROGRAM FOR TOMATOES
R. L. Brown

Southwest Florida in the 1980-81 season and 1981-82 season had experienced devastating freezes in December and January of those years. These freezes have resulted in the loss of millions of dollars to the Tomato Industry of Southwest Florida. These losses were of such magnitude that the industry was straining its ability to obtain credit. In addition to these two major loss years, the area, as well as the country, was experiencing one of the highest interest rate levels in recent history. It was because of this serious financial crunch that interest was expressed in the Federal Crop Insurance Program being offered for many crops throughout the country by the Federal Crop Insurance Corporation.

Beginning in April of 1982, a concerted effort was made in the area through the cooperative work with the Florida Fruit and Vegetable Association, Florida Department of Agriculture and Consumer Services as well as the Florida Tomato Committee to lobby the Federal Crop Insurance Corporation to develop a pilot program for fresh market tomatoes in Southwest Florida. The initial effort in this direction resulted in a special assistant to Secretary Block, Mr. Jim Johnson, coming to Southwest Florida in April of 1982 to meet with the area growers and the industry representative to discuss the needs of the area relative to the Federal Crop Insurance Program. At that time Mr. Johnson returned to Washington and made the request from the area that it be designated a pilot area for fresh vegetable crop insurance development on tomatoes and peppers.

The initial development of the crop insurance policy was initiated in the late summer and early fall of 1982 in cooperation with the Florida Fruit and Vegetable Association, Florida Department of Agriculture and the Florida Cooperative Extension Service. The initial meetings of the actuarial division with Federal Crop Insurance was made with growers throughout the Southwest Florida area to determine their needs and desires in regards to a fresh vegetable crop insurance program. As a result of these meetings the policy was developed to insure the risk capital that growers had invested in the crop against natural weather phenomenon. This approach of insuring investment capital against loss due to weather, is somewhat unique in the realm of Federal Crop Insurance. The policy basically allows the grower, if he chooses, to insure his investment of production money against natural disaster loss at a 50, 60, and 75 percent levels. The program is basically driven by the growers net income from production sold. If the grower fails to receive net income equal to his insured value due to losses resulting from weather phenomenon, he then is paid in proportion to his insurance value.

Provisions are written into the policy that prevents market abandonment of production. The only cause of loss are weather related phenomenon, such as hurricanes, freeze, hail and excessive rains.

The policy was offered to the growers in Southwest Florida the beginning of July of 1983 through July 31, 1983. During this period of the initial offering growers were required to commit to the program for the year. The initial sign up of acreage in Southwest Florida was somewhere in the neighborhood of 10,000 acres of tomatoes and 5,000 acres of pepper, which represent approximately 60 - 65 percent of the total acreage projected for the year in the area. This reception to the program was one of the best ever for a pilot program in the history of Federal Crop Insurance.

For further details in regards to this particular policy, I would suggest that individuals write to the Federal Crop Insurance Corporation and obtain a copy of the policy.

TOMATO STAND ESTABLISHMENT Herbert H. Bryan

Techniques used to grow transplants for glasshouse production in Europe where seed costs exceed \$3000/pound traditionally involve a lot of hand labor. Imbibed seed are spread by hand on a well prepared bed under glass and covered by fine sand. Young seedlings are planted in soil blocks or fiber glass blocks and very large actively growing transplants are planted in grow-bags, fiber blocks or soil in a highly controlled greenhouse environment.

Containerized transplants grown for field production in the United States must involve a conditioning process to prepare plants for transplant shock when they are moved to often adverse conditions (heat, cold, drought, torrential rains) in the fields. Recent trends have been to plant smaller transplants. An automated plug planting system has been developed, in which small plants grown in peat plugs are dispensed automatically at a rapid rate with extensive reduction of labor compared to conventional transplant systems. This machine has been tested with several crops in Florida. It does not, at present, have the capability of planting through plastic mulch and adaptation of this machine for tomato planting here will be precluded until an effective method for planting through plastic is developed.

Most tomatoes grown in Florida are planted through plastic mulch on raised beds and Speedling type transplants are usually planted by a water wheel or other method of punching holes in plastic beds, placing the transplants in the holes and setting soil around the root mass by water or other means. The hole punch system works fine on sandy soils with frequent sharpening or replacment of the punch cups; however, on rock soils where about 25 to 30% of Florida tomatoes are grown, hole punches have not been successful.

Many thousand acres of processing tomatoes are direct seeded in California. Direct seeding tomatoes on rock soils in Dade County is almost exclusively by plug mix planting. Seed and sometimes nutrients, pesticides and growth regulators are added to peat-lite mix and water to form the mixture used for plug-mix planting. Some growers delay planting 1 to 4 days after mixing the seed and media for plug-mix planting to allow imbibition of water to initiate the germination processes.

Growers devised an open type burner to make planting holes in the plastic. In the last year many Dade County growers have converted their planters to more fuel efficient closed jet burners developed for sowing pregerminated seed through plastic mulch. These burners allow planting to proceed when plastic mulch is wet, which often precluded planting with the open burner. Thus, the closed burner allows planting to proceed during light rain allowing more efficient use of labor than the open burner. Refinement of the closed jet burner to vertical action and use of various burner cup sizes will allow flexibility in spacing and hole size to accomodate planting of peppers, cucurbits and other crops, in addition to tomatoes, through plastic mulch.

Planting of pregerminated seed through plastic is on a commercial basis with at least one Immokalee grower. The system involves germinating seed in a container with aerated water, mixing seed with a gel carrier which reduces or prevents mechanical damage of pregerminated seed during the sowing process and reduces need for frequent watering during early seedling development. Germinating the seed with certain growth regulators or adding growth regulators to the gel before planting provides better plant stands and more vigorous seedlings capable of withstanding adverse conditions than plants grown without the germination or gel additives. Two machines have been adapted for planting pregerminated seed through plastic mulch - Fluid Drilling, Ltd. FD-567 with steel cups, and the Ag Mec Research, Inc. AMRI8201 with closed jet burners for punching planting holes.

Gel mix planting, a system which involves planting a mixture of peat-lite mix, gel and seed, which combines the principles and advantages of plug-mix planting and gel seeding for pregerminated seed is being researched for tomatoes and is based on pepper stand establishment work done by Johnathan Schultheis, an IFAS Vegetable Crops Department graduate student. The gel mix system stabilizes the seed-medium complex in the planting hole which reduces damage by heavy rains or extensive dry conditions. A machine for planting gel mix was fabricated by Precision Agricultural Products, Inc. and field tests were initiated in August.

Singulation or seed quantity control for pregerminated seed has been available for planting flats in stationary machinery for a few years. However, mechanisms for field planting have not been available. Larry Shaw and students in the IFAS Agricultural Engineering Department have fabricated a machine for picking pregerminated seed from a gel suspension, separating them and injecting them in a stream of gel for drilling or clump planting. Laboratory and field tests are planned for Fall, 1983.

Sowing of high quality coated seed has facilitated mechanization of seed sowing for transplant production in flats and IFAS - Agri-industry cooperative field tests began in August on a controlled seed quantity distribution system for coated seed, with potential for uncoated seed, that can be adapted to plug-mix, gel and gel mix planters to reduce number of seed required to establish a good stand.

LEACHING LOSSES AND FERTILIZER REPLENISHMENT OF FULL BED MULCHED TOMATOES

G. A. Marlowe, Jr., Phyllis R. Gilreath, and R. J. Wilder

A. Detection

February and March rainfall in the 1983 tomato growing season exceeded the 40 year moving average by 13.3 inches in the Manatee-Hillsborough area as shown in the following record:

Period	Precipitation by Months, Inches, USWB Data						Total
	Jan	Feb	Mar	Apr	May	June	
1925-65	2.3	2.7	3.3	3.3	7.6	8.8	28.0
1983	2.3	10.8	8.5	2.3	1.7	5.4	30.9

The soluble salt monitoring program being conducted by the Cooperative Extension Service in the area detected serious leaching of fertilizer in early March. The program was intensified and 13 farms were monitored for changes in the total soluble salt in the fertilizer found at three depths. Poorly drained and well-drained fields were observed and data was compared to monthly levels established in years of more normal rainfall. It was noted that 55% of the heavily leached fields were reading at one-third of "normal" and that 78% were below 50% of band reading in the average rainfall years.

Growing period	Soluble Salt Readings, 1978-82, ppm, Fert. Band Means 24 Commercial Fields, M-R District		
	0 to 2 inch	2 to 4 inch	4 to 8 inch
Jan	130,000	34,000	12,000
Feb	94,000	15,000	4,000
Mar	63,000	7,000	2,000
Apr	55,000	11,000	3,000
May	63,000	12,000	3,500
June	37,000	12,000	4,800

Most of the monitoring program assessed the fertilizer band at three depths at first, but later more rapid screening was needed and only the 0 to 2 inch levels was measured. A great deal of this monitoring program was based on portable soluble salt meter readings using Na_2SO_4 standards. The following means are presented to show the magnitude of leaching in heavily leached and slightly leached fields in the area.

Band depth	Means 13 commercial fields, April 1983, ppm		
	Heavily leached	Slightly leached	5 yr base level
0-2 inches	12,488	50,303	55,007
2-4 inches	3,629	6,722	10,908
4-8 inches	1,621	2,289	3,037

In rapid screening program 67 commercial fields were assessed and the following means for the 0 to 2 inch depth of the fertilizer band were found.

Heavily leached fields		Slightly leached fields	
Range, ppm	% in group	Range, ppm	% in group
Below 5,000	4.6	29,000 to 35,000	14.0
5,000 to 11,000	23.0	35,000 to 41,000	26.0
11,000 to 17,000	27.6	41,000 to 46,000	34.0
17,000 to 23,000	23.0	46,000 to 52,000	17.0
23,000 to 28,000	21.8	Over 52,000	9.0
Total	100.0	Total	100.0

B. Correction

The salt reading decline was detected 5 to 6 weeks before plant symptoms were evident on non-treated fields. Suggestions for replenishment were presented by newsletter, mass media and through grower contacts. Various methods of replenishment were outlined and the rates of fertilizer to use were provided.

In instances where 2/3 of the original fertilizer band was leached away, 4 to 5 ounces of a complete mix for every other plant was suggested. The primary method suggested was to pour the needed fertilizer into each hold. Some growers relied on foliar nutrient spray replenishment and others place a band at the outside base of the bed which was then covered. At the 4 ounce rate for every other stake, approximately 725 lbs of fertilizer (such as 10-0-20) per row acre was used.

Yield records were recorded for a high fertility and a lower fertility field, both of which had slight to moderately heavy leaching. The high fertility field had been supplied 24 lbs N, 501 lbs P_2O_5 and 453 lbs of K_2O per row acre. The lower fertility field had been provided with 273 lbs N, 130 lbs P_2O_5 , and 529 lbs of K_2O per row acre. Both fields were planted to the Sunny cultivar on 18 February, harvests were made on 30 May and 13 June. All fruit were ring sized. Three 15-plant samples of each treatment were taken but as these were not in structured treatment "block", statistical analysis was omitted, and only means could be used for approximate comparisons.

Results of replenishment on these fields is presented in Tables 1 and 2. It would have been nice to have a neat replicated experiment from which to draw more weighty conclusions, but the weather man did not tell us this was to be a record season.

Table 1. Influence of fertilizer replenishment on full bed mulched tomatoes, M-R District, April 1982. (High Fert. Field).

Fruit size	Marketable yield per plant, lbs		Probable increase due to replenishment
	Fertilizer treatment		
	None	10-0-20 4 oz/plant	
Ex. Large	10.6	12.0	1.4
Large	12.5	16.2	3.7
Medium	7.4	9.0	1.6
Small	2.8	3.7	0.9
Total	33.3	40.9	7.6

Table 2. Influence of fertilizer replenishment on full bed mulched tomatoes, M-R District, April 1983. (High Fert. Field).

Fruit size	Marketable yield per plant, lbs			Increase (probable) due to replenishment	
	Fertilizer treatment (4 oz 10-0-20)				
	None	Every plant (EP)	Every other plant (EOP)	EP	EOP
Ex. large	11.6	11.1	13.2	-0.5	1.6
Large	13.8	14.8	16.2	1.0	2.4
Medium	9.8	11.8	10.1	2.0	0.3
Small	2.0	3.5	2.7	1.5	0.7
Total	37.2	41.2	42.2	4.0	5.0

Numbers of fruit per plant were also increased accordingly:

Fruit size	Marketable fruit per plant			
	High fert. field		Low fert. field	
	None	4 oz/plant	None	4 oz/plant
Ex. large	23	26	25	28
Large	39	51	43	51
Medium	30	31	33	36
Small	18	23	12	17
Total	110	131	113	132

C. Summary

Several conclusions may be justified from this monitoring study:

1. The monitoring program should help to establish meaningful soluble salt-time course figures for each month of a "normal" growing season.
2. The monitoring program can be used for early detection of possible fertilizer leaching problems.
3. The replenishment method used helped to restore nutritional levels so that satisfactory yields could be attained even in an excess rainfall year.
4. The approximate cost of replenishment per row acre ranging from \$150.00 to \$250.00 per acre seems to have been justified due to the 450 to 800 cartons (25 lbs) marketable per row acre increase over the non-fertilizer plants.
5. The salt monitoring program should be continued and supported.

SOIL FERTILITY MANAGEMENT FOR TOMATOES
USING SEEP IRRIGATION AND PLASTIC MULCH

P. H. Everett

When discussing fertilizer management the following factors must be considered; (a) fertilizer rates, placements and sources, and (b) water control. When using the full-bed plastic mulch system most of the above factors as well as the management required are magnified because each factor must be managed as a part of the overall system and not as individual components. Management decisions on most, if not all, of the factors must be made prior to planting. Once the crop and system are established it is difficult to change any of the components. In the following discussion comments will be made on the various components or factors and their relationship to the overall system.

Fertilizer Rates: In general, basing the total amount of fertilizer on the number of expected harvests is a good rule-of-thumb. The number of harvests can vary according to cultural practice (stake or ground culture), season (spring, fall, or winter), marketing overlap with competing areas, etc. A nitrogen (N) fertilization guideline for single crop tomatoes based on 7,200 linear bed feet/A is:

(a) 1 or 2 harvests 180-220 lb N/A

(b) 3 or 4 harvests 240-275 lb N/A

In a double cropping sequence, increasing these N rates by 30% seldom improves production of the first crop, but it can increase yields of the second crop.

Potassium (K_2O) can be applied at 1.5 to 2.0 times the amount of N. There is evidence that the 1 to 2 ratio of N to K_2O is beneficial when using tomato varieties that are inclined toward graywall, yellow shoulder, and/or blotchy ripening. On land that has been farmed for several seasons and where soil tests indicate medium to high levels of available phosphorus, this element can be supplied by the addition of 50-100 lb P_2O_5 /A. The micronutrient requirement of a tomato crop can be met in most cases, by applying 0.5-1.0 lb/A of B and Cu; 1.5-2.0 lb/A Mn and Zn; 3.0-5.0 lb/A Fe and 0.01-0.02 lb/A Mo. These can be in the form of oxides, frits and/or sulfates.

Fertilizer Placement: This component of the overall system is very closely associated with fertilizer salt injury and leaching. There are two distinct fertilizer placements when using the plastic mulch-seep irrigation system. One placement is for the starter fertilizer and one is for the main part of the fertilizer that is needed to carry the crop to maturity.

There are several terms used in the industry to identify the starter fertilizer. Some of these are cold mix, bottom fertilizer, in-bed fertilizer, etc. Regardless of the term, it should refer to a small amount of fertilizer applied to get the seedling off to a good start. Three placements of starter fertilizer currently being used are described below:

- (a) Surface applied - Starter fertilizer (N and K) is spread in a 20" - 24" wide band on the surface of the finished bed. Bed surface at time of application must be moist and as smooth as possible. If the surface is dry benefit from the starter is reduced or in some cases eliminated. If the surface is rough the fertilizer will concentrate in depressions. If these depressions coincide with the planting hole, salt injury is likely to occur.

- (b) Wide Band method - Starter fertilizer (N-P-K) is spread in a 24" - 30" wide band either on the flat or a low pre-bed and then bedded-over. This method keeps the fertilizer in good contact with moist soil, but increases the risk of salt injury if application rates are too high.
- (c) Broadcast - Starter fertilizer (N-P-K) is spread uniformly over the entire area prior to bedding. During the bedding operation the fertilizer is incorporated throughout the bed. Advantages and disadvantages with this placement are similar to the wide band method.

Regardless of the placement used, only about 10-15% of the total N and K_2O should be applied as a starter. With the surface placement, all of the P_2O_5 and micro-nutrients should be applied and incorporated during bedding, because phosphate materials are relatively insoluble and surface application is not feasible. With either of the other two placements P_2O_5 and micronutrients should be applied as part of the starter fertilizer.

The remaining 85-90% of the N and K_2O is placed in narrow bands 9-10 inches to each side of the plant row. These bands can be placed directly on the bed surface or in shallow (1"-1½") furrows. Surface placement, as with the starter fertilizer, requires that good moisture be maintained at the bed surface at all times. If the soil surface becomes dry, capillarity is broken and there is no way to move soluble plant nutrients from the fertilizer bands into the root zone. When this happens the plants will gradually appear as if they are "running out" of fertilizer. This problem is often attributed to insufficient fertilizer, when in reality it is caused by improper water control.

The in-furrow method is more commonly used, because it gives better contact between fertilizer and moist soil, and allows a more flexibility with regards to water control. The furrow depth should be no deeper than 1½". Any deeper, the banded fertilizer will be more exposed to leaching by vertical movement of water in the bed. With current technology, it is extremely risky, because of possible salt injury and leaching, to place all of the fertilizer in the plant bed.

Fertilizer Sources: Nutrient sources for the starter fertilizer will depend on the placement used. If the starter is incorporated into the bed some water insoluble N, either slow release or natural organics, may be used. However, it is usually best to limit these to about 25% of the total N in the starter fertilizer. If the starter is placed on the bed surface only water soluble sources should be used.

In the fertilizer (85-90% of total N and K) that is banded on or near the bed surface only water soluble sources should be used. A fertilizer that has proven successful is a mixture of potassium nitrate and ammonium nitrate to give a ratio of about 70% nitrate-N and 30% ammoniacal. Since excess ammonium can contribute to blossom-end-rot of tomatoes, the ratio of nitrate to ammoniacal nitrogen in the total fertilizer (starter + top-band) should be given careful consideration when planning a fertilizer program. In calculating this ratio, sources such as urea, slow release N materials containing urea and natural organics must be considered as ammoniacal-N, because these materials are converted to ammonia when added to the soil.

Water Control: This component of the seep irrigation-plastic mulch system is of prime importance in its relationship to fertilizer management. There are several

concepts that should be remembered when using seep irrigation:

- (a) Water is supplied by capillarity from a perched water table and the direction of water movement (except when draining) is upward. When high rates of fertilizer are mixed in the beds, water soluble fertilizer salts can cause salt damage by moving into the root zone or around the plant stem. This is why it is suggested that only a small amount of starter fertilizer be mixed in the bed.
- (b) Maintain the water table at a constant level (usually 15" - 18") below the bed surface. Avoid, as much as possible, fluctuating the water table. Moving the water table up and down increases the leaching of fertilizer. In-bed fertilizer is more exposed to this type of leaching than surface applied fertilizer.
- (c) Avoid over-draining. Drain until the water table has been lowered back to the 15" - 18" level. Lowering the water table past this point increases pumping cost and waste water. If drainage is excessive the soil near the bed surface may become so dry that nutrients from the top-banded fertilizer can no longer be used by the plant.

FERTILIZER MANAGEMENT FOR OVERHEAD IRRIGATED TOMATOES

S. J. Locascio

Successful tomato production is closely related to rate and composition of fertilizer, its placement and to water management. Because of the potential value of mulched tomatoes, producers often overfertilize to minimize risk of production loss due to infertility. Although tomatoes are more tolerant to soluble salts than most vegetables, best growth is obtained when tolerant levels of fertilizer salts are used and soil moisture concentration is maintained at or just below field capacity. If the soil in the bed under the mulch is allowed to become dry, salts are concentrated and reductions in growth may occur. This potential injury can be minimized by proper fertilizer management.

With overhead irrigation, water is generally applied at rate of 1 to 1.5 inches per week. Water falling on the tomato plants is funneled into the plant hole and results in salt movement downward and away from the plant. In contrast, with sub-surface irrigation, water is applied from below the bed and salts movement is upward and accumulate at the highest point on the bed. Salt injury can be easily minimized with proper fertilizer management with overhead irrigated tomatoes.

Nutrient requirements. Flatwoods soils typically used for tomato production are natively poorly drained, extremely acid (pH 3.5 to 4.0) and must be limed to 6.0 to 6.5 for best tomato production. At low pH levels, Al, Fe and Mn are more soluble and their toxicity reduces tomato plant growth. After liming, risk of toxicity of these elements is reduced. Also, organisms transform organic-nitrogen to ammonium-nitrogen and nitrification from ammonium-nitrogen to nitrate-nitrogen proceed rapidly. The quantity and source of lime depends on soil test results. Dolomitic limestone is applied or Mg is added to the fertilize where soil Mg is below 10% of the soil's exchangeable cations. With high annual rainfall and low exchange capacity of these soils, soluble nutrient such as N and K do not accumulate from season to season and must be applied for each tomato crop. In some acid soils, applied P can be leached and in others is rapidly fixed to unavailable forms. Fertilizers generally must supply 90 to 95% of the crops N needs and 75% or more of the P, K, and

micronutrient requirements. Marl and rock soils have high pH levels in contrast to those of virgin flatwood soils but they are also infertile so that plant deficiencies of all element except Ca may occur without fertilization.

Rate. Fertilizer rates for tomatoes should be related to length and rate of crop growth. Rates that have provided maximum tomato production are as follows:

For 2 harvests: 160-240-240 lb/acre N-P₂O₅/K₂O

For 3 or 4 harvests: 220-240-330 lb/acre N-P₂O₅/K₂O

On newly planted soils or where micronutrient are known to be deficient, apply about 2.0 lb/acres Mn and Zn, 5.0 lb/acre Fe, and 1.0 lb/acre Cu and B. Micronutrients from several sources including oxides and sulfates have been equally effective and should be applied with the fertilizer.

Tomato production during the cooler period of winter occurs with lower light intensity and shorter days than occur in the spring which results in reduced plant growth rates. Under these conditions, fertilizer rates for N-P-K should be about 80% of those listed above.

Placement. Fertilizer should be placed in the bed in a location to minimize plant injury and to maximize nutrient uptake. With overhead irrigation, nutrient movement will be downward and away from the plant hole in the polyethylene mulch and soluble salt injury will not be as great a problem as with subsurface irrigation. At the lower rates of fertilizer listed above used with 4 to 5 feet bed centers, maximum tomato production has been obtained with 100% broadcast application of the fertilizer or combinations of broadcast and banded fertilizer. With higher fertilizer rates and wider bed spacing, 100% broadcast placement may result in reduced yields due to soluble salt injury and therefore a combination of broadcast and band placement results in best production. For the combination placement, 30 to 40% of the N and K and 100% of the P, and micronutrients are broadcast and incorporated in the bed. The remaining N and K is applied in a band 6 to 8 inches to the side of the tomato seed or transplant and 2 to 4 inches deep. Location of the band at this depth in the soil is essential for maximum nutrient utilization. The soil should be moist when the mulch is applied as it is difficult to wet soil in the bed after the mulch is applied on a dry soil.

Nutrient sources. Tomatoes grown with overhead irrigation can be grown successfully with N from soluble sources including NH_4NO_3 , KNO_3 , CaNO_3 , or part of the N from slow released N sources such as sulfur-coated urea (SCU) and isobutylidene diurea (IBDU). A minimum of 25% of the N should be in the $\text{NO}_3\text{-N}$ form. The use of urea and $(\text{NH}_4)\text{SO}_4$ should be minimized. Potassium can be supplied from KCl , K_2SO_4 or KNO_3 . In areas where the irrigation water is of medium to low quality, low salt index sources should be used to minimize salt injury from the fertilizer.

BACTERIAL DISEASE OF TOMATO

J. B. Jones

The tomato plant has a wide range of bacterial pathogens that cause minor as well as major problems in the field. The bacterial pathogens that have been observed in recent years in Florida will be discussed in this short paper. We will be discussing bacterial wilt, tomato pith necrosis, and several bacterial leaf spots.

First of all, the vascular disease bacterial wilt which can be one of the most devastating diseases in Florida is readily detectable in the field. It is characterized by a rapid wilting of the plant. These symptoms are primarily evident during the hot or warmer months. In some instances the pitch is hollow.

Tomato pitch necrosis, a vascular disease which was recently recognized in Florida, ordinarily is observed early in the spring. It appears to be quite destructive when first observed, but as the season progresses and the daily temperature increases the plants grow out of the malady. Symptoms include a brown canker on the stem and browning of the pith and vascular tissue. The pith deteriorates and many times when a longitudinal section is made through the affected tissue, a chambered pitch is present.

In the past year, three bacterial leaf spots have caused concern in certain areas of Florida. Bacterial spot incited by Xanthomonas campestris pv. vesicatoria is the predominate one in Florida. It attacks all above ground parts of the plant, causing extensive damage to the stem, leaf, flower, and fruit. The bacterium has an optimum temperature for development of 28°-30°C. Heavy rainfall is required for optimal disease development and spread.

A second bacterial-incited leaf spot that has occurred in epiphytotic proportions recently in Florida is bacterial speck incited by Pseudomonas syringae pv. tomato. Speck is similar to bacterial spot and affects all above ground parts of the plant. Leaf, stem, peduncle, and flower symptoms can not be distinguished from bacterial spot. However, fruit symptoms caused by speck are distinguishable from spot symptoms, in that, speck causes small black spots and spot causes larger brown to blackish spots. The bacterium has an optimum temperature of 18°-21°C

for infection and disease development. Thus, in southwestern Florida it usually is not a problem, since during the early spring when temperature conditions are optimal, precipitation is extremely low. However, this past spring was unusually wet and bacterial speck was a problem in several fields.

A third leaf spot, completely new to Florida, was found in the spring of 1983 in the Manatee-Ruskin area and in the Immokalee-Naples area. After extensive laboratory and growth room research it was determined to be incited by the bacterium, Pseudomonas viridiflava. Relatively little is known about this organism. However, it appears to be a weak pathogen that invades tomato plants under stress. It also appeared to be favored this past spring by cool, wet weather. Once the heavy rainfalls ceased, the disease appeared to subside. Preliminary laboratory findings confirm that the disease is favored by high moisture and/or injury.

A number of bacterial diseases affect tomato in Florida and are difficult to distinguish from one another. If the bacterial disease is progressing rapidly during the cooler periods of the year, then it is probably speck or P. viridiflava. If, on the other hand, it progressed during the hotter periods of the year, most likely it is bacterial spot. The only way to be absolutely sure is to isolate and identify.

TOMATO SECTION OF EXTENSION PLANT PATHOLOGY REPORT NO. 6 - FLORIDA
VEGETABLE PLANT DISEASE CHEMICAL CONTROL GUIDE.

Tom Kucharek
Extension Plant Pathologist
July, 1983

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomato	Benlate	1/2-1 lb.	N TL	Gray mold Leaf mold White mold (Sclerotinia) Phoma leaf spot	Target spot Rhizoctonia fruit rot	Field & Greenhouse.
	Botran 75 W	1 lb/100 gal water	N TL	Botrytis stem canker		Seedlings or newly set transplants may be injured by drenching. Greenhouse use only.
	Bravo 500	2 1/4-4 1/4 pts.	N TL	Early blight Late blight Gray leaf spot Leaf mold Septoria leaf spot Gray mold Black mold Rhizoctonia fruit rot Bacterial spot (when combined with Kocide 101, Tri-basic Copper Sulfate, Copper 53-W Tri-basic Copper Sulfate or CP-Basic Copper TS-53-WP)	Phoma leaf spot Target spot Rhizoctonia fruit rot Bacterial speck (when used as indicated for bacterial spot)	Do not use with Copper Count-N in concentrated spray mixtures.
	Dithane FZ	Field 0.8-2.4 qts. Greenhouse 4.5-6.1 fl oz/5000 sq ft	5	Leaf mold Early blight Late blight Gray leaf spot Septoria leaf spot Bacterial spot (use 1.2 qts combined with copper fungicides as in Dithane M-45)	See Dithane M-45	Do not use on young plants in greenhouse to avoid injury.

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomatoes (cont'd)	Dithane M-45	1 1/2-3 lbs.	5	Late blight Early blight Gray leaf spot Leaf mold Bacterial spot	Leaf mold Phoma leaf spot Target spot Bacterial spot & Bacterial speck (When combined with Kocide 101, Tri-basic Copper Sulfate, Copper 53-W Tri-basic Copper Sulfate or CP-Basic Copper TS-53-WP)	
	Dithane M-22	1-3 lbs.	5	Early blight Late blight Septoria leaf spot Gray leaf spot Leaf mold	See Dithane M-45	Field or greenhouse. Do not use on young tender plants under glass.
	Dithane M-22 Special	1-3 lbs.	5	Early blight Late blight Gray leaf spot Septoria leaf spot Bacterial spot	See Dithane M-45	To avoid injury do not use on young plants in greenhouse.
	Manzate	1 1/2-2 lbs.	5	Early blight Late blight Septoria leaf spot Gray leaf spot	See Dithane M-45	Do not use on young plants in greenhouse as injury may occur.
	Manzate D	1 1/2-2 lbs.	5	Early blight Late blight Septoria leaf spot	See Dithane M-45 & Gray leaf spot	Do not use on young plants in greenhouse as injury may occur.

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomatoes (cont'd)	Manzate 200	1 1/2-3 lbs.	5	Early blight Late blight Gray leaf spot Gray leaf mold Bacterial spot	See Dithane M-45	
	Manzate Flowable	Field 1.2-2.4 qts. Greenhouse 4.5 - 6.1 fl oz/5000 sq ft	5	Early blight Late blight Septoria leaf spot Gray leaf spot	See Dithane M-45	Field and greenhouse. Do not use on young seedlings in greenhouse as injury may occur.
	Manex ¹	1.2-1.6 qts	5	Leaf mold Early blight Late blight Gray leaf spot Septoria leaf spot	Target spot Phoma leaf spot	Field or greenhouse.
	Difolatan 4 F (Mechanically harvested tomatoes only)	2 1/2 - 5 pts.	NTL	Early blight Late blight Gray leaf spot Septoria leaf spot Fruit rot	Target spot Phoma leaf spot Leaf mold	1. For mechanically harvested tomatoes only. 2. Fruit spotting may occur when applied during high temperatures or drought stress.
	Dyrene (not for use in greenhouse)	2-5 lbs.	NTL	Botrytis Early blight Late blight Septoria leaf spot		If temperatures exceed 85°F do not use more than 1 lb. if tank mixed with a copper fungicide.

¹High rate is equivalent to 67% of Maneb a.i. in Dithane M-22 special, Dithane M-22, Manzate Flowable and Dithane FZ.

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomatoes (cont'd)	Kocide 101	2-4 lbs.	NTL	Early blight Bacterial speck Bacterial spot	See Dithane M-45	Min days to harvest is 5 if used with a Dithane or Manzate fungicide.
	Kocide 606	2 2/3-5 l/3 pts.	NTL	Early blight Bacterial speck Bacterial spot	See Dithane M-45	Same as Kocide 101.
	Tri-basic Copper Sulfate	2-4 lbs.	NTL	Bacterial spot Bacterial canker Early blight Late blight Leaf mold Septoria Stemphyllium leaf spot	See Dithane M-45	Same as Kocide 101.
	CP-Basic Copper TS-53 WP	2-4 lbs.	NTL	Same as Tri-basic Copper sulfate	See Dithane M-45	Same as Kocide 101.
	Copper 53-W Tri-basic Copper Sulfate	2-4 lbs.	NTL	Early blight Late blight Leaf Mold Septoria leaf spot Bacterial canker	See Dithane M-45	Same as Kocide 101.

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomatoes (cont'd)	JMS Stylet Oil	3 qts.	NTL	Potato virus Y Tobacco etch virus Pepper mottle virus	Tomato yellows	Must be applied with ground rig at 400 psi using Tee Jet TX5 SS nozzles. <u>READ LABEL</u>
	Ridomil 2E ¹ (Soil application)	2-4 pts. (Broadcast only)	PPI treatment for plant beds	Pythium damping off in plant beds Late blight Phytophthora stem canker		<u>Not a necessary treatment for Pythium if beds are fumigated prior to seeding and recontamination of fumigated soil is avoided. Not for use in greenhouses.</u>
	Ridomil 2E ¹ (Soil application)	4-8 pts. ² (Broadcast rate)		Pythium damping off for field	Phytophthora stem canker Late blight	Same as entry above.
	Ridomil 2E ¹ (Soil application)	4 pts. ³ (Broadcast rate)		Phytophthora or Pythium fruit rots	Late blight	Same as entry above.

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- ¹Do not apply more than 12 pints Ridomil 2E/season.
²PPI (via mechanical device) or POP1 (via irrigation) broadcast or banded.
³Soil surface 4-8 weeks before harvest followed by irrigation. If plastic used on beds, apply as a band next to bed in middles if roots have developed beyond plastic. Ridomil translocates upward in plant from roots. If plastic not used, band on soil below drip line.

Crop	Chemical	Rate/A	Minimum days to harvest	Pertinent Diseases listed on label	Pertinent Diseases not listed on the label but also controlled	Special Remarks
Tomatoes (cont'd)	Ridomil MZ-58 ¹ (Foliar spray)	1 1/2 - 2 lbs.	5	Late blight	Phytophthora stem canker Pythium fruit rot	Only Dithane M-45, Manzate 200, Manzate or Dithane M-22 may be tank mixed with Ridomil MZ-58. Do not apply more than 2 lbs/A of Manzate or Dithane fungicides with Ridomil MZ-58.

¹High rate is equivalent to 40% of Mancozeb a.i. in Dithane M-45 or Manzate 200.

LEGAL INSECTICIDES
FOR CONTROL OF INSECTS
ON
TOMATOES

August 1983

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TOMATOES-

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
ants	allethrin (Pyrellin SCS)	1 $\frac{1}{2}$ liquid (EC)	1-1 1/2 pts.	see label
aphids	allethrin (Pyrellin SCS)	1 $\frac{1}{2}$ liquid (EC)	1-2 2/2 pts.	see label
	aliphatic petroleum (JMS-Stylet Oil)	97.6 $\frac{1}{2}$ EC	see label.	see label
	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	demeton (Systox)	2 EC	1-1 1/2 pts./ 100 gal.	3
	diazinon	4 EC	1/2 pt.	1
	dimethoate (Cygon, Defend)	4 EC	1/2-1 pt.	7
	disulfoton (Di-Syston)	15 G	8-23.4 oz./1000 ft. row (any row space)	30
	endosulfan (Thiodan) (green aphid aphid)	3 EC	2/3 qt.	1
	lindane (Isotox-lindane)	25 WP	1 lb.	do not apply after fruits start to form
	malathion	5 EC	1 pt./100 gal.	1
	methamidophos (Monitor)	4 EC	1 1/2-2 pts.	7
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.

TOMATOES --

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
aphids (cont.)	methoxychlor + diazinon (Alfa-Tox)	30% liquid (EC)	2 1/2 qts.	1
	mevinphos (Phosdrin)	4 EC	1/4-1/2 pt.	1
	methyl parathion	4 EC	1-3 pts.	15
	monocrotophos (Azodrin)	5 S (EC)	7/8 pt.	21
	parathion	4 EC	1-2 pts.	10
	phosphamidon	8 EC	1/2 pt.	10
	pyrethrins + piperonyl butoxide (Pyrenone) (green peach aphid)	66% liquid (EC)	2-6 oz./100 gal.	0
	toxaphene (green peach aphid)	8 EC	2-5 pts.	1 - 2 pts. 3 - 2+ pts.
armyworms	allethrin (Pyrellin SCS)	1% liquid EC	1-1 1/2 pts.	see label
	carbaryl (Sevin)	5 B	40 lbs.	0
	diazinon	4 EC	3/4-1 pt.	6
	fenvalerate (Pydrin) (Southern, Sugarbeat Western Yellow-Striped)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methomyl (Lannate, Nudrin)	1.8 L	1-2 pts.	1
	methyl parathion	4 EC	1-3 pts.	15

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
armyworms (cont.)	parathion (up to 3rd instar)	4 EC	1-2 pts.	10
	toxaphene	5 B	20-40 lbs.	1
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 3 - 5 pts.
	trichlorofon (Dylox, Proxol)	5 B	20 lbs.	28
(fall armyworms)	carbaryl (Sevin)	80 WP	1 1/2-2 1/2 lbs.	0
	methomyl (Lannate, Nudrin)	1.8 L	2 pts.	1
	methoxychlor (Marlate)	50 WP	2-6 lbs.	1 - 3 1/2 lbs. 7 - 3 1/2+ lbs.
	methoxychlor + diazinon (Alfa-Tox)	30% liquid (EC)	2 1/2 qts.	1
(southern armyworms)	diazinon	4 EC	3/4-1 pt.	1
	fenvalerate (Pydrin)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.
(beet armyworms)	fenvalerate (Pydrin) (Sugarbeet armyworm)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
cabbage looper	<u>Bacillus thuringiensis</u> Bactospeine, Bactur, Dipel, Sok, Stan-Guard, Thuricide)	See individual labels.		0
	cryolite (Kryocide)	96 WP	15-30 lbs.	wash fruit
	endosulfan (Thiodan)	3 EC	1 qt.	1
	fenvalerate (Pydrin)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.
	methomyl (Lannate, Nudrin)	1.8 L +	1-2 pts. + 1/2 lb.	1 - 2 pts. 2 - 2+ pts.
	methyl parathion	4 EC	2-3 pts.	15
	monocrotophos (Azodrin)	5 S (EC)	1 5/8 pts.	21
	toxaphene	8 EC	2 pts.	1
	azinphosmethyl (Guthion)	2 S (EC)	1 1/2 pts.	0
Colorado potato beetle	carbaryl (Sevin)	80 WP	2/3-1 1/4 lb.	0
	disulfoton (Di-Syston)	8 EC	1.2-3.5 fl. oz./ 1000 ft. row (any row spacing) or 1-3 pts./A (38" row spacing)	30

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
Colorado potato beetle (cont.)	disulfoton (Di-Syston)	15 G	8-23.4 oz./1000 ft. row (any row spacing) or 6.7-20 lbs./A (38" row spacing)	30
	endosulfan (Thiodan)	3 EC	2/3 qt.	1
	fenvalerate (Pydrin)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methoxychlor (Marlate)	50 WP	2-6 lb.	1 - 3 1/2 lbs. 7 - 3 1/2+ lbs.
	parathion	4 EC	1-2 pts.	10
	phosphamidon	8 EC	1/2 pt.	10
	pyrethrins + piperonyl butoxide (Pyrenone)	66% liquid (EC)	2-6 oz./100 gal.	0
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 2 - 2+ pts.
corn earworm (See also tomato fruitworms)	azinphosmethyl (Guthion)	2 S (EC)	3-6 pts.	14
crickets	carbaryl (Sevin)	5 B	40 lbs.	0
	trichlorfon (Dylox, Proxol)	5 B	20 lbs.	28

TOMATOES ---

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
cutworms	allethrin (Pyrellin SCS)	1% liquid (EC)	1-1 1/2 pts.	see label
	carbaryl (Sevin)	80 WP	2 1/2 lbs.	0
	carbaryl (Sevin)	5 B	40 lbs.	0
	diazinon	14 G	14-28 lbs.	preplant
	diazinon	4 EC	2-4 qts.	preplant
	lindane (Isotox-lindane)	25 WP	1-2 lbs.	preplant (soil)
	methomyl (Lannate) (varigated cutworm)	1.8 L	2 pts.	1
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 3 - 2+ pts.
	trichlorfon (Dylox, Proxol) (surface-feeding cutworms)	5 B	20 lbs.	28
darkling ground beetles	carbaryl (Sevin)	5 B	40 lbs.	0
<u>Drosophila</u> (fruit flies)	azinphosmethyl (Guthion)	2 S (EC)	1 1/2-2 pts.	0
	diazinon	4 EC	1/2-1 1/2 pts.	1
	malathion	5 EC	2 1/2 pts.	1
	naled (Dibrom)	8 EC	1 pt.	1

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
European corn borer	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
flea beetles	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	carbaryl (Sevin)	80 WP	2/3-1 1/4 lbs.	0
	carbophenothion (Trithion) (potato flea beetle)	8 EC	1/2-1 pt.	7
	cryolite (Kryocide)	96 WP	15-30 lbs.	wash fruit
	disulfoton (Di-Syston)	8 EC	1.2-3.5 fl. oz./ 1000 ft. row (any row spacing) or 1-3 pt./A (38" row spacing)	30
	disulfoton (Di-Syston)	15 G	8-23.4 oz./1000 ft. row (any row spacing) or 6.7-20 lb./A (38" row spacing)	30
	endosulfan (Thiodan)	3 EC	2/3 qt.	1
	methyl parathion	4 EC	1-3 pts.	10 - 1 pt. 15 - 1+ pt.
	methoxychlor (Marlate)	50 WP	2-6 lbs.	1 - 3 1/2 lbs. 7 - 3 1/2+ lbs.

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
flea beetles (cont.)	methoxychlor + diazinon (Alfa-Tox)	30% liquid (EC)	2 1/2 qts.	1
	naled (Dibrom)	8 EC	1 pt.	1
	parathion	4 EC	1-2 pts.	10
	phosphamidon	8 EC	1/2 pts.	10
	pyrethrins + piperonyl butoxide (Pyrenone)	66% liquid (EC)	2-6 oz./100 gal.	0
	toxaphene	8 EC	2-3 pts.	1 - 2 pts. 3 - 2+ pts.
garden symphylans	fonofos (Dyfonate)	10 G	20 lbs.	preplant, broadcast
grasshoppers	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	carbaryl (Sevin)	5 B	40	0
	mevinphos (Phosdrin)	4 EC	1/2-1 pt.	1
	parathion	4 EC	1-2 pts.	10
	toxaphene	8 EC	2.5-4 pts.	1 - 2 pts. 3 - 2+ pts.

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
hornworms (tomato hornworms)	azinphosmethyl (Guthion)	2 S (EC)	3-6 pts.	14
	<u>Bacillus thuringiensis</u> Bactospeine, Bactur, Dipel, Stan-Guard, Sok, Thuricide)	See individual labels.		0
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
	cryolite (Kryocide)	96 WP	15-30 lbs.	wash fruit
	endosulfan (Thiodan)	3 EC	2/3-1 1/3 qts.	1
	fenvalerate (Pydrin)	2.4 EC	2 2/3-5 1/3 ozs.	1
	methomyl (Lannate)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.
	naled (Dibrom)	8 EC	1 pt.	1
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 3 - 2+ pts.
	trichlorfon (Dylox, Proxol)	80 SP	20 oz.	21

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
lacebugs	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
leafhoppers	allethrin (Pyrellin SCS)	1 & liquid EC	1-1 1/2 pts.	see label
	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	carbaryl (Sevin)	80 WP	2/3-1 1/4 lbs.	0
	carbophenothion (Trithion) (potato leafhopper)	8 EC	1/2-1 pt.	7
	disulfoton (Disyston)	8 EC	1.2-3.5 fl. oz./ 1000 ft. row (any row spacing) or 1-3 pts./A (38" row spacing)	30
	disulfoton (Di-Syston)	15 G	8-23.4 oz./1000 ft. row (any row spacing) or 6.720 lbs./A (38" row spacing)	30
	dimethoate (Cygon, Defend)	4 EC	1/2-1 pt.	7
	methoxychlor (Marlate)	50 WP	2-6 lbs.	1 - 3 1/2 lbs. 7 - 3 1/2+ lbs.

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
leafhoppers (cont.)	methyl parathion	4 EC	1-2 pts.	15
	mevinphos (Phosdrin)	4 EC	1/2-1 pt.	1
leafminers	allethrin (Pyrellin SCS)	1 $\frac{1}{2}$ liquid (EC)	1-1 1/2 pts.	see label
	azinphosmethyl (Guthion)	2 S (EC)	1 1/2-2 pts.	0
	carbophenothion (Trithion)	8 EC	1/2-1 pt.	7
	diazinon	4 EC	1/2 pt.	1
	diazinon	50 WP	1/2 lb.	1
	dimethoate (Cygon, Defend)	4 EC	1/2-1 pt.	7
	disulfoton (Di-Syston)	8 EC	1.2-3.5 fl. oz./ 1000 ft. row (any row spacing) or 1-3 pts/A (38" row spacing)	30
	disulfoton (DiSyston)	15 G	8-23.4 oz./1000 ft. row (any row spacing) or 6.7-20 lbs./A (38" row spacing)	30
	ethion	4 EC	1 pt.	2
	fenvalerate (Pydrin)	2.4 EC	10 2/3 ozs.	1

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
leafminers (cont.)	lindane (Isotox-linedane)	25 WP	1 1/2 lbs.	Do not apply af- ter fruit starts to form.
	methamidophos (Monitor) (adults)	4 EC	1 1/2-2 pts.	7
	methoxychlor + diazinon (Alfa-Tox)	30% liquid (EC)	2 1/2 qts.	1
	monocrotophos (Azodrin)	5 S (EC)	1 5/8 pts.	21
	naled (Dibrom)	8 EC	1 pt.	1
	oxamyl (Vydate L)	2 EC	2-4 pt./100 gal.	1
	parathion	4 EC	1-2 pts.	10
	phorate (Thimet)	15 G	15 oz./1000 ft. row (min. 38" spacing)	at planting
	phosphamidon	8 EC	1/2 pt.	10
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 3 - 2+ pts.
	trichlorfon (Dylox, Proxol)	80 SP	20 oz.	21
loopers	allethrin (Pyrellin SCS)	1% liquid (EC)	1-1 1/2 pts.	see label

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
loopers (cont.)	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1-2 pts. 2-2+ pts.
mites	allethrin (Pyrellin SCS)	1* liquid (EC)	1-1 1/2 pts.	see label
	carbophenothion (Trithion) (russet, tropical & two-spotted mites)	4 EC	1-2 pts.	7
	demeton (Systox)	2 EC	1-1 1/2 pt./100 gal.	3
	dicofol (Kelthane)	1.6 EC	1-2 qts.	2
	disulfoton (Di-Syston)	8 EC	1.2-3.5 fl. oz./ 1000 ft. row (any row spacing) or 1.3 pts. (38" row spacing)	30
	disulfoton (Di-Syston)	15 G	8-23.4 oz./1000 ft. row (any row spacing) or 6.7-20 lbs./A (38" row spacing)	30
	ethion (tropical, two-spotted, and tomato russet mites)	4 EC	1 pt.	2
	methyl parathion	4 EC	1-2 pts.	15
	mevinphos (Phosdrin)	4 EC	1/2 - 1 pt.	1
	naled (Dibrom)	8 EC	1 pt.	1

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
(tomato russet mite)	endosulfan (Thiodan)	3 EC	1 1/3 qt.	1
	malathion	25 WP	2-4 lbs.	1
	methyl parathion	4 EC	1-3 pts.	15
	parathion	4 EC	1-2 pts.	10
	sulfur (Kolospay)	81% WP	7 lbs.	0
	sulfur (Magneticide)	6 F	1/2-1 gal.	0
(spider mite)	malathion	5 EC	1 1/2 pts./100 gal.	1
mole crickets	diazinon	15 G	7 lbs.	preplant
	diazinon	4 EC	1 qt.	preplant, broadcast
pinworm (tomato pinworm)	allethrin (Pyrellin SCS)	1% liquid (EC)	1-1 1/2 pts.	see label
	azinphosmethyl (Guthion)	2 S (EC)	3-6 pts.	14
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
	cryolite (Kryocide)	96 WP	15-30 lbs.	wash fruit
	fenvalerate (Pydrin)	2.4 EC	5 1/3-10 2/3 ozs.	1

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
pinworm (tomato pinworm) cont.	methamidophos (Monitor) (suppression of low populations)	4 EC	1 1/2-2 pts.	7
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts. (ground application only)	1 - 2 pts. 2 - 2+ pts.
	toxaphene	8 EC	2-5 pts.	1 - 2 pts. 3 - 2+ pts.
plant bugs	allethrin (Pyrellin SCS)	1% liquid (EC)	1-1 1/2 pts.	see label
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
	methyl parathion	4 EC	2 pts.	15
	parathion	4 EC	1-2 pts.	10
potato flea beetle	carbophenothion (Trithion)	8 EC	1/2-1 pt.	7
potato psyllid	carbophenothion (Trithion)	4 EC	1-2 pts.	7
	endosulfan (Thiodan)	3 D	33 lbs.	1
	methyl parathion	4 EC	1-3 pts.	15
	parathion	4 EC	1-2 pts.	10
salt marsh caterpillar	trichlorfon (Dylox, Proxol)	5 B	20 lbs.	28

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
sowbug	carbaryl (Sevin)	5 B	40 lbs.	0
stinkbugs	azinphosmethyl (Guthion) (green stinkbugs)	2 S (EC)	1 1/2-2 pts.	0
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
	endosulfan (Thiodan)	3 EC	1-1 1/3 qts.	1
	parathion	4 EC	1-2 pts.	10
	phosphamidon	8 EC	1/2 pt.	10
	pyrethrins + piperonyl butoxide (Pyrenone)	66% liquid (EC)	2-6 oz./100 gal.	0
thrips	azinphosmethyl (Guthion)	2 S (EC)	2-3 pts.	0
	lindane (Isotox-lindane)	25 WP	1 lb.	Do not apply after fruit starts to form.
	parathion	4 EC	1-2 qts.	10
	toxaphene	8 EC	3 pts.	1 - 2 pts. 3 - 2+ pts.

TOMATOES -

INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
tomato fruitworm (same specifics as corn earworm and fruitworm)	azinphosmethyl (Guthion)	2 S (EC)	3-6 pts.	14
	carbaryl (Sevin)	80 WP	1 1/4-2 1/2 lbs.	0
	cryolite (Kryocide)	96 WP	15-30 lbs.	wash fruit
	fenvalerate (Pydrin)	2.4 EC	5 1/3-10 2/3 ozs.	1
	methamidophos (Monitor)	4 EC	1 1/2-2 pts.	7
	methomyl (Lannate, Nudrin)	1.8 L	2-4 pts.	1 - 2 pts. 2 - 2+ pts.
	methoxychlor + diazinon (Alfa-Tox)	30% liquid (EC)	2 1/2 qts.	1
	monocrotophos (Azodrin)	5 EC	1 5/8 pts.	21
	naled (Dibrom)	8 EC	1 pt.	1
	toxaphene	8 EC	2-5 pts.	3 - 2 pts. 5 - 5 pts.
tuberworm	azinphosmethyl (Guthion)	2 S (EC)	2 1/4-3 pts.	0
weevils	allethrin (Pyrellin SCS)	1% liquid (EC)	1-1 1/2 pts.	see label.
whitefly	azinphosmethyl (Guthion)	2 S (EC)	1 1/2-2 pts.	0
	endosulfan (Thiodan)	3 EC	2/3 qt./100 gal.	1
	parathion	4 EC	1-2 pts.	10

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INSECT	INSECTICIDE	FORMULATION	RATE/ACRE	MIN. DAYS TO HARVEST
whitefly (cont.)	phosphamidon	8 EC	1/2 pt.	10
white grubs	lindane (Isotox-lindane)	25 WP	1-2 lbs.	preplant (soil)
wireworms	diazinon	14 G	21-28 lbs.	preplant
	• diazinon	2 B	50 lbs.	none listed
	diazinon	14 G	70 lbs.	preplant, broadcast
	diazinon	4 EC	10 qts.	preplant, broadcast
	fonofos (Dyfonate)	10 G	20 lbs.	preplant, broadcast
	lindane (Isotox-lindane)	25 WP	1-2 lbs.	preplant (soil)
	parathion	10 G	30-40 lbs.	preplant, broadcast & disc 3 wks. preplanting
	parathion	4 EC	5 qts.	apply to soil surface pre- planting & work 6-9" into soil.

TOMATO NEMATOCIDES FOR FLORIDA

R. A. Dunn

Tomatoes are subject to damage by several plant nematodes in Florida, including root-knot, reniform, sting, and stubby-root. Risk of damage by any of these may be reduced by crop rotation (farming "new" land), but the value of the crop practically dictates that chemical nematocides be used even on most new land. On old vegetable land, nematocides are definitely necessary.

MULTI-PURPOSE SOIL FUMIGANTS. Most tomatoes are grown on some form of the full-bed plastic mulch system, in which one of the multi-purpose fumigants is an integral part of the program. Product choice is often dictated by the classes of pests other than nematodes for which control is desired. For instance, methyl bromide is most active of the fumigant ingredients against nutsedges (Cyperus spp.), so it is often preferred for that reason.

Table 1. MULTI-PURPOSE SOIL FUMIGANTS registered for tomatoes in Florida. The following materials can provide control of several classes of pests, depending on product, rate, and application procedure chosen. All are good nematocides when used legally and effectively for your purpose. All of these products are more effective when covered with a plastic tarp and some must be so covered to keep these volatile chemicals in the ground long enough to effectively control the target pests. Since most are thus used in plastic-covered beds, and bed widths are highly variable, rates are given on a broadcast acre basis. The actual amount of chemical used per acre of field depends on the portion of the file area which is actually occupies by the beds: if beds are 30 inches wide and are spaced 60 inches apart, cent-to-center, the treated area is 50% of the total field areas, so 50% of the broadcast rate of product would be needed; for 36-inch beds spaced 5 feet apart, the field requires $36/60 = 60\%$ of the broadcast rate.

ACTIVE

INGREDIENT(S)	PRODUCTS	BROADCAST RATE/ACRE
chloropicrin	Chlor-O-Pic, Picfume	35-78 gal. without tarp 11-15 gal. when tarped
methyl bromide/ chloropicrin mixtures often in 2:1 ratio but available in many proportions	Dowfume MC-33 Terr-O-Gas 67, many others	rate usually provides 180-240 lb methyl bromide/acre
metam-sodium	Vapam	40-60 gal. when tarped 80-100 gal. water sealed
D-D/SMDC	Vorlex	30-50 gal.

Table 2. FUMIGANT NEMATOCIDES REGISTERED FOR TOMATOES IN FLORIDA
Rates are believed to be correct for products named, and similar products of other brand names, when applied to mineral soils. Higher rates are required for muck (organic) soils. However, the grower has the final responsibility to see that each product is used legally; READ THE LABEL of the product to be sure that you are using it properly.

Nematicide	Broadcast (overall) rates		Row application rates, single chisel/row	
	Gal/acre	Fl oz/1000 ft/chisel spaced 12"	Gal/acre 36" row*	Fl oz/1000 ft/chisel, any spacing
D-D	20-25	59-73	9-11	79-97
Telone II	12-15	35-44	5.3-6.7	46-62
ethylene dibromide 85**	4.5-6.0	13-18	1.5-2.0	13-18
ethylene dibromide 90**	3.4-4.5	10.0-13.2	1.1-1.5	10.0-13.2
ethylene dibromide 100**	3.0-4.0	8.8-11.7	1.0-1.3	8.8-11.7

*Gal/acre estimated for row treatments to help determine the approximate amounts of chemical needed per acre of field. If rows are closer, more chemical will be needed per acre; if wider, less. If using more than one chisel/row, space chisels and apply the same rate of fumigant/chisel as for broadcast application.

**Ethylene dibromide "85" rates are believed to be accurate for products which contain 12 lb ethylene dibromide (EDB)/gallon, such as Dowfume W-85, EDB 85, or Soilbrom 85. Ethylene dibromide "90" rates are believed to be accurate for products containing 16 lb EDB/gal, such as Dowfume W-90, EDB-93, Red Panther Ethylene Dibromide-90, or Soilbrom 90. Ethylene dibromide "100" rates are believed to be accurate for any product containing 18.1 lb EDB/gal, such as Dowfume W-100 or Soilbrom 100.

FUMIGANT NEMATOCIDES. Where tomatoes are grown in less intensive culture, without use of plastic mulch, and where only nematode control is desired from the pre-plant fumigation, fumigant nematicides listed in Table 2 are appropriate, and generally much less expensive than the multi-purpose products listed in Table 1. These fumigants are all liquids which can be applied with relatively simple pump or gravity-flow regulators, making them economically feasible and often desirable for even the very small market garden operation.

NON-FUMIGANT NEMATICIDES. Although several "granular" or "contact" insecticide-nematicides have registration which include nematode control for tomatoes in Florida, they are generally inferior to fumigants for control of root-knot and reniform nematodes, which are the key nematode pests in most control programs. However, foliar application of Vydate L on a regular schedule of 2-4 pts/acre in at least 100 gal. of water/acre, at 1-2 week intervals, seems to suppress nematode activity in tomatoes. This may provide a reasonable means to prevent significant nematode damage to a second crop planted on plastic-mulched beds without disturbing the beds for fumigation.

SUGGESTED HERBICIDES FOR TOMATOES

W. M. Stall, Vegetable Crops Department

NOTE: Herbicides must be applied at exactly the correct rate and time to selectively control weed growth in a vegetable crop. Obtain consistent results by reading the herbicide label and other information about the proper application and timing of each herbicide. To avoid confusion between commercial formulations, suggested rates listed in this guide are stated as pounds active ingredient per acre (lbs. ai./acre) unless otherwise indicated. Apply lower rates for sandy and rockland soils with low organic matter and clay contents. Not all labeled herbicides are suggested due to either a lack of Florida data, or due to data indicating a degree of crop injury when applied under Florida conditions. When limited data is available the materials are suggested for use on a trial basis. Read each herbicide label for specific weeds controlled.

TOMATOES Bed Culture Without Mulch

Herbicide	Labelled crops	Time of application to crop	Rate (lbs. ai./acre)	
			Mineral	Muck
Paraquat	Tomatoes	Preemergence or pre-transplanting	0.5 to 1.0	-

Controls emerged weeds. Use a non-ionic spreader and thoroughly wet weed foliage.

Diphenamid (Enide)	Tomatoes	Preemergence or posttransplanting	3.0 to 4.0	-
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Controls germinating annuals. Apply to moist soil 1 week before or within 4 weeks after transplanting crops. For tomato, incorporate higher rate 0.5 to 2 inches. Note label precautions of replanting non-registered crops with 6 months.

TOMATOES
Bed Culture Without Mulch (CONTINUED)

Herbicide	Labelled crops	Time of application to crop	Rate (lbs. ai./acre)	
			Mineral	Muck
Napropamide (Devrinol)	Tomatoes (direct seeded & transplanted)	Preplant incorpor- ated	1.0	-
			to 2.0	

Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 1 - 2 inches. Incorporate same day as applied.

Tomato	Surface treatment	2.0	-
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A special Local Needs 24(c) Label for Florida only. Apply as a surface application to bed tops after bedding and after seeding or transplanting. Rainfall and/or overhead irrigation sufficient to wet soil 1 inch depth should follow treatment within 24 hours.

DCPA (Dacthal)	Established tomatoes	Posttransplanting after establishment	6.0 to 8.0	-
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Controls germinating annuals. Apply to weed-free soil 4 to 6 weeks after transplanting when crop is established and growing rapidly. Note label precautions of replanting non-registered crops within 8 months.

Trifluralin (Treflan)	Tomatoes (except Dade County)	Pretransplant incorporated	0.75 to 1.0	-
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Controls germinating annuals, especially grasses. Incorporate 4 inches or less within 8 hours. Results in Florida are erratic on soils with low organic matter and clay contents. Note label precautions of planting non-registered crops within 5 months.

TOMATOES
Bed Culture Without Mulch (CONTINUED)

Herbicide	Labelled crops	Time of application to crop	Rate (lbs. ai./acre)	
			Mineral	Muck
Pebulate (Tillam)	Tomatoes	Pre- or post- transplant incorporated	4.0	-

Controls germinating annuals and suppresses nutsedge. Incorporate 2 to 3 inches immediately, either before transplanting or in weed-free row middles.

Metribuzin (Sencor only)	Tomatoes	Pretransplant incorporated	0.25 to 0.5	-
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Use on a trial basis to control germinating weeds. Incorporate 2 to 4 inches. May be tank mixed with trifluralin.

Metribuzin (Sencor, Lexone)	Tomatoes	Postemergence posttransplanting after establishment	0.25 to 0.5	-
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Controls small emerged weeds after tomato transplants begin to grow. Apply in single or multiple applications with a minimum of 14 days between treatments & a maximum of 1.0 lb. ai./acre within a crop season. Avoid application for 3 days following cool, wet or cloudy weather to reduce possible crop injury.

	Postemergence or posttransplant as directed spray	0.5 to 1.0	-
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Use on a trial basis to control persistent weeds in tomato field after 5 to 6 true leaf stage or transplants begin to grow. Note all other precautions listed above.

TOMATOES
Full-Bed Plastic Mulch

Herbicide	Labelled crops	Time of application to crop	Rate (lbs. ai./acre)	
			Mineral	Muck
DCPA (Dacthal)	Established tomatoes	Postplanting row	6.0	-
		middles after crop	to	
		establishment	8.0	

Controls germinating annuals. Apply to moist soil in row middles after crop establishment. Note label precautions of replanting non-registered crops within 8 months.

Diphenamid (Enide)	Tomatoes	Pretransplant	3.0	-
		incorporated	to	
			4.0	

Controls germinating annuals. Apply as a directed band over plant holes after "plug" planting. Apply to moist soil in row middles soon after mulch is secured. Use lower rate for peppers. Note label precautions of replanting non-registered crops within 6 months.

Napropamide (Devrinol)	Tomatoes	Preplant incorporate,	1.0	-
		or surface applica-	to	
		tion	2.0	

		Surface application		
		to row middles between		
		plastic beds	2.0	

Controls germinating annuals. Apply to bed tops after bedding but before plastic application. Applications between beds should be irrigated. Surface applications are Special Needs 24(c) Labels for Florida only.

Chloramben (Amiben)	Tomatoes	Preplant to bed	3.0	-
		shoulders or post-		
		planting in row		
		middles		

A Special Local Needs 24(c) Label for Florida Only. Controls germinating annuals. Apply once per crop season while forming bed shoulders or after existing weeds in row middles are removed.

TOMATOES
Full-Bed Plastic Mulch (CONTINUED)

Herbicide	Labelled crops	Time of application to crop	Rate (lbs. ai./acre)	
			Mineral	Muck
Paraquat	Tomatoes	Postplanting directed spray in row middles	0.5	-

Controls emerged weeds. Direct spray over emerged weeds 1 to 6 inches tall in row middles between mulched beds. Use a non-toxic spreader. Do not apply more than 3 times per crop season.

Metribuzin (Sencor, Lexone)	Tomatoes	Directed spray in row middles	0.25 to 1.0	-
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Controls germinating annuals. Apply in single or multiple applications with a minimum of 14 days between treatments and a maximum of 1.0 lb. ai./acre within crop season. Avoid applications for 3 days following cool, wet or cloudy weather to reduce possible crop injury.

Estimated Effectiveness of Herbicides on Common Weeds in Florida Tomatoes

	Preplant Incorporated		Preemergence					Postemergence
	Pebulate (Tillam)	Trifluralin (Treflan)	Chloramben (Amiben)	DCPA (Dacthal)	Diphenamid (Enide)	Metribuzin (Lexone, Sencere)	Napropamide (Devrinol)	Paraquat
<u>Broadleaf weed</u>								
Cocklebur	No	No	No	No	No	Yes	No	Burn down
Sicklepod (coffee weed)	No	No	No	No	No	Yes	No	of all
Florida beggarweed	No	No	Yes	No	No	Yes	No	listed
Florida pusley	Yes	Yes	Yes	Yes	Yes	Yes	Yes	weeds -
Lambs quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	shielded
Morningglories	No	No	No	No	No	Yes	No	spray
Nightshade	No	No	Yes	No	No	No	No	in middles
Pigweed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	to emerged
Purslane	Yes	Yes	Yes	Yes	Yes	Yes	Yes	weeds -
Ragweed	Yes	No	Yes	No	No	Yes	No	<u>No residual</u>
Southern sida	Yes	No	No	No	No	Yes	No	<u>herbicidal</u>
Yerba de tago (Eclipta alba)	No	No	No	No	No	Yes	Yes	<u>activity</u>
<u>Rorippa terres</u>	No	No	No	Yes	No	Yes	Yes	
<u>Grass weed</u>								
Crabgrass	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Goosegrass	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Signalgrass	Yes	No	Yes	No	No	Yes	No	
Texas panicum	No	Yes	No	No	No	No	No	

