# TMV 26, A NEW LINE OF GREENHOUSE TOMATO--A COMPARISON TO TROPIC AND VENDOR CULTIVARS AS TO PRODUCTION AND QUALITY AND A COMPARISON TO TROPIC CULTIVAR AS TO TOBACCO MOSAIC VIRUS RESISTANCE

By

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# CHAPTER I

## INTRODUCTION

The tomato is the leading greenhouse vegetable grown in the United States and continues to gain in importance. In recent years there has been a shift as to areas in which production is increasing. Some reasons for this may be lower fuel costs, more favorable environmental conditions, and population increase. Oklahoma has benefited from this trend as more people are becoming involved in growing greenhouse tomatoes.

Problems associated with greenhouse tomato production have not necessarily increased, but because more people are involved in tomato production there has been increased interest in controlling the problems. Many people involved are inexperienced growers who never had previous experience with greenhouse production.

A grower using ground bed or soil culture methods faces many problems such as soil-borne diseases and, in some instances, poor soil, poor drainage, and accumulation of salts (1) (4) (5) (10) (21) (23).

This has led to the introduction of the ring and trough culture methods in the United States. It has been used for many years on the Island of Guernsey and has now been adapted for use here. This method of production is a modified hydroponic system using a lightweight artificial mix as the growing medium (10) (11).

Another problem that frequently occurs with greenhouse tomatoes is Tobacco Mosaic Virus (TMV). Since its discovery in the late 1800's it has been found to be a highly infectious and virulent disease (9). The symptoms are: leaves that are narrower and smaller than normal, yellow-green mottling on the leaves and stems, irregular leaf surface, and slightly stunted plants. TMV also tends to reduce the yield of the infected plants. The virus is so infectious and easily transmitted that if it comes in contact with hands, pruning tools, flats, or other objects that come in contact with plants, it will spread throughout the greenhouse.

TMV is resistant to drying, the dilution end-point is 1:1,000,000, but it can be inactivated by 10 minutes exposure to 90° C. Such characteristics and lack of a satisfactory vericide have made control difficult, but preventive measures are helpful. Prevention can take the form of soil sterilization and strict sanitation or the use of resistant cultivar (3) (8) (14) (18) (19) (22) (24) (26).

It is resistant cultivars that seem to be the most promising for controlling the virus. In the early 1960's, Dr. Howard Cordner, a plant breeder for Oklahoma State University, began screening several lines of tomatoes for TMV resistance and at the time of his death had several promising lines. In looking for this resistance he also maintained other desirable greenhouse tomato characteristics such as early maturity, high yield, and acceptable fruit quality. Preliminary screening by the Oklahoma State University Plant Pathology Department indicated several lines to have potential in exhibiting TMV resistance with one line, TMV 26, being superior to the others. TMV 26 also possessed the previously mentioned desirable characteristics for greenhouse tomatoes.

The objectives of this study were:

1. To compare TMV 26 with two widely grown greenhouse tomato cultivars in Oklahoma--"Tropic" and "Vendor"--in ground bed and ring culture as to total yield and marketable fruit.
2. To compare TMV 26 with "Tropic" and "Vendor" as to taste appeal and consumer acceptability.
3. To compare TMV 26 with "Tropic" relative to resistance to three strains of Tobacco Mosaic Virus.

# CHAPTER II

# LITERATURE REVIEW

## Production Factors

John E. Larson (16) found in his work at Texas A & M that for greenhouse tomatoes to produce at their maximum level they must have a rooting medium that meets several requirements:

1. have the proper balance of nutrients required by the plants,
2. the nutrients should be in solution or in a form readily available for uptake by the roots,
3. pH (acidity) should be in the range favorable for root growth,
4. no ions, elements, compounds, or organisms present in amounts toxic to plants or to cause interference with the uptake of water or essential nutrients,
5. sufficient moisture readily available to supply the needs of the plant at all times,
6. temperature should be in the range of 65 to 75 degrees Fahrenheit with 60 minimum and 80 maximum which is considered favorable for nutrient uptake and root growth of most plants,
7. concentration of salts in solution should range from about 400 to 1300 ppm for production of high quality fruit.

Dallyn and Sheldrake (10) (11), in their work with ring culture, have shown that with this method soil sterilization is not necessary

and soil-borne diseases are controlled. They also found that rings tend to warm-up faster than ground beds.

Boodley (4), in working with soilless mixes, stressed uniformity of the rooting medium was one of the biggest advantages that he has found.

Adamson and Maas (1) discovered that by using soilless mixes, they were able to raise commercial yield levels from approximately 8.5 kg/sqm of greenhouse space to 13.5 kg/sqm or more for the spring crop of tomatoes.

Verwer (23), Brooks (5), and Stoner (21) have all done research with artificial media and have found that water can become a limiting factor and nutrient imbalance can occur if care is not taken.

## Tobacco Mosaic Virus Resistance

Samuel (17), in work with TMV in 1934, made a diagram of the movement of the virus in the tomato plant. It showed TMV to be systemic in action and that it first appeared in the younger leaves.

Capoor (7) has also done work in the area of virus movement and has found the point of inoculation influences both direction and rate of TMV movement.

Cohen, Goodchild, and Wildman (9), in inoculating TMV into Nicotiana tabacum, found an increase in concentration of TMV in the plant two days after inoculation and it continued to increase throughout the 30-day period of observation.

Dawson (12), in contrasting the effects of resistant and susceptible tomato plants on TMV multiplication, showed a marked difference between the two. The susceptible plants increased in TMV concentration and virus particle number rapidly to a maximum at about 14 days after

inoculation. The resistant plants had no detectable virus in non-inoculated leaves until five weeks after inoculation.

Brown and Sinclair (6) worked on how TMV infection affected the yields of tomato plants. They found most of the inoculated plants had a marked decrease in yield.

Much research with TMV has occurred on time of inoculation and effect on yields. Heuberger and Moyer (15), as early as 1931, showed that early inoculations caused the greatest reduction in yields. Alexander (2) and Weber (25) who have conducted yield experiments in recent years, concur with Heuberger and Moyer's (15) earlier findings.

# CHAPTER III

## METHODS AND MATERIALS

### Production Factors

"Tropic", "Vendor", and TMV 26* tomatoes were grown in both ground and ring and trough culture. The ground bed was a sandy loam soil well supplied with organic matter. Rows of five plants each were spaced approximately 61.0 cm apart in the rows and 45.6 cm apart between the rows. The varieties were placed in a complete randomized block design. The plants were watered with a trickle irrigation system using viaflow tubes.

The spacing and randomization of the plants grown in the ring and trough culture were basically the same as that of the ground culture method. The rings used were 29.21 cm tall and 27.94 cm in diameter and were made of 2.54 cm (1 inch) poultry wire and the sides lined with black plastic. These were placed 61.0 cm apart, center to center, in troughs, also lined with plastic, that were 15.24 cm high, 40.64 cm wide, 3.9 m long and spaced 45.6 cm apart in the greenhouse. The soil-less growing medium used to fill the troughs and the rings was the Cornell Peat-Lite Mix:

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*TMV 26 is a greenhouse tomato line developed by Oklahoma State University and has promise of resistance to TMV.

| | 1 cubic yard |
|---|---|
| Shredded Sphagnum Peat | 11 bushels |
| Vermiculite | 11 bushels |
| Agricultural Limestone | 5 pounds |
| Superphosphate (0-20-0) | 2 pounds |
| 10-20-10 Fertilizer | 6 pounds |
| Borax (11% B or Borateem) | 10 grams |
| Iron, Chelated | 25 grams |

This part of the study was conducted in a 32' x 50' fiberglass covered greenhouse of the Oklahoma State University Greenhouse Range. The house was equipped with steam heat, a space heater and convection tube, an evaporative cooling system, and two exhaust fans for ventilation.

A soil test, using the spurway method, was taken weekly from both the ground bed and rings to determine the fertility requirements. When nitrogen was below the 5.25 ppm level the plants were fertilized with 750 ppm N, $P_2O_5$, and $K_2O$ supplied by a soluble 20-20-20 fertilizer. A soluble trace element fertilizer was added every fourth application.

All the tomato plants were tied with string from supporting wires, and pruned to a single stem. Pollination was done with a vibrating tomato pollinator daily between the hours of 10:00 a.m. and 2:00 p.m.

The fruit was harvested twice weekly. Total yield and total marketable yield were recorded for each cultivar and each method of culture.

Three tasting panels were conducted during the harvest period. Each variety and cultural method was identified by a number in order to attempt to eliminate bias. The panel rated the fruit on external appearance, flavor and quality. This was done by asking the panel to complete a questionnaire. A copy of the questionnaire is included in the Appendix.

The six tomatoes used in the panels were "Tropic", "Vendor", and TMV 26 from the ground bed, and "Tropic", "Vendor", and TMV 26 from the rings. Care was taken in selection to try to insure uniform ripeness among all the tomato samples. The panels were conducted on April 14, April 21, and May 12.

## Tobacco Mosaic Virus Resistance

Three different sources of strains of TMV were obtained, one from a commercial greenhouse in Kansas, one from a commercial greenhouse in Tulsa, Oklahoma, and one from the O.S.U. greenhouse. These were indexed on Nicotiana glutinosa plants on which the virus produces local lesions (necrosis or death of plant tissue in a localized area) to confirm the presence of TMV (20). They were then used to inoculate nine "Vendor" tomato plants, three of each source, to increase inoculum of the different strains. "Tropic" was the cultivar used to compare to the TMV 26 line as to TMV resistance because it is the leading greenhouse tomato in Oklahoma.

The experiment was set up in four phases: Kansas source of the virus with 20 "Tropic" and 20 TMV 26 plants, O.S.U. source of the virus with 20 "Tropic" and 20 TMV 26 plants, Tulsa source of the virus with 20 "Tropic" and 20 TMV 26 plants; and a control unit with five "Tropic" and five TMV 26 plants. Each set of 20 plants was arranged in four replications of five plants each. After inoculation, each group of 40 plants was placed in the same random order, thus resulting in three groups, one of each virus source, set up in the same random order.

The tomato plants used in this screening were six weeks old at the time of inoculation. They were grown in gallon containers using the

aforementioned Cornell Peat-Lite Mix (see page 7). The 20-20-20 fertilizer (750 ppm) was applied at two- to three-week intervals before and after inoculation so that nutrient deficiencies would not hinder the inoculation results. Before being inoculated with the virus, the tomato plants were indexed on N. glutinosa to confirm freedom from the virus. Inoculations were made on the dates shown in Table I.

TABLE I

DATES OF INOCULATION

| Treatment | Kansas Strain | Tulsa Strain | O.S.U. Strain | Control |
|---|---|---|---|---|
| Inoculation of Tomato Plants | April 5 | May 10 | May 10 | May 12 |
| Indexing on N. glutinosa | May 3 | June 7 | June 7 | June 9 |
| Check of the Indexing | May 6 | June 10 | June 10 | June 12 |

The material for inoculation consisted of 25 grams fresh weight of leaves of the infected tomato plant, which was allowed to dry, 25 ml of distilled water was added to the dried material and ground with a mortar and a pestle. The inoculation procedure began by dusting the plant with 600 grit carborundum powder to abrase the leaf surface when rubbed with inoculum to allow for ready entry of the virus (13). The liquid from the ground tissue was then applied to the second or third youngest set of leaves with a cottonswab. This was done for all three sources of TMV.

The control plants were also abrased with carborundum, but were inoculated with distilled water.

The plants were grown for four weeks after which one leaf was taken from each inoculated plant. These were taken from non-inoculated younger sets of leaves. Each leaf was then ground separately and indexed on a virus-free leaf of N. glutinosa, tags were used to identify the different leaves. Care was taken in inoculating the tobacco leaves so that excess bruising of the leaf tissue would not mask the lesions. After 72 hours the indexing was checked and the number of local lesions that were present were recorded.

# CHAPTER IV

## RESULTS AND DISCUSSION

### Production Factors

Yield data were recorded on total yield and total marketable fruit for all three cultivars in both ground and ring cultures. Harvest began on November 11, 1976, and ended on January 18, 1977, which consisted of 20 pickings and enough data to establish a pattern.

The data were analyzed using the analysis of variance to determine significant difference in yields between cultural methods and cultivars. Table II shows that with marketable pounds of tomatoes there was a significant difference between treatments by variety. Table II indicates that "Tropic", in both ring and ground cultures, had more marketable pounds than TMV 26 and "Vendor". TMV 26 in both ring and ground culture had more marketable pounds than "Vendor". Two cultivars, "Tropic" and "Vendor", grown in the ring culture produced more marketable fruit than the ground culture (Table II). The data on marketable number of fruits of tomatoes show a significant difference between the ring and ground method of cultures. The ring culture produced more marketable fruit than the ground beds.

Tables III and IV show the total pounds of tomatoes produced was significantly different between treatments and also between cultivars. When grown in the ring culture all cultivars produced more pounds of

TABLE II

MEAN WEIGHT AND NUMBER OF "TROPIC", "VENDOR", AND TMV 26 TOMATOES GROWN IN GROUND BEDS AND RING AND TROUGH CULTURE

| Treatment by Cultivar | Total Fruit per 1.58 sqm | Total Pounds per 1.58 sqm | Marketable Fruit per 1.58 sqm | Marketable Pounds per 1.58 sqm | Tomato Plants per 1.58 sqm |
|---|---|---|---|---|---|
| Ground Beds Tropic | 6.11 | 3.40 | 5.02 | 2.72 | 5.0 |
| Ring Beds Tropic | 8.21 | 3.77 | 7.23 | 3.44 | 5.4 |
| Ground Beds TMV 26 | 7.80 | 2.91 | 5.63 | 2.27 | 5.0 |
| Ring Beds TMV 26 | 8.94 | 2.87 | 6.19 | 2.23 | 6.0 |
| Ground Beds Vendor | 8.84 | 2.86 | 5.93 | 2.14 | 4.8 |
| Ring Beds Vendor | 12.55 | 3.37 | 6.67 | 2.18 | 6.0 |

TABLE III

ANALYSIS OF VARIANCE OF TOMATO FRUITS PRODUCED IN GROUND BEDS AND RING AND TROUGH CULTURE, EXCLUSIVE OF CULTIVAR

| Source of Variation | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Treatment-- Total Fruit | 1 | 805.0417 | 805.0417* | 26.205 |
| Treatment-- Total Pounds | 1 | 11.7040 | 11.7040** | 10.3353 |
| Treatment-- Marketable Fruit | 1 | 205.3350 | 205.3350** | 14.3324 |
| Treatment-- Marketable Pounds | 1 | 8.6689 | 8.6689 | 6.0567 |
| Treatment-- Plants per 1.58 sqm | 1 | 112.6667 | 112.6667* | 26.0 |

*Indicates significance at .01 level of probability or higher.

**Indicates significance at .05 level of probability or higher.

TABLE IV

ANALYSIS OF VARIANCE OF "TROPIC", "VENDOR", AND TMV 26 TOMATOES PRODUCED, EXCLUSIVE OF CULTURAL METHOD USED

| Source of Variation | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Cultivar-- Total Fruit | 2 | 1291.0633 | 645.5317** | 34.0882 |
| Cultivar-- Total Pounds | 2 | 50.0756 | 25.0378* | 12.0540 |
| Cultivar-- Marketable Fruit | 2 | 15.2633 | 7.6317 | 2.0188 |
| Cultivar-- Marketable Pounds | 2 | 102.6320 | 51.3160* | 21.8855 |
| Cultivar-- Plants per 1.58 sqm | 2 | 9.33 | 4.67 | 1.40 |

*Indicates significance at .01 level of probability or higher.

**Indicates significance at .05 level of probability or higher.

fruit than the ground culture except for the "Vendor" cultivar. "Tropic", TMV 26, and "Vendor" followed the same yield pattern as they did with marketable pounds of fruit (Table II).

With total number of tomatoes produced, there was a significant difference between treatments, between cultivars, and between treatment by cultivar (Tables III, IV, and V). The ring culture production method produced more fruit than ground culture in each variety. "Vendor" grown in both the ring and the ground beds produced more fruit than TMV 26 and "Tropic" grown in the ring and ground culture (Tables VI and VII). However, it should be recognized that the "Vendor" cultivar had large quantities of marketable fruit so that its marketable yield in pounds was less than TMV 26 and "Tropic".

This study may not give a true representation of the total production capacity of the tomato plants. A good yield commercially averages 17 pounds a plant for the season, which may include two crops. This study was terminated when it was determined there was enough data to analyze and a production trend had been established.

There was no statistical analysis run on the results of the tasting panel. Table VIII shows the results achieved from the panel, with five being the highest score and zero being the lowest. The participants in the quality evaluation were asked to rank the tomatoes, if they would purchase the tomatoes, and to chose their favorite tomato and the one they disliked the most. A copy of the questionnaire is located in the Appendix.

There appears to be no consistent favorite tomato or a consistent dislikable one. This is probably due to the fact that the tomatoes were

TABLE V

ANALYSIS OF VARIANCE OF "TROPIC", "VENDOR", AND TMV 26 TOMATOES GROWN IN GROUND BEDS AND RING AND TROUGH CULTURE

| Source of Variation | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Treatment by Cultivar-- Total Fruit | 2 | 168.6433 | 84.3217** | 4.4527 |
| Treatment by Cultivar-- Total Pounds | 2 | 8.1868 | 4.0934 | 1.9707 |
| Treatment by Cultivar-- Marketable Fruit | 2 | 81.9300 | 40.9650 | 2.6589 |
| Treatment by Cultivar-- Marketable Pounds | 2 | 17.4677 | 8.7338** | 3.7249 |
| Treatment by Cultivar-- Plants per 1.58 sqm | 2 | 17.3333 | 8.67 | 2.60 |

**Indicates significance at .05 level of probability or higher.

TABLE VI

MEAN WEIGHT AND NUMBER OF TOMATO FRUITS PRODUCED IN GROUND BEDS AND RING AND TROUGH CULTURE, EXCLUSIVE OF CULTIVAR

| Treatment | Total Fruit per 1.58 sqm | Total Pounds per 1.58 sqm | Marketable Fruit per 1.58 sqm | Marketable Pounds per 1.58 sqm | Tomato Plants per 1.58 sqm |
|---|---|---|---|---|---|
| Ground Beds | 7.58 | 3.06 | 5.53 | 2.38 | 4.93 |
| Ring Beds | 9.90 | 3.34 | 6.70 | 2.62 | 5.80 |

TABLE VII

MEAN WEIGHT AND NUMBER OF "TROPIC", "VENDOR", AND TMV 26 TOMATOES PRODUCED, EXCLUSIVE OF CULTURAL METHOD USED

| Cultivar | Total Fruit per 1.58 sqm | Total Pounds per 1.58 sqm | Marketable Fruit per 1.58 sqm | Marketable Pounds per 1.58 sqm | Tomato Plants per 1.58 sqm |
|---|---|---|---|---|---|
| Tropic | 7.16 | 3.58 | 6.13 | 3.08 | 5.20 |
| TMV 26 | 8.37 | 2.89 | 5.19 | 2.25 | 5.50 |
| Vendor | 10.70 | 3.12 | 6.30 | 2.16 | 5.40 |

TABLE VIII

QUALITY EVALUATION OF "TROPIC", "VENDOR", AND TMV 26 TOMATOES
GROWN IN GROUND BEDS AND RING AND TROUGH CULTURE

| Questions | TMV Ring | TMV Ground | Tropic Ring | Tropic Ground | Vendor Ring | Vendor Ground |
|---|---|---|---|---|---|---|
| External Ripeness | | | | | | |
| 1 | 4.0 | 4.2 | 4.6 | 3.8 | 4.6 | 3.8 |
| 2 | 4.4 | 4.4 | 3.6 | 3.6 | 4.8 | 4.4 |
| 3 | 3.6 | 3.2 | 3.4 | 3.6 | 4.8 | 4.2 |
| External Firmness | | | | | | |
| 1 | 4.0 | 4.2 | 4.0 | 3.8 | 4.6 | 3.8 |
| 2 | 3.4 | 4.8 | 4.6 | 3.8 | 4.2 | 3.4 |
| 3 | 4.0 | 3.4 | 4.2 | 4.0 | 3.2 | 4.6 |
| Would You Buy on External Quality | | | | | | |
| 1 | 4-Y,1-N | 5-Y | 5-Y | 5-Y | 1-Y,4-N | 4-Y,1-N |
| 2 | 5-Y | 3-Y,2-N | 3-Y,2-N | | | |
| 3 | 5-Y | 4-Y,1-N | 3-Y,2-N | 4-Y,1-N | 5-Y | 5-Y |
| Internal Firmness | | | | | | |
| 1 | 4.8 | 4.6 | 3.4 | 4.0 | 3.0 | 4.2 |
| 2 | 4.0 | 3.0 | 3.4 | 3.6 | 4.6 | 4.2 |
| 3 | 3.4 | 2.6 | 3.4 | 4.6 | 4.6 | 4.6 |
| Internal Meatiness | | | | | | |
| 1 | 4.8 | 3.6 | 3.6 | 3.2 | 2.6 | 4.8 |
| 2 | 3.4 | 3.0 | 4.8 | 4.4 | 3.8 | 4.0 |
| 3 | 3.6 | 3.4 | 3.4 | 4.4 | 4.2 | 4.2 |

TABLE VIII (Continued)

| Questions | TMV Ring | TMV Ground | Tropic Ring | Tropic Ground | Vendor Ring | Vendor Ground |
|---|---|---|---|---|---|---|
| Taste and Texture Firmness | | | | | | |
| 1 | 3.2 | 2.6 | 3.8 | 3.8 | 1.8 | 4.4 |
| 2 | 2.6 | 4.4 | 3.2 | 3.6 | 5.0 | 3.8 |
| 3 | 3.8 | 3.2 | 3.6 | 4.0 | 4.0 | 4.2 |
| General Flavor | | | | | | |
| 1 | B | B | B | B | C | B |
| 2 | B | A | B | B | A | A |
| 3 | B | C | B | A | C | B |
| Would You Buy on Internal Quality | | | | | | |
| 1 | 3-Y,2-N | 2-Y,3-N | 2-Y,3-N | 4-Y,1-N | 5-Y | 5-Y |
| 2 | 5-Y | 4-Y,1-N | 5-Y | 2-Y,3-N | 3-Y,2-N | 5-Y |
| 3 | 2-Y,3-N | 4-Y,1-N | 3-Y,2-N | 4-Y,1-N | 4-Y,1-N | 3-Y,2-N |
| High, Low Tomato | | | | | | |
| 1 | H-2,L-1 | H-0,L-2 | H-0,L-2 | H-2,L-0 | H-0,L-0 | H-1,L-0 |
| 2 | H-1,L-1 | H-0,L-1 | H-0,L-2 | H-0,L-0 | H-0,L-0 | H-3,L-0 |
| 3 | H-0,L-1 | H-0,L-0 | H-1,L-0 | H-0,L-4 | H-2,L-0 | H-2,L-0 |

so close in quality that the degree of ripeness was taken into consideration rather than the actual flavor of the tomatoes.

## Tobacco Mosaic Virus Resistance

The analysis of variance for variable lesions was made using a logrithm base 10 in order to have more equal variances. Analysis of variance on location (source of TMV) by variety of tomato plant indicated that no significant difference occurred in the number of lesions (Tables X and XI). Table XII, which is the analysis of variance of tomato plant variety taking each source of TMV into consideration separately, shows a significant difference at the .05 level between the lesion count of TMV 26 and "Tropic" tomato plants when inoculated with the Kansas source of TMV. As shown in Table XIII and illustrated in Figure 1, the lesion count was higher with TMV 26 tomato plants than with "Tropic" tomato plants.

These results were not consistent with preliminary trials by the Oklahoma State University Plant Pathology Department that showed TMV 26 was 63% more resistant to TMV than "Tropic". The inconsistency may be due to contamination problems and to many variables which were encountered to have a true error term. Another possible explanation for the difference in prelininary work and this trial may be attributed to different strains of TMV.

TABLE IX

LOGRITHMS AND ANTILOGRITHMS OF MEAN LESION COUNT ON *N. GLUTINOSA* IN TMV 26 AND "TROPIC" TOMATO PLANTS INOCULATED WITH KANSAS, O.S.U., AND TULSA SOURCES OF TMV

| Location by Variety | Lesions | Log Lesions (Base 10) | Antilogs |
|---|---|---|---|
| Kansas Source on TMV 26 | 2.70 | 0.4984 | 3.151 |
| Kansas Source on Tropic | 1.25 | 0.2760 | 1.888 |
| O.S.U. Source on TMV 26 | 4.20 | 0.5384 | 3.454 |
| O.S.U. Source on Tropic | 4.10 | 0.6137 | 4.109 |
| Tulsa Source on TMV 26 | 3.20 | 0.4566 | 2.861 |
| Tulsa Source on Tropic | 2.85 | 0.4929 | 3.111 |

TABLE X

ANALYSIS OF VARIANCE OF TMV 26 AND "TROPIC" TOMATO PLANTS INOCLUATED WITH KANSAS, O.S.U., AND TULSA SOURCES OF TMV

| Source | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Location by Variety | 2 | 10.3167 | 5.1583 | 0.4382 |

TABLE XI

ANALYSIS OF VARIANCE IN LOGRITHMS OF TMV 26 AND "TROPIC" TOMATO PLANTS INOCULATED WITH KANSAS, O.S.U., AND TULSA SOURCES OF TMV

| Source | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Location by Variety | 2 | 0.5235 | 0.2617 | 1.7688 |

TABLE XII

ANALYSIS OF VARIANCE IN LOGRITHMS OF MEAN LESION COUNT ON N. GLUTINOSA OF TMV 26 AND "TOPIC" TOMATO PLANTS INOCULATED WITH KANSAS, O.S.U., AND TULSA SOURCES OF TMV

| Source of Variation | df | Sum of Squares | Mean Square | F Value |
|---|---|---|---|---|
| Cultivar--Kansas | 1 | 0.4944 | 0.4944** | 7.1634 |
| Cultivar--O.S.U. | 1 | 0.5679 | 0.5679 | 0.1887 |
| Cultivar--Tulsa | 1 | 0.0131 | 0.0131 | 1.8067 |

**Indicates significance at .05 level of probability or higher.

TABLE XIII

LOGRITHMS OF MEAN LESION COUNT ON N. GLUTINOSA OF TMV 26 AND "TROPIC" TOMATO PLANTS INOCULATED WITH KANSAS, O.S.U., AND TULSA SOURCES OF TMV

| Variety | Kansas Source of TMV | O.S.U. Source of TMV | Tulsa Source of TMV |
|---|---|---|---|
| TMV 26 | 0.4984 | 0.5384 | 0.4566 |
| Tropic | 0.2760 | 0.6137 | 0.4929 |

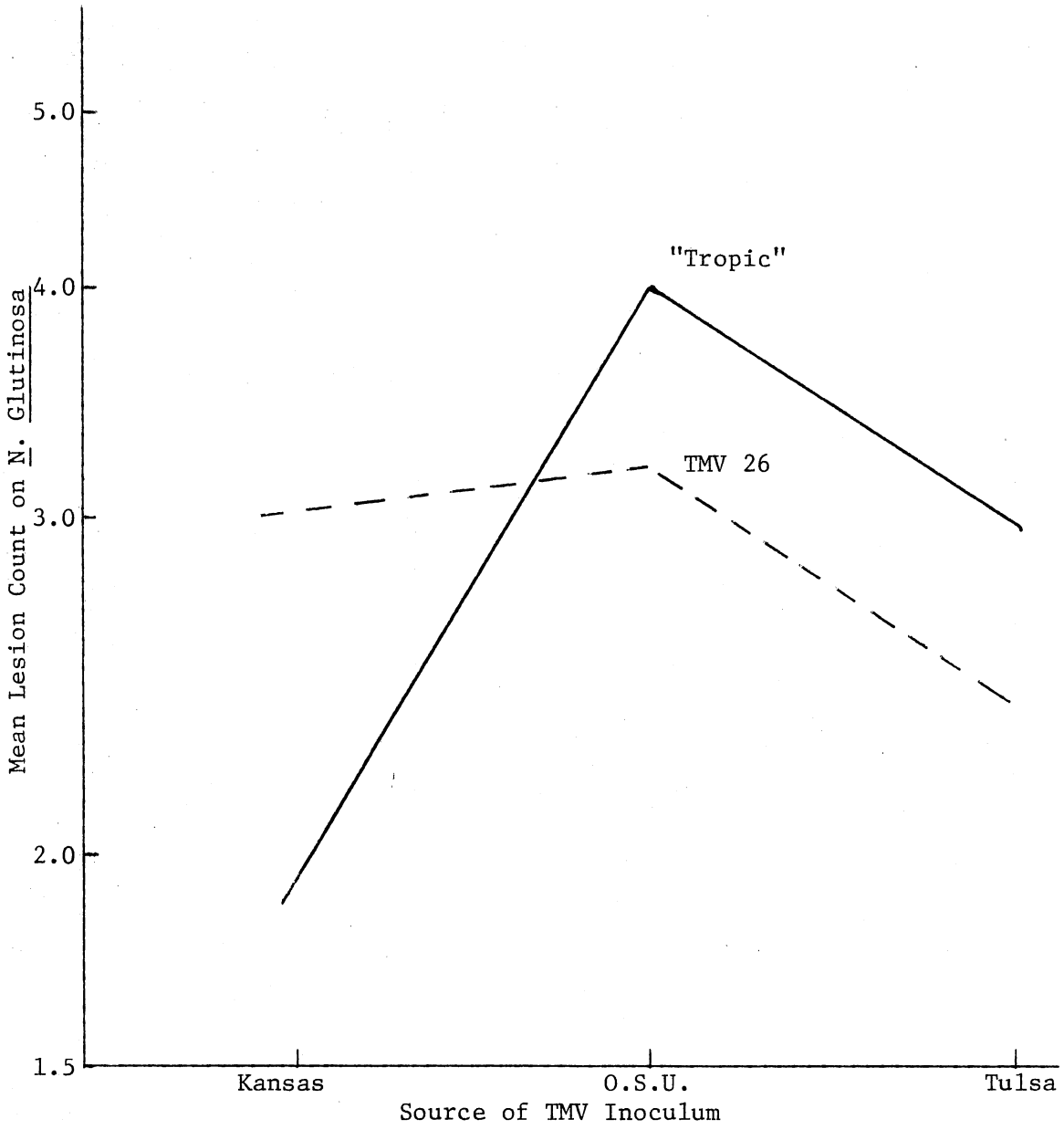


Figure 1. Interaction and Source of TMV Inoculum and Tomato Variety on the Lesion Count, Expressed in Antilogrithmic Notation

# CHAPTER V

## SUMMARY AND CONCLUSIONS

A major problem encountered by the commercial growers of greenhouse tomatoes is the control of tobacco mosaic virus. The primary control for this highly infectious disease is prevention which consists of sanitation, soil sterilization, and the use of resistant cultivars.

This study compared TMV 26, a new line of greenhouse tomato with some potential resistance, to "Tropic" and "Vendor" as to production quality. It was also compared to "Tropic" as to TMV resistance.

The yield data indicates that TMV 26 had acceptable yields both in the ring and ground culture. In marketable pounds of fruit, TMV 26 yielded less than "Tropic" but more than "Vendor". A more accurate analysis of the data may have been achieved if the plants had been somewhat randomized in the rows, rather than rows randomized in the house, and the data recorded from each plant rather than by row. The quality and consumer acceptability of TMV 26 as shown from the tasting panel indicated it to be very acceptable.

The tobacco mosaic resistance trials showed only a significant difference of local lesion count when using the Kansas source of TMV and the "Tropic" cultivar. The latter had fewer local lesions than TMV 26. Because of the contamination problems and variables involved, a valid statistical analysis was not totally achieved.

Further investigation of TMV 26 should be conducted by:

1. additional greenhouse trials to achieve more statistically accurate information,
2. field trials to determine its response to field conditions,
3. TMV resistant trials under strict sanitation to try to eliminate contamination and set-up to eliminate many of the variables and create a true error by utilizing the half leaf method of inoculating the tobacco plant, and
4. evaluate TMV resistance phenotypically as well as lesion count, also evaluate resistance under production situation.

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# APPENDIXES

You are requested to assist in a quality evaluation of tomato varieties and cultural methods. Please give careful thought and consideration before answering the items on the evaluation sheet and proceed as follows:

1. Tomatoes are numbered 1 through 6. Please rate each tomato as indicated on the evaluation sheet.
2. A knife for slicing and fork for eating is provided.
3. You may use salt on the tomato if you desire.
4. Please have a drink of water between each sample.
5. Thank you for your cooperation.

Tomato Taste and Appeal Survey

Rate on a scale of 0 to 5.

I. EXTERNAL APPEARANCES

A. RIPENESS (Even Red Color--5; Uneven With Green Spots--0)

Tomato 1 ____ Tomato 4 ____

Tomato 2 ____ Tomato 5 ____

Tomato 3 ____ Tomato 6 ____

B. FIRMNESS (Firm, No Soft Spots--5; Mushy--0)

Tomato 1 ____ Tomato 4 ____

Tomato 2 ____ Tomato 5 ____

Tomato 3 ____ Tomato 6 ____

C. WOULD YOU BUY THIS TOMATO ON VISIBLE QUALITIES ONLY?

Tomato 1 Yes No Tomato 4 Yes No

Tomato 2 Yes No Tomato 5 Yes No

Tomato 3 Yes No Tomato 6 Yes No

II. INTERNAL APPEARANCES

A. RIPENESS (Even Red Color With No Green Core--5; Uneven With Green Core--0)

Tomato 1 ____ Tomato 4 ____

Tomato 2 ____ Tomato 5 ____

Tomato 3 ____ Tomato 6 ____

B. MEATINESS (Few Seeds, Thick Walls--5; Many Seeds, Thin Walls--0)

Tomato 1 ____ Tomato 4 ____

Tomato 2 ____ Tomato 5 ____

Tomato 3 ____ Tomato 6 ____

III. TASTE AND TEXTURE

A. FIRMNESS (Firm--5; Mealy, Grainy--0)

Tomato 1 ____ Tomato 4 ____

Tomato 2 ____ Tomato 5 ____

Tomato 3 ____ Tomato 6 ____

B. GENERAL FLAVOR: EXCELLENT GOOD FAIR POOR

| | | | | |
|---|---|---|---|---|
| Tomato 1 | ____ | ____ | ____ | ____ |
| Tomato 2 | ____ | ____ | ____ | ____ |
| Tomato 3 | ____ | ____ | ____ | ____ |
| Tomato 4 | ____ | ____ | ____ | ____ |
| Tomato 5 | ____ | ____ | ____ | ____ |
| Tomato 6 | ____ | ____ | ____ | ____ |

C. WOULD YOU PURCHASE THIS TOMATO ON TASTE QUALITY ONLY?

| | | | | | |
|---|---|---|---|---|---|
| Tomato 1 | Yes | No | Tomato 4 | Yes | No |
| Tomato 2 | Yes | No | Tomato 5 | Yes | No |
| Tomato 3 | Yes | No | Tomato 6 | Yes | No |

IN CONSIDERING ALL FACTORS WHICH TOMATO WOULD YOU RATE HIGHEST? LOWEST?

1 2 3 4 5 6

ANY OTHER COMMENTS?

VITA[2]

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Master of Science

Thesis: TMV 26, A NEW LINE OF GREENHOUSE TOMATO--A COMPARISON TO TROPIC AND VENDOR CULTIVARS AS TO PRODUCTION AND QUALITY AND A COMPARISON TO TROPIC CULTIVAR AS TO TOBACCO MOSAIC VIRUS RESISTANCE

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