CHAPTER-III
MATERIALS AND METHODS

The experimental investigation based on “Seasonal incidence, yield losses and bio- efficacy of insecticides against major sucking pests infesting tomato” was carried out at the instructional farm, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat during Kharif 2016 under field condition. The detail of the materials used and method employed for different aspects of study are described here under.

3.1 Seasonal incidence of sucking pests of tomato

The population study of sucking pests was carried out on tomato variety JT-3 during kharif 2016. The crop was sown at Instructional Farm in a plot size of 9.0 m × 9.0 m at the spacing of 60 cm × 45 cm. All other agronomical practices was followed as per the scientific recommendations. The crop under the experiment was kept free from the insecticides throughout the season. The whole plots divided into 5 equal quadrates and from each 5 plants were selected randomly and tagged in each quadrate collectively total 25 plants were observed at weekly interval on standard weather week basis up to the maturity of crop.

3.1.1 Method of recording observations

Population of sucking pests was recorded from the tagged 5 plants at weekly interval from appearances of the pests till harvest. The population of aphid, jassid, whitefly and thrips was recorded early in the morning at weekly interval. Three leaves from top, bottom and lower portion of each plant was observed for the presence of nymphs and adults of aphid, jassids, whiteflies and thrips.

3.1.2 Weather parameter

Abiotic factors viz., maximum and minimum temperatures, morning and evening relative humidity, total rainfall, bright sunshine hours, wind velocity and evaporation rate were collected from the meteorological observatory, JAU, Junagadh. The data on pest population and different abiotic factors were worked out with correlation methods.

3.1.3 Effect of biotic and abiotic factors on population fluctuations of sucking pest of tomato

The weekly weather parameters were obtained from meteorological observatory of Central Experimental Research Station, Junagadh Agricultural
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University, Junagadh. With a view to study the effect of weather parameters on the population fluctuation of sucking pests of tomato and correlation was worked out by the method as suggested by Panse and Sukhatme (1985).

$$r_{X_1Y_1} = \frac{\sum X_1Y_1 - \frac{(\sum X_1)(\sum Y_1)}{n}}{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n}\right)\left(\sum Y_1^2 - \frac{(\sum Y_1)^2}{n}\right)}$$

Where,

- $r_{X_1Y_1}$ = simple correlation coefficient
- $X_1$ = various weather parameter
- $Y_1$ = weekly insect-pest population
- $n$ = number of observation

3.2 Estimation of yield losses

3.2.1 Details of the treatments

Both the treated and untreated plots were divided into 10 quadrate of size 1.2 m×1.8 m. two strips (Treatments) each of 9.0 m×9.0 m was prepared.

Unprotected (plot): The crop was kept free from insecticides and subjected to the natural occurrence of the sucking pests on tomato.

Protected (plot): The crop was protected against the sucking pests damaged through application of effective insecticides.

3.2.2 Observations to be recorded

1. Yield of treated plot kg/quadrate (1.2 m×1.8 m)
2. Yield of untreated plot kg/quadrate (1.2 m×1.8 m)

Yield of tomato from protected and unprotected plots were recorded from each quadrate at harvest and then analyzed statistically. The yield increased in protected plot over the unprotected (control) and avoidable loss was worked out from final yield of tomato using the formula mentioned below given by Pradhan (1969).

$$\text{Yield increased over control (}) = \frac{T-C}{C} \times 100$$

$$\text{Avoidable yield loss (loss}) = \frac{T-C}{T} \times 100$$

Where,

- $T$ = Yield from treated (protected) plots (kg/ha)
- $C$ = Yield from untreated (control) plots (kg/ha)
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3.3 Bio-efficacy of insecticides

3.3.1 Treatment details

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Technical name</th>
<th>Concentration (%)</th>
<th>Dose/10 litre of water</th>
<th>Manufacture name</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Imidaclorpid 30.5 SC</td>
<td>0.005%</td>
<td>1.6 ml</td>
<td>Bayer Crop Science Ltd.</td>
</tr>
<tr>
<td>T2</td>
<td>Spinosad 45 SC</td>
<td>0.009%</td>
<td>2 ml</td>
<td>Dow agro sciences Ltd.</td>
</tr>
<tr>
<td>T3</td>
<td>Acetamiprid 20 SP</td>
<td>0.008%</td>
<td>4 g</td>
<td>Rallis India Ltd.</td>
</tr>
<tr>
<td>T4</td>
<td>Clothianidin 50 WDG</td>
<td>0.025%</td>
<td>5 g</td>
<td>Sumitomo Chemical Pvt. Ltd.</td>
</tr>
<tr>
<td>T5</td>
<td>Thiacloprid 24 SC</td>
<td>0.024%</td>
<td>10 ml</td>
<td>Bayer Crop Science Ltd.</td>
</tr>
<tr>
<td>T6</td>
<td>Dinofuran 20 SG</td>
<td>0.01%</td>
<td>5 g</td>
<td>PI Industries Ltd.</td>
</tr>
<tr>
<td>T7</td>
<td>Difenthiuron 50 WP</td>
<td>0.05%</td>
<td>10 g</td>
<td>Syngenta India Ltd.</td>
</tr>
<tr>
<td>T8</td>
<td>Flonicamid 50 WG</td>
<td>0.015%</td>
<td>3 g</td>
<td>United Phosphorus Ltd.</td>
</tr>
<tr>
<td>T9</td>
<td>Dimethoate 30 EC</td>
<td>0.03%</td>
<td>10 ml</td>
<td>Rallis India Ltd.</td>
</tr>
<tr>
<td>T10</td>
<td>Control (No Spray)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

3.3.2 Application of treatments

All the recommended agronomical practices were followed. All the insecticides were applied in the form of foliar spray with the help of knapsack sprayer. For deciding the quantity of spray fluid required per plot, the control plot was sprayed with water and the required spray fluids were determined. Spray fluid was prepared by mixing measured quantity of water and insecticide. Care was also taken to rinse the sprayer thoroughly before and after each spray with soap water to avoid contamination from treatment to treatment. First spray was given at appearance of pest. Second and third spray was done at 15 days after first spray.

3.3.3 Method of recording observations

All the recommended practice was adopted for raising the crop. Observations on pest population was recorded from 5 randomly selected plants before 24 hours and after 2, 5 and 10 days of spraying from three leaves were selected representing top, middle and bottom regions of each plant. The per cent reduction in pest population over control was calculated by using following formula.

\[
\text{Per cent reduction in population} = \frac{X_1 - X_2}{X_1} \times 100
\]

Where,

\(X_1\) = population in control plots
\(X_2\) = population in treated plots
3.4 Yield and economics

With a view to evaluate the effect of different pesticides on the tomato yield, the tomato crop was harvested from each net plot. The harvested yield were weighed and converted on hectare basis. Economics of all treatments will be worked out by considering the price of products’ cost of insecticides and labor charges. CBR will be worked out to compare the economics of different insecticidal treatments. The percent increased yield over control will be also calculated by using following formula (Pradhan, 1969).

\[
\text{Yield increased over control (\%)} = \frac{T - C}{C} \times 100
\]

Where,

\(T=\) Yield of respective treatment (kg /ha)
\(C=\) Yield of control (kg/ha)

3.5 Statistical analysis

Statistical analysis of data was carried out as per the analysis of variance technique given by Panse and Sukhatme (1985).