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Management of Leaf Curl Disease of Tomato

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Abstract: Soil treatment with Furadan at the rate of 33.5 kg ha^{-1}, seedling treatments with skimmed milk (1:10 dilution of powder), foliar application of kitchen ash (sufficient to cover the foliage), Malathion and Metasystox at the rate of 0.02% and 0.03% respectively when applied in Tomato cv. Ruma VF, significantly reduced the insect vector population causing leaf curl disease. Malathion gave the best performance among the treatments in controlling disease incidence and severity. Metasystox and Furadan followed in order. The skimmed milk and kitchen ash also were effective.

Key words: Leaf curl disease, tomato, vector, soil treatment and foliar spray.

Introduction

Tomato leaf curl disease is one of the most commonly occurring viral diseases affecting tomatoes throughout Bangladesh. It is a destructive viral disease that appears at any growth stage of the plant affecting yield of crop. The loss due to leaf curl amounts up to 93.3% when the crop is infected at an early stage (Sastry and Singh, 1979). The incidence and severity of tomato leaf curl disease is considered to be directly related with the availability and abundance of its insect vector and susceptibility of the host (Verma *et al.*, 1989). The environmental factors viz. temperature, relative humidity, light etc. have direct impact on white fly abundance in the field. When the plants are infected, within 20 days of transplanting, the loss may be up to 92% while infections in 35 and 50 days old crops result in 74 and 29% loss respectively (Sastry and Singh, 1973).

Tomato leaf curl virus is transmitted by white fly *Bemisia tabaci* (Singh, 1989). The effective control measure with the combination of cultural practices, biological and chemical is of great importance in many terms of economic production. Management of viral tomato diseases through Integrated Disease Management (IDM) procedure has extra importance because of the fact that curative treatments of viral diseases is in most of the cases very difficult, if not impossible because of the special pathogenic nature of virus. With view to the above background, the present piece in work was under taken to achieve reduction in disease incidence and severity through controlling vector and to locate the most effective but economic means for it.

Materials and Methods

The experiment was conducted during October to March 1999 at the field laboratory of the Department of Genetics and Plant Breeding, Bangladesh Agricultural University (BAU). The experimental plot was well prepared into good tilth by ploughing and cross ploughing followed by laddering and recommended dose of manure and fertilizer was applied. The experiment was laid out in a randomized complete block design. The experimental field was first divided into three blocks, then each block was again divided into six plots, each of 5.0 sqm in size. Healthy looking tomato cv. Roma-VF seedlings of 30 days age were used in this study. There were six treatments comprising control, Skimmed milk with 10% dilution, Kitchen ash, Metasystox 25 EC @ 0.03%, Malathion 57 EC @ 0.02% and Furadan 5 G @ 33.5 kg ha^{-1}.

Furadan 5G was applied during the period of final land preparation at the rate of 33.5 kg ha^{-1}. The seedlings were treated with 10% skimmed milk solution before transplanting. Malathion 57 EC and Metasystox 25 EC were sprayed 30 days after transplantation at the rate of 2 ml/L (i.e. 0.2%) and 3ml/L (i.e. 0.3%). Sieved Kitchen Ash was applied to the seedlings 30 days after transplantation by manual spreading on the foliage and thereafter at 7 days interval until flowering stage was reached. Plants were randomly selected from each plot and each treatment for collection of data. Data on the following parameters were recorded: Insect population per plant, percentage symptom bearing leaves, shoots, fruits per plant, wt. of fruits per plant and yield per plot (Kg ha^{-1}).

For identification of viruses, electron micrographs were taken from Danish Govt. Institute of Seed Pathology for Developing Countries (DGISP), Copenhagen, Denmark and virus particles were identified according to CMI descriptions of plant virus. The comparisons among the individual treatments were presented by Duncun's New Multiple Range Test (DMRT).

Results and Discussion

At 30 days after planting (DAP) the highest number of insect populations were recorded from the plots where the plants did not receive any treatments. The lowest number of insect population was found in the plots where the plants were treated with skimmed milk. Near about similar results were found from the plants where the plots were treated with Furadan 5G @33.5 kg ha^{-1} (Table 1).

Table 1: Effect of pesticidal treatments in the field insect population per plant at different growth stages of plants

Treatments	Mean insect population/plant at		
	30 DAP	45 DAP**	60 DAP**
Control	1.81b	2.14a	2.67a
Skimmed milk 10% dilution	0.44b*	1.22c	2.11b
Kitchen ash as required	2.63a	2.00a	2.00b
Metasystox 25 EC @ 0.03%	2.67a	1.92ab	1.22bc
Malathion 57 EC @ 0.02%	2.78a	1.78ab	0.89c
Furadan 5G @ 33.5 Kg ha^{-1}	0.56a*	1.44bc	1.56bc
L.S.D.		0.4711	0.8851
Sx	0.1494	0.1065	0.1975

DAP = Days After Planting
* = Treatment given ** = All treatments given

At 45 DAP all the plants had all their respective treatments. At this stage the vector population in the control plots was increased by 27.97% in respect to 30 DAP. Increase in vector population was also recorded in the plots where the plants were treated with skimmed milk, Malathion 57 EC and Furadan 5G. Among the different treatments at 45 DAP significantly highest number (2.14) of vectors per plant was

Table 2: Effect of treatments against leaf curl disease of tomato on different growth stages of plant

Treatments	Percentage of symptom bearing leaves per plant	Percentage of symptom bearing shoots per plant	Percentage of symptom bearing plants per plot		
			90 DAP flowering	120 DAP fruiting	Percentage of Infected fruits
Control	55.52a	52.18a	44.45a	69.45a	37.67a
Skimmed milk 10% dilution	29.72c	22.87c	22.22bc	36.11bc	19.40c
Kitchen ash as required	35.43b	33.75b	30.55b	47.22b	24.43d
Metasystox 25 EC @ 0.03%	16.52c	13.17c	13.89cd	22.22dc	9.77c
Malathion 57 EC @ 0.02%	11.26f	9.22f	8.33d	13.90c	6.30f
Furadan 5G @ 33.5 Kg ha^{-1}	20.37d	17.36d	13.29cd	27.78cd	14.33d
L.S.D.	0.8224	2.56	11.81	13.06	1.832
Sx	0.1835	0.5727	2.636	2.913	0.4087

DAP = Days After Planting

Table 3: Effect of treatments against tomato leaf curl disease on different yield parameters of tomato

Treatments	Number of fruits per plant	Fruits diameter (cm)	Individual fruit weight (g)	Weight of fruits per plant (kg)	Yield per plot (kg)	Percentage of yield increase over control
Control	21.80c	3.18d	36.38e	0.79d	9.48d	
Skimmed milk 10% dilution	26.92b	4.43bc	45.47c	1.22bc	14.64bc	54.43
Kitchen ash as required	25.44bc	4.03c	41.18d	1.05cd	12.60cd	32.19
Metasystox 25 EC @ 0.03%	27.64ab	4.55ab	47.32c	1.48ab	17.76ab	87.34
Malathion 57 EC @ 0.02%	31.26a	4.90a	56.25a	1.56a	18.82a	97.47
Furadan 5G @ 33.5 Kg ha^{-1}	25.67ab	4.80ab	53.38ab	1.37ab	16.44ab	73.42
L.S.D.	5.28	0.46	2.52	0.28	3.46	2.41
Sx	1.18	0.11	0.56	0.06	0.77	0.54

Means followed by the same letter(s) in each column are not statistically different at 50 % level of significance by DMRT.

counted in the control plot which was followed by the plots treated with Kitchen ash , Metasystox 25 EC and Malathion 57 EC respectively. These effects were of close ranks statistically. Significantly the lowest number (1.22) of insects per plant was observed in the plots treated with skimmed milk, which was followed by the plots treated with Furadan (Table 1).

At 60 DAP the vector population per plant was decreased in the plots where the plants grown in the plots spraying with Metasystox 25 EC @ 0.03% and Malathion 57 EC @ 0.02%. The population remained the same and in all other treatments the insect vector population more or less increased. The vector population was highest in number (3.67) in the control plot (Table 1). The findings agree with the report that the incidence of tomato leaf curl virus transmitted by *Bemisia tabaci* was minimized by initial root dip of seedlings (cv. Pusa ruby) in 0.1% carbofural solution for 1 hr. followed by 2 foliar sprays of Agricultural spray oil first at 20 days after transplanting and the 2nd at 10 days after that (Singh, 1989). Significantly highest percentages of symptom bearing leaves and shoots per plant were recorded from the control plots. The plants grown in the plots spraying with Malathion 57 EC @ 0.02% produced the lowest percentage of symptom bearing leaves and shoots. The other treatments were given comparatively lower number of symptom bearing leaves and shoot.

Different treatments produced a highly significant variation in the percentage of symptom bearing plants per plot. At the flowering stage (90 DAP), significantly highest percentage of symptom bearing plants grown in the control plots having 44.45% (Table 2). Significantly lower number of symptom bearing plants was recorded from the plots where the plants were treated with skimmed and spraying with kitchen ash. The lowest number of symptom bearing plants were recorded in the plots with Malathion 57 EC spray (Table 2).

At fruiting stage (i.e. at 120 DAP) significantly highest percentage of symptom bearing plants were produced in the control plots where the significantly lowest number of symptom bearing plants grown in the plots sprayed with Malathion 57 EC @ 0.02%. The other treatments differed significantly from one another (Table 2).

A prominent significant variation was found in the percentage of abnormal fruits per plant among different treatments. The highest percentage of infected fruits per plant was found in the plants grown in control plot. The plants grown in the plots sprayed with Malathion 57 EC @ 0.02% produced the lowest percentage (6.30%) of abnormal fruits. (Table 2). All other treatments gave comparatively lower number of infected fruits compared with control.

The plants grown in the control plots produced lowest number of fruits and gave lowest fruit wt. and yield where the highest number of fruits and fruit yield was recorded from the plants grown in the plots being sprayed with Malathion 57 EC @ 0.02% (Table 3). The plants grown in the plots spraying with Malathion 57 EC @ 0.02% produced 97.47 % increase in yield over the control (Table 3).

In this experiment disease incidence was found to be directly related with whitefly population. There are plenty of confirmed reports that the causal virus is transmitted by whitefly (*Bemisia tabaci*) (Makkoub, 1978; Makkoub *et al.*, 1979; Dhanju and Verma, 1987; Cohen *et al.*, 1988; Mansour and Al-Musa, 1992; Brown, 1994; Ramirez and Maxwell, 1995). For reduction of insect population per plant, Malathion was the best followed by Metasystox and Furadan. Singh *et al.* (1995) observed that the alternate spray of insecticides and oil were the most effective treatments tested for reducing the vector (*Bemisia tabaci*) and incidence of the virus. The kitchen ash treatment did show effect on reducing insect population per plant. Singh (1985) suggested that for controlling, the whitefly (*Bemisia tabaci*) of cowpeas, dimethoate and phosphamidion were very effective as foliar spray, while carbofuran and phonate was highly effective granular application at planting. The skimmed milk treatment of seedlings also has shown significant effect reducing the insect population per plant. The effect of skimmed milk treatment, was highly significant, though not as much as the insecticides, in reducing disease intensity and severity. Ash treatment though was at bottom of the list among the treatments was found to be effective in reducing insect population per plant. Sastry and Singh (1973) observed that foliar sprays with Dimethoate (0.05%), Methylparathion (0.02%) and Oxydemetomethyl (0.02%) and Phorate 10G (15 kg ha^{-1}) at the time of planting not only reduced the population of whitefly but also resulted in less spread of leaf curl virus.

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