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PJBS

ISSN 1028-8880

# Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (2): 146-148, 2001


# Impact of Seed Treatment with Systemic Insecticides on Cotton Leaf Curl Disease

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**Abstract:** Field studies were conducted to assess the effect of seed dressing systemic insecticides on cotton leaf curl disease (CLCuD) and their impact on yield components. Spread of disease and severity was comparatively lower in treated plots than untreated control. Plants grew more vigorously in imidacloprid followed by thiamethoxam treatments. Seed treatment with imidacloprid proved to be the best. Average number of bolls per plant were 16 in imidacloprid treated plots followed by 12 in thiamethoxam treated plot and 10 in non-treated control. Other yield components were also more in treated plots than untreated control. The yield was estimated to be 80% more in imidacloprid treated plot and 18% in thiamethoxam treated plot over control.

**Key words:** Cotton leaf curl Disease (CLCuD), CLCuV, seed treatment, whitefly, systemic insecticides

## Introduction

Cotton leaf curl disease (CLCuD) was first recognized as a major problem for cotton production in 1991 in cotton growing areas of the Punjab province of Pakistan. The disease epidemics have been causing severe yield losses in the cotton-growing areas of Punjab, Pakistan since then. Losses can exceed 80% in a severely infected field. Recent evidence shows the affected area is expanding. The disease has now spread in Sindh province [Southwest of Punjab) and across the border into Indian Punjab and Rajastan, providing evidence that the affected area has been expanding. The probable cause of the disease is at least two whitefly transmitted gemini viruses collectively named as cotton leaf curl virus (CLCuV) and a nanovirus like DNA molecule that is encapcidated in geminiviral particle (Mansoor *et al.,* 1993; 1999; Nadeem *et el.,* 1997). Cotton is a major export crop and source of foreign exchange for Pakistan, the impact of the disease on the economy has been serious. One of the most important virus control strategies is the use of the resistant varieties developed by the Central Cotton Research Institute (CCRI), Multan, and other breeders of Punjab. Although recently introduced CIM and some other varieties show resistance to the disease, the old variety CIM-240 is still liked by the farmers due to its high yield and better fibre characteristics. This variety is susceptible to leaf curl disease especially in case of early infections. In present study we have explored the possibility of using systemic seed dressing insecticides to manage *Bemisie tabaci* (vector of the disease) early in the season in order to minimise the losses due to leaf curl disease in susceptible cotton cultivars.

## Materials and Methods

The experiment was conducted at Central Cotton Research Institute, Multan, experimental farm. The field for the trial was selected in an area where there was a history of high disease incidence in previous years. Treatments were arranged in a complete randomized block design. Treatments included two seed dressing insecticides and a non-treated control. Thiamethoxam (Actara, MIS Novartis Ltd.) at 3 gm/kg and imidacloprid (Confidor, M/S Buyer Ltd.) at 10 gm/kg were used for seed treatment of acid delinted cottonseed of commercial cotton variety CIM-240. Each plot consisted of four rows of 13 m long with a row to row distance of 0.75 m. An alley of 1.5 m was maintained between two plots. Treatment plots were thinned to approximately 40 plants per row. Treatments were replicated three times.

Weekly data on incidence and height of the plants were recorded. Whitefly populations per sq. inch of yellow sticky traps were recorded weekly from each replication. Data on yield components were recorded at the end of season. Five consecutive plants were selected from each replication to record data on yield components. A total of fifteen plants were selected from each treatment for recording number of bolls and boll weight.

## Results

**Disease incidence and whtteity Populations:** Seed treatment with Imidacloprid had less incidence of the disease till the end of July as compared with other treatments (Fig. 1, Table 1). The incidence was very low during early days of the growth and an abrupt increase was noticed from second to fourth week of July. Maximum level of the disease was recorded during the month of August in all the treatments. The height of the plants in Imidacloprid treated plots was more as compared with Thiamethoxam and control. Effect of systemic insecticide [seed treatments) on CLCuD and height of the plant 45 and 60 days after planting are given in Fig. 1 and 2.

After 45 days of planting the Imidacloprid treated plants had 7 to 8% less disease incidence and 1 3cm more height as compare to control (Fig. 3). The same difference was recorded upto sixty days after planting in case of incidence with less severity in Imidacloprid treated plot. The height of plants continuously increased in Imidacloprid treated plot after 60 days of planting (Fig. 3, Table 2).

The Whiteflies were observed in the field throughout the season with the range of 1.13 to 15.80 per sq. inch per night in all treatments. Maximum population of whiteflies was noted during the first week of June and end of September. There were no significant differences in whitefly populations between treatments (Table 1).

**Plant height:** The average plant height was 64.8 cm and 53.6 cm during first week of August in the plots treated with imidacloprid and thiamethoxam respectively as compared to 36.8 cm in non-treated control. Plant growth

Table 1: Number of whiteflies per sq. inch of Trap per 24 hours and Weather Conditions during cotton season

| Observations | | Whitefly population per sq. in per 24 hours | | | | Rain fall | Temp. °C | |
|---|---|---|---|---|---|---|---|---|
| | Dates | Control | Imidacloprid | Thiamethoxam | Average | (mm) | Max. | Min. |
| June | I | 10.2 | 10.4 | 9.8 | 10.13 | 3.4 | 41.2 | 28.8 |
| | II | 6.8 | 7.0 | 6.8 | 6.87 | 18.0 | 25.4 | 16.0 |
| | III | 8.0 | 9.0 | 8.8 | 8.80 | - | 42.8 | 28.4 |
| | IV | 7.5 | 7.4 | 7.4 | 7.43 | - | 42.5 | 31.0 |
| July | I | 6.4 | 6.4 | 6.2 | 6.33 | - | 39.0 | 31.0 |
| | II | 1.7 | 1.7 | 1.6 | 1.67 | 31.5 | 38.6 | 30.2 |
| | III | 4.0 | 4.2 | 4.1 | 4.10 | - | 37.5 | 29.3 |
| | IV | 2.8 | 2.4 | 2.2 | 2.40 | - | 38.8 | 20.5 |
| Aug | I | 1.1 | 1.2 | 1.1 | 1.13 | - | 38.3 | 30.3 |
| | II | 1.3 | 1.3 | 1.2 | 1.27 | - | 37.9 | 27.8 |
| | III | 4.0 | 4.0 | 3.9 | 3.97 | - | 39.7 | *28.8* |
| | IV | 4.7 | 4.8 | 4.7 | 4.73 | 22.5 | 35,9 | 27.5 |
| Sep | I | 7.9 | 8.0 | 7.7 | 7.87 | - | 35.2 | 27.1 |
| | II | 10.5 | 10.6 | 9.9 | 10.32 | - | 35.4 | 27.1 |
| | III | 15.4 | 16.3 | 15.7 | 15.80 | 1.8 | 31.6 | 25.5 |
| | IV | 8.1 | 8.1 | 7.5 | 7.90 | - | 35.2 | 24.9 |

Table *2:* Incidence of CLCuD and Height in Different seed treatments

| Observations | Dates | Cotton Leaf Curl Virus (%) | | | Height of the Plant (Cm) | | |
|---|---|---|---|---|---|---|---|
| | | Control | Imidacloprid | Thiamethoxam | Control | Imidacloprid | Thiamethoxam |
| June | I | - | - | - | 04.9 | 05.3 | 05.4 |
| | II | - | - | - | 09.0 | 10.5 | 10.4 |
| | III | - | - | - | 10.0 | 18.4 | 18.8 |
| | IV | 01.74 | 01.13 | 01.38 | 15.0 | 25.0 | 25.3 |
| July | I | 03.10 | 03.47 | 04.54 | 19.3 | 29.7 | 31.2 |
| | II | 28.27 | 20.88 | 27.42 | 26.3 | 39.5 | 38.8 |
| | III | 70.54 | 49.67 | 74.42 | 29.5 | 48.5 | 43.0 |
| | IV | 96.61 | 87.93 | 96.77 | 36.1 | 60.9 | 52.9 |
| Aug | I | 98.53 | 94.55 | 98.45 | 37.1 | 64.8 | 53.6 |
| | II | 99.61 | 98.01 | 99.48 | 48.1 | 73.8 | 59.5 |
| | III | 100.00 | 98.83 | 100.00 | 52.8 | 78.8 | 63.6 |
| | IV | 100.00 | 98.83 | 100.00 | 62.8 | 86.1 | 71.9 |
| Sep | I | | | | 66.2 | 91.5 | 75.8 |
| | II | | | | 66.8 | 92.3 | 80.3 |
| | III | | | | 71.0 | 93.9 | 82.2 |
| | IV | | | | 77.7 | 95.1 | 84.7 |

was observed as more vigorous in treated plots as compared with non-treated control (Fig. 3).

**Yield:** Average numbers of bolls per plant are given Table 3. Final height, average number of bolls per plant and average boll weight was highest in imidacloprid treated plot followed by thiamethoxam in which the final plant height was 84.4 cm, average number of bolls per plant were 12.1 and average boll weight was 2.8 gms. In both the seed treatments all the yield components were higher than the control treatment (Table 3).

Table 3: Effect of Seed treatments on Yield Components

| Observations | Treatment | | |
|---|---|---|---|
| | Thiamethoxam | Imidacloprid | Control |
| Final Height (cm) | 84.4 | 96.3 | 77.7 |
| Average No. of Bolls/Plant | 12.1 | 16.3 | 10.4 |
| Average Boll Weight (Gms) | 2.8 | 3.1 | 2.7 |
| Average Yield/ Plant (Gms) | 33.88 | 50.53 | 28.08 |
| Percent Increase over control | 18 | 80 | |

## Discussion

Early infection of cotton leaf curl disease suppresses the growth of cotton plants and subsequently the yield. The results show that the plants treated with insecticides grew more vigorously than non-treated ones. It has been observed that in general insecticide application to crops is not an effective means to control insect-transmitted plant viruses. Recently with the development of highly active new systemic insecticides, the probability of controlling some plant virus diseases is changing particularly those caused by viruses that are transmitted in a circulative manner. There has been a success in controlling barley yellow dwarf luteovirus (BYDV) by using imidacloprid in Australia and BCTV in California USA (McKirdy and Jones, 1996; Wang *et al*., 1999). Infectious agent of CLCuD is also transmitted in a persistent manner by whitefly (*Etemisia tabaci*). Although we did not notice any differences amongst whitefly populations between treated and non-treated control, the progress of disease was slower in treated plots than that on non-treated plot. It was observed that in first 45 days the CLCuD incidence progress was slower in some treated plots. This probably was due to the affect of insecticide on the whitefly

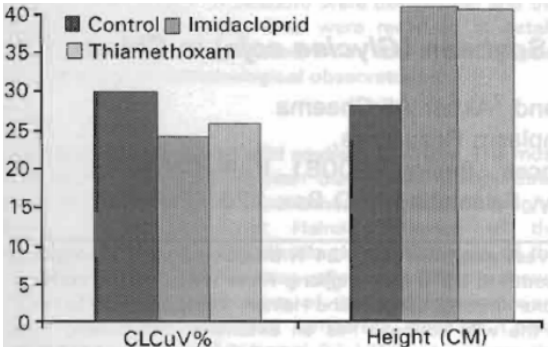


Fig. 1: Effect of seed treatment in CLCuV incidence and paint height after 45 days of planting

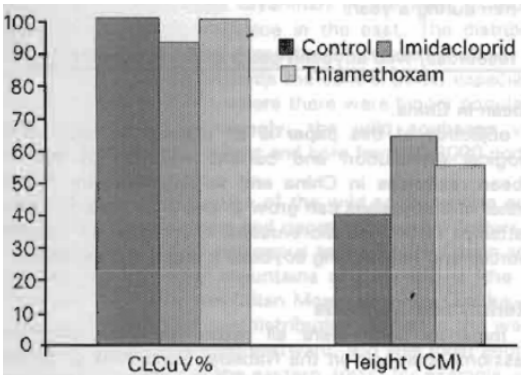


Fig. 2: Effect of seed treatment in CLCuV and height after 60 days of planting

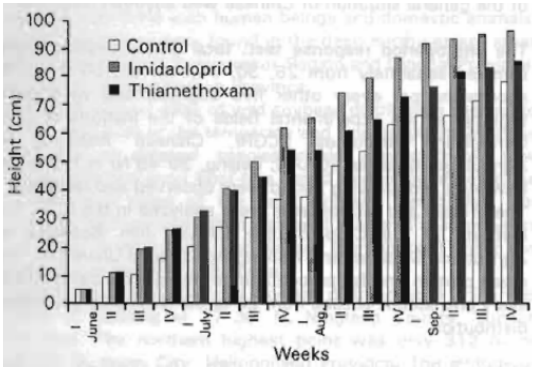


Fig. 3: Growth of cotton planting in different seed treatments during whole experiment

(*Bemisia tabaci*) the vector of the disease. Later on the disease progress was almost the same in all the treatments. It was also observed that severity of the disease was lesser on the plants treated with insecticides than on non-treated plants. This may be due to late infection and better growth of the plants in treated plots. There may be two factors that contributed in yield increase i.e. growth enhancing ability of the insecticide and slower spread of infection within treated plots. We suggest that further detailed studies may be carried out to see the impact of systemic insecticides on CLCuD and its vector *Bemisia tabaci.*

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