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Exclusion Techniques for the Control of Okra (*Abelmoschus esculentus*) Leaf Curl Virus Disease in Sudan

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Abstract: **Okra Leaf Curl Virus (OLV) disease is considered the most important disease of Okra in the Sudan. Two field experiments were conducted in Shambat (Northern Khartoum - Sudan) for the control of this disease by the exclusion of Whitefly (*Bemisia tabaci*) Vector. In one experiment the okra. Seedlings were covered with the mosquito nets for 40 days before transplanting and in the other experiment the okra seedlings were drenched with the systemic Actara insecticide (25% WG) for seven weeks after transplanting at weekly intervals. The covered technique resulted in 50% OLCV disease incidence while the drenching trial resulted in 55% disease incidence. The control (untreated) resulted in 75% disease incidence. Similarly the disease severity was higher than that obtained from the untreated control. The yield of previously covered and drenched treatments resulted in 6.53 tan/ha and 5.89 ton/ha respectively. The control treatment resulted in 3.56 tan/ha. Moreover, good quality okra pods were obtained from the treated treatments. The results of the present work are considered the first record for controlling OLCV disease in okra in the Sudan.**

Keywords: **Leaf Curl; Okra Control; Vector Exclusion; Virus Disease.**

I. INTRODUCTION

Okra (*Abelmoschus exulentus* L. (Moench) commonly called bamia, bindi or ladies fingers, is an important vegetable crop cultivated all over the Sudan. Its pods are cooked either green or in a dry powder form Okra fruits are highly nutritious providing good source of vitamins A+C. Okra in the Sudan is produced for local consumption or for transport to the middle east countries. Several factors such as hot weather, insect infestation and disease infection contribute to the low yield and quality of okra in the Sudan. Okra Leaf Curl Virus (OLCV) disease is considered the most important disease. Kirkpatrich (1931) was the first to demonstrate the transmission of OLCV by the Whitefly (*Bemisia tabaci* L. gene). Yassin and Nour (1965) and Yassin and Abu Salih (1972) considered the disease as the most important virus disease of okra in the Sudan. The leaf curling is either upward or down ward (Figure 1), and that the vein thickening is more pronounced on the underside of the leaves. The control of OLCV disease by insecticide spraying is not desirable because of the associated hazards as okra pods are mostly consumed fresh. Hence the present studies were intended to control OLCV disease through the exclusion of the whitefly vector by covering the okra seedlings with fine mosquito nets six weeks prior to transplanting or by drenching the seedlings with the systemic insecticide (Actara 25 W.G) for seven or left untreated as control.

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Figure 1: Infected and healthy leaves of okra

II. MATERIALS AND METHODS

Field trials were carried out in the experimental farm of the faculty of Agriculture, University of Khartoum, Sudan to study the effect of covering the okra seedlings with fine mosquito nets and to exclude the whitefly Vectors for six weeks. In the other trial the okra seedlings (at 2 to 3 leaf stage) 3 plants per hole with the systemic insecticide Actara 25 wg (water soluble) at the rate of 50 ml per hole at weekly internals for seven weeks. The control okra seedlings were left uncovered and untreated with the insecticide. All the treatments received regular watering, hand weeding and two doses of urea fertilizer (46% N) three weeks from sowing and at flower ling. Seven weeks from sowing the covered okra seedlings were removed.

The OLCV disease incidence was carried out at two weeks intervals till the end of the season.

The experimental units were arranged in a completely randomized design (CRD) with four replicates. The recorded data were expressed as percentage of disease incidence following the procedure described by Snedicore and Cochran (1967). The record on OLCV disease severity on the okra plants was also carried out at two weeks intervals and the data were expressed as scale of diseased severity following the procedure described by Snedicore and Cochran (1967). The harvesting of pods started two months from sowing at weekly intervals until the end of fruiting and expressed as ton/unit area (ton/ha).

III. RESULTS

The symptoms of OLCV disease first appeared in the control (untreated) okra plants 56 days from sowing. Infected leaves are smaller than healthy leaves showing leaf curling upwards or downwards with pronounced vein thickening in the underside of leaves (Figure 1). As shown in Figure 2 the higher mean of disease incidence was recorded from the control (untreated) plants 90 days after sowing. The least disease incidence (50%) was recorded from the previously covered plants and the Actara drenched plants (55%). There was no statistically significant difference between the diseases incidences recorded from the covered and/or drenched plants than the incidence recorded from the control (untreated) plants as shown in Figure 2. The results of disease severity recorded 90 days after transplanting are shown in Figure 3. Both the covered and Actara drenched okra plants and the lowest pod yield was recorded from the control okra plant (Figure 4). Moreover, healthy and good pods were obtained from the covered plants (Figure 5) while small pods were obtained from the untreated (control) okra plants.

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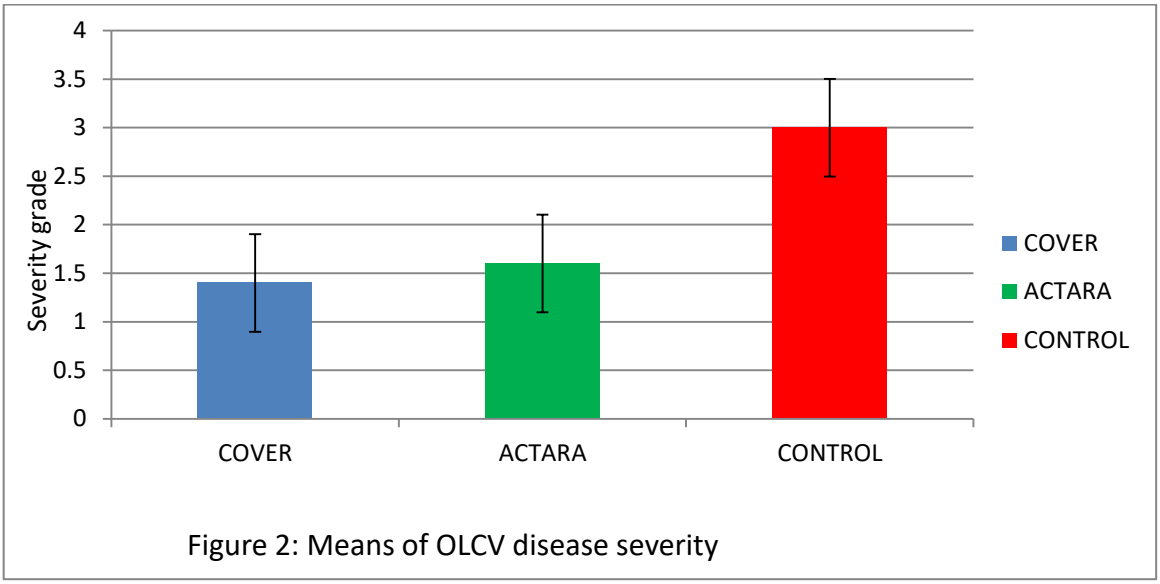

Figure 2: Means of OLCV disease severity

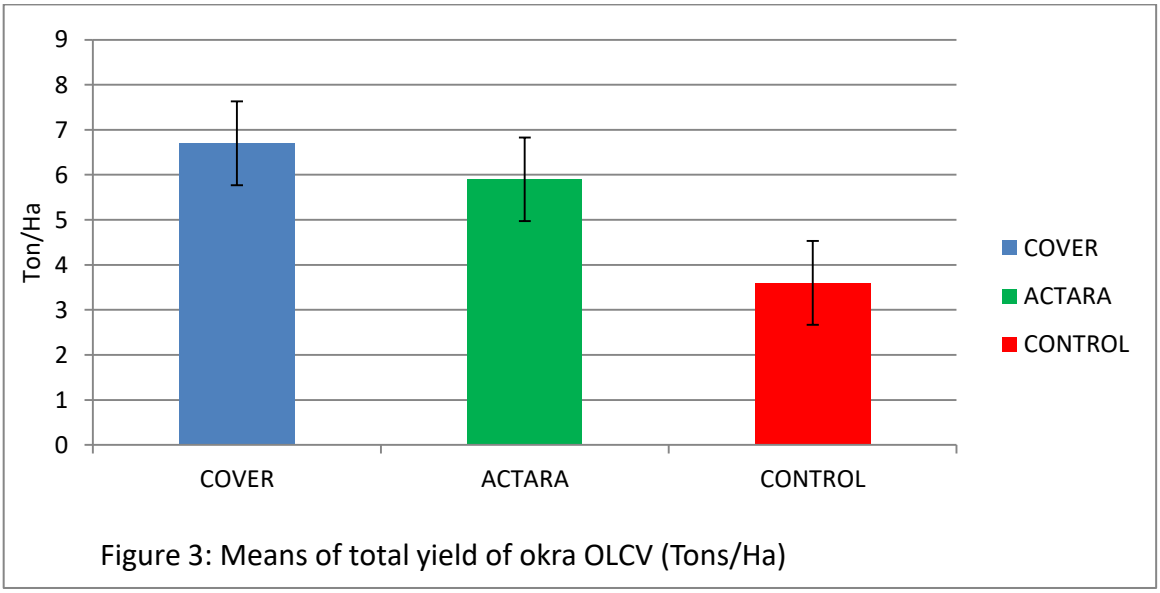

Figure 3: Means of total yield of okra OLCV (Tons/Ha)

Figure 4: Healthy pods producing by previuosly covered okra

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Figure 5: Infected pods produced from untreated okra

IV. DISCUSSION

The results of the present study have shown that covering the newly growing okra seedlings with fine mosquito nets or drenching them with the systemic insecticide Actara decreased the incidence and severity of the okra leaf curl virus disease and increased the yield of okra. Ahmed et al. (2014) reported similar results when they applied the same technique for the control of tomato leaf curl virus disease. Similar results were obtained on okra for the control of okra leaf curl virus disease (Amine, 2014). Also Cohen and Antigenu (1994) reported that growing okra seedlings in an insect-proof greenhouse and maintaining good control of whiteflies resulted in significant decrease in OLCV disease. Similar to the present results Polston and Anderson (1997) reported that using OLCV disease-free transplants was important in delaying and reducing the disease incidence. In the present study drenching the okra seedlings with the systemic insecticide Actara before transplanting gave similar results. Hence these results give the okra farmers the chance of using alternative methods to the control of OLCV. The present results also showed that the infection of the covered okra plants occurred late after removal of the cover, hence resulted in significant high yield as reported by Loannau and Lordanu (1985) who reported that the late infected OLCV is correlated with high yield and indicated that yield losses due to OLCV disease vary between 50%-82% depending on the time of infection. Atiri (1950) concluded that OLCV infection at flowering has little effect on the yield of okra plants. It is recommended that the okra growers should adopt the present techniques to reduce the okra OLCV disease infection and to increase the yield and quality of okra pods.

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