

STUDIES ON THE CONTROL OF SOIL-INHABITING PESTS ATTACKING SUGARCANE PLANTS BY TENEKIL IN COMPARISON WITH STANDARD PESTICIDES

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Plant pathogenic nematodes and subterranean termites severely damage sugarcane plants (*Saccharum* Spp.) in Sindh region of Pakistan resulting in a tremendous decline in yield of ripe crops. An indigenous pesticide Tenekil (Polychlorinated hydrocarbon), developed and formulated at PCSIR Laboratories, which has been successfully applied for the control of nematodes and termites both at the same time in comparison with Chlordane and Dieldrin. Sugarcane plants treated with 2.5% Tenekil at sowing stage and its further application after three months were found to be effective against nematodes and subterranean termites for a period of 10 months, till harvesting of ripe crops, resulted two fold increase in yield significantly. Whereas on comparison, sugarcane plants treated with 2.5% chlordane and 2.5% dieldrin separately with the same technique, remained unattacked by termites for 10 months. On the other hand heavy infestation of nematodes was noticed after six months causing poor plant growth and a remarkable decline in yield.

Key words: Nematodes, Termites, Sugarcane, Tenekil.

Introduction

Plant pathogenic nematodes and subterranean termites are common soil-inhabiting pests of sugarcane (*Saccharum* spp.) in Pakistan. Infestation of nematodes in sugarcane roots causes poor plant growth, nutrient deficiency and root disorders resulting considerable decline in yield of sugarcane crops every year [1]. Termites devour eye buds of sugarcane at sowing stage and the attack prolongs upto two months causing failure of germination. Infestation can be detected by discoloration of dried leaves [2,3]. According to our survey conducted in Nov.-Dec. 1989 for the evaluation of soil-inhabiting pests of sugarcane plants grown in Sindh region of Pakistan, revealed that heavy infestation of the most dominant termite species *Microtermes obesi* (Holmgren), *Coptotermes heimi* (Wasmann) and *Cryptotermes karachiensis* (n. spp.) interacting with nematode species *Helicotylenchus dihystra* (Cobb), *Hoplolaimus galeatus* (Cobb), and *Pratylenchus zaei* (Graham) resulted a severe decline in yield in terms of millions of rupees annually.

Ethylene dibromide and methyle bromide have been in practice for eradicating and controlling of nematodes population for the last many decades [1]. As early as 1969, modern nematicides like Furadon, Nemagon and Temik were introduced, but none of them have so far been most effective means used for successfully reducing nematodes population to very low levels for getting profitable yields of sugarcane. They don't completely eliminate plant nematodes from soil, but reduce population considerably resulting in better yields of crops [4,5].

Earlier in 1945, methods regarding the control of termites in sugarcane plants were practiced with copper sulphate,

sodium arsenate and paris green, and they have been gradually replaced by chlorinated hydrocarbons such as DDT, BHC, chlordane, heptachlor and dieldrin [6]. However, none of them proved to be effective for controlling both nematodes and termites jointly at the same time.

To our knowledge, no studies have ever been carried out yet to determine the dual action of an indigenous pesticide for the control of nematodes and termites, and our studies appear to indicate for the first time controlling both of them with tenekil [7] an indigenous pesticide developed at PCSIR Laboratories Complex, Karachi.

Materials and Methods

After preliminary investigations for controlling nematodes and termites by tenekil under laboratory conditions, further studies were undertaken in order to evaluate its efficacy against the soil inhabiting-pests attacking sugarcane plants in different ecological conditions in comparison with standard pesticides.

A plot of land measuring 72 sq. meters was selected in the Applied Biology and Marine Resources Research Centre's Experimental Farm of PCSIR Laboratories Complex, Karachi. After amending the soil with farmyard manure, 36 microplots each measuring 2 sq. meters were demarcated and tagged with iron plates. Random soil samples were taken separately from each microplot and were collected in polythene bags for the identification of pests in pretreated soil. The water emulsion of tenekil (polychlorinated hydrocarbon), dieldrin (hexachloro-epoxyoctahydro-dimethanonaphthalene), and chlordane (octachloro-hexahydro-methanoindene) were prepared at the concentrations of 0.5, 1.5 and 2.5% respectively. The sowing

setts of sugarcane measuring 3.5 x 22.5 cm were dipped in each concentration for 15 mins and dried at room temperature of 27°. The sowing setts were planted at a depth of 15 cm below the soil surface horizontally and a distance of 45 cm was maintained among them. Three replicates of micro plots were used for each treatment in a randomized block design and similarly one micro plot was allocated for control. The experimental plots were paved and watered regularly. Finally the soil of each plot was treated through irrigation with the aforesaid pesticides for the possible pests control in the soil individually after three months at the standard dosage rate of 2 lit/acre. The residual effects of pesticides depend upon the quality of soil and on different environmental ecological conditions, hence the same experiments with the same methodology were also conducted at Malir, Karachi. Soil samples were collected from each plot monthly and processed by improved Baermann's method for the post treatment of nematodes count as narrated by Winslow [8]. The technical data regarding the height and weight of plants from each plot was recorded statistically as presented in Table 1, and the significance of differences in the mean value was assessed by using L.S.D. (Least significant difference test) at 5 and 1% levels.

Results and Discussion

Periodical inspections were carried out on sugarcane experimental starting from sowing to harvest of ripe crops for a duration of 10 months. Monthly soil samples were collected for the determination and evaluation of pests population. First population peak of nematodes in association with termites was noticed in Oct. and the second one in Dec. 1989. The nematodes were further observed to be inhabiting rather eagerly in

termite galleries of the sugarcane plants upto 15 cm above the soil level. The joint infestation of nematodes and termites caused considerable loss in yield of sugarcane crops annually throughout Pakistan. The decline, however, follows severe damage induced by plant pathogenic nematodes and subterranean termites both at PCSIR's experimental farms and Malir, Karachi, and it gave the same results in either case from the comparative point of view. However, no marked ecological difference was noted in any case. It was further observed that nematodes caused roots necrosis, stunting, leaning, snapping and toppling leading to extensive loss in yield of sugarcane crop annually.

Sugarcane plants treated with 2.5% tenekil at sowing stage and a booster dose after 3 months through irrigation at the standard rate of 2/lit per acre prevented sugarcane plants against nematodes and termites for a period of 10 months till harvesting of ripe crop, resulted a significant increase in yield upto 175% i.e., 55 kg./2 sq. meters at the level of L.S.D. = .01, and the average height of plants was also enhanced doublefold i.e., 4.58 meters. Nevertheless sugarcane plants treated with dieldrin and chlordane with the same methodology and with the same concentrations remained unattacked by termites at 1% level of significance. With the result the yield of sugarcane crop increased upto 90.3% i.e., 38 kg./2 sq. meters and 75% i.e., 35 kg./2 sq. meters, and the height of plants also increased upto 3.66 meters and 3.05 meters respectively. From the comparative point of view the same doses of dieldrin and chlordane could not, however, prevented nematodes infestations after six months and it led to decrease of yield upto 30 and 36% ultimately. Moreover, poor plant growth, nutrient deficiency, root-disorder was also remarkably noticed in this case.

TABLE 1. EFFICACY OF TENEKIL AGAINST NEMATODES AND TERMITES IN COMPARISON WITH DIELDRIN AND CHLORDANE.

Treatments (%)	Plant infested/non-infested		Mean yield in kg/2 sq. meters	Average length of plants in meters	L.S.D. P=.05	L.S.D. P=.01
	Nematodes	Termites				
Tenekil						
0.5	++	+	32 (60.1)	3.05 (99.3)	—	—
1.5	+	+	43 (115.0)	3.97 (159.4)		
2.5	—	—	55 (175.0)	4.58 (199.3)	6.31	11.62
Dieldrin						
0.5	+++	+	31 (55.0)	2.54 (60.1)		
1.5	++	+	37 (85.0)	3.36 (119.6)		
2.5	++	—	38 (90.3)	3.66 (139.2)	5.28	9.72
Chlordane						
0.5	+++	++	26 (30.0)	2.75 (79.7)		
1.5	++	+	28 (40.0)	3.05 (99.3)		
2.5	++	—	35 (75.0)	3.05 (99.3)	5.82	10.79
Control	+++	+++	20	1.53		

+ = Slightly infested, ++ = Moderately infested, +++ = Heavily infested and — = Non-infested. L.S.D. = Least significant difference test. P = Probability. Figures in parentheses are percentage values.

In this connection mention must be made of this fact that untreated micro-plots used as control gave only a yield of 5% i.e., 20 kg/2 sq. meters, and the average height of control plants was recorded to be 1.53 meters.

Sowing setts treated with 0.5 and 1.5% Tenekil, Dieldrin and Chlordane were found to be infested by both with nematodes and termites after six months resulting a considerable reduction in height and a remarkable decrease in yield (Table 1). Moreover, Tenekil has also been reported to have low mammalian and avian toxicity [7], which plays a prominent role for its application in sugarcane fields without involving any risk whatsoever. The control of nematodes and termites both at the same time by Tenekil proved to be very effective comparatively than Dieldrin and Chlordane at 1% level, and the annual yield increased significantly upto 175% by the use of Tenekil, 90.3% by Dieldrin and 75% by Chlordane (Table 1).

Here, mention must be made of this fact while discussing the characteristic features of dieldrin and chlordane, which are currently being used for the control of termites attacking sugarcane plants have little effects against nematodes.

In the light of our investigations with the encouraging results, it is, however, recommended and suggested that 2.5% Tenekil could be used successfully for the total control of nematodes and termites both at the same time infesting sugar-

cane plants upto ten months i.e., till harvesting of the ripe crops.

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