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EFFECT OF DIFFERENT TREATMENTS ON POPULATION OF NEMATODES AND YIELD OF GUAR (*CYAMOPSIS TETRAGONOLOBA* L.)

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ABSTRACT: The impact of different treatments on population of three nematode species associated with guar (*Cyamopsis tetragonoloba*) and the yield of guar were investigated. The chemical nematicides and plant extracts significantly reduced the population densities of all three nematodes. Carbofuran was most effective against all the nematodes. Apart from other three treatments, *Tridax procumbens* emerged as an effective phytonematicide. *Helicotylenchus indicus*, *Rotylenchulus reniformis* and *Meloidogyne incognita* had similar population density levels and were more or less equally suppressed by all the treatments in the order: Carbofuran > *Tridax procumbens* > Fertinemakil Plus > *Withania somnifera*. The yield of guar was only slightly increased but not significantly.

Key Words: Cyamopsis tetragonoloba; Plant Extract; Carbofuran; Fertinemakil Plus; Nematodes; Yield; Pakistan.

INTRODUCTION

Guar (*Cyamopsis tetragonoloba* L.) a legume and a vegetable, also used for industrial gum is drought tolerant annual crop that grows in hot, semiarid regions with sandy soils. It is generally grown in May-June and harvested in September-October in Sindh. The early crop is usually utilized for green manure and the later crop for fodder, vegetable and seed (Sastri, 1950). The major world suppliers of guar gum are India, Pakistan, the United States and smaller acreages in Australia and Africa. The world demand for guar increased which lead to introduction of guar in other countries (Sultani, 2004). Of the various disease causing organisms, nematodes are known to decrease yield of guar (Raut and Sethi, 1980). In the present trial Fertinemakil, (a combination of neem cake and fungicide) plant extracts of *Tridax procumbens* L., *Withania somnifera* Dun. and carbofuran, a synthetic oxime carbamate were used for comparison.

The objective of the study was to evaluate the potential of chemical and plant extract against plant parasitic nematodes and yield of guar beans in a field trial.

MATERIALS AND METHODS

The experiment was conducted at Crop Diseases Research Institute, Pakistan Agricultural Research Council, Karachi University Campus in the last week of April 2009. The temperature during trial varied from 26° to 34°C. Soil samples were collected in the second week of April (fifteen days prior to sowing) from a depth of ≥ 0-35 cm. Population of the three dominant nematode species comprised 85% of the total stylet bearing nematodes were determined by a sieving and decantation and modified Baermann funnel technique (Southey, 1986). Five ml aliquots (15 replicates of nematodes suspension were used for nematode counts and value converted to number of nematodes per 200 ml of soil samples. The initial populations were 65.25 ± 6.89 *Helicotylenchus indicus*; 127.25 ± 9.32, *Rotylenchulus reniformis* and 49.75 ± 4.51, *Meloidogyne incognita* larvae per 200 ml soil. Two meter rows were prepared and seed of guar cv. Mirpur was sown at a distance of 15 cm and at a depth of 4 cm. Each treatment was replicated four times. The treatments were Fertinemakil plus @ 200 ml row^{-1} and carbofuran (commercial prod-

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uct Furadan) at 10 g row^{-1}, untreated rows were kept as control. The extract of *Tridax procumbens* L. and *Withania somnifera* Dun. were prepared by using 100g of air-dried plant material that was plunged into 400 ml of 80% ethanol at 50°C, stirred well and soaked for 24 h. The material was reduced to a 2 ml gummy mass in a rotary evaporator (Buchi Rotavapor R-200) and dissolved in 400 ml distilled water. Two hundred ml of each extract was applied to 2 m row of guar 10 days after germination at 15 cm depth by mixing the extract in the soil using a spade. The extracts were uniformly broadcasted in the furrow and corresponded application rate approximately 1300 kg ha^{-1} plant material in the form of extract applied to the guar field. Each treatment was replicated four times. Weeding was done manually and cow manure was used as fertilizer when the crop was 8-week-old. No fungal disease was observed and insect populations were at low level and not problematic. At the time of harvest soil samples were collected from a depth of 0–35 cm with a soil auger to determine nematode populations. Each final sample was a composite of 6–8 cores. To estimate the yield, total bean weight/plant from each treatment was determined. Treatments and controls were replicated four times. Data was subjected either to factorial analysis of variance (FANOVA) or one way analysis of variance (ANOVA). Duncan's multiple range test and Fisher's least significant test (LSD) were used as post-hoc tests (Zar, 1999).

RESULTS AND DISCUSSION

The results of FANOVA showed that both treatments and the nematode density were highly significant ($P < 0.001$). The interaction of treatments × nematodes was also found significant ($P < 0.001$) (Table 1). Leaving aside the chemical nematicide carbofuran, the best nematode control was obtained by the application of *Tridax procumbens*. Fertinemakil also gave good control. Whereas *Withania somnifera* effectively controlled only *H. indicus* and *R. reniformis* ($P< 0.05$). The control of *H. indicus* was obtained in the order carbofuran > *Tridax procumbens* > Fertinemakil > *Withania somnifera*. The order in which *R. reniformis* population was retarded was carbofuran = *Tridax procumbens* > Fertinemakil > *Withania somnifera*. *M. incognita* population was controlled by the treatments in the order carbofuran > *Tridax procumbens* > Fertinemakil ≥ *Withania somnifera* (Figure 1).

The ANOVA for yield showed a non-significant F-value ($F = 3.9$) (Table 2). The yield was therefore not significantly influenced by the treatments, although it was slightly elevated compared to controls (Figure 2). The field experiment demonstrated the nematicidal potential of the two extracts tested against nematodes associated with

Table 1. FANOVA for nematode populations

Source	SS	df	MS	F	P
Block	229.65	3	76.55	0.61	0.61 n.s.
Treatments	66178.83	4	16544.7	132.51	p < 0.001
Nematode	7340.63	2	3670.31	29.39	p < 0.001
T × N interaction	17305.86	8	2163.23	17.32	p < 0.001
Error	5243.6	42	124.84	-	-
Total	96298.58	59	-	-	-

L.S.D. (Treatments) = 9.205; L.S.D. (Nematodes) = 7.130

Table 2. ANOVA for yield

Source	SS	df	MS	F	P
Block	1768.6	3	589.5	0.921	0.460 n.s.
Treatments	18	4	467.5	0.7	0.58 n.s.
Error	7680.4	12	640.07	-	-
Total	9467.0	19	-	-	-

L.S.D. = 38.97

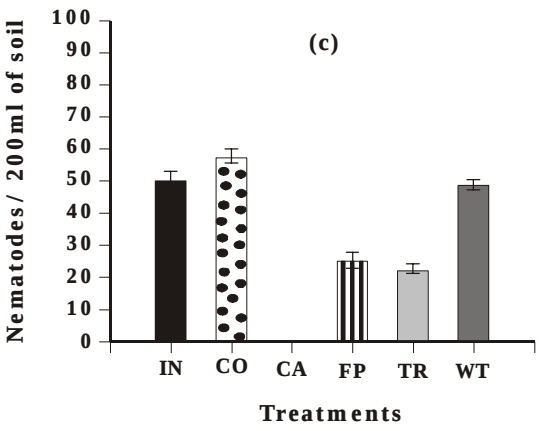

Figure 1. Effect of different treatments, under field conditions, on nematode soil populations densities (a= *Helicotylenchus indicus*; b = *Rotylenchulus reniformis*; c = *Meloidogyne incognita*; IN = Initial population; CO = Control; CA = Carbofuran; FP = Fertinemakil Plus; TR = *Tridax procumbens;* WT = *Withania somnifera)*

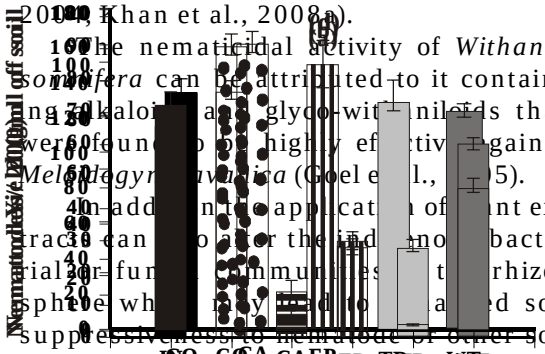

Figure 2. Effect of different treatments on yield (g) of guar, under field conditions (Initials as in Figure. 1)

guar and slightly increased the yield.

Several mechanisms may be involved in the suppression of nematode soil populations. Plant-extracts often contain phenolic compounds, organic acids, terpenes and terpenoids, coumarin like compounds and other metabolites (Muller and Gooch, 1982; Insunza et al., 2001; Shaukat et al., 2004; Khan et al., 2008a).

The nematicidal activity of *Withania somnifera* can be attributed to it containing alkaloids and glycowithanolids that were found to be highly effective against *Meloidogyne javanica* (Goel et al., 2005). In addition to application of plant extracts can also alter the indigenous bacterial or fungal communities in the rhizosphere which may lead to increased soil suppressiveness to nematode pl other soil borne plant pathogens. *Tridax procumbens* leaves in common practice are used for surface wounds. *T. procumbens* have been found to reduce galling index of *Meloidogyne incognita* (Tsay et al., 2004); its dried leaves have been used as manure (D'Addabbo 1995) and extracts have antimicrobial properties (Mehta et al., 1983).

In earlier studies Fertinemakil plus suppressed the nematode population and enhanced the yield of mungbean (Khan et al., 2008) and maize (Khan et al., 2009).

Present results indicated that plant extracts and Fertinemakil plus were effective in reducing population of *H. indicus, R.*

reniformis and *M. incognita*. The efficacy of plant materials depend on many factors including the nematode species present. (McSorley and Gallaher, 1996), length of time since application and its chemical composition (Stirling, 1991) besides the environment factors and agricultural practices.

Although the chemical nematicide Carbofuran was the most effective in controlling the three nematodes. However, the results indicate that the use of plant extracts, Fertinemakil and nematicide (Carbofuran) in combined application are expected to provide better options for nematode control. Chitwood (2002) suggested that agricultural utilization of phytochemicals although currently uneconomical in many situations, offer tremendous potential.

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