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EFFECT OF SOIL DRESSING OF NEEM OIL FOR NEMATICIDAL ACTIVITY IN/ON TOMATO CROP

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Abstract

In India the farmers mostly rely on a mixture of chemical pesticides to limit the losses from pests and disease. Inappropriate handling and unsafe spraying of the agrochemicals cause high risk of health hazards. Degraded pesticide resulted in soil and groundwater pollution has nutritionally imbalanced and unproductive lands. So to reduce the pesticide residue incidence an an eco-friendly alternative is the need of the hour. Therefore, Neem based pesticides are more attractive biopesticides in integrated pest management programs (IPM) as they diminish the risk of exposing natural enemies of pests. The usage of neem biopesticides has developed as promising alternate to chemical pesticides when used in IPM. Neem oil based formulations have been tried against M. incognita as seed and bare root dip treatment was carried out in tomato. Soil was treated with neem oil and compared with carbofuran and untreated control. Neem oil was applied at two different dosages (4 litres/ha and 5 litres/ha) and Carbofuran 3G @ 1 kg/ha. Neem oil was applied before planting by mixing with organic fertilizer (1000 kgs) and applied as soil drench before planting.

Keywords- eco-friendly alternative, neem biopesticides, Neem oil based formulations, M. incognita, carbofuran.

I. INTRODUCTION

Agriculture production plays a vital role in Indian economy. However pests and diseases are the serious issue that effect the production of the agricultural crops. These pests are effectively controlled by application of several synthetic pesticides. Excessive and indiscriminate application of pesticides leads to the deposit of pesticide residues in/on crops. The presence of these pesticide residues in agriculture commodities has raised major concern among the consumers. To overcome these residues in agricultural commodities ecofriendly neem based biopesticides were introduced which are very effective against a number of pests and also safe to natural enemies.

Neem is (Azadirachta indica A. Juss Fam. Meliaceae) currently developed as one of the significant means to be used in protection of crops from pest attack. Neem has many insecticidal substances including triterpenoids, azadirachtin and limonoids including Meliantriol, Salanin, Nimbin and a host of other terpenoids. The neem seed kernel extracts has insecticidal, repellent, antifeedant, ovi-position deterrent and growth regulatory properties. The active key ingredient is azadirachtin termed as Azadirachtin A, a tetranortriterpenoid that exhibits classical insect growth regulatory (IGR) effects on the immature stages of insects. Trigloylazadirachtol (azadirachtin B) is present at concentrations upto 20% of that of azadirachtin, other azadirachtins (C-L) occur at much lower concentrations.Neem seed kernel extract (NSKE) is widely recommended as a potent insecticide for the management of a large number of pests especially the Lepidopteran pests. Recent research carried out in India and abroad has led to the development of effective formulations of neem (Nimbecidine, Nimbo bas, etc), which are being commercially produced.

AzadirachtaindicaA. Juss (Meliaceae) (Neem tree) as a highlight, researches have depicted various mechanisms of action for its insect control. More than 100 compounds have been isolated from various parts of the Neem (Luo et al., 1999). It is common to find a range of biological activities, including insect anti-feedant and growth regulating properties, antibacterial, anti-fungal and anti-viral activities, anti-protozoal, and anti-sickling properties. In the recent past, chemical constituents of Neem seeds have been intensively explored since they have proved to be an excellent source of a wide variety of chemicals useful to the management of pestiferous insects (Kumar et al., 2003). More than 500 insect pest species are listed as sensitive to Neem seed extracts (Morgan, 2009). The main metabolite of Neem is a limonoid known as azadirachtin.

Tomato (Lycopersicon esculentum) is one of the main protective food crops of India. India ranks second in the area as well as production of tomato next to China (Parveen Kumar, 2016). Tomato is infested bynumerous insect pests and is susceptible to a variety of diseases (Reddy et al. 2007).. Among these pests whiteflies, leaf miners cause large yield losses. To control the yield in tomato loss pesticides have emerged as an important constituent in crop protection and it overcomes the pest incidences to ensure sustainable returns. The increased chemical pesticide usage leads to the deposit of these pesticides in/on crops. So to decrease the chemical pesticide residue level in vegetables it is necessary to search for an alternative means of pest control. Botanical pesticide plays an important role and it is an alternative to chemical pesticide. These botanical pesticides have pest repellent, anti feedant, Insect growth regulatory activity and will not show any residues on field crops. The increasing interests in neem in recent years has resulted in the development of cheap, safer and ecofriendly nematicides and pesticides. Neem seed constitutes the basic raw materials for neem products. Considering safety to the environment, human health hazards and cost of nematode management, the non chemical means especially botanical nematicides will be much safer and highly practicable. It can easily fit into the integrated nematode management programmes. Sivakumarand Gunasekaran (2011).

Pervaiz et al.,(2003) two year study shows that neem oil and fish emulsion had no phytotoxic effect on tomato. The foliar applications of neem oil were tested for bacterial spot of tomato in green house condition showed less symptoms when compared to water treated control. Azadiractin exhibits good efficacy against key pests such as whiteflies, leafminers, fungus gnats, thrips, aphids and many leaf eating caterpillars. Azadirachtin has minimal to no impact on non target organisms, is compatible with other biological control agents and has a good fit into classical Integrated Pest Management Programmes (John 1999).

Neem oil based formulations have been tried against M. incognita as seed treatment and bare root dip with varying degrees of success. (Javedet al., 2008). The growing demand for natural products has been intensified in the past decades as they are extensively used as biologically active compounds and are being considered an important alternative strategy for sustainable insect pest management in agriculture, because they are biodegradable and potentially suitable for the use in integrated management programs (Rattan, 2010). So the present study was designed to check the nematicidal activity of neem oil in tomato.

II. MATERIALS AND METHODS

The seedlings of Tomato were collected from Tamilnadu Agricultural University, Coimbatore. The plants were cultivated during late winter and early summer when the temperature is below 300C i.e during the months of January and February, 2018. The pH of the cultivated land is acidic with the value of 8.1. Field treatments details were given in table 1. The size of the field was 14 X 14 m and in each bed and watered regularly with frequent weeding. At the time of transplanting, soil was treated with neem oil and compared with carbofuran and untreated control. Neem oil was applied at two different dosages (4 litres/ha and 5 litres/ha) and Carbofuran 3G @ 1 kg/ha. Neem oil was applied before planting by mixing with organic fertilizer (1000 kgs) and applied as soil drench before planting.

The experiment was concluded 90 days after sowing. Observation was made on 90th day for nematode population in soil.

Table 1: Field treatment details

S. No.	Treatments	Products/ dosage
1.	T1	Neem oil (4 litres/ha)
2.	T2	Neem oil (5 litres/ha)
3.	T3	Carbofuran 3G (1 Kg/ha)
4.	T4	Control

2.1.Biochemical Analysis:

The protein and carbohydrate content in the plant samples were estimated according to the methods of Lowry et al, (1951) and Anthrone reagent method respectively. The amino acid content was also estimated by ninhydrin reagent method. The entire procedure was repeated for plants grown in all the treatments including control.

III. RESULTS AND DISCUSSION

The protein, carbohydrate and aminoacid content in the application of Neem oil (5 litres/ha) plant samples were 4.23, 2.96 and 6.90, respectively whereas in carbofuran shows 6.62, 3.06 and 7.25, respectively. Nematode populations were analysed after 90 days of planting of Tomato in different treatments. Neem oil (5 litres/ha) and carbofuran showed good reduction of nematode population followed by neem oil (4 litres/ha). Similar trend was noticed in biometric data of Tomato crop. The yield / hectare of tomato was high in neem oil (5 litres/ha) treated plot. It recorded 27.43% of yield increase compared to control plot. In all the treatments, comparatively Neem oil applied at the rate of 5 litres/ ha showed significant difference in biometric and yieldwise. Whereas, nematode population results revealed that neem oil (5litres/hec) and carbofuran results were on par. Various neem products including neem cake,its oil and Nimin as urea coating agents and root-dip or seed treatment with neem extracts have been found to be nematicidal against several species of parasitic nematodes (Alam, 1991) attacking vegetables and legumes (Haseeb et al., 2005). The results clearly indicated that the neem oil formulation NO 60EC (C) as seed dressing and seedling bare root dip had significantly reduced the root galling by M. incognita by recording the lowest root knot index of 2.0, lowest soil population of nematodes and highest brinjal fruit yield Sivakumarand Gunasekaran (2011). Effect of neem oil on the bio-chemical parameters in tomato was illustrated in table 2.

Table 2: Effect of Neem oil on the bio-chemical parameters in Tomato

S. No.	Treatments	Estimation of Protein (mg/g)	Estimation of Carbohydrate (mg/g)	Estimation of Amino acid (mg/g)	Estimation of Starch (mg/g)
1.	T1	3.75	2.77	6.37	1.18
2.	T2	4.23	2.96	6.90	1.24
3.	T3	6.62	3.06	7.25	1.72
4.	T4	2.87	2.87	6.44	0.66

Table 3: Nematode populations and percent reduction of Nematodes in different treatments

Treatments	Nematode population (250 cc soil)	Percent reduction of Nematodes
T1	89.8	71.00%
T2	69.6	77.52%
T3	68.7	77.81%
T4	309.7	-

Table 4: Biometric and harvest data of Tomato

S. No.	Treatment	Plant height (Cms)	No. of fruits/plot	Single fruit weight (Gms)	Yield/plot (Kgs)	Yield /Hec (Kgs)	Yield increase (%)
1.	T1	89.52	242.33	85.42	36.59	1970.22	20.89
2.	T2	92.56	220.23	89.58	39.89	2147.91	27.43
3.	T3	91.65	257.83	87.93	38.02	2047.22	23.87
4.	T4	76.11	111.66	47.08	29.52	1558.53	-

The percent reduction of nematodes in soil with neem oil (T2) was 77.52% when compared with carbofuran was 77.81%. Biometric and harvest data of tomato on 90 days with neem oil (T2) showed 27.43% of yield increase whereas with carbofuran was 23.87%. Nematode populations and percent reduction of nematodes in different treatments were mentioned in table 3. The Central Insecticides Board of India has approved the registration of 300 ppm oil based and 1500 ppm kernel based neem formulations (Akhtar, 2000). An experiment was conducted at the Vegetable Research Farm, Punjab Agricultural University, Ludhiana, India during the year 2001 with the aim to reduce the insecticide usage on brinjal crop against brinjal shoot and fruit borer, Leucinodesorbonalis Guenee.eem products and without any insecticidal spray for the control of L. orbonalis, resulted in significantly lower fruit damage (28.29 %) as compared to the field conditions (55.08%) even after following an alternate spray schedule of recommended insecticides. Fruit damage in net house was nearly 50% lower than the fruit damage recorded under field condition (Kaur et al., 2004). Biometric and harvest data of tomato were depicted in table 4. The yield of tomato in treatments were 20.89 (T1), 27.43 (T2) and 23.87 (T3), respectively. Yield data of tomato treated with different concentrations neem oil and carbofuran was illustrated in figure 1. It is concluded that neem oil, an organic pesticide is very effective on controlling nematodes as of carbofuran. Hence, usage of organic products is recommended instead of using chemical fertilizers. This experiment reveals that the neem oil also used for nematode control if it was applied as soil dressing material.

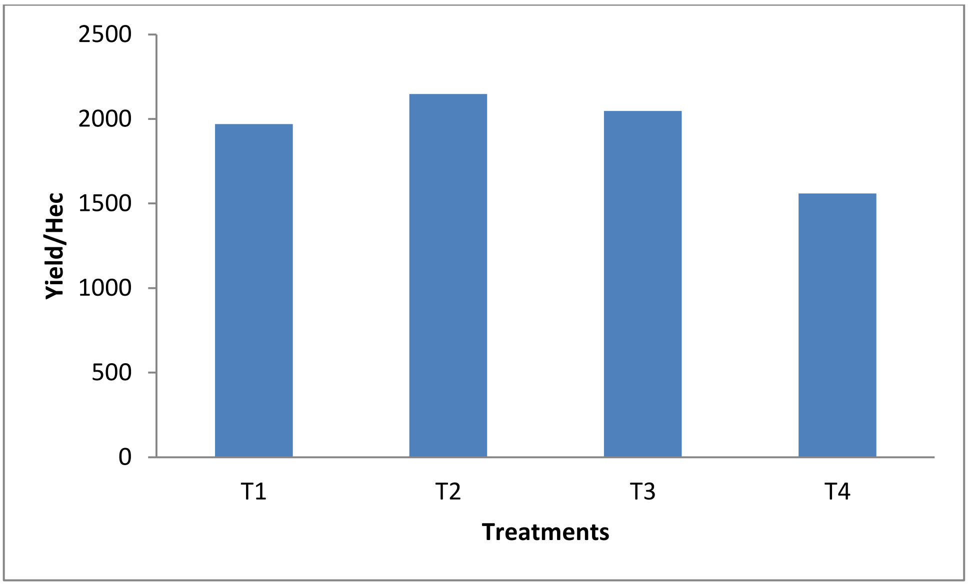

Figure 1. Yield data of Tomato treated with different concentrations Neem oil and Carbofuran.

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