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Infectivity of *Meloidogyne javanica* Treub on Tomato CV. UC82B as Influenced by Different Levels of Rice Husk and Guinea Grass Ashes

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Abstract: The infectivity of *Meloidogyne javanica* on tomato cv. UC82B in soil amended with different levels of rice husk and guinea grass ashes was investigated under screen house conditions in 2008 and 2009 at Federal College of Agriculture Ishiagu, SE Nigeria. The ashes were respectively applied at three levels (10, 20 and 30 t ha^{-1}) with the untreated as the control. The treatments were fitted in Completely Randomized Design replicated four times. Tomato cv. UC82B was used as the test crop. Data were collected on: plant height (cm) and number of leaves at 50% anthesis, number and fruit weight at harvest and galled roots and gall index at harvest. Results showed that the ashes at different levels performed better than the control. Ashes increased significantly ($P<0.05$) the number and weight of fruits and reduced the number of galled roots. There was no significant ($P>0.05$) effect of the ashes on plant height, number of leaves and gall index. The ashes exhibited nematicidal potentials as well as soil nutrient enhancement. The two ashes are therefore recommended to be used at 30 t ha^{-1}.

Key words: Different levels · Nematicidal potentials · Screen house conditions · Nutrient enhancement

INTRODUCTION

Efforts are intensively employed to evolve strategies of low cost agricultural production by utilizing otherwise thought organic wastes in our environments. Several attempts have been made by researchers to put these organic wastes to proper use and the results obtained have been beneficial. The use of different sources of ash is yet to be fully explored, especially in the production of important vegetables. Tomato (*Lycopersicon esculentum* Mill) is a solanacious plant. The fruit is very rich in essential vitamins and mineral salts [1]. It generates income to its growers. A tropical warm season crop, it is said to have originated in Tropical Central and South America [2] and it is grown all over Nigeria. The bulk of production is from the dry season cropping particularly under irrigation in the Northern states and near riverbanks in the southern states of Nigeria. According to Centre for Overseas Pest Research (COPR) [2], the total land area covered annually is over one million hectares with most of the production from the Northern Guinea Sudan Savannah.

Tomato grows well in many types of soils ranging from sandy to the heavy clayey soils [3]. Jaraba *et al.* [4] reported that sand to sandy-loam soils are conducive to *Meloidogyne* species.

Nematodes are one of the major pests of tomato globally especially in the tropical and subtropical regions. The production of tomato is impaired by among other factors its infestation by nematodes [5]. Adesiyan *et al.* [6] reported reductions in yield ranging from 28 to 68%. Over sixty species of plant parasitic nematode attack tomato but the most destructive nematodes responsible for enormous yield losses of tomato are the root-knot nematodes belonging to the genus, *Meloidogyne* [7, 8].

Nematodes in agricultural soils are being controlled with synthetic pesticides like carbofuran, furadan, which are very expensive and misapplication of any might result in an adverse effect on the environment. Pyrethriods and other newly developed safer pesticides are expensive. Alternative control measures which are cheaper, available and environmentally friendly should therefore be developed and used in controlling nematode attacks on tomato to ensure higher productivity and sustenance of the crop in Nigeria.

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This work was therefore aimed at evaluating the effects of different levels of rice husk and guinea grass (*Panicum maximum*) ashes on the control of *Meloidogyne javanica* infesting tomato cv. UC82B.

MATERIALS AND METHODS

Pot experiments were carried out in the Research and Teaching Farm of the Federal College of Agriculture Ishiagu. Seeds of UC82B variety were obtained from National Institute of Horticultural Research (NIHORT) Okigwe, Imo State, Nigeria. Sandy loam soil which is conducive to both tomato and root knot nematode was used for the experiment.

Top soil (0-30cm depth) was collected from the same site for the two-year experiment and sterilized in the laboratory using electric soil sterilizer at 50°C for two hours.

Seedlings were raised in the nursery comprising sterilized top soil, well cured poultry manure and river sand mixed in the ratio of 3:2:1, respectively.

Rice husks obtained from rice mills in Ishiagu and dried guinea grass obtained from the Federal College of Agriculture Ishiagu premises were respectively burnt to ashes.

One kilogram of the sterilized top soil was filled into black polythene bags of 30 x 28 cm. Each pot was amended with the different levels (10, 20 and 30 t ha^{-1}) of the different ashes, respectively and watered two days before transplanting. The unamended pots served as the control. Four weeks old seedlings from the nursery were transplanted into the pots at one plant per pot.

Eggs of *Meloidogyne javanica* from infected roots of Indian spinach (*Spinache oleraceae)* already maintained in buckets were extracted using the methods of Hussey and Barker [9]. 5000 eggs of *M. javanica* were inoculated into each plant with the aid of a graduated syringe by opening the soil 3 cm from the roots, 2 cm deep and depositing the eggs covered lightly with soil.

The design of the experiment was Completely Randomized Design (CRD) with four treatment levels each and replicated four times in each year. Each replicate had 10 plants. Five plants were randomly selected and tagged in each replicate and data were collected from them on: plant height (cm) at 50% anthesis, number of leaves at 50% anthesis, number of fruit at harvest, fruit weight (kg) at harvest, number of galled roots per plant at harvest and gall indices. Gall indices were scaled according to rating scheme of Taylor and Sasser[10]: 0= no galls, 1=1-2galls, 2=3-10galls, 3=11-30galls, 4=31-100 and 5= above 100galls.

Combined analysis of variance was performed on the 2008 and 2009 data using GENSTAT 3 Edition Release 7.2. Significant treatment means were separated using F-LSD=LSD procedure as outlined in Obi [11].

RESULTS AND DISCUSSION

The results in Table 1 showed that the application of the soil amendments did not have any significant ($P>0.05$) effect statistically on the plant height and number of leaves produced by the plants at 50% anthesis. There were slight increases in plant heights and number of leaves above the control. These results evidenced the fact that some soil amendments improves the soil nutrients but its nutrient constituents vary with the sources. The result therefore is contrast with the findings of Owolabi *et al.* [12] that sawdust ash applied at 3, 6 and 9 t ha^{-1} increased okra leaf. The effect of the soil amendments on the activities of the nematode is similar with the unamended soil.

The soil amendments at different levels increased significantly ($P<0.05$) the number of fruits and fruit weights produced by the plants (Table 2). The number of fruits increased with increase in concentration of the amendments. The highest number of fruits (13.25) was obtained at grass ash at 30t/ha, which differed significantly ($P<0.05$) from the control. All the levels of the amended soil produced more fruits than the control.

Table1: Effect of ashes on mean plant height and number of leaves at 50% anthesis

Ashes (t ha^{-1})	Plant height (cm)	Number of leaves
GA 10	30.90	12.50
GA 20	21.60	14.75
GA 30	16.95	15.50
RA 10	23.18	16.00
RA 20	17.05	15.00
RA 30	15.85	12.75
CONTROL	15.90	11.50
F-$LSD_{0.05}$	NS	NS

Ns= Not significant

GA= Grass ash, RA= Rice husk ash.

Table 2: Effect of ashes on mean number of fruits and fruit weight (kg) at harvest

Ashes (t ha^{-1})	number of fruits	fruit weight (kg)
GA 10	11.50	10.66
GA 20	12.75	11.18
GA 30	13.25	12.70
RA 10	11.00	12.30
RA 20	12.25	13.83
RA 30	12.75	13.83
CONTROL	8.00	8.65
F-$LSD_{0.05}$	1.35	1.82

Table 3: Effect of ashes on mean number galled roots/plant and gall indices at harvest

Ashes (t ha^{-1})	galled roots	gall indices
GA 10	8.50	3.50
GA 20	7.75	3.00
GA 30	7.75	3.00
RA 10	10.00	2.75
RA 20	10.00	3.00
RA 30	9.50	3.00
CONTROL	13.75	4.00

F-$LSD_{0.05}$ 0.85 NS

This was attributed to the enhancement of the soil productivity by the amendments. The result here agrees with Owolabi *et al.* [12] who reported that sawdust ash manure at 2, 4, 6 and 8 t ha^{-1} increased the number and weight of tomato fruit significantly. Application of ashes to the soil increased the micro and macro nutrients in the soil. This in no doubt contributed to the increase in the number of fruits produced by the plants. Ojeniyi *et al.* [13] stated that the increases in growth and yield of tomato given by animal manure-amended plant residues is consistent with increased N and K concentrations of tomato plant. This also contributed to increase in weight of the fruits.

There was significant ($P<0.05$) effect on the number of galled roots per plant by the amendments. There was decreased number of galled roots with increasing the concentrations of the amendments when compared with the control. Galls are the results of adverse relationship of root-knot nematode with a susceptible host. These galls interfere with such functions of plants as conduction and translocation of food and water in plants. Addition of the ashes to the soil improved the nutrient status of the soil thereby improving the health status of the plants. This led to the increase and improved processes and functions of the plant. The treated plants produced more number of fruit and weight than the untreated. The soil amendments conferred tolerance to the activities of nematodes in the plants. Soil amendments of different kinds used as nutrient sources for crop production have been found effective in control of root diseases of plant, according to Abubakar *et al.* [5]. The results obtained with using of these ashes showed that they have nematicidal potentials. Abubakar and Majeed [14] reported that remarkable reductions had been achieved in nematode population in both green house and field conditions with concomitant increase in growth and yield.

There was no significant ($P>0.05$) effect on the gall indices statistically. The results lent credence to already discussed issues.

CONCLUSION

The results of this experiment revealed that the ashes of rice husk and guinea grass have nematicidal potentials. They are readily available, cheap and environmentally friendly, it is therefore recommended that the ashes be used at 30tha^{-1} or more to combat nematode problems in the production of tomato cv. UC82B.

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