MANAGEMENT OF *MELOIDOGYNE INCOGNITA* INFECTIONS ON SOYBEAN (GLYCIN MAX) WITH *JATROPHA CURCAS* LEAF POWDER AS SOIL AMENDMENT IN ISHIAGU, NIGERIA.

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ABSTRACT
Powdery leaf extract of *Jatropha curcas* at 2tons/ha, 4tons/ha and 6tons/ha with zero application as the control (0 tons/ha) were evaluated for the control of *Meloidogyne incognita* infections on soybean (*Glycine max*) field at the Research and Teaching Farm of Federal College of Agriculture Ishiagu, in 2013 and 2014 cropping seasons. The extract was used as soil amendment. The experimental design was Randomized Complete Block Design (RCBD) with four treatments replicated three (3) times. Data were collected on plant height (cm) and number of leaves at, four(4),six (6) and eight (8) weeks after planting, number and weight (kg) of fruits at harvest, number of galled roots, and number of galls per root, at harvest. Collected data were averaged over the two years and subjected to combined analysis of variance. There were no significant ($P > 0.05$) effects on the plant height, number of leaves and fruits. The extract significantly ($P<0.05$) affected the weight of fruits, number of galled roots and gall index. Result indicated that *J. curcas* at 6tons/ha of powdery extracts reduced nematode infections on soybean field which led to significant increase in fruit weight. Farmers are therefore, recommended to use powdery leaf extracts of *Jatropha curcas* at 6tons/ha or at higher dosages as soil amendment to control *M. incognita* infection.

Keywords: *Jatropha curcas;* leaf powder; *Meloidogyne incognita;* gall reduction; fruit weight.

INTRODUCTION

Soybean (*Glycine max)* is a herbaceous leguminous plant cultivated in many areas of the world, from the tropics to temperate regions. It is also found as a dual purpose grain legume plant, native to East Asia that is grown for oil and protein around the world (Alex, 2007). Wlang, *et al,* (2001) stated that it is an important cash crop in the legume family giving relatively high returns for a limited land area and is well adapted to the hot semi-arid conditions characterizing many of the regions where it is grown.

Soybean fruits are known as rich source of protein, high level of vitamins B, E and K and also account for about 56 % of the global oil seed production. Among the many pests that affect grain legumes, soybeans production particularly, are plant parasitic nematodes (Muthukarishnan *et al*, 2003). The most predominant species of root knot nematodes are *Meloidogyne incognita, M. javanica* and *M. arenaria. Meloidogyne spp* are notoriously difficult to control because of their wide host range and high rates of reproduction (Udo, *et al,* 2008). *Meloidogyne incognita* causes severe yield losses, typically up to 50 percent. This is mainly as a result of root deformation which diminishes their function and predisposes plants to pathogens. It affects crops directly and indirectly by their interaction with various soil borne fungi, bacteria and viruses, (Udo, *et al.,* 2008).

Root-knot nematode (*Meloidogyne incognita*) has been one of the major limiting factors to soybean production in Ishiagu, Southeastern Nigeria. The root-knot nematode (*Meloidogyne incognita*) causes conspicuous root galls and serious reductions of growth and yield in soybean. Local farmers use inorganic nematicides like Furadan and some Pyretheroids in controlling the effects of this nematode. Though, nematicides hold major promise in nematodes control (Adegbite, and Adesiyani, 2001), the high cost, their non-availability at the time of need and the hazards they pose as environmental pollutants discourage most potential users in Nigeria.

The cost of chemical control of root-knot nematode infections is high and unaffordable to the poor resource farmers. It is most times hazardous to the environment. There is therefore, the need to find other control measures that are readily available, cheap and environmentally friendly.

The objectives of this research were to determine the effect of powdery leaf extract of *Jatropha* on the performance of soybean and control of root-knot nematode infections on soybean.

MATERIALS AND METHODS

The study was conducted at the Research and Teaching Farm of Federal College of Agriculture Ishiagu, Ebonyi state, Nigeria in 2013 and 2014. Ishiagu lies within the longitude of $08^{0}0.3^{1}$E and latitude of $06^{0}0.25^{1}$N in the derived Savannah region.

Local soybean (*Glycine max*) seeds which are highly susceptible to nematodes were collected from local farmers in Ishiagu, Ebonyi State. The susceptibility of this soybean is a source of worry to the local farmers. *Jatropha* leaves were collected within Ishiagu, and identified in the Horticulture Department of Federal College of Agriculture Ishiagu.

The experimental site measuring 10 m x10 m was marked out, ploughed, harrowed in each year. The site was divided into three blocks with each block containing four plots measuring 2m x 2m each. The blocks were 1m apart while the plots were 0.5m apart within the blocks.

JATROPHA LEAF POWDER PREPARATION

Fresh leaves of the test plant were washed with clean water, rinsed twice in two separate clean water, and sun-dried for eight days. The dried leaves were ground to powder using electric milling machine.

EXPERIMENTAL DESIGN

The experimental design used in this research was Randomized Complete Block Design (RCBD), with four treatments replicated three (3) times. The treatments were 2 tons/ha, 4 tons/ha, 6 tons/ha and 0 tons/ha (control). The treatments were randomly applied to the plots, worked into the soil with garden fork two days before planting. The soybean seeds were sown two seeds per hole at a spacing of 50 cm X 50 cm and later thinned down to one two weeks after emergence.

Data Collection

Data were collected on the following parameters:

i. Plant height (cm) at 4, 6 and 8 weeks after planting.
ii. Number of plant leaves at 4, 6 and 8 weeks after planting.
iii. Number of fruits per treatment at harvest.
iv. Weight (kg) of fruits per treatment at harvest.
v. Number of galled roots per treatment at harvest.
vi. Number of galls per root (gall index) at harvest scaled thus: 0 = No galls. 1 = 1─ 10 galls, 2 = 11─ 20 galls, 3 = 21─ 30 galls, 4 = 31─ 40 galls, 5 = 41─ 50 galls and 6 = > 51 galls.

Statistical Analysis

The averaged data over the two years were subjected to combined analysis of variance (ANOVA). Significant treatment means were separated using Least Significant Difference at 5% level of probability as outlined in Obi (2002).

RESULTS

The effect of powdery leaf extracts of *Jatropha curcas* on the number of galled roots and galls at harvest on *Meloidogyne incognita* of soybean (*Glycine max*) is shown on Table 1. It was observed that plants at the control plots had the highest galled roots concentration at harvest (2.63), while plants at the plots that received 6tons/ha of *Jatropha curcas* had the least concentration of galled roots at harvest (0.64).

The number of galls per root at harvest was significantly ($P<0.05$) reduced by the extracts. Application of 6tons/ha of *Jatropha* extract gave the lowest concentration of galls per root at harvest (0.38), while control had the highest number of galls per root at harvest (1.31).

Table 2, shows the effect of *Jatropha* leaf powder application on the plant height at Four, Six and Eight weeks after planting. Results obtained showed that the treatment did not significantly ($P>0.05$) affect the plant height.

The results in Table 3 showed that *Jatropha* powdery leaf extract at Four, Six and Eight weeks after planting showed no significant($P>0.05$) effect on the number of leaves produced by the plants. The powdery leaf extract showed no significant ($P>0.05$) effect on the number of plant fruits at harvest, (Table 4).

The application of *Jatropha* leaf powder on the plants had significant ($P<0.05$) effect on the weight of fruits. The fruits obtained at the control plots had the least weight at harvest. The highest fruit weight of 0.60kg was obtained from the plants treated with 6tons/ha of *Jatropha* leaf powder. This differed significantly ($P<0.05$) from all the treatment levels and control.

Discussion

Results obtained showed that there was a general reduction in nematode (*Meloidogyne incognita*) infestation of soybean (*Glycine max*) upon the application of powdery extracts of *Jatropha curcas*.

Powdery leaf extracts of *Jatropha curcas* significantly suppressed *Meloidogyne incognita* gall formation on the roots of soybean as obtained from the plants in the plots amended with powdery leaf extract. Gall formation on the roots is the physical indication of the attack of nematodes on susceptible plants. The amount and concentration of the galls on the roots show the severity and susceptibility level of the test crop. This study showed that the *Jatropha* leaf contains properties that are inimical to root knot nematode. Nematicidal activity of *J. curcas* extracts in this study was in line with the work of Eyong *et al*, (2006) and Kuete *et al*, (2007) where the leaf extract was reported to have antimicrobial property.

The weight of the fruits increased with the increase in the levels of the powdery extract applied. The numbers of galled roots and galls per root on the treated plants, though varied with the levels of the extract applied, were drastically reduced could have led to the significant increase in the yield of treated soybean plant. This was attributed to plants on the treated plots growing under pest free environment provided by the application of the leaf extract. This proved the nematicidal efficacy of the extract when compared to the plants on the control plots. The finding also lent credence to the work of Natarajan *et al*., (2006) where extract of *Tagetes erecta* boosted the height of tomatoes growing on nematode infected soil.

In conclusion, the study showed that powdery leaf extract of *Jatropha curcas* significantly suppressed *Meloidogyne incognita* infections on soybean. Synthetic chemicals have been used to control plant pathogenic nematodes in the farmers' fields. These chemicals, though efficacious, are

costly and may constitute health hazards to farm households and the environment. Reducing these situations in the farms through the use of natural plant extract is one of the challenges in Nigeria. Farmers are therefore, recommended to use *J. curcas* extracts at higher dosage which are affordable, available and environmentally friendly for the control of *M. incognita* infections on soybean and related crops.

Table 1: **Effect of *Jatropha* Powdery Leaf Extract on the Number of Galled Roots and Galls per Root (Gall index) at Harvest**.

Extract (tons/ha)	Number of Galled Roots	Gall index
Control	7.63	2.31
2	3.20	0.75
4	0.89	0.58
6	0.64	0.38
$LSD_{(0.05)}$	1.05	0.57

Table 2**: Effect of *Jatropha* Powdery Leaf Extract on plant height(cm) at 4, 6 and 8 weeks after planting (WAP)**.

Extract(tons/ha)	4WAP	6WAP	8WAP
Control	12.12	24.33	41.63
2	12.04	22.98	40.97
4	12.11	23.96	41.65
6	12.18	25.61	44.44
$LSD_{(0.05)}$	**NS**	**NS**	**NS**

NS = Not Significant.

Table 3: **Effect of *Jatropha* Leaf Extract on the number of plant leaf at 4,6 and 8 weeks after planting (WAP).**

Treatments (tons/ha)	4WAP	6WAP	8WAP
Control	13.50	37.92	111.5
2	12.52	36.33	127.2
4	12.35	35.92	114.7
6	12.38	39.20	117.2
$LSD_{(0.05)}$	NS	NS	NS_

NS = Not Significant.

Table 4: **Effect of Powdery Leaf Extract on the number of fruits and Weight (kg) of fruits per treatment at harvest**.

Extract (tons/ha)	Number of fruits	Weight of fruits(kg)
Control	230.4	0.45
2	251.9	0.50
4	266.9	0.55
6	284.8	0.60
$LSD_{(0.05)}$)	**NS**	**0.012**

NS = Not Significant

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