Management of Groundnut (*Arachis hypogea*) Root-Knot Nematode (*Meloidogyne incognita*): Effect of *Prosopis africana* Pods

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Plant derived nematicides became the focus of research with the loss of interest in the use of chemical nematicides among farmers (Elbadri, 2008). Several plants have been evaluated for their nematicidal potential. There is no report yet on the efficacy of pods of *Prosopis africana* (Guill. & Perr.) Taub. *P. africana* which is mostly found in the savannah region and belongs to the family mimosidae. Popularly used as a soup condiment in Nigeria, it is also widely known for its medicinal properties, most especially as a remedy against tooth infection (Iwu, 1993). The pods have a shiny smooth layer which is resistance to biological degradation because of the presence of condensed tannins which are widely distributed in legume pasture species. The anti microbial properties of *P. africana* have been widely reported, but there is no information on the nematicidal properties of the pods. This research aimed at evaluating the nematicidal potential of the pods.

P. africana pods were picked up under the mother trees on the University of Ilorin campus. The pods were spilled opened manually and the seeds were separated. The pods were pounded in to fine powder in batches using the local wooden mortar and pestle. Field experiments were repeated in three growing seasons between May to August (in the year 2014, 2015 and 2016) at the University of Ilorin teaching and research farm in the southern guinea savannah ecological zone of Nigeria with an annual rainfall which ranges between 1000 mm to 1500 mm. A 100 m x 80 m piece of land with soil pH 5.7 was ploughed and harrowed. Each groundnut plots consisted of six 15 m long ridges with 1 m apart and 75 cm spacing between the ridges. Seeds (kampala cv) were sown at 5 cm depth and 25 cm apart. The experiment was a randomised complete block design (RCBD) with 5 treatments and each was replicated 6 times making a total of 30 groundnut plots. The treatments consisted of carbofuran a standard nematicide as check. Pod powder was applied at three rates viz, 200 g, 400 g and 600 g per plot. The standard synthetic check was applied at 2.0 kg a.i./ha. Each groundnut plant was inoculated at the base with 300 eggs of *M. incognita* a week after emergence (Fabiyi *et al.,* 2019), while the treatments were applied at two weeks after inoculation. The rows were weeded manually with hoe twice before flowering and earth up was done at the second weeding. Subsequent weeding after flowering was done by hand pulling to avoid damage to the developing pods. Triple superphosphate (TSP) fertilizer was applied at 50 kg/ha. Data was taken from seven weeks after planting on the vegetative growth which was represented by plant height and number of leaves. Seeds were weighed at harvest as a measure of yield, while nematode populations in groundnut roots were evaluated in the laboratory. Data collected were analysed using a two-way analysis of variance with a generalised linear model. Significant means were separated using the New Duncan's Multiple Range Test at 5% level of probability (p=0.05). All statistical analyses were done with IBM SPSS statistics version 21.

Significant differences were observed in the growth pattern of the treated groundnut plants over the three years period of the experiment. Significantly (p=0.05) stunted growth was recorded in the untreated control plants, they exhibited fewer numbers of leaves and shorter plants as opposed to the treated plants (Tables 1 and 2). This was constant through the experimental

Table 1: Plant Height of Groundnut Plants.

Treatments	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP	13WAP	14WAP
Prosopis africana (0g)	16.2^{c}	17.1^{c}	18.5^{bc}	19.0^{c}	20.0^{c}	21.4^{b}	23.6^{c}	24.2^{c}
Prosopis africana (200g)	19.7^{b}	20.8^{b}	21.0^{b}	22.5^{b}	23.7^{b}	27.1^{b}	29.2^{b}	30.0^{b}
Prosopis africana (400g)	20.7^{b}	21.3^{b}	21.2^{b}	22.6^{b}	24.0^{b}	30.3^{a}	31.4^{b}	32.0^{b}
Prosopis africana (600g)	23.1^{a}	24.2^{a}	24.8^{a}	26.3^{a}	27.6^{a}	31.0^{a}	36.9^{a}	38.2^{a}
Carbofuran	23.4^{a}	24.7^{a}	24.9^{a}	26.7^{a}	27.8^{a}	31.8^{a}	36.0^{a}	36.6^{a}

Each value represents the mean values of data taken over a period of three years
Values with different alphabets along the same column are statistically different at p=0.05

Table 2: Number of Leaves of Groundnuts Plants.

Treatments	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP	13WAP	14WAP
Prosopis africana (0g)	79.2^{e}	85.2^{e}	97.8^{e}	103.6^{e}	116.2^{e}	124.0^{e}	131.2^{e}	139.8^{e}
Prosopis africana (200g)	151.8^{d}	160.6^{d}	171.6^{d}	182.6^{d}	193.2^{d}	204.8^{d}	211.6^{d}	220.2^{d}
Prosopis africana (400g)	163.8^{c}	176.2^{c}	185.6^{c}	196.6^{c}	208.8^{c}	220.0^{c}	231.6^{c}	243.4^{c}
Prosopis africana (600g)	186.8^{b}	192.2^{b}	203.6^{b}	221.2^{b}	239.4^{b}	248.2^{b}	260.8^{b}	278.8^{b}
Carbofuran	211.2^{a}	239.1^{a}	254.1^{a}	279.4^{a}	288.7^{a}	301.3^{a}	327.5^{a}	343.1^{a}

Each value represents the mean values of data taken over a period of three years
Values with different alphabets along the same column are statistically different at p=0.05

years. Higher yield was achieved in the plants treated with 600 g of powder compared with the plants which received 200 & 400 g powder (Table 3). Similarly significantly fewer root galls and nematodes were observed in the roots of plants treated with the highest quantity of powder (Tables 3), while higher nematode population build up characterized by root galls was seen in the untreated plants. In most cases there are no significant difference in plants treated with the highest quantity of powder and carbofuran treatments.

The observed nematicidal activity in this research could be attributed to the presence of condensed tannins which were discovered in abundance in the powdered pods of *P. africana* (Abah *et al.,* 2015; Kolapo *et al.,* 2009). The pounded dry pods of *P. africana* are used as fish poison (Akaaimo and Raji, 2006). Condensed tannins have been employed in the control of synthetic anthelmintic-resistant gastrointestinal parasites (Min and Hart, 2003). The toxicity of condensed tannins to gastrointestinal nematodes was also evaluated by Max *et al*., (2015), they reported that death of nematodes was due to ingestion of tannins. The pods of *P. africana* are good substitute for the environmentally toxic synthetic nematicide; it is also available at no cost to the resource

Table 3: Yield of Groundnuts and Nematode population on roots at harvest

Treatments	Seed Weight (Kg/60m^{2})	Nematode Population
Prosopis africana (0g)	4.19^{d}	939.7^{d}
Prosopis africana (200g)	8.34^{c}	38.5^{c}
Prosopis africana (400g)	11.10^{b}	23.3^{b}
Prosopis africana (600g)	14.18^{a}	18.6^{a}
Carbofuran	14.43^{a}	16.7^{a}

Each value represents the mean values of data taken over a period of three years
Values with different alphabets along the same column are statistically different at p=0.05

poor farmer. The present investigation establishes the promising nature of *Prosopis africana* pod powder in the management of *Meloidogyne incognita* parasitizing groundnut, it could serve as a substitute to the toxic synthetic nematicide.

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