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THE EFFECTS OF PRE-PLANT TREATMENT WITH NEMATICIDAL PLANT EXTRACTS ON INFECTIVITY OF ROOT-KNOT *NEMATODES MELOIDOGYNE* SPP ON LIVINGSTONE POTATO *PLECTRANTHUS ESCULENTUS* (*RIZGA*)

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Abstract

Field experiments were conducted in 2008 and 2009 growing seasons at National Root Crops Research Institute (N.R.C.R.I.), Umudike, Abia State Nigeria to evaluate the effects of pre-plant treatments with nematicidal plant extracts on the productivity of Livingstone potato (Rizga) and to determine the level of control contributed by them in reducing the infectivity of root-knot nematodes *Meloidogyne* spp. on the crop. The experiments consisted of two 'Rizga' varieties, five treatments and three replications laid out in randomized complete block design. The results showed that there were no significant effects of the nematicidal plant treatment on growth though control plants had higher growth and yield values than treated plants. Riyom variety had significantly higher values than Loangat variety for all the growth parameters measured in 2008 (Table1). No significant interaction was obtained between variety and treatment for both years for all the parameters measured and for the *Meloidogyne* spp. damage symptoms, Riyom variety had higher severity index in both 2008 and 2009 growing seasons. In addition though treatments were not significant for both years, pre-plant treatments with ginger, golden seal and alligator pepper extracts had remarkably lower values when destructively sampled for eggs. These plant extracts therefore offer promising alternatives to root-knot nematode control.

KEYWORDS: *Meloidogyne* spp., pre-plant treatment, nematicidal plant extract, Livingstone potato (Rizga).

INTRODUCTION

Of the many nematode species attacking minor root and tuber crops like Livingstone potato(*Plectranthus esculentus*), Giant taro(*Alocasia* spp.) and Hausa potato (*Solenostemon rotundifolius*), the most widely distributed root-knot nematodes, *Meloidogyne* spp. are of major importance (Bridge et.al. 2005 Okorocha and Ezigbo1992). In addition assessment of nematode damage to the minor root and tuber crops and their economic importance in productions systems needs to receive greater research attention (Bridge et.al.2005)

Several researches are being carried out on Integrated Pest Management (IMP) systems that can reduce the pest and disease populations in the soil and thereby increase yield of crops (Sasser 1989, Onyenobi 2000 and Okorocha 2012). A number of such reports have shown that some plant extracts like *Azadirachta indica* (neem) and *Curcuma longa* L. (Turmeric) possess medicinal and nematicidal properties (Radwanski and Wickens 1981). The pursuance of similar solutions gave birth to these pest management studies. The objective of this field experiment was therefore to evaluate the effects of pre-plant treatment with nematicidal plant extracts on the productivity of Rizga and to determine the level of control contributed by them in reducing root-knot nematodes in the soil and increasing the yields of the crop.

METHODOLOGY

This field experiment was set up in 2008 and 2009 growing seasons at NRCRI farms, Umudike at Longitude 07^0 33' E and Latitude 05^0 29' N.

Rizga planting materials were treated with 5 different treatments consisting of dipping in 5% dilution of turmeric, golden seal, ginger, alligator pepper and 0 (no dipping). The extracts were prepared by marcerating 25 gms of nematicidal plants in 500 mls of water. These were used to cure the rizga planting material by dipping for one hour in nematicidal plant extract and air-drying them on the Lab. Bench for 12 hours before planting.

The Rizga plants were planted in the field in randomized complete block design consisting of 2 varieties and 5 treatments in 3 replications giving a total

Table 1: Rating Scale for the Presence of Root – Knot Nematode Galls or Egg Masses on Roots**.**

Number of Galls or Egg Masses	Gall Index (GI) or Egg Mass Index (EI)	
0	0	
1 – 2	1	
3 – 10	2	R
11 – 30	3	S
31 – 100	4	
100 +	5	

Table 2: Effect of Pre-Plant Treatment with Nematicidal Plant Extract on Infectivity of Root-Knot Nematodes on Growth and Yield of Livingstone Potato (Rizga) 2008.

Treatment	Tot rt yld kg/plt	Ave samp wt(g)	Stdcount at harvest	Plt Height (Cm)	Branch no
0 control	1.66	217	8.33	64.7	15.17
Turmeric	1.38	155	7.33	65.5	14.55
Golden seal	0.98	101	7.17	59.5	10.88
Ginger	1.11	142	6.67	52.5	11.58
Alligator pepper	1.25	118	7.50	57.9	11.82
LSD0.05	0.712n.s	94.5n.s	1.711n.s	14.92n.s	5.807 n.s
Loangat	0.86	113	4.27	54.6	12.27
Riyom	1.69	180	10.53	65.4	13.33
LSD0.05	0.45*	59.8	1.082*	9.44*	3.673 n.s

Table 3: Effect of Pre-Plant Treatment with Nematicidal Plant Extract on Infectivity of *Meloidogyne* spp and Damage Symptoms on Livingstone Potato (Rizga) 2008.

Treatment	Root-knot index	No. of Females	Nema Pop at mid-season	Nema Pop at harvest
0 control	3.945	95	2400	800
Turmeric	3.889	87	1150	933
Golden Seal	3.445	60	2000	1383
Ginger	3.500	124	2700	733
Alligator Pepper	3.556	59	967	1017
LSD(0.05)	0.4420n.s	110.8n.s	2813.9n.s	699.0n.s
Loangat	3.500	64	2380	1113
Riyom	3.833	106	1307	833
LSD(0.05)	0.2795	70.0n.s	1779.7n.s	442.1n.s

of 30 plots with plot size of 4mx3m (12m^2) and planting space of 30cm.

Soil samples were also collected at planting, mid-season and harvest and analyzed for nematode populations. All agronomic inputs including basal rate of fertilizer NPK 15:15:15 were applied and parameters shown in the tables were measured at harvest at five months after planting. In addition the root samples were rated for severity of nematode infection using the rating scale (0-5) shown on Table 1.

RESULTS HIGHLIGHTS IN 2008

There was no significant effects of the treatments on all the growth parameters measured, however 0 (control) tended to have higher growth and yield values than treated plants (Table 2). On the other hand Riyom variety was significantly higher than Loangat for all the growth parameters measured. In addition no significant interaction between variety and treatment for all the parameters measured was obtained.

In table 3, though treatments were not significant, treatments with alligator pepper gave the least damage symptoms. The root-knot severity index for Riyom variety was also significantly higher than that of Loangat.

The nematode population build-up at mid-season was observed to be lowest for plants treated with alligator pepper while control plants tended to have higher damage symptoms.

Table 4: Effect of Pre-Plant Treatment with Nematicidal Plant Extract on Infectivity of Root-Knot Nematodes on Growth and Yield of Livingstone Potato (Rizga) 2009.

Treatment	UnSale Tubwt (g)	UnSale Tubno	TotalTub NetYld (kg)	STCNT4WAP	SALE Tubwt (g)
0 control	176	69.0	0.800	25.50	448
Turmeric	235	82.3	0.900	32.17	541
Golden Seal	174	69.5	0.750	30.00	457
Ginger	174	57.7	0.755	29.67	447
Alligator Pepper	236	87.3	0.600	31.33	378
Furadan	230	99.3	0.817	34.33	517
LSD(0.05)	132.9 n.s	48.80 n.s	0.389 n.s	4.410 *	226.1 n.s
Loangat	247	88.8	0.796	33.50	452
Riyom	161	66.3	0.744	22.50	478
LSD(0.05)	76.7 *	28.18 n.s	0.225 n.s	2.546 *	130.6 n.s

Table 5: Effect of Pre-Plant Treatment with Nematicidal Plant Extract on Infectivity of Root-Knot Nematodes on Growth and Yield of Livingstone Potato (Rizga) 2009.

Treatment	Sale TubNo.	PltHIG 8WAP (cm)	LeafNo 8WAP	Harstcnt	BranchNo 8WAP
0 control	61.7	28.3	113.3	7.50	10.67
Turmeric	57.8	33.0	107.2	8.83	10.33
Golden Seal	69.2	30.5	101.5	8.33	9.00
Ginger	64.7	27.5	110.2	8.83	12.00
Alligator Pepper	59.7	30.7	116.5	7.83	12.50
Furadan	72.3	32.2	106.2	10.50	8.67
LSD(0.05)	31.39 n.s	8.09 n.s	36.82 n.s	2.763 n.s	4.194 n.s
Loangat	63.4	35.5	110.9	8.83	10.22
Riyom	65.1	25.2	107.3	8.44	10.83
LSD(0.05)	18.12 n.s	4.67 *	21.26 n.s	1.595 n.s	2.422 n.s
LSD (VTY x Biopes 0.05)	44.39 n.s	11.45 n.s	52.07 n.s	3.907 n.s	5.931 n.s

Table 6: Effect of Pre-Plant Treatment with Nematicidal Plant Extract on Infectivity of Meloidogyne spp and Damage Symptoms on Livingstone Potato (Rizga) 2009.

Treatment	FINEMSO POP	GALL NO.	NO. Eggs	RKNIND
0 control	433	215.3	2533	5.000
Turmeric	617	207.5	2967	5.000
Golden Seal	850	185.8	1650	4.833
Ginger	1000	212.0	1150	5.000
Alligator Pepper	550	245.0	2167	5.000
Furadan	650	229.5	1550	5.000
LSD(0.05)	584.8 n.s	62.46 n.s	2094.0 n.s	0.1996 n.s
Loangat	756	204.7	1811	4.944
Riyom	611	227.1	2194	5.000
LSD(0.05)	337.6 n.s	36.06 n.s	1208.9 n.s	0.1152 n.s
LSD (VTY x Biopes 0.05)	827.1 n.s	88.33 n.s	2961.3 n.s	0.2822 n.s

RESULTS HIGHLIGHTS IN 2009

There were significant effects (Table 4) of the treatments used on some growth parameters like stand count at 4 Weeks After Planting with Tumeric showing comparable high values for growth to the indicator treatment Furadan and all the treatments had higher stand count than the control. In Table 5, the stand count at harvest though not

significant showed the same trend where Tumeric had comparable values with Furadan indicator while control – no-pre-plant extract treatment had the least value. As seen from Table 6, treatments were not again significant on the damage symptoms; however treatments with golden seal, ginger and alligator pepper had lower values when their roots were destructively sampled for eggs.

CONCLUSION

It therefore does appear that these plant extracts are promising nematicidal plants for nematode control. They will be incorporated with few other nematicidal plants for further pest management studies.

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