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Effect of Soil Amendment with Rice Husks And Cow Dung on the Incidence and Severity of Pythium Damping- Off of "Egusi" Melon (*Colocynthis Vulgaris* (L) Kantz) in the Savanna Agroecologies of Nigeria.

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ABSTRACT

Experiments were conducted in green-house for 2 years to study the effects of organic manure amendments on the incidence of Pythium damping-off of melon. Pasturized soil in plastic pots was infected with cultures of *Pythium aphanidermatum* and mixed with rice husks and cow dungs respectively. The organic amendments added to the soil were allowed to decompose for 0, 5, 10, 15, and 20 days before planting melon seeds, while the control experiment was *Pythium* -infected soil without amendments. *Pythium* damping-off was less severe in the seedlings raised under rice husk and cow dung amendments. Increase in days of decomposition before planting also influenced significantly the effect of rice husk and cow dung compost on the incidence and severity of the disease. The number of developed leaves of melon seedlings was highest in soil with seeds sown 20 days after amendment with compost. Melon seedlings in the control without compost amendment collapsed 7 days after germination.

KEY WORDS: *Pythium aphanidermatum*, Soil amendment, Melon, Damping off

INTRODUCTION

"Egusi" Melon (*Colocynthis vulgaris* (L) kantz) belongs to the family *Cucurbitaceae (*Ikereogu, 1984, Adeyemi, 1991) and it is closely related to *Colocynthis citrulus*. It is a native of West Africa and distributed throughout the Mediterranean and the Tropics (Tindal, 1993). Melon (egusi) appears to be the least studied tropical vegetable in agricultural research. These low research attentions given to this crop may be because melon is closely linked with traditional inter-cropping systems that have only been investigated in Nigeria recently (Ikereogu, 1984, Adeyemi, 1991). Melon is a creeping annual plant, which possess hairy stems deeply divided and triangular-shaped leaves and small yellow flowers. The large circular fruit has small flat seeds embedded in white flesh. According to IITA (Anon, 1984) egusi melon is a short season crop and is therefore always planted at the on-set of rains or towards the end of seasonal rains. Fruits can be harvested after 80-100 days and are later cut to allow softening of the pulp and extraction of the seeds.

Shelled melon seed is a popular foodstuff in Nigeria, Ghana, Zaire and many parts of Africa. In Nigeria over 360,000 hectares were grown with egusi melon during the 1980-81 growing season (Ikeorgu, 1984). Little is known about the productive potentials of egusi melon grown sole or inter-cropped. Dehulled melon seeds are indispensable condiments in most of Nigerian vegetable soups. The ground seeds are used for preparing the popular 'egusi' soup and melon ball snacks (Oyenuga, 1968). The whole seeds may also be fermented into a smelly food condiment called 'ogiri' (Odunfa, 1981), while in some parts of southern Nigeria, ground melon seed are mixed with a ground fungus (*Pleurotus tuberregium*) and moulded into a stabilized meat substitute (Nwokolo and Sim, 1987). In traditional medicine egusi leaves are believed to possess some therapeutical properties and are commonly used for this purpose in south-eastern Nigeria (Adeyemi, 1991). The seeds contain on a dry basis 55% oil, 28% crude protein, (Abaelu *et al* .,1979), 5% carbohydrates and vitamins like A, B complex (riboflavin and nicotianamides) and Vitamin C (Ascorbic acid) (Tindall, 1975, Abaelu *et al* .,1979).

The egusi melon production in Nigeria is seriously affected by many fungal diseases which include root rot diseases, pre and post emergence damping-off (wet-rot) caused primarily by *Pythium species*, Powdery mildews caused by *Pseudoperenospora cubensis*, and anthracnose caused by *Collectotrichum lagenarium* (Onwueme and Sinha, 1991; Amusa and Bayewu, 1999). *Pythium* damping off is a very serious seedling disease of melon in the Sudan and Northern guinea savanna agro ecologies of Nigeria. Symptoms of the disease on the field include stunting and the production of small yellowish leaves, wilting and finally death of the whole plant. Roots of the affected plant appear water- soaked and flaccid, and at times the crowns of the plant often become girdled. Several methods have been adopted for controlling diseases of melon including *Pythium* damping-off. Such methods include the use of fungicides, planting of resistant varieties, sanitation and farm hygiene (Tindal, 1975, Peregrine and Ahmed, 1983; Amusa and Bayewu, 1999). However farmers do not apply any costly disease control methods in melon production in Nigeria.

Although chemical control is still widely used for reducing plant pests, there is considerable public pressure to limit or even ban their use because chemicals are expensive and are limited to few cash crops in most developing countries (Beckman, 1997). Although pesticides reduce crop losses, pesticide use has often led to increased and incessant pest outbreaks and additional crop losses because of the inadvertent destruction of natural enemies of the pests and the emergence of pest resistance and secondary pests (Yudelman *et al*., 1998). The hazard in the use of pesticides on human health appears highest in developing countries where farmers use a high proportion of the older pesticides that have long been banned in developed countries, but are still sold in large volume in developing nations.

The use of farmyard manure in maintaining soil fertility and productivity is a well known agricultural practice in the West African savanna zone in general (Heathcote, 1970). Organic farmers often use composts as soil amendments, particularly in intensive vegetable production systems, to improve soil fertility and quality and sustain productivity (Dic and McCoy, 1993; Maynard, 1994). Compost improves biological, chemical, and physical properties of amended soils (Epstein *et al*., 1976; Khaleel *et al*., 1981). Furthermore, composts incorporated into cultivated soil or potted soils can provide effective biological control of diseases caused by soil

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borne plant pathogens (Gamliel and Stapleton, 1993; Muhammad *et al.*, 2001; Abbasi *et al.*, 2002). The incidence of seedling blight diseases of *Pakia biglobosa* was reduced in seedlings raised in soils with sawdust or rice husk amendments (Mohammed *et al.*, 2001). The objective of this study was to determine the effects of rice-husk and cow dung composts on the incidence and severity of *Pythium* damping-off of melon.

MATERIALS AND METHODS

Melon plants showing symptoms of damping off disease were obtained from the teaching and research farm of the Faculty of Agriculture Usmanu Danfodiyo University, Sokoto. *Pythium aphanidermatum* (EDSON). Fitz. was found associated with these diseased melon plants. Several small tissue sections 1-3 mm square were cut from the margins of the lesions from plants and surface disinfected in absolute alcohol for 15-30 seconds. The sections were then rinsed in three successive changes of sterile distilled water, blotted dry on clean sterile paper towels and plated on potato dextrose agar (PDA) in petri dishes.

The tissues were incubated at 25°C 1°C for 4 days. The isolated pathogen was identified using cultural and morphological features. The isolate was also confirmed by comparing with a reference culture which had been identified by the International Mycological Institute, CABI Bioscience, Egham, UK obtained from the International institute of Tropical Agriculture (IITA), Ibadan, Nigeria,

Thirty six one-liter bottom perforated plastic buckets were each filled with 5 kg pasteurized soil and arranged on a bench in green-house at the Biological garden, Usmanu Danfodiyo University, Sokoto. Six culture plates of the pathogen maintained on PDA were homogenized with 50 ml sterile water in a blender and the suspension mixed thoroughly to 2.5 cm -3.5 cm soil depth in each bucket to make 2.5×10^{6} (cfu)/g. The buckets containing the infested soils were arranged in 2 lots. The soil in each lot was amended by mixing thoroughly with 100 g rice-husks or cow dung composts (table 1) respectively and watered with 250 ml daily and allowed to decay for 0, 5, 10, 15, 20 days, respectively, before planting the melon seeds. The composition of the composts is as follows rice-husks 16.4g/kgN, 9.0 mg/kg P, 21.3 mol/kg K, Cow dung: 22.1g/kgN, 10.6 mol/kg P, 26.5 mol/kg K. There were additional replicates of soil that were inoculated with the pathogen but without any amendment to serve as control. Five seeds were planted per bucket and 25 buckets represented each treatment. Each treatment was replicated 3 times. The seedlings were examined for damping off symptoms at interval of 7, 15 and 30 days after planting both in the treatment and the control.

A completely randomized design with three replications of five treatment of each of the amendments viz. 0, 5, 10, 15 and 20-days and a control was used. The dependent variables were percentage infected seedlings, average number of leaves and average height of the seedlings taken at 7, 15 and 30 days after planting.

Disease incidence was based on the percentage of infected melon plants per treatments, while the severity of the disease was based on level of infection and classified as follows 1=no symptoms of infection; 2= less than 25% of the leaves were infected; 3= between 26 and 50% of the leaves of the plant is affected by the disease; 4=between 51 and 75% of the leaves of the plant is affected with the symptoms of the disease, while 5= over 75% of the plant is affected, accompanied with wilting and death of the seedling. The experiment was conducted in year 2000 and repeated in 2001.

The Statistical Analysis Software (SAS institute Inc., Cary, NC) was used for conducting analysis of variance (ANOVA) on the data while the means separation was by Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The results obtained showed that suppression of damping-off in melon caused by *Pythium aphanidermatum* was enhanced by increasing the composting time (Table 1). There were significant differences in number of leaves at 7th day after germination; and in height of the seedlings at 7th and 15th day after germination at different compost ages in comparison with the control (Table 1).

Table 1. The effects of soil amendment with organic wastes on the incidence of *Pythium* damping –off caused by *Pythium aphanidermatum* and the growth of melon.

Level of Amendment (Organic wastes)	Level of Treatments (Days)	Percentage incidence of seedling blight			Average number of compound leaves			Average height of the seedlings		
		Days after germination (DAG)								
		7	15	30	7	15	30	7	15	30
	Control	75a	80a	83a	6c	8d	12d	6d	9d	12c
Cattle manure	0 day	71b	69b	65b	6c	8d	12d	7d	11aa	14d
Cattle manure	5 days	67c	54b	50c	7c	10c	13dc	10c	13b	16c
Cattle manure	10 days	49d	41c	37d	9b	12b	15bc	10c	15cb	19bc
Cattle manure	15 days	33e	29d	25e	11a	13b	17b	12b	19b	22b
Cattle manure	20 days	20f	18e	16f	12a	15a	20a	14a	21a	25a
	Control	75a	81a	85a	5d	7d	11d	6c	10c	11c
Rice husk	0 day	72b	68b	64b	7c	8d	10c	8bc	13d	13d
Rice husk	5 days	62c	54c	53c	8c	12b	15d	8bc	12d	15c
Rice husk	10 days	45c	42d	40d	11b	12b	18b	9b	15d	18b
Rice husk	15 days	32e	29e	28e	13b	14a	21a	11a	16b	20c
Rice husk	20 days	22e	19f	18f	14a	15a	21a	12a	18a	23d

Means followed by the same letters are not significantly different at 5% level probability according to Duncan Multiple Range Test.

The amended soil with incubation period of 20 days before planting, reduced the incidence of *Pythium* damping off from 85% and 80% in controls to 17% and 15%, respectively, at 30 days after planting (DAP). It was also observed that the mean severity of *Pythium*-damping off-disease of melon was reduced from about 4.5 in controls to 2.4 and 2.6 in cow dung and rice husk amended soils respectively (Figure 1). It has also been reported that the incidence of anthracnose fruit rot was reduced in organic tomatoes harvested from plots amended with a high rate of cannery waste compost compared with non-amended control (Abbasi *et al.*, 2002). Alvarz *et al.*, (1995) reported that compost amendment increased the activities of bio-control agents in the rhizosphere of tomato plants and reduced the severity of diseases caused by soil borne plant pathogens of this crop.

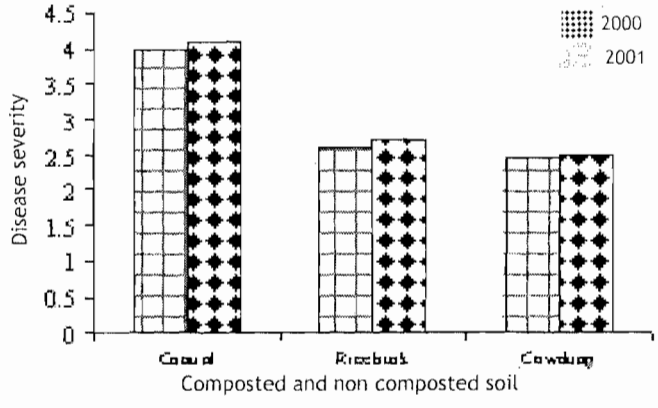

Fig 1: Effect of organic manure on severity of pythium wet rot of melon

The results obtained in the present study imply that an increase in time of decomposition of the compost in the composted soil before planting enhanced suppression of the *Pythium* damping-off of melon (Figure. 2). The natural organic

manures in the form of rice-husks and cowdung probably contain microbes, which are likely to produce antibiotics that have suppressive effects on the activities of the pathogen (Hadar *et al.*, 1984). Chitin at 5% resulted in maximum inhibition of *Fusarium spp* by 80-90% after 4 weeks of amendment (Gupta, 1986). Compost has been found to be more beneficial if it is adequately stabilized before its utilization (Chen and Ibar, 1993).

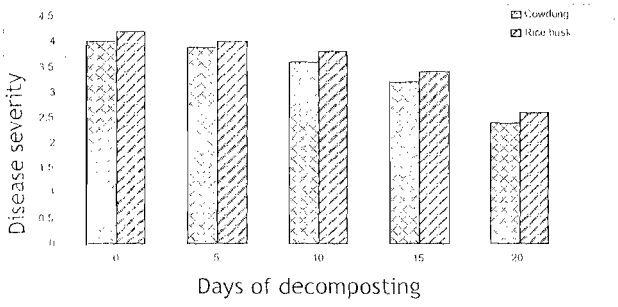

Fig 2: Effect of time of decomposting on the severity of pythium damping-off of melon

Suppression of *Pythium* damping-off in melon using soil amendments with rice husk and cow dung was possibly due to the activity of microorganisms promoted by the amendments. This explanation is supported by the report that compost incorporated into soil improved the effective biological control of diseases caused by soil borne plant pathogens (Dick and McCoy, 1993, Gamliel and Stapleton, 1993, Hoitink, *et al.*, 1993, Muhammad *et al.*, 2001). It was also reported that soil antibiosis increased through competition for available nutrients and oxygen by the large microbial population enhanced by manure (Barakat, Mohamed and Habib 1986). Soil amendment with cassava peel wastes was reported to be effective in control of *Pythium* wet-rot of tomato in Sokoto (Muhammad and Manga, 1997).

Average number of compound leaves (ANCL) developed was also found to increase significantly in the amended soil. The largest ANCL of 24 and the maximum seedling length of 24cm were recorded in a 20 day composted soil, and at 30 DAP (Table 1). It was observed that melon plants in the soil-amended experiments in both years were bigger and greener than in control, with the most favorable effect observed on the amended soil allowed to decay for 20 days before planting. Compost amendment might have contributed to increase in growth by improving the water holding capacity of soil and allowing faster plant establishment. However, plant growth-promoting micro-organisms and bio-control agents have been reported to be stimulated in the rhizospshere by compost amendment (Alverez *et al.*, 1995). Organic manure is known to add nutrients to the soil thereby increasing the soil fertility and thus increasing the vigor of the plants growing in it and also making the plant less prone to infection by pathogens. According to Chen and Ibar (1993), compost amendment improves drainage and water retention of amended soils and release of essential nutrients during the growing season at rates required for crop intake if appropriate amendment rates are utilized. Adebayo (1986) also reported that cow dung manure led to highest nodule dry mass production and highest N fixation in a local cowpea variety *Vigna unguiculata* v Ife Brown compared with household and poultry manure. Planting 20 days after decomposition of composts in the composted soil produced the largest number of ANCL and also the maximum seedling length because the compost might have been adequately stabilized. The beneficial effects of composts to plant growth only occur consistently if the composts have been stabilized adequately before their utilization because inadequately stabilized compost can be phototoxic and therefore inhibit plant growth (Chen and Ibar, 1993).

The results obtained in this study showed that *Pythium* damping-off of melon in greenhouses can be controlled by properly applied soil amendments. It is envisaged that, if the technology is applied in the field it may become sustainable method of controlling soil borne disease of melon as already demonstrated for tomatoes (Abbasi *et al*, 2002), cucumber (Stone *et al.*, 2001), lettuce (Gamliel and Stapleton, 1993) and vegetable (Maynard, 1994) both in green-house experiments and on the field. Cow-dung and rice husks wastes, are abundant in many developing countries of the world with resources-poor agriculture, hence these organic wastes could serve as affordable alternatives to pesticides in addition to their use as organic fertilizers.

CONCLUSIONS

From the results obtained, it can be concluded soil amendment with rice husks and cow dung allowed to decompost for 20 days prior to planting reduced consistently the incidence and severity of *Pythium* damping- off and increased leaf production and the seedling height of melon.

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