Nigerian Journal of Basic and Applied Sciences vol. 16 No. 2 December 2008 203 - 206

Amelioration of Purple Blotch Disease in Onion (*Allium cepa* L.) Seedlings with Organic Soil Amendments

***[1]K. Shehu, [1]H.A Suberu and [2]M.D. Magaji**
Department of Biological Sciences Usmanu Danfodiyo University, Sokoto
°Department of Crop Science Usmanu Danfodiyo University, Sokoto.

ABSTRACT: Pot experiments with transplanted onion seedlings were evaluated for management of purple blotch disease. Sets of 100,150 and 200g of poultry droppings, cattle dung, neem leaves, rice husk and a mixture of rice husk and poultry droppings (1:1) were incorporated per kilogram of soil. Spore suspension of *Alternaria porr*i ($5x10^5$) was also applied to the rhizosphere of the onion seedlings. Common symptoms of purple blotch (elliptical purple lesions, wilting and defoliation) were assessed. Poultry dropping amendment was most effective; reducing lesions to 15± 3.6% from 85± 2.6%, wilting reduced to 20± 4.0% from 70± 3.0% and defoliation to zero from 60± 3.5%. The amendments, especially at the concentration of 150 and 200g/kg soil reduced symptoms severity compared to control. Onion farming should be complemented with application of degradable organic materials, especally poultry droppings and cattle dung, to reduce the incidence and severity of purple blotch disease.

INTRODUCTION

Purple blotch, induced by *Alternaria porri* Ell. [Ciferri], is an important disease of onion worldwide and is more prevalent in warm, humid environments. The disease is a major constraint to onion production in Nigeria with a yield loss ranging from 25 – 40% annually (Yar'adua, 2003; Abubakar *et al*., 2006). The pathogen is soil borne and its inoculum can remain viable in the soil for many years (Yar'adua, 2003). Although resistance of onion to this pathogen has been reported, there are currently no commercially available resistant cultivars in Nigeria (Abubakar *et al*., 2006). The use of chemical fungicides such as benomyl, chlorothalonil, and Mancozeb as soil drenches was reported to be effective in managing purple blotch (Suheri and Price, 2001). However, fungicide drenches, are not widely practiced by small farm holders, typical of onion farmers in Nigeria, since they are relatively expensive and are not readily available to the farmers. The development of resistance of chemical fungicides by some plant pathogens, environmental degradation potential and deleterious effects on beneficial microbes have also caused considerable difficulties in the continuous use of the chemicals.

In recent years some control strategies have employed composted organic amendments in disease suppression (Muhammad *et al*., 2001). The ccommon control measure for purple blotch disease of onion in Nigeria involves rogueing of infected onion plants to reduce the survival of the pathogen in infected onion debris in the soil. This control strategy is, however, labour intensive and often not effective particularly during the rainy season which favours disease development.

Organic materials such as animal manures and plant residues are conventionally used as soil amendments to improve soil fertility. Soil amendments provide adequate nutrients to the plants which improve growth and reduce their predisposal to soil borne diseases (Coventry *et al*., 2002).The application of organic amendments to soil is emerging as an economically and environmentally acceptable alternative to disposal through landfill and incineration because of agronomic benefits associated with their use. Increasing plant productivity associated with fertilization is likely to increase the amount of carbon added to the soil, thereby increasing microbial growth and activity. Such effects however, are likely to affect plant health through their influence on soil microbial population and interactions with plants. Organic matter application can also have a direct stimulatory effect on the microbial community in particular the saprophytes. Although the use of organic amendments for the management of plant diseases has met with some success, levels of disease

control have not been consistent or predictable. Not only do amendments from different materials vary in disease suppression but those from different batches of the same material are also variable (Flores *et al*., 2006). This variability is poorly understood because of the poor understanding of the mechanisms by which composted amendments suppressed plant diseases.

The study was carried out to evaluate the efficacy of poultry droppings, cattle dung, rice husk and neem leaves used as soil amendments for their influence in the control of purple blotch disease of onion.

MATERIALS AND METHODS

Preparation of soil amendments & inoculation.

Two kilogram of autoclaved soil was bulked with either 100, 150or 200g powder, of either poultry droppings, cattle dung, rice husk, neem leaves, and mixture (1:1) of rice husk and poultry droppings per polypot (20cm x 30cm). Amended soil was allowed to stand for five days. Then, one week old five onion seedlings (cultivar "Gindin Tasa") were transplanted into each polypot. Twenty four hours after transplanting, the rhizosphere of these seedlings was innoculated with 20ml spore suspension of *A. porri* containing $5x10^5$ spores/ml. Four replications were prepared for each amendment. A polypot with five seedlings of unamended soil but inoculated with the spore suspension served as control. The seedlings were observed and evaluated for symptoms of purple blotch: purple elliptical lesions, wilting and defoliation six weeks after amendment. The number of onion plants showing characteristic symptoms of purple blotch in each amendment was divided by the total number of plants in the treatment to determine the influence of amendment on the disease development.The data was expressed as percentage of the total number of plants per treatment following the method of Coventry *et al.*(2002). Data were analysed using an analysis of variance procedure (ANOVA). Tukey Kramer Multiple Comparisons Tests were employed for the seperation of treatment means where necessary.

RESULTS

Elliptical Purple Lesions in the Onion Seedlings.

All the amendments significantly ($p>0.05$) reduced the elliptical purple lesions in the onion leaves. Poultry droppings were found to reduce significantly ($p>0.05$) the elliptical purple blotch lesions from 85% in the control to 60, 20 and 15% at 100, 150 and 200g/kg soil respectively (Table 1).

Table 1: Effect of soil amendments on elliptical purple lesions on onion seedlings infected with *A. porri*

Amendments	Concentration (g/kg)	Purple lesions (%)
Control	0	85 ± 2.6^{a}
Poultry droppings	100	60 ± 2.0^{e}
,,	150	20 ± 2.0^{j}
,,	200	15 ± 3.6^{k}
Cattle dung	100	75 ± 2.0^{c}
,,	150	51.5 ± 2.3^{g}
,,	200	40 ± 2.6^{i}
Rice husk	100	80 ± 7.0^{b}
,,	150	60 ± 2.0^{e}
,,	200	50 ± 7.0^{g}
Rice husk – Poultry droppings	100	80 ± 5.0^{b}
,,	150	55.5 ± 2.5^{f}
,,	200	45 ± 2.6^{h}
Neem leaves	100	85 ± 1.0^{a}
,,	150	65 ± 2.0^{d}
,,	200	50 ± 4.0^{g}

Values are mean ± standard deviation (n = 3). Means with the same letters are not significantly different ($P > 0.05$) according to Tukey Kramer Multiple Comparisons, using Graph Pad Instat Software (San Diego USA).

The lesions were higher in the corresponding treatments with Cattle dung, Rice husk, Neem leaves and mixture of Rice husk and Poultry droppings. The percentage of purple lesions in soil amended with Neem leaves at 100g/kg (85%) did not differ ($p<0.05$) from the unamended (85%). Similarly, the number of the lesions in Cattle dung and Rice husk – Poultry droppings amended treatments did not differ significantly at 150g/kg. There was a consistent decrease in purple blotch

lesions as the concentration of the amendments increased. Poultry droppings and Cattle dung were found to be more suppressive to purple blotch lesions than Neem leaves, which showed the least suppressive effect. The decrease in purple blotch lesions ranged from 15±3 to 50±4 at 200g/kg of Poultry droppings and Neem leaves respectively.

Wilting in the Onion Seedlings.

The effect of organic soil amendments on wilting of purple blotch infected onion plants is shown in (Table 2).

Table 2: Effect of soil amendments on Wilting of onion seedlings infected with *A. porri.*

Amendments	Concentration (g/kg)	Wilting (%)
Control	0	70 ± 3.0^{a}
Poultry droppings	100	40 ± 2.0^{d}
,,	150	25 ± 4.4^{e}
,,	200	20 ± 4.0^{f}
Cattle dung	100	57 ± 1.7^{b}
,,	150	50 ± 5.3^{c}
,,	200	43 ± 2.0^{d}
Rice husk	100	55 ± 1.0^{b}
,,	150	55 ± 3.0^{b}
,,	200	40 ± 6.1^{d}
Rice husk – Poultry droppings	100	$55 \pm 1.7_{b}$
,,	150	52 ± 3.0^{c}
,,	200	51.7 ± 4.2^{c}
Neem leaves	100	58 ± 3.0^{b}
,,	150	50 ± 2.0^{c}
,,	200	50 ± 2.6^{c}

Values are mean ± standard deviation (n = 3). Means with the same letters are not significantly different (P > 0.05) according to Tukey Kramer Multiple Comparisons, using Graph Pad Instat Software (San Diego USA).

The result indicated that onion plants grown in soil amended with increasing amounts (100, 150 and 200g/kg soil) of Poultry droppings were less susceptible to wilting as a result of purple blotch infection caused by *A. porri* compared with those grown in non amended soil (control). Plant grown in soil amended with poultry droppings had significantly lower levels of wilting than plants grown in soil amended with other materials at the concentration (100, 150 and 200g/kg soil) which were less wilted compared with the control. The maximum percentage of wilted plants was obtained in Neem leaves amended soil (58%) at 100 g/kg soil. Wilting was observed to decrease with increasing concentration of the amendments. Higher dosage (200g/kg) was most effective than lower doses (150 and 100 g/kg).

Defoliation in Onion Seedlings.

Application of varying levels of the amendments significantly ($p < 0.05$) reduced defoliation in the purple blotch infected plants. The highest percentage defoliation was recorded in Neem leaf – amended soil (50, 40 and 40% at 100, 150 and 200g/kg soil respectively). Percentage defoliation in Neem leaf, Cattle dung and Rice husk – Poultry droppings did not differ significantly from each other at 100 and 150g/kg soil concentrations. However, there was a significant difference in leaf defoliation between neem leaf (40%) and rice husk – poultry droppings (30%) at the concentration of 200g/kg soil, indicating that application of a mixture of rice husk and poultry droppings to the soil was more effective in reducing leaf defoliation than neem leaf. A higher dosage of the amendments (200g/kg soil) was found to be more effective in suppressing leaf defoliation than lower dosages (100 and 150g/kg soil) in all the amendments (Table 3).

DISCUSSION

Purple blotch symptoms were significantly reduced in onions seedlings grown in soil amended with the selected organic materials. The reduction of the severity of the symptoms was consistent with increase in quantity of the organic material incorporated with the soil. It is either that, the particular amendment affected the pathogen directly, or it supported the development of secondary microflora that had the ability to antagonise or compete with the pathogen. Stimulation of antagonistic micro organisms by soil amendments or induced defense reaction in the host plant tissue has been reported (Flores *et al.,* 2006; Coventry *et al*. 2002). Saw dust and rice husk amendments were reported to reduce incidence of seedling blight of *Tamarindus indica* (Muhammad *et al.,* 2001). Sharifi *et al.* (2006) demonstrated that microorganisms present in the composted organic matter were responsible for suppression of the plant pathogens.

The fact that poultry droppings was the most effective in the amelioration of purple blotch symptoms may be a result of toxocity and or acidity that affected the survival of *Alternaria porri* (Edriss *et.al.*, 2006). The percentage of onion plants infected with purple blotch disease was significanyly ($p > 0.05$) lower in onion seedlings grown in amended soil. Although, the absolute levels and consistency with which these amendments supressed purple blotch varied, in general,poultry droppings and cattle dung were found to be the most effective. The application of degradable organic materials, especially poultry droppings and cattle dung; will reduce considerably the incidence of purple blotch disease and hence improved yield of the crop.

Table 3: Effect of amendments on defoliation of purple blotch infected onion seedlings.

Amendments	Concentration (g/kg)	Defoliation (%)
Control	0	60 ± 3.5^{a}
Poultry droppings	100	30 ± 4.0^{e}
,,	150	20 ± 3.0^{f}
,,	200	0.0 ± 0.0^{g}
Cattle dung	100	40 ± 2.0^{d}
,,	150	40 ± 3.6^{d}
,,	200	30 ± 5.3^{e}
Rice husk	100	50 ± 2.0^{b}
,,	150	45 ± 1.7^{c}
,,	200	40 ± 3.0^{d}
Rice husk – Poultry droppings	100	46 ± 2.0^{c}
,,	150	40 ± 2.0^{d}
,,	200	30 ± 6.0^{e}
Neem leaves	100	50 ± 3.0^{b}
,,	150	40 ± 5.3^{d}
,,	200	40 ± 3.1^{d}

Values are mean ± standard deviation (n = 3). Means with the same letters are not significantly different ($P > 0.05$) according to Tukey Kramer Multiple Comparisons, using Graph Pad Instat Software (San Diego USA).

REFERENCES

Abubakar, L., Ado, S.G., Suberu, H.A. and Magaji, M.D. (2006). Screening of onion cultivars for Resistance to Purple blotch (*Alternaria porri L.*) Disease. Biological and Environmental. *Journal for the Tropics* **3(3):** 30 – 36.

Coventry, E., Noble, R., Mead, A., and Whipp, J.M. (2002). Control of Allium White rot (*Sclerotium cepivorum)* with composted onion waste *Soil Biology and Biochemistry* **34 (7):** 1037-1045.

Edriss, B., Mohammed, Z., Javad, B., and Anoushirvan, M.B. (2006). Evaluation of microbiological and chemical parameters during waste water sludge and saw dust co - composting. *Jour. Appl. Environ. Mgt.*10 **(12):** 115-119

Flores, M.,E, Montes, R. B., Jimenez, A. P. and Nava, R. J. (2006). Pathogenic diversity of *Sclerotium rolfsii* isolates from Mexico and potential control of southern blight through solarization and organic amendments. *Crop protection* **25 (3):** 195 - 199.

Muhammad, S., Suberu, H .A., Amusa, N .A., and Magaji, M. D. (2001). The effect of soil amendments with sawdust and rice husk on the growth and incidence of seedling blight of *Tamarindus indica* caused by *Macrophomina phaseolina* and *Rhizoctonia solani Moor J. Agric. Res*. **2(1):** 40-46.

Sharifi, T. A., Saberi, R. R. and Heidarian, R. (2006). Antagonistic effects of several bacteria on *Fusarium oxysporum*, the causal agent of root and crown rot of onion under field conditions *Commun. Agric Appl. Biol, Sci*, **69 (4):** 657-661.

Suheri, H. and Price, T.V. (2001). The Epidemiology of purple blotch on leeks in Victoria, Australia. *European Journal of plant Pathology*. **107:** 503 – 510.

Yar'adua, A.A. (2003). Some studies on epidemiology of purple blotch of onion (*Allium cepa* L.) in Zaria, Nigeria. *Danmasani* **1(6,7,8):** 98 -106.