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Impact of soil treatments in the management of wilt disease of water melon (*Citrullus lanatus*) in humid South Eastern Nigeria

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A field experiment was conducted in the University teaching and train field of Michael Okpara University farm to determine the effect of some soil treatments on wilt disease and to investigate the productivity of *Citrillus lanatus* under different soil amendments. The experiment was laid out in a randomized complete block design (RCBD) with six (oil palm bunch ash, saw dust ash, kitchen wood ash, termite mound, control and poultry dropping) with three replicates. The results obtained showed that all the amendments exhibited positive anti pathogenic effect against wilt disease of *Citrullus lanatus*. Among the treatments found effective, include poultry droppings which had the best performance on most parameters tested and significantly at (P≤ 0.05) and produced the highest number of leaves (46.37), had the highest number of branches (2.58). However, in terms of disease incidence, oil palm bunch ash, saw dust ash, kitchen wood ash (16.70) recorded the least followed by termite mount, poultry droppings(22.2) while data on disease severity saw dust ash and kitchen ash (1.00) have the least. Based on the result of this trial and considering the potency of these organic amendments attention should be paid the use of organic soil treatments by farmers, such as with poultry droppings, kitchen ash, saw dust ash or with oil palm bunch ash for combine aims of wilt disease management and for improved production of *Citrillus lanatus.*

Key words: Wilt disease, organic amendments, botanicals, bacterial pathogen.

INTRODUCTION

Watermelon (*Citrullus lanatus)* is one of the world most important vegetables, as the crop is cultivated both for its fruit and the vegetative parts (Schippers, 2000; Roshan Regmi *et al*., 2014) which are highly nutritious. While some workers indicate that watermelon do not have a large fertilizer requirements and that the crop can be grown with little or no fertilizer after heavily fertilized crops or on fertile lands (Waller, 1990).), other authors have reported the crop to be a heavy feeder of nitrogen and therefore requires a liberal application of 200kg/ha, NPK fertilizer, which needs to be applied two weeks before sowing, and to be followed by an application of nitrogenous fertilizer at 5 weeks interval up to flowering (Rice *et al*., 1994). Hill and Walter, 1999).

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This requirement can also be adequately be met by using organic amendments as they are the most important sources of nitrogen. Considering the fact extensive use of inorganic fertilizer has a depressing effect on yield which experts say causes reduction in number of fruits, delays and reduces fruit setting, which subsequently delays ripening, and leads to heavy vegetative growth (Evanylo *et al*., 2007).

Studies carried out in Nigeria and elsewhere confirmed organic amendments such as poultry manure were effective as effective as nutrient sources for increasing yield and nutrient status of crops such as maize, amaranth, sorghum and pepper (Waller, 1990). The recent interest in organic mineral fertilizers arose from high cost and scarcity of inorganic fertilizers, the huge amount of organic fertilizers Researcher, 201. For crop production, and handling problems (Bates and Robinson (1995). Mary (2002) has advocated an integral use of organic manure and inorganic fertilizers for the supply of adequate quantities of plant nutrient required to sustain maximum crop productivity and profitability while minimizing environmental impact from nutrient use. Organo-mineral fertilizer is a low input technology of improving the nutrient status of tropical soils for sustainable crop production. They combine the attributes of both organic and inorganic fertilizers (Zitter, 1985).). Although the ability of organic manures and organo-mineral fertilizers to compete favourably with chemical fertilizers have no doubt been established for an array of tropical crops, it is still highly imperative to test their efficacies in deep nitrogen feeder crops like watermelon.

Fusarium is one of the fungal general that produces mycotoxins. Fungi belonging to species *fusarium oxysporum* are distributed worldwide. All of the *Fusarium* wilt pathogens are soil-borne and specific to their host. They are weather organisms (Roshan Regmi *et al*., 2014). Symptoms may appear to be more severe when soils are acidic and poorly fertilized and high temperature. The restricted water in the plant brought about by the damage done to the conducting vessels (Miller *et al.,*1996).

The main aim this paper is To evaluate the impact of organic soil treatments on wilt infested water melon (*Citrullus lanatus)* field.

Diseases of Watermelon

A plant is said to wilt if its leaves and branches become limp due to water deficiency. Wilting can be pathological or physiological. It is pathological when it is caused by a plant pathogenic organisms such as bacteria, fungi, nematodes and physiological when it is caused by drought (Louter and Wukasch,2003). Wilt is a symptom created with water stress (Robert *et al.,*2004).

Wilt can also be caused by high molecular-weight polysaccharides restricting the flow of xylem sap on endplates and lateral pits of xylem vessel cells(Robert *et al.,2004).*

Fusarium wilts of cucurbits crops is caused by different types of the fungus *Fusarium oxysporum* (Miller *et al.,*1996). These are *F. oxysporum, f.sp lycopesici,(tomato), F.oxysporum F. sp melongenenae (egg plant), F. oxysporum F. sp capsici (pepper), F. oxysporum f. sp niveum (watermelon).*

Fusarium is one of the fungal genera that produces myotoxins. Fungi belonging to species *fusarium oxysporum* are distributed worldwide (Youlai *et al.,* 2005). All of the *Fusarium* wilt pathogens are soil-borne and specific to their host. They arm weather organisms (Miller *et al.,*1996). Symptoms may appear to be more severe when soils are acidic and poorly fertilized and high temperature. The restricted water in the plant brought about by the damage done to the conducting vessels (Miller *et al*.,1996).

Control is by use of cultural methods such as Crop protection and organic methods, which is the use of soil amendments.

Bacterial wilt is characterized initially by wilting and drying of individual leaves. Within a day or two the wilting symptoms spread to leaves up and down a runner. The bacteria spread, with collapses eventually. The first or primary symptoms are reorganized by water soaked nature. Since disease is a soil born, the damage in the symptom starts from the roots and branches above wilting o plants and seedling is the main symptoms of the disease. This may be temporarily, during middle of the day or more permanent leading to necrosis, chlorosis and death of plants. In some plants, necrosis and leaf shedding are well prominent than wilting (Hill and Waller, 1999).

Spread occurs as a result of excess water either inform of flooding or too much moisture, which help to carry the passive pathogen to the other parts of the plants. Other means of spread include; rain splash and sand driven wind, which injured the leaves at soft parts of the plants.
The standard control methods adopted so far such as resistance varieties, Crop rotation is very useful at least 3-6 years rotation and Integrated pest management (IPM) and cultural practices may be helpful but not totally effective. However, the use of plant extracts is as traditional protectants of both field and a stored product is an old practice used all over the world. This tradition has been neglected by farmers with the advent of synthetic pesticide by pest had led to search for new classes of pesticide with lower mammalian toxicity and a low persistence in the environment.

Recently, alternative pesticide of plant origin Azadirachtin extracted from *Azadirachta indica* (neem tree) is the most famous of its kind.

Botanicals have been found non-toxic on the environment and highly potent in controlling most plant diseases and pests with no traceable adverse effect on beneficial organism Finney. (1990) showed that pesticides

derived from higher plant are safe to the environment, broad spectrum in activity (Bates and Robinson, 1995).) reported that most promising species for consideration as potential grain protectants belongs to the general *Azadirachta citrus, Xylopia* and *Gongronema latifolum.* This study was undertaken to determine the efficacy of soil amendment treatment in control of Wilt disease of *Citrullus lanatus* and to evaluate its yield response to organic soil treatments (Louter and Wukasch, 2003).

MATERIALS AND METHODS

The experiment was carried out in the Teaching and Research farms of Michael Okpara University of Agriculture, Umudike. The seed that was used for this investigation was obtained from National Agricultural Seed Council, Umudike. The seeds were sown in drills in the field.

The organic manure provides the soil with humus and all the nutrients necessary for plant growth. The humus makes the soil easier to cultivate and increases its permeability and retention capacity for water and nutrients.

The organic manure obtained for this work included; poultry droppings, kitchen wood ash, oil palm bunch ash, saw dust ash and termite mound. However, the poultry droppings will stay a few weeks old before it is used, to make sure it got fermented

Treatment Application of Manure

The plot was treated with six treatments; they are five organic soil treatment and the other one is the control. The organic soil treatments were applied two weeks after planting, and the method used in the application was ring method.

The organic amendments were: kitchen wood ash, Poultry dropping, oil palm, bunch ash, saw dust ash and Termite mound. The poultry droppings were spread on top of the beds at least two weeks before planting and it was thereby incorporate with the soil on top of the ridges, so it has time to decompose. The organic manure was applied four weeks after planting at the base of the crops, it will be covered with the soil. The bed was made after the existing vegetation is cleared with the measurement of 7m, planting depth of about 3cm, planting or sowing space of 1m x 1m apart carried out. Seeds were sown two seeds per stand based on the recommended measurement and spacing.

Weeding of the experimental plot was done manually, by hand hoeing. The first weeding was done two to three weeks after planting, which will be repeated every three to four weeks interval thereafter.

Diseases and pests control was applied by the use crop protection measure such as cultural methods and the use of organic soil treatment. Data were collected on growth and yield parameters based on the following: vine length (cm), number of leaves, stem diameter (cm), number of branches, weight of harvested leaves and fruits (g)

Disease assessments : These were done based on:

(A) Disease severity scale 1-6:

- 1 – No symptom on leaf surface
- 2 – One or a few lesions or spots on leaf surface
- 3 – About 10% spot on leaf surface
- 4 – About 20% spot on leaf surface
- 5 – About 50% spot on leaf surface
- 6 – Above 75% spot on leaf surface

(B) Disease incidence:

Data were collected at one week intervals from the experimental plots, which was randomly selected, tagged and recorded.

The disease incidence of wilt was determined using the formula:

$$\text{Percentage disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plant sampled}} \times \frac{100}{1}$$

The leaves were harvested in a fresh green state, but for the pods will be harvested when the leaves mature at the end of the growing season, approximately three months and above in the field, that is when the leaves and vines turned yellow, (Mary Peet; 2002)

Data on leaf weight per plant collected was based on the 48 plants sampled, 3 plants from each ridge which will be harvested, but different from the other parameters measured i.e. plant height(vine length), stem diameter, and number of branches on the same plot were collected, tagged and recorded as above.

All the data collected was analyzed statistically using analysis of variance (ANOVA), and the means was separated using Fishier's Least Significant Difference (FLSD) at 5% (P= 0.05).

RESULTS AND DISCUSSION

Percentage Diseases Incidence

The influence of soil treatment on disease parameters of C*itrillus lanatus* is presented in the Table 1 as follows;

From the result, it was observed that the treatments differ significantly at 5% probability level. However oil palm bunch ash (16.70%) saw dust ash (16.70%) and kitchen ash (16.70%) have the least disease incidence followed by termite mount and poultry dropping (22.23%) when compared with the control (50.0%).

Disease Severity

The trials showed that the severity of wilt differs significantly with the treatments (5% probability levels), oil palm bunch ash (1.33), saw dust (1.00), kitchen ash (1.00),

termite mount (1.67) and poultry dropping (1.67) differ significantly from the control (3.00) while saw dust ash, kitchen ash (1.00) have the least disease severity followed by oil palm bunch ash (1.333) followed by termite mount and poultry dropping (1.67).

Table 1: Influence of Soil Treatments on Wilt Disease of *Citrullus lanatus*

Treatment	Disease incidence	Disease severity
Oil bunch ash	16.70c	1.33b
Saw dust ash	16.70c	1.00b
Kitchen ash	16.70c	1.00b
Termite mound	22.23b	1.67b
Control	50.00a	3.00a
Poultry dropping	22.23b	1.67b
Lsd	28.73*	1.03*

*= significant at 5%
**= Significant at 1%

Influence of Soil Amendments on Growth Parameters

From the results (Table 2), it was observed that the treatments had no effect on vine length at five week after planting (5 WAP) at 5% for significant level. Number of leaves. The mean values obtained from number of leaves differs among the treatments. Poultry dropping showed highest value of 46.37 while the control showed the least value of 23.23, at 5% significant level.

The mean values obtained from number of branches differs significantly at 1% probability level. However poultry dropping (2.58) had the highest mean while control (1.43) had the least mean value. From the result, it was observed that the treatment differs significantly at 5% probability level. Termite mount (1.27) had the highest mean value while control (0.65) had the least mean value. The mean values obtained from dry matter weight differs significantly at 5% probability level, poultry droppings (32.18) had the highest mean value while control (20.18) had the least mean value.). Among the treatments compared, poultry droppings had the best performance on most parameters tested and significantly at ($P \leq 0.05$); had the highest number of leaves (46.37), had the highest number of branches (2.58). However, oil palm bunch ash, saw dust ash, kitchen ash (16.70) recorded the least disease, followed by termite mount, poultry droppings (22.2).

Table 2: Influence of Soil Amendments on Growth Parameters

TREATMENTS	Plant Height	No. of leaves	No. of branches	Stem diameter	Dry matter weight
Oil palm bunch ash	101.37a	39.07b	2.33b	0.92b	30.63a
Saw dust ash	99.33a	38.63b	2.08c	0.87b	30.30a
Kitchen ash	92.10a	36.63b	2.17c	0.77c	30.37a
Termite mound	82.93a	31.83b	1.93d	1.27a	28.78a
Control	71.83a	23.23c	1.43c	0.65c	20.18a
Poultry dropping	97.97a	46.37a	2.58a	0.88b	32.18a
LSD	43.30ns	18.76*	0.32**	0.48*	22.77*

Ns= non-significant
*= significant at 5 %
**= significant at 1 %

DISCUSSION

Bacterial wilt, caused by the bacterium (*Erwinia tracheiphila*), is a destructive disease of plants belonging to the cucurbit family (Zitter, 1985). From the result obtained it is clear that all the treatments used were effective in controlling wilt diease of *Citrullus lanatus*. Evanylo, *et al* (2007) also found out that organic matter and soil nutrients increased with application rate of poultry manure and therefore affirmed that poultry manure contains organic matter, N, P, K, Ca and Mg which are released into the soil upon decomposition of

the manure, and that depletion of soil organic matter under intensive cropping can be amended by proper addition of poultry manure into the soil. The result also proved that soil treatments (oil palm bunch ash, saw dust ash, kitchen ash, termite mound and poultry droppings) led to less disease incidence, least severity and in addition amendments increased yield (dry matter weight Similar results have been reported by earlier workers (Evanylo *et al.,*2007). The reduction in disease incidence and severity observed in this trial was in line with the work of Roshan *et al*., (2011) who reported that soil treatments reduced the disease intensity (PDI) of leaf spot of tomato caused by (*Alternarria Solani*).

The application of organic amendments improved soil fertility and increased total yield. (Evanylo *et al.,*2007). The effect of synthetic fertilizer are harzardous to human and wildlife, under such debilitating circumstances, there is interest in exploring organic alternative options to control wilt disease of *Citrillus canalus.*

CONCLUSION

Based on the result of this field trial, it is suggested since all the organic soil treatments applied, produced better results from amendments with poultry droppings, kitchen ash, saw dust ash as well as oil palm bunch ash and also helped to realize the combine objectives of wilt disease control and improved yield production of *Citrillus lanatus*, it is preferred to the conventional use of synthetic chemicals with their attendants health hazards.

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