Standard Research Journal of Agricultural Sciences Vol1 (3): 36-40, December 2013
http://www.standresjournals.org/journals/SRJAS

Research Article

Effects of farm yard manure application on the incidence of fusarium wilt in tomato caused by *Fusarium oxysporum* f. *sp. lycopersici* (Snyder and Hans) in Nigerian sudan savanna

*** [1]Umar S, [2]Aliyu B.S, [2]Mustapha Y and [3]Kutama A.S**

[1]Department of Biological Sciences, College of Arts, Sciences and Remedial Studies, Kano
[2]Department of Plant Biology, Bayero University, Kano, Nigeria
[3]Department of Biological Sciences, Faculty of Science, Federal University, Dutse, Jigawa State, Nigeria

*Corresponding Author E-mail: kutamasak@yahoo.com; Tel: +2347067371893

Accepted 18 December 2013

Abstract

The trials were conducted at the international institute for tropical agriculture (IITA) screen house Kano station, in the 2010 and 2011 to study the influence of different quantities (0.0, 25, 50, 75 and 100kg/ha) of farmyard manure (FYM) on the growth and disease incidence of *Fusarium* wilt in tomato. The trials were laid out in randomized complete block design (RCBD) in three replications. The results obtained from the investigations in both 2010 and 2011 showed that there was consistently significant (P>0.05) reduction in the incidences and severities of tomato wilt due to *Fusarium* and resultant increase in plant height, stem circumference, and number of leaves in all the treated plants especially at 25 kg/ha and above compared with control (0.0kg/ha). This suggests that application of farm yard manure at ≥25kg/ha could be beneficial to farmers in the reduction of wilt caused by *Fusarium* for higher yield tomato production in northern Nigeria.

Keywords: farmyard manure, tomato wilt, *Fusarium oxysporum*, disease incidence

INTRODUCTION

The production of tomato is of worldwide agricultural importance. Tomato (*Lycopersicon esculentum*) is one of the most popular important commercial vegetable crops rich in vitamins A, B, and C grown throughout the world. In India, it occupies an area of 0.54 million ha with a production of 7.60 million tons (Suarez et al., 2007). Many diseases and disorders affect tomatoes during the growing season. *Fusarium oxysporum* f.sp.*lycopersici* (FOL) is a highly destructive pathogen of both greenhouse and field grown tomatoes in warm vegetable production areas such as the tropics. The disease caused by this fungus is characterized by wilted plants, yellowed leaves and minimal/reduced or even total loss/ absent crop yield. There may be a 30 to 40% yield loss (Pelta, 2001).

Fusarium wilt diseases, caused by pathogenic formae speciales of the soil-inhabiting fungus; *Fusarium oxysporum* Schlectend Fr., can cause severe losses in a wide variety of crop plants (Agrios, 2005). On tomato, two distinct symptoms caused by the pathogen can cause either a vascular wilt (F*. oxysporum f. sp. lycopersici* W. C. Snyder and H. N. Hans.) or a crown and root rot *(F. oxysporum f. sp. radicis-lycopersici* W. R. Jarvis and Shoemaker). Both of these pathogens occur throughout most tomato growing areas and either can devastate a crop. *Fusarium oxysporum f. sp. lycopersici* (FOL) is a known pathogen of tomato plant which is an economically important crop (Suárez *et al*., 2007).

Tomato yield is significantly reduced by *F. oxysporum f. sp. lycopersici* because it can destroy roots of tomatoes at growth stages.

Numerous strategies have been proposed to control this fungal pathogen (Biondi *et al*., 2004; Ahmed, 2011). However, management of seed-borne and soil-borne diseases such as wilt caused by *Fusarium* species has always been problematic (Rao and Balachadran, 2002; Haware and Kannaiyan, 1992). Soil solarization/disinfection, crop rotation and mixed cropping are the best ways of eliminating soil borne pathogens (Sullivan, 2004). Seed treatment with synthetic fungicides considerably reduce wilt incidence in tomato. However, their use is costly as well as environmentally undesirable (Song and Goodman, 2001). The use of resistant varieties is one of the most effective alternative approaches to controlling wilt disease (Singh, 2005). But, due to breakdown of resistance in the face of high pathogenic variability in the pathogen population, the usefulness of many resistant cultivars is restricted to only a few years (Kutama *et al*., 2011; 2013). Thus, there is a need to develop alternative strategies to provide durable resistance over a broad geographic area. In this context, biocontrol is an eco-friendly way of managing fusarium wilt in tomato which offers an alternative to fungicides (Prasad and Rangeshwaran, 2000). The aim of the research therefore, is to evaluate the efficacy of farm yard manure at different quantities in the control of fusarium wilt in tomato caused by *F. oxysporum f. sp. lycopersici*.

MATERIALS AND METHODS

The research work was carried out in the 2010 and 2011 at international institute for tropical agriculture (IITA) screen house Kano station, The trials were laid out on a Randomized Complete Block Design consisting of three replications and five (5) treatments, which were the quantities of farm yard manure ((0.0, 25, 50, 75 and 100kg/ha).

Isolation of Fungi from the Soil

Soil sample was collected from an infested farm in Minjibir area of Kano state in the 2010 agricultural year. Five kilograms of soil sample was obtained from hot spot (infested tomato farm) at a depth of 30cm using a soil corer, brought and mixed with distilled water to form a soil solution/suspension in the laboratory. Fungi were isolated by direct soil plate method described by Mehrotra and Aggarwal (2003). Small amount of soil suspension was dispersed across the bottom of sterile Petri-dishes using a sterilized syringe as described by Warcup (1950). Prepared PDA medium was dispensed into the Petri-dish and rotated to distribute the soil particles. The plates were later incubated for 1- 7 days at room temperature and later observed for fungal growth.

Preparation of Potting Mixture

Sandy –loam soil and farmyard manure were weighed using weighing balance to get an accurate proportion of each. The soil was sterilized at IITA in a sterilizing machine and farmyard manure was mixed into soil in proportion of 25g, 50g, 75g and 100g/2500g of soil in each pot. The total of 24 plastic pots of 18cm in length and 19cm in diameter were filled with soil and labeled A-C

Planting of Tomato Seeds

Tomato seeds US82B variety were sown on 25th November, 2010 and 28th November, 2011 and watered for five days. About 250 seeds were sown in nursery in the department of Biological Sciences, Bayero University, Kano. The tomato seeds germinate after seven days of planting.

Transplanting and Inoculation

One tomato seedling was transplanted into each plastic pot. Pots were watered twice a day with water and placed in random order under the sun. The pathogen was inoculated into the tomato seedlings by dip root method at a density of 10 power 6 colony forming unit /ml of inoculums as described by Verma and Singh (1980). Roots of the tomato seedlings were dipped into the inoculums for 10 minutes.

Data Collection and analysis

Data was recorded at 2 weeks interval for 8 weeks. The data that were collected are the height, diameter, Disease incidence (%) and disease severity. The various data collected were analyzed on a Genstat 2.0 soft ware, using ANOVA and LSD.

RESULTS

Effect of Farmyard Manure (Fym) on the Plant Height of Tomato Infested with *Fusarium Oxysporum*

In table 2 below, at two weeks after inoculation (2WAI) treatment with 100g 0f FYM has the highest plant height which is 19.00cm then followed by 75g with 18.10cm. There is no significant difference between the two treatments. 25g has plant height of 17.90cm followed by 50g with 16.90cm and there is no significance difference between the two treatments. 0.00g has the least plant height of 15.50 cm, there is significance difference between 0.00gand the other treatments.

After four weeks of inoculation, 100g has the highest plant height of 23.10 cm then followed by 75g and 50g with 22.20 cm and 22.00 cm respectively. 25g has plant height of 21.50 cm and the least height is in 0.00g with 19.40 cm in which there is no significance difference between all of the treatments. After six weeks of inoculation,100g as the highest plant height of 30.40 cm then 75g with 27.60 cm. this indicates that there is significance difference between the two treatments.25g and 50g has plant height of 25.90 cm and 25.10 cm respectively, in which there is no significance difference between the two treatments. 0.0g has the least plant height of 23.80 cm and indicates that there is significance difference between 0.00g and other treatments.

After eight weeks of inoculation, 100g has the highest plant height of 39.20 cm followed by 75g with 37.20 cm. There is no significance difference between the two treatments. 50g has plant height of 34.50 cm then 25g with 34.10 cm in which there is no significance difference between the two treatments. 0.0g has the least plant height of 28.20 cm. There is significance difference between 0.0g and the other treatments.

WAI = Weeks after Inoculation

Table 1. Effect of farmyard manure on the plant height (cm) of *Lycopersicon esculentum* (Tomato) infested with *Fusarium oxysporum*

Quantity of FYM (g)	2WAI	4WAI	6WAI	8WAI
0.00 (control)	15.5	19.4	23.8	28.2
25.0	17.9	21.5	25.9	34.1
50.0	16.9	22.0	25.1	34.5
75.0	18.1	22.2	27.6	37.2
100.0	19.0	23.1	30.4	39.2
Mean	19.6	21.6	26.6	34.6
LSD (0.05)	1.09	4.08	1.84	3.63

Effect of farmyard manure (fym) on the stem circumference of tomato infested with *fusarium oxysporum*

In table 2 below, after two weeks of inoculation, 100g has the largest stem circumference which is 0.70cm then followed by 50g with o.6cm. There is no significance difference between the two treatments. 75g and 25g have the same stem circumference which is 0.5cm and there is no significance difference between the two treatments. 0.0g has the least stem circumference with o.40cm and differs significantly with other treatments.

Four weeks after inoculation, 100g has the largest stem circumference with 1.00cm followed by 75g, 50g and 25g which have the same stem circumference of 0.80cm. The least stem circumference is in 0.0g with 0.60cm, this indicates that there is no significance difference between all of the treatments.

At six weeks after inoculation, 100g has the largest stem circumference which is 1.60cm then followed by 50g with 1.30cm. There is no significance difference between the two treatments. 75g and 25g have the same stem circumference with 1.10cm and there is no significance difference between the two treatments. 0.0g has the least stem circumference which is 0.90cm. There is significance difference between 0.0g and other three treatments.

Eight weeks after inoculation, 100g has the largest stem circumference which is 2.50cm then followed by 75g and 50g with 2.00cm each. There is no significance difference between the three treatments.25g has stem circumference of 1.60cm and the least in 0.0g with 1.50cm in which there is no significance difference between the two treatments.

Table 2. Effect of farmyard manure on the stem circumference (cm) of tomato plant infested with *Fusarium oxysporum*

Quantity of FYM (g)	2WAI	4WAI	6WAI	8WAI
0.0 (control)	0.4	0.6	0.9	1.5
25.0	0.5	0.8	1.1	1.6
50.0	0.6	0.8	1.3	2.0
75.0	0.5	0.8	1.1	2.0
100.0	0.7	1.1	1.6	2.5
Mean	0.5	0.8	1.2	1.9
LSD (0.05)	0.2	0.2	0.3	0.8

WAI = Weeks after Inoculation

Effect of farmyard manure (fym) on the stem incidence of fusarium wilt in tomato infested with *fusarium oxysporum*

In table 3 below, at two weeks after inoculation.0.0g and 50g have the highest percentage incidence of *Fusarium* wilt which is 100%. 25g has 67% then followed by 75g with 33% and 100g has the lowest percentage with 0.0% incidence. This indicates there is significance difference 100g and other three treatments.

At four weeks after inoculation, 0.0g and 50g have the same percentage which is 100% then followed by 25g and 75g both with 67% incidence. The lowest percentage is in 100g with 33% incidence and this indicates that there is no significance difference between all the treatments.

At six weeks after inoculation, 0.0g, 25g, 50g and 75g have the same percentage which is 100% incidence then followed by 100g with 67% incidence. There is no significance difference between all treatments.

At eight weeks after inoculation, all the treatments have the same percentage of incidence which is 100%. There is no significance difference between all the treatments.

Table 3. Effect of farm yard manure on the incidence (%) of Fusarium wilt in Tomato infested with *Fusarium oxysporum*

Quantity of FYM (g)	2WAI	4WAI	6WAI	8WAI
1.0 (control)	100	100	100	100
25.0	67	67	100	100
50.0	100	100	100	100
75.0	33	67	100	100
100.0	0	33	6	100
Mean	60	73	93	100
LSD (0.05)	67	85	47	0

WAI = Weeks after Inoculation

DISCUSSION

The production of economic yield in any crop generally depends upon the cumulative effects of interactions among several factors such as genetic make-up of crop variety, climatic factors, mineral nutrition and the cultural practices adopted for its cultivation. These plus the various environmental factors such as temperature, light, rainfall and relative humidity that prevail during different plant growth stages and development exert considerable influence on vegetative growth, seed yield and seed quality, as well as the incidence of certain pests and diseases. The seed yield and quality depend upon the production of photosynthate and their partitioning in the plant. Application of organic manures has been a noble and traditional practice of maintaining soil health and fertility. The importance of organic manures is, now-a-days realized because of high cost of fertilizers and its negative consequences on continues usage, and the inherent capacity of organic manure to supply most essential nutrients for a balanced nutrition to the crop growth. Organic nutrients generally facilitate crop rooting, improve water retention capacity and results in the even distribution of nutrients in soil profile. Moreover, the unbalanced and continuous use of chemical fertilizers is leading to reduction in crop yields and in imbalance of nutrients in the soil which has adverse effect on soil health. Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of organics which are needed to check the yield and quality levels. Use of organic manures alone, helps in improving physico-chemical properties of the soil and also improves the efficient utilization of applied fertilizers. Considering the importance of these organic manures and their utility, the present investigation was undertaken to find out the effect of farmyard manure on the incidence of *fusarium* wilt in tomato. The results obtained in this study are discussed below.

Effect of farmyard manure on plant height, stem circumference and incidence of fusarium wilt in tomato infested with *fusarium oxysporum*

Significant differences in plant height and stem circumference from 2 to 8 WAI due to the increase in FYM application were observed. Maximum plant height (19.0, 23.1, 30.4 and 39.2cm) at 2, 4, 6 and 8 WAI was recorded, followed by the treatment with 75, 50 and 25g of FYM. Maximum stem circumference (0.7, 1.1, 1.6 and 2.5cm) at 2, 4, 6 and 8 WAI respectively was also recorded, followed by 50, 75 and 25g FYM. These results are supported by the report of Sharma (1995) in tomato, Wange and Kale (2004) in brinjal. The highest disease incidence (100, 100, 100 and 100%) at 2, 4, 6 and 8 WAI was recorded, followed by 50, 25 and 75g. But the significantly lowest plant height (15.5, 19.4, 23.8 and 28.2cm) and stem circumference (0.4, 0.6, 0.9 and 1.5cm) at 2, 4, 6 and 8 WAI, respectively was observed in 0.0g (control). The lowest disease incidence (0, 33, 67 and 10%) at 2, 4, 6 and 8 WAI was in 100g FYM. The plant height and stem circumference increases as the amount ***/*** quantity of FYM increases. It could be attributed to the quick and readily availability of major nutrients like N, P and K to plants at the stages of plant growth (Peralta *et al*., 2001). This increased plant height may be due to increased uptake of primary nutrients, which might have enhanced cell division and cell elongation. These results are in conformity with the findings of Kumaran *et al*. (1998) in tomato and Reddy (1999) in tomato.

References

Agrios G (2005). Plant Pathology. 5th ed. Amsterdam: Elsevier Academic. Pp. 522.

Ahmed M(2011). Management of Fusarium wilt of tomato by soil amendment with *Trichoderma koningii* and a white sterile fungus. Indian J. Res. 5: 35-38.

Biondi N, Piccardi R, Margheri MC, Rodolfi L, Smith GD, Tredici MR(2004). Evaluation of Nostoc strain ATCC 53789 as a potential source of natural pesticides. Appl. Environ. Microbiol. 70: 3313-3320.

Haware MP, Kannaiyan J(1992). *Seed Science Technology*. 20: 597-601.

Kirankumar R, Jagadeesh KS, Krishnaraj PU, Patil MS(2008). Provide article title. *J. Agric. Sci.* 21(2): 309-311.

Kumaran SS, Natarajan S, Thamburaj S(1998). Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. *South Indian Hortic*, 46 (3 and 4): 203-205.

Kutama AS, Auyo MI, Umar S, Umar ML (2013). Reduction in growth and yield parameters of sorghum genotypes screened for loose smuts in Nigerian Sudan Savanna. *World J. Agric. Res.* 1(5):185-192

Kutama AS, Emechebe AM, Aliyu BS(2011). Field evaluation of some inoculation techniques on the incidence and severity of sorghum head smut (*Sporisorium reilianum*) in Nigerian Sudan savanna. *Bio. Environ. Sci. J. Tropics*. 8(3):292-296.

Pan Germany(2010). Fusarium Wilt.PestizidAktions-Netzwerk. Web. 23 Nov. 2010.

Peralta DI, Iris E, Spooner GC, David M(2001). "Granule-bound starch synthase (GBSSI) gene phylogeny of wild tomatoes (Solanum L. section Lycopersicon [Mill.Wettst.subsectionLycopersicon)". American J. Bot. 88 (10): 1888–1902.

Rao AV, Balachandran B(2002). Role of oxidative stress and antioxidants in neurodegenerative diseases". Nutritional Neurosci. 5 (5): 291–309.

Reddy VC(1999). Effect of urban garbage compost on growth and yield of tomato *Curr. Res*., 28: 43-44.

Sharma SK(1995). Seed production of tomato as influenced by nitrogen, phosphorous and potassium fertilization. *Annals of Agric. Res*. 16: 399-400.

Shidfar F, Froghifar N, Vafa M, Rajab A, Hosseini S, Shidfar S, Gohari M(2011). "The effects of tomato consumption on serum glucose, apolipoprotein B, apolipoprotein A-I, homocysteine and blood pressure in type 2 diabetic patients." Int. J. Food Sci. Nutr. 62(3):289-942.

Singh RS(2005). Plant diseases*,* Oxford and IBH 547 publication Co. Pvt. Ltd. Pp. 470-476.

Snyder WC, Hansen HN(1940). The species concept in Fusarium. Amer. J. Bot. 27:64-67.

Song F, Goodman RM (2001). Physiology and Molecular Plant Pathology. 59: 1-11.

Suárez-Estrella F, Vargas-Garcia C, Lopez MJ, Capel C, Moreno J(2007). Antagonistic activity of bacteria and fungi from horticultural compost against Fusariumoxysporum f. sp melonis. Crop Prot. 26: 46-53.

Sullivan P(2004). Sustainable management of soil-borne plant disease-soil systems guide. National sustainable agriculture information service. Fayetteville, Arkansas. Pp. 56-59.

Verma JP, Singh RP(1980). Inoculation and detection of phytopathogenic bacteria, in phytopathological techniques. J.N. Chand and G.S. Saharan eds. Pp. 76-79

Wange SS, Kale RH(2004). Effect of bio-fertilizers under graded nitrogen levels on brinjal crop. J. Soils and Crops. 14 (1): 9-11.

Warcup JH(x1950). The soil plate method for isolation of fungifrom soil. Nature eds. 166: 117- 118.