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Research Paper

EFFECT OF FUNGICIDE AND NEEM LEAF EXTRACT SPRAYS ON THE MANAGEMENT OF *Alternaria solani* LEAF SPOT DISEASE OF EGGPLANT (*Solanum melongena* L)

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Abstract

The aim of this study was to investigate the effect of fungicides and neem leaf extract sprays on the management of *Alternaria solani* leaf spot disease of the popular round-shaped-green eggplant variety, Marvel (*Solanum melongena* L). The investigation was carried out during the 2013 cropping season at the Teaching and Research Farm of Ebonyi State University. The experiment was laid out in randomized complete block design (RCBD) with three replications. Standard rates of two systemic fungicides: benlate and hexaconazole 5% SC and neem leaf extract at 10% concentration were applied at ten days intervals for the management of *Alternaria solani* leaf spot disease of eggplant. Results showed that neem leaf extract recorded a much lower percent disease index than the two fungicides and the control; which subsequently resulted in higher percent disease control. Neem leaf extract sprays also brought about a higher yield and percent yield increase more than the fungicides. Benefit-cost ratio due to use of neem material for leaf spot disease control was also higher compared to the fungicides. These indicate therefore, that the neem leaf extract could be among the alternatives instead of the use of inorganic synthetic chemicals with attendant health and environmental problems.

Key words: Fungicides, neem leaf extract, alternaria leaf spot, management, eggplant.

INTRODUCTION

Plant diseases have continued to play a major limiting role in Agricultural production, particularly in intensively managed crops (Reuveni and Reuveni, 1998). Host resistance where it is available, is the most environment friendly method of diseases management, and where fungicides are needed, few sprays would be needed (Kankwatsa *et al*., 2002). Plant resistance to diseases is not permanent, and could break down in the presence of pre-disposing environmental factors (Genotype X Environment interactions) or due to the emergence of new pathotypes of pathogens.

Protection of crop plants from diseases is an integral and important part of crop production. This is achieved today in industrialized and developing countries alike almost entirely through the application of chemicals (Agu, 1997). Concerns about food safety, environmental quality and

pesticides resistance have however dictated the need for alternative pest management techniques (Hewitt, 1998). The use of plant materials for diseases control is among the possible strategy for inclusion in an integrated pest management Programme (IPM). (Reuveni and Reuveni, 1998). The neem plant (*Azadirachta indica* A. Juss) presents a potential for control of plant fungal diseases with chemical compounds which are environment friendly. Neem plant extract (leaf, seed, bark) can be applied in many ways such as sprays, powders, drenches or diluents in irrigation waters. One valuable property of the neem plant materials in plant diseases control is that some of its compounds act as systemic agent in certain plant species (NRC, 1992). Neem products have been shown to be effective on a wide range of pests and diseases of many crops worldwide (Saxena, 1989).

Eggplant (*Solanum melongena* L.) is one of the most popular of the many species of solanum that bear non-sweat, non-acid vegetable type of fruits. Eggplant consumption has the potential of balancing the nutrition problems of mankind. It is a fair source of vitamin C and iron, and a poor source of cellulose, traces of protein and contains 89.6% of water (Ekpoudom, 1985). It is a welcome fruit vegetable eaten raw in formal and informal occasions by urban as well as rural Nigerians.

Eggplant grown in the field is faced with both biotic and abiotic hazards. Hazard that arise from biotic factors are by far the most serious. The qualities of eggplant (leaves and fruits) are reduced by various pathogenic organisms during growth in the field (Tindall, 1983; Rice *et al.,* 1990).

The aim of the study was to investigate the efficacy of neem leaf extract as a possible alternative to the use of synthetic chemicals for the management of Alternaria leaf spot disease of eggplant.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm of Ebonyi State University Abakaliki, during the 2013 cropping season. Abakaliki is located in sub-humid agro-ecological zone (lat.06^{0}04'N; long. 08^0 65' E and at an elevation of 71.44mm above sea level) southeast of derived savanna belt of Nigeria. The soils of the experiment site is sandy loam in nature with available nutrient status of medium nitrogen, phosphorus and potassium. The rainfall pattern is bimodal (April- July) and (September – November). The mean annual rainfall ranges between 1700 to 2000mm. The mean temperature range is between 24-28^{o}C while the relative humidity is between 60-80%. The experiment was laid out in randomized complete Block design (RCBD) with three replications. The treatment included systemic chemicals (Benlate-bemomyi):Methyl,1-(butylcartamoyl)-2 benzimidazole carbamate and Hexaconazole 5% SC; plant material (Neem leaf extract) and the control. Benlate was applied at the rate of1.5 kg/ ha; hexaconazole 5% at the rate of 1.2lit/ha and the neem plant extract at the rate of 2,500lit/ha.

Nursery seedlings of the popular egg plant variety, round shaped-green, Marvel were transplanted at two weeks old into plots measuring 2m x 2m at a spacing 45cm x 60cm. Each plot contained twelve plants and a projected plant population of 42, 857 plants per hectare. N.P.K 15:15:15 fertilizer was applied at the rate of 150kg/ha. All other recommended agronomic practices for the cultivation of eggplant were followed and applied as and when necessary.

Three sprays each of all treatments were applied immediately after the appearance of disease at an interval of ten days. The observation on percent disease index (PD1) of Alternaria leaf spot were recorded at fifteen days intervals after the last spray on five randomly selected plants in each treatment. Three branches on each plant were randomly tagged and intensity of Alternaria leaf spot disease on all the leaves of these tagged branches were graded by adopting the modified 0-4 scale as given by Wheeler (1982), where:1= trace, 25% leaf area spotted,2= 26-50% leaf area spotted, 3= 51- 75% leaf area spotted,4= 76- 100% leaf area spotted. Percent disease index (PDI) was calculated thus:

$$PD1 = \frac{\text{sum of individual rating}}{\text{Number of leaves assessed}} \times \frac{100}{\text{max. score}}$$

Ten grams of neem plant leaves was cut into small pieces and macerated using pestle and mortar in 50ml of water. The content was strained through a clean muslin cloth. The volume was then made up to 100ml to obtain 10% concentration. The extract was centrifuged for five minutes at 3000rpm. The supernatant was used for spray. Plants were spayed with 1 litre (100ml) per plot per treatment, and each plot consisted of three rows of four plants each.

Young leaves of eggplant showing early signs of leaf spot disease were collected from the University farm and used for the isolation. This was to reduce the isolation of secondary organisms. Water Agar (WA) and Potato Dextrose Agar (PDA) was used for the isolation. Pieces of infected eggplant leaves in a clean glassware Petri-dish was surface sterilized in 0.1% mercury chloride for 1 minute, and then rinsed three times in sterile water. About three pieces of the tissue were aseptically transferred into a glassware Petri dish of water Agar medium. It was incubated at 30+ 2^0C in a sterile chamber for 3days. When growth was observed around the leaf sections, it was aseptically transfered into a glassware Petri-dish of potato dextrose Agra (PDA) medium and incubated at 30+ 2^oC in a sterile chamber for 3 days to observe profuse hyphal growth. Any observed growth was sub-cultured on fresh PDA medium. The fungal growth was characterized and identified based on the mycelial and fruiting body characteristics. Conidial suspension of Alternaria was prepared by flooding the surface of the culture plates with sterile distilled water, scrapping the surface with a bent glass rod, and filtering the suspension through two folds of cheese cloth. The concentration of the pathogen was adjusted to 10^6 or 10^8 spore/ml by dilution and counting with a haemocytometer. All the seedlings were sprayed with spore suspension of *Alternaria solani* until run off using a hand sprayer at 3 weeks after planting. Inoculated seedlings were immediately covered with transparent polythene materials for 18hrs to provide high humidity necessary for infection and also to prevent spores from being washed off seedlings (Bankole and Adebanjo, 1996). Protection of the plants commenced seven days after inoculation with Alternaria spore suspension.

Disease and yield data were collected. Benefit-cost ratio was further calculated. Disease and yield data were statistically analysed following the procedure of Obi, 2002. Treatment means were separated by using Fisher's least significant test (F-LSD). Values in percentages were analysed statistically after carrying out data transformation.

RESULTS AND DISCUSSION

The results, Table I and Figure I, show effect of fungicides and neem leaf extract on percent disease index (PDI), percent disease control, yield and percent yield increase. The results show that percent disease index (PDI) was generally reduced by treatment irrespective of the type over the control which recorded the highest percent disease index (23.86%). Neem leaf extract recorded the least percent disease index (8.13%) and hence the highest percent disease control (65.93%) was significantly better (P=o.05) than benlate (11.68%) and Hexaconazole 5% SC (13.35%). Neem leaf extract also brought about the highest percent yield increase (27.23%) and recorded the highest yield of 5.738 tons/ha. This was better than the fungicides, benlate (4.798 ton/ha) and Hexaconazole (5.090 tons/ha). The control recorded the least yield (4.510 tons/ha).

Table 1: Main effect of fungicides and neem leaf extract on mean PDI, percent diseases control, yield, % yield increase and benefit- cost ratio.

Treatment	Mean PDI	Percent diseases control	Yield wt/ha(tons)	Percent yield increase	Benefit Cost-ratio (BCR)
Benlate	11.68	51.05	4.798	6.39	4.23
Hexaconazole 5% S.C	13.35	44.05	5.090	12.86	5.80
			-	-	
Néem leaf extract	8.13	65.93	5.758	27.23	8.30
Control	23.86	-	4.510	-	-
LSD(0.05)	0.328	-	0.0035	-	-

ECONOMICS OF DISEASE CONTROL

The use of neem leaf extract in the management of Alternaria leaf spot disease of eggplant resulted in the highest benefit- cost ratio (Table 2). Result show that for every N1.00 invested, there is a return of N86.29. The least return on investment was benlate. The implication of this result is that farmers stand to save a lot of money by using the neem leaf extract because it is readily available and will also ensure a safe environment. The results of this study corroborated those of earlier works on the efficacy of neem and other plant materials in reducing plant foliar diseases and subsequent increase in plant yield. Mumuni *et al.,* (2013) had reported the effectiveness of *Azadirachta indica* products for lowering damages by soil arthropods and leaf spot diseases for increased peanut yield in Ghana. Similar results have also been reported by Aage *et al.,* (2003), Natarajen *et al*., (2005) and Kishore and Panda, (2005) on disease reduction, and Hossain and Hossain,(2013), Adiver, (2004), Gopal *et al.,* (2006) and Ihejirika *et al.,* (2006) on increased yield efficacy of neem and other plant materials. The use of plant extracts with antifungal activity therefore offers on economical, safe and easily available alternative method for the management of leafspot disease of eggplant (Rahman and Hossain, 1996). Farmers in the country could now exploit the potential of *A. indica* for the management of other plant foliar diseases for increased crop production and for the sustenance of a clean and healthy environment.

Table 2: Economics of fungicides and neem leaf extract in eggplant production/ha.

			Benlate	**Hexaconazole 5% SC**	**Neem leaf extract**
	Unit	**Rate**	**Amount**	**Amount**	**Amount**
A. Variable Cost 200g of seed	gram	10	2000	2000	2000
2.5g Benlate	gram	1000	2500	-	-
1.2lit.hexaconazole 5%. sc	litre	1000	-	1,200	-
500g neem leaf extract	gram	10	-	-	500
Labour					
Clearing	Manday	2000	2000	2000	2000
Tilling	Manday	4000	4000	4000	4000
Transplanting	Manday	1800	1800	1800	1800
Harvesting	Manday	3000	3000	3000	3000
Total variable cost			15,300	14,000	13,300
B. Revenue					
4.798 tons		200	959,600	-	-
5.090 tons		200	-	1,018,000	-
5.738 tons		200	-	-	1,147,600
Total rev. (TR)			959.600	1,018,00	1,147,600
Gross margin					
(Net revenue) TR-TC			944,300	1,004,000	1,134,300
Marginal revenue (BCR) TR/ TVC			1:62.72	1:72.71	1:86.29

REFERENCES

Agu, C.M (1997). Pathogenity of Meloidogyne javanica on soybean as affected by soil units of Eastern Nigeria, its interaction with Rhizoctonia solani and control with neem (A. indica) Ph.D thesis. Crop Science Department, University of Nigeria Nsukka 208 (Unpublished).

Aage, V.E; Gaikwad, S.J; Behere, G.T. and Tajame, V.S (2003). Efficacy of extracts of certain indigenous medicinal plants against Cercospora leaf spot of groundnut, *J. Soils and Crops*. 13(1): 140-144.

Adiver, S.S (2004). Field efficacy of botanical preparations on late leaf spot(*Cercospora personata*)of groundnut (*Arachis hypogaea*) *Oil seed Res*. 21 (2): 369-370.

Bankole, S.A and Adebanjo, A (1996). Biocontrol of brown blotch of cowpea caused by *Colletotrichum truncatum* with *Trichoderma viride. Crop protection*, 15(7): 633-636.

Ekpodom, T.E (1985). Cultivation of garden egg (*Solanum melongena* L.) in urban homes. The Uyo-Cross River State experience (Unpublished)Pp.15.

Gopal, K; Ahmad, S.K and Babu, G.P (2006). Estimation of losses due to tikka leaf spot in groundnut (*Arachis hypogaea* L.), Legume Res. 29 (4): 289-291.

Hewitt, H.G (1998). Fungicides in crop protection. CAB international, Wallingford, Oxon, Oxio. SDE, UK Pp 125-130.

Hossain, M.H and Hssain, I. (2013). Screening of different plant extract against leaf spot (*Cercospora arachidicola* and *Cercosporidium personatum*) of groundnut (*Arachis hypogaea* L.).

Ihejirika, G.O; Nwufo, M.I; Duruigbo, C.I; Onweremadu, O.P; Obili, E.R, Omuoha, K and Ogbede, O. (2006). Effect of plant extracts and plant density on the severity of leaf spot disease of groundnut. *J. plant science* 1 (4): 374-377.

Kankwatsa, P; Adipala, E; Hakiza, J.J; Olanya, M; Kidanemariam, H.M (2002). Effect of integrating planting time, fungicide application and host resistance on potato late blight development in south-western Uganda. *Journal of phytopathology*, 150:248-257.

Kishore. G.K and Pande, S (2005). Integrated applications of aqueous leaf extract of *Datura mete*l and chlorothalonil improved control of late leaf spot and rust of groundnut. *Australian plant pathrology* 34(2): 261-264.

Natarajan D; Srinivasan, K, Mohanasundari, C.; Perumal, G; Dheen, M. A.N; Ganapathi, G.A. and Rajarajan, T. (2005). Antifungal properties of three medicinal plants extracts against *Cercospora arachidichola*. *Advances in plant science* 18(1): 45-47.

National Research Council, (1992). Neem- A tree for solving global problems. National Academy press Washington DC Pp 139.

Obi, I.U (2002). Statistical Method of Detecting Differences Between Treatment Means and Research Methodology Issues in Laboratory and Field Experiments. Second Edition. SNAAP Press Ltd, Enugu, Nigeria Pp. 116.

Rahman, M.A and Hossain, I (1996). Controlling Cercospora leaf spot of Okra with plant extract. *Bangladesh hort*. 24 (1 and 20): 147-149.

Reuveni, R. and Reuveni, M (1998). Foliar fertilizer therapy –a concept in integrated pest management. *Crop protection* 17 (2): 111-118.

Rice, R.P; Rice, L.W and Tindall, H.D (1990). Fruits and vegetables production in warm climates, International Editions; Macmillan Educational Ltd. Pp 256-259.

Saxena, R.C. (1989). Insecticides from neem Pp 110-135 in: insecticides of plant origin, edited by J.T Armason, B.J.R. Philogene and P. Morand. ACS symposium series No. 387. American Chemical Society, Washington, USA.

Tindall, H.D (1983). Vegetables in the tropics. Macmillan Educational Ltd. Hound mills; Basingstoke, Hampshire Pp 365-368.

Wheeler, B.E.J (1982). An introduction to plant diseases. John Willey and Sons Ltd. Chinchester Pp 49-70.