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The Anecdotal Use of Fungicides in the Management of Cowpea Bacterial Blight *Xanthomonas Axonopodis* pv. *Vignicola*

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Abstract. The control measure of most seed-borne diseases can be improved by seed treatment with an antibiotic or fungicides.However, the unwittingly use of fungicides on any perceived disease, makes their use economically risky proposition. The objective of this research was to investigate the effectiveness of some fungicides in the management of Xanthomonasaxonopodispvvignicola, the incitant of bacterial blight of cowpea. Seven cowpea genotypes (Ife-brown, SAMPEA-7, Local Wusasa, Local Sabon-Gari, Local Samaru, IT86D-714A and IT98-503-1) were obtained from seed companies, research institutes, and open markets within Zaria area. The different fungicides used by the seed companies were Apron-star, Dress and Team and the same were used to treat other seed lots. Seeds were inoculated by soaking hundred seeds in 100 ml of bacteria suspension adjusted ca.4.7 x 10^7cfu/ml for 4 h before fungicide treatment.There was general reflection of susceptibility of SAMPEA-7 to Xav as observed in the various parts of all the seedlings (Root, cotyledon, stem and leaf). Fungicides used in the seed treatment did not have significant effect on the pathogen attached to the seeds. Most fungicides do not control bacterial pathogens and most will not control all types of fungal diseases. Anecdotal use of chemical pesticides should be discouraged and farmers are advised to seek for proper diagnosis of pest problems as well as appropriate protection products from plant protectionists. Without proper identification of disease and the disease causing agent, disease control measure can be a waste of time and money and can lead to further plant losses.

Keywords: Bacterial blight, management, fungicicides, anecdotal, risky.

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Introduction

Cowpea (Vignaunguiculata L. Walp) is a source of protein in most homes and the fodder is used for animal feed (Alabi and Emechebe, 2004). Cowpea bacterial blight (CoBB) caused by *Xanthomonasaxonopodis*pv.*vignicola*(*Xav.*), [Burkholder] Dye is a widely spread disease of cowpea that has been reported in all cowpea growing areas (Alabi and Emechebe, 2004).In heavily infected cowpea with*Xav*,disease symptoms may be found on the aerial plant parts including leaves, stems, pods and seeds and yield loss may exceed 40- 68 % (Singh *et al*., 2001; Okechukwu*et al*., 2010).The control measure can be improved by seed treatment with an antibiotic or fungicides (Jindal and Thind, 1990). The uses of antibiotics have been found to be effective (Emechebe, 1997) but they are expensive and beyond the reach of resource-poor farmers. Hitherto,there is no reliable and commercially available chemical for the control of *Xav*.(Opio*et al*., 1996; Ferreira *et al*., 2003).Probably the largest numbers and the most common chemical tools for the plant disease control are fungicides (Nene andThapliyal, 1993).Akpa and Manzo (1991) reported that seed treatment with fungicides (Apron plus and fanasan-D) significantly reduce seed-borne diseases. Another strategy is to use a mixture of two fungicides, one component of the mixture is a “single-site” and the other is a “multi-site” fungicide. Some examples of this type of mixture are Zyban, ConSyst, Sprectro 90 and Stature. This strategy is unique to fungicides as we still have several types of fungicide that have “multi-site” activity. Some examples of these multi-site toxicant fungicides are chlorothalonil, coppers and mancozeb. It is also important to apply the fungicide at the label rate, and notto apply at reduced rates. Repeated applications of single site compounds at reduced rates will promote resistance development.The fundamental basis for disease prevention relies on modification of the environment to reduce the risk of disease. Once the crop is exhibiting symptoms, it may not be possible to avoid losses. Seeds must be treated with seed treating fungicide to reduce infection by fungal pathogens found in the soil. Cowpea seeds are treated with Bavistin 2g for every kiloof seeds. Now-a-days organic fungicide like *Trichodermaviridi*is recommended for pulses at the rate of 4g per kilogram of seed.Again, organic fungicides are not

common in sub-Saharan Africa. Fungicides are metabolic inhibitors and their modes of action can be classified into four broad groups.

- Inhibitors of electron transport chain.
- Inhibitors of enzymes.
- Inhibitors of nucleic acid metabolism and protein synthesis.
- Inhibitors of sterol synthesis.

Application of chemicals to plants in order to prevent or inhibit disease development is fundamental means to manage disease outbreak (Matheron, 2001). However, the unwittingly use of fungicides on any perceived disease, with allegedly failure makes their use economically risky proposition.The objective of this research was to investigate the effectiveness of some fungicides in the management of *Xanthomonasaxonopodis*pv.*vignicola*, the incitant of bacterial blight of cowpea.

Materials and methods

Three Ife-brown seed lots werecollected from different cowpea seed companies and were treated with different fungicides;Alheri seed treated with Apron star (Alheri A), Premier seed treated with Dress force (Premier D), Masalaha seed treated with Team (Masalaha T). Three seed lots of local varieties were purchased from open markets within Zaria; these were Local treated with Apron star (Local A), Local treated withDress force (Local D), andLocal treated with team (LocalT). Two seed lots, IT86D-714 treated with Apron star (IT86D-714A and IT98-503-1 treated with Team (IT98K-503-IT) were obtained from International Institute of Tropical Agriculture (IITA).Five seed lots of SAMPEA-7 and one Local Ife-brown were obtained from Institute for Agricultural Research and open market respectively. These are SAMPEA-7 treated with Apron star (SAMPEA-7A), SAMPEA-7 treated with Team (SAMPEA-7T), SAMPEA-7 treated with Dress force (SAMPEA-7D),untreated SAMPEA-7 as control (SAMPEA-7C), inoculated SAMPEA-7 (SAMPEA-7I), and inoculated Ife-brown (Ife-brown I) making a total of fourteen seed lots, that were used in the trial. The inoculated Ife-brown was as a result of its

moderate resistance to *Xav*., and inoculated SAMPEA-7 was as a result of its known susceptibility to*Xav*.to serve as positive controland wassoaked in ethanol for 20 minutes before inoculation to remove all inherent pathogens. These were carefully selected to reflect the various sources farmers usually obtained seeds. The different fungicides used by the seed companies were Apron-star (tiamethoam 20 % + metalaxyl-m 20 % + difenocoazole 20 % w/w), Dress force (imidacloprids 20 % + metalaxyl-m 20 % + tebuconazoles 20 %) and Team (carbendazin 12 % + mancozeb63 %). Seeds were inoculated by soaking hundred seeds in 100 ml of bacteria suspension adjusted 4.7 x 10^7cfu/ml for 4 h before fungicide treatment. The fungicidal treatment was done at the rate of 2 g/kg of seeds. Seeds from each seed lot were planted in plastic pots of 25 cm diameter filled with sterile soil. Each seed lots were planted at the rate of 3 seeds per pot but thinned to 2 plants per pot after seedling establishment, with 5 replications. The seeded pots were placed randomly in the screen house and observed for germination. After which the plants were observed for a typical blight symptoms on root, cotyledons, stem, leaves and general seedling mortality for two weeks. Disease incidences were taken by counting the number of infected plants and severity were scored using a modified CIAT 1-9 scale (Opio*et al*., 1993). In addition leaf lesion severity, disease severity was also measured by percentage of defoliated leaf. To determine the number of infected leaf and consequently the fallen leaves,ten plants were randomly chosen in pots and tagged. The number of leaves with blight and the number of fallen leaves (indicated by blight on the nodes) on the tagged plants were counted. The total number of leaves, produced by the tagged plants were recorded, from which, the percentage of infected leaves, were calculated. The experiments were laid out using CRD. Data collected were analyzed statistically using ANOVA and means was separated by means of New Duncan's multiple Range Tests. The trials were repeated once.

RESULTS

The result shows that all seed lots had high incidence of CoBB on root, cotyledon, stem, and leaf both treatedand untreated but inoculated compared to the control

(Table1). On the seed cotyledon there was statistical difference between all the treatments except SAMPEA-7D and SAMPEA-7T that are statistically similar. The incidence of CoBB on the stem was higher on SAMPEA-7D and SAMPEA-7I (5.30 %), this was followed by Ife-brown I. There was no statistical difference between Local T and Local A treatments, between IT98k-503-IT, IT86D-714A and Alheri A and also between Premier D and MasalahaT. The incidence of CoBB on the leaf was higher on SAMPEA-7I followed by Ife-brown I. There was however statistical difference ($P \leq 0.05$) between all the treatments except Premier D and IT98-503IT which are statistically similar. Table 2 shows CoBB severity on the leaf. Leaf defoliation (pre-mature leaf shedding) is another symptom of CoBB. Compared to control treatment, all the treatments had higher severity. There was statistical difference in disease severity between all the treatments at 14 DAI. Similar result was observed 21 DAI except Local A and Local T. At 28 DAI, there was statistical difference between all the treatments except Alheri A, Premier D and IT98K-503IT that were statistically similar. At 35 DAI, however, there was statistical difference between all the treatments. At 42 DAI, Alheri A and IT86D-721 A, Local A and Local D were statistically similar; there was statistically difference between all the treatments. Similar result was observed at 49 DAI, only IT86D-721A and Premier D were statistically similar.In all the results, there was general reflection of susceptibility or otherwise of the host plant than the effect of fungicides. Putting the results together, the fungicides treated treatments did not significantly performed better than the untreated but inoculated treatments.

Table 1: Incidence of CoBB on Seedling Parts (%) 14 DAI in 2011 combineanalysis of two trials

Source/Variety	Root	Cotyledon	Stem	Leaf
Alheri A	4.50h	2.00f	1.15g	9.45l
Premier D	4.25i	1.65g	1.10h	10.25i
Masalaha T	4.50h	2.05f	1.10h	9.90j
IT86D-714A	4.50h	1.00j	1.25g	9.65k
IT98K-503-1T	6.60g	2.20d	1.15g	10.25i
Local A	6.75e	2.25c	1.30f	11.75f
Local D	6.65f	2.00f	1.45e	10.95h
Local T	7.00d	2.20e	1.40f	11.40g
SAMPEA-7A	10.15c	3.20b	2.10d	12.20e
SAMPEA-7T	10.50b	3.45a	2.35c	12.25d
SAMPEA-7D	10.75a	3.50a	5.30a	12.35c
SAMPEA-7I	4.50h	1.25h	5.30a	19.75a
Ife-brown I	4.20j	1.15i	3.50b	17.40b
SAMPEA-7C	0.00k	0.00k	0.00i	0.00m
S.E	0.92	0.20	1.3	0.41

Means in a column followed by the same letter are not significantly different at $p \leq 0.05$ level of significance NDMRT test.

Table 2: Severity of blight on the leaf part at 14, 14, 28, 35, 42, and 28DAI (% Defoliation) in 2011 two trials combine analysis

Source/Variety	14	21	28	35	42	49
Alheri A	2.90f	13.95f	14.70i	14.95k	37.21k	63.00a
Premier D	2.65i	13.85g	14.70i	14.70l	39.20h	59.50i
Masalaha T	3.00e	12.90k	14.60j	15.10i	40.80d	56.90j
IT86D-721A	3.20d	13.50j	15.00f	15.45e	37.21k	59.50i
IT98K-503-1T	2.70h	13.80h	14.70i	15.05j	39.90f	61.30c
Local A	2.40k	13.70i	14.95g	15.15h	38.90i	59.65g
Local D	2.80g	12.60l	14.90h	15.05j	38.90i	59.55h
Local T	3.50a	13.70i	14.95g	15.25g	37.80j	60.50d
SAMPEA-7A	3.30c	15.10d	16.00d	17.20c	39.60g	60.05f
SAMPEA-7T	3.40b	15.11c	16.20b	16.85d	54.25b	59.65g
SAMPEA-7D	3.20d	15.00e	16.15c	17.50b	52.95c	60.20e
SAMPEA-7I	3.00e	15.25a	16.40a	18.30a	55.10a	62.50b
Ife-brown I	2.95h	15.15b	15.15e	15.40f	40.60e	61.30c
SAMPEA-7C	0.00j	0.00m	0.00k	0.00m	13.00l	15.00k
S.E	0.04	0.01	0.03	0.04	0.004	0.03

Means in a column followed by the same letter are not significantly different at 5 % level of significance NDMRT test.

Discussion

There was high CoBB incidence on root and leaf of all the treatments irrespective of the variety. This shows the nutritional differences in the various parts of the seedling. This result is in agreement with Green *et al*. (2007) who reported that rhizosphere support high growth of pathogens. Also Yaryura *et al*. (2008) paralleled this observation by reporting that extract produced when bacteria and roots are simultaneously present, allow colonization to occur and that bacterial growth are facilitated. The low incidence of CoBB on cotyledons and stem observed could be as a result of the differential location of pathogen on the seeds at the time of germination (Buyer *et al*., 1999). Bacteria carried on the hilum can move to any parts of the developing seedling and cause disease symptoms during favourable condition (Dath and Devadath, 1983), while bacteria carried on the embryo could lead to seedling mortality (Nome *et al*., 2011). There was general reflection of susceptibility of SAMPEA-7 to *Xav*.as observed in the various parts of all the seedlings (Root, cotyledon, stem and leaf). Fungicides used in the seed treatment did not have significant effect on the pathogen attached to the seeds.

These results confirm the report of McMullen and Lamey (2000) and Shenge (2007) that most fungicides do not control bacterial pathogens and most will not control all types of fungal diseases. Most seed treatment products are either fungicides or insecticides were usually applied to seed before planting (McMullen and Lamey, 2000). The percentage defoliation was higher in the susceptible variety (SAMPEA-7) than other varieties. There was a general steady increase in the percentage defoliation from 14-49DAI in all the varieties. This shows the in ability of fungicides to systemically translocate to the vascular system of plant or had no effect on the pathogen.But most farmers in Africa use fungicides or insecticides for control of any perceived disease problem on their crops (Dadari *et al*., 2005). Defoliation is a subtle symptom of CoBB. Defoliation was mainly due to large population of *Xav*.colonizing the xylem vessels (Gartemann *et al*., 2003). Bacterial pathogen can reduce phosphorylation by causing a loss of chloroplast structure and function (Kosuge and Kimpel, 1982). Plant pathogenic bacteria produce Extracellular Polymeric

Substances (EPS) that cause water soaking of intercellular spaces of leaves. Water soaking is a result of altered plant membrane functions, which will also cause a loss of compartmentation and possibly a disruption of chloroplast function (Kosuge and Kimpel, 1982). Disruption of membrane permeability is an important cause of defoliation (Chlaupowicz *et al*., 2010) and this might possibly account for the high percentage defoliation of all the treatments irrespective of variety. The pathogen, once established in host tissue, redirect the host nutrients for their own use. In most diseases the water flow through the xylem is reduced to a mere 2-4 % of that flowing through stems of healthy plants (Goodwin, 1992; Chaube and Pundhir, 2005).

Conclusion

Control measures depend on proper identification of disease and their causal agent (s). Without proper identification of disease and the disease causing agent, disease control measure can be a waste of time and money and can lead to further plant losses. Anecdotal use of chemical pesticides should be discouraged and farmers are advised to seek for proper diagnosis of pest problems as well as appropriate protection products from plant protectionists. Despite the popular pressure to curtail the use of chemical pesticides, chemical pesticides application remains the veritable and effective means of controlling pest and diseases, especially if properly applied in the integrated pest management approach.

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