

Effect of Fertilizer on Varietal Response Against Leaf Spot Diseases in Banana (*Musa spp.*)

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ABSTRACT

The experiment was designed to find out the suitable fertilizer management package to control Banana leaf spot disease and to find the varietal respond against the leaf spot diseases. Banana is affected with two major leaf spot diseases caused by *Mycosphaerella musicola* Leach (Yellow Sigatoka) and *Mycosphaerella fijiensis* Morelett (Black Sigatoka). Septoria leaf spot disease of which causal organism is *Septoria eumusae* was observed in the experimental plants.

Three types of fertilizer management packages as Department of Agriculture recommendation, Cow dung and ash form of paddy husk with three Banana varieties of Marthamalu, Ambun, Ambul were applied in a split plot design keeping the fertilizer treatment as main plots. The least disease severity value was detected under the cow dung application on variety Marthamalu. According to the result of the experiment, combination of cow dung and variety Marthamalu can be successfully used to control the Septoria leaf spot disease.

KEY WORDS: Black sigatoka, *Micosphiarella spp*, septoria disease, yellow sigatoka

INTRODUCTION

Banana (*Musa spp.*) is of vital important food in the world as dessert bananas and as an important staple food in countries like equatorial Africa. As it is a good source of sugar, Africa like countries produce beer using fermented banana. Since the fruit is high in energy but low in fat and is also rich in vitamins B6 and C It is a healthy food for particularly people with digestive problems. Consequently it has both nutritive and healthful values.

The total banana cultivated land extent In Sri Lanka estimated in year 2005 was 55997 ha and the fertilizer requirement was 10824 mt (Anon, 2006). The target production in the Maha season of year 2005/2006 was 485204 mt but achieved production was 239384 mt. Such a huge deference between estimated production and farmers' production is due to the major constrains in banana cultivation. Out of all the constraints, leaf spot disease plays a significant role for the reduction of the Banana production.

Banana is widely affected by the leaf spot diseases resulting low yields. Recorded leaf spot diseases from Sri Lanka are mainly caused by the *Micosphiarella spp*. It causes two major leaf spot diseases. Black sigatoka (BS) disease caused by *M. fijiensis* Morulet is the most aggressive and the major world wide constraint to the plantain production. This was recorded from the Sigatoka district in Fiji Island in 1963. Yellow Sigatoka (YS) caused by the *M. musicola* leach was first recorded from Java in 1902 (Zimmermann, 1902).

Yellow Sigatoka is the most economically important musa spot disease in Sri Lanka. It affects wide range of banana genotypes in the country. YS was first recorded in Sri Lanka in 1919 (Stover, 1972).BS was first identified in Sri Lanka in 1995

(D.R Jones, 1995). It is very similar to the YS but is more virulent and affects wide range of banana genotypes.

Another recently found musa foliar spot disease is the septoriya leaf spot disease and is also named as sigatoka-like disease (Carlier et al., 2000). The causal organism is *M. eumusae* (Carliar et al., 1999). This disease resembles *M. musicola* and *M. fijiensis* in the telamorp stage and has been named *S. eumusae*. on its anamorph stage. (Udugama, 2002)

Banana foliar spot diseases cause defoliation and destruction of banana leaves reducing the active leaf area of the plant for photosynthesis. This results premature ripening of fruits and reduction of yields. The soil-disease-pest complex can be controlled by the combination of inorganic fertilizers, fungicides and insecticides/nematicides. Chemical control strategies are socio-economically unsound among the resource poor small holders growing plantain. Chemical control of these foliar diseases is of much Expensive and their application may be hazardous to the health in the village homesteads where the bulk of plantain is grown.

The main objective of the research project is to find an echo friendly solution for the leaf spot diseases and to reduce the money wastage for chemicals. As leaf spot diseases are highly infected with low vigorous plants, Organic fertilizers rich with beneficial organisms and their secretions consisting disease resistant bio chemicals can be used to increase the resistance of the plant against the leaf spot disease. By examine the varietals performance of *Musa spp.*, best varieties which show significant resistance to the spot diseases can be evaluated.

MATERIALS AND METHODS

Location of the experiment

The experiment was carried out at the research field of Regional agricultural research and development center, Makandura.

Plant materials and treatments

The most commonly and widely cultivating local varieties of Marthamalu Ambun and Ambul was used in this experiment. Disease free vigorous Banana suckers were used as planting materials.

The corm stumps of all the planting materials were pre treated with sterilizing slurry of which composition is fresh cow dung furadan fungicide and ash.

Experimental design and cultural practices

The experimental design was split plot design with four replications. The plot size was 9m × 3m. Different fertilizer management practices were taken as the main plot and the three deferent varieties were considered as sub plots

A₁ husk)

A₂ = Department of Agriculture Recommendation (DOA)

A₃ = Cow dung

V₁ = Ambul

V₂ = Marthamalu

V₃ = Ambun

All the 60cm × 60cm × 60cm size planting pits were filled with cow dung (2 kg/pit) and topsoil (2kg/pit). Each plants was spaced by 3m × 3m resulting the plant density of 1110 plants per ha.

Data were recorded on each plants of the entire main and sub plots. As there were three varieties and three types of fertilizer treatments, three main plots and three subplots were maintained in each replicates. Major plots were separately treated with three deferent fertilizers of DOA recommended fertilizer, cow dung and ash form of the paddy husk. One type of banana variety was established in an individual sub plot. One month after planting all the banana plants were treated with three different fertilizer treatments while DOA recommendation dosage was applied by every four months, all other treatments of dosages were applied monthly (Table 01).

Data recording and analyzing

As the experiment was focused on leaf spot disease, disease severity was evaluated every week. The percentage of leaf area with symptoms was recorded using the modified scale of Stover and Dicson as describe at the International Institute of Tropical agriculture (Stover, 1970).

Calculation of Disease severity

To calculate the infection index a modified scale was used. The derived scale for evaluating the disease

is as follows. 7 grads were defined and each grade denotes the percentage of the total leaf area covered by the leaf spots

0 = no symptoms

1 = lower than 1%

2 = 1-5%

3 = 6-15%

4 = 16-33%

5 = 34-50%

6 = 51-100%

7 = complete

Table 1 - Varieties and fertilizer Treatments:

Treatment type	Dosage	
A1 - Cow dung	2Kg/pit	
A2 - Ash form of paddy husk	2Kg/pit	
A3 - DOA recommended	Urea	40 g/pit
	TSP	26.7g/pit
	MO P	83.3g/pit

The infection index was calculated using the following equation

$$\text{Disease severity} = \frac{\sum nb}{(N-1)T} \times 100$$

n = number of leaves in each grade

b = grade in the derived scale

N = Number of grades used in the Scale

T = Total number of leaves scored

All the data were analyzed using the Statistical Analyzing Software (SAS)

Disease identification and Confirmation

The spores shape of the fungi was examine through the stereo microscope. The shape of the leaf spots and the spore shapes were characteristics to the *Septoria eumusae*. At the anamorph stage the conidiophores are non-septet and shorter than the *M. musicola* and *M. fijiensis* (Udugama, 2002). Conidia produce from the Apex of the conoidiophores are 0-5 septet. How ever the pathogenicity of *Septoria eumusae* was confirmed by the koach's postulation techniques.

RESULTS AND DISCUSSION

Treatment Effect

According to the SAS out put the treatment effect was significant ($p < 0.05$). In comparing the separated means, the treatment cow dung denoted by A3 has shown a significantly deferent low disease severity value. The treatment ash (ash form of paddy

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husk) denoted by A2 has shown the highest significant disease severity value.(Table 2).

Table 2 - Disease severity with Different Fertilizer treatments:

Treatment	Mean disease severity value
A1- Ash	3.30 ^a
A2 - DOA recommendation	3.82 ^{ab}
A3 - Cow dung	3.04 ^c

^{abc} Mean values with unlike superscripts are significantly deferent

Varietals performance

According to the output of statistical analysis system (SAS) the variatals effect is as significant as its probability value is lower than the critical probability value of 0.05. Out of all three varieties, the variety Marathamalu denoted by V2 has shown the lowest significant disease severity value. Variety Ambun denoted by V1 has shown the highest significant disease severity value. (Table 3.)

Table 3 - Disease severity with Different Varieties:

Variety	Mean disease severity value
V1 - Ambul	4.63 ^a
V2 - Marthamalu	1.77 ^c
V3 - Ambun	3.04 ^b

^{abc} Mean values with unlike superscripts are significantly deferent

Disease severity with time

All the varieties demonstrate a gradual increase of the disease severity against all the three different treatments with time. It may be caused by the population increase of the pathogen with time (Figure 1, 2, 3). Only variety Ambul was having a decline in disease severity under the fertilizer application of DOA recommendation after the fourth week. But in the case of cow dung treatment, there is a trend of decreasing the disease severity at the latter phase (Figure 3).

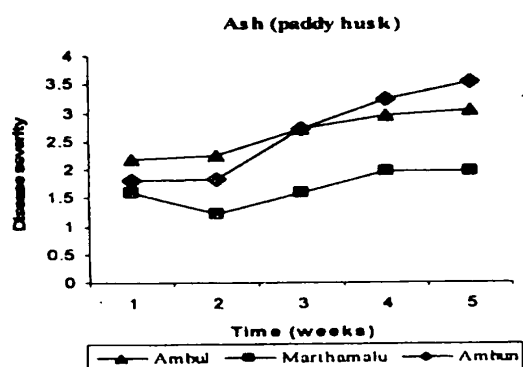


Figure 1 - Varietals respond with time against Ash:

Reason may be that the cow dung is rich with higher organic compound and a very good substrate for the microbial activity which may result in higher population density of antagonistic microorganisms.

Variety Marthamalu has shown a comparatively low significant disease severity value against cow dung treatment (Figure 3).

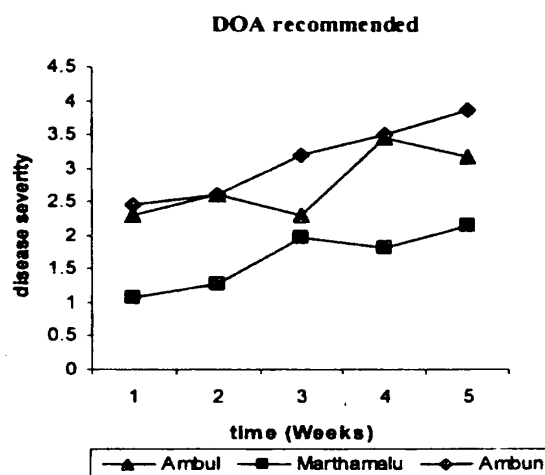


Figure 2 -Varietals respond with time against DOA recommended fertilizer treatment:

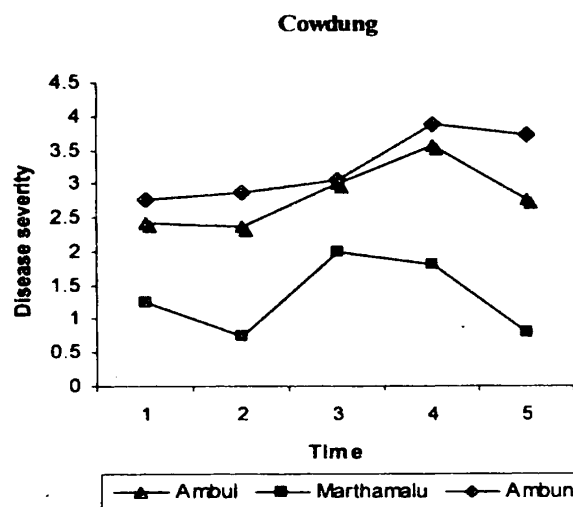


Figure 3 - Varietals respond with time against Cow dung fertilizer treatment:

CONCLUSIONS

The results of the study revealed that the banana plants treated with cow dung has performed comparatively higher resistance against Septoria leaf spot disease.

According to the varietal performance in the study, Marthamalu has shown a significant resistant against septoria leaf spot disease. Consequently, combination of cow dung as the best treatment and the Marthamalu as the best variety in the experiment will give better scope performance for successful banana cultivation.

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