International Journal of Development and Sustainability
ISSN: 2168-8662 – www.isdsnet.com/ijds
Volume 3 Number 2 (2014): Pages 388-392
ISDS Article ID: IJDS12102501

ISDS JOURNALS

Short Communication

Field evaluation of copper based fungicides to control Phytophthora pod rot of cocoa in Nigeria

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Abstract

Copper based fungicides are the only pesticide currently registered for use on cocoa for controlling *Phytophthora* pod rot in Nigeria. Black pod disease caused by *Phytophthora megakarya* and *P. palmivora* is the most important and devastating disease of cocoa in Nigeria. Four candidates fungicides were evaluated for their effectiveness against black pod disease in three different agro-ecological zones: Ibadan (Oyo State), Owena (Ondo State) and Ajassor (Cross River State). Ridomil Plus containing copper+metalaxl, Ridomil Gold containing copper+metalaxl-M, Funguran OH containing copper hydroxide and Champ D.P. also containing copper hydroxide were tested for their efficacy in a field trial. Compared with unsprayed plots, Ridomil Gold significantly reduced black pod infection from an average of 67.4% to in the first year to 19.7%. This pattern was similarly followed in the second year when percentage incidence of black pod infection was reduced to 12.7%. The other fungicides tested also reduced infection but to a lesser extent when compared with the performance of Ridomil Gold.

Keywords: Fungicides; Phytophthora; Cocoa; Nigeria

Cite this article as: Agbeniyi, S.O. and Oni, M.O. (2014), "Field evaluation of copper based fungicides to control Phytophthora pod rot of cocoa in Nigeria", *International Journal of Development and Sustainability*, Vol. 3 No. 2, pp. 388-392.

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1. Introduction

Cocoa *(Theobroma cacao L*) represents an important export commodity for producing countries. Africa is responsible for about 65% of the world production of dry cocoa beans, Cote d'Ivoire being the largest producer. Black pod disease caused by *Phytophtora spp* is a global problem. It causes an estimated 44% yield loss worldwide, and in some parts of West Africa leads to crop losses of up to 100% (Annon, 2002). *Phytophthora megakarya*, the most aggressive species, is presently restricted to Nigeria, Cameroon and Ghana. *Phytophthora palmivora* is however endemic in most cocoa growing regions of the world.

Several workers have reported the yearly incidence of black pod disease in Nigeria and various attempts to manage the disease outbreaks (Adegbola, 1990, Agbeniyi and Adedeji, 2003, Orisajo *et al.* 2012). Norgrove (2007) also reported that "cocoa yields were 2.5 times greater in the high spray treatment than in the low spray treatment". Persistence of fungicides on pods in the field as well as the cost implications are some of the factors limiting widespread use of fungicides. Smallholders grow over 80% of the cocoa. Without protection, cocoa pods can easily succumb to infection by *P.megakarya and P. palmivora*. This situation warranted continuous search for an effective but cheap fungicides allowed by the European Union. In the studies reported here, four candidate fungicides were compared for their efficacy in the field trial at Ibadan (Oyo State), Owena (Ondo State) and Ajassor (Cross River State).

2. Material and methods

The fungicides tested were:

- Ridomil Gold and Ridomil Plus supplied by Syngenta Nigeria Ltd.
- Funguran OH supplied by INSIS and
- Champ D.P. supplied by SARO Agrochemical Ltd.

Fungicides	Weight in 10 litres of water
Ridomil Gold	50g
Champ D.P.	40g
Champ D.P.	60g
Champ D.P.	80g
Funguran OH	40g
Funguran OH	60g
Funguran OH	80g
Ridomil plus	33g
Control	0.0g

The site used for these studies contained F3 Amazon varieties planted in rows. The spacing was 8" x 8". The experimental design was randomized complete block design. The treatment plots contained nine trees

each separated by three rows of trees. Each treatment had thr3ee replications. There were six applications at 3 weekly intervals from June to October using CP 15 knapsack sprayers, spraying pods on the trunks and as much as possible on the canopy. Pods were harvested at 3-weekly intervals and a day before spraying.

Details of the sites for the experiments are summarized below:

Location of plot	General Remarks
Ibadan	Mild dry period, humid area. High black pod history
Ikom	High forest area, early crop season, humid areas.
Owena	Humid area, high forest belt. High black pod history

There were three replications of each fungicide treatment at all stations. Pods were sprayed to run off.

3. Results and discussion

The summary of green pods before spraying application for each treatment is shown in Table 1 and 3. Ridomil Gold treated plots with a mean annual percentage infection of 19.7% in the first year and 12.7% in the second year were significantly (5%) better than plots treated with other fungicides. Ridomil plus ,Funguran OH, and Champ D.P followed in that order of diminishing efficacy. However, the systemic qualities imputed to Ridomil Gold were of special interest in the control of black pod disease. Therefore, higher concentration of Champ D.P. and Funguran OH (40,60 and 80g/10 litres of water) were tested. Ridomil Gold at 50g/10 litres perform significantly better than 80g of either Champ D.P. or Funguran OH. A survey of percentage black pod incidence at each of the three experimental fields indicate that the fungicide tested were effective in the control of *P. megakarya*. Ridomil Gold and Funguran OH were the best chemicals with Ridomil Gold having the edge over Funguran OH , Champ DP and Ridomil plus (Table 2 and 4).

Table 1. Total number green pods at each spraying application in the first year

Fungicide	Conc. (g)/ 10lts of water	Spraying Application						
		1st	2nd	3rd	4th	5th	6th	Total
Ridomil Gold	50	145	116	86	16	99	35	497
Ridomil plus	33	130	168	59	36	99	23	459
Champ D.P.	40	121	123	42	48	98	65	497
Champ D.P.	60	201	163	91	42	37	79	563
Champ D.P.	80	109	83	69	42	85	70	458
Funguran OH	40	117	107	107	48	98	65	542
Funguran OH	60	150	131	101	42	37	29	411
Funguran OH	80	94	25	52	44	83	60	438
Control	0.0	101	100	78	39	62	12	540

Table 2. Development of pod rot on cocoa pods sprayed with fungicides in the first year

Fungicide	Conc. (g)/ 10lts of water	%Black pods							
		1st spray	2nd spray	3rd spray	4th spray	5th spray	6th spray	Total	mean
Ridomil Gold	50	20.7	25.8	869	12.5	2.5	0.0	1184	19.7e
Ridomil plus	33	16.9	45.4	49.1	20.8	2.0	0.0	134.2	22.3d
Champ D.P.	40	11.0	64.2	45.2	7.4	24.5	11.1	163.4	27.2c
Champ D.P.	60	18.9	44.2	34.1	19.0	18.8	29.0	164.0	27.3c
Champ D.P.	80	23.8	34.9	37.9	3.7	14.0	31.8	146.1	24.4cd
Funguran OH	40	36.8	46.2	60.7	18.7	9.1	30.4	201.1	33.6b
Funguran OH	60	2.7	48.5	42.3	9.5	24.3	31.0	188.3	31.3b
Funguran OH	80	22.7	19.7	18.2	19.0	15.2	25.0	119.8	19.9e`
Control	0.0	51.6	50.6	50.9	76.9	72.5	72.0	374.5	67.4a

Means not followed by the same letter are significantly different (p=0.05)

Table 3: Total number green pods at each spraying application in the second year

Fungicide	Conc. (g)/ 10 lts of water	1st	2nd	3rd	4th	5th	Total
Ridomil Gold	50	14	7	19	37	26	103
Ridomil plus	33	10	22	34	39	32	137
Champ D.P.	40	37	17	37	23	48	160
Champ D.P.	60	29	12	29	25	40	145
Champ D.P.	80	22	9	22	1	41	128
Funguran OH	40	34	32	18	18	9	138
Funguran OH	60	10	25	15	58	63	177
Funguran OH	80	17	13	02	45	41	118
Control	0.0	13	21	19	93	68	214

Table 4: Development of pod rot on cocoa pods sprayed with fungicides in the second year

Fungicide	Conc. (g)/ 10lts of water	Spraying Application						
		1st spray	2nd spray	3rd spray	4th spray	5th spray	Total	Mean
Ridomil Gold	50	0	0.0	42.2	32.7	7.8	72.2	12.7e
Ridomil plus	33	0	0.0	83.0	20.8	0.0	103.8	20.7cd
Champ D.P.	40	0	8.3	75.7	34.0	9.6	128.0	25.6b
Champ D.P.	60	0	16.6	74.9	28.3	6.0	125.8	25.1b
Champ D.P.	80	0	9.4	62.3	8.3	1.5	81.5	16.3c
Funguran OH	40	0	63.3	64.2	30.0	7.6	108.1	21.6cd
Funguran OH	60	0	4.1	33.3	23.4	2.7	63.5	12.7d
Funguran OH	80	0	0.0	33.3	29.8	2.0	65.1	13.0e
Control	0.0	0	57.6	83.3	56.2	19.9	213	42.6a

Means not followed by the same letter are significantly different (p=0.05)

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