FIELD EVALUATION OF FUNGICIDES AGAINST PURPLE BLOTCH (*ALTERNARIA PORRI*) OF BULB ONION (*ALLIUM CEPA*)

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ABSTRACT

Seven fungicides were evaluated during a dry season and a wet season for efficacy on disease incidence and disease severity of purple blotch of bulb onion. The fungicides used were benomyl, 50% WP, 10% a.i.; mancozeb, 80% WP, 0.16% a.i.; captan, 80% WP, 0.10% a.i.; chlorothalonil, 50% EC, 0.10% a.i.; metalazyl, 72% WP, 0.036% a.i.; copper-oxychloride 50% WP, 0.10% a.i. and manzeb, 80% WP, 0.16% a.i. Fungicidal treatments reduced the rate of purple blotch incidence and severity in the wet season. All the fugicides tested resulted in higher yields. Mancozeb was most effective in both the dry and wet seasons. Yield losses in unprotected plots were estimated at 53.8% and 67.5% for the dry and wet seasons respectively. Yields were negatively correlated to coefficient of disease index (CODEX).

Key words: *Bulb onion. Purple blotch.* Alternaria porri. *Fungicidal control.*

INTRODUCTION

The purple blotch disease of bulb onion (*Allium cepa.* L.) caused by the fungus *Alternaria porri* (Ellis) cif. is one of the main diseases limiting onion production in the tropics (Pathak *et al.* 1996). Initial infestation shows small white sunken spots, which then enlarge, become zonated and eventually girdle the affected area. Purple spots on the affected area can be seen only in the wet season. The pathogen can affect any part of the plant under favourable conditions. The disease was recorded in Papua New Guinea (PNG) as early as 1963 (Shaw 1984) and is now reported to be widespread (Wiles 1992 a).

The disease was reported to be very destructive in Southern U.S.A., Puerto Rico, Kenya and India (Ellis and Holliday, 1970). In India, Sandhu *et al.* (1981), reported yield loss of more than 50% on seed crops. There are no estimates of yield loss due to the purple blotch disease of onion in PNG. As resistant varieties are not available in PNG, control of the disease by fungicides is seen as the most effective short term control method. Many fungicides have been used to control the disease in certain parts of the world where the disease was serious (Gupta and Pandey 1986; Gupta *et al.* 1991, Srivastava *et al.* 1991). Wiles (1992 a) recommended 2g/1 litre of Dithane M-45 and Benlate for the control of purple blotch in PNG. This recommendations were made without proper screening of fungicides available on the market in PNG at that time.

Many new fungicides have come on the market with little or no information on their effectiveness in controlling the disease under PNG conditions. As purple blotch disease is widespread in PNG, effective fungicides need to be determined for purple blotch control under our environmental conditions. Several selected fungicides; benomyl (Benlate), chlorothalonil (Bravo), captan (Captan), copper-oxychloride (Champion Copper), mancozeb (Dithane M-45), manzeb (Dithane M-22) and metalazyl (Ridomil) were screened in two seasons, wet and dry. The present study was conducted to find out which fungicides are effective for the control of purple blotch on onion, their effect on yield and to estimate the yield loss in the dry and wet seasons.

MATERIAL AND METHODS

The field trials were conducted between August 1994 and June 1995 at Brahman, (500 m.a.s.l), Upper Ramu in the Madang Province. The dry season trial was planted on August 5th, 1994 and

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harvested on December 2nd, 1994 (119 days growing period) and the wet season trial was planted on February 6th, 1995 and harvested on June 15th, 1995 (128 days growing period). The long term average monthly rainfall for the dry and wet season ranges from 50-150 mm and over 250 mm respectively. Both trials were conducted on soils that were cleared from secondary forest. The soil was friable, free draining and high in organic matter.

Bulb onion seeds of cultivar Tropic Brown were sown on steam sterilized seed beds of 1:2:1 parts of sand, top soil and chicken manure respectively. The seed beds were watered every afternoon. After 6 weeks the seedling were hardened for 2-3 hours in the afternoons for two weeks. At 8 weeks the seedlings were transplanted onto plots of 0.6 x 1.6 m size at a plant spacing of 0.40 m x 0.10 m. The trial design used was randomised complete block design (RCBD) of eight treatments, replicated four times.

First sprays were applied 30 days after planting (DAP) and sprayed bi-monthly untill two weeks before harvest. Active ingredient of fungicides used was that recommended by the manufactures (see Table 1) with 2 mls/L of the sticker Agral. Eight Knapsack sprayes were used, one for each fungicide. The control was sprayed with water. Weeds were removed manually every two weeks with the aid of a spade.

Percentage of purple blotch disease incidence (PDI) and severity (PDS) assessment on leaves of fifteen inner most plants was done before each spraying time. This assessment was done 6 times. The mean is presented in Table 1. The number of leaves infected and the area affected were assessed using the assessment key of James *et al.* (1978) for *Rhynchosporium* leaf blotch of barley. A score between 0-4 was used, where 0 for no infection and 4 for 75-100% necrotic infection. Coefficient of disease index (CODEX) by using the formula of Datar and Mayee (1981).

$$\text{CODEX} = \frac{\text{PDI X PDS}}{100}$$

where, PDI = frequency of leaves affected
PDS = Intensity/extent of damage of the affected area.

Table 1: *Effect of different fungicides on the control of purple blotch of bulb onion during dry and wet seasons at Brahman, Upper Ramu*

	Dry (1994)				Wet (1995)				
Fungi-cide	Doses a.i.(%)	Disease inciden-ce. %	Disease severity 1%	Yield (kg/m^2) 2	Bulb weight (g)	Disease inciden-ce. %	Disease severity 1%	Yield (kg/m^2) 2	Bulb weight (g)
Mancozeb	0.16	4.8	2.6	2.12a	33.9	34.90	12.10	3.91a	62.9
Ridomi	0.036	9.2	6.0	1.31b	20.9	47	15.90	1.99bc	31.9
Manzeb	0.16	8.6	5.8	1.32b	21.1	38.5	14.5	2.38abc	38.2
Benlate	0.10	9.4	6.4	1.29b	20.7	38.8	14.8	2.34abc	37.4
CuOCl	0.10	11.7	7.2	1.0b	16.0	42.6	15.2	2.07abc	33.1
Captan	0.10	6.4	4.8	1.38b	22.1	36.8	14.2	2.86ab	45.8
Bravo	0.10	8.4	5.6	1.35b	21.6	36	13.6	3.32ab	53.1
Control	-	12.2	8.4	0.98b	15.7	52.2	24.3	1.27b	20.4
CV				0.242				0.322	
LSD				0.626				1.559	

1. Disease severity rating system: 0 = No disease, 1 = 1-25% of area affected. 2 = 26-50%, 3 = 51.75%. 4 = 76-100% or dead.
2. Numbers in each column followed by the same letter do not differ significantly at p = 0.01 according to Duncan's multiple range test.

The bulbs were harvested from the soil manually. Undried leaves were removed with the aid of a kitchen knife after curing for two days. The bulbs were then weighed. Data for each season was analysed by analysis of variance and means separated by Duncan's Multiple Range Test (DMRT) at (P=0.05 x 0.01). Simple regression analysis was carried out on yield and disease intensity to determine the influence of fungicides.

RESULTS

The effect the seven fungicides had on yield, disease incidence and disease severity during the dry and wet seasons are shown in Table 1. In the dry season, plots treated with Mancozeb yielded significantly higher than the other treatments. They gave the biggest bulb weight and highest yield. No significant differences were observed in yield between the other treatments and the control in the dry season although the control treatment yielded the smallest bulbs and gave the lowest yield. In the wet season trial. Mancozeb treated plots again yielded significantly higher than Ridomil and the control (unsprayed) but not the other treatments. Bravo and Captan treated plots also yielded significantly higher than the control in the wet season. In general, disease incidence, disease severity, yield and bulb weight (kg/m^2) were lower in the dry season than the wet season.

Purple blotch was generally severe in the wet than the dry season. In both seasons, disease incidence and severity were lower in the sprayed plots than the control. All the fungicides screened performed well in the wet season except Ridomil. Yield losses in non-protected plots were predicted as the difference between the control and the highest yield divided by the highest yield multiplied by 100. Yield losses in non-protected plots were 53.8% and 67.5% in the dry and wet seasons respectively.

To quantify the effect of disease on yield, total yield (y) in (kg/m^2) were regressed on the coefficient of disease index (CODEX) (x) in percentage. In the dry season, yields (Y in Kg/ m) were predicted by the equation:

$$y = 1.947 - 1.105x,\ R^2 = 0.7875.$$

In the wet season yields were predicted by the equation:

$$y = 4.073 - 0.245x,\ R^2 = 0.6786.$$

DISCUSSION

At Brahaman the variety Tropic Brown was very susceptible to purple blotch in a variety evaluation trial done earlier in 1991 (S. Ivahupa, unpub.). It was mentioned that purple blotch was the major disease that affected all the cultivars tested there.

The severity of the purple blotch depended on the season, the location of the trial and the fungicide used. In the dry season trial, the disease CODEX of the treatments were not significantly different, hence no significant differences were obtained in the yields. The effect of fungicides could not be properly understood in that season.

Plots used in both seasons were established close to each other and the increase in blight severity could be due to a higher level of initial disease in the wet season. This suggested that there was some spread of inoculum from the previous season since the pathogen is known to over - season in crop debris (Pandotra 1965, Gupta and Pathak 1988) and in soil (Basu 1971, Khare and Nema 1981).

The efficacy of fungicides on purple blotch disease was greater in the wet season than the dry season. There was significant reduction in disease incidence and severity in sprayed plots. The highest efficacy of fungicidal control was obtained in plots treated with Mancozeb. Captan and Bravo were also effective. These fungicides have been reported to be effective in purple blotch control in other countries (Gupta and Pandey 1986, Srivastava *et al.*, 1991). The yield per hectare of plots treated with mancozeb in this trial was higher than that recorded by Sowei (1994) and estimated by Wiles (1992b). Bulb yield were correlated with disease CODEX. The highest yields were obtained where the CODEX were lowest, thus reflecting that metalaxyl controls the disease effectively (Pandotra 1965; Srivastava *et al.*, 1991; Gupta and Pandey 1986, Wiles 1992a), they have not performed better than the control under Brahman conditions.

CONCLUSION

All the fungicides used in this trial have the potential for purple blotch control. They have increased bulb weights and improved yield over the control. For this trial, mancozeb (1.6 g/L) is recommended every 14 days starting 30 days after planting, both as curative and protective sprays where the disease has become endemic.

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