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Integrated management of acha brown leaf spot disease through the use of nitrogen fertilizer and the fungicide kitazine

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Effect of The three rates of nitrogen [0, 30 and 60kg N/ha and three levels of fungicide kitazine (diisopropy-5-benzyl thio-phosphate) at 1.5 and 2.0 1/ha on rice leaf scald management was assessed under upland condition. Brown spot (BS) disease was controlled in infected acha plants with application of the fungicide. Application of high rate of nitrogen greatly increased the severity of the BS, especially where fungicide was not used. Also, grain yield and number of panicles per meter square were increase*d* significantly [p=0.05] with the use of nitrogen fertilizer and treatment of acha plants infected by BS with kitazine. However, plant height and tiller number were not affected by the treatment.

Keywords: Acha, Brown Leaf spot, kitazine, Nitrogen, Yield.

Introduction

Fonio (Digitaria exilis and Digitaria iburua) is probably the oldest African cereal. For thousands of years West Africans have cultivated it across the dry savannas. Indeed, it was once their major food. Even though few other people have ever heard of it, this crop still remains important in certain regions of Mali, Burkina Faso, Guinea, and Nigeria, for instance, it is either the staple or a major part of the diet. In Nigeria it is usually called "acha." Birds may badly damage the crop in some areas; bird-scaring is usually necessary in those locations. The plants are also susceptible to smut and other fungal diseases**.** Pest and diseases are important natural factors that limit the production of food crops including acha [Kauffman et al., 2003]. In severe cases 100% losses are recorded. Blast [Pyricularia oryzae Cav.] and the brown leaf spot [Dresclera oryzae] [Breda de Haan Subram and Jain] were the major diseases affecting acha [Kang et al., 1999 and Ishii, 2001]. Wrong use of fertilizer especially nitrogen has aggravated the incidence of these diseases Ho [1998] and Teich [1998] found that heavy vegetative growth resulting from use of high dose of

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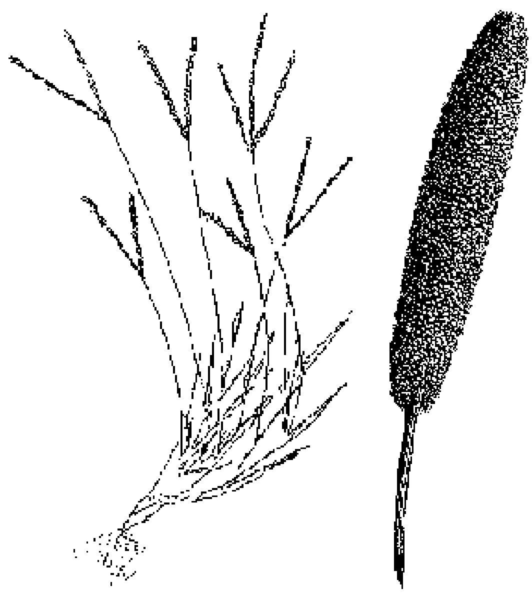
fertilizers [mainly nitrogenous ones] induce susceptibility to disease. Sere [2003] reported that application of 2 litres/ha of kitazine [diisopropyl-5-benzyl thio-phosphate] effectively controlled rice blast (*Pyricularia oryzae)*, Brown spot (*Helmithosporium oryzae*,) white gall [*Corallocystostroma oryzae* Yu & Zhang] and Virescence [*Sclerophthora macrospora* (Sacc.) Thirum, Shaw & Naras. There is therefore the need to assess the reaction of these acha land races (D. iburua and D. exilis) to brown spot disease and to control it using this newly formulated chemical [Kitazine] in an integrated manner, with cultural method.



Materials and methods

This study on the management of Brown leaf spot disease was carried out on acha plants on the field known to be naturally infested with the pathogen, using three levels of nitrogen from urea [0,60 and 90 kg N/ha], two acha land races [D. iburua and D. exilis] susceptible to Brown leaf spot disease and three levels of fungicide, Kitazine [diisopropyl-5-benzyl thio-phosphate] at 0, 1.5 and 2 1/ha using factorial split-plot design.

The nitrogen levels were the main plot, the fungicide sub-plot and varieties the sub-sub plot. The trial was replicated thrice. The plot size of 3m x 2 m was used with planting spacing of 25cm x 25cm. Fungicide was represented as (F), nitrogen fertilizer = (N), acha ascensions = (A), No fungicide = (FO), 1.5 L/ha kitazine = (F1), 2 L/ha kitazine = (F2), 0 kg N/ha =

(NO), 30 kg N/ha = (N1), 60 kg N/ha = (N2), acha land races D. iburua (LR1), and D. exilis (LR2).

Data were collected on brown leaf spot incidence, severity, agronomic and yield characters of acha. Internationally accepted Standard Evaluation System Scale [SES], IRRI, (1996) 0-9 was used to score the leaf incidence and severity based on the number of spots on leaves per plant per hill and per plot.

SES, SCALE

0=no scald, 1-3=about 2 mm length, 4-5 = about 2%-10% affected 6-7=about 11%-50% leaf affected 8-9 = about 51%-100% leaf affected. Plant height was taken at maturity using a meter ruler to measure from the base to the apex of the flag leaf of the mother tiller per hill. Tiller number was obtained by counting the number of tiller in five hills per plot and the means were used for the statistical analysis. Number of panicle per square was obtained by counting the number of panicles in ten randomly selected hills at harvest and the average number obtained was multiplied by the number of hills per meter square.

Initial weight of seeds was taken then dried until constant weight was obtained. Yield of acha was assessed by harvesting acha within one meter square, by panicle method,(Chakravarty and Biswas, 1999). They were threshed, dried, winnowed and weighed using a weighing balance. The mean weights obtained were recorded in tons/ha.

Statistical Analysis

Data obtained were subjected to analysis of variance procedures to determine the significance of the treatment effects and their interactions [Steel and Torries, 1980]. A protected Duncan Multiple Range Test [DMRT] at 0.05 was carried out to compare treatment means.

Results

The effect of three rates of nitrogen fertilizer and three fungicide levels on plant height, tiller numbers and number of panicles per meter square are presented in tables 1 and 2 for D. ibura and D. exilis respectively. The main effects of the treatments were not significant on plant height and tiller number at [$p=0.05$].However, significant effects [$p=0.05$] of the treatments were observed on the number of panicles per meter square. The various main treatments or their combinations significantly [$p=0.05$] increased the number of panicles per meter square for both varieties.

Brown spot incidence ranged from 1-8 for D. ibura [Table 3] and 1-7 D. exilis [Table3] while the disease severities ranged from 0 – 6 for both varieties. There were significant decreases [p=0.05] in the brown spot incidence and severity within each variety as the concentration of the fungicide increased [Tables 3]. However, a significant [p=0.05] increase in the virulence of the pathogen was observed with the application of high dose [60 kg N/ha] of nitrogen fertilizer where fungicide was not applied. This resulted to increased brown spot severity in both ascensions.

No significant differences existed between nitrogen levels used on the brown spot incidences and severities in both D. ibura and D. exilis. The levels of the fungicide alone or its combination with nitrogen fertilizer significantly [p=0.05] reduced the brown spot incidence and severity (Table 3). Nitrogen used singly caused a significant (p=0.05) increase in brown spot incidence, but this effect was cancelled by the interaction between it and the fungicide.

The effects of nitrogen levels and the different concentrations of the fungicide on grain yield are presented in Tables 4. Grain yield and weight of 1000 grains of Faro 43 ranged from 0.6 to 2.8 t/ha and 10 to 38 grams respectively table 4. In Faro 46 grain yield ranged from 0.5 to 2.9 t/ha and 10 to 39 and weight of 1000 grains ranged from 10 to 39 grams (table 4). The grain yield and weight of 1000 grains in both varieties were significantly (p=0.05) increased by the use of various treatment levels of nitrogen and fungicide, singly or in combinations.

Table 1. Effectof nitrogen fertilizer and kitazine on plant, tiller number and Panicles per meter square of *D. ibura*

Control treatment	Plant height (cm)	Tiller number	Panicle/meter square
F0N0	88a	10a	99a
F0N1	89a	11a	125b
F0N2	90a	11a	126c
F1N0	91a	10a	115b
F1N1	89a	15a	208c
F1N2	90a	14a	228c
F2N0	88a	13a	118b
F2N1	90a	14a	230c
F2N2	91a	16a	238c

F0N0 = no fungicide and nitrogen, F0N1 = no fungicide and 30kg N/ha, F0N2 = no fungicide With 60kg N/ha, F1N0 = 1.5 1/ha with no nitrogen, F1N1 = 1.5 1/ha kitazine with 30kg N/ha, F1N2 = 1.5 1/ha kitazine with 60 kg N/ha F2N0 = 2 1/ha kitazine with no nitrogen, F2N1 = 1/ha 1/ha kitazine with 30kg N/ha and F2N2 = 2 1/ha kitazine with 60kg N/ha. Figures carrying similar letter are not significantly different according to Duncan Multiple Range Test [DMRT] at p=0.05.

Table 2. Effectof nitrogen fertilizer and kitazine on plant, tiller number and Panicles per meter square of *D. exilis*

Control treatment	Plant height (cm)	Tiller number	Panicle/meter square
F0N0	71a	13a	104a
F0N1	88a	14a	128b
F0N2	89a	13a	130c
F1N0	73a	14a	110b
F1N1	85a	12a	206c
F1N2	80a	13a	230c
F2N0	75a	12a	117b
F2N1	80a	12a	236c
F2N2	93a	13a	237c

F0N0 = no fungicide and nitrogen, F0N1 = no fungicide and 30kg N/ha, F0N2 = no fungicide With 60kg N/ha, F1N0 = 1.5 1/ha with no nitrogen, F1N1 = 1.5 1/ha kitazine with 30kg N/ha, F1N2 = 1.5 1/ha kitazine with 60 kg N/ha F2N0 = 2 1/ha kitazine with no nitrogen, F2N1 = 1/ha 1/ha kitazine with 30kg N/ha and F2N2 = 2 1/ha kitazine with 60kg N/ha. Figures carrying similar letter are not significantly different according to Duncan Multiple Range Test [DMRT] at p=0.05.

Table 3. Effect of nitrogen fertilizer and kitazine on brown spot disease of *D. ibura*

Treatments	**Brown spot (SES Scale, 0.9)**			
	D. iburua		*D. exilis*	
	Incidence	Severity	Incidence	Severity
F0N0	5a	3b	5a	3b
F0N1	7a	2b	7a	2b
F0N2	8a	6a	7a	6a
F1N0	1b	0b	1b	0b
F1N1	0b	0b	0b	0b
F1N2	2b	1b	3b	0b
F2N0	0b	0b	0b	0b
F2N1	2b	2b	3b	1b
F2N2	3b	1b	3b	2b

F0N0 = no fungicide and nitrogen, F0N1 = no fungicide and 30kg N/ha, F0N2 = no fungicide With 60kg N/ha, F1N0 = 1.5 1/ha with no nitrogen, F1N1 = 1.5 1/ha kitazine with 30kg N/ha, F1N2 = 1.5 1/ha kitazine with 60 kg N/ha F2N0 = 2 1/ha kitazine with no nitrogen, F2N1 = 1/ha 1/ha kitazine with 30kg N/ha and F2N2 = 2 1/ha kitazine with 60kg N/ha. Figures carrying similar letter are not significantly different according to Duncan Multiple Range Test [DMRT] at p=0.05.

Standard Evaluation System Scale 0-9

0=no leaf scald,1-3= scald is about 2 mm length 4-5 = about 2-10% leaf area affected, 6-7 = about 11-50% leaf area affected and 8-9= about 51-100% leaf area affected

Table 4. Effect of nitrogen fertilizer and kitazine on grain yield *D. ibura* and *D. exilis*

Treatments	**Grain yield (*D. ibura*) (t/ha)**	**Grain yield (*D. exilis*) (t/ha)**
F0N0	0.6c	0.5c
F0N1	0.9a	0.7a
F0N2	0.8a	0.5a
F1N0	1.0b	0.7b
F1N1	1.6b	1.4b
F1N2	1.8b	1.3b
F2N0	0.6b	0.7b
F2N1	1.8b	0.9b
F2N2	1.7b	0.8b

F0N0 = no fungicide and nitrogen, F0N1 = no fungicide and 30kg N/ha, F0N2 = no fungicide With 60kg N/ha, F1N0 = 1.5 1/ha with no nitrogen, F1N1 = 1.5 1/ha kitazine with 60kg N/ha, F1N2 = 1.5 1/ha kitazine with 90 kg N/ha F2N0 = 2 1/ha kitazine with no nitrogen, F2N1 = 1/ha 1/ha kitazine with 60kg N/ha and F2N2 = 2 1/ha kitazine with 90kg N/ha.

Figures carrying similar letter are not significantly different according to Duncan Multiple Range Test [DMRT] at p=0.05.

Discussion

The results obtained indicated that rice leaf scald caused by Gerlacia oryzae (Hashioka & Yokogi) W. Gams. can be kept under check through appropriate agronomic practices (Mia, et al., 2001). It has been demonstrated that high doses of nitrogen could aggravate the leaf scald disease (Ho, 1998). Similar observation was also made in this trial even at application of recommended dose of 60 kg N/ha. However, such negative influence was eliminated by the application of the fungicide even at a lower dose of 1.5 I/ha (Sere, 2000). By reducing the virulence of the leaf scald pathogen the plants were able to make use of the available nitrogen for formation of the photosynthate, (Chakravaty and Biswas, 1999).

The resultant effect of this was the increased grain yield, weight of 1000 grains and number of panicles per meter square. It could be deduced that the fungicide (Kitazine) is potent in the control of leaf scald disease even in highly susceptible rice (Faro 43 and 46). Therefore, it Could be of great importance, especially when used with other cultural practices through an integrated management system.

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