A Survey of Rice Diseases in Cameroon

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ABSTRACT

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Rice diseases in experimental plots throughout the major rice-growing areas of Cameroon were surveyed from July of 1988 through May of 1989. The diseases found are discussed, including some estimation of their economic importance. Generally, disease severity was less pronounced under irrigated conditions than in the uplands and varied remarkably among the different rice-growing areas. The relatively low occurrence of diseases in the extreme north was probably a result of high soil fertility or higher wind velocities and lower humidity than in the other areas. In the western highlands, the climate was more conducive to disease. For example, the Mbo Plain location was found to be suitable for screening for resistance to rice blast (caused by *Magnaporthe grisea*), and the Ndop plain location was suitable for screening for resistance to sheath rot (caused by *Sarocladium oryzae*) and glume discoloration (caused by several pathogenic fungi including *Cochliobolus miyabeanus*).

Rice is a relatively new crop in Cameroon and is currently grown on about 20,000 ha of mostly irrigated fields. Rice cultivation covers a broad range of climatic conditions, from a dry, Sahelian climate, with less than 1,000 mm of rain, in the northern provinces to a humid, tropical climate, with over 2,000 mm of rain, in the western highlands (1,10).

Irrigation is the most widely practiced production system, accounting for over 90% of the land area under rice and contributing about 94% of total annual production (2–5). There are four main government-initiated irrigated rice development projects situated in different parts of the country (Table 1). Upland rice is also grown on a small scale as a subsistence crop by peasant farmers in different parts of the country.

Although rice production has increased sharply in the past few years (Table 1), the importation of milled rice has continued at approximately 40,000 metric tons annually since 1985 (3,4). This indicates that demand for rice has increased, and the government wants to further increase national rice production.

Diseases are major constraints to increased rice production in Cameroon (3–5). According to one estimate (4), diseases cause annual rice yield losses of 10–30%. Therefore, the development or identification of cultivars with resistance or tolerance to major diseases would be of considerable benefit in stabilizing rice production in Cameroon. There is, however, little or no current information on the occurrence and severity of rice diseases in the country. Therefore, this study was undertaken with the purpose of defining the rice disease situation in irrigated and upland fields in Cameroon.

MATERIALS AND METHODS

Experimental rice plots and farmers' fields were surveyed for disease incidence in the extreme north, north, north west, and west provinces of Cameroon, as indicated in Figure 1. The 21 sites were selected to cover as wide a range as possible of the different climatic conditions, cultivation techniques, cultivars, and soil types in the major rice-growing areas of Cameroon. The survey covered the full life cycle of the crop from nursery to harvest in the 1988 wet season (July to December) and in the 1989 dry season (January to May). At each site, six nurseries and 12 rice fields each were examined at nine spots: the four corners, midway along each edge, and at the center.

Nursery beds were examined 3 wk after sowing, and visual scores of incidence and severity of diseases, especially seedling blast and brown spot, were recorded using the International Rice Research Institute (IRRI) standard evaluation system (6). The visual rating for disease damage was made on a scale of one to nine (6), and the severity of each disease per sampling spot was recorded. The average score from the six nurseries sampled at each site was noted.

Transplanted paddy and upland rice fields were similarly monitored at each location and scored for disease incidence and severity at maximum tillering (40 days after transplanting) and a week before harvest. Both wet and dry season crops were surveyed. Data on incidence and severity of foliar diseases like leaf blast (caused by *Magnaporthe grisea* (T. T. Hebert) Yaegashi & Udagawa, syn. *Ceratosphaeria grisea* T. T. Hebert, syn. *Pyricularia oryzae*), leaf scald (caused by *Monographella albescens* (Thuem.) Parkinson et al, syn. *Rhynchosporium oryzae* Hashioka & Yokogi), brown spot (caused by *Cochliobolus miyabeanus* (Ito & Kuribayashi in Ito) Drechs. ex Dastur, syn. *Helminthosporium oryzae* Breda de Haan), and bacterial leaf blight (caused by *Xanthomonas oryzae* (Uyeda and Ishiyama)), were recorded on a scale of one to nine (6). The average score from 12 sampled fields at each of the 21 rice-growing areas (Fig. 1) was noted.

Tillers of each hill at each sample spot were closely examined, and the presence and extent of damage of sheath rot (caused by *Sarocladium oryzae* (Sawada) W. Gams and D. Hawksw., syn. *Acrocylindrium oryzae* Sawada) and neck blast (caused by *M. grisea*) were again scored using the IRRI scale. The percentage of damage due to dirty panicle or glume discoloration (caused by several plant pathogenic fungi including *C. miyabeanus*) was assessed on the basis of the percentage of spikelets per panicle affected (6). The incidence and severity for the diseases scored in this study were summarized into three broad classes: low (L), where damage on the respective plant part or organ was less than 10%;

Table 1. Rice production in different rice-growing areas of Cameroon

Cultivation method / Area	Area (ha, ×100)		Production (t, ×100)	
	1981–82	1986–87	1981–82	1986–87
Irrigated rice				
Extreme north	172	105 (87)[a]	416	780
North	...	40	...	86
North west	26	34	58	104
West	10	10	10	20
Upland rice	7	10	14	24

[a] Double-cropped area.

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moderate (M), with damage between 10 and 50%; and high (H), with over 50% damage.

RESULTS

The distribution and severity of rice diseases in Cameroon are summarized in Table 2. Disease incidence and severities arising from natural infection in the field varied markedly among the different rice-growing areas in the country. The northern provinces had far fewer disease problems than the western highlands. The incidence and severity of each disease are described below.

Rice blast. Blast is perhaps the most widely distributed disease in Cameroon. Previous reports indicate that the causal fungus produces spots or lesions on leaves (leaf blast), nodes (node blast), neck or panicle (neck blast), or other parts of the panicle (panicle blast) (7,8, 12,13). In this study, leaf and neck blast were observed in all areas in Cameroon where rice is grown, whereas other forms were seldom, if ever, seen. The incidence of blast was, however, more apparent at Mbo Plain in the west than in the other provinces (Table 2). Climatic factors at Mbo Plain probably favor the development of this disease. In all rice-growing areas, cultivars suffered more severe attack of blast during the dry cropping season, which is a period of cooler temperatures.

At each location there was far less blast in irrigated than in upland rice fields. For a given cultivar, the severity of blast was higher in upland cultivation than under irrigation.

Sheath rot. Sheath rot was quite widespread at Ndop Plain, where moderate to severe levels of infection were recorded, but occurred sporadically at Menchum Valley, which is also in the north west (Fig. 1). Low to moderate levels were recorded for the remaining locations, with more severe disease recorded for the dry season crop.

Glume discoloration. Glume discoloration also occurred widely at Ndop Plain, where moderate to severe infection levels were recorded. In the provinces of the extreme north, north, and west, only low levels were observed. Glume discoloration seemed to be compounded by the severity of sheath rot and incomplete panicle exsertion. These are problems associated with low temperature (3–5,10). The economic importance of glume discoloration may be similar to that of sheath rot.

Leaf scald. This disease was quite widespread at Mbo Plain (west), Ndop Plain (north west), and at Karewa and Lagdo (north), where low to moderate levels were recorded. Leaf scald was more severe under upland conditions (Table 2). At Mbo Plain and at Befang in the north west, disease severity was greater with higher rates of nitrogen application (3,5,6) and occurred on mature leaves, in most cases near the tips (12,13).

Brown spot. Brown spot occurred in a mild form everywhere in the upland and irrigated fields in the west, north west, and north. Local distribution at each site indicated that the disease was more prevalent in upland rice fields (Table 2). In Cameroon, its economic importance may be similar to that of leaf scald.

Bacterial leaf blight. This disease was recorded only in the extreme north on test cultivars in experimental fields at Yagoua and Maga. IR 46, the only cultivar grown on about 11,000 ha of irrigated fields at Yagoua, Maga, and Kousseri, was found to be resistant to the current races of the pathogen. Sporadic infection was, however, noted on some hills of IR 46 at Maga. Pale yellow leaves, which are typical of the disease (15), were observed in the older plants.

Reactions of recommended cultivars to major diseases. Cultivars that had been recommended for introduction were tested for their reactions to major

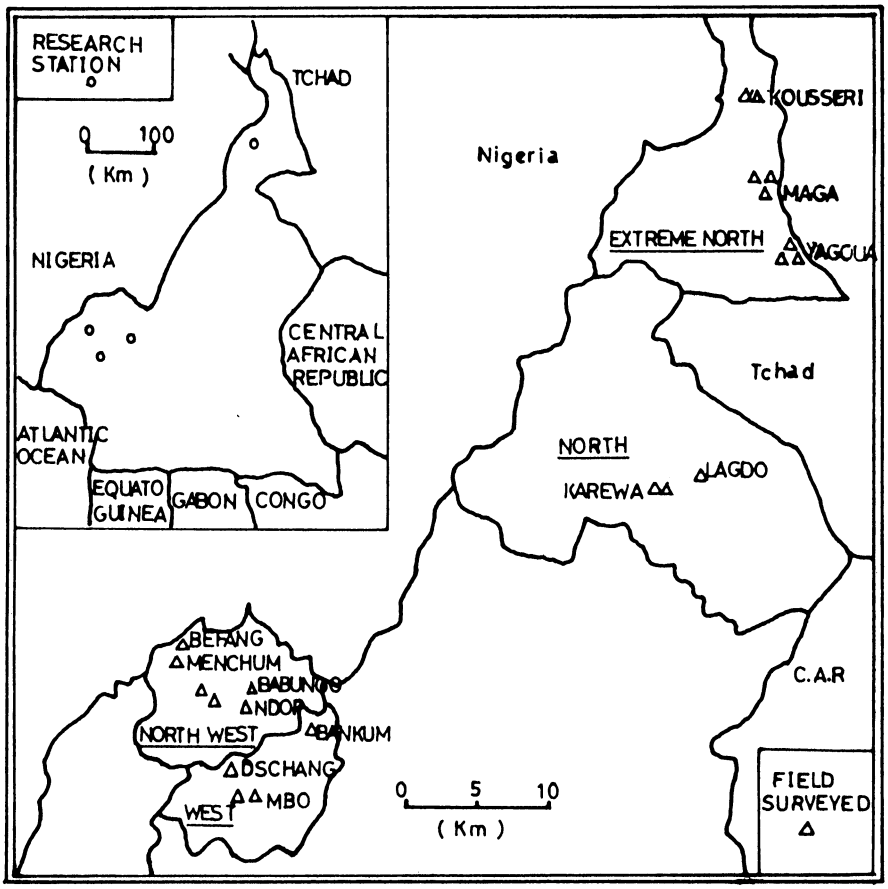

Fig. 1. Survey sites of irrigated and upland rice fields in Cameroon. At each site, six nurseries and 12 fields were surveyed.

Table 2. Distribution and severity of diseases of rice in Cameroon

Disease	Irrigated				Upland	
	Extreme north (300 m)[a]	North (200 m)	North west (1,200 m)	West (600 m)	North west (1,200 m)	West (600 m)
Leaf blast	L*[b]	L/M	L	L/M	L/M	M/H
Neck blast	L*	L/M	L	L/M	L/M	M/H
Sheath rot	L*	L	H	L	M	L
Glume discoloration	L*	L	H	L	M	L
Leaf scald	0	L	L	M	M	M/H
Brown spot	0	L	L	L	M	M
Bacterial leaf blight	L	0	0	0	0	0

[a] Altitude.

[b] L = low (damage less than 10%), M = moderate (damage between 10 and 50%), H = high (damage above 50%), 0 = disease not recorded. * = Only dry season crop (December–April) affected.

diseases such as blast, sheath rot, and glume discoloration under irrigated conditions and blast, leaf scald, and brown spot under upland conditions are shown in Tables 3 and 4. The tests were conducted in the habitats where the cultivars were to be introduced.

In many instances, the same cultivar showed wide discrepancies in its reaction to the same pathogen when grown in different areas and under irrigated or upland conditions. For example, IR 46, which was highly resistant to blast, sheath rot, and glume discoloration in the extreme north, was rated moderately resistant or moderately susceptible to these diseases in the north (Karewa) and west (Mbo Plain) (Table 3). Similarly, IRAT 112, which was resistant to leaf and neck blast, leaf scald, and brown spot at Befang, was moderately resistant to these diseases at Mbo Plain (Table 4).

Table 3. Reaction of recommended rice cultivars grown under irrigation to three major diseases in Cameroon (1988–89 crop)

Area Survey site	Cultivar	Disease: Leaf and neck blast	Disease: Sheath scald	Disease: Glume discoloration
Extreme north				
Yagoua, Maga, and Kousseri	IR 46	R[a]	R	R
North				
Lagdo	BKN 7033-3-3-2-2-3	MR	R	R
	ITA 222	MS	MR	MS
Karewa	BKN 7033-3-3-2-2-3	MR	R	R
	IR 46	MS	MR	MR
	ITA 222	MS	MR	MR
North west				
Ndop Plain	IR 7167-33-2-3	R	MR	MR
	Tainan V	MR	MR	MR
Tingo-Menchum Valley	CICA 8	R	R	R
West				
Mbo Plain	CICA 8	MS	R	R
	IR 46	MS	MR	MR
	ITA 222	MS	MR	MR

[a] Diseases were rated on the IRRI scale (6): R = resistant (score 0–3), MR = moderately resistant (score 4–5), MS = moderately susceptible (score 5–6).

Table 4. Reactions of recommended and promising upland rice cultivars to three major diseases in Cameroon (1988–89 crop)

Area Survey site	Cultivar[a]	Disease: Leaf and neck blast	Disease: Leaf scald	Disease: Brown spot
West				
Mbo Plain	IRAT 10	MR[b]	MR	MR
	IRAT 70*	MR	MR	MR
North west				
Babungo	M 55	MR	MS	MR
	IRAT 112*	MR	MR	MR
Befang	IRAT 112*	R	R	R
	ITA 208*	R	R	R

[a] Asterisks indicate promising cultivars

[b] Diseases were rated on the IRRI scale (6); R = resistant (score 0–3), MR = moderately resistant (score 4–5), MS = moderately susceptible (score 5–6).

DISCUSSION

The incidence and severity of diseases in irrigated paddy in Cameroon were far lower than in the uplands (Tables 2–4). Severe blast, leaf scald, and brown spot were recorded in the uplands. The incidence of sheath rot and glume discoloration was quite high under irrigated conditions at one location, Bamunka farm in Ndop Plain. Glume discoloration appeared to be compounded by the severity of sheath rot and incomplete panicle exsertion. The incidence and severity of sheath rot and glume discoloration at Bamunka appeared to be favored by low air and water temperatures. However, general observations indicated far less disease intensity under irrigated conditions. This may partly be attributed to increased uptake of silicon when rice is grown under waterlogged conditions, which toughens the plant cell walls. Numerous investigators have reported increased silification of plant cells in irrigated rice (12,13). The toughened cell walls deter or inhibit penetration and subsequent establishment of the fungi that cause diseases such as blast and brown spot.

The higher disease incidence in upland rice may also be influenced by the peasant farming cultivation methods in Cameroon (4,10). The fields are small patches surrounded by bushes or grasses, which serve as windbreaks. These probably favor longer retention of water droplets from rain or dew, which are requisite for successful germination of fungal spores and subsequent invasion.

A higher incidence of diseases such as leaf and neck blast, leaf scald, and brown spot was observed at Mbo Plain, Karewa, and Lagdo under irrigated conditions in the dry season crop than in the rainy season crop. This may result from early drying of these areas at the onset of the dry season, which exposes the rice plant to water stress during the maturing phase of the crop. Several workers have demonstrated that water stress predisposes rice plants to leaf and neck blast and brown spot (8,12).

The relatively low incidence and severity of diseases in the extreme north province of Cameroon can be attributed to a variety of conditions associated with the area. In general, native fertility of the soil is high (4,12). Rice in the extreme north is generally healthy and vigorous, enabling it to better resist invasion by pathogens. Diseases like brown spot, which are associated with nutrient imbalances such as potassium deficiency (7,12), are of no significance in the extreme north. Irrigated rice fields in the extreme north at Yagoua, Maga, and Kousseri (Fig. 1) consist of large expanses of open lands, with consistent breezes and low humidity during much of the growing season. These environmental factors probably play a significant role in the low severity and incidence of diseases there. Water droplets on leaf surfaces are not retained long enough to facilitate spore germination and subsequent establishment of the pathogens.

In conclusion, variations in disease incidence and severity are apparent in the different rice-growing areas of Cameroon. It is, therefore, important that programs to develop cultivars with resistance to the major diseases consider other factors including the environmental conditions and cultivation practices in the area of intended cultivation. Of all the rice-growing areas surveyed in Cameroon, Mbo Plain in the west and Ndop Plain in the north west have the greatest need for disease resistance in cultivars, because the climatic factors in these areas favor disease development. High resistance is a lesser priority in the north and the extreme north, since the environments of these areas are not conducive to disease establishment. The current phase of the rice research program, located in the west and north west, emphasizes development of cultivars resistant to the major diseases.

LITERATURE CITED

1. Anonymous. 1983. United States Agency for International Development. Agriculture Sector Briefing paper. 40 pp.

2. Anonymous. 1986. International Fertilizer Development Center/United States Agency for International Development. Cameroon Fertilizer Sector Study. 14 pp.
3. Anonymous. 1986. National Cereals Research and Extension Project. Annual Report, 1986. 296 pp.
4. Anonymous. 1987. National Cereals Research and Extension Project. Annual Report, 1987. 284 pp.
5. Anonymous. 1988. National Cereals Research and Extension Project. Annual Report, 1988. 286 pp.
6. Anonymous. 1988. Standard Evaluation System for Rice, International Rice Testing Program. International Rice Research Institute, Los Baños, Philippines. 44 pp.
7. Awoderu, V. A. 1974. Rice diseases in Nigeria. PANS 20:416-424.
8. Bidaix, J. M. 1978. Screening for horizontal resistance to rice blast (*Pyricularia oryzae*) in Africa. Pages 159-174 in: Rice in Africa. I. W. Buddenhagen and G. J. Persley, eds. Academic Press, London.
9. Fomba, S. N. 1984. Rice disease situation in mangrove and associated swamps in Sierra Leone. Trop. Pest Manage. 30:73-81.
10. Jones, M. P. 1989. Yield potential of IR 7167-33-2-3 and Tainan V at Ndop Plain in north west Cameroon. IRRI Tech. Newsl. 14:23-24.
11. Kauffman, H. E., and Rao, P. S. 1972. Resistance to bacterial leaf blight in India. Pages 283-287 in: Rice Breeding. International Rice Research Institute, Los Baños, Philippines.
12. Ou, S. H. 1972. Rice Diseases. Commonwealth Mycological Institute, Kew, England. 280 pp.
13. Raymundo, S. A. 1980. Diseases of Rice in Sierra Leone. Tech. Bull. 4. Rice Research Station, Rokupr, Sierra Leone. 86 pp.
14. Raymundo, S. A., and Fomba, S. N. 1979. Dirty panicle or glume discoloration of rice in Sierra Leone. Int. Rice Res. Newsl. 4:7.
15. Ten Have, H., and Kauffman, H. E. 1972. Effect of nitrogen and spacing on bacterial leaf blight of rice. Indian Farming 21:8-13.