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WEED PROBLEMS IN PLUVIAL RICE CULTIVATION IN IVORY COAST

H. MERLIER

Institut de Recherches d'Agronomiques Tropicales, B.P. 635, Bouaké, Ivory Coast

Introduction

Herbicide trials on pluvial rice in Ivory Coast were commenced by IRAT in 1968. However, the yields in herbicide treatments of these trials, when compared with the corresponding checks with weed infestation were sometimes variable and contradictory. Tropical weed growth in West Africa is characterized by strong emergence, often more than 10,000 seedlings per square metre, and by rapid dèvelopment; some weeds completing their growth cycle within one month.

It is usually considered that weeding in cereals should be done as early as possible. However, in 1973, a weeding done 15 days late resulted in the best yields, although the rice at that time had been covered with weeds.

Trials were established in 1974-75 to study the behaviour of rice under different durations of weed infestation and to study the effects of *Digitaria horizontalis*, a common weed of pluvial rice fields.

Materials and Methods

The trials were conducted at Bouaké on deep-ploughed soil (25 cm) which had been fertilized with (kg/ha) 40N; $80P_2O_5$; $80K_2O$. The seedbed was later disc-harrowed. Planting was done mechanically in lines 25 cm apart, using 60 kg seed/ha of rice variety Iguape Cateto. Supplementary nitrogen (20 kg/ha N) was supplied 30 days after planting and again at booting stage.

Treatment plots were 1.25 m x 14 m and were separated by 1.25 m alley-ways. The treatments were replicated six times. After planting on clean soil, the plots were left to natural weed infestation. The first weeding was followed by complete clearing at increasingly later stages. The control plot was not weeded throughout the 130 day cycle. Observations on the weed flora and weight were made at the first weeding. Paddy yield was estimated on the four centre rows for a 12 m length of the plots.

Results

The weed species whose dry weights were greater than 1% of the total weight of weeds at the end of weed infestation period are listed in Table 1. The percentage of each species in the total weight is given as well as the total weight of weeds after the different periods of infestation. The partial and the total weights include the minor weed species not shown in Table 1.

TABLE 1

Percent and total weight of weed dry matter after various infestation periods

Year	1974		1975				
	Duration of weed infestation in days						
	30	60	40	60	80	100	130
Major weed species	Dry weight of weeds as % of total weed weight						
Eleusine indica	66	50	4	4	2	2	-
Digitaria horizontalis	10	20	8	10	12	15	-
Brachiaria lata	5	12	16	18	6	6	-
Dactyloctenium aegyptium	3	5	-	-	-	-	-
Total for *Graminaceae*	84%	87%	30%	34%	21%	24%	-
Kyllinga squamulata	4	1					-
Celosia argentea	2	4	1	3	4	6	-
Commelina benghalensis	2	2	29	32	43	37	-
Trianthema portulacastrum	-	-	11	13	10	15	-
Tridax procumbens	1	1	9	6	5	5	-
Amaranthus viridis			5	1	1	2	-
Boerhavia diffusa			4	-	-	-	
Sida urens			1	1	3	3	-
Ipomea eriocarpa				-	2	4	-
Total of miscellaneous weeds	16%	13%	70%	66%	79%	76%	-
Total wt (t/ha)	2	7	1	1.4	3.8	4.8	11

The control plot was not weighed in 1974 because of severe lodging. In 1975, the total weight of the control was obtained, but not the weights of individual weed species. The late weighings gave only an estimate of the total weed growth, as they did not include those weeds which had already completed their cycle.

The difference in composition of the weed flora in the

TABLE 2

Rainfall at 10 day intervals, total rainfall (mm) and paddy yield in cleared control plots

Year	Yield (t/ha)	Rainfall in 10 day intervals (mm) 1	2	3	4	5	6	7	8	9	10	11	12	13	Total (mm)
1973	2.10	19	10	7	10	6[a]	165	18	41	44	144	43	8	8	523
1974	4.90	27	35	35	5	85	69	19	95	86	44	40	16	3[a]	550
1975	0.80	37[a]	42	21[a]	62	55	2	18[a]	0[a]	40	29	54	75[a]	42	477

a) Rainfall to which one irrigation was added, between 15-20 mm. The total rainfall in 1975 was between 552-577 mm.

two years is due to differences in soil type, the 1974 trial being on soil which was more acidic and gravelly than the 1975 trial soil.

Rainfall during the 1973-1975 growing seasons is shown in Table 2. The 10-day intervals commenced at the date of sowing. In the second half of the cycle the decadal evapotranspiration was 40 mm. The rice showed visible signs of stress when the decadal rainfall was less than 30 mm.

The paddy yield of variety Iguape Cateto and the dry weight of weeds after various periods of infestation are shown in Figure 1. The yields in the 1974 control plot were close to the maximum possible for Iguape Cateto under good conditions. The effects of the duration of weed infestation on yield components (panicle weight and number of panicles per sqm) are shown in Figure 2. These results were obtained by counting and weighing a control row 12 m long.

The damage caused by *Digitaria horizontalis* relative to plant density is shown in Figure 3. Various densities of *Digitaria horizontalis* were obtained by hand weeding. Two treatments consisting of a pure stand of *Digitaria horizontalis* (10,000 plants/m^2 at emergence) and a weedy check, produced no rice yield. These two treatments produced 7 and 15 t/ha dry matter respectively.

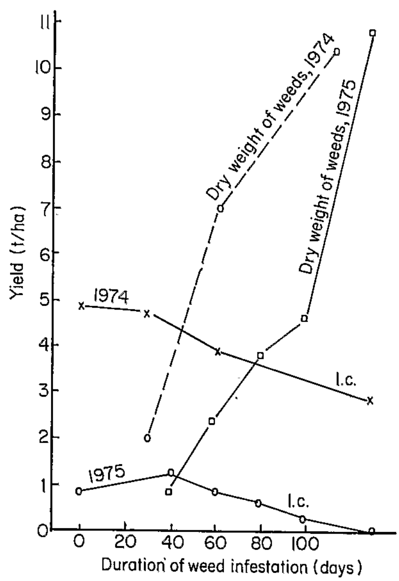

Fig. 1. Yield of variety Iguape Cateto (I.C.) and dry weight of weeds after different periods of infestation.

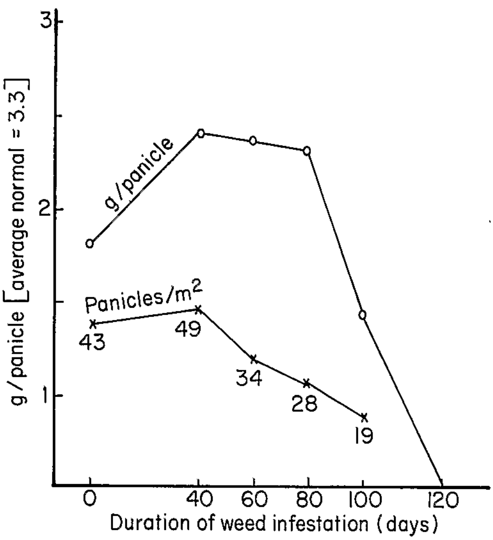

Fig. 2. Influence of the duration of weed infestation on panicle weight (average, normal) and no. panicles/m^2 (average, normal)

Discussion

Fertilization of trials was planned in such a way as not to limit crop yield. However, it was thought that fertilization may have increased weed damage. There were important annual differences in both the composition of the weed flora and the total weight of weeds. Weed damage was insignificant during the first month, although the predominance of *Eleusine indica* in the 1974 season gave cause for alarm.

The increasing duration of weed stress caused moderate and increasing yield reduction (Figure 1). In 1975, however, *Digitaria horizontalis* at 5 plants/m^2 caused 40% harvest loss (Figure 3), which was as great a reduction as was caused by total natural weed infestation in 1974. In all cases, the weed damage could be related to the rainfall and the density of the rice crop.

Recent work on drought resistance has shown that rice is most susceptible to drought in the period following panicle initiation (Reyniers, 1975). For Iguape Cateto, this occurred at 70-73 days after planting. There was a positive correlation between yield and rainfall during the critical period (80-90 days), although the total rainfall in the three years was almost the same (Table 2). Rainfall during this period was more important for final yield than that at the beginning or end of the cycle. This was clearly illustrated in the rainfall and yield patterns for 1973 and 1975.

Dense planting of rice itself can limit yields, as was shown by experiments in which rice was thinned to half density of the control 15 days after planting. The thinned plots yielded 1.8 t/ha, which was double the unthinned control. The control treatments were planted at the same density as those used for weed infestation studies (Merlier, unpublished data).

The effects of weeds on rice yields depended largely on the rainfall during the critical period. If water requirements of the rice were satisfied, weeds were not damaging during the first month of the cycle, irrespective of whether other conditions were optimal for the rice or not. Weed damage only became noticeable when infestation persisted for at least two months. If the water needs of rice during panicle initiation were not supplied, weed competition at this time would increase water shortage and reduce productive tillers of the rice plant. Permanent weed

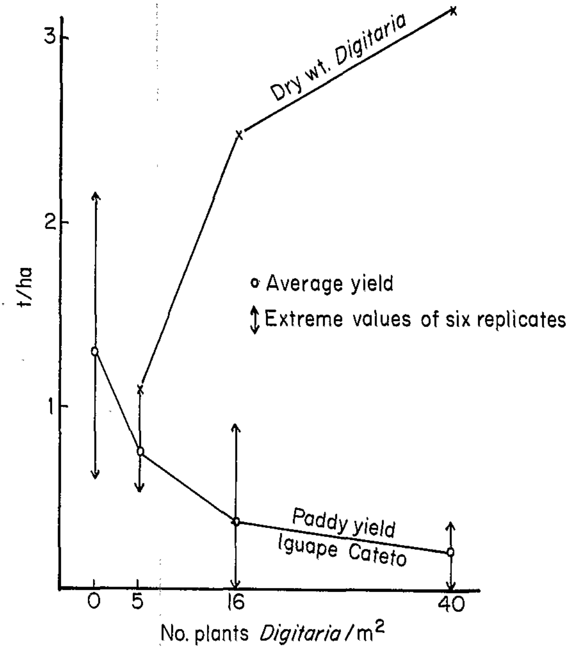

Fig. 3. Specific damage caused by *Digitaria horizontalis* as a function of the no. plants/m^2.

infestation caused total yield loss, especially if *Digitaria* sp. was present.

In conclusion, these trials on weed damage on pluvial rice have shown the importance of plant density to yield. This density, which is used in large-scale cultivation, was originally chosen to guard against stresses at the beginning of cultivation. The plant density chosen also increased the crop's ability to compete with weeds especially as only hand-weeding was possible and labour was in short supply. Weeding is essential, especially for mechanical harvesting, and some suitable chemicals have been identified.

Further work is in progress on the effects of weed infestation in less densely planted rice. Observations during 1976 suggest that lower plant densities will reduce the need for nitrogen fertilizer, which is an important saving in African agriculture.

References

Reyniers, F.N. (1975). Rapport analytique de physiologie. IRAT, Bouaké, Ivory Coast.