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SHORT COMMUNICATION

Evaluation of Herbicides for Rain-fed Upland Rice, *Oryza sativa* L.

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Under puddled conditions of rice culture, both the nature of land preparation as well as the presence of standing water effectively prevents the growth of weeds in rice fields at least for 3 weeks, after which further weedings have to be done.[3] In upland rice culture, however, rice and weed seeds germinate alike and weeds offer severe competition to rice from very early stages of growth. Rice is very sensitive to weed competition in the early stages of growth and the failure to control weeds during the first 3 weeks after planting reduces the yield by 50%.[2] Often a combination of several methods is required for controlling the weed growth in upland paddy culture and the use of pre-emergent herbicides appear to be most promising. This paper reports the results of an experiment conducted to evaluate herbicides for upland rice grown under upland rain-fed conditions.

The experiment was carried out on the upland rice fields of the Agricultural Research Station, Maha Illuppallama during the period October 1973 to January 1974. The soil was a sandy loam containing 1.3% organic matter, 72 kg/ha available phosphate (Olsen's) and 0.52 me (%) exchangeable potassium. The pH was 5.5.

The weed control treatments consisted of Benthiocarb, Butachlor, C—288, Prefo-ran, A—820, USB 3153, Hand weeding and Unweeded control. The herbicides in liquid form were applied at the rate of 2 kg/ha a.i. 15 days after sowing. The hand weeded plots were weeded on 4 occasions after rice emergence.

The treatments were arranged in randomized complete blocks, replicated 3 times. Each plot measured 15 m^2. The plots were equally divided and plants from one half of each plot were used for sampling while those of the other half were kept for recording the final grain yield.

The land was thoroughly prepared to eliminate all existing weeds. Nitrogen as ammonium sulphate (20%N) was applied at the rate of 25 kg/ha and 50.2 kg/ha at 17 and 40 days after rice emergence (DARE) respectively. 37.6 kg/ha of potassium as

muriate of potash (60%K_2O) was applied 4 days before sowing and 18.8 kg/ha was top dressed 42 DARE. The total dressing of phosphate (54.5 kg/ha as Concentrated super phosphate) was applied 4 days before sowing.

Immediately before sowing rice, a mixture of seeds of the following weeds commonly found in the upland rice fields in the dry zone were sown at the rate of 10g/15m^2, *Echinochloa colonum* L, *Echinochloa crusgalli* L, *Cynodon dactylon* L, *Eleucine indica* Gaertn, *Celosia argentea* L, *Trianthema portalacastrum* L, *Mimosa pudica* L, *Acanthesperma hispidia* L. Unsprouted seeds of the 3-months aged rice variety BG—34—8 were sown in furrows 25 cm apart and covered lightly with soil on 5 October.

The weeds within each plot were sampled at 14, 25, 42 and 82 DARE from a sampling area of 7,500 cm^2. All weeds within the sampling area were grouped into monocotyledonous and dicotyledonous species, identified and counted. The final grain yield of rice was harvested from an area of 5.625 m^2, 105 DARE. Visual observations on crop injury and weed control rating were made at the same sampling dates using a 0—100% scale.

Herbicide toxicity, weed control rating and weed occurance

The herbicides had no phytotoxic effect on rice plants. All herbicides except Preforan, Benthiocarb and A—820 controlled over 93% of the weeds up to 25 DARE. At 42 DARE, C—288 gave 95% weed control, followed by USB 3153 (65%) and Butachlor (63%), while Preforan controlled only 15% of the weeds. In the subsequent samplings only C—288 controlled over 77% of the weeds, whereas the other herbicides controlled less than 30% of the weeds.

Weed count was high from early stages of growth and the unweeded control had 1141 weeds/m^2 at 14 DARE (Table 1). The maximum weed count for all treatments was recorded during a period of between 42 — 65 DARE. The herbicides controlled both mono and dicotyledonous weeds to a considerable extent when compared with the unweeded control. C—288 completely controlled both mono and dicotyledonous weeds up to 25 DARE and in the later growth, a few weed species (*Echinochloa Spp. Eleusine indica* Gaertn and *Panicum Spp.*) appeared in the plots treated with this herbicide. Butachlor and USB 3153 had a higher percentage of dicotyledonous weeds up to 14 days while this effect was maintained for Butachlor at 25, 65 and 82 DARE. Of the dicotyledonous weeds found in these treatments *Mimosa pudica* L, *Celosia argentea* L, *Acanthesperma hispidia* L and *Aeschynomene indica* L were the most prominent.

In all other treatments, the proportion of monocotyledonous weeds was higher than dicotyledonous weeds. The unweeded control contained over 81% of monocotyledonous weeds at all samplings. In all treatments *Cyperus iria* L, *Echinochloa colonum* L,

TABLE 1. The effect of treatments on weed number/m² and the percentage of dicotyledonous and monocotyledonous weeds.

Treatments	14 DARE			25 DARE			42 DARE			65 DARE			82 DARE		
	No.	Mon.	Dic.	No.	Mon.	Dic.	No.	Mon.	Dic.	No.	Mon.	Dic.	No.	Mon.	Dic.
Benthiocarb	78	66	33	90	28	72	177	66	35	124	35	65	253	73	27
Butachlor	27	22	78	82	7	93	269	76	24	72	21	79	78	33	67
C — 288	—	—	—	—	—	—	9	56	44	41	68	32	9	—	100
Preforan	144	59	41	207	66	54	233	78	22	253	82	18	239	72	28
A — 820	129	60	40	266	60	40	239	69	31	293	73	27	201	63	37
USB 3153	51	39	61	96	55	45	123	63	37	88	67	33	136	71	29
Hand weeded	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Untreated control	1141	81	19	1347	90	10	702	89	11	585	87	13	379	87	13

DARE = Days After Rice Emergence.

TABLE 2. The effects of treatments on yield components and final grain yield of rice.

	Panicle number/m²	Panicle weight g/m²	Panicle length, cm	Final grain yield, kg/ha.
Benthiocarb	183	97.8	17.8	762.50
Butachlor	211	92.3	17.6	840.27
C — 288	371	245.3	19.2	1774.00
Preforan	79	29.7	14.1	224.29
A — 820	152	66.3	16.2	524.27
USB 3153	229	116.1	18.2	1016.30
Hand weeded	345	305.0	18.0	2507.33
Untreated control	—	—	—	—
LSD (P = 0.05)	—	—	—	440.60

Echinochloa crusgalli L, *Echinochloa stagnina* L and *Cyanodon dactylon* L, were found up to 25 DARE whereas *Fimbristylis miliacea* Vhal., *Eleusine indica* Gaertn, *Cyperus rotundus* L, and *Panicum Spp.* were found at the later stages of growth of the rice crop.

Analysis of grain yield

The unweeded control failed to produce any grain yield due to heavy weed competition during all stages of growth (Table 2). Velmurugu[4] also found a yield reduction of 25 to 30% in tall medium-aged rice varieties (4 to 4½ months), while in the case of dwarf short-aged varieties (3 to 3½ months) the yield was reduced to zero by intensive weed competition. Hand weeding increased panicle weight/m^2 and this was reflected in a significantly higher grain yield compared with all other treatments. Of the herbicidal treatments, an increased yield was obtained with C 288 due to an 8% increase in panicle number/m^2 when compared with hand weeding. However, the increase in panicle number was associated with a reduction in the weight of panicles/m^2 by 25%. As reported by Auma and Gunasena[1] there was a significant linear correlation between final grain yield and panicle weight as represented by the equation $Y = 94.42 + 6.70$. The panicle weight accounted for 54% of the variation in grain yield.

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