

EFFECT OF METHODS OF PLANTING AND HERBICIDES ON RICE/WEED COMPETITION

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Summary. A field experiment to compare three methods of planting and six herbicides on rice/weed competition was done on the research farm of Banaras Hindu University, India, during the monsoon season of 1980. The rice yield from direct seeding (dry), direct seeding (puddled) and transplanted was 2012, 3000 and 4175 kg ha⁻¹ respectively. Increased yields were associated with reduced dry matter production of weeds.

Rice yield was increased from 2137 kg ha⁻¹ in the unweeded control to 4050 kg ha⁻¹ by handweeding. The application of herbicides increased yield but not as much as handweeding. Butachlor (liquid and granular formulations) and propanil were most effective at reducing weed dry matter production and increased yield to about 3500 kg ha⁻¹, while 2,4-D (liquid and granular formulations) and MCPA were least effective.

INTRODUCTION

In India rice is grown in areas ranging from irrigated river valleys and deltas of coastal plains to low lying conditions of central and north-eastern regions. Of the total area under rice 75% falls under unassured irrigation, i.e. rainfed subject to alternate flooding and drying conditions.

Most expansion in rice growing areas may be under upland conditions due to increase in irrigation facilities and because most potential lowland areas are already under rice cultivation. Upland rice now accounts for about 75% of the total area of rice in India (38.5 million ha). Upland rice has a greater weed problem than lowland rice. It is estimated that maximum grain yield reduction (33%) is caused by weeds which draw 30% of the plant nutrients from the soil (Subramaniam 1980). Other workers have estimated the losses in grain yield caused by weeds in rice to range between 10 and 70% (Heydatullah and Sen 1942; Mani *et al.* 1968; Sharma *et al.* 1977). Gopalakrishna and Rao (1973) estimated that the extent of yield reduction due to weeds is 15 to 20% in transplanted rice, 30 to 35% in direct sown rice under puddled conditions and 50% in direct sown rice under upland conditions.

Handweeding is the most popular method of weed control, but the timely control of weeds by this method is difficult especially in the early stages because,

- (i) their similarity in morphology and age with rice seedlings,
- (ii) weather may not permit such operations, and
- (iii) labour may not be available when required.

Hence the present experiment on weed control with herbicides under different methods of rice planting was planned.

MATERIALS AND METHODS

The experiment was carried out during the monsoon season (Kharif) 1980 at the Research Farm, Banaras Hindu University, India. A split plot design with three replicates was used with three sowing methods as the main plots and 10 weed control treatments as the split-plots. The hand-weeded control was weeded at 20, 40 and 60 days after sowing/planting.

Rice (cv. Cauvery) was sown in lines 25 cm apart at the rate of 100 kg ha⁻¹. The direct sowing under dry and puddled conditions was done on July 2, 1980 and July 4, 1980 respectively, while the transplanting was done on July 22, 1980. Fertilizer applied was 120 kg N ha⁻¹, 26 kg P ha⁻¹ and 50 kg K ha⁻¹. Half the rate of nitrogen and the full rate of phosphorous and potash were applied at the last ploughing/puddling. The remaining rate of nitrogen was topdressed in two equal applications, viz, at 30 days after transplanting or sowing and at panicle initiation stage. Pre- and post-emergence herbicides were applied 2 and 20 days respectively after sowing or transplanting. The liquid formulations were applied with a foot sprayer while the granules were broadcasted uniformly after mixing with dry soil. Nitrogen depletion by weeds (in weed dry matter) was estimated at harvest stage by modified Nessler's reagent method.

RESULTS AND DISCUSSION

Weed dry matter production: The most abundant weed species found in the experimental plot were couch (*Cynodon dactylon*), awnless barnyard grass (*Echinochloa colonum*), nutgrass (*Cyperus rotundus*), *Fimbristylis miliacea*, asthma plant (*Euphorbia hirta*), *Corchorus acutangulus*, white eclipta (*Eclipta prostrata*), *Phyllanthus niruri*, *Ammania baccifera* and hairy wandering jew (*Commelina benghalensis*).

There was a significant difference in dry matter production of weeds under different planting methods, the maximum being in direct sowing (179.9 g m⁻²), the minimum in transplanting (84.6 g m⁻²) (Table 1). Among the weed control treatments, handweeding produced the lowest weed dry matter while it was highest in the unweeded control. Butachlor (granular and liquid), thiobencarb, propanil and nitrofen reduced dry matter production of weeds, while the phenoxy group of herbicides were less effective.

Nitrogen depletion by weeds: The planting methods had a significant effect on nitrogen depletion (Table 1). The maximum nitrogen depletion (22.8 kg ha⁻¹) was in direct sowing while the minimum (9.6 kg ha⁻¹) was in transplanting, which shows that dry matter of weeds has positive relation with nitrogen uptake. Among the weed control treatments, maximum nitrogen depletion was recorded in the unweeded control (34.4 kg ha⁻¹) and the minimum in handweeding (6.3 kg ha⁻¹). The phenoxy herbicides had less effect in checking nitrogen depletion whereas butachlor (granular and liquid), thiobencarb, nitrofen and propanil were most effective in reducing nitrogen depletion by weeds.

Yield and yield attributes: The method of rice cultivation had a significant effect on grain and straw yields (Table 1). Transplanting produced the maximum grain yield (4175 kg ha⁻¹). The lowest grain yield (2012 kg ha⁻¹) was obtained from direct seeding in dry conditions. In the weed control treatments, the highest yield was obtained by handweeding. Grain yields in the butachlor (liquid and granules), thiobencarb and propanil treatments were equal. In the

Table 1. Yield and yield components of rice (cv. Cauvery) and nitrogen removal by weeds as affected by planting method and weed control treatments.

Treatments	Rate (kg ha ⁻¹)	Application time	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Panicle density (no m ⁻²)	Grains/ panicle (no.)	Weed dry matter production (g m ⁻²)	N depletion by weeds (kg ha ⁻¹)
<i>Main plot</i>								
Direct sowing (dry)	-	-	2012	4350	230	55.4	179.9	22.8
Direct sowing (puddled)	-	-	3000	6325	309	68.0	135.8	17.8
Transplanted	-	-	4175	9212	344	75.6	84.6	9.6
LSD (P=0.05)			323	875	8	1.1	6.7	1.3
<i>Sub plot</i>								
Butachlor (L) ¹	2	Pre ²	3412	7512	322	69.9	96.2	13.6
Butachlor (G) ¹	1	Pre	3575	7362	326	69.7	92.5	13.1
Nitrofen	2	Pre	3050	6875	290	67.2	119.7	15.8
2,4-D (G)	1	Pre	2425	5650	247	61.2	187.5	19.1
2,4-D (L)	1	Post	2575	5662	264	63.7	184.4	18.6
MCPA	1	Post	2537	5475	259	64.0	182.8	18.7
Thiobencarb	2	Post	3325	7275	307	66.2	108.2	13.8
Propanil	2	Post	3562	7725	326	71.0	100.1	13.9
Handweeded	-	-	4050	7975	370	72.3	36.7	6.3
Unweeded control	-	-	2137	4775	230	58.2	226.3	34.3
LSD (P=0.05)			260	675	6	1.7	12.6	1.3
Interaction			NS	NS	Sig.	Sig.	Sig.	Sig.

¹G = granular, L = liquid formulation.

²Pre = pre-emergence, Post = post-emergence.

pre-emergence treatments, nitrofen gave the lowest grain yield. Grain yields in the 2,4-D (liquid and granules) and MCPA treatments were equal but lower than the grain yield from other herbicides. The unweeded control treatment produced the lowest grain yield. All the yield components measured were significantly affected by planting methods and weed control treatments except the test weight of grains.

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