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Economics of Integrated Weed Management in Rice Based Intercropping under Rainfed Conditions of Nagaland

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Rice is the major crop of north-east region which accounts for about 89% of the area and 92% of the total production of food grains (Sharma and Singh, 1998). The extent of weed menaces is more serious in upland rice than lowland rice mainly due to variations in hydrology, reduction in rice grain yield may range from 5-100% (Singh *et al.*, 2002). Groundnut is new introduction to NEH region and is becoming popular under upland conditions. Initial slow growth combined with prostrate nature of its growth and hot humid climate prevailing during **kharif** season permit early and severe crop-weed competition resulting in loss of yield to the tune of 35 to 80% (Murthy *et al.*, 1994). Intercropping suppresses weeds better than sole cropping and provides an opportunity to utilize crop themselves as tools of weed management (Rao and Shetty, 1976). But intercropping system alone is not sufficient to ensure adequate weed management because of varied canopy coverage prevailing in intercrops. Intercropping in combination with weed management practices may suppress the weed infestation to an economic level. The present investigation therefore was undertaken to develop effective weed control practices for rice-based intercropping.

A field experiment was conducted at Research Farm of School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema Campus during the **kharif** season of 2002. The soil was sandy loam, high in organic carbon (1.04%), medium in available nitrogen (282.6 kg ha^{-1}), available P_2O_5 (19.2 kg ha^{-1}) and available K_2O (112 kg ha^{-1}) and acidic in reaction (pH 4.6). Treatments comprised two cropping systems (sole rice and rice+groundnut intercropping) and five weed control measures (Table 1) were laid out in randomized block design with three replications. Groundnut and rice were sown in 1:1 row ratio.

The relative densities of broad and narrow leaf in the experimental field were 44.37 and 45.63%, respectively. The dominant weed flora found in the experimental field were *Amaranthus viridis, Boreria hispida, Digitaria sanguinalis, Elusine indica, Euphorbia hirta, Mimosa pudica* and *Setaria glauca*. Intercropping of rice+groundnut

Table 1. Effect of intercropping and weed control treatments on weed growth, yield, net return and benefit : cost ratio

Treatment	Weed density (No m^{-2})	Weed dry weight (g m^{-2})	Rice grain yield (kg ha^{-1})	Groundnut pod yield (kg ha^{-1})	Rice equivalent yield (kg ha^{-1})	Net return (Rs. ha^{-1})	B : C ratio
Intercropping							
Rice	15	21.10	1057	–	1057	1216	1.22
Rice+groundnut	9	15.73	895	1356	7676	36227	4.65
LSD (P=0.05)	2	2.14	NS	--	577	–	–
Weed control measures							
HW 20 DAS	13	16.26	1027	605	3880	15799	2.64
HW 20 and 40 DAS	11	10.67	1336	869	5505	25246	3.64
Oxyfluorfen at 0.20 kg ha^{-1}	12	22.92	833	704	41477	17741	2.86
Oxyfluorfen at 0.20 kg ha^{-1}+HW 40 DAS	8	8.47	1146	1170	6824	33323	4.41
Weedy	16	33.92	539	217	1448	1501	1.14
LSD (P=0.05)	2.6	3.39	284	216	912	–	–

NS=Not Significant.

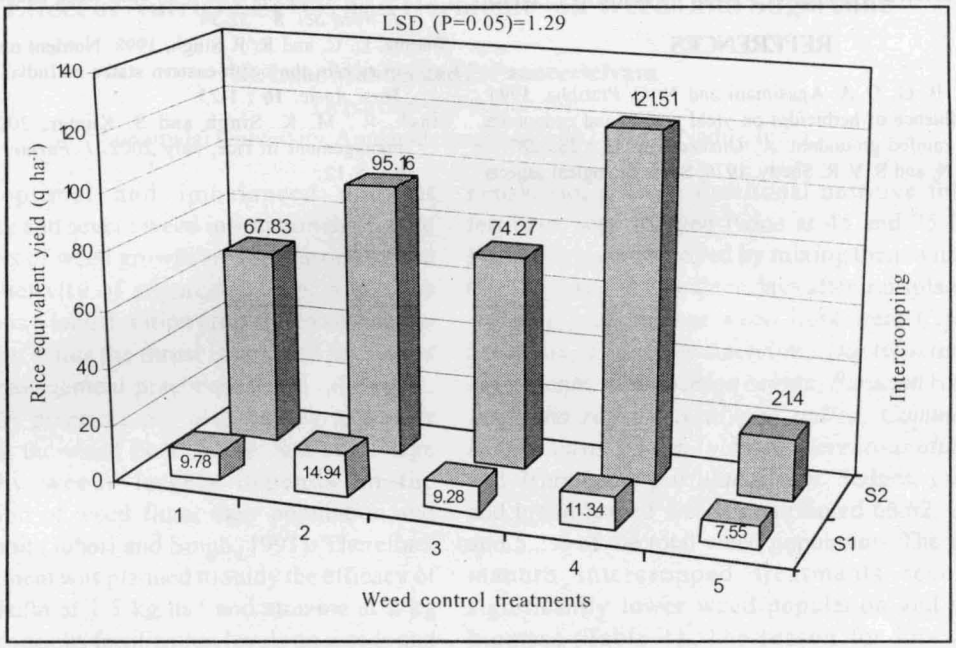

Fig. 1. Interaction of intercropping and weed control treatments on rice equivalent yield.

1–HW at 20 DAS, 2–HW at 20 & 40 DAS, 3–Oxyflourfen at 0.20 kg ha^{-1}, 4–Oxyflourfen at 0.20 kg ha^{-1}+HW at 40 DAS, 5–Weedy, S_1–Sole rice, S_2–Rice+groundnut.

significantly reduced the weed density and weed dry weight (Table 1). Due to vertical growth of rice and lateral growth of groundnut, there might be shading effect on weeds. Oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS significantly reduced weed density as compared to weedy. However, it was at par with hand weeding at 20 DAS and oxyfluorfen at 0.20 kg ha^{-1} and significantly inferior to hand weeding twice. Oxyfluorfen at 0.20 kg ha^{-1} + HW at 40 DAS recorded the minimum weed dry weight which was at par with hand weeding twice and significantly inferior to hand weeding at 20 DAS, and oxyfluorfen at 0. 20 kg ha^{-1}.

Rice grain yield in sole rice was higher than rice+groundnut intercropping (Table 1). Hand weeding at 20 and 40 DAS recorded the maximum rice grain yield which was at par with oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS and both these treatments were significantly superior to other weed control treatments. The maximum pod yield of groundnut was obtained from oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS which was significantly superior to all other treatments.

Inclusion of groundnut as an intercrop with rice recorded significantly more rice equivalent yield as compared to sole rice. Oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS recorded the highest rice equivalent yield which was significantly more than weedy. Rice equivalent yield in hand weeding at 20 DAS, hand weeding at 20 and 40 DAS and oxyfluorfen at 0.20 kg ha^{-1} were at par with each other. Interaction effect of intercropping and weed control treatments on rice equivalent yield (Fig. 1) revealed that the highest rice equivalent yield was obtained with rice+groundnut intercropping x oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS which was significantly more than any other treatment combination. The benefit : cost ratio was also more in rice+groundnut intercropping and integration of weed management practices viz.,

oxyfluorfen at 0.20 kg ha^{-1}+hand weeding at 40 DAS.

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