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Efficacy of herbicides and mulching for controlling weeds in transplanted rice

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ABSTRACT

The efficacy of selected herbicides along with mulching for weed control in transplanted rice was evaluated under temperate conditions of Kashmir during wet seasons of 2006 and 2007. All the weed control treatments were superior to weedy conditions. Butachlor (1kg a.i. ha^{-1} 3-5 days after transplanting) + brown sarson (Brassica campestris) straw mulching and pretilachlor (1 kg a.i. ha^{-1} 3-5 days after transplanting) + brown sarson straw mulching had a mean grain yield of 9.3 and 9.2, respectively and were significantly superior to herbicide combination treatments viz. butachlor (1 kg a.i. ha^{-1}) followed by (fb) 2,4-D (0.5 kg a.i. ha^{-1} 20 days after transplanting) or pretilachlor (1 kg a.i. ha^{-1}) 2,4-D (0.5 kg a.i. ha^{-1}). All the weed control treatments resulted in higher uptake of nitrogen. Among weed control combination treatments, butachlor (1kg ha^{-1}) + brown sarson straw mulching and pretilachlor (1 kg a.i. ha^{-1}) + brown sarson straw mulching proved most profitable with net returns of Rs 35,813 ha^{-1}and Rs 35,294 ha^{-1}and benefit: cost ratio of 1.63 and 1.60, respectively.

Key words: *transplanted rice, mulching, herbicides, weed-control efficiency*

The dominance of rice-brown sarson (*Brassica campestris*) cropping system in the Kashmir valley and continuous use of one herbicide butachlor alone, over years in rice has not succeeded in controlling various weed flora and has resulted in yield reduction from 25 to 53 % (Bali *et al* 1994*)*. Hence study was undertaken to determine the efficacy of combination of herbicides or with organic mulches for effective control of weeds in transplanted rice. Field experiments were conducted to study the performance of various combinations of herbicides in transplanted rice under temperate conditions of Kashmir province.

The field experiments were conducted during the wet seasons of 2006 and 2007 at Wadura campus of the SKUAST University, Kashmir. The pH, organic carbon and available N, P, K content were 7.2, 0.8% 333, 6 and 198 kg ha^{-1}, respectively. The treatments comprised of butachlor 5G at 0.5 kg ha^{-1}, 3-5 days after transplanting (DAT)+ mulching with brown sarson straw(BSS); butachlor 5G at 1 kg ha^{-1}, 3-5 DAT+ mulching with BSS; Pretilachlor 50 EC at 0.5 lt ha^{-1}, 3-5 DAT+ mulching with BSS; Pretilachlor 50 EC at 1 lt ha^{-1}, 3-5 DAT+ mulching with BSS; butachlor 5G at 1 kg ha^{-1}, 3-5 DAT followed by (fb) 2,4-D 38% EC at 0.5 lt ha^{-1}; Pretilachlor 50 EC at 1 lt ha^{-1}, 3-5 DAT fb 2,4-D 38% EC at 0.5 lt ha^{-1}; weed free and weedy check in a randomized complete block design with three replications. Thirty days old seedlings of Shalimar rice-1 were transplanted with 3 seedlings hill^{-1} in puddled field at 20X10 cm spacing during the first week of June. Crop was supplied with a fertility dose of 120, 60 and 40 kg N, P_2O_5 and K_2O ha^{-1}, respectively. Full dose of P_2O_5 and K_2O through diammonium-phosphate and muriate of potash, half of N through urea were applied as basal dose at the time of puddling. Remaining N was top dressed at 25 and 45 DAT in equal splits. Weed samples were collected by using a quadrate (0.5 mX0.5 m) randomly at two places inside a plot and then converted to per square meter. Crop samples were collected from one meter row length and then converted to per square meter. Data were pooled for analysis as Bartlet test indicated its homogeneity over the years. Nitrogen use efficiency (NUE) was computed by using the formula (kg grains per kg nitrogen applied) X 100, whereas weed control efficiency was computed on population basis.

The most dominant weed species found in the weedy plots were *Echinochloa crusgalli, Cyperus iria, Cyperus rotundus, Ammania* spp., *Marselia quatrifolium, Potamegatone* spp. It was found that all the weed control treatment combinations were significantly superior to the weedy check with respect to yield attributes viz. panicles m^{-2}, panicle weight, no. of grains $panicles^{-1}$ (Table 1). Among the weed control measures, hand-weeding recorded the lowest weed count and dry weight (Table 2) and highest number of panicles m^{-2}, panicle weight, grains $panicles^{-1}$ and grain yield (Table 1). An increase of 97.4 % yield over the weedy check was observed mainly owing to manual removal of weed flora. Better control of weeds facilitated the crop for better absorption of nutrients (Rao 1995), as evident from N uptake by crop and weeds (Table 1). The weed control measures resulted in higher N uptake by crops and helped in realizing higher grain yield of rice (Rao 1995 and Jacob and Syriac 2005). Among the herbicide treatments, maximum grain yield, height and faourable yield attributes were obtained with the application of butachlor 1 kg ha^{-1} at 3-5 DAT + BSS mulching and recorded an increase of 89.7% yield over weedy check, however, it was at par with pretilachlor 1 kg a.i. ha^{-1} 3-5 DAT + BSS mulching, butachlor 0.5 kg ha^{-1} +BSS mulching and pretilachlor 0.5 kg ha^{-1} +BSS mulching. This increase in yield could be due to lower weed count that resulted in efficient utilization of available resources by the crop (Sundari and Kathiresan, 2002).

All the weed control treatments registered a significant reduction in total weed population and total weed dry matter compared with the weedy check throughout the crop growth (Table 2). It was further observed that among all herbicide treatments, butachlor 1 kg ha^{-1} + BSS mulching reduced total weed density and weed dry matter significantly by 94.7 and 98.9 %, respectively, compared to weedy check, though it remained at par with application of pretilachlor 1 kg ha^{-1} +BSS mulching and butachlor 0.5 kg ha^{-1} +BSS mulching. Treatment of butachlor 1 kg ha^{-1} fb 2, 4-D 0.5 kg ha^{-1} and pretilachlor 1 kg ha^{-1} fb 2, 4-D 0.5 kg ha^{-1} were also effective in reducing weed density and dry matter as compared to weedy check but could not compete with the other treatments due to the fact that subsequent emergence of weeds was not controlled after 40 DAT but controlled by the BSS mulching.

It was also found that the highest N-use efficiency was recorded under weed free conditions (Table 1). Among different weed control treatment combinations Butachlor 1 kg ha^{-1} 2, 4-D 0.5 kg ha^{-1} and pretilachlor 1 kg ha^{-1} fb 2, 4-D 0.5 kg ha^{-1} were found to be superior with respect to N-use efficiency as compared with weedy check. Crop also exhibited improvement in N uptake with the adoption of combined weed control measures. Highest N uptake was recorded under weed free condition followed by the

Table 1. Grain yield, yield attributes, nitrogen uptake, N-use efficiency and economics in transplanted rice under different weed control treatments (pooled data)

Treatments	Panicles-^{2m}	Grains $panicle^{-1}$	Grain yield (t ha^{-1})	N uptake (kg ha^{-1}) Crop	Weeds	N-use efficiency (kg grain kg N applied)	Net returns (Rs ha^{-1})	Benefit : cost ratio
Butachlor(5G)@0.5kg ha^{-1}+BSS mulch	362.95	113.50	9.09	163.7	6.68	75.8	34406	1.5
Butachlor(5G)@1kg ha^{-1} +BSS mulch	378.93	119.17	9.25	166.5	6.54	77.1	35813	1.6
Pretilachlor(50EC)@0.5kg ha^{-1} +BSS mulch	376.34	107.00	8.96	161.2	10.07	74.7	33987	1.5
Pretilachlor(50EC)@1kg ha^{-1} +BSS mulch	378.33	117.67	9.17	165.0	6.63	76.4	35294	1.6
Butachlor(5G)@1kg ha^{-1} fb 2,4-D (38EC)@0.5kg ha^{-1}	320.53	104.50	8.63	155.3	10.33	71.9	31906	1.4
Pretilachlor (50EC)@1kg ha^{-1} fb 2,4-D (38EC)@0.5kg ha^{-1}	304.58	103.50	8.54	153.8	14.68	71.2	31388	1.4
Weed free	397.87	120.50	9.63	173.3	0.00	80.2	34156	1.3
Weedy	242.49	52.56	4.88	87.8	31.75	0.41	8468	0.3
CD(P=0.05)	24.26	2.78	0.31	5.58	-	-	-	-

Table 2. Weed count, weed dry matter and weed control efficiency in transplanted rice under different weed control treatments (pooled data)

Treatments	Total weed population (no m^{-2})	Total weed dry matter (g m^{-2})	Weed control efficiency (%)
Butachlor(5G)@0.5kg ha^{-1}+BSS mulch	2.49 (5.20)	3.31 (10.00)	93.9
Butachlor(5G)@1kg ha^{-1} +BSS mulch	2.41 (4.82)	3.19 (9.17)	94.3
Pretilachlor(50EC)@0.5kg ha^{-1} +BSS mulch	2.61 (5.82)	3.46 (11.00)	93.2
Pretilachlor(50EC)@1kg ha^{-1} +BSS mulch	2.47 (5.12)	3.27 (9.73)	94.0
Butachlor(5G)@1kg ha^{-1} fb 2,4-D(38EC)@0.5kg ha^{-1}	2.67 (6.15)	3.65 (12.33)	92.8
Pretilachlor(50EC)@1kg ha^{-1} fb 2,4-D(38EC)@0.5kg ha^{-1}	2.84 (7.08)	3.83 (13.67)	91.2
Weed free	1.00 (0.00)	1.00 (0.00)	100.0
Weedy check	9.27 (85.00)	4.81 (22.17)	-
CD(P=0.05)	0.11	0.12	-

Values within parentheses are original.

application of butachlor 1 kg ha^{-1} + BSS mulching (Table-1). Lowest N uptake was under weedy conditions. The N uptake by weeds followed the reverse trend. Effective combined weed control measures reduced the weed biomass which in turn reduced weed competition and there by resulted in the improvement of N uptake by crop. (Bali *et al*., 2006).

Crop yield and weed control efficiency were positively correlated. One percent increase in weed control efficiency caused increase in grain yield by 44.63 kg. This increase in grain yield by increasing WCE was also reported by Singh and Singh (2006). However, the uptake of nitrogen by weeds was negatively correlated with grain yield. Regression analysis (y = 10197 – 155.08 x) also indicated that one kg increase in N uptake by weeds causes reduction in grain yield by 155.08 kg ha^{-1}. The competitive effect of weeds for nutrient was also reported by Bali *et al*. 2006.

On the basis of two years mean, the maximum net returns and benefit: cost ratio was obtained with butachlor 1 kg ha^{-1} + BSS mulching followed by pretilachlor 1 kg ha^{-1} +BSS mulching (Table 1). The corresponding values being Rs.35813 and1.63 and Rs.35294 and 1.60, though weed free condition gave the maximum yield but net returns and benefit: cost ratio was not highest due to involvement of more labour (Bali *et al* 1997 and Bhowmik and Ghosh, 2006).

Therefore, combination of different weed control measures i.e. butachlor or pretilachlor 1 kg a.i. ha^{-1} along with brown sarson straw mulching 3-5 days after transplanting proved to be effective and a profitable alternative to the existing recommendation of butachlor combined with one hand weeding under the temperate conditions of Kashmir valley.

REFERENCES

Sundari A and Kathiresan R M 2002. Integrated weed management in irrigated Sorghum. Indian J Weed Sci. 34 (3&4): 313-315

Bali SA Mahinder Singh, Dileep Kachroo, Sharma BC and Shivram DR2006. Efficacy of herbicides in transplanted, medium- duration rice (*Oryza sativa)* under sub-tropical conditions of Jammu. Indian J Agronomy 51(2): 128-130

Bali AS , Shah MH, Bali A S, Hassan B, Singh KN and Khant RH 1997. Effect of weed control and irrigation regimes on transplanted rice(*Oryza sativa)* in Kashmir valley. Indian J of Agric Sci 67(10): 451-453

Jacob D and Syriac Elizabeth K 2005. Relative efficacy of different spacing and weed control methods in scented rice. Oryza 42 (1): 75-77

Bhowmik MK and R. K.Ghosh. 2006. Sole and combined use of herbicides for weed control in transplanted rice during dry season. Oryza 43(1): 45-47

Rao AS 1995. Susceptibility of various weed groups as influenced by herbicide mixture and sequential application in transplanted rice. Annals of Agricultural Research16 (2): 455-459

Singh P and Singh SS 2006. Effect of establishment methods, fertility levels and weed-management practice in aromatic rice (*Oryza sativa).* Indian J Agronomy 51(4): 247-250