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# Weed management through green manuring in direct seeded rice (*Oryza sativa*) under medium land condition at East Singhbhum District of Jharkhand, India

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## ABSTRACT

Intercropping of green manuring in direct seeded Rice variety Naveen under medium land condition was studied to evaluate the weed dynamics at Zonal Research Station, Darisai, East Singhbhum, Jharkhand, during wet season 2010 and 2011. The significantly highest yield attributing parameters, grain (40.33 qha<sup>-1</sup>) and straw (80 qha<sup>-1</sup>) yield, maximum gross (Rs. 27817 ha<sup>-1</sup>) and net return (Rs. 17186 ha<sup>-1</sup>) was recorded in two hand weedings and was at par with incorporation of green manuring crops, recorded 45.37%, 32%, 40.76% and 56.91% higher grain yield as compared to application of 2,4-D on intercropped *Sesbania Aculeata* (Dhaincha), *Crotalaria Juncea* (Sunn Hemp), *Vigna Mungo* (Black Gram) and Weedy Check, respectively. Significantly maximum benefit cost ratio 2.64 was recorded with *Sesbania* incorporated in Rice and was at par with two hand weedings, Sunn Hemp and Black Gram incorporated in Rice. Minimum weeds were recorded with Dhaincha intercropped and incorporated in Rice, this treatment was at par with incorporation of Sunn Hemp and Black Gram. Thus, on the basis of B:C ratio, incorporation of Dhaincha in direct seeded Rice is concluded as more profitable than two hand weedings and 2,4-D application for controlling weeds as well.

**Key words :** Weed management, Direct seeded rice, Green manures, Intercropping, Incorporating

## Introduction

Growing of wet season crops in Rain-fed condition is the most common practices in Jharkhand. Direct seeding of Rice is generally practiced in Saraikela-Kharsawan and West Singhbhum districts of Jharkhand to avoid delayed transplanting or sometimes no transplanting due to erratic rainfall. But among the various constraints in this type of practices, weeds are the major menace restricting the productivity. Yield loss due to weeds in direct

seeded Rice varies from 40 to 100% (Choubey *et al.*, 2001). Of the total annual loss of agricultural produce from various parts in India, weeds account for 45 percent, insects 30 percent, diseases 20 per cent and other pests 5 per cent (Raja *et al.*, 2008). Hence, weeds are considered to be the major problem of crops and their management is essential to optimize crop productivity. In sustainable agriculture, an alternative method to chemical and mechanical weed control in crops is, the use of live mulches with fast-growing annual green manure. These Green Manure

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crops germinate quickly and cover the ground surface rapidly, ultimately help in smoothening of weeds. Hence, an attempt has been made to evaluate the intercropping of green manuring crops with Rice on weed dynamics of Mid-land Rice cultivation.

## Materials and Methods

A field experiment was conducted during in wet seasons of 2010 and 2011 at Zonal Research Station, Darisai, Jharkhand, situated at latitude of 22°41' N, longitude of 86°23' E and altitude of 124 m above the mean sea level. The soil was silt loam in texture with pH 6.0 having 250.25, 16.45 and 136.0 kg ha<sup>-1</sup> available N, P and K, respectively. The experiment was laid out in Randomized Block Design with three replications, consisting of eight treatments i.e., Rice variety Naveen intercropped with three green manuring crops, viz., *Sesbania Aculeata* (Dhaincha), *Crotolaria Juncea* (Sunn Hemp), *Vigna Mungo* (Black Gram), incorporated by mechanical means and destroyed by weedicide 2,4-D in 20 days after sowing (DAS) along with two hand weedings (at 20 and 40 DAS) and weedy check. Sowing of Rice and green manuring crops were done simultaneously with seed rate of 80 kg ha<sup>-1</sup> and 40 kg ha<sup>-1</sup>, respectively. Green manuring seeds were broadcasted first and then Rice was sown at 20 cm row spacing. Recommended dose of fertilizers 80: 40: 40 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> respectively were applied through Urea, Single Super Phosphate and Muriate of Potash. Half

of the fertilizer N, full dose of P and K were applied as basal. Remaining half of N was applied in two equal splits doses, once at tillering and rest at panicle initiation stage. The yield attributing parameters and yield of the crop were recorded after physiological maturity.

The Weed Control Efficiency (WCE) was calculated by using the formula:

$$WCE = (DCM - DTM) \times (100 \div DMC)$$

Where, DMC= Dry Matter of weed in control plot  
DMT = Dry Matter of weeds in a treatment

The Weed Index was worked out using the formula:

$$WI = (X - Y) \times (100 \div X)$$

Where, X= Yield from weed free plot  
Y= Yield from treated plot

## Results and Discussion

The highest number of total tillers and effective tillers m<sup>-2</sup>, maximum 1000 seed weight and grains per panicle were recorded by two hand weedings at 20 and 40 days after sowing followed by incorporation of Sunn Hemp at 20 days after sowing and were at par with incorporation of Dhaincha, Black Gram and application of 2,4-D on Sunn Hemp owing to significantly highest grain (40.33 q ha<sup>-1</sup>) and straw (80.00 qha<sup>-1</sup>) yield which recorded 45.37%, 32%, 40.76% and 56.91% higher grain yield as compared to application of 2,4-D on intercropped Dhaincha, Sunn Hemp, Black Gram and weedy check, respectively. Maximum plant height (126.93 cm) and

**Table 1.** Growth and yield attributes, grain and straw yield and harvest index of Rice as influenced by green manuring crops (mean of 2 years)

Treatment	Plant height (cm)	Total tillers m <sup>-2</sup>	Effective tillers m <sup>-2</sup>	Panicle length (cm)	Grains panicle <sup>-1</sup>	1,000 grain weight (g)	Grain yield (q ha <sup>-1</sup> )	Straw yield (q ha <sup>-1</sup> )	Harvest Index (%)
<i>Sesbania aculeate</i> –incorporated	120.07	408.33	406.00	27.80	108.53	19.20	39.33	75.00	34.47
<i>Crotolaria juncea</i> –incorporated	126.93	418.67	415.33	29.23	114.93	19.13	39.67	77.33	33.91
<i>Vigna mungo</i> –incorporated	126.57	408.33	405.33	27.20	107.67	19.53	33.00	74.67	30.54
<i>Sesbania aculeate</i> + 2,4-D	121.77	359.67	358.00	28.23	101.87	19.27	23.67	63.00	27.42
<i>Crotolaria juncea</i> + 2,4-D	125.53	405.33	405.00	27.90	103.07	19.40	29.33	71.33	28.81
<i>Vigna mungo</i> + 2,4-D	122.67	383.67	380.33	28.30	95.20	19.00	25.67	67.67	27.45
2 Hand weedings (20 & 40 DAS)	120.10	472.00	464.67	27.33	113.93	20.20	40.33	80.00	33.29
Weedy check	125.52	270.00	265.67	27.80	91.73	18.60	18.67	60.00	23.87
SEm ±	2.33	31.35	30.44	1.19	4.99	0.26	3.51	71.13	2.50
CD (P=0.05)	NS	96.03	93.23	NS	15.29	0.80	10.74	4.32	NS

*Sesbania Aculeata* (Dhaincha), *Crotolaria Juncea* (Sunn Hemp), *Vigna Mungo* (Black Gram)

panicle length (29.23 cm) were recorded with incorporation of Sunn Hemp at 20 days after sowing.

Study on weeds showed that, during crop period about 42 major weeds belonging to different families were found. They have been classified as grasses (17), broad leaved weeds (20) and sedges (05). Major grasses found in the crop field were *Echinochloa Colonum* (Jungle Rice), *Echinochloa Crus-Galli* (Cockspur Grass or Barnyard Millet), *Echinochloa glabrescens* (Barnyard Grass), *Cynodon dactylon* (Dhoob Grass), *Eleusine indica* (Goose Grass), *Imperata cylindrical* (Cogon Grass), *Digitaria sanguinalis* (Hairy Crab Grass), *Digitaria bicornis* (Finger Crab Grass), *Paspalum conjugatum* (Buffalo Grass), *Urochloa mutica* (Para Grass), *Dactyloctenium aegyptium* (Crow foot Grass), *Ischaemum rugosum* (Muraino Grass), *Isachne globosa* (Swamp Millet), *Eragrostis tenella* (Japanese Love Grass, Bharbhushi), *Paspalum conjugatum* (Carabao Grass), *Panicum repens* (Torpedo Grass) and *Paspalidum flavidum* (Yellow Water Crown Grass). Major broad leaved weeds were *Commelina benghalensis* (Benghal dayflower), *Commelina nudiflora* (Creeping dayflower), *Commelina diffusa* (Climbing dayflower), *Ageratum conyzoides* (Chickweed or Goatweed), *Alternanthera sessilis* (Dwarf Copperleaf), *Cleome rutidosperma* (Fringed Spider flower), *Cleome viscosa* (Asian Spider flower), *Celosia argentea* (Silver cock's comb), *Eclipta prostrata* (Bhringraj), *Physalis minima* (Native Gooseberry), *Heliotropium indicum* (Indian Heliotrope), *Lindernia antipoda* (Alston), *Ludwigia parvifolia* (Paddy Clove), *Ludwigia octovalvis* (Wild Clove), *Melochia corchorifolia* (Chocolate weed), *Phyllanthus niruri* (Bhumi Amla), *Stellaria media* (Chickweed), *Sida acuta* (Sida), *Sida cordifolia* (Bala), *Zizyphus rotundifolia* (Jharber) and sedges were *Cyperus rotundus* (Java grass), *Cyperus difformis* (Motha), *Cyperus iria* (Rice flate sedge), *Fimbristylis miliacea* (Grasslike fimbry), *Cyperus javanicus* (Java sedge). During crop growth period broad leaved weeds were more in number from initial stage to the last stage of crop.

Analysis of weed flora revealed that grassy weeds, broad leaf weeds and sedges constituted 29.93%, 67.47% and 2.6% of total weed flora respectively at 40 DAS in weedy check. Intercropping of green manuring crops showed non-significant effect on total number of weeds at 20 DAS, but all the treatments affected significantly at 40 and 60 DAS. Weed density was maximum (500 m<sup>-2</sup>) at 40 DAS and minimum (110 m<sup>-2</sup>) at 60 DAS in weedy check

**Table 2.** Number of weeds (m<sup>-2</sup>), no. of broad leaf, narrow leaf & sedges, dry matter of weeds (gm m<sup>-2</sup>), weed control efficiency (%) and weed index (%) of Rice as influenced by green manuring crops

Treatment	Total no. of weeds			Dry matter of weeds			WCE		WI
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	40 DAS	60 DAS	
<i>Sesbania aculeate</i> –incorporated	10.62 (115.33)	5.86 (35.33)	6.50 (45.00)	24.56	2.70	14.87	97.86	85.12	2.48
<i>Crotolaria juncea</i> –incorporated	9.62 (93.00)	7.19 (52.33)	3.69 (13.67)	31.60	5.39	3.95	95.73	96.05	1.65
<i>Vigna mungo</i> –incorporated	9.00 (84.33)	7.74 (66.00)	5.19 (28.33)	20.01	5.75	6.92	95.44	93.08	18.18
<i>Sesbania aculeate</i> + 2,4-D	10.35 (107.67)	14.63 (245.67)	5.10 (28.00)	19.60	52.74	5.30	58.21	94.70	41.33
<i>Crotolaria juncea</i> + 2,4-D	12.38 (160.33)	11.91 (146.00)	5.43 (32.67)	20.26	12.07	11.48	90.44	88.51	27.27
<i>Vigna mungo</i> + 2,4-D	10.06 (101.67)	13.11 (180.67)	8.37 (77.00)	26.82	15.21	33.56	87.95	66.43	36.37
2 Hand weedings (20 & 40 DAS)	9.72(95.67)	11.46 (133.67)	3.16 (10.00)	51.20	7.36	1.89	94.17	98.11	-
Weedy check	11.40 (130.33)	22.08 (500.00)	10.43 (110.00)	41.36	126.19	99.98	-	-	53.72
SEm ±	1.00	2.11	0.96	5.85	24.18	16.25	-	-	-
CD (P=0.05)	NS	6.47	2.93	17.93	74.04	49.77	-	-	-

Values given in parentheses are the original means, subjected to square root transformation.

**Table 3.** Cost of cultivation, gross return, net return in (Rs ha<sup>-1</sup>) and benefit cost ratio of Rice as influenced by green manuring crops Grain, Rs. 650 q<sup>-1</sup>; straw, Rs 20 q<sup>-1</sup>

Treatment	Cost of Cultivation	Gross Return	Net Return	Benefit : Cost Ratio
<i>Sesbania aculeate</i> -incorporated	10256.12	27066.67	16810.55	2.64
<i>Crotolaria juncea</i> -incorporated	11831.12	27330.00	15498.88	2.31
<i>Vigna mungo</i> -incorporated	11156.12	22943.33	11787.21	2.06
<i>Sesbania aculeate</i> + 2,4-D	9198.12	16643.33	7445.21	1.81
<i>Crotolaria juncea</i> + 2,4-D	10773.12	20493.33	9720.21	1.90
<i>Vigna mungo</i> + 2,4-D	10098.12	18036.67	7938.55	1.79
2 Hand weedings (20 & 40 DAS)	10631.12	27816.67	17185.55	2.62
Weedy check	7631.12	13333.33	5702.21	1.75
SEm ±		2288.27	2590.29	0.22
CD (P=0.05)		7008.02	7932.98	0.67

(Table 2). At 40 DAS, minimum numbers of weed were recorded with Dhaincha intercropped and incorporated in Rice. Incorporation of green manuring crops and treatments two hand weedings at 20 DAS & 40 DAS were statistically equal with applying 2,4-D on Sunn Hemp in reducing weed density at 40 DAS, whereas, at 60 DAS incorporation of Sunn Hemp and black gram, application of 2,4-D on Dhaincha and Sunn Hemp were equal with two hand weedings.

There was no significant difference among treatments on dry matter production of weeds except weedy check at 40 and 60 DAS. Maximum dry matter accumulation was recorded in weedy check at 40 DAS followed by 60 DAS. Incorporation of green manuring crops and treatments two hand weedings at 20 DAS & 40 DAS were statistically equal with applying 2,4-D on Sunn Hemp and Black Gram in reducing weed dry matter at 40 DAS, whereas, at 60 DAS incorporation of green manuring crops and application of 2,4-D on Dhaincha and Sunn Hemp were equal with two hand weedings.

Maximum weed control efficiency (97.86%) at 40 DAS was recorded with incorporation of Dhaincha and at 60 DAS, it was maximum with two hand weedings (98.11%) followed by incorporation of Sunn Hemp at 20 DAS (96.05%). Majhi *et al.* (2011) also recorded similar findings. Weed index was minimum (1.65%) with incorporation of Sunn Hemp followed by incorporation of Dhaincha at 20 DAS.

Maximum gross (Rs. 27816.67 ha<sup>-1</sup>) and net (Rs. 17185.55 ha<sup>-1</sup>) return was recorded in two hand weedings and was at par with incorporation of green manuring crops. Significantly maximum benefit cost ratio 2.64 was recorded with Dhaincha in-

corporated in Rice and was at par with two hand weedings, Sunn Hemp and Black Gram incorporated in Rice. Incorporation of Dhaincha gave 31.44%, 28.03%, 32.20% and 33.71% more benefit cost ratio as compared to application of 2,4-D on intercropped Dhaincha, Sunn Hemp, Black Gram and weedy check, respectively. Ravi Sankar *et al.* (2007) also reported, Rice intercropped with Dhaincha gives better benefit cost ratio.

Thus, on the basis of B:C ratio, it is more beneficial to incorporate Dhaincha in Rice crop at 20 DAS than two hand weedings at 20 DAS & 40 DAS and 2,4-D application for controlling weeds and getting profitable yield.

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