



## Weed management in organically grown scented rice

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### ABSTRACT

A field experiment on evaluation of weed management practices in scented rice under organic production system was conducted during 2017-18 at All India Coordinated Research Project on Farming System, College of Agriculture, Rewa (M.P.). *Fimbristylis dichotoma* was the most dominating weed in rice field followed by *Jussia suffurusticosa*. Incorporation of mustard oil cake at 5 t/ha along with one hand weeding gave maximum weed control efficiency (68%). Growth and development of rice was better with incorporation of mustard oil cake 15 days before sowing 5 t/ha + 1 hand weeding (HW) followed by two HW at 20 and 40 days after transplanting (DAT) and locally available weed mulch *Saccharum spontaneam* at 3 t/ha + 1 hand weeding. These treatments gave 34 to 56% higher grain yield as compared to farmer's practice of weed control as mulching with mango leaves. Net profit of ₹ 62061/ha was maximum in mulching with locally available weeds + 1 hand weeding followed by ₹ 56695/ha in two HW at 20 and 40 DAT.

Rice is an important crop of rice-wheat crop zone of Madhya Pradesh, which occupies an area of 1.93 million hectares with an average production of 2.78 million tonnes (Anonymous 2017). The average productivity of rice is 1.44 t/ha, which is low due to use of local varieties, weed competition, erratic and uneven distribution of monsoon rain with frequent prolonged dry period. Organic farming is a production system that avoids the use of synthetic chemical fertilizer, pesticides and growth regulating hormones and raises the rice with the use of organic manures, bio-fertilizers, oil cake, crop rotation, legumes, green manure and biological pest control.

Weeds become most limiting factor in organic farming. None of the cultural practices were found effective to reduce the weeds in rice under organic production system and grain yield of rice is reduced by 57 to 61% due to weed competition (Mukherjee *et al.* 2008). Some cultural practices like intercropping of *Sesbania* in rice, close row spacing or high seed rate, stale seed bed, mulching by crop residues or tree leaves, hand weeding and hoeing are found effective to reduce the weeds under organic rice production system. Any practices aimed at enhancing competitive availability of the crop and weed can bring down the adverse effect of weeds on rice crop (Rao *et al.* 2007). Seedling vigor, early growth rate,

tillering ability, stale seed bed, higher fertilizer dose, hoeing and mulching can give competitive advantage to the crop.

Use of mustard oil cake is found beneficial as it increases the growth of rice and suppresses the weed growth (Islam *et al.* 2007). Intercropping suppress weeds better than sole cropping and thus provides an opportunity to utilize crop themselves as tools for weed management (Rao and Shetty 1981). Cultivation of rice at narrow/close row spacing has been found effective to reduce the weed growth and increase the rice yield as compared to wider row spaced rice crop (Bhan 1968). It has been reported by Bond and Grundy (2001) that organic farming is gaining momentum in India owing to the concerns expressed on the safety of environment, soil, water and food chain. Cultivating crops organically and at the same time maintaining higher production level is a big challenge. Since chemical intervention is not permitted for weed management, non-chemical weed management is the major limitation in rice under organic farming. Hence, the present study was conducted to identify suitable weed management method in organically grown scented rice.

The present investigation was conducted on silty clay loam soil of All India Coordinated Research Project on Farming System, Kuthulia Farm JNKVV,

College of Agriculture, Rewa during *Kharif* season of 2017. The experimental field was low in available nitrogen (180.31 kg/ha), medium in available phosphorus (16.93 kg/ha) and high in available potash (283.6 kg/ha).

The scented rice variety 'PS-5' was transplanted on 8<sup>th</sup> July 2017 using 22 days old seedlings. Two seedlings per hill were transplanted at the planting geometry of 20 x 15 cm in all the plots and i at spacing was kept 15 x 15 cm. The weed control treatments were two hand weedings (HW) at 20 and 40 days after transplanting (DAT), cono-weeder 20 DAT + one HW at 40 DAT, inter cropping with *Sesbania*, stale seed bed + reduced spacing up to 25% + mulching with wheat straw + one hand weeding, locally available weed mulch + 1 hand weeding, incorporation of mustard oil cake at 5 t/ha, 15 days before sowing + 1 HW and mulching with locally available tree dry leaves (mango) at 3 t/ha practiced by farmers as mulching under organic production system. The experimental design was RBD with three replications. The cropping system was rice-garlic. Fertilizer dose was kept 120 kg N/ha through 1/3<sup>rd</sup> N through FYM, 1/3<sup>rd</sup> N through vermicompost and 1/3<sup>rd</sup> N through oil cake.

Ten weed species were recorded in the experimental field (**Table 1**). The dominant weeds were *Fimbristylis dichotoma* (30.5%), *Jussia suffruticosa* (20.3%), *Monochoria vaginalis* (15.9%), *Eclipta alba* (14.5%), *Polygonum barbatum* (8.7%), *Alternanthera sessilis* (5.7%) and *Echinochloa colona* (4.3%). The total monocot weeds were 50.7% while dicot weeds were 49.2%.

*Fimbristylis dichotoma* was dominating weed in hoeing through cono-weeder at 20 DAT and one HW at 40 DAT (**Table 1**). *Alternanthera sessilis* was dominating weed in stale seed bed + reduced spacing up to 25% + mulching with wheat straw + one hand weeding treatment. *Monochoria vaginalis* was dominating weed in mulching through locally available weed + 1 hand weeding, incorporation of mustard oil cake at 5 t/ha at 15 days before sowing + 1 HW and two hand weeding at 20 and 40 DAT. Among various cultural and mechanical treatments, two hand weeding at 20 and 40 DAT was found most effective method of weed control as compared to one hand weeding and mechanical hoeing. It was due to effective elimination of early and late emerging weeds by hand weeding. Hoieng with cono-weeder and hand weeding was found less effective as compared to two hand weedings because hoeing could control the weed between the rows, but the weeds within the rows were unaffected. Similar findings were also noted by Jain *et al.* (1988) and Ramamoorthy *et al.* (2009).

Inter cropping of *Sesbania* with rice reduced the *Echinochloa colona* and *Monochoria vaginalis* as compared to two hand weeding at 20 and 40 DAT due to faster growth and allelopathic effect of *Sesbania*. Inter cropping of *Sesbania* in rice reduced the weed intensity was also reported by Yadav *et al.* (2010). Stale seed bed delayed the planting of rice by 5 to 6 days and reduced row to row spacing reduced the problem of *Eclipta alba* and *Polygonum barbatum* as compared to two hand weeding given at 20 and 40 DAT. Similar findings were also reported by Bhan *et*

**Table 1. Average weed biomass/m<sup>2</sup> at 40 DAT under various treatments**

Treatment	<i>Echino- cloa colona</i>	<i>Mono- choria vaginalis</i>	<i>Fimbri- stylis dichotoma</i>	<i>Jussia Suffrusti- cosa</i>	<i>Eclipta alba</i>	<i>Polygo- num barbatum</i>	<i>Alternan- thera sessillis</i>	Weed biomass (g/m <sup>2</sup> ) at harvest	Weed control efficiency (%)
Two hand weeding (20 and 40 DAT)	3.66 (2.03)	9.00 (3.08)	9.33 (3.13)	2.20 (1.64)	5.00 (2.34)	0.66 (1.08)	0 (0.70)	45.66	52.26
Conoweeder (20 DAT) + one HW (40 DAT)	3.66 (2.03)	7.66 (2.85)	8.66 (3.02)	1.90 (1.54)	4.33 (2.19)	1.16 (1.28)	4.66 (2.27)	55.00	42.50
Inter cropping with <i>Sesbania</i>	2.33 (1.68)	5.66 (2.41)	8.33 (2.97)	4.20 (2.16)	4.33 (2.19)	4.00 (2.12)	1.00 (1.22)	64.66	32.40
Stale seed bed + reduced spacing up to (25%) + mulching with wheat straw + one hand weeding	2.66 (1.77)	5.33 (2.41)	3.66 (2.04)	4.90 (2.32)	1.33 (1.35)	0 (0.70)	7.33 (2.79)	81.00	15.32
Locally available weed mulch + 1 hand weeding	2.33 (1.68)	7.33 (2.79)	4.33 (2.19)	2.30 (1.67)	2.33 (1.68)	0 (0.70)	3.66 (2.04)	69.33	27.52
Incorporation of mustard oil cake 15 days before sowing at 5 t/ha +1 HW	2.33 (1.68)	7.66 (2.85)	4.33 (2.19)	2.13 (1.62)	3.66 (2.03)	3.66 (2.03)	4.66 (2.27)	30.66	67.94
ITK practices by farmers as mulching with mango leaaves 3 t/ha	1.00 (1.22)	3.66 (2.04)	7.00 (2.73)	4.66 (2.27)	3.33 (1.95)	2.00 (1.58)	1.30 (1.34)	95.66	00.00
LSD (p=0.05)	0.02	0.04	0.01	0.02	0.02	0.03	0.08	15.2	-

Values in parentheses are the square root transformed value

al. (1968), Ramamoorthy *et al.* (2009) and Singh (2014). Mulching through mango leaf at 3 t/ha for weed control as practiced by farmers and wheat straw mulching after stale seed bed + reduced spacing up to 25% + one hand weeding were found effective to reduced the weed intensity of *E. colona* and *M. vaginalis* as compared to two hand weeding at 20 and 40 DAT. Incorporation of oil cake at 5 t/ha in addition to organic manures and 1 HW at 20 DAT reduced the problem of *F. Dichotoma* and *M. Vaginalis*, which might be due to good rice growth owing to higher level of oil cake, which suppressed the weed growth. Similar finding was also reported by Islam *et al.* (2007).

Weed biomass was minimum (30.66 g/m<sup>2</sup>) with incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW while it was maximum in mulching with mango leaves as farmers practice (95.66 g/m<sup>2</sup>). Among weed control and cultural practices, hoeing through cono-weeder at 20 DT + 1 HW at 40 DAT gave lowest weed biomass (45.66 g/m<sup>2</sup>) followed by two hand weeding at 20 and 40 DAT. Weed control efficiency was maximum (67.94%) with incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW followed by hoeing through cono-weeder at 20 DAT + 1 HW at 40 DAT (52.26%). These treatments were found effective over hand weeding and mulching with mango leaves for weed control as farmer practice.

The plant height of rice was maximum in mulching with mango leaves for weed control followed by incorporation of mustard oil cake at 5

t/ha (15 days before sowing) + 1 HW (**Table 2**). The superior growth and yield attributes of rice due to incorporation oil cake has also been reported by Islam *et al.* (2007).

The productive tillers/meter row length and panicle length of rice were maximum in stale seed bed + reduced spacing up to 25% + mulching with wheat straw + one hand weeding at 40 DAT followed by incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW and two hand weedings at 20 and 40 DAT (**Table 2**). These treatments gave 7.75 to 17.58% higher number of productive tillers than farmers practice as mulching with mango leaves. Panicle were 8.23% longer under incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW followed by two hand weedings given at 20 and 40 DAT and in hoeing with cono-weeder at 20 DAT + 1 HW at 40 DAT.

Number of filled grains/panicle and test weight of rice were significantly maximum under incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW followed by locally available weed mulch + 1 hand pulling/hand weeding at 40 DAT. Test weight of rice was maximum (28.43g) in inter cropping with *Sesbania* followed by 27.53g in two hand weedings at 20 and 40 DAT. It may be due to weed free atmosphere to rice by two hand weedings at 20 and 40 DAT. The positive effect of two hand weedings on rice was also reported by Ramamoorthy *et al.* (2009) while Islam *et al.* (2007) reported the positive effect of extra oil cake given in rice.

**Table 2. Rice growth and yield attributing characters, grain yield, straw yield, weed index and economics as affected by different weed control treatments**

Treatment	Plant height (cm)	No. of productive tillers/m row length	Panicle length (cm)	No. of sound grains/panicle	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Weed index	Net profit (x10 <sup>3</sup> `/ha)	B:C ratio
Two hand weedings (20 and 40 DAT)	75.2	69.7	25.2	188.6	27.5	4.7	10.09	00	56.96	2.16
		(8.1%)		(31.1%)	(1.5%)	(33.7%)	(18.3%)		(82.2%)	(25.6%)
Conoweeder 20 DAT + one HW (40 DAT)	79.1	64.5	25.3	141.2	27.3	4.2	10.43	10.7	50.67	2.05
		(0.2%)		(0)	(0.5%)	(19.4%)	(22.3%)		(62.0%)	(19.2%)
Inter cropping with <i>Sesbania</i>	74.9	66.0	25.0	143.6	28.4	3.8	9.67	19.4	48.77	2.18
		(2.4%)		(0)	(4.8%)	(7.7%)	(13.4%)		(56.0%)	(26.7%)
Staleseedbed + reducedspacing up to (25%) + mulchingwithwheatstraw + one hand weeding	73.9	75.8	24.2	145.0	27.4	4.2	8.62	9.6	48.32	1.97
		(17.6%)		(0.8%)	(1.0%)	(20.8%)	(1.0%)		(54.6%)	(14.5%)
Locally available weed mulch + 1 hand pulling/hand weeding	75.6	67.0	24.3	154.5	27.2	4.7	8.74	-0.4	62.06	2.38
		(3.9%)		(7.4%)	(0.1%)	(34.3%)	(2.5%)		(98.5%)	(38.4%)
Incorporation of mustard oil cake 15 days before sowing at 5 t/ha + 1HW	87.4	69.4	26.3	159.2	27.3	5.5	12.74	-16.9	4.43	1.03
		(7.7%)		(10.6%)	(0.7%)	(56.3%)	(49.3%)		(0)	(0)
ITK treatment on weed control practices by farmers as mulching with mango leaves	88.3	64.4	24.3	143.8	27.1	3.5	8.53	25.2	31.26	1.72
		(0)		(0)	(0)	(0)	(0)		(0)	(0)
LSD (p=0.05)	1.00	2.44	0.44	6.43	0.14	9.28	5.19	-	-	-

Figures in parentheses are per cent increased over ITK treatment

The grain yield of rice was maximum (5.47 t/ha) with incorporation of mustard oil cake at 5 t/ha (15 days before sowing) + 1 HW, which was 56.3% higher than ITK (mulching with locally available tree dry leaves) treatment on weed control practiced by farmers as mulching with leaf of mango followed by 4.7 t/ha in locally available weed mulch + 1 hand pulling/hand weeding at 40 DAT and 4.68 t/ha in two hand weedings at 20 and 40 DAT.

Weed index was maximum (25.2%) with farmers practices of mulching with mango leaves for weed control followed by inter cropping with *Sesbania* and hoeing with cono-weeder at 20 DAT + 1 HW at 40 DAT. The similar finding was also reported by Islam *et al.* (2007).

It was concluded that incorporation of mustard oil cake at 5 t/ha 15 days before sowing along with 1 HW gave maximum weed control efficiency, greater yield attributing character of rice and maximum grain yield followed by two hand weedings at 20 and 40 DAT. These treatments gave 33 to 46% higher grain yield as compared to farmers practice of weed control as mulching with mango leaves at 3 t/ha. Net profit ` 62061/ha was maximum in mulching with locally available weed mulch *Saccharum spontaneum* at 3 t/ha + 1 hand pulling/hand weeding followed by ` 56695/ha in two hand weedings at 20 and 40 DAT.

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