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## Effect of brown manuring on growth components of direct seeded rice

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### Abstract

A field experiment was conducted with ten treatments and three replications, laid out with randomised complete block design to study the Effect of brown manuring on growth components of direct seeded rice at Kelageri village of Dharwad district, nearer to Main Agricultural Research Station, Dharwad during *kharif* season 2016. The results revealed that weed free check recorded significantly highest plant height at harvest (70 cm), leaf area (21.00 dm<sup>2</sup> plant<sup>-1</sup>), and total dry matter accumulation (72.33 g plant<sup>-1</sup>) over all other treatments except application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> (69.67 cm, 20.60 dm<sup>2</sup> plant<sup>-1</sup>, 1.03, and 70.00 g plant<sup>-1</sup> respectively).

**Keywords:** Direct seeded rice, knockdown, brown manuring

### Introduction

Rice (*Oryza sativa* L.) is world's most important food grain crop and is a staple food for more than half of the world's population. Rice provides 30 to 75 per cent of the total calories to more than 3 billion Asians. India is the second largest country having an area of 44.1 m ha with production of 106.54 m tones. In Karnataka, rice is grown in an area of about 1.29 m ha with an annual production of 3.36 m tones and productivity of about 2,587 kg ha<sup>-1</sup> which is little higher than national average of 2,462 kg ha<sup>-1</sup> (Anon., 2016) [1].

Weed poses a serious threat to the direct seeded rice crop by competing for nutrients, light, space and moisture throughout the growing season. Hand weeding is a common method of weed control adopted by farmers but comparatively this method is costly and time consuming. Besides hand weeding, a number of herbicides have been identified and tested for direct seeded rice around the world.

Brown manuring practice is one of the important technologies to manage the green manures in the field. Brown manuring is a technique to grow green manure crops in standing crop and brown manuring them with the help of herbicide for manuring. After knocking down, the color of the green manure crop residue becomes brown so it is called brown manuring. It reduces the use of herbicide during crop growth, accumulates soil nitrogen and maintains ground cover during growing season. Brown manuring involves growing a green legume crop with minimal fertilizer and herbicide inputs to achieve maximum dry matter production of crop before the major weed species have to be set viable seeds. Brown manuring is a practice of seeding *sesbania* with rice and applying of 2, 4- D @ 400-500 g ha<sup>-1</sup> to knockdown the *sesbania* at 30 days after seeding. This practice results into falling of *sesbania* leaves on the ground and forms mulch and helps in smothering of weeds and conserving moisture (Singh and Walia, 2014) [5].

### Material and method

A field experiment was conducted on "Effect of brown manuring on growth components of direct seeded rice" during *kharif* 2016. The experiment was conducted on red clay loam soil. The soil pH was 8.0 and was low in available nitrogen (280 kg ha<sup>-1</sup>), medium in available phosphorus (30.02 kg ha<sup>-1</sup>) and high in available potassium (360 kg ha<sup>-1</sup>). It was carried out on farmer's field at Kelageri village of Dharwad district. This lies between 15.45° North latitude and 74.97° East longitudes and at an altitude of 650 m above mean sea level. It is situated in the Northern Transitional Zone (Zone VIII) of agro-climatic zones of Karnataka. Rice (Jaya) was sown on 5<sup>th</sup> June 2016 with seed rate of 80 kg ha<sup>-1</sup> and sunnhemp at 8 kg ha<sup>-1</sup> by opening furrows with the help of seed drill as per treatments at spacing of 20 cm x 10 cm. The crop was fertilized with 100:50:50:20 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O: ZnSO<sub>4</sub>.7H<sub>2</sub>O kg ha<sup>-1</sup>. Treatments consist of 10 treatments viz., T<sub>1</sub>:Rice (sole crop): Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence (PE), T<sub>2</sub>:Rice (sole crop): Bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> as early post emergence (21

DAS), T<sub>3</sub>:Rice (sole crop): Farmers practice: 2 Hand weeding + 1 intercultivation, T<sub>4</sub>:Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as PE: *In-situ* incorporation of sunnhemp at 28 DAS, T<sub>5</sub>:Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as PE : knockdown of sunnhemp by 2,4-D @ 0.5 kg ha<sup>-1</sup> at 28 DAS, T<sub>6</sub>:Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as PE: knockdown of sunnhemp by 2,4- D @ 1 kg ha<sup>-1</sup> at 28 DAS, T<sub>7</sub>:Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 125 ml ha<sup>-1</sup> at 28 DAS, T<sub>8</sub>:Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> at 28 DAS, T<sub>9</sub>:Unweeded check and T<sub>10</sub>:Weed free check and was laid out in randomized complete block design with three replications. Pre emergence herbicide was sprayed at 1 days after sowing (DAS), early post emergence herbicide at 21 DAS and post emergence herbicide at 28 DAS to kill the sunnhemp for brown manuring. In farmers practice one hand weeding was done at 14 DAS and one intercultivation at 21 DAS. The herbicides were sprayed with knapsack sprayer using 750 litre of spray solution per hectare. *In-situ* incorporation of sunnhemp was done in T<sub>4</sub> treatment. Plant growth parameters *viz.*, plant height at harvest, leaf area, leaf area index and total dry matter accumulation were recorded at 30, 60, 90 DAS and at harvest.

### Results and discussion

The plant height was increased at all the growth stages of the crop. At 30 DAS, significantly higher plant height (15.30 cm) was recorded with weed free check when compared to all other treatments. This was closely followed by farmers practice of two hand weedings and one intercultivation which recorded significantly higher plant height (13.30 cm) when compared to intercropping with sunnhemp treatments *viz.*, T<sub>4</sub> (10.17 cm), T<sub>5</sub> (10.20 cm), T<sub>6</sub> (10.23 cm), T<sub>7</sub> (10.70 cm) and T<sub>8</sub> (10.77 cm) and it was on par with application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence (13.07 cm) and application of bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> as early post emergence (12.93 cm). Unweeded check recorded significantly lower plant height (7.9 cm) over all other treatments.

The plant height was increased from 40.67 cm at 60 DAS to 66.50 cm at 90 DAS with application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> which was significantly higher over farmers practice of two hand weeding and one intercultivation (35.00 and 59.00 cm, respectively),

T<sub>1</sub>, T<sub>2</sub>, T<sub>4</sub> and other brown manuring treatments (Table 1). Lowest plant height was recorded with unweeded check (20.73 and 40.00 cm, respectively) might be due to suppression of rice growth by weeds which might have competed for nutrients, moisture and light. These lines are in line with the findings of Gopinath *et al.* (2012) [2] who reported application of butachlor @ 1.5 kg ha<sup>-1</sup> as pre emergence followed by hand weeding at 40 DAS resulted in the maximum plant height.

Leaf area increased from 30 to 90 DAS and declined at harvest. Weed free check recorded significantly higher leaf area and leaf area index over rest of the treatments except application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> (Tables 2 and 3). Shushama *et al.* (2009) [4] also reported the similar results in direct seeded upland rainfed rice.

Significantly higher total dry matter accumulation of rice (1.41) at 30 DAS was observed with weed free check when compared to all other treatments. This was closely followed by farmers practice of two hand weedings and one intercultivation which recorded significantly higher total dry matter accumulation (1.18 g plant<sup>-1</sup>) when compared to intercropping with sunnhemp treatments *viz.*, T<sub>4</sub> (0.75 g plant<sup>-1</sup>), T<sub>5</sub> (0.78 g plant<sup>-1</sup>), T<sub>6</sub> (0.80 g plant<sup>-1</sup>), T<sub>7</sub> (0.82 g plant<sup>-1</sup>) and T<sub>8</sub> (0.79 g plant<sup>-1</sup>). Unweeded check recorded significantly lower total dry matter accumulation of rice (0.32 g plant<sup>-1</sup>) when compared to all other treatments. At 60, 90 DAS and at harvest weed free check recorded significantly higher total dry matter accumulation (11.33, 39.67 and 72.33 g plant<sup>-1</sup>, respectively) and it was on par with application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup>. Among brown manuring treatments, application of butachlor 50 EC @ 3.0 l ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> was recorded higher total dry matter accumulation at 60, 90 DAS and at harvest significantly when compared to farmers practice of two hand weedings and one intercultivation, T<sub>4</sub> and other brown manuring treatments (Table 4). Joshi *et al.* (2015) [3] reported the application of pendimethalin @ 1,000 g ha<sup>-1</sup> + bispyribac sodium @ 25 g ha<sup>-1</sup> + 1 hand weeding at 45 DAS, recorded the maximum crop dry matter in direct seeded aerobic rice.

**Table 1:** Effect of weed management practices on plant height at different growth stages of direct seeded rice

Treatments	Plant height of rice (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> Rice: sole crop: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as pre emergence (PE)	13.07	28.00	50.00	53.67
T <sub>2</sub> Rice: sole crop: Bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> as early post emergence (21 DAS)	12.77	33.20	56.03	58.77
T <sub>3</sub> Rice: sole crop: Farmers practice: 2 HW + 1 IC	13.30	35.00	59.00	62.07
T <sub>4</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: <i>In-situ</i> incorporation of sunnhemp at 28 DAS	10.17	32.33	55.05	57.58
T <sub>5</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4-D @ 0.5 kg ha <sup>-1</sup> at 28 DAS	10.20	30.90	54.17	56.67
T <sub>6</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4- D @ 1 kg ha <sup>-1</sup> at 28 DAS	10.23	33.17	57.02	60.50
T <sub>7</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 125 ml ha <sup>-1</sup>	10.70	34.00	58.02	61.07
T <sub>8</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup>	10.77	40.67	66.50	69.67
T <sub>9</sub> Unweeded check	7.90	20.73	40.00	41.37
T <sub>10</sub> Weed free check	15.30	44.00	70.00	72.17
S.Em. ±	0.67	1.48	2.22	2.17
C.D (p=0.05)	1.98	4.39	6.60	6.44

**Table 2:** Effect of weed management practices on leaf area at different growth stages of direct seeded rice

Treatments	Leaf area of rice (dm <sup>2</sup> plant <sup>-1</sup> )			
	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> Rice: sole crop: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as pre emergence (PE)	11.20	23.60	63.40	16.00
T <sub>2</sub> Rice: sole crop: Bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> as early post emergence (21 DAS)	10.80	24.60	66.40	17.60
T <sub>3</sub> Rice: sole crop: Farmers practice: 2 HW + 1 IC	11.50	25.30	67.80	18.60
T <sub>4</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: <i>In-situ</i> incorporation of sunnhemp at 28 DAS	8.90	24.30	66.00	17.30
T <sub>5</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4-D @ 0.5 kg ha <sup>-1</sup> at 28 DAS	8.70	24.00	65.40	17.00
T <sub>6</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4- D @ 1 kg ha <sup>-1</sup>	9.10	25.00	67.00	17.80
T <sub>7</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 125 ml ha <sup>-1</sup> at 28 DAS	9.50	25.10	67.50	18.00
T <sub>8</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> at 28 DAS	9.70	27.20	72.20	20.60
T <sub>9</sub> Unweeded check	4.50	18.00	50.00	4.20
T <sub>10</sub> Weed free check	12.70	27.60	73.60	21.00
S.Em. ±	0.35	0.56	1.47	0.52
C.D (p=0.05)	1.04	1.65	4.35	1.53

**Table 3:** Effect of weed management practices on leaf area index at different growth stages of direct seeded rice

Treatments	Leaf area index			
	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> Rice: sole crop: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as pre emergence (PE)	0.56	1.18	3.17	0.80
T <sub>2</sub> Rice: sole crop: Bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> as early post emergence (21 DAS)	0.54	1.23	3.32	0.88
T <sub>3</sub> Rice: sole crop: Farmers practice: 2 HW + 1 IC	0.58	1.27	3.39	0.93
T <sub>4</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: <i>In-situ</i> incorporation of sunnhemp at 28 DAS	0.45	1.22	3.30	0.87
T <sub>5</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4-D @ 0.5 kg ha <sup>-1</sup> at 28 DAS	0.44	1.20	3.27	0.85
T <sub>6</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4- D @ 1 kg ha <sup>-1</sup> at 28 DAS	0.46	1.25	3.35	0.89
T <sub>7</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 125 ml ha <sup>-1</sup> at 28 DAS	0.48	1.26	3.38	0.90
T <sub>8</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> at 28 DAS	0.49	1.36	3.61	1.03
T <sub>9</sub> Unweeded check	0.23	0.90	2.50	0.21
T <sub>10</sub> Weed free check	0.64	1.38	3.68	1.05
S.Em. ±	0.02	0.03	0.07	0.03
C.D (p=0.05)	0.05	0.08	0.21	0.09

**Table 4:** Effect of weed management practices on total dry matter accumulation at different growth stages of direct seeded rice

Treatments	Total dry matter accumulation of rice (g plant <sup>-1</sup> )			
	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> Rice: sole crop: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as pre emergence (PE)	1.02	6.83	23.17	53.83
T <sub>2</sub> Rice: sole crop: Bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> as early post emergence (21 DAS)	1.13	7.73	27.67	61.23
T <sub>3</sub> Rice: sole crop: Farmers practice: 2 HW + 1 IC	1.18	8.60	30.67	62.67
T <sub>4</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: <i>In-situ</i> incorporation of sunnhemp at 28 DAS	0.75	7.53	27.33	60.67
T <sub>5</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE : knockdown of sunnhemp by 2,4-D @ 0.5 kg ha <sup>-1</sup> at 28 DAS	0.78	7.27	26.33	59.00
T <sub>6</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by 2,4- D @ 1 kg ha <sup>-1</sup> at 28 DAS	0.80	8.00	28.33	62.17
T <sub>7</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 125 ml ha <sup>-1</sup> at 28 DAS	0.82	8.37	29.00	63.00
T <sub>8</sub> Rice + sunnhemp: Butachlor 50 EC @ 3.0 l ha <sup>-1</sup> as PE: knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha <sup>-1</sup> at 28 DAS	0.79	10.83	36.33	70.00
T <sub>9</sub> Unweeded check	0.32	3.83	16.55	36.43
T <sub>10</sub> Weed free check	1.41	11.33	39.67	72.33
S.Em. ±	0.06	0.53	1.58	2.39
C.D (p=0.05)	0.18	1.58	4.69	7.12

### Conclusion

It can be concluded that application of butachlor 50 EC @ 3.0 ha<sup>-1</sup> as pre emergence followed by knockdown of sunnhemp by bispyribac sodium 10% SC @ 250 ml ha<sup>-1</sup> recorded higher growth parameters when compared to farmers practice of two hand weedings and one intercultivation. This treatment will be good alternative with respect to existing farmers practice.

Though weed free check recorded higher growth parameters but it is not practicable under field condition due to non availability of labourers and also incessant rains during crop growth.

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