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## Influence of integrated weed management practices on growth parameters, yield attributes of machine transplanted rice crop

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**Abstract**

A field experiment was conducted in machine transplanted rice crop at Agricultural Research Institute, Rajendranagar, Hyderabad during *kharif*, 2019 to study the efficacy of different herbicides, herbicide mixtures and to identify efficient weed management option for machine transplanted rice. Weed management practices significantly influenced the growth parameters, yield attributes and yield of machine transplanted rice crop. Hand weeding at 20, 40 DAT recorded significantly higher growth parameters like plant height, tillers, leaf area index, dry matter production and was at par with penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT. Hand weeding at 20, 40 DAT noticed significantly increased yield attributes, grain yield (6.92 t ha<sup>-1</sup>) and at par with penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT (6.73 t ha<sup>-1</sup>). Weedy check recorded lowest grain yield among all treatments (3.79 t ha<sup>-1</sup>).

**Keywords:** weed management, transplanted rice, leaf area index, yield, harvest index

**Introduction**

Rice is the staple food grain of Indian sub continent and the country food security mainly depends on the productivity of rice in different ecosystems. Demand for rice is growing day by day and it is estimated that by 2025, 130 million tonnes would be the country's requirement (Ramachandra *et al.*, 2012) [6]. In India, manual transplanting is most common and traditional method of establishment in lowlands. Increased labour wages and shortage of labour during peak period of transplanting leading to delayed transplanting. So as to avoid this problem some farmers are adopting machine transplanting. Weeds being a major biotic cause of reduced yields in rice by competing for each and every growth resource. Transplanted rice encounters diverse type of weed flora consisting of grasses, broad-leaf weeds and sedges. Weeds by the virtue of their high adaptability and faster growth dominate the crop habitat and reduce the crop yield. Under machine transplanting inter row spacing of 30 cm allows severe weed infestation in the field and finally resulting in significant yield loss. Thus, weed management is an essential practice in machine transplanted rice and farmers are looking for better weed management option in machine transplanting. The present investigation was undertaken to study effect of different weed management practices on growth, yield attributes and yield of machine transplanted rice crop.

**Materials and methods**

The present investigation entitled "Weed management in machine transplanted rice" was conducted during *kharif*, 2019 at ARI Farm, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. The soil of the experimental site was sandy loam in texture, slightly alkaline, medium in organic carbon and available nitrogen and potassium, high in available phosphorus.

The experiment was laid out in Randomized Block Design (RBD) consisting of eight treatments *viz.*, pretilachlor @ 625 g a.i ha<sup>-1</sup> as PE at 3 DAT + cono weeder at 15, 30 & 45 DAT (T<sub>1</sub>), pretilachlor @ 625 g a.i ha<sup>-1</sup> as PE at 3 DAT + power weeder at 15, 30 & 45 DAT (T<sub>2</sub>), flucetosulfuron 10 % WG @ 25 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40

DAT (T<sub>3</sub>), penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT (T<sub>4</sub>), penoxsulam 0.97% W/W + butachlor 38.8% W/W @ 820 g ha<sup>-1</sup> at 7 DAT + power weeder at 30-40 DAT (T<sub>5</sub>), bentazone @ 960 g a.i ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT (T<sub>6</sub>), weedy check (T<sub>7</sub>) and hand weeding at 20, 40 DAT (T<sub>8</sub>). The recommended dose of fertilizers 120-60-40 kg NPK ha<sup>-1</sup> in the form of diammonium phosphate, urea and muriate of potash was applied to all treatments.

Paddy mat nursery was sown on July 11<sup>th</sup> 2019 (variety RNR-15048) and 22 days old seedlings were used for transplanting in main field with self propelled 6 row paddy transplanter at a spacing of 30 cm x 12 cm in a plot size of 7.5 m x 4.0 m. The pre emergence herbicide pretilachlor was applied at 3 DAT as sand mix broadcast using 50 kg sand ha<sup>-1</sup>, penoxsulam + butachlor (pre mix herbicide combination) was applied at 7 DAT and the post emergence herbicides were applied at 2-3 leaf stage of weeds (15 DAT) as spray using knapsack sprayer with flood jet nozzle in a spray volume of 300 litres ha<sup>-1</sup>. Need based plant protection measures for the control of insect pests were taken and the crop was harvested on November 14<sup>th</sup> 2019. Destructive sampling the above ground portion of five hills in each plot was done to record dry matter production. The yield parameters were recorded from 5 random plant samples per plot and mean values were recorded. Grain and straw yield was recorded from net plot of each treatment and finally expressed as tonnes ha<sup>-1</sup>.

## Results and discussion

### Growth parameters

Influence of different weed management practices in machine transplanted rice was found significant with growth parameters like plant height. At harvest, the plant height of rice crop had recorded maximum with T<sub>8</sub> treatment i.e. hand weeding at 20, 40 DAT (109.0 cm) which was at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (105.4 cm), while lowest plant height was observed with T<sub>7</sub> treatment (79.5 cm). The number of tillers were significantly more at harvest for machine transplanted rice with hand weeding at 20, 40 DAT (392.6 m<sup>-2</sup>) (T<sub>8</sub>) and was

statistically at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (377.5 m<sup>-2</sup>). Lowest number of tillers were produced by weedy check (T<sub>7</sub>) (211.9 m<sup>-2</sup>).

LAI is the best measure of capacity of crop to produce dry matter as the leaves are main parts of photosynthesis. Highest LAI with T<sub>8</sub> i.e. hand weeding at 20, 40 DAT (5.01) significantly at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} and weedy check recorded lowest LAI (3.51). Higher dry matter production at harvest was recorded with T<sub>8</sub> i.e. hand weeding at 20, 40 DAT (14.71 t ha<sup>-1</sup>) which was at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (14.31 t ha<sup>-1</sup>) and minimum crop dry matter was observed with weedy check plot (8.79 t ha<sup>-1</sup>). This was due to weed free conditions and improved soil aeration by mechanical weeding which had provided enough light, space and nutrients leading to increased growth parameters i.e plant height, tiller production, LAI and dry matter production. These results corroborate with the findings of Manjunatha *et al.* (2013) [12], Khare *et al.* (2014) [11] and Veeraputhiran and Balasubramanian (2013) [8].

### Yield attributes and yield

Number of panicles at harvest was a important determinant of grain yield in rice. Treatment 8 i.e. hand weeding at 20, 40 DAT (314) recorded higher number of productive tillers m<sup>-2</sup>, statistically at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (303). Weedy check (T<sub>7</sub>) recorded lower number of productive tillers m<sup>-2</sup> (184). Scrutiny of data (table 2) revealed that panicle length and test weight were not significantly influenced by weed management practices. T<sub>8</sub> i.e. hand weeding at 20, 40 DAT (3.53 g) attained more panicle weight which was at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (3.20 g). Weedy check plot recorded lowest panicle weight (1.90 g).

**Table 1:** Effect of weed management practices on growth parameters of machine transplanted rice

Treatments	Plant height (cm) at harvest	Tillers (No.m <sup>-2</sup> ) at harvest	LAI at harvest	Dry matter production at harvest (t ha <sup>-1</sup> )
T <sub>1</sub> - Pretilachlor @ 625 g a.i ha <sup>-1</sup> as PE at 3 DAT + cono weeder at 15, 30 & 45 DAT	92.8	312.1	4.26	12.86
T <sub>2</sub> - Pretilachlor @ 625 g a.i ha <sup>-1</sup> as PE at 3 DAT + power weeder at 15, 30 & 45 DAT	94.3	325.0	4.37	13.08
T <sub>3</sub> - Flucetosulfuron 10 % WG @ 25 g ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	102.4	367.2	4.73	13.95
T <sub>4</sub> - Penoxsulam 1.02 % W/W + cyhalofop- p- butyl 5.1 % W/W @ 153 g ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	105.4	377.5	4.87	14.31
T <sub>5</sub> - Penoxsulam 0.97 % W/W + butachlor 38.8 % W/W @ 820 g ha <sup>-1</sup> at 7 DAT + power weeder at 30 - 40 DAT.	101.0	356.1	4.67	13.46
T <sub>6</sub> - Bentazone @ 960 g a.i ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	86.2	262.5	3.84	11.64
T <sub>7</sub> - Weedy check (control).	79.5	211.9	3.51	8.79
T <sub>8</sub> - Hand weeding at 20, 40 DAT.	109.0	392.6	5.01	14.71
SEm±	1.82	6.14	0.06	0.19
CD	5.57	18.30	0.18	0.59

T<sub>8</sub> i.e. hand weeding at 20, 40 DAT (217.3) recorded higher number of grains panicle<sup>-1</sup> which was at par with T<sub>4</sub> {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @

153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (209.3) while higher weed persistence caused significantly lowest grains per panicle in T<sub>7</sub> treatment (158.3)

due to resource stress. Hand weeding at 20, 40 DAT ( $T_8$ ) (209.0) recorded higher number of filled grains panicle<sup>-1</sup>, statistically at par with  $T_4$  {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (198.7). Lower number of filled grains panicle<sup>-1</sup> was observed with  $T_7$  {weedy check} (140.0). Significant increase in yield attributes

like panicles m<sup>-2</sup>, panicle weight and grains per panicle under hand weeding and herbicide combination was due to effective and prolonged control of weeds, that lead to increased nutrient uptake by rice crop, good source- sink relationship thus, higher sink capacity. Similar results were reported with Nalini *et al.* (2012) [3].

**Table 2:** Effect of weed management practices on yield parameters of machine transplanted rice

Treatments	No. of panicles m <sup>-2</sup>	Panicle length (cm)	Panicle weight (g)	Test weight (g)	Total No. of grains panicle <sup>-1</sup>	No. of filled grains panicle <sup>-1</sup>	Sterility %
T <sub>1</sub>	242	24.0	2.27	13.2	178.7	159.0	11.0
T <sub>2</sub>	250	24.3	2.37	13.3	182.3	161.7	11.3
T <sub>3</sub>	283	24.2	3.00	13.2	201.0	184.0	8.5
T <sub>4</sub>	303	24.3	3.20	13.3	209.3	198.7	5.1
T <sub>5</sub>	270	24.1	2.63	13.3	192.7	178.7	7.3
T <sub>6</sub>	205	23.8	2.13	13.2	164.7	147.7	10.3
T <sub>7</sub>	184	23.7	1.90	13.2	158.3	140.0	11.6
T <sub>8</sub>	314	24.3	3.53	13.2	217.3	209.0	3.8
SEm±	6.67	0.49	0.11	0.08	4.13	3.32	0.56
CD	20.43	NS	0.39	NS	12.64	10.16	1.65

Grain yield is the final product of growth and development and is mainly controlled by dry matter accumulation during the ripening phase. Data pertaining to machine transplanted rice grain yield was significantly influenced by different weed management practices.  $T_8$  treatment i.e hand weeding at 20, 40 DAT had produced significantly higher rice grain yield of 6.92 t ha<sup>-1</sup>, statistically at par with  $T_4$  {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (6.73 t ha<sup>-1</sup>) while grain yield obtained with  $T_7$  {weedy check} (3.79 t ha<sup>-1</sup>) was found to be lowest. Control of weeds by herbicide during early stages of rice resulted in lower competition to the crop for moisture, sunlight and nutrients that influenced the crop to grow better as evidenced in increased yield attributes and yield (Prakash *et al.* 2013) [5]. Lowest grain yield with weedy check ( $T_8$ ) was due to the intense competition between

weeds and crop for all growth resources throughout the crop season (Patra *et al.*, 2011) [4].

Hand weeding at 20, 40 DAT ( $T_8$ ) had recorded higher straw yield (7.66 t ha<sup>-1</sup>) statistically at par with  $T_4$  {penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT} (7.47 t ha<sup>-1</sup>). Lowest straw yield was obtained with  $T_7$  {weedy check} (4.58 t ha<sup>-1</sup>). More straw yield was due to less crop weed competition that led to taller plants, more number of tillers and dry matter production which resulted in higher straw yield. Subramanyam *et al.* (2007) [7] also reported similar results. Perusal of the results (table 3) revealed that harvest index of rice had not differed significantly with weed management practices. This was due to almost similar increase in grain and straw yield with each treatment.

**Table 3:** Effect of weed management practices on grain, straw yield and harvest index of machine transplanted rice

Treatments	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Harvest index
T <sub>1</sub> - Pretilachlor @ 625 g a.i ha <sup>-1</sup> as PE at 3 DAT + cono weeder at 15, 30 & 45 DAT	5.88	6.58	47.2
T <sub>2</sub> - Pretilachlor @ 625 g a.i ha <sup>-1</sup> as PE at 3 DAT + power weeder at 15, 30 & 45 DAT	5.99	6.66	47.4
T <sub>3</sub> - Flucetosulfuron 10 % WG @ 25 g ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	6.41	7.17	47.2
T <sub>4</sub> - Penoxsulam 1.02 % W/W + cyhalofop- p- butyl 5.1 % W/W @ 153 g ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	6.73	7.47	47.6
T <sub>5</sub> - Penoxsulam 0.97 % W/W + butachlor 38.8 % W/W @ 820 g ha <sup>-1</sup> at 7 DAT + power weeder at 30 - 40 DAT.	6.25	6.81	47.8
T <sub>6</sub> - Bentazone @ 960 g a.i ha <sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30 - 40 DAT.	5.48	5.99	47.8
T <sub>7</sub> - Weedy check (control).	3.79	4.68	44.8
T <sub>8</sub> - Hand weeding at 20, 40 DAT.	6.92	7.66	47.5
SEm±	0.13	0.15	0.75
CD	0.41	0.46	NS

## Conclusion

Based on the experimental results, it was concluded that among different weed management practices, hand weeding at 20, 40 DAT can be followed based on the availability of human labor, otherwise penoxsulam 1.02% W/W + cyhalofop-p-butyl 5.1% W/W @ 153 g ha<sup>-1</sup> at 2-3 leaf stage of weeds + power weeder at 30-40 DAT can be recommended as an efficient weed management practice for realizing higher growth, yield attributes and yield in machine transplanted rice crop.

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