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**PM Motghare**

M.Sc. Students, Agronomy  
Section, College of Agriculture,  
Nagpur, Maharashtra, India

**KB Chandewar**

M.Sc. Students, Agronomy  
Section, College of Agriculture,  
Nagpur, Maharashtra, India

**A L Uparkar**

M.Sc. student, Department of  
Agronomy, College of  
Agriculture, Nagpur,  
Maharashtra, India

**SS Sardare**

M.Sc. Students, Animal Science  
Department, College of  
Agriculture, Nagpur,  
Maharashtra, India

**VG Nagdeote**

Associate Professor of  
Agronomy, Agronomy Section,  
College of Agriculture (Dr.  
PDKV, Akola), Nagpur,  
Maharashtra, India

**Correspondence****PM Motghare**

M.Sc. Students, Agronomy  
Section, College of Agriculture,  
Nagpur, Maharashtra, India

## Effect of cultural and chemical weed management on growth and yield of Drilled Paddy (*Oryza sativa* L.)

PM Motghare, KB Chandewar, AL Uparkar, SS Sardare and VG Nagdeote

**Abstract**

An investigation was conducted at College of Agriculture, Nagpur to study the effect of Weed management in drilled paddy (*Oryza sativa* L.) during *khari* season of 2014-2015. The experiment was laid down in Randomized block design having treatments viz., Control (T<sub>1</sub>), 2 hand weeding at 20 and 40 DAS (T<sub>2</sub>), Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS (T<sub>3</sub>), Pretilachlor @ 750g a.i. ha<sup>-1</sup> at 7 DAS(T<sub>4</sub>), 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>5</sub>), Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>6</sub>), Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS + 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>7</sub>), Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>8</sub>), Pretilachlor @ 750 g a.i. ha<sup>-1</sup> at 7 DAS + 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>9</sub>), Pretilachlor @ 750 g a.i. ha<sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>10</sub>) thereby making Ten treatment combinations replicated three times. Rice variety PKV- Khamang was used as a test crop. Results showed that 2 hand weeding at 20 and 40 DAS (T<sub>2</sub>) significantly influenced the growth and yield attributing characters viz., Height of plant (cm), Number of effective tillers hill<sup>-1</sup>, Number of panicles hill<sup>-1</sup>, Number of grains panicle<sup>-1</sup>, Test weight (g), Yield of grains hill<sup>-1</sup>(g), Yield of straw hill<sup>-1</sup>(g), Yield of grains (q ha<sup>-1</sup>), Yield of straw (q ha<sup>-1</sup>), and Harvest index (%) and it was at par with treatments (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>), (T<sub>10</sub>).

**Keywords:** Growth attributes, rice, butachlor, 2, 4 D, pretilachlor, pyrazosulfuron, yield attributes

**Introduction**

Rice (*Oryza sativa* L.) belongs to the family *poaceae*. Rice is one of the most important staple food grain crop of the world, which constitutes the principle food for about 60 percent of the world's human population and two third of Indian population. Rice provides about 22 percent of the world's supply of calories and 17 percent of the proteins. It contains nearly about 70 percent carbohydrates and 6-7 percent protein. Biological value of its protein is high. It contains less fat i.e. 2-2.5 percent and much of the fat is lost during milling. It contains a low percentage of calcium. Also rice grain contains much 'B' group vitamins and minerals. The production of Rice during the year 2013-14 was 106.54 Million tonnes from 439.49 lakh ha area with productivity of 2424 kg ha<sup>-1</sup> (Anonymous, 2014) [1].

Weed infestation is one of the limiting factors in rice production. Uncertain rainfall, lack of protective irrigation, attack of pest and disease reduces the rice yield. In cultivated rice field equilibrium in plant communities is not a static relationship. The species diversity varies with type of rice culture. Subramanian *et al.* (2006) [7] reported that weed management in rice gave 50.7% additional grain yield over no weeded check. Reduction of yield due to weeds estimated to around 15-20% in transplanted rice, 30-35% for direct seeded rice and above 50% for upland rice. Mechanical and cultural methods are not always possible to be adopted on account of scarcity of labour in the peak period of rice transplanting. In such situation the herbicides are the only way to control weeds. At present, there are quite number of selective herbicides like Butachlor, Pendimethalin, Benthiocarb, Ronstar, Pretilachlor, 2, 4-D, Pyrazosulfuron ethyl and Anilophos are used in paddy crop for weed control.

**Materials and Methods**

A field experiment was conducted at Agronomy farm, College of Agriculture, Nagpur during summer season of 2013-2014. The experiment was laid down in Randomized block design having treatments viz., Control (T<sub>1</sub>), 2 hand weeding at 20 and 40 DAS (T<sub>2</sub>), Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS (T<sub>3</sub>), Pretilachlor @ 750g a.i. ha<sup>-1</sup> at 7 DAS(T<sub>4</sub>), 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>5</sub>), Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>6</sub>), Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS + 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>7</sub>),

Butachlor @ 1500 g a.i. ha<sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>8</sub>), Pretilachlor @ 750 g a.i. ha<sup>-1</sup> at 7 DAS + 2, 4 D @ 1000 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>9</sub>), Pretilachlor @ 750 g a.i. ha<sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha<sup>-1</sup> at 20 - 25 DAS(T<sub>10</sub>) thereby making Ten treatment combinations replicated three times. The soil of experimental plot was low in available nitrogen (230.71 kg ha<sup>-1</sup>), high in available phosphorus (31.76 kg ha<sup>-1</sup>) and organic carbon (0.58 %) and low in available potash (280.53 kg ha<sup>-1</sup>) as regards to fertility status and slightly alkaline in reaction (pH 7.8). The soil of the experimental field was clayey in texture. The crop variety PKV- Khamang was used in experiments. Gross plot size was 4.2 m × 4.5 m and net plot size was 3.6 m × 4.2 m. Full dose of phosphorus and potash applied at time sowing and half nitrogen were applied at sowing and remaining dose of N was applied at 30 and 60 DAS. Butachlor, 2, 4 - D, Pretilachlor and Pyrazosulfuron ethyl are the commercial products used as herbicides in experiment. Each herbicide was mixed with 2 litres of water and then sprayed uniformly. Height of plant (cm) and Number of effective tillers hill<sup>-1</sup> were recorded before harvesting and at the time of harvesting, Number of panicles hill<sup>-1</sup>, Number of grains panicle<sup>-1</sup>, Yield of grains hill<sup>-1</sup>(g), Yield of straw hill<sup>-1</sup>(g), Test weight (g), Yield of grains (q ha<sup>-1</sup>), Yield of straw (q ha<sup>-1</sup>) and Harvest index (%) were recorded. In order to represent the plot, five plants of rice from each net plot were selected randomly for various biometric observations on post harvest studies. The selected five plants were labeled and all biometric observations were recorded properly on them.

#### Details of herbicide's used

##### Butachlor

Common name is Butachlor. Trade name is Machete. Chemical name: N - butaxymethyl -2- chloro-2:6' diethyl acetanilide. Doses: 1.0 - 4.5 kg a. i. ha<sup>-1</sup>. It is a Selective type of herbicide. Application: Pre-emergence. Mode of action: It is rapidly absorbed by the germinated shoots and secondarily by the roots, with translocation through the plant. Type of weed control: Control of Annual grasses and certain broad-leaved weeds in rice. 2, 4-D Common name: 2, 4 -D. Trade name: Weedmar. Chemical name: 2, 4 - dichlorophenoxy acetic acid. Empirical formula: C<sub>8</sub>H<sub>6</sub>Cl<sub>2</sub>O<sub>3</sub>. Dose: 0.28 - 2.3 kg ha<sup>-1</sup>. Type of herbicide: Selective. Time of Application: Post- emergence. Mode of action: Salt is readily absorbed by roots, while esters are readily absorbed by the foliage. Translocation occurs at the meristematic regions of shoots and roots. Type of weed control: Control of annual and perennial broad- leaved weeds in cereals.

##### Pretilachlor

Common name: Pretilachlor. Trade name: Refit. Chemical name: 2 - chloro - N - (2, 6- diethylphenyl) - H - (2 - propoxyethyl) = acetamide. Empirical Name: C<sub>17</sub>H<sub>26</sub>ClNO<sub>2</sub>. Dose: 0.75 kg ha<sup>-1</sup>. Type of herbicide: Selective herbicide. Time of application: Pre-emergence. Mode of action: It is taken up readily by the hypocotyls, mesocotyls and coleoptile and by the roots of germinating weeds. Types of weed control: Annual grasses, broad leaved weeds and sedges in transplanted and seeded rice.

##### Pyrazosulfuron ethyl

Common name: Pyrazosulfuron ethyl. Trade name: Sathi. Chemical name: Ethyl-5 (4, 6 dimethoxy-2- pyrimidinyl) amino) carbonyl) amino) sulfonyl)-1 methyl-1H pyrazole- 4- carboxylate. Empirical formula: C<sub>14</sub>H<sub>18</sub>N<sub>6</sub>. Doses: 15 - 30 g ha<sup>-1</sup>. Type of Herbicide: Selective. Time of application: Pre or early post emergence. Mode of action: It is absorbed by roots or leaves and translocated to the meristem. Type of weed control: Annual, perennial broad leaved weeds and sedges.

#### Results and Discussion

##### Effect on Growth attributing characters

The data pertaining to growth attributes studied viz., Height of plant (cm) and Number of effective tillers hill<sup>-1</sup> as influenced by various treatments are presented in table 1.

##### Effect of hand weeding and chemical herbicide

Data in table 1 shows that the maximum mean plant height at harvest was (95.27) cm. However it was at par with the treatments (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>) and (T<sub>10</sub>). Dhanwate (2000), Singh and Singh (2006) [6] reported that might be due to good aeration of soil and least weed population and less weed competition for soil moisture, plant nutrients, solar radiation and space during active growth period increased the plant height. And also the maximum mean number of effective tillers hill<sup>-1</sup> (9.23) recorded in treatment two hand weeding at 20 and 40 DAS (T<sub>2</sub>) followed by (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>) and (T<sub>10</sub>). Dhanwate (2000), Singh and Singh (2006) [6] reported that effective tillers hill<sup>-1</sup> were increased under mechanical and herbicide combination treatments due to effective control of weeds. And it was at par with treatments (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>) and (T<sub>10</sub>).

##### Effect on Yield contributing characters

The data in respect of yield contributing characters viz., Number of panicles plant<sup>-1</sup>, Number of grains panicle<sup>-1</sup>, Test weight, Yield of grains hill<sup>-1</sup> (g), Yield of straw hill<sup>-1</sup> (g), Grain yield(q ha<sup>-1</sup>), Straw yield(q ha<sup>-1</sup>) and Harvest index as influenced by various weed control treatments are presented in Table 1.

**Table 1:** Effect of cultural and chemical weed management on growth and yield of Drilled Paddy (*Oryza sativa* L.)

Treatment	Mean plant height (cm) at harvest	Effective tillers hill <sup>-1</sup> at harvest	No. of panicle plant <sup>-1</sup>	No. of grains panice <sup>-1</sup>	Test weight (g)	Yield of grains hill <sup>-1</sup> (g)	Yield of straw hill <sup>-1</sup> (g)	grain yield (q ha <sup>-1</sup> )	straw yield (q ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> Control	76.10	3.50	3.50	92.07	11.98	4.53	40.63	11.23	20.24	35.68
T <sub>2</sub> Two hand weeding at 20 and 40 DAS	95.27	9.23	9.23	126.27	14.70	11.73	57.78	27.05	38.63	41.18
T <sub>3</sub> Butachlor @ 1500 g a.i. ha <sup>-1</sup> at 7 DAS	84.60	4.89	4.89	109.83	12.70	7.75	42.80	16.50	25.50	39.28
T <sub>4</sub> Pretilachlor @ 750 g a.i. ha <sup>-1</sup> at 7 DAS	83.07	4.13	4.13	102.77	12.57	7.26	42.32	15.20	25.33	37.50
T <sub>5</sub> 2, 4 - D @ 1000 g a.i. ha <sup>-1</sup> at 20 - 25 DAS	82.50	3.80	3.80	101.17	12.27	6.83	41.07	13.73	23.30	37.08
T <sub>6</sub> Pyrazosulfuron ethyl @ 25 g a.i. ha <sup>-1</sup>	82.83	4.67	4.67	106.87	12.46	7.06	41.72	14.37	24.70	36.78

	at 20 - 25 DAS										
T <sub>7</sub>	Butachlor @ 1500 g a.i. ha <sup>-1</sup> at 7 DAS + 2, 4 - D @ 1000 g a.i. ha <sup>-1</sup> at 20 - 25 DAS	92.17	8.57	8.57	123.37	14.53	10.86	55.82	25.47	34.57	42.42
T <sub>8</sub>	Butachlor @ 1500 g a.i. ha <sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha <sup>-1</sup> at 20 - 25 DAS	91.77	8.40	8.40	121.67	14.21	10.51	55.38	24.37	33.33	42.24
T <sub>9</sub>	Pretilachlor @ 750 g a.i. ha <sup>-1</sup> at 7 DAS + 2, 4 - D @ 1000 g a.i. ha <sup>-1</sup> at 20 - 25 DAS	91.70	7.23	7.23	120.22	13.96	10.25	54.67	23.83	32.67	42.18
T <sub>10</sub>	Pretilachlor @ 750 g a.i. ha <sup>-1</sup> at 7 DAS + Pyrazosulfuron ethyl @ 25 g a.i. ha <sup>-1</sup> at 20 - 25 DAS	91.67	7.07	7.07	119.33	13.67	10.08	54.13	22.50	32.03	41.26
SE (m) ±		160	0.81	0.81	2.36	0.69	0.57	1.48	1.65	2.24	2.07
CD at 5%		4.76	2.40	2.40	7.02	N.S	1.68	4.40	4.89	6.67	N.S.
GM		87.17	6.15	6.15	112.35	13.30	8.69	48.63	19.53	29.03	39.61

### Effect of hand weeding and chemical herbicide

Data in table 1 shows that Treatment of two hand weeding at 20 and 40 DAS (T<sub>2</sub>) was recorded significantly more number of panicles plant<sup>-1</sup> (9.23), maximum number of grains (126.27) panicle<sup>-1</sup>, maximum test weight (14.70) and result significantly at par with the treatments (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>) and (T<sub>10</sub>). Similar results were found by Singh and Singh (2006)<sup>[6]</sup>, Rajkhowa *et al.* (2007)<sup>[4]</sup>. They reported that reduction in dry matter production by weed under herbicidal and mechanical treatments that subsequently increased nutrient and moisture availability to the paddy crop. Data in table 1 shows that Treatment of two hand weeding at 20 and 40 DAS (T<sub>2</sub>) recorded significantly more yield of grains hill<sup>-1</sup> (11.73 g), yield of straw hill<sup>-1</sup> (57.78 g), grain yield (27.05 q ha<sup>-1</sup>), straw yield (38.63 q ha<sup>-1</sup>) which was at par with treatments (T<sub>7</sub>), (T<sub>8</sub>), (T<sub>9</sub>) and (T<sub>10</sub>). Increase in straw yield of paddy might be due to luxurious crop growth and less crop weed competition. Similar results were also reported by Sharma *et al.* (2007)<sup>[15]</sup>, Patra *et al.* (2011)<sup>[3]</sup>, Surin *et al.* (2013)<sup>[8]</sup> and Upasani *et al.* (2014)<sup>[9]</sup>. Harvest index was 39.61. Harvest index did not show significant differences. Maximum harvest index (42.42) recorded by treatment (T<sub>7</sub>).

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