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Influence of mechanical and chemical weed management practices on growth and yield of transplanted rice

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ABSTRACT

An experiment was conducted at the Research Farm, College of Agriculture, Nagpur during kharif season of 2010-2011. The experiment was laid out in Randomized Block Design with six treatments and four replications. The lowest weed dry matter and highest weed control efficiency were recorded with two hoeing and two weeding at 20 and 40 DAT. The treatment also recorded highest grain yield and straw yield of rice.

***Keywords*:** Ethoxysulfuron, rice, weed dry matter and management

Rice (*Oryza sativa* Linn.) is a major staple food after wheat and an exportable commodity. It is one of the most important cereal crops and a major source of calories for 50% of the world population. The crop can be grown under varied cultivation system. Rice cultivation methods can be divided into dry, semi-dry and intensive cultivation. In Eastern Vidarbha region it is mainly grown by puddle transplanted method or intensive cultivation method, which is considered as most perfect method of rice cultivation. Because, sufficient time for puddling is available as seedlings are grown in the nursery, there after 4-6 weeks old seedlings are transplanted manually in puddle and continuous flooded field.

Weed infestation is one of the serious constraints in rice production. Other factors like uncertain rainfall, attack of pest and diseases reduces the rice yield. Weed affects rice by competing for nutrient, light, water and space. The species diversity varies with type of rice culture. Anantha Kumari and Rao (1993) observed that transplanted rice crop faces diverse type of weed flora, consisting of grasses, sedges and some broad-leaf weeds. Competition of these weeds brought about reduction in yield of rice by 50 %.

The use of herbicide is one of the most labour saving innovation to enhance productivity in modern rice cultivation. Several pre-emergence herbicides like butachlor, thiobencarb, pendimethalin, oxyfluorfen and nitrofen either alone or in combination with hand weeding provide a fair degree of weed control. But use of same group of herbicide with similar mode of action over the period of time on a same piece of land leads to imbalance in weed flora, environmental contamination and development of resistance in weeds.

In herbicidal control there is no automatic signal to stop a farmer who may be applying the chemical inaccurately till he sees the results in the crop sprayed. It requires considerable skill. In some cases residual effect of herbicide on succeeding crop had been observed (Jackson, 1967). To overcome those problems an effort has been made with a promising post-emergence herbicide ethoxysulfuron to determine its suitable dose to keep the land free during critical period of crop growth. The predominant weed flora in rice field of the experimental site has been cited in table-1.

Table 1: Weed flora observed in the rice plot

SL. No.	Common name	Scientific name
A) Dicot weeds		
i.	Wild Patur	*Sonchus arvensis*
ii.	Dudhi (choti)	*Euphorbia hirta*
iii.	Hazardana	*Phyllanthus niruri*
iv.	Lajari	*Biophytum sensitivum*
v.	Ghogali	*Physalis minima linn*
vi.	Wild jute	*Corchorus actutangulus*
vii.	Wild gobi	*Launea asphanifolia*
viii.	Undirkani	*Ipomoea repans poir*
ix.	Kateri chauli	*Amaranthus spilosus*
x.	Kunjar bhaji	*Dijeria arvensis*
xi.	Chandvel	*Convolvulus arvensia*
xii.	Deepmal	*Acalypha indica*
xiii.	Reshimkata	*Alternathera triandra*
B) Monocot weeds		
i.	Sawa	*Echinochloa crusgalli*
ii.	Lavala	*Cyperus rotundus*
iii.	Doob	*Cynodon dactylon*
iv.	Barnyard grass	*Echinochloa colonum*
v.	Kena	*Commelina bengalensis*

MATERIALS AND METHODS

The present investigation was carried out at the Research Farm, College of Agriculture, Nagpur during the *kharif* season of 2010-2011. The soil of experimental plot was silt clay in texture having slightly alkaline nature pH (7.8). With regard to the fertility status, it was low in available nitrogen,

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moderate in available phosphorus, fairly rich in available potassium and moderate in organic carbon content. Nagpur is situated at elevation of 321 meter above mean sea level and at latitude $21^0$10 North and longitude at $79^0$19 East, having tropical climate with assured but variable rainfall in *kharif* season associated with severe hot summer. Weekly and monthly meteorological data in respect of rainfall, humidity, minimum and maximum temperature and rainy days of *kharif* and *rabi*, 2010-2011 recorded at Meteorological Observatory, College of Agriculture, Nagpur.

The experiment was laid out in Randomized Block Design with four replication and six treatments. The experimental treatment were T_1- unweeded check,T_2 - two hoeing and two weeding at 20 and 40 DAT, T_3 - ethoxysulfuron 15WDG @ 10g *a.i.*ha^{-1} at 3-4 days after transplanting (DAT), T_4 - ethoxysulfuron 15WDG @ 12.5g *a.i.*ha^{-1} at 3-4 DAT, T_5 - ethoxysulfuron 15WDG @ 15g *a.i.*ha^{-1} at 3-4 DAT, T_6 - ethoxysulfuron 15WDG @ 17.5g *a.i.*ha^{-1} at 3-4 DAT.

The seeds of paddy variety PKV-HMT were sown in nursery bed on 26^{th} June 2010. The nursery was raised following recommended package of practices. The experimental field was ploughed twice, puddled and then leveled by planker. The layout was made after puddling and leveling. Transplanting was done on 27^{th}July 2010.The paddy crop was fertilized with recommended dose of 100:50:50 kg NPK ha^{-1}. Nitrogen was applied through urea in three split doses and crop was raised following recommended package of practices.

Ethoxysulfuron 15%WDG @ 12.5-17.5g a.i.ha^{-1} was used as herbicide in the experiment. Herbicide was mixed with two liters of water and then sprayed uniformly. Ethoxysulfuron is mainly taken up by the leaves and is translocated into the plant to act by inhibition of the acetolactate synthesis. After inhibition of plant growth, chlorotic patches develop and spread at first acropetally, and then basipetally. The action of the product reaches its conclusion about 3-4 weeks after application with the death of the whole plant.

RESULTS AND DISCUSSION

The mean plant height was recorded significantly less in un-weeded check (T_1), so found inferior. Weed control treatment with two hoeing and two weeding at 20 and 40 DAT (T_2) was statistically superior over other treatments. Among herbicidal treatment, application of ethoxysulfuron 15WDG @15g *a.i.* ha^{-1} at 3-4 DAT (T_5) recorded significantly more plant height, but it was found comparable with ethoxysulfuron 15WDG @12.5g *a.i.* ha^{-1} at 3-4 DAT (T_4) and ethoxysulfuron 15WDG @17.5g *a.i.* ha^{-1} at 3-4 DAT (T_6) treatments. The increase in plant height under two hoeing and two weeding at 20 and 40 DAT might be due to good aeration of soil and least weed population observed in these treatments, which reduced crop weed competition for soil moisture, plant nutrients, solar radiation and space during active growth period. Similar results are in confirmation with those reported by Ramana *et al.* (2007), Singh *et al.* (2005) and Subramanayam *et al.* (2003).

The data pertaining to number of tillers $hill^{-1}$ as influenced by different treatments are presented in Table-2 the treatment two hoeing and two weeding at 20 and 40 DAT (T_2) was significantly superior over rest of treatment. Treatment unweeded check (T_1) was recorded minimum number of tillers. Among herbicidal weed control treatment ethoxysulfuron @15g *a.i.* ha^{-1} at 3-4 DAT (T_5) was significantly produced more numbers of tillers over other treatments but was satisfactory similar with ethoxysulfuron@ 12.5g *a.i.* ha^{-1} at 3-4 DAT (T_4). Number of tillers significantly increased by all the given treatments over unweeded check (T_1) where more weed population was observed which affect adversely production of tillers. These results are in agreement with those reported by Subramanyam *et al.* (2007) and Ramana *et al.* (2007).

The data pertaining to mean number of effective tillers $hill^{-1}$ as influenced by different treatments are presented in Table- 2. The data indicated that mean number of effective tillers was 8.36 at harvest. Weed control with two hoeing and two weeding at 20 and 40 DAT (T_2) recorded significantly highest number of effective tillers over rest of the treatments. Among herbicidal treatments ethoxysulfuron @15g *a.i.*ha^{-1} at 3-4 DAT (T_5), ethoxysulfuron @ 12.5g *a.i.*ha^{-1} at 3-4 DAT (T_4) were found at par. Minimum number of tillers was recorded in un-weeded control (T_1). Production of effective tillers has great effect on yield of paddy. The results are in confirmation with those reported by Saha Sanjay (2005) and Singh *et al.* (2006).

The data regarding mean dry matter production $hill^{-1}$ as influenced by different treatments are presented in Table-2. The treatment with two hoeing and two weeding at 20 and 40 DAT (T_2) recorded significantly highest dry weight over rest of the treatments. The increase in dry matter accumulation in weed control treatments might be due to less weed competition and good aeration of soil, thereby facilitating luxurious crop growth resulting into more dry matter accumulation $hill^{-1}$ as compared to unweeded control treatment. These results are supported by Subramanyam *et al.* (2007). The data pertaining to mean number of effective panicle $hill^{-1}$as influenced by different treatments are presented in Table-2. Weed control with two hoeing and two weeding at 20 and 40 DAT (T_2) recorded significantly maximum number of panicles $hill^{-1}$ among all treatments. Ethoxysulfuron @ 15g *a.i.* ha^{-1} at 3-4 DAT (T_5) produced significantly more panicles over rest of the treatments, but was at par with(T_4).Less number of panicle $hill^{-1}$ were recorded with un-weeded control (T_1). Awan *et al.* (2004) and Singh *et al.* (2006), Rajkhowa *et al.* (2007) observed same result with weed free check.

Table 2: Growth and yield of transplanted rice as influenced by weed management practices

Treatments	Plant height (cm)	No. of tillers $hill^{-1}$	No. of effective tillers $hill^{-1}$	Dry matter $hill^{-1}$(g)	No. of panicles $hill^{-1}$	No. of grains $panicles^{-1}$	Grain yield (q ha^{-1})
T_1- Un-weeded check	43.75	7.16	4.89	21.98	4.89	109.75	23.80
T_2- Two hoeings and two weedings at 20 and 40 DAT	63.55	17.39	12.89	35.23	12.89	131.50	42.95
T_3- Ethoxysulfuron 15WDG @10g *a.i.* ha^{-1} at 3-4 DAT	57.53	9.18	7.67	30.08	7.26	120.00	31.30
T_4- Ethoxysulfuron 15WDG @12.5g *a.i.* ha^{-1} at 3- 4DAT	58.72	12.29	8.64	31.38	8.64	124.96	38.04
T_5- Ethoxysulfuron 15WDG @15g *a.i.* ha^{-1} at 3-4DAT	58.95	12.71	8.85	31.92	8.85	125.21	38.20
T_6- Ethoxysulfuron 15WDG @ 17.5g *a.i.* ha^{-1} at 3-4DAT	58.45	9.68	7.26	31.18	8.00	123.88	36.30
SEm (±)	**0.43**	**0.93**	**0.23**	**0.42**	**0.23**	**0.14**	**0.42**
LSD (0.05)	**1.28**	**2.78**	**0.69**	**1.26**	**0.69**	**0.44**	**1.25**

Data pertaining to mean number of grains $panicle^{-1}$ as influenced by different treatments are presented in Table-2.Treatment un-weeded check (T_1) recorded less number of grains $panicle^{-1}$ and two hoeings and two weedings at 20 and 40 DAT (T_2) recorded significantly higher number of grains $panicle^{-1}$ over all the treatments. Among herbicide treatment, ethoxysulfuron 15 g ha^{-1} at 3-4 DAT (T_5) recorded significantly superior number of grains $panicle^{-1}$ and was at par with ethoxysulfuron @12.5g *a.i.* ha^{-1} at 3-4 (T_4) DAT.

Relevant data on grain yield per hectare as affected by different treatments are presented in table-2. Data indicated that two hoeing and two weeding at 20 and 40 DAT (T_2) recorded significantly highest grain yield (42.95q ha^{-1}) over rest of the treatments. In herbicide application, treatment ethoxysulfuron @15g *a.i.* ha^{-1} at 3-4 DAT (T_5) produced significantly higher grain yield but gives statistically similar yield with ethoxysulfuron @ 12.5g *a.i.* ha^{-1} at 3-4 DAT (T_4). Lowest grain yield of 23.80q ha^{-1} was recorded in unweeded control (T_1) among the various treatments. Mean grain yield of paddy was recorded as 34.89q ha^{-1}. Similar results are also recorded by Subramanyan *et al.* (2003) Ramana *et al.* (2007) and Singh *et al.* (2006).

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