

## Effect of Different Herbicide Combinations on Weed Dynamics and Production Potential of Transplanted Rice

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### ABSTRACT

A field experiment was conducted at College Farm, Agricultural College, Mahanandi on sandy loam soils to know the efficacy of different herbicides in transplanted rice. Most of the improved crop management practices in rice cultivation failed in controlling weeds due to poor and improper management. At present the use of herbicides or manual is not effective in timely controlling the weed population. Hence, the present investigation was aimed to study the influence of herbicide in combination with hand weeding on the productivity of transplanted rice. The experiment comprised of 8 treatments i.e., such as application of herbicides alone and their integration with one hand weeding, two hand weeding and unweeded check were tested in randomized block design with three replications. Among these treatments, the lower weed density and weed dry weight, higher weed control efficiency, yield attributes, maximum grain yield (5637.00 kg ha<sup>-1</sup>), straw yield (6599.00 kg ha<sup>-1</sup>) and harvest index (46.60 %) were recorded under two hand weeding, which was at par with post emergence application of bispyribac sodium 20 g a.i. ha<sup>-1</sup> in combination with hand weeding at 40 DAT.

**Key words:** Transplanted rice, Herbicides, Hand weeding, Weed control efficiency, Yield attributes and Yield.

### INTRODUCTION

Rice [*Oryza sativa* (L.)] is the most important and extensively grown food crop in India with an area of 44.8 million hectares, production of 104.4 million tones and productivity of 2390 kg ha<sup>-1</sup>. In Andhra Pradesh, it is grown in an area of 4.51 lakh hectares with a production of 13.77 lakh tonnes and productivity of 2891 kg

ha<sup>-1</sup>. The major weed flora observed in the experimental plot are *Echinochloa colonum*, *Echinochloa crus-galli* among grasses, *Cyperus rotundus*, *Cyperus difformis*, *Cyperus iria* among sedges and *Eclipta alba* and *Ammania baccifera* among broad leaved weeds.

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However due to increased labour wages and non availability of labour during peak periods of agricultural operations, timely weeding is not possible besides it is time taking and tedious. Therefore, farmers resorted to increased use of herbicides as it reduced human drudgery and weed management became more efficient in addition to saving of time and being less expensive<sup>5</sup>. The use of herbicides offers selective, effective and economical control of weeds right from the beginning, giving crop the advantage of good start and competitive superiority. Therefore, there is a necessity that these herbicides are applied with hand weeding to widen weed control spectrum. Hence, the present investigation was to study the influence of chemicals in combination with hand weeding on weed control efficiency and productivity of transplanted rice.

#### MATERIAL AND METHODS

A field experiment was conducted to study “Efficacy of different herbicides in transplanted rice [*Oryza sativa* (L.)] in Scarce Rainfall Zone of Andhra Pradesh” under irrigated conditions during *kharif*, 2017-18 on sandy loam soils of College Farm, Agricultural College, Mahanandi, Andhra Pradesh. The rainfall received during the crop growth period was very meagre *i.e.* 791.2 mm. The soil of the experimental site was neutral pH (7.91), medium in organic carbon (0.55%), low in N (227 kg ha<sup>-1</sup>), high in P<sub>2</sub>O<sub>5</sub> (82 kg ha<sup>-1</sup>) and high in K<sub>2</sub>O (1024 kg ha<sup>-1</sup>). The experiment was laid out in a randomized block design having eight treatments and replicated thrice.

The treatments consisting of T<sub>1</sub>: Control (Unweeded), T<sub>2</sub>: Two hand weedings at 20 and 40 DAT, T<sub>3</sub>: Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha<sup>-1</sup> at 15-20 DAT, T<sub>4</sub>: Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha<sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT, T<sub>5</sub>: Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha<sup>-1</sup> at 15-20 DAT, T<sub>6</sub>: Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha<sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT, T<sub>7</sub>: Bispyribac Sodium 10 % SC @ 200 ml ha<sup>-1</sup> at 15-20 DAT, T<sub>8</sub>: Bispyribac Sodium 10 % SC @ 200 ml ha<sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT. The fertilizers such as urea, single super phosphate and muriate of potash were used for the supply of NPK and the entire quantity phosphorous applied as basal dose at the time of transplanting and nitrogen and potassium were applied in 3 equal splits @ tillering, panicle initiation and grain filling stage of the crop. The seed rate used for study was 75 kg ha<sup>-1</sup> with a spacing of 25 x 15 cm. Weed species present in the experimental plot were identified at flowering stage of crop from weedy check plot and grouped as grasses, sedges and broad leaved weeds. The data on weed density and weed dry weight were recorded with the help of a quadrat (0.25 m<sup>2</sup>) at four places randomly chosen and then expressed in number per square metre and gram per square metre. The weed control efficiency was worked out on the basis of weed dry matter recorded in each treatment at 30, 60, 90 DAT and at harvest by using the formula suggested by Mani *et al.*<sup>3</sup>.

$$\text{WCE} = \frac{\text{DM}_C - \text{DM}_T}{\text{DM}_C} \times 100$$

Where,

DM<sub>C</sub> = Dry matter of weeds in the unweeded check (control)

DM<sub>T</sub> = Dry matter of weeds in the treatment imposed plot.

Values were subjected to square root transformation ( $\sqrt{x+0.5}$ ) prior to statistical analysis to normalize their distribution.

Observations on yield attributes and yield of crop were recorded and statistically analysed.

## RESULTS AND DISCUSSION

### Weed Flora

During crop growth period, weed flora belonging to eight taxonomic families was observed, of which seven species were grasses, four species were sedges and seven species were broad leaved weeds. The predominant weed species observed were *Echinochloa colonum*, *Echinochloa crus-galli* among grasses, *Cyperus rotundus*, *Cyperus difformis*, *Cyperus iria* among sedges and *Eclipta alba* and *Ammania baccifera* among broad leaved weeds.

### Effect on weeds

All the weed control treatments significantly reduced weed density, total dry weight of weeds. The lower dry weight of weeds was recorded under two hand weeding at 20 and 40 DAT, which was on par with post emergence application of bispyribac sodium 20 g a.i. ha<sup>-1</sup> in combination with hand weeding at 40 DAT. The reduced density and dry weight of weeds might be attributed to broad spectrum and season long weed control by the application of post emergence herbicides followed by hand weeding as observed in the plots in which two hand weeding were given. This might be due to effective inhibition of aceto lactate synthase (ALS) enzyme which in turn blocks branched chain amino acid biosynthesis leading to death of weeds. The higher weed density and dry weight was recorded with unweeded check. It means that if weeds were not controlled properly within critical period of crop weed competition, their density continuously remained increasing and affected the crop growth. These results are in line with findings of Singh *et al.*<sup>7</sup>.

The higher weed control efficiency was observed under two hand weeding, which was on par with post emergence application of bispyribac sodium 20 g a.i. ha<sup>-1</sup> supplemented with hand weeding at 40 DAT. Similar findings were also reported by Yadav *et al.*<sup>11</sup> and Parthipan and Ravi<sup>4</sup>.

### Effect on yield attributes and yields of crop

Higher number of productive tillers hill<sup>-1</sup>, total number of grains panicle<sup>-1</sup> and test weight of transplanted rice were significantly influenced by weed control treatments. Maximum number of productive tillers hill<sup>-1</sup> was recorded in twohand weeding at 20 and 40 DAT, which was on par with post emergence application of bispyribac sodium 20 g a.i. ha<sup>-1</sup> in combination with hand weeding at 40 DAT and unweeded check recorded minimum number of productive tillers hill<sup>-1</sup>. Increase in number of productive tillers hill<sup>-1</sup>, total number of grains panicle<sup>-1</sup>, test weight might be due to better environment and ultimate development of large sink created out of reduced crop weed competition. Similar findings were also reported by Survase *et al.*<sup>8</sup> and Rishi Raj *et al.*<sup>6</sup>.

The higher grain yield and straw yield were observed with two hand weeding over application of herbicides alone, herbicides followed by one-hand weeding and unweeded check. This might be attributed to reduced competition by weeds due to frequent elimination of weeds from the field that leads to reduce weed density, weed dry weight and results in good yields. However, the grain yield and straw yield recorded with post emergence application of bispyribac sodium 20 g a.i. ha<sup>-1</sup> followed by hand weeding at 40 DAT was comparable with that of two hand weeding. Higher yields under these treatments might be due to increased productive tillers, panicles m<sup>-2</sup> and grains panicle<sup>-1</sup>. Similar findings were also confirmatory with the findings of Deepthi Kiran and Subramanyam<sup>2</sup> and Veeraputhiran and Balasubramanian<sup>9</sup>.

The higher harvest index of rice was registered with post-emergence application of bispyribac sodium *fb* hand weeding at 40 DAT (T<sub>8</sub>). This might be due to greater translocation of photosynthates from source to sink resulted in higher harvest index under weed control treatments as compared to unweeded check. Similar results were confirmatory with the findings of Uma *et al.*<sup>10</sup>.

**Table 1. Influence of different weed management practices on weed density, weed dry weight and weed control efficiency in transplanted rice**

Treatment	Weed density (No m <sup>-2</sup> )	Weed dry weight (g m <sup>-2</sup> )	Weed Control Efficiency (WCE)
T <sub>1</sub> :Control (Unweeded)	253.00(15.92)	114.61(10.73)	0.00
T <sub>2</sub> : Two hand weedings at 20 and 40 DAT	16.00(4.06)	7.83(2.89)	93.19
T <sub>3</sub> : Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT	68.00(8.28)	28.48(5.38)	75.13
T <sub>4</sub> :Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	25.33(5.08)	14.26(3.84)	87.59
T <sub>5</sub> :Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT	85.00(9.25)	34.33(5.90)	70.04
T <sub>6</sub> :Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	27.00(5.24)	15.77(3.99)	86.19
T <sub>7</sub> :Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT	56.67(7.56)	23.25(4.87)	79.62
T <sub>8</sub> :Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	21.67(4.71)	12.99(3.63)	88.67
S.Em ±	3.89	1.57	0.53
CD (P = 0.05)	11.80	4.77	1.63

**Table 2. Influence of different weed management practices on yield attributing characters of transplanted rice**

Treatment	Number of productive tillers hill <sup>-1</sup>	Total number of grains panicle <sup>-1</sup>	Test weight (g)
T <sub>1</sub> : Control (Unweeded)	14.00	106	16.7
T <sub>2</sub> : Two hand weedings at 20 and 40 DAT	20.00	138	18.2
T <sub>3</sub> : Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT	16.00	116	17.2
T <sub>4</sub> :Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	18.00	130	17.5
T <sub>5</sub> :Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT	15.00	113	17.0
T <sub>6</sub> : Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	18.00	125	17.6
T <sub>7</sub> :Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT	16.00	118	17.3
T <sub>8</sub> :Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	19.00	133	17.7
S.Em ±	0.61	1.91	0.31
CD (P = 0.05)	1.85	5.79	0.95

**Table 3. Influence of different weed management practices on grain yield, straw yield and harvest index**

Treatment	Grain yield (Kg ha <sup>-1</sup> )	Straw yield (Kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> : Control (Unweeded)	3749.00	5112	42.31
T <sub>2</sub> : Two hand weedings at 20 and 40 DAT	5637.00	6599	46.07
T <sub>3</sub> : Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT	4631.00	5768	44.53
T <sub>4</sub> : Triafamone 20 % + Ethoxysulfuron 10 % WP @ 225 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	5233.00	6018	46.52
T <sub>5</sub> : Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT	4436.00	5615	44.19
T <sub>6</sub> : Chloromuron-ethyl 10 % + metsulfuron-methyl 10 % WP @ 20 g ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	4974.00	6038	45.19
T <sub>7</sub> : Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT	4780.00	5932	44.63
T <sub>8</sub> : Bispyribac Sodium 10 % SC @ 200 ml ha <sup>-1</sup> at 15-20 DAT + hand weeding at 40 DAT	5431.00	6220	46.60
S.Em ±	117.26	142.40	0.83
CD (P = 0.05)	355.67	431.91	2.52

### CONCLUSION

From the above results, it can be concluded that lower weed density, weed dry weight, higher weed control efficiency, higher yield

attributes and yield was obtained with two hand weeding at 20 and 40 DAT, however it was on par with the application of bispyribac sodium 20 g *a.i.* at 20DAT as post emergence

in combination with hand weeding at 40DAT and the higher harvest index was also observed with the same treatment. Over all, it can be concluded that from the present investigation, post emergence application of bispyribac sodium 20 g a.i.ha<sup>-1</sup> in combination with hand weeding at 40 DAT can be recommended for effective weed control and higher productivity of transplanted rice.

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