*The Andhra Agric. J* 70 (1): 018-024, 2023
10.61657/aaj.2023.2

# Growth Parameters of Direct Sown Rice as Influenced by Different Weed Management Practices

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## ABSTRACT

A field experiment was conducted to study the effect of sequentially applied herbicides on growth and yield of direct sown rice was carried out at at Agricultural College Farm, Bapatla during *kharif* 2015-16 and 2016-17. Pre emergence application of bensulfuron methyl + pretilachlor with safener *fb* post emergence application of azimsulfuron at 25 DAS *fb* post emergence application of metsulfuron methyl and chlorimuron ethyl at 45 DAS ($T_9$) recorded significantly maximum number of tillers (563 and 573 No. $m^{-2}$), higher dry matter 11931 and 13556 kg $ha^{-1}$) at harvest during both the years respectively and it was on par with Pre-emergence application of bensulfuron methyl @ 60 g a.i. $ha^{-1}$ + pretilachlor with safener at 500 g a.i. $ha^{-1}$ *fb* post-emergence application of bispyribac-sodium @ 25 g a.i. $ha^{-1}$ at 25 DAS *fb* post-emergence application of metsulfuron methyl and chlorimuron ethyl @ 4 g a.i. $ha^{-1}$ applied at 45 DAS ($T_{10}$) and Pre-emergence application of pyrazosulfuron ethyl @ 25 g a.i. $ha^{-1}$ *fb* post-emergence application of azimsulfuron @ 20 g a.i. $ha^{-1}$ at 25 DAS *fb* post-emergence application of metsulfuron methyl and chlorimuron ethyl @ 4 g a.i. $ha^{-1}$ applied at 45 DAS ($T_7$), which was however inferior to weed free treatment ($T_{13}$). The lowest dry matter accumulation and yield over rest of the treatments was associated with weedy check ($T_{14}$).

**Key words:** *Direct sown rice, Weed management, Tillers, Drymatter accumulation, Grain yield and Straw yield*

The traditional method of growing rice, which involves transplanting in puddled conditions, is primarily used by farmers. But, it requires a lot of labor, water and energy. Thus, more resource-efficient alternative ways of rice farming are required to ensure the sustainability of rice production. The direct seeded rice (DSR) method has attracted a lot of interest as a potential substitute for transplanting under puddle conditions because it is water, labor, energy and environmentally friendly (Kumar and Ladha, 2011). Yet, weed control is a significant barrier to DSR's success when compared to rice that has been transplanted (Chauhan and Yadav, 2013). In DSR, weeds grow more quickly in moist soil than in puddled transplanted rice, which puts the crop in intense competition for resources.

Using herbicides is the best alternative strategy for early-stage, targeted, and cost-effective weed management, giving crops a competitive edge and a head start. Nevertheless, no single herbicide can effectively control a wide range of weeds in rice that has been direct seeded. Combination products, which combine two or more herbicides, have gained popularity in recent years because to their increased effectiveness against a variety of weed species. With this in mind, the current research was carried out to assess the influence of different weed management strategies on growth parameters of direct sown Rice

## MATERIAL AND METHODS

A field experiment was conducted during *Kharif* 2015 and 2016 to study efficacy of sequential application of herbicides on growth and yield of direct sown rice at the Agricultural College Farm, Bapatla, Guntur, Andhra Pradesh. The experiment was conducted in randomized complete block design with fourteen treatments replicated thrice and the details of which are given hereunder.

Plant height was measured in centimetres from ground level to the tip of the top most fully opened leaf at 30 DAS, 60 DAS and at harvest of all the five labelled hills and was averaged per hill. All tillers from the five labelled plants were counted at 30 DAS, 60 DAS and at harvest and mean number of tillers $hill^{-1}$ was arrived. The mean value was multiplied by number of hills in one square metre area to express per square metre area. Plants enclosed in an area of 0.25 $m^2$ from the sampling area were removed at maturity. The plant samples so collected were sundried and later oven dried at $60^0C$ till a constant weight was obtained. The data was computed and expressed in kg $ha^{-1}$. The data of each year was analyzed and means were separated using critical difference (CD) at p=0.05 (Gomez and Gomez, 1984).

| **Treatments** | **Dose (g $ha^{-1}$)** | **Time (DAS)** |
|---|---|---|
| $T_1$. Pyrazosulfuron ethyl *fb* Azimsulfuron | 25 *fb* 20 | Pre *fb* Post |
| $T_2$. Pyrazosulfuron ethyl *fb* Bispyribac-sodium | 25 *fb* 25 | Pre *fb* Post |
| $T_3$. Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron | 60 + 500 *fb* 20 | Pre *fb* Post |
| $T_4$. Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium | 60 + 500 *fb* 25 | Pre *fb* Post |
| $T_5$. Oxadiargyl *fb* Azimsulfuron | 75 *fb* 20 | Pre *fb* Post |
| $T_6$. Oxadiargyl *fb* Bispyribac-sodium | 75 *fb* 25 | Pre *fb* Post |
| $T_7$. Pyrazosulfuron ethyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_8$. Pyrazosulfuron ethyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_9$. Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_{10}$. Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_{11}$. Oxadiargyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_{12}$. Oxadiargyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post |
| $T_{13}$. Weed free | - | - |
| $T_{14}$. Weedy check | - | - |

## RESULTS AND DISCUSSION

### Plant Height

Plant height (cm) measured at different stages of rice was significantly influenced by weed management treatments (Table 1) during both the years of study. Plant height of rice was found to increase progressively with advance of age of crop up to flowering. At 30 DAS weed control treatments recorded significantly increased plant height over weedy check ($T_{14}$). However, among these treatment $T_{13}$ (weed free) recorded the highest plant height (36.3 and 35.6 cm), which was at par with corresponding treatments $T_9$, $T_3$, $T_{10}$, $T_4$, $T_7$, $T_1$, $T_2$, $T_{11}$. Obviously the lowest plant height was associated with weedy check ($T_{14}$).

At 60 DAS, the highest plant height was registered with treatment $T_{13}$ (weedy check) (76.1 and 73.9 cm during 2015-16 & 2016-17, Respectively) which was however at par with sequential application of herbicides (pre emergence followed by post emergence at 25 and 45 DAS). This phenomenon manifestation of the herbicidal effect can be attributed against all groups of weeds which generated a favorable rhizosphere for crop growth and thus resulted in the highest plant height. All most a similar trend was observed at harvest as well. Weed free situation persisting for nutrition, water, space and light availability throughout the crop growth period, as a result of herbicides application at critical period of crop weed competition enhanced the plant height as evident in the present finding in concurrence with those of Yadav *et al.* (2008a), Sori (2008), Yadav *et al.* (2008b), Yadav *et al.* (2009), Rammu Lodhi (2016) and Vijay Singh *et al.* (2016).

**Table 1. Plant height (cm) at different growth stages of direct seeded rice as influenced by weed management practices during *kharif* 2015-16 and 2016-17**

| Treatments | Dose | Time | 30DAS | | 60DAS | | At harvest | |
|---|---|---|---|---|---|---|---|---|
| | (g ha$^{-1}$) | (DAS) | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
| $T_1$ Pyrazosulfuron ethyl *fb* Azimsulfuron | 25 *fb* 20 | Pre *fb* Post | 31.4 | 32.6 | 60.9 | 62.7 | 81.2 | 78.8 |
| $T_2$ Pyrazosulfuron ethyl *fb* Bispyribac-sodium | 25 *fb* 25 | Pre *fb* Post | 29.6 | 30.7 | 58.1 | 59.1 | 79.5 | 76.5 |
| $T_3$ Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron | 60 + 500 *fb* 20 | Pre *fb* Post | 35.3 | 36.4 | 63.6 | 65.8 | 84.3 | 84 |
| $T_4$ Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium | 60 + 500 *fb* 25 | Pre *fb* Post | 34.2 | 33.4 | 60.6 | 62.1 | 81.6 | 79.9 |
| $T_5$ Oxadiargyl *fb* Azimsulfuron | 75 *fb* 20 | Pre *fb* Post | 31.7 | 29.5 | 59.4 | 61.1 | 75 | 75.8 |
| $T_6$ Oxadiargyl *fb* Bispyribac-sodium | 75 *fb* 25 | Pre *fb* Post | 28.4 | 28.3 | 57.4 | 59.1 | 73.8 | 71.9 |
| $T_7$ Pyrazosulfuron ethyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 32.7 | 33.9 | 69.8 | 71.8 | 92 | 88.1 |
| $T_8$ Pyrazosulfuron ethyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 31 | 29.6 | 66.7 | 68.9 | 89.8 | 86.3 |
| $T_9$ Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 35.9 | 36.2 | 75 | 74 | 93.8 | 94.4 |
| $T_{10}$ Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 33.9 | 34.5 | 73.7 | 71.7 | 91.4 | 92.7 |
| $T_{11}$ Oxadiargyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 32.1 | 30.8 | 68.8 | 65.7 | 84.4 | 87 |
| $T_{12}$ Oxadiargyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 28.8 | 29.5 | 66.9 | 64.8 | 85.9 | 83.3 |
| $T_{13}$ Weed free | - | - | 36.3 | 35.6 | 76.1 | 73.9 | 96.6 | 95.7 |
| $T_{14}$ Weedy check | - | - | 19.6 | 16.2 | 48.8 | 42.2 | 61.9 | 65.6 |
| **SEm±** | - | - | 2.4 | 2.1 | 2.6 | 3.7 | 3.6 | 2.9 |
| **CD (P = 0.05)** | - | - | 7.1 | 6.1 | 7.7 | 10.8 | 10.4 | 8.4 |

**Table 2. Number of tillers (No. $m^{-2}$) at different growth stages of direct seeded rice as influenced by weed management practices during *kharif* 2015-16 and 2016-17**

| Treatments | Dose | Time | 30DAS | | 60DAS | | At harvest | |
|---|---|---|---|---|---|---|---|---|
| | (g $ha^{-1}$) | (DAS) | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
| $T_1$. Pyrazosulfuron ethyl *fb* Azimsulfuron | 25 *fb* 20 | Pre *fb* Post | 308 | 328 | 371 | 384 | 357 | 368 |
| $T_2$. Pyrazosulfuron ethyl *fb* Bispyribac-sodium | 25 *fb* 25 | Pre *fb* Post | 301 | 321 | 350 | 374 | 349 | 363 |
| $T_3$. Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron | 60 + 500 *fb* 20 | Pre *fb* Post | 335 | 355 | 394 | 413 | 380 | 387 |
| $T_4$. Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium | 60 + 500 *fb* 25 | Pre *fb* Post | 332 | 337 | 383 | 395 | 362 | 377 |
| $T_5$. Oxadiargyl *fb* Azimsulfuron | 75 *fb* 20 | Pre *fb* Post | 310 | 317 | 347 | 366 | 344 | 356 |
| $T_6$. Oxadiargyl *fb* Bispyribac-sodium | 75 *fb* 25 | Pre *fb* Post | 284 | 312 | 335 | 354 | 328 | 345 |
| $T_7$. Pyrazosulfuron ethyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 311 | 325 | 542 | 631 | 497 | 502 |
| $T_8$. Pyrazosulfuron ethyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 306 | 319 | 532 | 595 | 491 | 493 |
| $T_9$. Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 342 | 356 | 585 | 672 | 563 | 573 |
| $T_{10}$. Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 325 | 338 | 567 | 642 | 540 | 556 |
| $T_{11}$. Oxadiargyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 305 | 314 | 495 | 536 | 456 | 469 |
| $T_{12}$. Oxadiargyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 311 | 307 | 474 | 513 | 443 | 457 |
| $T_{13}$. Weed free | - | - | 334 | 358 | 596 | 683 | 584 | 609 |
| $T_{14}$. Weedy check | - | - | 183 | 197 | 359 | 389 | 312 | 361 |
| **SEm ±** | - | - | 26.7 | 25.4 | 25.5 | 32.4 | 24.1 | 31.4 |
| **CD (P = 0.05)** | - | - | 78 | 74 | 74 | 94 | 70 | 91 |

**Table 3. Drymatter accumulation (kg ha$^{-1}$) at different growth stages of direct seeded rice as influenced by weed management practices during *kharif* 2015-16 and 2016-17**

| Treatments | Dose | Time | 30DAS | | 60DAS | | At harvest | |
|---|---|---|---|---|---|---|---|---|
| | (g ha$^{-1}$) | (DAS) | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
| $T_1$ Pyrazosulfuron ethyl *fb* Azimsulfuron | 25 *fb* 20 | Pre *fb* Post | 287 | 393 | 1182 | 1311 | 9621 | 9882 |
| $T_2$ Pyrazosulfuron ethyl *fb* Bispyribac-sodium | 25 *fb* 25 | Pre *fb* Post | 281 | 381 | 1159 | 1243 | 9306 | 10027 |
| $T_3$ Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron | 60 + 500 *fb* 20 | Pre *fb* Post | 342 | 426 | 1281 | 1551 | 10218 | 11399 |
| $T_4$ Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium | 60 + 500 *fb* 25 | Pre *fb* Post | 314 | 415 | 1243 | 1426 | 9340 | 11488 |
| $T_5$ Oxadiargyl *fb* Azimsulfuron | 75 *fb* 20 | Pre *fb* Post | 277 | 382 | 1125 | 1137 | 9372 | 9828 |
| $T_6$ Oxadiargyl *fb* Bispyribac-sodium | 75 *fb* 25 | Pre *fb* Post | 268 | 357 | 1083 | 1003 | 8903 | 9647 |
| $T_7$ Pyrazosulfuron ethyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 289 | 433 | 2100 | 2249 | 11734 | 12666 |
| $T_8$ Pyrazosulfuron ethyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 25 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 286 | 384 | 2069 | 2090 | 11145 | 12439 |
| $T_9$ Bensulfuron methyl + Pretilachlor with safener *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 358 | 439 | 2285 | 2450 | 11931 | 13556 |
| $T_{10}$ Bensulfuron methyl + Pretilachlor with safener *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 60 + 500 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 327 | 421 | 2207 | 2294 | 11551 | 13373 |
| $T_{11}$ Oxadiargyl *fb* Azimsulfuron *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 20 *fb* 4 | Pre *fb* Post *fb* Post | 283 | 383 | 2008 | 2030 | 11238 | 12105 |
| $T_{12}$ Oxadiargyl *fb* Bispyribac-sodium *fb* Metsulfuron methyl + Chlorimuron ethyl | 75 *fb* 25 *fb* 4 | Pre *fb* Post *fb* Post | 273 | 377 | 2049 | 1907 | 10900 | 12366 |
| $T_{13}$ Weed free | - | - | 391 | 449 | 2379 | 2547 | 12303 | 13936 |
| $T_{14}$ Weedy check | - | - | 172 | 267 | 716 | 621 | 6289 | 6804 |
| **SEm ±** | - | - | 17 | 29 | 97 | 116 | 560 | 468 |
| **CD (P = 0.05)** | - | - | 48 | 83 | 281 | 337 | 1628 | 1360 |

**Number of Tillers (No. m$^{-2}$)**

At 30 DAS, the treatment $T_{13}$ (weed free) registered significantly the highest number of tillers m$^{-2}$, which was significantly superior to weedy check ($T_{14}$). At 60 DAS, among the herbicide combinations pre emergence application of bensulfuron methyl + pretilachlor with safener *fb* post emergence application of azimsulfuron at 25 DAS *fb* post emergence application of metsulfuron methyl and chlorimuron ethyl at 45 DAS ($T_9$) though recorded significantly maximum number of tillers (585 and 672 No. m$^{-2}$ during 2015-16 and 2016-17, respectively) and comparable with treatments $T_{10}$, $T_7$ and $T_8$, which was however inferior to weed free treatment ($T_{13}$). The lowest number of tillers (359 and 389 No. m$^{-2}$) over rest of the treatments was associated with treatment $T_{14}$ (weedy check). Almost the above mentioned trend was unalterably exhibited at maturity stage also during both the years of study. This might be due to facilitating better utilization of plant nutrients by crop under reduced competition from weeds. These results are corroborating with those reported by Sori (2008), Jaya Suria *et al.* (2011), Naseeruddin and Subramanyam, (2013), Rammu Lodhi, (2016) and Vijay Singh *et al.* (2016).

**Drymatter Accumulation**

Drymatter accumulation increased progressively with the advance in the age of crop. Among the herbicide treatments, the highest drymatter accumulation was recorded under treatment $T_9$ (pre emergence application of bensulfuron methyl + pretilachlor with safener *fb* post emergence application of azimsulfuron at 25 DAS *fb* post emergence application of metsulfuron methyl and chlorimuron ethyl at 45 DAS), which was found significantly superior to the treatment $T_3$, $T_4$, $T_1$, $T_2$, $T_5$, $T_6$ and $T_{14}$ except $T_{13}$ (weed free) at 60 DAS during both the years of study. Almost a similar trend was observed at maturity stage.

Weedy check plots registered the minimum production of assimilates in the assimilatory apparatus at 30, 60 and harvest. The minimum magnitude of drymatter under weedy check may be attributed to the increased competition among crop and weeds, which might have hampered the plant growth resulting in reduced drymatter production. Similar line of results was also reported by Singh *et al.* (2007), Rammu Lodhi (2016), Jyothi Basu *et al.*, (2020a &2020b).

On the basis two years data, it was concluded that pre-emergence application of bensulfuron methyl + pretilachlor with safener *fb* post emergence application of azimsulfuron at 25 DAS *fb* post emergence application of metsulfuron methyl and chlorimuron ethyl at 45 DAS ($T_9$) found more productive in achieving higher drymatter in direct seeded rice.

**LITERATURE CITED**

**Gomez KA and Gomez A A 1984.** Statistical Procedures for Agricultural Research (2 ed.). John wiley and sons, New York, 680 p.

**Rammu Lodhi 2016.** Efficacy of Bensulfuron methyl + Pretilachlor against Weeds in Transplanted Rice. *M.Sc Thesis.* Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India

**Naseeruddin R and Subramanyam D 2013.** Performance of low dose high efficacy herbicides in drum seeded rice. *Indian Journal of Weed Science.* 45 (4): 285–288.

**Singh S, Ladha J K, Gupta R K, Bhushan L, Rao A N, Sivaprasad B and Singh R P 2007.** Evaluation of mulching, intercropping with *sesbania* and herbicide use for weed management in direct seeded rice (*Oryza sativa* L.), *Crop protection.* 26 (4): 518-524.

**Jaya Suria A S M, Juraimi A S, Rahman M M, Man A B and Selamat A 2011.** Efficacy and economics of different herbicides in aerobic rice system. *African Journal of Biotechnology.* 10(41): 8007-8022.

**Sori O 2008.** Efficacy and economics of post emergence herbicides in transplanted rice. *M.Sc. Thesis*, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh.

**Yadav D B, Samunder Singh and Ashok Yadav 2008a.** Evaluation of azimsulfuron and metsulfuron-methyl alone and in combination for weed control in transplanted rice. *Indian Journal of Weed Science.* 40 (1 & 2): 16-20.

**Yadav D B, Ashok Yadav, Punia S S and Balyan R S 2008b.** Evaluation of azim-sulfuron for the Control of complex weed flora in transplanted rice. *Indian Journal of Weed Science.* 40 (3 & 4): 126-132.

**Yadav D B, Ashok Yadav and Punia S S 2009.** Evaluation of bispyribac-sodium for weed control in transplanted rice. *Indian Journal of Weed Science*. 41(1&2); 23-27.

**Jyothi Basu B, Prasad P V N, Murthy V R K, Ashoka Rani Y and Prasad P R K 2020[a].** Evaluation of sequential application of herbicides for controlling complex weed flora in direct sown rice. *Indian Journal of Plant Protection.* 48(4): 482–490.

**Jyothi Basu B, Prasad P V N, Murthy V R K, Ashoka Rani Y and Prasad P R K 2020[b].** Bioefficacy and phytotoxicity of herbicides in rice and their residual effect on succeeding greengram. *International Journal of Agriculture Sciences.* 12(11): 9940–9944.

**Kumar V and Ladha J K 2011.** Direct seeded rice: Recent development and future research needs. *Advances in Agronomy.* 111: 297-413.

**Chauhan B S and Yadav A 2013.** Weed management approaches for direct-seeded rice in India: A review. Indian Journal of Weed Science 45: 1-6.

**Vijay Singh, Mangi L, Jat Zahoor, Ganie A, Bhagirath Chauhan S and Raj K Gupta 2016.** Herbicide options for effective weed management in dry directseeded rice under scented rice-wheat rotation of western Indo-Gangetic Plains. *Crop Protection*. 81: 168-176

Received on 20.09.2022 and Accepted on 03.02.2023