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# Yield and Economics of different Weed Management Practices in Summer Direct Seeded Rice (*Oryza sativa* L.)

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**ABSTRACT: Weeds are the major constraint in crop production and mostly managed by hand weeding manually. But, ever increasing labour wages has made manual weeding uneconomical in spite of the yield benefit. A field experiment was carried out during summer 2021 at Zonal Agricultural Research Station, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bengaluru, Karnataka to analyse the yield and economics of weed management in direct seeded rice. The experiment was laid out in randomized complete block design with twelve treatments and three replications. The treatments consisted of seven herbicides, three allelochemicals, hand weeding and unweeded check. All the treatments recorded significantly higher yield and economics when compared to unweeded control. Among all the herbicide treatments, significantly higher weed control efficiency, yield attributes and grain yield of summer direct seeded rice was recorded with bispyribac sodium 40 g ha$^{-1}$ as post emergence and the same treatment has also recoded higher net returns and B:C ratio followed by bensulfuron methyl + pretilachlor 660 g ha$^{-1}$ as pre emergence. Even though hand weeding at 20 and 40 DAS has recorded highest yield attributes and grain yield, the B:C was lower than bispyribac sodium40 g ha$^{-1}$ as post emergence due to high cost of manual weeding. Unweeded control has recorded lowest yield attributes, yield and monitory returns.**

**Keywords:** Direct seeded rice, bispyribac sodium, bensulfuron methyl + pretilachlor, allelochemicals, economics.

## INTRODUCTION

Rice (*Oryza sativa* L.) is the most common food crop grown in the world and it feeds more than half of the world's population and also an integral source of income for most people. Direct seeded rice has emerged as a pragmatic technology to save water and labor resources, curtail the methane emissions, and improves rice yields (Nawaz *et al*., 2022). Direct seeding of rice establishment is spreading more rapidly in Asia particularly in Philippines, Malaysia and Thailand as the farmers are seeking higher productivity and profitability to withstand the increasing costs and scarcity of farm labour (Pandey and Velesco 2002; Shekhawat *et al*., 2020).

Traditionally rice is grown under transplanted conditions with continuous submerge demanding huge amount of water. But, due to the emerging problems of labour and water scarcity, direct seeded rice is being popularized now a days. In this system, the crop is grown under non puddled and non saturated conditions and the cultivation is similar to an usual upland crop. The system offers several advantages over transplanting like no nursery management, less labour, water requirement, high water use efficiency, lower greenhouse gas emissions, early crop maturity (Roy, 2016).

In direct seeded rice, weeds are the major constraint as the aerobic soil environment along with heavy fertilization will provide favourable conditions for weed emergence and growth (Kachroo and Bazaya 2011; Kumar *et al*., 2022). The yield losses due to weeds often ranges between 91.4 to 99.0 % emphasizing the importance of weed control in direct seeded rice (Chhokar *et al*., 2014). On the contrary, ever increasing labour wages restricts the farmers to opt for chemical weed control over hand weeding which is not economical in the current context (Ahmed *et al*., 2021) and weed control by herbicides is considered as the most economical way (Saha *et al*., 2021). So, the herbicides besides providing good weed control, it should also improve crop yield and economical returns.

## MATERIAL AND METHODS

A field investigation was conducted during summer, 2021 at Zonal Agricultural Research Station (ZARS), Gandhi Krishi Vignana Kendra (GKVK), University of Agricultural Sciences, Bengaluru coming under Eastern Dry Zone of Karnataka. The experiment was laid out in RCBD with 12 treatments replicated thrice. The treatments were *viz*., bensulfuron methyl + pretilachlor 660 g ha$^{-1}$ as pre emergence; pyrazosulfuron ethyl 40 g ha$^{-1}$ as pre emergence;

oxadiargyl 100 g $ha^{-1}$ pre emergence; bispyribac sodium 40 g $ha^{-1}$ as post emergence; quizolofop-p-ethyl 37.5 g $ha^{-1}$ as post emergence; cyhalofop-p-butyl 100 g $ha^{-1}$ as post emergence; metamifop 100 g $ha^{-1}$ as post emergence; *Leucas aspera* plant extract; *Eucalyptus* leaf extract; *Hyptissaveolensis* plant extract; hand weeding at 20 and 40 DAS and unweeded control. The herbicides were applied using spray volume of 750 $Lha^{-1}$ for pre emergence and 500 L $ha^{-1}$ for post emergence with knapsack sprayer having flood jet nozzle. The allelochemical plant extracts were applied at 10 % w/v as post emergence application.

Rice variety '*MAS 946-1*' was line sown by providing a space of 30 cm between the roes and the recommended dose of fertilizer *i.e.*, 100-50-50 kg of N, $P_2O_5$ and $K_2O$ was applied with three splits of nitrogen. The crop is irrigated thrice a week to meet crop water demand. Observations on yield attributes *viz*., productive tillers per meter row length, panicle length, panicle weight per meter row length, 1000 grain weight, total number of grains $panicle^{-1}$, number of filled grains $panicle^{-1}$, number of unfilled grains $panicle^{-1}$, per cent chaffiness and grain and straw yield were recorded at harvest. The weed control efficiency is calculated based on the weed dry weight data at harvest. The economics were worked out based on the cost of inputs, labour charges and prices of outputs during the course of investigation. All the data presented in this paper was the mean of two seasons and the results are presented and discussed at a probability level of 5 %.

## RESULTS AND DISCUSSION

**Weed control efficiency.** The crop yield is directly proportional to weed control efficiency (Table 2) in any crop. Among herbicide treatments, highest weed control efficiency was recorded with bispyribac sodium 40 g $ha^{-1}$ as post emergence (71.15 %) followed by bensulfuron methyl + pretilachlor 660 g $ha^{-1}$ as pre emergence (69.91 %). Higher weed control efficiency in these treatments were due to better reduction in the total weed dry weight because of effective suppression of weeds. Bhuiyan and Mahbub (2021) also reported that these herbicides have good weed control efficiency.

**Yield Attributes:**

Among all the herbicide treatments, bispyribac sodium 40 g $ha^{-1}$ as post emergence (Table 1) had recorded significantly higher productive tillers per meter row length (175.7), panicle length (19.66 cm), panicle weight per meter row length (109.8g), total number of grains $panicle^{-1}$ (67.06), filled grains $panicle^{-1}$ (63.94) and 1000 grain weight (21.37g) and lower number of unfilled grains $panicle^{-1}$ (3.12) and percent chaffiness (4.7 %). All those yield attributes were on par with bensulfuron methyl + pretilachlor 660 g $ha^{-1}$ (169.7, 19.32 cm, 107.5 g, 64.38, 60.08, 21.36 g, 4.30 and 6.7 %, respectively) and hand weeding at 20 and 40 DAS (179.8, 19.83 cm, 112.0 g, 68.63, 65.67, 21.43 g, 2.96 and 4.3%, respectively). The results are in agreement with the findings of Yogananda *et al*. (2017) who also reported that herbicides, bispyribac sodium and bensulfuron methyl + pretilachlor was highly effective in improving the yield attributes of direct seeded rice due to efficient reduction in the growth of weeds. Unweeded control has recorded lowest yield attributes (Yogananda *et al*., 2017).

**Yield.** Grain yield and straw yield of direct seeded ricewere significantly influenced by the different weed management practices (Table 2). Among the different herbicide treatments, bispyribac sodium 40 g $ha^{-1}$ as post emergence recorded higher grain yield (4994 kg $ha^{-1}$) and straw yield (6916 kg $ha^{-1}$) and found to be statistically on par with bensulfuron methyl + pretilachlor 660 g $ha^{-1}$ as pre emergence (4940 and 6820 kg $ha^{-1}$, respectively) and hand weeding at 20 and 40 DAS (5213 and 7045 kg $ha^{-1}$, respectively). Significantly higher grain yield in bispyribac sodium and bensulfuron methyl + pretilachlor was due to higher yield attributes which were attained these respective treatments. Similar improvement in yield and yield attributing parameters was also reported by Prakash *et al*. (2017); Yogananda *et al*. (2021). Unweeded control has recorded lowest grain and straw yield.

**Table 1: Yield parameters of summer direct seeded rice as influenced by different weed management practices.**

| Treatments | Productive tillers per meter row length | Panicle length (cm) | Panicle weight (g) per meter row length | 1000 grain weight (g) | Total no. of grains $panicle^{-1}$ | No. of filled grains $panicle^{-1}$ | No. of unfilled grains $panicle^{-1}$ | Per cent chaffiness |
|---|---|---|---|---|---|---|---|---|
| Bensulfuron methyl + pretilachlor 660 g $ha^{-1}$ as pre emergence | 169.7 | 19.32 | 107.5 | 21.36 | 64.38 | 60.08 | 4.30 | 6.7 |
| Pyrazosulfuron ethyl 40 g $ha^{-1}$ as pre emergence | 167.3 | 19.23 | 101.3 | 21.31 | 64.31 | 59.08 | 5.22 | 8.1 |
| Oxadiargyl 100 g $ha^{-1}$pre emergence | 165.2 | 18.87 | 98.2 | 21.31 | 63.46 | 57.85 | 5.60 | 8.8 |
| Bispyribac sodium 40 g $ha^{-1}$ as post emergence | 175.7 | 19.66 | 109.8 | 21.37 | 67.06 | 63.94 | 3.12 | 4.7 |
| Quizalofop-p-ethyl 37.5 g $ha^{-1}$ as post emergence | 141.2 | 17.52 | 90.0 | 21.21 | 53.50 | 44.73 | 8.77 | 16.4 |
| Cyhalofop-p-butyl 100 g $ha^{-1}$ as post emergence | 155.5 | 17.72 | 95.5 | 21.23 | 53.28 | 47.01 | 6.27 | 11.8 |
| Metamifop 100 g $ha^{-1}$ as post emergence | 160.2 | 19.17 | 93.4 | 21.32 | 63.24 | 57.18 | 6.06 | 9.6 |
| *Leucas aspera* plant extract | 123.2 | 15.72 | 83.5 | 20.81 | 50.76 | 38.78 | 11.98 | 23.6 |
| *Eucalyptus* leaf extract | 142.6 | 17.04 | 89.1 | 21.13 | 49.25 | 40.01 | 9.24 | 18.8 |
| *Hyptis suaveolens* plant extract | 130.0 | 16.66 | 86.3 | 20.96 | 51.07 | 39.62 | 11.45 | 22.4 |
| Hand weeding at 20 and 40 DAS | 179.8 | 19.83 | 112.0 | 21.43 | 68.63 | 65.67 | 2.96 | 4.3 |
| Unweeded control | 73.3 | 14.31 | 56.8 | 20.09 | 52.82 | 34.62 | 18.20 | 34.5 |
| S.Em± | 4.11 | 0.23 | 2.75 | NS | 1.55 | 2.11 | 0.49 | NA |
| LSD (p=0.05) | 12.05 | 0.68 | 8.07 | | 4.54 | 6.18 | 1.44 | |

**Table 2: Grain, straw yield and weed control efficiency of summer direct seeded rice as influenced by different weed management practices.**

| Treatments | Grain yield (kg ha$^{-1}$) | Straw yield (kg ha$^{-1}$) | Weed control efficiency (%) |
|---|---|---|---|
| Bensulfuron methyl + pretilachlor 660 g ha$^{-1}$ as pre emergence | 4940 | 6820 | 69.91 |
| Pyrazosulfuron ethyl 40 g ha$^{-1}$ as pre emergence | 4850 | 6687 | 68.66 |
| Oxadiargyl 100 g ha$^{-1}$pre emergence | 4624 | 6679 | 64.23 |
| Bispyribac sodium 40 g ha$^{-1}$ as post emergence | 4994 | 6916 | 71.15 |
| Quizalofop-p-ethyl 37.5 g ha$^{-1}$ as post emergence | 3877 | 5946 | 53.56 |
| Cyhalofop-p-butyl 100 g ha$^{-1}$ as post emergence | 3911 | 5978 | 57.69 |
| Metamifop 100 g ha$^{-1}$ as post emergence | 4285 | 6028 | 58.91 |
| *Leucas aspera* plant extract | 2215 | 4208 | 46.35 |
| *Eucalyptus* leaf extract | 3672 | 5515 | 51.46 |
| *Hyptis suaveolens* plant extract | 3038 | 4718 | 48.10 |
| Hand weeding at 20 and 40 DAS | 5213 | 7045 | 78.02 |
| Unweeded control | 702 | 1500 | - |
| S.Em± | 110 | 130 | NA |
| LSD (p=0.05) | 322 | 381 | |

**Table 3: Economics of summer direct seeded rice as influenced by different weed management practices.**

| Treatments | Cost of cultivation (Rs. ha$^{-1}$) | Gross returns (Rs. ha$^{-1}$) | Net returns (Rs. ha$^{-1}$) | B:C ratio |
|---|---|---|---|---|
| Bensulfuron methyl + pretilachlor 660 g ha$^{-1}$ as pre emergence | 34221 | 87733 | 53512 | 2.56 |
| Pyrazosulfuron ethyl 40 g ha$^{-1}$ as pre emergence | 34075 | 86127 | 52052 | 2.53 |
| Oxadiargyl 100 g ha$^{-1}$pre emergence | 34163 | 82725 | 48562 | 2.42 |
| Bispyribac sodium 40 g ha$^{-1}$ as post emergence | 34554 | 88735 | 54181 | 2.57 |
| Quizalofop-p-ethyl 37.5 g ha$^{-1}$ as post emergence | 34456 | 70043 | 35587 | 2.03 |
| Cyhalofop-p-butyl 100 g ha$^{-1}$ as post emergence | 32918 | 70620 | 37702 | 2.15 |
| Metamifop 100 g ha$^{-1}$ as post emergence | 34052 | 76325 | 42273 | 2.24 |
| *Leucas aspera* plant extract | 32911 | 41635 | 8724 | 1.27 |
| *Eucalyptus* leaf extract | 32911 | 66108 | 33197 | 2.01 |
| *Hyptis suaveolens* plant extract | 32911 | 55004 | 22093 | 1.67 |
| Hand weeding at 20 and 40 DAS | 39311 | 92289 | 52978 | 2.35 |
| Unweeded control | 29310 | 13530 | -15780 | 0.46 |

**Economics.** The main aim of any agricultural technology/practice is to obtain maximum economic returns per rupee invested. Economics gives a clear idea about the optimum level of input to be used for obtaining maximum profit. Out of all the treatments, highest cost of cultivation was recorded with hand weeding at 20 and 40 DAS (Table 3) due to higher labour wages for hand weeding and with the benefit of higher yield, the same treatment recorded highest gross returns (Rs. 92289ha$^{-1}$). But, when net returns and B:C ratio is considered then bispyribac sodium 40 g ha$^{-1}$ as post emergence (Rs. 54181ha$^{-1}$ and 2.57, respectively) was superior followed by bensulfuron methyl + pretilachlor 660 g ha$^{-1}$ as pre emergence (Rs. 53512ha$^{-1}$ and 2.56, respectively). The results are in accordance with Singh *et al.* (2016); Yogananda *et al*. (2021). The lowest net returns (Rs. -15780ha$^{-1}$) and B:C ratio (0.46) were reported in unweeded control (Barla *et al*., 2021).

## CONCLUSION

From this present study, it can be inferred that, under the present scenario of labour scarcity and high labour wages, application of bispyribac sodium 40 g ha$^{-1}$ as post emergence or bensulfuron methyl + pretilachlor 660 gha$^{-1}$ as pre emergence were reported to recoded higher weed control efficiency, yield attributes, grain yield as well monitory returns in summer direct seeded rice.

## FUTURE SCOPE

Even though the chemical weed management by herbicides were highly effective it cannot be adoptable under organic farming. Hence, there is a need to focus on allelochemical weed control for higher productivity and economics. Use of *Eucalyptus* leaf extract for organic weed management needs to be further investigated.

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**Conflict of interest.** None.

## REFERENCES

Ahmed, S., Kumar, V., Alam, M., Dewan, M. R., Bhuiyan, K.A., Miajy, A. A., Saha, A., Singh, S., Timsina, J. and Krupnik, T. J. (2021). Integrated weed management in transplanted rice: options for addressing labor constraints and improving farmers' income in Bangladesh. *Weed Technology*, *35*(5), 697-709.

Bhuiyan, M. K. A. and Mahbub, M. M. (2021). Weed persistence, crop resistance and pitytotonic effects of new molecule herbicides in transplanted rice. *Bangladesh Journal*, *7*(1&2), 85-90.

Chhokar, R. S., Sharma, R. K., Gathala, M. K. and Pundir, A. K. (2014). Effect of crop establishment techniques on weeds and rice yield. *Crop Protection, 64*, 7–12.

Kumar, R., Singh, A. K., Shanker, R., Singh, A. K., Bhushan, S., Kumawat, N., Singh, N. K. and Singh, A. K. (2022). Weed management practices on crop productivity and economics in dry-direct seeded rice under hill and plateau region of eastern India: Weed management practices on productivity of direct seeded rice. *Journal of Agri Search, 9*(1), 12-15.

Kachroo, D. and Bazaya, B. R. (2011). Efficacy of different herbicides on growth and yield of direct wet seeded rice sown through drum seeder. *Indian Journal of Weed Science, 43*(1&2), 67-69.

Nawaz, A., Rehman, A.U., Rehman, A., Ahmad, S., Siddique, K.M. and Farooq, M. (2022). Increasing sustainability for rice production systems. *Journal of Cereal Science, 103*, 103-108.

Pandey, S. and Velasco, L. (2002). Economics of direct seeding in Asia: patterns of adoption and research priorities. In: Proceedings of the International Workshop on Direct Seeding in Asian Rice Systems: Strategic Research Issues and Opportunities. 25-28th January 2002, Bangkok, Thailand. International Rice Research Institute, Los Banos, Philippines, pp: 3-14.

Prakash, J., Singh, R., Yadav, R. S., Vivek, Yadav, R. B., Dhyani, B. P. and Sengar, R. S. (2017). Effect of different herbicide and their combination on weed dynamics in transplanted rice. *Research Journal of Chemistry and Environmental Science, 5*(4), 71-75.

Roy, J. B. (2016). Weed dynamics and yield of direct seeded upland rice (*Oryza sativa* L.) under integrated weed management practices. *M.Sc. (Agri.) Thesis*, Orissa Univ. Agric. Tech., Bhubaneswar.

Singh, V., Jat, M. L., Ganie, Z. A., Chauhan, B. S. and Gupta, R. K. (2016). Herbicide options for effective weed management in dry direct seeded rice under scented rice-wheat rotation of western Indo-Gangetic plains. *Crop Protection, 81*(5), 168-176.

Shekhawat, K., Rathore, S. S. and Chauhan, B. S. (2020). Weed management in dry direct-seeded rice: A review on challenges and opportunities for sustainable rice production. *Agronomy, 10*(9), 12-64.

Saha, S., Munda, S., Singh, S., Kumar, V., Jangde, H. K., Mahapatra, A. and Chauhan, B. S. (2021). Crop establishment and weed control options for sustaining dry direct seeded rice production in eastern India. *Agronomy, 11*(2), 389-409.

Yogananda, S. B., Thimmegowda, P. and Shruthi, G. K. (2017). Weed management effect on growth and yield of wet direct-seeded rice in Cauvery command area of Karnataka. *Indian Journal of Weed Science, 49*(3), 219-222.

Yogananda, S. B., Thimmegowda, P. and Shruthi, G. K. (2021). Weed management in wet (drum)-seeded rice under Southern dry zone of Karnataka. *Indian Journal of Weed Science, 53*(2), 117-122.

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