

## EFFECT OF NUTRIENT AND WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD PARAMETERS OF RICE GROWN UNDER SEMI DRY CONDITION SEMI DRY RICE IN CENTRAL TELANGANA ZONE

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**ABSTRACT:** A field experiment was carried out at College Farm, Agril. College, Aswaraopet, Bhadradi Kothagudem Dist. The experimental site was sandy clay loam ~~soil in texture~~. The experiment was laid out in a split plot design with three replications comprising of three nutrient (~~chemical fertilizer alone and integration of fertilizers with organic manures~~) and four weed management practices (~~Control, combination of pre/early post-emergence and post-emergence herbicides along with hand weeding~~) in rice grown under semi dry condition semi dry rice during ~~kharif 2016 and 2017. Application of integrated nutrient and weed management recorded significantly superior growth and yield parameters and yield compared to sole application of herbicides or control.~~ Plant height, dry matter production, no. of panicles  $m^{-2}$ , no. of filled grains panicle $^{-1}$ , test weight (g), grain and straw yield (t) and harvest index (t) were higher with 75% RDF + 25% N through vermicompost and control of weeds by Bispyribac sodium 10% SC @25 g ha $^{-1}$  (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha $^{-1}$  + 2, 4-D 80% WP @ 0.5 kg a.i ha $^{-1}$ ) + HW @ 50 DAS at par with 75% RDF + 25% N through FYM and Bispyribac sodium 10% SC @25 g ha $^{-1}$  (Pre-Emg.) fb Hand weeding @ 20, 40 DAS as compared to 100% RDF and control.

**Key words:** Nutrient, weed, dry matter, grain yield, semi dry rice.

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**INTRODUCTION:** Globally in 2020, rice ~~was is~~ grown in an ~~area aereage~~ of 162.06 M ha with production of 755.47 M t and productivity of 4.66 t ~~kg t~~ ha $^{-1}$  (FAOSTAT, 2019-20). India ranks second after China with production of 177.65 million metric tons. ~~In India r~~Rice occupies an area of 43.66 M ha with production and productivity of 118.87 M t and 2.723 ~~kg t~~ ha $^{-1}$ , respectively ~~in India,~~ whereas in Telangana, it is grown in an area of 3.19 M ha with production of 11.12 M t and productivity of 3.483 ~~kg t~~ ha $^{-1}$  (CMIE, 2019-20).

Rice plays a unique role in Indian economy among South Asian countries. Major share of rice is cultivated during *kharif* season. Several constraints ~~involved with are associated with~~ transplanted puddled rice ~~owing to its are~~ large water demand (1000–2000 mm) ~~for puddling and continuous flooding,~~ high energy requirement of 5630–8448 MJ ha $^{-1}$  and 15–20% higher labor inputs (Saharawat *et al.*, 2010) compared to direct-seeded rice, which made it unaffordable for small and marginal farmers of Southeast Asia (Bhatt *et al.*, 2016). To overcome these difficulties, semi dry rice is the better alternate option in boosting the crop productivity and maintaining national food security.

Semi dry rice (Dry direct seeded) is a rice cultivation system during which crop is exposed to that is connected with upland conditions in early growth phase ~~of crop growth~~ and low land conditions in later stages. In semi dry system, rice is treated as rainfed crop for 40-45 days before being switched to wet crop, when enough water is available (Chatterjee and Maiti, 1985). It is especially important when canal water is not released in time, delaying transplanting of rice.

Both crop and weeds respond to increase in soil fertility. ~~Initial dose of nitrogen fertilizer may be delayed and usage of organic manures starve the weed growth initially.~~ Integrated nutrient management is regarded as a valuable tool for small and marginal farmers to increase crop yield and profitability on a long-term basis (Choudhary and Suri, 2014). In semi dry rice, due to the concurrent crop and weed growth, absence of standing water in the initial crop establishment phase, aggravates weed insurgence. Efficient weed management is a key to success in semi dry rice (Kapila Shekawat *et al.*, 2020).

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**MATERIALS AND METHODS:** A field experiment was carried out at College Farm, Agricultural College, Aswaraopet, Bhadradi Kothagudem District, Professor Jayashankar Telangana State Agricultural University ~~on in~~ semi dry rice as influenced by nutrient and weed management practices during *kharif* 2016 and 2017. The experimental site was situated at an altitude of 162 m above mean sea level at 17 $^{\circ}$ 24'54" N latitude and 81 $^{\circ}$ 10'34" E longitude. Total precipitation received during the

cropping period was 524.60 mm and 572.8 mm in 30 and 32 rainy days in 2016 and 2017 respectively. During two years of the crop growth period, congenial weather conditions was prevailed. The soil of the experimental plot was textural class of soil was sandy clay loam in texture, soil with low nitrogen (N), medium in phosphorus (P) and available potassium (K). The experiment was laid out in split plot design with main plots as three levels of nutrient management as main plot treatment (M<sub>1</sub> - 100% RDF, M<sub>2</sub> - 75% RDF + 25% N through vermicompost and M<sub>3</sub> - 75% RDF + 25% N through FYM) while, subplots consisted of four weed management practices i.e. S<sub>1</sub> - Control, S<sub>2</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> pre-emergence (Pre-Emg.) fb Hand weeding @ 20, 40 DAS, S<sub>3</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> as early post emergence (Early Post-Emg.) fb (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS and S<sub>4</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2,4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS. Sowing of rice variety (KNM-118) variety was done by following the spacing 20 cm x 15 cm with a seed rate of 50 kg ha<sup>-1</sup> in the first fortnight of July. A knapsack sprayer with a flat fan nozzle adjusted to deliver 500 litres of water per hectare was used to apply herbicides. Nitrogen, phosphorus and potassium in the form of Through-urea, SSP and muriate of potash were applied as per treatment, the recommended dose of fertilizer (RDF) for the crop was 100: 50: 40 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O kg ha<sup>-1</sup>. Nitrogen and potassium were applied in three and two equal splits at At the time of sowing, maximum tillering and panicle initiation stages, and at sowing and panicle initiation stages, respectively. Nitrogen was supplied in three equal splits. Potassium was applied in two splits at the time of sowing and panicle initiation stages, while as phosphorus was applied in a single dose as a basal dose at sowing. Zinc sulphate @ 5 kg ha<sup>-1</sup> along with 20 kg urea was dissolved in 500 l ha<sup>-1</sup> of water and sprayed at 25 and 40 days after sowing (DAS) to control khaira (Zn deficiency). Ferrous sulphate @ 5 g l<sup>-1</sup> was sprayed with 1 g citric acid at 15 DAS to ameliorate iron deficiency.

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Plant height of the semi dry rice was measured with the help of a meter scale from the bottom base of the plant to top of the longest leaf at 30, 60, 90 DAS and up to tip of the panicle at the time of harvest. Five hills were selected from each plot randomly and mean height was calculated and expressed in cm. Five destructive samples were collected from the third row of each plot at 30, 60 and 90 DAS and at harvest. Plant roots were removed, initially sun dried and then dried in hot air oven at 60°C till a constant dry weight was obtained. Later the plant dry weight is converted and expressed in kg ha<sup>-1</sup>.

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The number of panicles were recorded from each plot at harvesting within the net plot by using a quadrat of size 50 cm x 50 cm (0.25 m<sup>2</sup>) in the area marked for observations and expressed as number of panicles m<sup>-2</sup>. Five panicles were collected randomly from the net plot and filled grains from each panicle were counted separately and average filled grains panicle<sup>-1</sup> was reported. A random sample of dried seed was taken from each treatment plot and 1000 grains were counted and the weight was recorded in grams.

Grain yield was recorded separately from each treatment's net plot area and converted to per hectare yield, after which the grain was sun-dried to moisture content of 12 percent, later, cleaned, weighed, and expressed in kg ha<sup>-1</sup>. After separating the grains, left over straw from each net plot treatment was sun dried until a constant weight and yield per plot was recorded and expressed in kg ha<sup>-1</sup>. The straw harvested from the net plot area of each treatment was sun dried until constant weight and yield per plot was recorded and expressed in kg ha<sup>-1</sup>. The grain and straw yield from the net plot area of each treatment was computed and expressed in kg ha<sup>-1</sup>.

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Harvest index was calculated by using the following formula

$$HI (\%) = \text{Grain yield (kg ha}^{-1}\text{)} / \text{Biological yield (kg ha}^{-1}\text{)} \times 100$$

$$\text{Where, biological yield} = \text{Grain yield (kg ha}^{-1}\text{)} + \text{Straw yield (kg ha}^{-1}\text{)}$$

## RESULTS AND DISCUSSION:

**Plant height (Cm):** The results of different nutrient and weed management practices significantly influenced the During both years of experimentation plant height of semi dry rice cultivated under semi dry condition was significantly influenced by nutrient and weed management practices during kharif 2016 and 2017 at harvest. Taller plants were produced during kharif 2017 as compared to 2016 presented in table 1.

Taller plants were observed with M<sub>2</sub> [75% RDF + 25% N through vermicompost] (95.6 cm) followed by M<sub>3</sub> [75% RDF + 25% N through FYM] at harvest (89.9 cm) in kharif 2017, while shorter

plants were observed with M<sub>1</sub> [100% RDF] at harvest. The main plot treatments of rice crop sown in 2016 showed a similar trend of linear increase in plant height.

Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS {S<sub>4</sub>} treatment substantially generated taller plants at harvest (101.0 cm) in 2017, which was statistically similar to plant height of treatment with Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS {S<sub>2</sub>} at harvest (93.2 cm). Dwarf plants were reported by control treatment {S<sub>1</sub>}. In *khariif* 2016, there was no change in the trend of plant height among sub plots.

It is evident from the ~~table 4~~ data (Table 1), interaction effect between nutrient and weed management practices on plant height of semi dry rice was found to be non-significant at ~~all growth intervals~~ during both the years.

Integration of inorganic and organic manures improved root penetration, nutrients and moisture absorption thus accelerating cell division, elongation and plant height as corroborated by Siddaram *et al.* (2017) and Supreet Sanjan *et al.* (2018).

Efficient weed ~~control~~ practices ~~had ameliorated field conditions~~ reduced ~~ing~~ crop weed competition for resources and thereby ~~resulting in to enhancing~~ maximum plant growth as stated by Choudhary and Anil (2018) and Pooja and Saravanne (2021).

**Dry matter production (kg ha<sup>-1</sup>):** During both years of study, ~~drymatter production was significantly influenced by nutrient and weed management practices there was a significant variation in nutrient and weed practices relevant to dry matter production in semi dry rice~~ at harvest, ~~as shown in the (Table 1).~~

During *khariif* 2017, 75% RDF + 25% N through vermicompost *i.e.* M<sub>2</sub> ~~produced supplied~~ higher dry matter at harvest (9086 kg ha<sup>-1</sup>) than M<sub>3</sub> [75% RDF + 25% N through FYM] (8474 kg ha<sup>-1</sup>). The chemically fertilized treatment *i.e.* M<sub>1</sub> [100% RDF] yielded lesser dry mater of 7271 kg ha<sup>-1</sup>. In 2016, *khariif* rice produced similar dry matter production results.

~~According to statistical analysis of W~~weed management practices ~~significantly influenced the on rice~~ dry matter production ~~during both years of experimentation. Maximum dry matter production (10602 kg ha<sup>-1</sup>) was recorded by in khariif 2017, S<sub>4</sub> [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS) + HW @ 50 DAS] followed by accerued higher dry matter at harvest (10602 kg ha<sup>-1</sup>) than S<sub>2</sub> [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS] (10017 kg ha<sup>-1</sup>) and S<sub>3</sub> [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Early Po Emg.) fb (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS] and S<sub>1</sub> [Control] produced the lowest dry matter of 4631 kg ha<sup>-1</sup>. ~~was recorded in S1 (control). In khariif 2016, a similar pattern of results was observed.~~~~

The availability of continuous, slow and adequate nutrients through ~~integration of organics and inorganic sources s~~, increased cell division, ~~cell~~ elongation and various metabolic processes, ~~culminating in to such as photosynthesis resulted~~ in taller plants with more tillers and larger leaf area, which ultimately produced the highest dry matter accumulation. The findings agree with Shalini *et al.* (2017) and Ajmal (2020).

Effective weed management combined with chemical and physical approaches, according to Priyanka *et al.* (2019) and Soujanya (2020), removed weeds and made better use of available resources during critical period of crop weed competition, favouring increased dry matter production.

**No. of panicles (m<sup>-2</sup>):** A significant difference in no. of panicles m<sup>-2</sup> was noticed among nutrient and weed management treatments as well as their interaction effect in *khariif* 2016 and 2017 (Table 1).

Data associated with nutrient treatments tested, M<sub>2</sub> [~~75% RDF + 25% N through vermicompost~~] produced maximum no. of panicles m<sup>-2</sup> (214.2, 220.5) during 1<sup>st</sup> and 2<sup>nd</sup> year of experimentation, ~~respectively~~ which was at par with M<sub>3</sub> [~~75% RDF + 25% N through FYM~~] (206.4, 214.9). Minimum no. of panicles m<sup>-2</sup> was generated with M<sub>1</sub> [100% RDF] (181.7, 187.9).

Out of four weed management practices, Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS had put forth more no. of panicles m<sup>-2</sup> (235.0, 243.5) during ~~khariif~~ 2016 and 2017 which was statistically similar with Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS (230.6, 239.1). In both years, Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Early Po Emg.) fb

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**Comment [L16]:** Not clear, from the table, since data has not been reflected at different growth stages, the results reflect ambiguity, which should be avoided.

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(Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS yielded considerably more no. of panicles m<sup>-2</sup> (188.6, 196.0) than Control.

Better performance of integrated application of inorganic fertilizers and organic manures was due to continuous and adequate supply of nutrients at every phenophase, improving photosynthetic efficiency, higher LAI thereby better translocation of photosynthates from source to sink leading to higher no. of panicles m<sup>-2</sup> as reported by Anusha (2016) and Siddaram *et al.* (2017).

Higher no. of panicles m<sup>-2</sup> produced was due to efficient weed control through critical period of crop weed competition led to maximum LAI and extended availability of nutrients during reproductive phase, assimilate partitioning to the sink, ultimately contributed for maximum tillers and higher no. of panicles m<sup>-2</sup>. These results are corroborated by Chakraborti (2017) and Goswami *et al.* (2018).

**No. of filled grains panicle<sup>-1</sup>:** Nutrient and weed management practices significantly influenced the number of filled grains panicle<sup>-1</sup> of semi-dry rice during both years of investigation. Results are presented in the table 1.

In terms of nutrient management practices of two years, M<sub>2</sub> recorded significantly higher number of filled grains i.e. 75% RDF + 25% N through vermicompost (86.7, 90.8) though remaining at par with M<sub>3</sub> had given rise to highest number of filled grains panicle<sup>-1</sup>, proportionate to M<sub>3</sub> i.e. (84.7, 88.2) but and significantly superior to M<sub>1</sub> [100% RDF] (77.0, 79.0) in two successive years.

With regard to weed management practices, greater number of filled grains were registered in S<sub>4</sub> treatment [Bispyribac sodium 10 SC 25 g ha<sup>-1</sup> (PE) fb (Pyrazosulfuron ethyl + 2, 4 D) + HW at 50 DAS] (92.6, 97.7) though remaining at par with S<sub>2</sub> resulted in higher number of filled grains panicle<sup>-1</sup> and comparable to Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS (S<sub>2</sub>) (91.3, 95.0) but significantly superior to others, and the lowest number of filled grains panicle<sup>-1</sup> was registered with control i.e. S<sub>1</sub> (66.7, 67.7) over two years.

Interaction of main and subplot treatments on number of filled grains panicle<sup>-1</sup> was not significant in both the years.

Increased chlorophyll concentration in leaves and optimal nutrient balance between source and sink might have enhanced photosynthates transfer of photosynthates to grain resulting in proper grain filling development. These results are in conformity with findings of Supreet Sanjan *et al.* (2018) and Pandit *et al.* (2020).

There were more number of filled grains in S<sub>4</sub> due to adequate availability of growth resources as a result of decreased weed competition and greater photosynthates transfer. Similar findings were observed by Murali *et al.* (2017) and Lokesh *et al.* (2021).

**Test Weight (g):** There was no significant difference on test weight with nutrient management practices during both years. However, significance was noticed with test weight of weed management practices presented in table 1.

Nutrient management practices did not exert any significant influence on test weight of semi-dry rice during both the years of field study (Table 1). However weed management practices did influence the test weight significantly during both years.

Significant difference was observed by weed management practices with test weight during both years. Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS registered higher test weight of 22.3 and 22.7 g followed by Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS i.e. S<sub>2</sub> (22.0, 22.6 g) and Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Early Po Emg.) fb (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS (21.9, 22.7 g). Lower test weight of 18.4 and 19.3 g was recorded by S<sub>1</sub> which was significantly inferior to the other weed management practices.

There was non-significant interaction effect on test weight with nutrient and weed management practices during both the years.

Weed free environment, especially during critical stages of crop growth, had resulted in adequate photosynthates and translocation from source to sink and thus lead to increased test weight as suggested by Dibakar *et al.* (2016), Sylvestre *et al.* (2019) and Srinivasa Rao *et al.* (2019).

**Grain yield (kg ha<sup>-1</sup>):** During both years of of experimentaion/kharif 2016 and 2017, the impact of nutrient and weed management practices on rice grain yield and their interaction was noteworthy.

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Grain yield was higher in *kharif* 2017 due to higher rainfall as compared to 2016 year as presented in table 1.

Amongst nutrient management practices, 75% RDF + 25% N through vermicompost ( $M_2$ ) yielded highest grain yield of 4060 and 4436 kg ha<sup>-1</sup> which was comparable with 75% RDF + 25% N through FYM *i.e.*  $M_3$  (3702, 4270 kg ha<sup>-1</sup>),  $M_1$  treatment with 100% RDF yielded the lowest yield of 3198 and 3467 kg ha<sup>-1</sup> during *kharif* 2016 and 2017.

During *kharif* 2016 and 2017, Highest grain yields of 4845 and 5400 kg ha<sup>-1</sup> was achieved by  $S_4$  [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS] and was statistically equivalent with  $S_2$  [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS] (4619 and 5133 kg ha<sup>-1</sup>). Unlike  $S_4$ , the control treatment had minimum yield of 1828 and 1983 kg ha<sup>-1</sup>.

Combination with 75% RDF and 25% N through vermicompost or FYM provided slow and continuous release of better nutrients to crop at different growth intervals, allowing the crop to assimilate adequate photosynthetic products, resulting in increased dry matter, source and sink capacity and ultimately yield. The findings agreed with those of Gayatri *et al.* (2017) and Rishikesh *et al.* (2020).

An integrated weed management approach with the hand weeding and herbicides with different mode of actions to combat weed menaces in semi dry rice and prevent changes in weed community structure throughout the crop growth period might have improved source and sink capacity *viz.*, no. of panicles m<sup>-2</sup> and total no. of grains panicle<sup>-1</sup>, which expedited higher production of yield as stated by Priyanka *et al.* (2019) and Abhinandan Singh and Pandey (2019).

**Straw Yield (Kg ha<sup>-1</sup>):** During both years of the experiment, the straw yield of semi dry rice was statistically different, however, interaction effect was not significant with nutrient and weed management practices following an unchanging pattern as presented in the table 1.

$M_2$  *i.e.* 75% RDF + 25% N through vermicompost increased straw yield (4850, 5235 kg ha<sup>-1</sup>) to statistically comparable level with  $M_3$  [75% RDF + 25% N through FYM] (4635, 5039 kg ha<sup>-1</sup>). During the two-year study, the chemically fertilized treatment yielded less straw of 4131, 4346 kg ha<sup>-1</sup>.

Apart from nutrient practices, over two successive years,  $S_4$  *i.e.* Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS produced higher straw yields of 5452 and 5929 kg ha<sup>-1</sup> as compared to  $S_2$  [Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS] (5333, 5776 kg ha<sup>-1</sup>), respectively.  $S_3$  *i.e.* Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Early Po Emg.) fb (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS was the next best treatment, with straw yields of 4530 and 4796 kg ha<sup>-1</sup>. The control treatment,  $S_1$ , produced the least amount of straw (2839, 2993 kg ha<sup>-1</sup>).

In neither of the two years, there was interaction effect of nutrient and weed management practices on straw yield.

Enhanced nutrient supply had improved metabolic activity and cell division, leading to increased growth traits such as plant height, leaf area, number of tillers and higher dry matter production, resulting in higher rice straw output. Meena *et al.* (2019) found similar results.

Luxuriant crop growth with higher plant height, leaf area, number of tillers and higher dry matter production, coupled with less crop weed competition at critical growth stages, resulted in higher straw yield. The control produced the lowest straw yield of rice due to intense weed competition for growth resources, and thereby lowered straw yield. The results of this study agree with those of Sylvestre *et al.* (2019) and Neha Sharma *et al.* (2021).

**Harvest Index:** Only weed management practices had substantial impact on harvest index, and no significant differences were seen with nutrient treatments, and interaction effect was not statistically detectable across the two-year study period presented in table 1.

There was non-significant difference found on harvest index with different nutrient treatments.

Regarding weed practices, Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb (Pyrazosulfuron ethyl 10 % WP @ 25 g ha<sup>-1</sup> + 2, 4-D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW @ 50 DAS { $S_4$ } recorded highest harvest index of 47.1 and 47.6% followed by Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) fb Hand weeding @ 20, 40 DAS { $S_2$ } (46.6, 47.0%) and Bispyribac sodium 10%

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SC @25 g ha<sup>-1</sup> (Early Po Emg.) fb (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 - D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35 - 40 DAS {S<sub>3</sub>} (42.9, 43.6%). During both years of study, lowest harvest index was found with control treatment (38.3, 39.4%).

Control of weed population reduced competition for resources which lead to high dry matter accumulation, grain and straw output. Results are in accordance with Srinivas Rao *et al.* (2019) and Lokesh *et al.* (2021).

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**Table 1: Growth and yield attributes of semi dry rice as influenced by nutrient and weed management practices during *kharif*, 2016 & 2017.**

Treatments	Plant height (Cm)		Dry matter (kg ha <sup>-1</sup> )		No. of panicles (m <sup>-2</sup> )		No. of filled grains panicle <sup>-1</sup>		Test weight (g)		Grain yield (kg ha <sup>-1</sup> )		Straw yield (kg ha <sup>-1</sup> )		Harvest index (%)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
<b>Main plots: Nutrient Management (M)</b>																
M <sub>1</sub>	78.1	80.3	6864	7271	181.7	187.9	77.0	79.0	22.1	22.6	3197	3467	4131	4346	42.7	43.5
M <sub>2</sub>	92.9	95.6	8567	9086	214.2	220.5	86.7	90.8	20.9	21.2	4060	4436	4850	5235	44.9	44.7
M <sub>3</sub>	87.4	89.9	8000	8474	206.4	214.9	84.7	88.2	20.3	21.6	3702	4270	4635	5039	43.4	45.0
Sem±	2.14	2.19	194	200	4.83	5.86	1.92	2.16	0.46	0.53	100	108	138	131	1.4	0.5
CD ( <i>P</i> =0.05)	8.4	8.6	761	786	19.0	23.0	7.5	8.5	NS	NS	394	425	542	513	NS	NS
<b>Sub plots: Weed Management (S)</b>																
S <sub>1</sub>	73.6	75.7	4371	4631	148.9	152.5	66.7	67.7	18.4	19.3	1828	1983	2839	2993	38.3	39.4
S <sub>2</sub>	90.6	93.2	9457	10017	230.6	239.1	91.3	95	22.0	22.6	4619	5133	5333	5776	46.6	47.0
S <sub>3</sub>	82.1	84.5	7417	7857	188.6	196	80.6	83.5	21.9	22.7	3320	3716	4530	4796	42.9	43.6
S <sub>4</sub>	98.2	101.0	9996	10602	235	243.5	92.6	97.7	22.3	22.7	4845	5400	5452	5929	47.1	47.6
Sem±	2.80	2.90	204	220	4.4	4.61	2.65	2.86	0.48	0.49	91	120	94	125	1.2	1.1
CD ( <i>P</i> =0.05)	8.3	8.6	606	654	13.1	13.7	7.9	8.5	1.4	1.5	270	356	280	371	3.6	3.3
<b>Interaction</b>																
<b>M × S</b>																
Sem±	4.85	5.03	353	381	7.61	7.98	4.6	4.95	0.84	0.85	157	208	163	216	2.1	1.9
CD ( <i>P</i> =0.05)	NS	NS	1050	1133	22.6	23.7	NS	NS	NS	NS	468	617	NS	NS	NS	NS
<b>S × M</b>																
Sem±	5.44	5.63	418	446	9.44	10.47	5.1	5.55	0.99	1.05	196	242	228	264	2.7	2.0
CD ( <i>P</i> =0.05)	NS	NS	1175	1246	27	30.6	NS	NS	NS	NS	560	677	NS	NS	NS	NS

**Comment [L22]:** The unit of Grain yield and straw yield should be written in t/ha , rather than kg/ha

**Comment [L23]:** It is better to place mean column, for better understanding and easy interpretation of the results.

**Nutrient Management**

M<sub>1</sub> – 100% RDF

M<sub>2</sub> – 75% RDF + 25% N through Vermicompost

M<sub>3</sub> – 75% RDF + 25% N through FYM

**Weed Management**

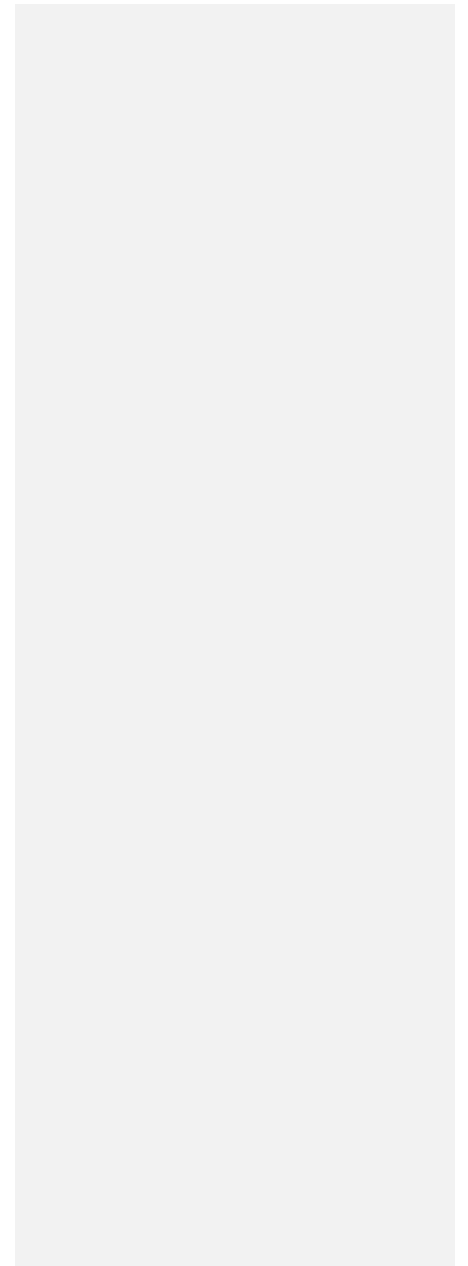
S<sub>1</sub> - Control

S<sub>2</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS

S<sub>3</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha<sup>-1</sup> + 2,4 – D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) at 35-40 DAS

S<sub>4</sub> - Bispyribac sodium 10% SC @25 g ha<sup>-1</sup> (Pre-Emg.) *fb* (Pyrazosulfuron ethyl 10% WP @ 25 g ha<sup>-1</sup> + 2, 4 – D 80% WP @ 0.5 kg a.i ha<sup>-1</sup>) + HW at 50 DAS

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