EFFECT OF NUTRIENT AND WEED MANAGEMENT PRACTICES ON GROWTH, YIELD PARAMETERS AND YIELD OF SEMI DRY RICE IN CENTRAL TELANGANA ONE

ABSTRACT: A field experiment was carried out at College Farm, Agril. College, Aswaraopet, Bhadradri Kothagudem Dist. The experimental site was sandy clay loam soil.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 weedings) in 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, grain and straw yield and harvest index were higher with 75% RDF+25% N through vermicompost and 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 DASat par with 75% RDF + 25% N through FYM and Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DASas compared to 100% RDF and control.

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

INTRODUCTION: Globally in 2020, rice is grown in an acreage of 162.06 M ha with production of 755.47 M t and productivity of 4661 kg ha^{-1} (FAOSTAT, 2019-20). India ranks second after China with production of 177.65 million metric tons. Rice occupies an area of 43.66 M ha with production and productivity of 118.87 M t and 2723 kg ha^{-1} respectively in India, whereasin Telangana, it is grown in an area of 3.19 M ha with production of 11.12 M t and productivity of 3483 kg 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 transplanted puddled rice 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.

Semidry rice (Dry direct seeded) is a system that is connected with upland conditions in early 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).

MATERIALS AND METHODS: A field experiment was carried outat College Farm, Agricultural College, Aswaraopet, Bhadradri Kothagudem District, Professor Jayashankar Telangana State Agricultural Universityin 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 $17^0$24’54” N latitude and $81^0$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 textural class of soil was sandy clay loam soil with low nitrogen, medium in available phosphorus and potassium. The experiment was laid out in split plot design with main plots as three levels of nutrient management(M_1 - 100% RDF, M_2 - 75% RDF + 25% N through vermicompost and M_3 - 75% RDF + 25% N through FYM)while, subplots consisted of four weed management practices *i.e.* S_1 – Control, S_2- Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS, S_3 - Bispyribac sodium 10% SC @25 g ha^{-1} (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1}) at 35 - 40 DAS and S_4 - 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.Sowing of KNM-118 variety was doneby following the spacing 20 cm x 15 cm with a seed rate of 50 kg ha^{-1} 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. Through urea, SSP and muriate of potash, the recommended dose of fertilizer (RDF) for the crop was 100: 50: 40 kg N, P_2O_5, K_2O kg ha^{-1}. At the sowing, maximum tillering and panicle initiation stages, nitrogen was supplied in three equal splits. Potassium was applied in two splits at the time of sowing and panicle initiation stages, while phosphorus applied as a basal dose at sowing.Zinc sulphate @ 5 kg ha^{-}

^{1}along with 20 kg urea was dissolved in 500 l ha^{-1}of water and sprayed at 25 and 40 DAS to control *khaira*(Zn deficiency). Ferrous sulphate @ 5 g l^{-1} was sprayed with 1 g citric acid at 15 DAS to ameliorate iron deficiency.

Plant height of the semi dry rice was measured with the help of a meter scale from the bottom of the plant 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 harvest. Plant roots were removed, initially sun dried and then dried in hot air oven at 60^{o}C till a constant dry weight was obtained. Later the plant dry weight was converted and expressed in kg ha^{-1}.

The number of panicles were recorded from each plot at harvesting within the net plot by using a quadrate of size 50 cm × 50 cm (0.25 m^{2}) in the area marked for observations and expressed as number of panicles m^{-2}. Five panicles were collected randomly from the net plot and filled grains from each panicle were counted separately and average filled grains panicle^{-1} 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 per cent, later, cleaned, weighed, and expressed in kg ha^{-1}. 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^{-1}. 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^{-1}. The grain and straw yield from the net plot area of each treatment was computed and expressed in kg ha^{-1}.

Harvest index was calculated by using the following formula

HI (%) = Grain yield (kg ha^{-1}) / Biological yield (kg ha^{-1})× 100

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

RESULTS AND DISCUSSION:

Plant height (Cm): The results of different nutrient and weed management practices significantly influenced the plant height of semi dry rice 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_2 [75% RDF + 25% N through vermicompost] (95.6 cm) followed by M_3 [75% RDF + 25% N through FYM] at harvest (89.9 cm) in *kharif* 2017, while shorter plants were observed with M_1 [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^{-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{S_4} 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^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS{S_2} at harvest (93.2 cm). Dwarf plants were reported by control treatment {S_1}. In *kharif* 2016, there was no change in the trend of plant height among sub plots.

It is evident from the 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 practices had ameliorated field conditions reducing crop weed competition for resources and thereby enhancing maximum plant growth as stated by Choudhary and Anil (2018) and Pooja and Saravanne (2021).

Dry matter production (kg ha^{-1}): During both years of study, there was a significant variation in nutrient and weed practices relevant to dry matter productionin semi dry rice at harvest, as shown in the table 1.

During *kharif* 2017, 75% RDF + 25% N through vermicompost *i.e.* M_2 supplied higher dry matter at harvest (9086 kg ha^{-1}) than M_3 [75% RDF + 25% N through FYM] (8474kg ha^{-1}). The chemically fertilized treatment *i.e.*M_1 [100% RDF] yielded lesser dry mater of 7271 kg ha^{-1}. In 2016, *kharif* rice produced similar dry matter production results.

According to statistical analysis of weed management practices on rice dry matter production in *kharif* 2017, S_4 [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) +HW @ 50 DAS] accrued higher dry matter at harvest (10602 kg ha^{-1}) than S_2 [Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS] (10017 kg ha^{-1}) and S_3 [Bispyribac sodium 10% SC @25 g ha^{-1} (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1})at

35 - 40 DAS] and S_1 [Control] produced the lowest dry matter of 4631kg ha^{-1}. In *kharif* 2016, a similar pattern of results was observed.

The availability of continuous, slow and adequate nutrients through organics and inorganics, increased cell division, elongation and various metabolic processes 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^{-2}): A significant difference in no. of panicles m^{-2} was noticed among nutrient and weed management treatments as well as their interaction effect in *kharif* 2016 and 2017(Table 1).

Data associated with nutrient treatments tested, M_2 [75% RDF + 25% N through vermicompost] produced maximum no. of panicles m^{-2} (214.2, 220.5) during 1st and 2nd year of experimentation which was at par with M_3 [75% RDF + 25% N through FYM] (206.4, 214.9). Minimum no. of panicles m^{-2} was generated with M_1 [100% RDF] (181.7, 187.9).

Out of four weed management practices, 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 had put forth more no. of panicles m^{-2} (235.0, 243.5) during *kharif* 2016 and 2017 which was statistically similar withBispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS (230.6, 239.1). In both years, Bispyribac sodium 10% SC @25 g ha^{-1} (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1}) at 35 - 40 DAS yielded considerably more no. of panicles m^{-2} (188.6, 196.0) than Control.

Better performance of integrated application of inorganic fertilizes 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^{-2} as reported by Anusha (2016) and Siddaram*et al*. (2017).

Higher no. of panicles m^{-2} 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^{-2}. These results are corroborated by Chakraborti (2017) and Goswami *et al*. (2018).

No. of filled grains panicle^{-1}: Nutrient and weed management practices significantly influenced the number of filled grains panicle^{-1} of semi dry rice during both years of investigation. Results are presented in the table 1.

In terms of nutrient practices of two years, M_2 *i.e.*75% RDF + 25% N through vermicompost (86.7, 90.8) had given rise to highest number of filled grains panicle^{-1}, proportionate to M_3 *i.e.*84.7, 88.2 and significantly superior to M_1 [100% RDF] (77.0, 79.0) in two successive years.

S_4[Bispyribac sodium 10 SC 25 g ha^{-1} (PE) *fb* (Pyrazosulfuron ethyl + 2, 4-D) + HW at 50 DAS] (92.6, 97.7) resulted in higher number of filled grains panicle^{-1} and comparable to Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS {S_2} (91.3, 95.0). The lowest number of filled grains panicle^{-1} was registered with control *i.e.* S_1 (66.7, 67.7) over two years.

Interaction of main and subplot treatments on number of filled grains panicle^{-1} was not significant in both the years.

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

There were more filled grains 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.

Significant difference was observed by weed management practices with test weight during both years. 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 registered higher test weight of 22.3 and 22.7 g followed by Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS*i.e.* S_2 (22.0, 22.6 g) and Bispyribac sodium 10% SC @25 g ha^{-1} (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1}) at 35 - 40 DAS(21.9, 22.7 g). Lower test weight of 18.4 and 19.3 g was recorded by S_1 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^{-1}): During *kharif* 2016 and 2017, the impact of nutrient and weed management practices on rice grain yield and their interaction was noteworthy. Grain yield was higher in *kharif* 2017due 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^{-1} which was comparable with 75% RDF + 25% N through FYM *i.e.* M_3 (3702, 4270 kg ha^{-1}), M_1 treatment with 100% RDF yielded the lowest yield of 3198 and 3467 kg ha^{-1} during *kharif* 2016 and 2017.

During *kharif* 2016 and 2017, highest grain yields of 4845 and 5400 kg ha^{-1} achieved by S_4 [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] and was statistically equivalent with S_2[Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS] (4619 and 5133 kg ha^{-1}). Unlike S_4, the control treatment had minimum yield of 1828 and 1983 kg ha^{-1}.

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 withthe 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^{-2} and total no. of grains panicle^{-1}, which expedited higher production of yield as stated by Priyanka *et al*. (2019) and Abhinandan Singh and Pandey (2019).

Straw Yield (Kg ha^{-1}): 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 patternaspresented in the table 1.

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

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

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^{-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{S_4} recorded highest harvest index of 47.1 and 47.6% followed byBispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS {S_2}(46.6, 47.0%) and Bispyribac sodium 10% SC @25 g ha^{-1} (Early Po Emg.) *fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1})at 35 - 40 DAS{S_3} (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^{-1})		No. of panicles (m^{-2})		No. of filled grains panicle^{-1}		Test weight (g)		Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Harvest index (%)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Main plots: Nutrient Management(M)																
M_1	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_2	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_3	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 (*P=0.05*)	8.4	8.6	761	786	19.0	23.0	7.5	8.5	NS	NS	394	425	542	513	NS	NS
Sub plots: Weed Management (S)																
S_1	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_2	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_3	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_4	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 (*P=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
Interaction																
M × S																
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 (*P=0.05*)	NS	NS	1050	1133	22.6	23.7	NS	NS	NS	NS	468	617	NS	NS	NS	NS
S×M																
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 (*P=0.05*)	NS	NS	1175	1246	27	30.6	NS	NS	NS	NS	560	677	NS	NS	NS	NS

Nutrient Management

M_1 – 100% RDF
M_2 – 75% RDF + 25% N through Vermicompost
M_3 - 75% RDF + 25% N through FYM

Weed Management

S_1 - Control
S_2- Bispyribac sodium 10% SC @25 g ha^{-1} (Pre-Emg.) *fb* Hand weeding @ 20, 40 DAS
S_3 - Bispyribac sodium 10% SC @25 g ha^{-1} (Early PoEmg.)*fb* (Fenoxaprop-p-ethyl @ 62.5 g a.i ha^{-1} + 2,4 – D 80% WP @ 0.5 kg a.i ha^{-1}) at 35-40 DAS
S_4 - 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 at 50 DAS