**International Archive of Applied Sciences and Technology**
Int. Arch. App. Sci. Technol; Vol 11 [3] September 2020 : 19-25

[ISO9001: 2008 Certified Organization]
www.soeagra.com/iaast.html

IAAST
ONLINE ISSN 2277- 1565
PRINT ISSN 0976 - 4828

CODEN: IAASCA ORIGINAL ARTICLE

DOI: .10.15515/iaast.0976-4828.11.3.1925

# Response of Nitrogen Scheduling and Weed Management on Weed and Growth Attributes of Direct Seeded Rice (*Oryza sativa* L.) in Central Punjab.

**Gurpreet Singh, Santosh Kumar, Parminder Kaur, Rupinder Singh, Mandeep Kaur, Chandanpreet Kaur**
Mata Gujri College, Sri Fatehgarh Sahib, Punjab – 140406, India

**ABSTRACT**
*The experiment was conduct at Experimental Farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during kharif 2018 to study the effect of nitrogen scheduling and weed management on direct seeded rice (Oryza sativa L.) under irrigated conditions in central plain region of Punjab. Experiment laid out in split plot design comprised of eighteen treatments with three replications. The results indicated that the minimum weed density, total weed dry weight and highest weed control efficiency was recorded under nitrogen schedule of ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing), which was statistically at par with ¹/₃ basal + ¹/₃ at 2 (weeks after sowing) + ¹/₃ at 6 (weeks after sowing) and significant than other nitrogen schedules. Among nitrogen scheduling the maximum plant height and plant dry matter accumulation was recorded under nitrogen schedule at ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing), which was statistically at par with 1/3 (basal) + 1/3 (2 weeks after sowing) and which was significantly superior over other treatments. In case of weed management, significantly lower weed density, dry weight and higher weed control efficiency were recorded under application of bispyribac-sodium @ 25 g ha$^{-1}$ fb carfentrazone @ 20 g ha$^{-1}$ and brown manuring + 2, 4-D @ 1 kg ha$^{-1}$, which were significantly superior over other treatments. In growth attributes the maximum plant height and plant dry matter accumulation were recorded under bispyribac-sodium @ 25 g ha$^{-1}$ fb carfentrazone @ 20 g ha$^{-1}$ which was statistically at par with brown manuring + 2, 4-D @ 1 kg ha$^{-1}$.*
**Key words:** *Direct seeded rice (DSR), Nitrogen schedule, Weed management, Intraction effect, Weed and Growth attributes.*

Received 15.05.2019 Revised 22.06.2019 Accepted 21.07.2019

**CITATION OF THIS ARTICLE**
G Singh, S Kumar, P Kaur, R Singh, M Kaur, C Kaur. Response of Nitrogen Scheduling and Weed Management on Weed and Growth Attributes of Direct Seeded Rice (*Oryza sativa* L.) in Central Punjab.. Int. Arch. App. Sci. Technol; Vol 11 [3] September 2020: 19-25

## INTRODUCTION

Rice (*Oryza sativa* L.) is the leading cereal of the world and two third of the Asian peoples receive their daily calories from rice. Globally, rice is cultivated on 158.84 m ha with the annual production of around 471.72 m t with average productivity of 4.43 t ha$^{-1}$ [1]. India is the second largest producer of rice only after China. In India, area under cultivation of rice is around 43.1 m ha with production of 110.15 m t and average productivity of 2.55 t ha$^{-1}$ [2].

In Punjab, the production (basmati & non- basmati varieties) at high record of 186 lakh tonne for the 2016-2017 *kharif* season, nearly 10 lakh tonne more than last year's 176 lakh tonne. Farmers in Punjab have sown paddy in nearly 30.10 lakh hectares against the 29.75 lakh hectares last year. The state has paddy yield close to 60 q ha$^{-1}$ according to economic survey 2015-16 [2].

It is predominantly grown by transplanting seedlings, this practice consumes about 150 ha-cm of water and engagement of labour for transplanting and weeding (Mahajan and Chauhan 2016)[14]. Manual transplanting is labour cumbersome and scarcity of labour during peak season force to the shifting of crop establishment methods from transplanting to direct-seeded rice (DSR) [7]. It has several advantages such as requirement of 35-57% less water and 67% less labour over transplanting rice. Apart from these, DSR requires less use of machine, and have lesser methane emission [3].

Weed are major biological constraint in DSR, mainly due to absence of impounding of water at crop emergence, hence, production and weed management are crucial for increasing the productivity of rice [4]. The extent of yield reduction of rice due to weeds has been estimated up to 95% in India [16]. The direct-seeded rice stimulates more weed growth than transplanted rice, thus their management becomes more complex. Weed control, particularly during the initial stages of crop establishment is very essential in realizing higher yield. Enormous amount of variations occur in dominance and abundance of weed species with change in crop establishment and weed control methods [22]. In recent era, weedy rice is emerging as a major problem in DSR [17]. Javier *et al.*, [10] has observed a shift in weed flora by the change in crop establishment method.

Rice plant require sufficient N at early and mid-tillering stage to achieve an adequate yield attributes *viz.* number of panicles, grain numbers per panicle. There is need to measure N requirement of crop at different critical stages of growth [19]. Nitrogen use efficiency (NUE) of rice is usually low due to leaching, volatilization and denitrification losses. Moreover, direct-seeded rice soils are often exposed to dry and wet conditions and difference in N dynamics and losses pathways often results in different fertilizer recoveries in aerobic soils. Split application is one of the strategies for efficient use of N fertilizers throughout the growing season by synchronizing with plant demand, reducing denitrification losses and improved N uptake for maximum straw and grain yield and harvest index in DSR [13].

The application of herbicides with split dose nitrogen has been reported for minimized weed density and maximum crop growth and yield in DSR [12]. Therefore, to assess the performance of different herbicides under nitrogen schedule on direct-seeded rice.

## MATERIAL AND METHODS

The experiment was conducted at the Experimental Farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during the *Kharif* season, year 2018. The soil is alluvial having sandy clay loam in texture with normal soil reaction (7.8), low organic carbon (0.49%), low available N (295.51 kg $ha^{-1}$), and medium in available $P_2O_5$ (21.11 kg $ha^{-1}$) and $K_2O$ (150.50 kg $ha^{-1}$). There was 637 mm rainfall during the crop season of 2018. The experiment was laid out in split-plot design with 18 treatment combinations (3 nitrogen schedules and 6 weed management including weed free and weedy check) and replicated three times. The nitrogen schedule was subjected to main plots, viz. $N_1$: ¼ (basal) + ¾ (at 6 weeks after sowing), $N_2$: $^1/_3$ (basal) + $^1/_3$ (2 weeks after sowing) + $^1/_3$ (6 weeks after sowing), $N_3$: ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing), while weed management was placed in sub plots, viz. $W_0$: weed free, $W_1$: weedy check, $W_2$: pendimethalin @ 1 kg $ha^{-1}$ *fb* bispyribac- sodium @ 25 g $ha^{-1}$, $W_3$: bispyribac-sodium @ 25 g $ha^{-1}$ *fb* carfentrazone @ 20 g $ha^{-1}$, $W_4$: almix (metsulfuron 10% + chlorimuron ethyl 10% WP) @ 4 g $ha^{-1}$, $W_5$: brown manuring + 2, 4-D @ 1 kg $ha^{-1}$. Recommended dose of N, P and K were applied at 120 kg N $ha^{-1}$, 60 kg $P_2O_5$ $ha^{-1}$ and 40 kg $K_2O$ $ha^{-1}$. Full dose of phosphorus and potash were applied as basal application and nitrogen was applied as treatment wise. The rice variety PR-126 was used for seeding of rice. The sowing was done with use of seed rate 20 kg $ha^{-1}$ in line in 3.6 m x 4.0 m gross plot size. Sowing was done manually with the help of spade at a spacing of row 20 cm. The herbicides were applied with the help of a hand-operated knapsack sprayer fitted with flat-fan nozzle. Weed density, weed dry weight data, weed control efficiency, plant height and plant dry matter accumulation were collected at 30, 60, 90 DAS and at harvest stage. The data on weeds were subjected to square-root transformation ($\sqrt{x+0.5}$) to normalize their distribution. Weeds were cut at ground level, washed with tap water, sundried, dried at 70°C for 48 hr. and then weighed. The data recorded on various parameters of rice crop were analyzed following standard statistical analysis of variance procedure.

## RESULT AND DISCUSSION

### Weed flora

The major weeds identified during experiment *Eichinochloa crusgalli, Echinochloa colona, Cynodon dactylon, Eleusine indica, Leptochloa chinensis, Digitaria sanguinalis, Oryza sativa* (weedy rice) were grasses and four species of *Cyperus iria, Cyperus rotundus, Cyperus difformis,* and *Fimbristylis miliacea* were sedges and remaining species of boad leaf weeds were *Causulia axillaris, Eclipta alba, Ammania baccifera, Cyperus rotundus, Phyllanthus niruri, Commelina benghalensis, Euphorbia hirta, Ludwigia parviflora* and *Spilanthus acmella.* Similar result was reported by Chongtham *et al.*, 2014[5].

### Weed density (no. m$^{-2}$)

Aerobic soil conditions and dry-tillage practices, besides alternate wetting and drying conditions under DSR made congenial environment for flourishing weed flora results in the total weed density gradually increased up to 60 DAS and thereafter it decreased to harvest stage. More weed density results in the more dry matter of weeds but only at the particular number because more density results in the competition between weed plants. There was a declining trend in weed population after 60 DAS due to completion of life cycle of some weeds and also due to suppression of small late emerged weeds by luxuriant weeds. Nitrogen schedule had significant influences on the total weed density at 30, 60, 90 DAS and at harvest stage.

The minimum weed density were recorded under nitrogen scheduling at ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing) which was statistically at par with $^1/_3$ (basal) + $^1/_3$ (2 weeks after sowing) + $^1/_3$ (6 weeks after sowing) and maximum weed density was recorded under ¼ (basal) + ¾ (at 6 weeks after sowing) at 30, 60, 90 and at harvest stage of crop growth during the experimentation (Table 1). This might be due to the fact that treatments in which nitrogen was not applied at sowing resulted in less nitrogen availability to weeds during initial stages which led to poor weed growth in early stages of crop. Higher weed density in treatment ¼ (basal) + ¾ (at 6 weeks after sowing) due to most of the nitrogen was applied within a month in the stage of crop which is a critical period of the crop and weed competition in rice. So, this results in more number of weed plants. These findings are conformity with findings of Kumar and Singh, 2016[12].

The weed density was significantly reduced with the application of herbicides as compared to weedy check. Among the treatments bispyribac-sodium @ 25 g ha$^{-1}$[b7] *fb* carfentrazone @ 20 g ha$^{-1}$ which was at par to brown manuring + 2, 4-D @1 kg ha$^{-1}$. These were most effective in reducing the density of weeds because of sequential application, bispyribac-sodium and carfentrazone have been reported (Singh *et al.,* 2013)[20] the most effective control over grasses and sedges (Chongtham *et al.*, 2014)[5]. It was observed that total weed density at all the stages of observation was found to be significantly lower when brown manuring is done with sesbania (Goswami *et al.*, 2017)[8].

The interaction effect between nitrogen scheduling and weed management on weed density was non-significant at 30, 90 DAS and at harvest stage but significant at 60 DAS during crop growth. At this stage, the treatments combination of bispyribac-Na @ 25.0 g ha$^{-1}$ *fb* carfentrazone @ 20.0 g ha$^{-1}$ with ¼ 2 WAS + ¼ 4 WAS + ¼ 6 WAS+ ¼ 8 WAS was significantly superior over the rest of the treatment combinations during the experimentation (Table 2).

### Weed dry matter (g m$^{-2}$)

During the experiment weed dry matter was gradually increased due to continuous growth of weeds during the crop growth period. Among the nitrogen schedule ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing) has produced significantly lower weed dry matter which was at par with $^1/_3$ (basal) + $^1/_3$ (2 weeks after sowing) + $^1/_3$ (6 weeks after sowing) during the most of the observations (Table 1). The maximum weed dry matter was recorded under the nitrogen schedule ¼ (basal) + ¾ (at 6 weeks after sowing) due to most of the nitrogen is applied at early stage of crop growth results in the more competition and dry matter of weeds. The minimum dry matter in nitrogen schedule ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing) is due to skipping the application of basal nitrogen. Growth and development of weed plants are adversely affected by the scheduling of nitrogen due to less availability of nutrients to weed plants. These findings were similar with the results reported by Sharma [19], Kumar and Singh, [12], Chaudhary *et al.* [6], Singh *et al.* [21].

The application of treatment bispyribac-sodium @ 25 g ha$^{-1}$ *fb* carfentrazone @ 20 g ha$^{-1}$ results in significantly reduction of weed dry matter which was at par with treatment brown manuring + 2, 4-D @ 1 kg ha$^{-1}$ during most of the observations. Low dry matter of weeds was due to the smothering effect of brown manuring (Table 1). These findings were confirmed with Chongtham *et al.*, [5].

The interaction effect between nitrogen scheduling and weed management on weed dry matter was non-significant at 30, 90 DAS and at 120 DAS but significant at 60 DAS during crop growth. At this stage, the treatments combination of bispyribac-Na @ 25.0 g ha$^{-1}$ *fb* carfentrazone @ 20.0 g ha$^{-1}$ with ¼ 2 WAS + ¼ 4 WAS + ¼ 6 WAS+ ¼ 8 WAS was significantly superior over the rest of the treatments combinations during the experimentation (Table 2). There is a better efficacy of herbicide with the combination of nitrogen schedule due to nitrogen is applied at that time period when crop is able to quickly uptake and utilize it efficiently. These findings were confirmed with Kumar and Singh [12] and Singh *et al.* [21].

**Weed control efficiency (%)**

It is the effectiveness of different weed management practices over the weedy check. Under different nitrogen schedule, nitrogen application as ¼ 2 WAS + ¼ 4 WAS + ¼ 6 WAS + ¼ 8 WAS recorded highest weed control efficiency due to lower dry matter accumulation of weeds at all the stages of crop growth during the whole experiment (Table 1) and followed by nitrogen application as $^1/_3$ (basal) + $^1/_3$ (2 weeks after sowing) + $^1/_3$ (6 weeks after sowing). These findings were confirmed with Sharma [19]] and Kumar and Singh. [12].

From the different weed management practices, application of bispyribac-Na @ 25.0 g ha$^{-1}$ *fb* carfentrazone @ 20.0 g ha$^{-1}$ and brown manuring + 2, 4-D @ 1.0 kg ha$^{-1}$ recorded higher weed control efficiency than other weed management practices due to smothering effect of dhaincha and inhibition of broad leaf weeds by 2, 4-D (Tables 1). The result is supported by the Goswami *et al.* [8] and Iliger *et al.* [9].

Table no. 1 Response of nitrogen scheduling and weed management on total weed density (no. m$^{-2}$), weed dry matter (g m$^{-2}$) and weed control efficiency (%) at different days of observations.

| Treatments | Weed density (no. m$^{-2}$) | | | | Dry matter (g m$^{-2}$) | | | | WCE (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS |
| **MAIN PLOT** | | | | | | | | | | |
| $N_1$ | 11.46 (158.00) | 14.27 (244.44) | 14.25 (246.17) | 12.69 (199.94) | 4.25 (21.56) | 11.11 (155.28) | 11.85 (173.92) | 12.33 (187.69) | 44.64 | 56.08 |
| $N_2$ | 12.84 (200.56) | 12.35 (183.33) | 13.40 (216.56) | 12.38 (191.06) | 4.68 (25.31) | 9.84 (123.06) | 11.00 (151.39) | 11.28 (160.42) | 37.27 | 62.58 |
| $N_3$ | 10.83 (141.44) | 10.79 (147.44) | 12.14 (180.89) | 11.42 (168.89) | 3.99 (19.00) | 8.26 (88.67) | 9.53 (118.75) | 9.37 (122.64) | 46.09 | 64.99 |
| **SEM±** | **0.24** | **0.45** | **0.40** | **0.25** | **0.11** | **0.44** | **0.39** | **0.54** | **2.37** | **3.97** |
| **CD (P=0.05)** | **0.94** | **1.76** | **1.55** | **0.97** | **0.41** | **1.72** | **1.53** | **2.13** | **N S** | **15.57** |
| **SUB PLOT** | | | | | | | | | | |
| $W_0$ | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 100.00 | 100.00 |
| $W_1$ | 16.42 (275.89) | 19.18 (370.11) | 18.85 (366.33) | 18.31 (360.67) | 6.23 (38.50) | 17.68 (314.44) | 18.09 (333.61) | 17.82 (331.78) | 0.00 | 0.00 |
| $W_2$ | 10.95 (121.44) | 14.70 (219.00) | 16.61 (277.33) | 14.28 (207.56) | 3.59 (13.23) | 10.62 (118.44) | 12.35 (155.33) | 12.60 (159.72) | 65.26 | 62.96 |
| $W_3$ | 14.67 (216.56) | 12.41 (164.44) | 12.55 (158.11) | 11.29 (131.78) | 5.66 (31.72) | 8.40 (73.89) | 9.12 (84.17) | 9.47 (95.28) | 15.68 | 76.78 |
| $W_4$ | 15.06 (229.67) | 14.50 (210.56) | 16.40 (272.44) | 15.35 (245.22) | 5.43 (29.56) | 11.63 (137.22) | 13.48 (186.94) | 13.95 (199.72) | 24.37 | 55.84 |
| $W_5$ | 12.46 (156.44) | 13.32 (186.33) | 14.47 (213.00) | 13.05 (174.56) | 4.24 (18.72) | 9.40 (90.00) | 11.02 (128.06) | 11.39 (135.00) | 50.69 | 71.73 |
| **SEM±** | **0.55** | **0.49** | **0.68** | **1.08** | **0.26** | **0.36** | **0.72** | **0.75** | **5.80** | **2.34** |
| **CD (P=0.05)** | **1.59** | **1.42** | **1.95** | **3.12** | **0.75** | **1.05** | **2.08** | **2.18** | **16.75** | **6.76** |

## Effect on crop

### Growth character

Nitrogen scheduling and weed management practices had significant effect on growth attributes viz., plant height and plant dry matter accumulation on 30, 60, 90 DAS and at harvest stage. Maximum plant height and dry matter accumulation was in nitrogen schedule ¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing) which is followed by $^{1}/_{3}$ (basal) + $^{1}/_{3}$ (2 weeks after sowing) + $^{1}/_{3}$ (6 weeks after sowing) (Table 3). It is due to the better availability of nitrogen during crop growth stage and also by low weed-crop competition resulting in favourable conditions for growth and development of crop. Minimum plant height and dry matter accumulation was recorded in nitrogen schedule ¼ (basal) + ¾ (at 6 weeks after sowing). Split application of nitrogen provide continuous supply of nutrients which results in good growth attributes and more nitrogen use efficiency. These results are in accordance to the findings of Chaudhary *et al.*, (2011)[6], Sharma (2007)[19] and Kumar and Singh [12].

Amongst various weed management treatments, application of bispyribac-Na @ 25.0 g ha$^{-1}$ *fb* carfentrazone @ 20.0 g ha$^{-1}$ increases growth attributes like plant height and dry matter accumulation (Table 3). It is due to better control of post emergence herbicides bispyribac-Na and carfentrazone on second flush of weeds. These findings were supported by Khaliq *et al.* [11] and Singh *et al.* [20]. Among treatments bispyribac-sodium @ 25 g ha$^{-1}$ *fb* carfentrazone @ 20 g ha$^{-1}$ was at par with brown manuring + 2, 4-D @1 kg ha$^{-1}$.

Table no. 2 Interaction effect between nitrogen scheduling and weed management practices on total weed density (no. m$^{-2}$) and weed dry matter (g m$^{-2}$) at 60 DAS of direct seeded rice.

| Weed management practices | Weed density (no. m$^{-2}$) | | | Dry matter (g m$^{-2}$) | | |
|---|---|---|---|---|---|---|
| | nitrogen scheduling methods | | | nitrogen scheduling methods | | |
| | Nitrogen scheduling as ¼ basal + $^{3}/_{4}$ at 6 WAS | Nitrogen scheduling as $^{1}/_{3}$ basal + $^{1}/_{3}$ at 2 WAS + $^{1}/_{3}$ at 6 WAS | Nitrogen scheduling as ¼ at 2 WAS + ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS | Nitrogen scheduling as ¼ basal + $^{3}/_{4}$ at 6 WAS | Nitrogen scheduling as $^{1}/_{3}$ basal + $^{1}/_{3}$ at 2 WAS + $^{1}/_{3}$ at 6 WAS | Nitrogen scheduling as ¼ at 2 WAS + ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS |
| **$W_0$** | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) |
| **$W_1$** | 20.89 (437.67) | 18.72 (350.33) | 17.92 (322.33) | 18.96 (360.00) | 18.12 (328.33) | 15.96 (255.00) |
| **$W_2$** | 16.45 (274.67) | 14.38 (206.33) | 13.27 (176.00) | 13.56 (185.00) | 9.61 (95.00) | 8.68 (75.33) |
| **$W_3$** | 16.08 (258.67) | 12.74 (162.00) | 8.40 (72.67) | 9.65 (98.33) | 9.06 (81.67) | 6.48 (41.67) |
| **$W_4$** | 15.42 (337.33) | 14.39 (206.67) | 13.69 (187.67) | 12.92 (170.00) | 11.77 (138.33) | 10.19 (103.33) |
| **$W_5$** | 16.08 (258.33) | 13.15 (174.67) | 10.74 (126.00) | 10.88 (118.33) | 9.77 (95.00) | 7.55 (56.67) |

| | **SEM±** | **CD (P=0.05)** | **SEM±** | **CD (P=0.05)** |
|---|---|---|---|---|
| Weed management practices at same level of nitrogen scheduling methods | **0.849** | **2.453** | **0.629** | **1.816** |
| Nitrogen scheduling methods at different level of weed management practices | **0.895** | **2.585** | **0.722** | **2.085** |

Table no. 3 Response of nitrogen scheduling and weed management on plant height (cm) and plant dry matter accumulation (g $m^{-2}$) at 30, 60, 90 DAS and at harvest stage.

| Treatments | Plant height (cm) | | | | Plant dry matter (g $m^{-2}$) | | | |
|---|---|---|---|---|---|---|---|---|
| | **30 DAS** | **60 DAS** | **90 DAS** | **At harvest** | **30 DAS** | **60 DAS** | **90 DAS** | **At harvest** |
| **MAIN PLOT** | | | | | | | | |
| **$N_1$** | 24.82 | 53.83 | 76.05 | 74.16 | 29.00 | 211.67 | 775.22 | 960.17 |
| **$N_2$** | 26.49 | 58.36 | 82.04 | 77.60 | 31.56 | 228.06 | 823.67 | 1043.44 |
| **$N_3$** | 22.36 | 61.56 | 84.14 | 81.91 | 26.16 | 243.83 | 846.78 | 1103.44 |
| **SEM±** | **0.54** | **1.02** | **1.51** | **1.46** | **0.89** | **5.71** | **13.85** | **17.13** |
| **CD (P=0.05)** | **2.12** | **3.99** | **5.94** | **5.72** | **3.51** | **22.44** | **54.39** | **67.26** |
| **SUB PLOT** | | | | | | | | |
| **$W_0$** | 31.76 | 72.56 | 94.69 | 92.58 | 39.56 | 265.56 | 933.11 | 1296.44 |
| **$W_1$** | 15.32 | 36.63 | 54.73 | 49.73 | 14.76 | 143.11 | 509.33 | 639.78 |
| **$W_2$** | 28.14 | 56.88 | 82.77 | 78.66 | 35.33 | 232.22 | 855.56 | 1012.78 |
| **$W_3$** | 26.06 | 66.24 | 89.40 | 86.96 | 32.67 | 257.78 | 906.22 | 1198.11 |
| **$W_4$** | 20.54 | 53.46 | 77.14 | 75.70 | 23.33 | 227.78 | 805.22 | 920.00 |
| **$W_5$** | 25.51 | 61.72 | 85.73 | 83.73 | 27.78 | 240.67 | 881.89 | 1147.00 |
| **SEM±** | **1.45** | **1.60** | **1.85** | **1.90** | **4.09** | **25.21** | **36.13** | **21.86** |
| **CD (P=0.05)** | **4.20** | **4.63** | **5.34** | **5.47** | **11.82** | **72.82** | **104.35** | **63.13** |

## CONCLUSION

From the results obtained during the present investigation with different treatments the combination of $N_3$-¼ (at 2 weeks after sowing) + ¼ (at 4 weeks after sowing) + ¼ (at 6 weeks after sowing) + ¼ (at 8 weeks after sowing) with $W_3$- bispyribac-Na @ 25.0 g $ha^{-1}$ *fb* carfentrazone @ 20.0 g $ha^{-1}$ results in the lesser weed density, weed dry matter and higher weed control efficiency, plant height and plant dry matter accumulation.

## REFERENCES


1. Anonymous 2016. Area production of rice in India. http://www.indiastat.com
2. Anonymous (2017). Annual Research Report, Ministry of Agriculture & Farmers Welfare Government of India Krishi Bhawan, New Delhi. pp 2.
3. Chauhan B S, Mahajan G, Sardana V, Timsina J and Jat M L. (2012). Productivity and sustainability of the rice–wheat cropping system in the Indo- Gangetic Plains of the Indian subcontinent: problems, opportunities and strategies. *Advances in Agronomy* **117**: 315–369.
4. Chauhan B S. (2012). Weed management in direct seeded rice systems. Los Banos (Philippines) *International Rice Research Institute* 20p.
5. Chongtham S K, Singh R P, Lhungdim J and Ahmed I. (2014). Effect of crop establishment methods and weed management practices on weeds, growth and yield of direct seeded rice. *Research on Crops* **16**(1): 21-26.
6. Choudhary S K, Jha S and Sinha N K. (2011). Influence of nitrogen and weed management practices on productivity and nutrient uptake of wet direct-seeded rice. *Oryza* **48**(3): 222-225.
7. Choudhary V K. (2017). Seed hydro-priming and in-situ moisture conservation on direct seeded rice: Emergence, productivity, root behaviour and weed competitiveness. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences* **87**(1): 181-191.
8. Goswami G, Singh Y and Kumar S. (2017). Effect of agronomic practices and weed management practices on weed dry weight and weed control efficiency in direct-seeded rice under rainfed condition of eastern Uttar Pardesh, India. *International Journal of Current Microbiology and Applied Sciences* **6**(9): 2132-2138.
9. Illiger M D, Sutar R, Chogatapur S V and Parmeshwarareddy R. (2017). Effect of brown manuring on soil properties, grain yield and economics of different crops. *Advances in Research* **12**(6**)** 1-11.
10. Javier F E, Furuya S, Soriano R and Garcia F. (2005). Management of wet direct seeded rice. II: weed control by water and herbicides. *Philipines Journal of Crop Sciences* **30**: 11-17.
11. Khaliq A, Matbool A, Ahmed N, Rasul F and Awan I U. (2012). Post emergence chemical weed control in direct seeded fine rice. *Journal of Animal and Plant Science* **22**: 1101-1106.
12. Kumar S and Singh R K. (2016). Interaction effect of nitrogen schedule and weed management on yield of direct-seeded rice. *Indian Journal of Weed Science* **48**(4): 372–377.
13. Lampayan R M, Bouman B A M, De-Dios J L, Espiritu A J, Soriano J B, Lactaoen A T, Faronilo J E and Thant K M. (2010). Yield of aerobic rice in rainfed lowlands of the Philippines as affected by nitrogen management and row spacing. *Field Crops Research* **116**(1): 165-174.


 

14. Mahajan G and Chauhan B S. (2016). Performance of dry direct seeded rice in response to genotype and seeding rate. *Agronomy Journal* **108**(1): 257-265.
15. Nainwal K. and Verma O. (2013). Resource conserving technologies (RCT) in rice-wheat cropping system. *Indian Farmer's Digest* **46**(10): 7-9.
16. Naresh R K, Gupta R K, Singh R V, Singh D, Singh B, Singh V K, Jain N and Bhatia A. 2011. Direct seeded rice: potential, performance and problems- A review. *Current Advances in Agricultural Science* **3**(2): 105-110.
17. Rao A N, Johnson D E, Sivaprasad B, Ladha J K and Mortimer A M. (2007). Weed management indirect-seeded rice. *Advances in Agronomy* **93**: 153–255.
18. Rehman H U, Shahzad M A, Basra and Wahid A. (2013). Optimizing nitrogen-split application time to improve dry matter accumulation and yield in dry direct-seeded rice. *International Journal of Agriculture and Botany* **15**(1): 41-47.
19. Sharma R P. (2007). Dry matter accumulation and nitrogen uptake pattern in direct-seeded upland rainfed rice (*Oryza sativa*) as influenced by nitrogen and weed management practices. *Journal of Farming Systems Research and Development* **13**(2): 191-197.
20. Singh A, Singh R K, Kumar P and Singh S. (2013). Growth, weed control and yield of direct-seeded rice as influenced by different herbicides. *Indian Journal of Weed Science* **45**(4): 235-238.
21. Singh D K, Pandey, Priyanker, Qureshi A and Gupta S. (2015). Nitrogen management strategies for direct-seeded aerobic rice (*Oryza sativa* L.) grown in mollisols of Uttarakhand (India). *International Journal of Applied and Pure Science and Agriculture* **1**(7): 130-138.
22. Singh S, Singh G, Singh V P and Singh A P. (2005). Effect of establishment methods and weed management practices on weeds and rice in rice-wheat cropping system. *Indian Journal of Weed Sciences* **37**: 51-57.

 