The Andhra Agric. J 61(2):266-273, 2014

# Effect of Nitrogen and Weed Management Practices on Growth and Yield of Aromatic Rice under Aerobic Culture

**S Tirumala Reddy, D Srinivasulu Reddy, V Sumathi and D Subramanyam**
Department of Agronomy, S V Agricultural College, A.N.G.R.A.U, Tirupati 517 502

**ABSTRACT**

A field experiment was conducted at S.V. Agricultural College farm, Tirupati for two consecutive seasons of *rabi,* 2009, and 2010 on sandy clay loam soils to study the effect of varied nitrogen and weed management practices on growth parameters and yield of aromatic rice under aerobic culture. The results indicated that highest values of growth parameters *viz.,* plant height, leaf area index, number of tillers $m^{-2}$ and dry matter production were recorded with application of highest level of nitrogen *i.e.* 160 kg $ha^{-1}$ while the lowest with lower level of nitrogen *i.e.* 100 kg $ha^{-1}$. Among the weed management practices pre emergence application of oxadiargyl @ 75 g $ha^{-1}$ fb hand weeding at 25 DAS recorded the highest growth parameters and yield of aromatic rice, which was comparable with pre emergence application of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS. The lowest growth and yield was associated with un-weeded check.

**Key words :** Aromatic rice, Aerobic culture, Growth parameters, Nitrogen and Weed management.

Rice is the staple food for more than three billion people, and over half the world's population and is the single biggest user of fresh water. On an average, about 2,500 liters of water need to be supplied (by rainfall and/or irrigation) to a rice field to produce 1 kg of rough rice. Aerobic rice saves water input and increases water productivity by reducing water requirement for land preparation and limiting seepage, percolation, and evaporation losses. Nitrogen is the most important limiting nutrient in rice production and has a positive influence on the yield. Yield losses due to weeds are greater in direct-seeded rice up to 73 per cent (Milberg and Hallgren, 2004). Research results from various locations showed that herbicides alone do not solve the purpose of weed control satisfactorily and they cause environmental pollution and hence environment friendly, low volume and labour efficient methods of weed control for aerobic rice is essential. Hence, the present experiment was conducted to study the effect of nitrogen along with weed management practices on growth parameters and yield of aromatic rice under aerobic culture.

## MATERIAL AND METHODS

A field experiment was conducted for two consecutive seasons of *rabi,* 2009, and 2010 at S.V.Agrilcultural College, Tirupati. The soil of the experimental site was sandy clay loam in texture. The experiment was laid out in split plot design replicated thrice. The treatments comprised of four levels of nitrogen *viz.*, 100 kg $ha^{-1}$ ($N_1$), 120 kg $ha^{-1}$($N_2$), 140 kg $ha^{-1}$($N_3$) and 160 kg $ha^{-1}$ ($N_4$) assigned to main plots and seven weed management practices *viz.*, Un-weeded check ($W_1$), PE of pretilachlor @ 500 g a.i $ha^{-1}$ ($W_2$), PE of oxadiargyl @ 75 g a.i $ha^{-1}$ ($W_3$), PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$($W_4$), PE of pretilachlor @ 500 g a.i $ha^{-1}$ fb hand weeding at 25 DAS($W_5$), PE of oxadiargyl @ 75 g a.i $ha^{-1}$ fb hand weeding at 25 DAS($W_6$) and PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS($W_7$) allotted to sub plots. Recommended dose of 60 and 50 kg $ha^{-1}$ $P_2O_5$ and $k_2O$ applied basally. The test variety of rice was sugandha samba (RNR 2465). Nitrogen was applied in three equal splits *viz.,* basal, maximum tillering and at panicle initiation. Growth parameters *viz.,* plant height, leaf

Table 1. Plant height (cm) of aromatic rice at different growth stages as influenced by nitrogen and weed management practices under aerobic culture

| Treatments | *Rabi*,2009 | | | | *Rabi*,2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | AT | MT | PI | FL | AT | MT | PI | FL |
| **Nitrogen** | | | | | | | | |
| 100 kg $ha^{-1}$ ($N_1$) | 18.7 | 38.5 | 46.0 | 55.0 | 19.0 | 39.0 | 47.9 | 55.3 |
| 120 kg $ha^{-1}$ ($N_2$) | 19.8 | 40.2 | 50.5 | 57.9 | 20.1 | 41.0 | 51.7 | 58.5 |
| 140 kg $ha^{-1}$ ($N_3$) | 20.6 | 43.0 | 52.3 | 62.0 | 21.0 | 43.4 | 54.0 | 62.2 |
| 160 kg $ha^{-1}$ ($N_4$) | 20.7 | 43.7 | 52.5 | 62.3 | 21.3 | 43.6 | 54.5 | 63.2 |
| SEm $\pm$ | 0.20 | 0.30 | 0.32 | 0.47 | 0.19 | 0.34 | 0.45 | 0.56 |
| CD (P=0.05) | 0.7 | 1.0 | 1.1 | 1.6 | 0.7 | 1.2 | 1.6 | 1.9 |
| **Weed management** | | | | | | | | |
| Un-weeded check ($W_1$) | 13.3 | 30.4 | 37.7 | 47.1 | 13.3 | 31.0 | 41.4 | 47.7 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ ($W_2$) | 19.6 | 39.5 | 48.4 | 53.0 | 19.1 | 40.2 | 48.6 | 57.8 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ ($W_3$) | 20.7 | 41.8 | 50.6 | 59.2 | 20.7 | 42.1 | 51.8 | 60.3 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ ($W_4$) | 20.4 | 41.5 | 50.5 | 58.7 | 20.4 | 42.1 | 51.5 | 59.9 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_5$) | 21.3 | 43.8 | 53.6 | 63.2 | 22.0 | 44.0 | 54.6 | 62.4 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_6$) | 22.3 | 46.7 | 55.7 | 67.2 | 23.4 | 46.5 | 58.3 | 65.7 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_7$) | 22.1 | 45.9 | 55.6 | 66.7 | 23.3 | 46.2 | 57.9 | 64.6 |
| SEm $\pm$ | 0.21 | 0.52 | 0.56 | 0.98 | 0.38 | 0.50 | 0.93 | 0.70 |
| CD (P=0.05) | 0.6 | 1.5 | 1.6 | 2.8 | 1.1 | 1.4 | 2.6 | 2.0 |

AT- Active tillering, MT- Maximum tillering, PI- Panicle initiation, FL- Flowering

Table 2. Leaf area index of aromatic rice at different growth stages as influenced by nitrogen and weed management practices under aerobic culture

| Treatments | *Rabi*,2009 | | | | | *Rabi*,2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AT | MT | PI | FL | At harvest | AT | MT | PI | FL | At harvest |
| **Nitrogen** | | | | | | | | | | |
| 100 kg $ha^{-1}$ ($N_1$) | 0.46 | 1.26 | 2.7 | 3.28 | 1.15 | 0.51 | 1.42 | 2.91 | 3.91 | 1.28 |
| 120 kg $ha^{-1}$ ($N_2$) | 0.53 | 1.36 | 2.89 | 3.63 | 1.21 | 0.58 | 1.55 | 3.09 | 4.02 | 1.35 |
| 140 kg $ha^{-1}$ ($N_3$) | 0.58 | 1.57 | 3.16 | 3.81 | 1.29 | 0.64 | 1.77 | 3.34 | 4.34 | 1.43 |
| 160 kg $ha^{-1}$ ($N_4$) | 0.61 | 1.62 | 3.19 | 3.89 | 1.33 | 0.66 | 1.84 | 3.49 | 4.41 | 1.46 |
| SEm $\pm$ | 0.01 | 0.01 | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.05 | 0.02 | 0.01 |
| CD (P=0.05) | 0.03 | 0.06 | 0.04 | 0.09 | 0.07 | 0.03 | 0.08 | 0.16 | 0.08 | 0.04 |
| **Weed management** | | | | | | | | | | |
| Un-weeded check ($W_1$) | 0.29 | 1.13 | 1.26 | 1.82 | 0.58 | 0.33 | 1.19 | 1.36 | 1.94 | 0.63 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ ($W_2$) | 0.50 | 1.33 | 3.06 | 3.67 | 1.23 | 0.55 | 1.51 | 3.17 | 4.21 | 1.37 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ ($W_3$) | 0.57 | 1.44 | 3.19 | 3.85 | 1.33 | 0.61 | 1.65 | 3.38 | 4.40 | 1.46 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ ($W_4$) | 0.54 | 1.43 | 3.15 | 3.82 | 1.30 | 0.59 | 1.62 | 3.36 | 4.34 | 1.44 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_5$) | 0.61 | 1.54 | 3.33 | 4.02 | 1.38 | 0.66 | 1.75 | 3.58 | 4.64 | 1.54 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_6$) | 0.67 | 1.68 | 3.5 | 4.21 | 1.46 | 0.73 | 1.91 | 3.84 | 4.87 | 1.62 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_7$) | 0.65 | 1.63 | 3.46 | 4.18 | 1.43 | 0.71 | 1.86 | 3.77 | 4.81 | 1.61 |
| SEm $\pm$ | 0.01 | 0.02 | 0.02 | 0.05 | 0.01 | 0.01 | 0.04 | 0.06 | 0.04 | 0.02 |
| CD (P=0.05) | 0.03 | 0.08 | 0.05 | 0.15 | 0.04 | 0.03 | 0.10 | 0.18 | 0.10 | 0.05 |

area index, number of tillers $m^{-2}$, drymatter production were recorded at different stages of crop growth *viz*., active tillering, maximum tillering, panicle initiation, flowering and at harvest. Yield was recorded at harvest.

## RESULTS AND DISCUSSION

The plant height tends to increase with advance in the age of crop up to flowering (Table 1). The plant height measured at different growth stages *i.e.,* active tillering, maximum tillering, panicle initiation and flowering recorded highest values with the highest level of nitrogen application 160 kg $ha^{-1}$, which was at par with 140 kg $ha^{-1}$ during both the years. The next best was with nitrogen application 120 kg $ha^{-1}$ and it was significantly superior to 100 kg $ha^{-1}$. The shortest plants were recorded with application of nitrogen 100 kg $ha^{-1}$. The increase in plant height with increased levels of nitrogen might be attributed to the fact that higher nitrogen levels induce cell division and maintain higher auxin levels, which in turn stimulate cell elongation along the main axis leading to better elongation of internodes and finally resulted in conspicuous increase in plant height. Similar results of increase in plant height with increasing nitrogen levels have been amply documented by Maheswari *et al.* (2008) and Sathiya and Ramesh, (2009). Among different weed management practices, the tallest plants were noticed with pre-emergence(PE) application of oxadiargyl @ 75 g $ha^{-1}$ supplemented with HW at 25 DAS, which was at par with PE application of pyrazosulfuron ethyl @ 20g $ha^{-1}$ supplemented with HW at 25 DAS and both of them were significantly higher than rest of the weed management practices. This might be due to effective control of weeds by oxadiargyl or pyrazosulfuron lead to elimination of weed competition during critical stages of crop, resulted in increased plant height. The next best weed management practice in recording the plant height was the PE application of pretilachlor @ 500g $ha^{-1}$ supplemented with HW at 25 DAS which was significantly higher than with PE application of oxadiargyl @ 75 g $ha^{-1}$ alone and pyrazosulfuron ethyl @ 20g $ha^{-1}$ alone and these two weed management practices were comparable with each other and significantly higher than with pretilachlor 500 @ g$ha^{-1}$ alone. The shortest plants were recorded with un-weeded check at all the stages of crop growth during both the years of experimentation due to heavy weed infestation, which resulted in increased competition for growth resources between crop and weeds which in turn reduced the plant height. These results corroborates the documented evidence by Ramana *et al*. (2007) and Bhandare *et al.* (2011)

Leaf area index (Table 2) and number of tillers $m^{-2}$ (Table 3) of aromatic rice increased progressively with the advance in the age of the crop up to flowering and then declined to harvest due to senescence of older leaves and mortality of tillers, where as dry matter production (Table 4) increased progressively up to harvest during both the years. All these growth parameters registered the highest with 160 kg N $ha^{-1}$, which was at par with 140 kg N $ha^{-1}$. The next best nitrogen application 120 kg N $ha^{-1}$ and it was significantly superior to 100 kg N $ha^{-1}$. Higher nitrogen levels increases the availability of vital nutrients, there by production of more number of leaves and tillers per unit area, in addition to these higher plant height with higher level of nitrogen resulted in higher dry matter production. These findings are in conformity with those of Devi and Sumathi (2011). With regard to weed management practices, the highest growth parameters were recorded with pre-emergence application of oxadiargyl @ 75 g $ha^{-1}$ supplemented with HW at 25 DAS, comparable with $W_7$ and these in turn superior to $W_5$. The next best treatment was $W_3$, which was at par with $W_4$ and both of them were significantly higher than $W_2$. Significantly lowest growth parameters were observed with $W_1$. The highest growth parameters with $W_6$ owing to effective control of all category of weeds during active crop growth period and reduced the nutrient uptake by weeds and gave better environment for development of growth attributing characters and lowest with $W_1$ was due to severe competition of rice plant with weeds for available nutrients which in turn reduced the plant height, number of tillers resulted in reduced dry matter production. Similar results were reported by Bhandare *et al.* (2011).

The highest grain yield and net returns (Table 5) were recorded with application of nitrogen 140 kg $ha^{-1}$, where as highest straw yield was produced with 160 kg N $ha^{-1}$ and both of them were in turn comparable. Application 120 kg N $ha^{-1}$ was next best level, while the lowest grain and straw

Table 3. No. of tillers ($m^{-2}$) of aromatic rice at different growth stages as influenced by nitrogen and weed management practices under aerobic culture

| Treatments | *Rabi*,2009 | | | | | *Rabi*,2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AT | MT | PI | FL | At harvest | AT | MT | PI | FL | At harvest |
| **Nitrogen** | | | | | | | | | | |
| 100 kg $ha^{-1}$ ($N_1$) | 133 | 296 | 334 | 353 | 232 | 139 | 310 | 348 | 356 | 235 |
| 120 kg $ha^{-1}$ ($N_2$) | 138 | 310 | 343 | 361 | 245 | 143 | 319 | 356 | 364 | 251 |
| 140 kg $ha^{-1}$ ($N_3$) | 144 | 323 | 352 | 368 | 259 | 149 | 329 | 367 | 372 | 262 |
| 160 kg $ha^{-1}$ ($N_4$) | 146 | 329 | 354 | 369 | 262 | 150 | 334 | 373 | 376 | 265 |
| SEm ± | 1.22 | 3.22 | 1.99 | 1.67 | 1.41 | 0.58 | 2.31 | 2.05 | 1.93 | 1.11 |
| CD (P=0.05) | 4 | 12 | 7 | 6 | 5 | 2 | 7 | 7 | 7 | 4 |
| **Weed management** | | | | | | | | | | |
| Un-weeded check ($W_1$) | 80 | 247 | 275 | 307 | 218 | 82 | 238 | 305 | 313 | 228 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ ($W_2$) | 135 | 303 | 336 | 358 | 237 | 141 | 316 | 352 | 360 | 247 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ ($W_3$) | 144 | 319 | 354 | 367 | 250 | 153 | 331 | 366 | 371 | 254 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ ($W_4$) | 142 | 316 | 349 | 365 | 248 | 150 | 326 | 362 | 368 | 252 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_5$) | 156 | 331 | 362 | 374 | 256 | 159 | 341 | 374 | 379 | 259 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_6$) | 162 | 347 | 376 | 387 | 270 | 167 | 357 | 386 | 390 | 268 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_7$) | 160 | 344 | 372 | 382 | 266 | 165 | 352 | 382 | 387 | 265 |
| SEm ± | 1.22 | 3.74 | 2.44 | 2.06 | 1.66 | 1.51 | 3.13 | 1.98 | 2.36 | 1.58 |
| CD (P=0.05) | 3 | 10 | 7 | 6 | 5 | 4 | 9 | 6 | 7 | 4 |

Table 4. Dry matter production of aromatic rice (kg $ha^{-1}$) at different growth stages as influenced by nitrogen and weed management practices under aerobic culture

| Treatments | *Rabi*,2009 | | | | | *Rabi*,2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AT | MT | PI | FL | At harvest | AT | MT | PI | FL | At harvest |
| **Nitrogen** | | | | | | | | | | |
| 100 kg $ha^{-1}$ ($N_1$) | 1668 | 4190 | 5844 | 6246 | 7310 | 1674 | 4139 | 5804 | 6272 | 7374 |
| 120 kg $ha^{-1}$ ($N_2$) | 1814 | 4460 | 6135 | 6546 | 7591 | 1828 | 4429 | 6178 | 6601 | 7693 |
| 140 kg $ha^{-1}$ ($N_3$) | 2070 | 5003 | 6759 | 7117 | 8283 | 2158 | 5125 | 6986 | 7411 | 8485 |
| 160 kg $ha^{-1}$ ($N_4$) | 2121 | 5064 | 6761 | 7184 | 8354 | 2196 | 5192 | 7074 | 7503 | 8557 |
| SEm $\pm$ | 16.3 | 18.8 | 26 | 28.29 | 34.82 | 11.98 | 22.24 | 27.25 | 28 | 22.48 |
| CD (P=0.05) | 57 | 65 | 90 | 98 | 121 | 42 | 77 | 95 | 97 | 78 |
| **Weed management** | | | | | | | | | | |
| Un-weeded check ($W_1$) | 594 | 2267 | 3516 | 4080 | 4420 | 839 | 2251 | 3613 | 4180 | 4561 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ ($W_2$) | 1906 | 4580 | 6358 | 6757 | 8006 | 1955 | 4779 | 6564 | 6984 | 8185 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ ($W_3$) | 2003 | 4804 | 6511 | 6902 | 8164 | 2027 | 4919 | 6729 | 7168 | 8364 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ ($W_4$) | 1977 | 4763 | 6460 | 6842 | 8106 | 2017 | 4882 | 6694 | 7129 | 8318 |
| PE of pretilachlor @ 500 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_5$) | 2253 | 5299 | 7090 | 7464 | 8673 | 2230 | 5266 | 7217 | 7591 | 8773 |
| PE of oxadiargyl @ 75 g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_6$) | 2360 | 5548 | 7371 | 7716 | 8924 | 2349 | 5493 | 7403 | 7815 | 9014 |
| PE of pyrazosulfuron ethyl @ 20g a.i $ha^{-1}$ fb hand weeding at 25 DAS ($W_7$) | 2334 | 5495 | 7321 | 7651 | 8898 | 2330 | 5457 | 7353 | 7761 | 8975 |
| SEm $\pm$ | 23.77 | 24.68 | 19.14 | 26.89 | 26.52 | 19.6 | 27.39 | 34.19 | 35.9 | 43.4 |
| CD (P=0.05) | 67 | 70 | 55 | 76 | 75 | 56 | 78 | 98 | 102 | 123 |

Table 5. Grain, straw yield, harvest index and net returns of aromatic rice as influenced by nitrogen and weed management practices under aerobic culture

| Treatments | *Rabi*, 2009 | | | | *Rabi*, 2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | Grain yield (kg ha$^{-1}$) | Straw yield (kg ha$^{-1}$) | Harvest index | Net returns (Rs ha$^{-1}$) | Grain yield (kg ha$^{-1}$) | Straw yield (kg ha$^{-1}$) | Harvest index | Net returns (Rs ha$^{-1}$) |
| **Nitrogen** | | | | | | | | |
| 100 kg ha$^{-1}$ ($N_1$) | 1802 | 4231 | 0.28 | 36742 | 1844 | 4281 | 0.28 | 37455 |
| 120 kg ha$^{-1}$ ($N_2$) | 2062 | 4682 | 0.29 | 43248 | 2089 | 4759 | 0.29 | 43596 |
| 140 kg ha$^{-1}$ ($N_3$) | 2364 | 4940 | 0.31 | 50870 | 2431 | 4995 | 0.31 | 52187 |
| 160 kg ha$^{-1}$ ($N_4$) | 2324 | 5023 | 0.30 | 49700 | 2380 | 5093 | 0.30 | 50760 |
| SEm ± | 15.25 | 24.40 | 0.002 | 394 | 19.75 | 29.55 | 0.002 | 499 |
| CD (P=0.05) | 53 | 84 | 0.01 | 1365 | 68 | 102 | 0.01 | 1727 |
| **Weed management** | | | | | | | | |
| Un-weeded check ($W_1$) | 463 | 3643 | 0.11 | 3202 | 500 | 3594 | 0.12 | 3702 |
| PE of pretilachlor @ 500 g a.i ha$^{-1}$ ($W_2$) | 1818 | 4630 | 0.28 | 37434 | 1925 | 4719 | 0.28 | 39806 |
| PE of oxadiargyl @ 75 g a.i ha$^{-1}$ ($W_3$) | 2211 | 4783 | 0.32 | 47171 | 2275 | 4856 | 0.32 | 48446 |
| PE of pyrazosulfuron ethyl @ 20g a.i ha$^{-1}$ ($W_4$) | 2189 | 4769 | 0.31 | 47031 | 2201 | 4841 | 0.31 | 47000 |
| PE of pretilachlor @ 500 g a.i ha$^{-1}$ fb hand weeding at 25 DAS ($W_5$) | 2517 | 4910 | 0.34 | 54142 | 2591 | 5042 | 0.34 | 55716 |
| PE of oxadiargyl @ 75 g a.i ha$^{-1}$ fb hand weeding at 25 DAS ($W_6$) | 2917 | 5154 | 0.36 | 64105 | 2936 | 5227 | 0.36 | 64244 |
| PE of pyrazosulfuron ethyl @ 20g a.i ha$^{-1}$ fb hand weeding at 25 DAS ($W_7$) | 2852 | 5144 | 0.35 | 62893 | 2872 | 5196 | 0.35 | 63082 |
| SEm ± | 27.62 | 31.72 | 0.003 | 689 | 26.71 | 41.65 | 0.003 | 674 |
| CD (P=0.05) | 79 | 90 | 0.01 | 1958 | 76 | 118 | 0.01 | 1916 |

yields along with net returns were recorded with application of 100 kg N ha$^{-1}$. Increased N supply would have improved the metabolic activity and cell division resulting in increased growth and yield components coupled with higher metabolic activity, produced higher yields of aerobic rice led to higher returns. Higher levels of nitrogen application at 160 kg N ha$^{-1}$ recorded lesser grain yield than 140 kg N ha$^{-1}$ due to the reason that over dose of nitrogen application produced profuse tillering which led to competition among them resulting in conversion of lesser number of tillers into effective tillers and reduced the quantity of transfer of photosynthates from source to sink would have resulted with more number of ill filled grains. These results are in accordance with the findings of Gautam *et al.* (2008) and Sathiya and Ramesh, (2009). Among the weed management practices, the highest grain and straw yields along with net returns were recorded with pre-emergence application of oxadiargyl @ 75 g ha$^{-1}$ supplemented with HW at 25 DAS, comparable with PE application of pyrazosulfuron ethyl @ 20g ha$^{-1}$ supplemented with HW at 25 DAS and these in turn superior to PE of pretilachlor @ 500 g ha$^{-1}$ supplemented with HW at 25 DAS. Application of herbicides alone with out hand weeding oxadiargyl @ 75 g ha$^{-1}$ and pyrazosulfuron ethyl @ 20g ha$^{-1}$ were next best treatments comparable with each other and both of them were significantly higher than pretilachlor @ 500 g ha$^{-1}$. Significantly lowest yields and returns were observed with un-weeded check. The highest yields and net returns with PE of oxadiargyl @ 75 g ha$^{-1}$ supplemented with HW at 25 DAS might be due to higher weed control efficiency during early growth stages of crop, there by competition between crop and weeds for nutrients was minimized and made the crop plants to utilize available nutrients more efficiently through out crop growth period which in turn positively influenced the grain and straw yields in turn resulted in higher returns and lowest with un-weeded check was due to severe competition offered by weeds for available growth resources through out crop growth period severely affect the yields. These results are in confirmity with the findings of Rajkhowa *et al.* (2005) and Arul Chezhian and Kathiresan, (2008).

The experimental results concluded that nitrogen @ 140 kg ha$^{-1}$ with pre emergence application of oxadiargyl @ 75 g ha$^{-1}$ or pyrazosulfuron ethyl @ 20g ha$^{-1}$ supplemented with hand weeding at 25 DAS was effective for higher growth parameters and yield of aromatic rice under aerobic culture.

## LITERATURE CITED

**Arul Chezhian M P and Kathiresan R M 2008** Studies on the effect of Integrated weed management in rice. *Plant Archives*, 8 (2): 679-682.

**Bhandare V L, Nawlakhe S M, Mankar D D and Adkine P M 2011** Efficacy of oxadiargyl on weed control and yield of aromatic rice. *Journal of Soils and Crops,* 21(2): 273-279.

**Devi M G and Sumathi V 2011** Effect of nitrogen management on growth, yield and quality of scented rice (Oryza sativa L.) under aerobic conditions. *Journal of Research ANGRAU,* 39(3): 81-83. 6.

**Gautam A K, Kumar K, Dinesh Shivay Y S and Mishra B N 2008** Influence of nitrogen levels and plant spacing on growth, productivity and quality of two inbred varieties and a hybrid of aromatic rice. *Archives of Agronomy and Soil Science,* 54: 515-532.

**Maheswari J, Jaya Kumar Bose, Sangeetha S P, Sanjutha S and Sathya Priya R 2008** Irrigation regimes and N levels influence chlorophyll, leaf area index, proline and soluble protein content of Aerobic rice. *International Journal of Agricultural Research,* 3(4): 307-316.

**Milberg P and Hallgren E 2004** Yield loss due to weeds in cereals and its large-scale variability in Sweden. *Field crops Research,* 86 (2-3): 199-209.

**Rajkhowa D J, Barua I C, Deka N and Borah D 2005** Bio-efficacy of oxadiargyl in transplanted rice under rainfed conditions. *Indian Journal of Weed Science,* 37(3/4): 258-259.

**Ramana A V, Reddy D S and Ramakumar Reddy K 2007** Influence of sowing time and nitrogen levels on growth, yield and N uptake of rainfed upland rice varieties. *The Andhra Agricultural Journal,* 54(3&4): 114-120.

**Sathiya K and Ramesh T 2009** Effect of split application of nitrogen on growth and yield of aerobic rice. *Asian Journal of Experimental Sciences,* 23 (1): 303-306.

(Received on 29.09.2012 and revised on 17.01.2013)