(Anon, 2016). Its cultivation is mainly practiced through transplanting which is cumbersome and labour intensive. Increasing water scarcity, water loving nature of rice and increasing labour wages trigger to switch for such alternative crop establishment methods which can increase water productivity. It has been recognized as the principal method of rice establishment since 1950's in developing countries (Pandey and Velasco, 2005). Improved short duration and high yielding varieties, nutrient and weed management techniques encouraged the farmers to shift from traditional system of transplanting to DSR culture. Direct seeding offers certain advantages like saving irrigation water, labour, energy, time, reduces emission of greenhouse-gases, better growth of succeeding crops, etc.

Direct seeded rice crop has a higher nutrient requirement as compared to a transplanted crop because of the higher plant density and greater production of biomass in the vegetative phase (Dingkuhn *et al*., 1990). Proper weed management practices along with integrated nutrient management (Sarkar and Gangwar, 2001), more particularly with major nutrients, significantly influence the crop productivity in upland situations. Fertilizer management can definitely alter the competitive balance between crops and weeds, but methods to incorporate it into integrated weed management are yet to be developed (Buhler, 2002).Integrated use of chemical fertilizers with manures, compost and green manure crops is very important for sustainable rice production especially under rainfed upland conditions (Meelu, 1996).

Application of manure compost may also enhance soil microbial activities that improve the crop growth, and restrain the pests and diseases Compared with chemical fertilizers, manure compost has been comprehensively tested and determined as effective in increasing nutrient availability to crops, thus improving grain yield in a cost-effective and environmentally friendly manner (Ahmad *et al*., 2007; Leite *et al*.,2010). The addition of manure compost can also increase the levels of organic matter and improve soil porosity, structural stability, moisture, and nutrient availability, as well as biological activity (Wang *et al*., 2011).

## 2. Materials and methods

A field experiment was conducted at ICR farm of Assam Agricultural University, Jorhat, Assam during the autumn season. The soil of experimental plot was sandy loam in texture with pH 4.95, organic carbon of 0.53% and 263.87, 22.10 and 134.71 kg/ha N, P and K, respectively. The experiment was carried out in factorial randomized block design replicated thrice with 15 treatments involving 3 varieties; Inglongkiri, Maizubiron and Rasi adopting 5 treatments of weed and nutrient management, *i.e.* 20-10-10 kg/ha N-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g/ha followed by grubber 30 DAS ($W_1$), 30-15-15 kg/ha N-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g/ha followed by grubber 30 DAS ($W_2$), 10-5-5 kg/ha N-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g/ha followed by grubber 30 DAS + Vermicompost @ 1 t/ha (at sowing & 30 DAS) + Sesbania (*Sesbania aculeata*) green mulch (up to 30 days) ($W_3$), 10-5-5 kg/ha N-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g/ha followed by grubber 30 DAS with intra-row spacing 15cm ($W_4$), and 20-10-10 kg/ha N-$P_2O_5$-$K_2O$ + Weedy check ($W_5$).

The nutrients N, $P_2O_5$, $K_2O$ were applied in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. The required amounts of $P_2O_5$ fertilizers, as per treatment, were applied as basal in the lines one day prior to sowing and thoroughly mixed with the soil.

The required amounts of N and $K_2O$ fertilizers, as per treatment, were applied in two splits. Half of nitrogenous and potassic fertilizers was applied 20 days after sowing. The second top dressing with the remaining quantities of nitrogenous and potassic fertilizers was done in 40 days after sowing. The vermicompost @ 1 t/ha was applied in rows in two equal splits *i.e.* at basal and 30 DAS. *Sesbania aculeata* as green mulch was grown and incorporated in soil at 30 days DAS. The pre-emergence application of pretilachlor (Craze 50 EC) was made by spraying the herbicide spray solution on the soil surface uniformly, one day after sowing of rice seed. The spray solution, on the basis of spray volume of 500 l/ha, was sprayed as per the treatments by using knapsack sprayer. While applying the pre-emergence herbicide, care was taken to ensure that the herbicide drift dose not reaches to adjacent experimental plots. Mechanical weeding, as per treatment, was done on 30 DAS by using manually operated grubber.

## 3. Results and discussion

**3.1 Physico-chemical properties of soil:** The soil physico-chemical properties like, pH, organic carbon, available N, $P_2O_5$ and $K_2O$ did not differ significantly amongst the varieties as well as weed and nutrient management practices. This might be due to the fact that these physico-chemical properties of soil, generally, do not change significantly over short period of time. (Ian and Kulvadee, 2006).

**3.2 Soil moisture content (%):** The data on soil moisture content at 30, 60, 90 DAS and at harvest of crop are presented in Table 2. Soil moisture content varied from 19.09 % to 20.88 % throughout the crop growth period.

**3.3 $NO_3^-$-N and $NH_4^+$-N content in soil:** Most plants absorb both $NO_3^-$ and $NH_4^+$ mineral forms of N (Nascente *et al.*, 2012). $NO_3$-N predominates in the upland rice cultivation (D'Andrea *et al.*, 2004). No significant influence was observed on $NO_3^-$-N and $NH_4^+$-N due to varieties. Application of 10-5-5 kg/ha N-$P_2O_5$-$K_2O$ along with vermicompost @ 1t/ha, sesbania green mulch, pretilachlor @ 750g a.i./ha and grubber at 30 DAS showed significantly higher $NO_3^-$-N at 15 and 35 DAS, and $NH_4^+$-N at 15 DAS, 55 DAS and 70 DAS. This might be due to application of fertilizers at sowing, 15 DAS and 40 DAS along with incorporation of vermicompost at sowing and 30 DAS. Moreover, this treatment also recorded significantly higher microbial population as well as soil microbial biomass carbon (Nascente *et al.*, 2012). Less amount of $NH_4^+$-N in upland condition might be due to its oxidation to $NO_3$ and higher $NO_3^-$ -N is attributed to nitrification of $NH_4^+$-N under upland condition (Zia *et al.*, 2001).

**3.4 Soil microbial biomass carbon**: There was no significant difference in soil microbial biomass carbon at all three periods i.e. at initial, 30 DAS and at harvest of crop growth due to varieties. At 30 DAS, weed and nutrient management practice of application of 10-5-5 kg/ha N-$P_2O_5$-$K_2O$, vermicompost @ 1t/ha, sesbania green mulch, pretilachlor @ 750g a.i./ha and use of grubber 30 DAS showed significantly higher soil microbial biomass carbon (323.72) followed by that (308.53) in application of 30-15-15 kg/ha N-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g a.i./ha and grubber 30 DAS. This might be due to application of organic source of nutrients including growing sesbania up to 30 DAS and then incorporated into soil which may improve the microbial activities. A similar finding was also reported by Shen *et al.*, 1984.

**3.5 Bacterial and fungal populations:** Varieties could not bring about significant difference in bacterial and fungal population at all the three stages *i.e.* initial, 30 DAS and at harvest of crop. Application of 10-5-5 kg/ha N-$P_2O_5$-$K_2O$ along with vermicompost @ 1t/ha, sesbania green

**Table 1: Effect of variety, weed and nutrient management practices on available N, $P_2O_5$, $K_2O$, organic carbon and soil pH after harvest of rice**

| Treatment | Available N (kg ha$^{-1}$) | Available $P_2O_5$ (kg ha$^{-1}$) | Available $K_2O$ (kg ha$^{-1}$) | Organ Carbon (%) | Soil pH |
|---|---|---|---|---|---|
| **Variety** | | | | | |
| $V_1$: *Inglongkiri* | 247.53 | 21.40 | 136.44 | 0.50 | 4.97 |
| $V_2$: *Maizubiron* | 250.67 | 20.75 | 136.69 | 0.51 | 4.95 |
| $V_3$: Rasi | 251.21 | 21.07 | 138.78 | 0.50 | 4.93 |
| S.Em ± | 6.68 | 0.23 | 4.25 | 0.12 | 0.05 |
| CD (P = 0.05) | NS | NS | NS | NS | NS |
| **Weed and nutrient management** | | | | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. ha$^{-1}$+ grubber 30 DAS | 244.47 | 20.72 | 138.42 | 0.51 | 4.96 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. ha$^{-1}$+ grubber 30 DAS | 241.12 | 21.22 | 144.55 | 0.51 | 4.94 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @ 750g a.i. ha$^{-1}$+ grubber 30 DAS | 256.11 | 21.44 | 137.76 | 0.51 | 5.03 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750g a.i. ha$^{-1}$+ grubber 30 DAS | 258.55 | 21.28 | 134.69 | 0.49 | 4.94 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 248.79 | 20.70 | 131.09 | 0.50 | 4.91 |
| S.Em ± | 8.63 | 0.30 | 5.49 | 0.10 | 0.06 |
| CD (P = 0.05) | NS | NS | NS | NS | NS |
| **Interaction (V×W)** | | | | | |
| S.Em ± | 14.94 | 0.52 | 9.51 | 0.13 | 0.11 |
| CD (P = 0.05) | NS | NS | NS | NS | NS |

**Table 2: Effect of variety, weed and nutrient management practices on soil moisture content at different days after sowing (DAS) and at harvest of rice**

(without statistical analysis)

| Treatment | Soil moisture (%) at 0-15 cm depth | | | |
|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | At harvest |
| **Variety** | | | | |
| $V_1$: *Inglongkiri* | 19.26 | 19.96 | 20.54 | 20.63 |
| $V_2$: *Maizubiron* | 19.57 | 20.39 | 20.75 | 19.96 |
| $V_3$: Rasi | 19.39 | 20.39 | 20.77 | 20.35 |
| **Weed and nutrient management** | | | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 19.17 | 20.03 | 20.27 | 20.80 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 19.09 | 20.29 | 21.00 | 20.29 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 19.59 | 20.37 | 20.64 | 20.60 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 19.47 | 20.32 | 20.88 | 19.79 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 19.72 | 20.20 | 20.66 | 20.08 |

Field capacity=23.5%

PWP=11.4%

**Table 3: Effect of variety, weed and nutrient management practices on soil microbial biomass carbon at initial, 30 days after sowing (DAS) and at harvest of rice**

| Treatment | Soil Microbial Biomass Carbon ($\mu g\ g^{-1}$ soil) | | |
|---|---|---|---|
| | Initial | 30 DAS | Harvest |
| **Variety** | | | |
| $V_1$: *Inglongkiri* | 153.92 | 274.30 | 133.24 |
| $V_2$: *Maizubiron* | 153.10 | 275.89 | 129.80 |
| $V_3$: Rasi | 155.93 | 281.02 | 139.34 |
| S.Em ± | 9.05 | 14.36 | 7.27 |
| CD (P = 0.05) | NS | NS | NS |
| **Weed and nutrient management** | | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 166.66 | 275.32 | 139.50 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 169.89 | 308.53 | 138.28 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost@ 1t/ha + sesbania green mulch + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 144.12 | 323.72 | 134.67 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 137.98 | 250.72 | 129.24 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 152.93 | 227.06 | 128.97 |
| S.Em ± | 11.69 | 18.54 | 9.39 |
| CD (P = 0.05) | NS | 53.70 | NS |

**Table 4: Effect of variety, weed and nutrient management practices on $NH_4^+$ -N at different days after sowing (DAS) of rice**

| Treatment | $NH_4^+$ -N (kg/ha soil) | | | |
|---|---|---|---|---|
| | **15 DAS** | **35 DAS** | **55 DAS** | **70 DAS** |
| **Variety** | | | | |
| $V_1$: *Inglongkiri* | 28.67 | 44.48 | 43.20 | 35.14 |
| $V_2$: *Maizubiron* | 25.61 | 44.61 | 42.94 | 32.51 |
| $V_3$: Rasi | 26.84 | 46.88 | 45.34 | 33.67 |
| S.Em ± | 0.97 | 1.12 | 2.05 | 0.91 |
| CD (P = 0.05) | NS | NS | NS | NS |
| **Weed and nutrient management** | | | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @750g a.i. $ha^{-1}$+ grubber 30 DAS | 27.35 | 46.24 | 43.57 | 33.91 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 29.32 | 47.11 | 45.40 | 36.17 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 31.72 | 47.12 | 42.14 | 37.99 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 26.64 | 44.30 | 45.52 | 33.64 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$+ weedy check | 20.16 | 41.83 | 42.49 | 27.16 |
| S.Em ± | 1.25 | 1.45 | 2.65 | 1.18 |
| CD (P = 0.05) | 3.63 | NS | 2.80 | 7.21 |

**Table 5: Effect of variety, weed and nutrient management practices on $NO_3^+$- N at different growth stages of rice**

| Treatment | $NO_3^+$- N (kg/ha soil) | | | |
|---|---|---|---|---|
| | 15 DAS | 35 DAS | 55 DAS | 70 DAS |
| **Variety** | | | | |
| $V_1$: *Inglongkiri* | 38.67 | 53.28 | 49.21 | 38.48 |
| $V_2$: *Maizubiron* | 35.61 | 53.21 | 50.09 | 38.61 |
| $V_3$: Rasi | 36.84 | 54.81 | 51.46 | 40.88 |
| S.Em ± | 0.97 | 1.17 | 1.14 | 1.12 |
| CD (P = 0.05) | NS | NS | NS | NS |
| **Weed and nutrient management** | | | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 37.35 | 56.24 | 50.24 | 40.24 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 39.32 | 57.11 | 51.11 | 41.11 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 41.72 | 57.12 | 51.12 | 41.12 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 36.64 | 50.64 | 50.62 | 38.30 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 30.16 | 47.72 | 48.17 | 35.83 |
| S.Em ± | 1.25 | 1.52 | 1.47 | 1.45 |
| CD (P = 0.05) | 3.62 | 4.39 | NS | NS |

**Table 6: Effect of variety, weed and nutrient management practices on bacterial count at different days after sowing (DAS) of rice**

| Treatment | Bacterial count ($-\log x\ 10^{-6}$ cfu/g soil) | | |
|---|---|---|---|
| | 40 DAS | 60 DAS | 75 DAS |
| **Variety** | | | |
| $V_1$: *Inglongkiri* | 16.26 | 18.89 | 21.23 |
| $V_2$: *Maizubiron* | 15.83 | 18.73 | 20.80 |
| $V_3$: Rasi | 16.83 | 19.53 | 21.27 |
| S.Em ± | 0.52 | 0.68 | 0.67 |
| CD (P = 0.05) | NS | NS | NS |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 16.68 | 19.89 | 22.07 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 17.34 | 20.11 | 23.07 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @750 g a.i. $ha^{-1}$+ grubber 30 DAS | 16.31 | 19.41 | 21.69 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 15.75 | 18.29 | 20.25 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 15.46 | 17.56 | 18.40 |
| S.Em ± | 0.68 | 0.81 | 0.87 |
| CD (P = 0.05) | NS | NS | 2.52 |

**Table 7: Effect of variety, weed and nutrient management practices on fungal count at different days after sowing (DAS) of rice**

| Treatment | Fungal count ($-\log \times 10^{-6}$ cfu/g soil) | | |
|---|---|---|---|
| | 40 DAS | 60 DAS | 75 DAS |
| **Variety** | | | |
| $V_1$: *Inglongkiri* | 9.40 | 11.20 | 12.48 |
| $V_2$: *Maizubiron* | 8.87 | 11.20 | 12.31 |
| $V_3$: Rasi | 10.53 | 12.13 | 14.10 |
| S.Em ± | 0.51 | 0.42 | 0.72 |
| CD (P = 0.05) | NS | NS | NS |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 10.17 | 11.72 | 13.64 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 10.67 | 12.56 | 14.57 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @750 g a.i. $ha^{-1}$+ grubber 30 DAS | 10.06 | 11.83 | 13.11 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750 g a.i. $ha^{-1}$+ grubber 30 DAS | 9.22 | 11.22 | 12.11 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 7.89 | 10.22 | 11.39 |
| S.Em ± | 0.65 | 0.54 | 0.94 |
| CD (P = 0.05) | 1.90 | NS | NS |

**Table 8: Effect of variety, weed and nutrient management practices on grain yield, straw yield and harvest index of rice**

| Treatment | Grain yield (kg/ha) | Straw yield (kg/ha) |
|---|---|---|
| **Variety** | | |
| $V_1$: *Inglongkiri* | 1596 | 2105 |
| $V_2$: *Maizubiron* | 1550 | 2103 |
| $V_3$: Rasi | 1605 | 2017 |
| S.Em ± | 20 | 11 |
| CD (P = 0.05) | NS | 31 |
| **Weed and nutrient management** | | |
| $W_1$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 1877 | 2533 |
| $W_2$: 30-15-15 kg/haN-$P_2O_5$-$K_2O$ + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 2087 | 2631 |
| $W_3$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + vermicompost @ 1t/ha + sesbania green mulch + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 1679 | 2256 |
| $W_4$: 10-5-5 kg/haN-$P_2O_5$-$K_2O$ + intra-row spacing 15 cm + pretilachlor @ 750g a.i. $ha^{-1}$+ grubber 30 DAS | 1573 | 2092 |
| $W_5$: 20-10-10 kg/haN-$P_2O_5$-$K_2O$ + weedy check | 703 | 863 |
| S.Em ± | 26 | 14 |
| CD (P = 0.05) | 75 | 40 |
| **Interaction (V×W)** | | |
| S.Em ± | 45 | 24 |
| CD (P = 0.05) | 131 | 70 |

**Table 8.1 Interaction effect of variety with weed and nutrient management practices on grain yield (kg/ha) of rice**

| Variety | Weed and nutrient management | | | | |
|---|---|---|---|---|---|
| | $W_1$ | $W_2$ | $W_3$ | $W_4$ | $W_5$ |
| $V_1$ | 1900 | 2068 | 1676 | 1573 | 765 |
| $V_2$ | 1782 | 2005 | 1619 | 1553 | 789 |
| $V_3$ | 1950 | 2187 | 1742 | 1593 | 555 |
| SEm± | 45 | | | | |
| C.D. (P=0.05) | 131 | | | | |

**Table 8.2 Interaction effect of variety with weed and nutrient management practices on straw yield (kg/ha) of rice**

| Variety | Weed and nutrient management | | | | |
|---|---|---|---|---|---|
| | $W_1$ | $W_2$ | $W_3$ | $W_4$ | $W_5$ |
| $V_1$ | 2550 | 2624 | 2275 | 2126 | 951 |
| $V_2$ | 2542 | 2658 | 2265 | 2121 | 929 |
| $V_3$ | 2507 | 2612 | 2228 | 2029 | 710 |
| SEm± | 24 | | | | |
| C.D. (P=0.05) | 70 | | | | |

mulch, pretilachlor @ 750 g a.i./ha and working with grubber 30 DAS showed significantly higher bacterial population at 75 DAS and fungal population at 40 DAS. This might be due to application of organic manure *i.e.* (i) vermicompost at initial and 30 DAS (ii) growing of sesbania as green mulch which was incorporated into soil at 30 DAS. Similar findings were reported by Zia *et al.* (2001) and D'Andrea *et al.* (2004).

**3.6 Grain yield and straw yield (kg/ha):** A perusal of the findings revealed that there was no significant difference in grain yield amongst the three varieties tested while Inglonkiri showed significantly higher straw yield. It might be due to significantly higher plant height at harvest in Inglongkiri. Regarding the factor, weed and nutrient management, application of 30-15-15 kg/ha $N$-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g a.i./ha and use of grubber 30 DAS ($W_2$) showed significantly higher grain yield and straw yield. The higher grain yield might be due to better nutrition of rice crop owing to application of higher dose of major nutrients as well as reduction in crop weed competition due to combined methods of weed control *i.e.* chemical and mechanical, that resulted in statistically superior growth characters (LAI, number of tillers and dry matter accumulation) and yield attributing characters (number of panicles, panicle length and number of filled grains). Kavitha *et al.,* (2010) reported that application of pretilachlor suppressed the weed in the early growth stages of *autumn* rice leading to higher yield. The higher straw yield might be due to higher amount of dry matter production at 30 and 60 DAS in $W_2$. The improved cultivars produced higher yields than traditional cultivars in both high and low fertility conditions (Saito *et al*., 2006). The grain and straw yield were affected significantly by the interaction effect of varieties and weed and nutrient management practices. The results revealed that higher grain yield was given by Rasi, when combined with application of 30-15-15 kg/ha N-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g a.i./ha and use of grubber 30 DAS ($W_2$) while Inglongkiri showed significantly higher straw yield when combined with $W_2$.

## 4. Conclusion

The pH, organic carbon, available N, $P_2O_5$ and $K_2O$ in soil at harvest were not significantly influenced by variety or weed and nutrient management practices. Varieties showed no significant effect on soil microbial biomass carbon, bacterial and fungal count, and $NO_3$-N and $NH_4$-N content in soil. However, application of 10-5-5 kg/haN-$P_2O_5$-$K_2O$, vermicompost @ 1t/ha, *Sesbania* green mulch, pretilachlor @ 750g a.i./ha and grubber 30 DAS showed significantly higher soil microbial biomass carbon (323.72) at 30 DAS and also gave significantly higher bacterial count at 75 DAS (23.07) and higher fungal count at 60 DAS (10.67). This was followed by that in 30-15-15 kg/haN-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g a.i./ha and grubber 30 DAS. Application of 10-5-5 kg/ha N-$P_2O_5$-$K_2O$ along with vermicompost @ 1 t/ha, *Sesbania* green mulch, pretilachlor @ 750 g a.i. /ha and grubber 30 DAS gave significantly higher $NO_3$-N at 35, 55 and 70 DAS, and $NH_4$-N at 15 DAS and 70 DAS. Variety *Inglongkiri* resulted significantly higher straw yield (21.05) but was at par with that in *Maizubiron* (21.03) but both were significantly superior to that in Rasi (20.17). The grain yield (2087) and straw yield (2631) recorded with application of 30-15-15 kg/ha N-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g a.i. /ha and grubber 30 DAS was significantly higher than that (1877 and 2533) in application of 20-10-10 kg/haN-$P_2O_5$-$K_2O$ along with pretilachlor @ 750 g/ha and working with grubber 30 DAS.

## Acknowledgements

We are grateful to DPGS and Department of Agronomy, College of Agriculture, Assam Agricultural University, Jorhat for providing the necessary infrastructural facilities.

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