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# Comparative study of the nutritional qualities of rice hybrids grown under different INM practices

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**Abstract**
An attempt has been made to study the response of rice hybrids *viz.*, Sahyadri-3 and Sahyadri-4 to integrated nutrient management comprising different combinations of chemical fertilizers with FYM, poultry manure, glyricidia (green manure) and Biofertilizers (Azospirillum and PSB) in lateritic soils of South Konkan during *Kharif*, It was revealed from the study that the performance of Sahyadri-3 and Sahyadri-4 hybrid rice in terms of their yield attributes, grain yield productivity, quality traits and economics (gross returns, net returns, B:C ratio) were highest under the application of 50 per cent recommended dose of N through chemical fertilizers, 25 per cent through application of FYM and remaining 25 per cent through poultry manure application. However, in general its effects were statistically at par with those of integrated nutrient management treatments. The said effects due to above treatments were superior over to those of alone application of 100 % N applied through inorganic fertilizers to both the rice hybrids.

**Keywords**: Lateritic soil, rice, RDN, FYM, poultry manure, glyricidia and economic traits.

## Introduction
Introduction of hybrid rice is an important step towards augmentation of rice yield. Hybrid rice yield about 15-20% more than the promising high-yielding commercial varieties (Metwally *et al*. 2011) [10]. Fertilizers are costly inputs and need to be managed efficiently for higher nutrient recovery returns. The fertilizers contribute 50 to 60 per cent in crop yield enhancement. Nitrogen is considered as the 'King pin' in paddy fertilization since rice responded universally to nitrogen application. The laterite and lateritic soils cover an area of 15, 28, 400 ha in the state of Maharashtra out of which almost 70 percent area is distributed in the Konkan region. the soils have low to medium status of available N, very low to low available $P_2O_5$ status and low to high $K_2O$ whereas the organic carbon status of soil in high to very high (Kadrekar *et al.* 1981) [8]. Rice is a major crop grown during *Kharif* season and the efficiency of conventional fertilizers applied through broadcast method is low primarily due to heavy rains received during *Kharif* season. The balanced fertilizer application to be very effective in enhancing crop yields and improving the fertility of the lateritic soils in the region (Dongale *et al.* 1987, Kadrekar 1993) [2, 7]. Therefore, judicious use of organic and inorganic sources of plant nutrition is to be evaluated under existing climatic conditions to increase the productivity of rice. The effects of organic and inorganic fertilizers are complementary to each other in terms of soil fertility improvement and sustainable agriculture. The increasing demand for rice grain production has to be achieved by using limited available resources in a sustainable manner. Balanced fertilization involves application of essential plant nutrients *viz.*, nitrogen, phosphorous, and potassium, not only in right proportion, but also in optimum quantities through correct methods and time of application, suited for a specific soil-crop-climate situation (Pieters 2004).

In recent years with rapid increase in the number of poultry farm, a substantial amount of poultry waste is produced in India due to increase in poultry industry. Due to its rapid mineralization, it has been recognized as a valuable source of plant nutrient for crop plants. Glyricidia (*Glyricidia muculeata*) is the most promising green leaf manure for transplanted rice for enhancing the rice productivity and also to substitute inorganic N to some extent. Biomass production and nitrogen accumulation in glyricidia is very high and also very fast. Its decomposition in soil is also faster than Dhaincha. Glyricidia leaves contain up to 2.7 percent N and have narrow C:N ratio. Besides having low lignin and polyphenolic content, they decompose rapidly in soil and mineral N tends to become available within 10-15 days after incorporation (Kadam *et al.* 1985) [6]. Farmyard manure is a heterogeneous composted organic material consisting of dung, crop residue, and/or household sweeping in various stages of decomposition.

Farmyard manure is mostly available and produced in farms, and is an important organic resource for agricultural production in live stock based farming systems in many countries including semi-arid regions of India. Fulfillment of nutritional requirement of hybrid rice through inorganic fertilizers is not only costly but it also detoriate the soil health, as these soils are more hungry than thirsty. Value of collective use of manures and fertilizers on sustainable crop production has been tested and proven through several long term experiments (Nambiar 1995) [12]. Combined application of fertilizers and manures unfailingly sustained productivity. Therefore, the present investigation *viz*., "Comparative study of the nutritional qualities of rice hybrids grown under different INM practices" was undertaken.

## Material and Methods

The field experiment was conducted at Dapoli, Dist. Ratnagiri during *Kharif* season on lateritic soils. The soil was sandy clay loam in texture, slightly acidic in reaction and having low electrical conductivity, very high in organic carbon, medium in available nitrogen and low in available phosphorus and potassium. The region receives very high rainfall (above 3000 mm, annually). The hybrid rice variety Sahyadri-3 and Sahyadri-4 were taken as a test crop during *Kharif*. Sahyadri-3 and Sahyadri-4 are late (125-130 days) and mid-late (115 to 120 days), respectively varieties, having long slender grain with 90 to 120 cm plant height, non-lodging, non-shedding and has yield potential of about 6.5 to 7.0 tons per hectare (Anonymous 2013) [1]. Experiment was laid out with Randomized Block Design comprising of fourteen treatments replicated three times.

**$T_1$:** RDF-100 % i.e. 150 kg N,50 kg $P_2O_5$ and 50 kg $K_2Oha^{-1}$,
**$T_2$:** 100 % RDN through FYM,
**$T_3$:**100 % RDN through PM,
**$T_4$:**100 % N-GM-Glyricidia(GM) @ 15 t $ha^{-1}$,
**$T_5$:**75 % RDF + 25 % RDN through FYM,
**$T_6$:** 75 % RDF + 25 % RDN through PM,
**$T_7$:** 75 % RDF + Glyricidia @ 3.75 t $ha^{-1}$,
**$T_8$:**75 % RDF + Biofertilizer (Azospirillum + PSB),
**$T_9$:** 50 % RDF + 50 % RDN through FYM,
**$T_{10}$:** 50 % RDF + 50 % RDN through PM,
**$T_{11}$:** 50 % RDF + Glyricidia @ 7.5 t $ha^{-1}$,
**$T_{12}$:** 50% RDF + 25% RDN through FYM + 25% RDN through PM,
**$T_{13}$**: 50% RDF + 25 % RDN through FYM + Glyricidia @3.75 t $ha^{-1}$,
**$T_{14}$:** 50% RDF + 25% RDN through PM + Glyricidia @ 3.75 t $ha^{-1}$.

Sample was prepared with the following standard procedure the rice grains of rice hybrids were dehusked with the wooden plank so as to get whole grain brown rice. The brown rice was ground to 100 mesh in an electric grinder and used for chemical analysis. **Crude fat** in 100 mesh moisture free rice flour was estimated by using Soxhlet extraction method (NIN 1977) [11]. About 2 gm rice flour was extracted with petroleum ether (B.P. 40-60*c) under constant extraction of 8 hours. Protein finely ground 100 mesh oven dried rice flour (0.5 g) was digested with minimum volume of conc. $H_2SO_4$ using $H_2O_2$. The volume of digested sample was made to 100 ml and 5 ml aliquots from the digested sample were used for estimation of nitrogen by Micro-Kjeldhal method (NIN 1977) [11]. Per cent nitrogen was multiplied by 5.95 to obtain per cent protein. Carbohydrate content was found out by difference i.e., by substracting from 100, the sum of the values (per 100 g) for moisture, crude protein, crude Fat and ash (NIN 1977) [11].

**Crude Fiber** was estimated according to the standard methods described in the manual of Laboratory techniques (NIN 1977) [11].

## Results and Discussion

The growth, Productivity and quality of any crop depend upon different factors which are existed during the growth period of crop. It is well known fact that application of organic manures in combination with inorganic / mineral fertilizers minimized vegetative growth, grain yield, straw yield and improved quality of produce and also the soil health along with the sustainability of soil fertility.

Grain yield of hybrid rice varied from 50.19 to 60.28 q $ha^{-1}$ among various treatments of nutrient management during first year of experiment and from 62.8 to 66.3 q $ha^{-1}$ during second year of experiment. Among these treatments significantly highest grain yield was recorded under the Treatment $T_1$ (60.28 q $ha^{-1}$) receiving 100 per cent RDF, which was at par with treatments $T_5$, $T_6$, $T_7$, $T_{13}$ and $T_{14}$, during first year of experiment.

The significantly highest grain yield was recorded with treatment $T_{13}$ (66.3 q $ha^{-1}$) receiving 50 per cent RDF + 25 per cent RDN through FYM + Glyricidia (GM) 3.75 t $ha^{-1}$,which was at par with treatments $T_2$, $T_3$, $T_4$, $T_5$, $T_{11}$, $T_{12}$ and $T_{14}$ during second year of experiment.

**Table 1:** Effect of INM on yield of hybrid rice

| Tr. No. | Treatments | Sahyadri – 3 Grain yield | | Sahyadri – 4 Grain yield | |
|---|---|---|---|---|---|
| | | 2011 | 2012 | 2011 | 2012 |
| $T_1$ | RDF | 60.28 | 62.8 | 63.90 | 62.27 |
| $T_2$ | 100 % N-FYM | 55.73 | 65.4 | 54.80 | 64.31 |
| $T_3$ | 100 % N-PM | 55.74 | 65.4 | 57.52 | 64.78 |
| $T_4$ | 100 % N-GM | 54.16 | 65.6 | 57.73 | 63.84 |
| $T_5$ | ¾ RDN + ¼ N-FYM | 57.43 | 64.6 | 56.81 | 66.20 |
| $T_6$ | ¾ RDN + ¼ N-PM | 57.57 | 64.3 | 55.21 | 66.87 |
| $T_7$ | ¾ RDN + ¼ N-GM | 58.24 | 63.2 | 56.04 | 64.96 |
| $T_8$ | ¾ RDN + BF | 50.19 | 63.7 | 57.96 | 64.61 |
| $T_9$ | ½ RDN + ½ N-FYM | 51.46 | 64.1 | 55.62 | 64.05 |
| $T_{10}$ | ½ RDN + ½ N-PM | 56.70 | 63.8 | 58.00 | 65.91 |
| $T_{11}$ | ½ RDN + ½ N-GM | 55.82 | 65.3 | 58.65 | 63.18 |
| $T_{12}$ | ½ RDN + ¼ N-FYM + ¼ N-PM | 54.77 | 66.0 | 56.45 | 67.00 |
| $T_{13}$ | ½ RDN + ¼ N-FYM + ¼ N-GM | 58.88 | 66.3 | 58.69 | 66.02 |
| $T_{14}$ | ½ RDN + ¼ N-PM + ¼ N-GM | 58.22 | 65.5 | 57.89 | 65.22 |
| S.E. ± | | 1.04 | 0.6 | 1.31 | 0.82 |
| C.D. (P=0.05) | | 3.02 | 1.9 | 3.82 | 2.37 |

The increase in yield was attributed to the better availability of nutrients throughout the crop growth period and thereby increased the yields. Similar results were reported by Prasad (1994) [13]. Organics were beneficial in reducing the fixation or precipitation with those of soil components of added or mineralized nutrients and played complementary role to boost the crop yield. This is in agreement with the findings of Kher (1993) [9]. The increased grain yield might be due to increase in number of panicles $m^{-2}$, length of panicle as a result of adequate availability and transformation of organic nitrogen during reproductive and grain filling stages coupled with increased rate of photosynthesis and better availability and translocation of nutrients and photosynthates from source to sink. The reason may be application of organic manure might be enhance the physicochemical properties of soil and durable availability of plant nutrients for longer period (Singh *et al.* 2000) [17].

**Sahyadri-3**

**Protein** content in grain of rice was significantly influenced by different nutrient management treatments. The Protein content in rice grain varied from 6.89 to 8.14 per cent, during first year of study. In the second year of study, it varied from 7.60 to 8.63 per cent among the various treatments. There were significant differences in protein content of rice grain due to application of different nutrient management treatments. The maximum values of protein observed in the treatment $T_{11}$ receiving 50 per cent RDF + Glyricidia (GM) @ 7.5 t $ha^{-1}$ (8.14 %), which was significantly superior to rest of the treatments and at par with treatment $T_1$, $T_6$, $T_7$, $T_9$, $T_{10}$, $T_{12}$, $T_{13}$ and $T_{14}$ during first year of study. In the second year, treatment $T_{12}$ receiving 50 per cent RDF + 25 per cent RDN through FYM + 25 per cent RDN through PM (8.63 %), which was significantly superior and at par with treatment $T_2$, $T_3$, $T_{13}$ and $T_{14}$. Jagtap (2007) [5] reported that the maximum and significant protein value received from treatment i.e. application of inorganic fertilizers along with FYM @ 2.5 t $ha^{-1}$ and glyricidia @ 2.5 t $ha^{-1}$.

Sharma and Namdeo (1999) [16] noted that the combined application of Rhizobium + FYM + phosphorus solubilizing bacteria with N + P fertilizers gave higher protein content over recommended N and P fertilizers. Saleha (1992) [14] studied and observed organic v/s inorganic sources of nitrogen application through FYM, Poultry manure and inorganic sources which improved quality and registered increase in protein content over rest of other treatments.

**Crude fat** content in grain of rice was significantly influenced by different nutrient management treatments. The crude fat in rice grain varied from 1.89 to 2.07 per cent, during first year of study. In the second year of study, it varied from 1.85 to 2.10 per cent among the various treatments. There were significant differences in crude fat of rice grain due to application of different nutrient management treatments. The maximum values of crude fat observed in the treatment $T_{12}$ receiving 50 per cent RDF + 25 per cent RDN through FYM + 25 per cent RDN through PM (2.07 %), which was significantly superior to rest of the treatments and at par with treatment $T_1$, $T_2$, $T_3$, $T_6$, $T_7$, $T_{11}$ and $T_{13}$ during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (2.10 %), which was significantly superior over rest of the treatments. Dosani *et al.* (1999) [3] observed that the treatment combination of poultry manure @ 3 t $ha^{-1}$ + recommended dose of fertilizers recorded maximum oil percent in groundnut.

**Crude fiber** content in grain of rice was significantly influenced by different nutrient management treatments. The crude fiber in rice grain varied from 0.70 to 0.81 per cent, during first year of study. In the second year of study, it varied from 0.67 to 0.82 per cent among the various treatments. Similar results are in agreement with Sawant (2004) [15]. There were significant differences in crude fiber of rice grain due to application of different nutrient management treatments. The maximum values of crude fiber observed in the treatment $T_{12}$ receiving 50 per cent RDF + 25 per cent RDN through FYM + 25 per cent RDN through PM (0.81 %), which was significantly superior to rest of the treatments and at par with treatment $T_1$ and $T_{13}$ during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (0.82 %) which was significantly superior over rest of the treatments and at par with treatment $T_3$, $T_4$ and $T_{12}$.

**Water soluble carbohydrate** content in grain of rice was significantly influenced by different nutrient management treatments. The water soluble carbohydrates in rice grain varied from 80.79 to 82.15 per cent during first year of study. In the second year of study, it varied from 79.37 to 82.06 per cent among the various treatments. Ghadi *et al.* (2002) [4] recorded total carbohydrate content in promising rice varieties grown in Konkan region varied from 76.60 to 81.47 per cent. It is revealed from data that the water soluble carbohydrates significantly influenced due to application of sources manures. There were significant differences in carbohydrate content of rice grain due to application of different nutrient management treatments. The maximum values of carbohydrate observed in the treatment $T_8$ receiving 75 per cent RDF + Biofertilizers (82.15 %), which was significantly superior to rest of the treatments during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (82.06 %) which was significantly superior over rest of the treatments and at par with treatment $T_3$, $T_9$ and $T_{12}$.

**Ash content** in rice was significantly influenced by different nutrient management treatments. The ash in rice grain varied from 7.73 to 9.44 per cent during first year of study. In the second year of study, it varied from 6.46 to 10.09 per cent among the various treatments. there were significant differences in ash content of rice grain due to application of different nutrient management treatments. The maximum values of ash observed in the treatment $T_4$ receiving Glyricidia (GM) @ 15 t $ha^{-1}$ (9.44 %), which was significantly superior to rest of the treatments and at par with treatment $T_2$, $T_3$ and $T_5$, during first year of study. In the second year, treatment $T_8$ receiving 75 per cent RDF + Biofertilizers (9.59 %) which was significantly superior over rest of the treatments and at par with treatment $T_6$.

**Table 2:** Effect of INM on quality parameters of hybrid rice

| Tr. No. | Treatments | Sahyadri – 3 | | | | | | Sahyadri - 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Protein (%) | | Crude fat (%) | | Crude fiber (%) | | Protein (%) | | Crude fat (%) | | Crude fiber (%) | |
| | | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 |
| $T_1$ | RDF | 7.60 | 8.01 | 1.98 | 1.94 | 0.79 | 0.757 | 8.66 | 7.92 | 1.99 | 1.95 | 0.77 | 0.743 |
| $T_2$ | 100 % N-FYM | 6.89 | 8.56 | 2.03 | 2.10 | 0.76 | 0.823 | 7.24 | 8.51 | 2.03 | 2.11 | 0.76 | 0.810 |
| $T_3$ | 100 % N-PM | 6.89 | 8.52 | 2.00 | 2.01 | 0.76 | 0.810 | 7.34 | 8.42 | 2.05 | 2.05 | 0.74 | 0.790 |
| $T_4$ | 100 % N-GM | 7.11 | 8.29 | 1.89 | 1.99 | 0.76 | 0.797 | 7.30 | 8.23 | 1.97 | 2.04 | 0.77 | 0.763 |
| $T_5$ | ¾ RDN + ¼ N-FYM | 7.30 | 7.87 | 1.92 | 1.96 | 0.71 | 0.767 | 7.46 | 7.80 | 2.00 | 2.02 | 0.71 | 0.747 |
| $T_6$ | ¾ RDN + ¼ N-PM | 7.50 | 7.60 | 1.98 | 1.92 | 0.73 | 0.733 | 7.38 | 7.71 | 1.92 | 1.99 | 0.72 | 0.713 |
| $T_7$ | ¾ RDN + ¼ N-GM | 7.75 | 8.06 | 1.98 | 1.90 | 0.70 | 0.710 | 7.49 | 8.08 | 1.87 | 1.96 | 0.69 | 0.697 |
| $T_8$ | ¾ RDN + BF | 7.26 | 8.01 | 1.93 | 1.85 | 0.72 | 0.673 | 7.68 | 7.99 | 1.91 | 1.82 | 0.69 | 0.653 |
| $T_9$ | ½ RDN + ½ N-FYM | 7.88 | 8.26 | 1.92 | 2.03 | 0.71 | 0.790 | 7.88 | 8.28 | 1.89 | 2.04 | 0.69 | 0.783 |
| $T_{10}$ | ½ RDN + ½ N-PM | 8.00 | 8.17 | 1.92 | 1.99 | 0.72 | 0.770 | 7.74 | 8.22 | 1.94 | 2.04 | 0.70 | 0.767 |
| $T_{11}$ | ½ RDN + ½ N-GM | 8.14 | 7.91 | 2.04 | 1.96 | 0.71 | 0.740 | 7.85 | 7.94 | 1.97 | 1.98 | 0.73 | 0.733 |
| $T_{12}$ | ½ RDN + ¼ N-FYM + ¼ N-PM | 7.54 | 8.63 | 2.07 | 2.04 | 0.81 | 0.807 | 7.54 | 8.55 | 1.98 | 2.04 | 0.81 | 0.793 |
| $T_{13}$ | ½ RDN + ¼ N-FYM + ¼ N-GM | 8.00 | 8.61 | 2.00 | 2.00 | 0.79 | 0.783 | 7.71 | 8.39 | 2.01 | 2.01 | 0.81 | 0.763 |
| $T_{14}$ | ½ RDN + ¼ N-PM + ¼ N-GM | 7.90 | 8.53 | 1.96 | 1.95 | 0.71 | 0.753 | 7.45 | 8.50 | 1.94 | 1.97 | 0.74 | 0.757 |
| S.E. ± | | 0.25 | 0.05 | 0.03 | 0.01 | 0.01 | 0.012 | 0.14 | 0.05 | 0.02 | 0.02 | 0.02 | 0.010 |
| C.D. (P=0.05) | | 0.73 | 0.16 | 0.09 | 0.04 | 0.03 | 0.034 | 0.40 | 0.16 | 0.06 | 0.06 | 0.04 | 0.029 |

**Sahyadri-4**

**Protein content** in grain of rice was significantly influenced by different nutrient management treatments. The Protein content in rice grain varied from 7.24 to 8.66 per cent during first year of study. In the second year of study, it varied from 7.71 to 8.55 per cent among the various treatments. There were significant differences in protein content of rice grain due to application of different nutrient management treatments. The maximum values of protein observed in the treatment $T_1$ receiving 100 per cent RDF (8.66 %), which was significantly superior to rest of the treatments during first year of study. In the second year, treatment $T_{12}$ receiving 50 per cent RDF + 25 per cent RDN through FYM + 25 per cent RDN through PM (8.63 %) which was significantly superior and at par with treatment $T_2$, $T_3$, $T_{13}$ and $T_{14}$. Jagtap (2007) [5] reported that the maximum and significant value was received from treatment i.e. application of in organic fertilizers along with FYM @ 2.5 t $ha^{-1}$ and glyricidia @ 2.5 t $ha^{-1}$. Sharma and Namdeo (1999) [16] noted that the combined application of Rhizobium + FYM + phosphorus solubilizing bacteria with N + P fertilizers gave higher protein content over recommended N and P fertilizers. Saleha (1992) [14] studied and observed organic v/s inorganic sources of nitrogen application through FYM, poultry manure and inorganic sources which improved quality and registered increase in protein content over all other treatments.

**Crude fat content** in grain of rice was significantly influenced by different nutrient management treatments. The crude fat in rice grain varied from 1.87 to 2.05 per cent during first year of study. In the second year of study, it varied from 1.82 to 2.11 per cent among the various treatments. There were significant differences in crude fat of rice grain due to application of different nutrient management treatments. The maximum values of crude fat observed in the treatment $T_3$ receiving 100 per cent RDN through PM (2.05 %), which was significantly superior to rest of the treatments and at par with treatment $T_1$, $T_2$, $T_5$ and $T_{13}$ during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (2.11 %) which was significantly superior over rest of the treatments and at par with treatment $T_3$. Dosani *et al*. (1999) [3] observed that the treatment combination of poultry manure @ 3 t $ha^{-1}$ + recommended dose of fertilizers recorded maximum oil percent in groundnut.

**Crude fiber content** in grain of rice was significantly influenced by different nutrient management treatments. The crude fiber in rice grain varied from 0.69 to 0.81 per cent during first year of study. In the second year of study, it varied from 0.65 to 0.81 per cent among the various treatments. Similar results are in agreement with Sawant (2004) [15]. There were significant differences in crude fiber of rice grain due to application of different nutrient management treatments. The maximum values of crude fiber observed in the treatment $T_{12}$ and $T_{13}$ receiving 50 per cent RDF + 25 per cent RDN through FYM + 25 per cent RDN through PM and 50 percent RDF + 25 per cent RDN through FYM + Glyricidia (GM) @ 3.75 t $ha^{-1}$ (0.81 %), which was significantly superior to rest of the treatments and at par with treatment $T_1$ and $T_4$ during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (0.81 %) which was significantly superior over rest of the treatments and at par with treatment $T_3$ and $T_{12}$.

**Carbohydrates** (%)

**Water soluble carbohydrate content** in grain of rice was significantly influenced by different nutrient management treatments. The water soluble carbohydrates in rice grain varied from 80.51 to 82.19 per cent during first year of study. In the second year of study, it varied from 80.12 to 82.18 per cent among the various treatments. Ghadi *et al.* (2002) [4] recorded total carbohydrate content in promising rice varieties grown in Konkan region varied from 76.60 to 81.47 per cent. It is revealed from data that the water soluble carbohydrates significantly influenced due to application of sources manures. There were significant differences in carbohydrate content of rice grain due to application of different nutrient management treatments. The maximum values of carbohydrate observed in the treatment $T_8$ receiving 75 per cent RDF + Biofertilizers (82.19 %), which was significantly superior to rest of the treatments during first year of study. In the second year, treatment $T_2$ receiving 100 per cent RDN through FYM (82.18 %) which was significantly superior over rest of the treatments and at par with treatment $T_{12}$.

**Ash content (%)**

Ash content in rice was significantly influenced by different nutrient management treatments. The ash in rice grain varied from 6.57 to 9.46 per cent during first year of study. In the second year of study, it varied from 6.39 to 9.41 per cent among the various treatments. There were significant differences in ash content of rice grain due to application of different nutrient management treatments. The maximum values of ash observed in the treatment $T_4$ receiving Glyricidia (GM) @ 15 t $ha^{-1}$ (9.46 %), which was significantly superior to rest of the treatments during first year of study. In the second year, treatment $T_8$ receiving 75 per cent RDF + Biofertilizers (9.41 %) which was significantly superior over rest of the treatments.

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