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# Nutrient Management in Bengal Aromatic Rice of Terai-Teesta Alluvial Zone in West Bengal

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## ABSTRACT

A field experiment was conducted during *kharif* season of 2018-19 and 2019-20 at Jalpaiguri district of West Bengal to study the effect of combination of organic and inorganic sources of nutrients in aromatic rice variety Kalonunia production. The experiment consisted of three treatments comprising of farmers' practice *i.e.,* imbalanced use of fertilizers (30 kg N/ ha + 20 kg $P_2O_5$ /ha + 20 Kg $K_2O$ /ha), T1; 80% RDN (RDF-50:25:25 Kg/ ha) through inorganic source + 20% N through organic Sources (FYM and mustard cake), T2: 60% RDN (RDF- 50:25:25 Kg/ha) through inorganic source + 40% N through organic sources (FYM and mustard cake).The results indicated that, application of 60% RDN through inorganic source + 40% N through organic sources gave maximum grain yield (2.48 t/ha) and straw yield (6.62 t/ha). and recorded significantly higher growth parameters and yield attributes whereas lowest observation was with famers' practice.

**Key Words:** Economics, Nutrient, Farm Yard Manure, Mustard cake, Grain yield.

## INTRODUCTION

The domestication and adaptation of different rice cultivars mainly by the Asian and African peasant farmers over thousands of year's results in selection of cultivars suited to needs, local cultural practices and agro-ecological conditions. Aromatic rice is categorized in two types: (i) Basmati and (ii) non-Basmati, with specific distinctions in terms of grains quality features and geographical areas of cultivation. Basmati, the long-grains ones, are traditionally cultivated at the foothills of Himalayans in north states while short and medium-grain non-Basmati scented rice are grown in small pockets of the native areas in different parts of the country (Nene, 1998). The state of West Bengal has precious wealth of genetic diversity in different indigenous aromatic rice. It is estimated that about 3.0 to 3.5lakh tonnes of such premium rice is produced every year in the state (Bhattacharya, 2003). These non-Basmati scented rice includes Gobindabhog, Tulaipanji, Kalonunia, Radhunipagal, Badshabhog, Kataribhog, etc.; which have different end-uses like cooked table rice, pulse-mixed rice (bhog), dessert (payesh), polao, biriyani etc.

Farmers in north Bengal areas specially Jalpaiguri district produce Kalonunia rice mostly for sale of their produce to the rice mills for earning money at a time, and sometimes a small portion for their family use. They cultivated the variety usually with low inputs and traditional practices intermixed with a few modern technologies in recent times during *kharif* season. The nutrition of indigenous tall *indica* rice, traditionally by organic manures may be refined or upgraded for better yield and quality. Therefore, a suitable combination of organic and inorganic source of nutrients is necessary for sustainable indigenous rice production that can ensure food production with high quality. Keeping in view, a study was undertaken to assess the appropriate use of organic manure in combination with chemical fertilizers for improvement of grain yield and quality of Kalonunia rice.

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**Table 1. Effect of nutrient management on growth attributes of Kalonunia rice (Pooled over two years).**

| Treatment | Plant Height (cm) | | Number of Tillers/$m^2$ | | Dry matter accumulation (g/$m^2$) | |
|---|---|---|---|---|---|---|
| | 28 DAT | 84 DAT | 28 DAT | 84 DAT | 28 DAT | 84 DAT |
| Farmers' practice | 66.85 | 131.54 | 236.58 | 287.52 | 181.78 | 502.41 |
| T1 | 67.45 | 128.82 | 239.70 | 292.87 | 184.40 | 524.17 |
| T2 | 67.54 | 125.93 | 243.44 | 298.36 | 189.15 | 533.40 |
| SEm(±) | 0.030 | 0.205 | 0.252 | 0.397 | 0.873 | 1.157 |
| CD at 5 % | 0.10 | 0.64 | 0.79 | 1.24 | 1.85 | 4.61 |

## MATERIALS AND METHODS

An On Farm trial (OFT) was conducted during *kharif* season of 2018-19 and 2019-20 for assessing the effect of integrated nutrient management in terms of yield and economy of Bengal aromatic rice Var. Kalonunia. Experiment was conducted at seven different locations of Jalpaiguri district on 0.42 ha of area comprising 0.06 ha each with treatments namely farmers' practice *i.e.,* imbalanced use of fertilizers (30 kg N/ ha + 20 kg $P_2O_5$ /ha + 20 Kg $K_2O$ /ha), T1; 80% RDN (RDF- 50:25:25 Kg/ha) through inorganic source + 20% N through organic Sources (FYM and mustard cake), T2: 60% RDN (RDF- 50:25:25 Kg/ha) through inorganic source + 40% N through organic sources (FYM and mustard cake) in randomised block design with seven replications.

The experiment was conducted on a medium low land, which belonged to the class of sandy loam with low fertility and acidic in reaction. The average initial physico-chemical properties of the experimental soil were bulk density (1.57g/$cm^3$), pH (5.25), EC (0.23 dS/m), organic carbon (0.54 %), available N (232.74 kg/ha), available P (28.28 kg/ha), available K (239.54 kg/ha) and available S (6.31 kg/ha). Three weeks old seedlings @ 2-3/ hill were transplanted manually at the spacing of 20 cm × 15 cm in the main field. Recommended dose of fertilizers for Kalonunia was 50:25:25 kg of NPK/ ha. Nitrogen was supplied through urea, phosphorus through single super phosphate and potassium through muriate of potash. Farmers usually applied 20:20:20 kg/ ha of N: $P_2O_5$: $K_2O$ at basal + 10 kg N/ ha at 4 wk after transplanting. Treatment T1, FYM was applied @ 2 t and 25:10 kg of $P_2O_5$:$K_2O$/ ha at basal, 25 Kg nitrogen was applied at 3 wk after transplanting and 15:15 kg/ ha of N: $K_2O$ at 6 wk after transplanting. Treatment T2, FYM was applied @ 2t/ ha and 25:10 kg $P_2O_5$:$K_2O$/ ha at basal, 15 Kg N and 0.2 t mustard cake/ ha at 3 wk after transplanting and 15:15 Kg/ ha of N:$K_2O$ at 6 wk after transplanting. The crop was harvested by sickles at ground level, when 80% of the panicles with 80% grains in each panicle were matured. After proper cleaning and drying, the grains and straws of each plot were weighed separately and the yields were calculated in terms of t/ ha. The data collected as described earlier were subjected to statistical analysis by the analysis of variance method suitable for randomised block design (Gomez and Gomez, 1984) using OPSTAT on-line software. The significance of different sources of variation was testes by Fisher's F test for appropriate degrees of freedom. Fisher and Yates table (1963) was consulted to test 'F' statistics as well as for computation of critical difference (C.D.) at 5% level of significance.

**Table 2. Effect of nutrient management on yield attributes and yield of Kalonunia rice (Pooled over two years).**

| Treatment | Yield Components | | | | Grain yield (t/ha) | Straw yield (t/ ha) |
|---|---|---|---|---|---|---|
| | Panicle length (cm) | No. of Panicle/ $m^2$ | No. of filled grain/ Panicle | 1000 grain weight (g) | | |
| Farmers' practice | 24.0 | 259.0 | 95.0 | 13.3 | 2.07 | 6.40 |
| T1 | 25.9 | 274.5 | 103.0 | 13.2 | 2.36 | 6.57 |
| T2 | 27.1 | 281.0 | 107.5 | 13.3 | 2.48 | 6.62 |
| SEm(±) | 0.114 | 0.825 | 0.461 | 0.002 | 0.015 | 0.008 |
| CD at 5 % | 0.35 | 2.57 | 1.44 | NS | 0.11 | 0.03 |

## RESULTS AND DISCUSSION

The growth parameters *i.e.,* plant height and number of ttillers/$m^2$ and dry matter accumulation (g/$m^2$) of Kalaonunia rice, varied significantly due to application of different sources of nutrients. The data (Table 1) indicated that highest plant height found (67.54 cm and 125.93 cm) at 28 and 84 DAT in T2 compared to other treatments. Among the different treatments, 60% RDN through Inorganic source + 40% through Organic Sources (FYM and mustard cake) recorded higher number of tillers/$m^2$ (243.44 and 298.36) and dry matter accumulation (189.15 and 533.40 g/ $m^2$) compared to other treatment. This might be due to higher availability of essential nutrients and application of organic source which helped in improving the physical condition of the soil for better root proliferation leading to higher absorption of water and nutrients and ultimately resulting in higher growth attributes. Similar results have also been reported by Rathiya *et al* (2017) and Mahapatra *et al* (2004).

There was a steady increasing trend in accumulation of aerial dry matter in Kalonunia rice with the advancement of crop growth. Combination of Inorganic and organic offers more balanced nutrition to the plants which positively affect number of tillers.

Maximum grain yield (2.48 t/ha) and straw yield (6.62 t/ha) were obtained with the application of 60% RDN through inorganic source and 40% N through organic Sources which was followed by application of 80% RDN through inorganic source and 20% N through organic Sources. Similar was the trend in case of yield attributes also except test weight. The minimum grain yield (2.07 t/ha) and straw yield (6.40 t/ha) were recorded in farmer's practices during both year of investigation. Combination of FYM, mustard cake and inorganic fertilizers enhanced the yield attributes and production than the farmer's practices. Generally, chemical fertilizer enhances the yield but in aromatic landraces more application of inorganic causes lodging and

**Table 3. Effect of nutrient management on Economics of rice (Mean data of two years).**

| Technology option | Cost of cultivation (Rs./ha) | Gross return (Rs./ ha) | Net return (Rs./ ha) | BC ratio |
|---|---|---|---|---|
| Farmers' practice | 35,580 | 72,390 | 36,810 | 2.03 |
| T1 | 38,225 | 81,655 | 43,430 | 2.13 |
| T2 | 36,235 | 85645 | 49,410 | 2.36 |

reduces the aroma. So, appropriate combination of inorganic and organic fertilizers may help achieving the higher yield and quality of indigenous aromatic rice. Adhikary and Majumdar (2002) also suggested combined application of chemical fertilizers and organic manures for attaining higher grain yields. Higher yields under combined use of RFD and FYM could be attributed to well decomposition of FYM, which favoured better nutrient availability coupled with higher assimilation of nutrients.

Among different treatments cost of cultivation was found highest in T1(Rs. 38,225/ha-) whereas lowest cost of cultivation was recorded in farmers' practices Rs. 35,580/-ha due to more cost regarding inorganic as well as organic fertilizer and management of resources.

## CONCLUSION

The combination of inorganic and organic fertilizer showed positive response in terms of growth parameter as well as yield attributes that enhances the yield and quality of Kalonuina rice. Application of 60% RDN through inorganic source and 40% N through oganic sources (T2) showed significant responses than other treatments in terms of all characters. Among the three treatments, T2 resulted in highest B:C ratio and net returns. On the basis of present investigation, it can be concluded that the application of 60% RDN through inorganic source and 40% N through organic sources found most effective in increasing the growth, yield and quality of rice and also helped in maintaining soil health for sustainable aromatic rice production.

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