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# RESPONSE OF RICE VARIETIES TO INORGANIC NUTRIENT SOURCES IN ACIDIC SOIL CONDITION IN MEGHALAYA

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***Abstract:*** A pot study was conducted at Research Farm of College of Agriculture, Kyrdemkulai, Ri-Bhoi District, Meghalaya. The objective of study is to know about inherent nutrient supplying capacity of soil in terms of increasing growth and yield attributing characters of four different rice varieties viz., Bhalum-1, DRR-46, DRR-42 and IURON-514. The source of nutrient application were urea, diammonium phosphate and lime ($CaCO_3$) and rate of nutrient application were 80 kg N/ha and 25.8 kg P/ha. The lime was applied @ 1 tonne/ha. The order of rice varieties with respect to tillers per plant was DRR-46 > Bhalum-1 > IURON-514 > DRR-42. Out of the total dry matter production, 60 to 74 % accumulated in the above ground dry matter at 60 DAS; while at harvest same was 65.5 to 73 %. Rice variety DRR-46 and Bhalum-1 recorded significantly higher values for growth (plant height and tiller/plants) and yield attributes (panicle length, filled and total spikelet) over other varieties.

***Keywords:*** Rice, DRR-46, growth attributes, acidic soil

The rice is the staple food of Meghalaya characterised by two different types of growing ecosystem (lowland and upland ecosystem), use of traditional knowledge for crop management, organic production system, use of traditional varieties and shifting cultivation (De, 2021). Along with that, significant variation in rainfall and topography of land adds to diversity of rice cultivation and need of special practices for rice production system. The factors such as availability of organic manure in plenty, heavy rainfall, organic matter from residue of previous season vegetable crop and state government initiative and promotion for organic farming leading to very low or negligible use of chemicals fertilizers for nutrient addition. The rice production in region is mainly sustained by high organic matter content in soil (Choudhary *et al*., 2013), use of traditional varieties and practices responding to organic production system of management (Das *et al*., 2015) and washing in of forest letter in decomposed and un-decomposed form to valley area where rice cultivation is done. In case of upland direct seeded rice cultivation, the problem of fading of organic carbon due to clearing of vegetation and heavy rainfall is very common. This leads to increase in need of external source of crop nutrition either through organic manure or inorganic chemical fertilizers. The adoption of high yielding varieties needs more nutrients and that to in special reference to upland rice cultivation. In such situation study of nutrient supplying capacity of inherent soil and varietal response to this inherent soil nutrient reserve is of prime importance and therefore the present study was planned.

## METHODOLOGY

A pot experiment was conducted during *kharif* (wet) season of 2020 at Research Farm of College of Agriculture, Kyrdemkulai, Ri-Bhoi District, Meghalaya. The climate of selected area is subtropical type with average seasonal (SW monsoon) and annual precipitation of 1424.1 and

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2119.3 mm, respectively. The soil was collected from Research Farm grown with wild vegetation and while selecting the soil, the care is taken to remove the top 4-5 cm depth of soil which is rich in decomposed and un-decomposed organic manure. This was insured in order to grow the rice in inherent soil without added organic manure due to wild vegetation which may act as nutrient source and thereby affect the nutrient response of rice to inorganic sources of nutrients. The soil was mixed thoroughly 2-3 times and filled in pot each carrying 9.5 to 10 kg soil. Four rice varieties viz., DRR-46, IURON-514, Bhalum-1 and DRR-42 were sown on 19th June 2020 and gap filling was done after 8-10 days. In each pot, three rice seeds were dibbled and five replications were maintained for each variety to have sufficient samples. The nutrients were applied through chemical fertilizers (Urea for nitrogen diammonium phosphate for phosphorus and calcium carbonate of calcium) and rate of nutrient application was 80 kg N/ha, 25.8 kg P/ha and lime @ 1 t/ha/. All nutrients were applied at the time of sowing. The plant biometric parameters and yield attributes were measured by following standard procedure. The statistical significance among applied treatments were studied using the F-test and least significant difference (LSD) values ($P = 0.01$).

## RESULTS AND DISCUSSION

The selected varieties were differing significantly in growth attributes (height and tillers/plant) with significantly highest height in IURON-514 over all other varieties (Table 1). The Bhalum-1 stand second and found significant over DRR-46 and DRR-42. The rice varieties DRR-46 and Bhalum-1 was significantly superior over other varieties in terms of tillers/plant and above ground dry matter accumulation. The highest tillers/plant and above ground shoot dry matter accumulation at harvest was recorded in DRR-46 (5 tiller/plant and 9.23 g/plant). In case of root dry matter accumulation, Bhalum-1 and IURON-514 had significantly higher root dry matter over DRR-46 and DRR-42 both at 60 DAS and at harvest. The variation in trend of shoot and root dry matter accumulation indicates the varied level of water and nutrient acquisition capacity of roots. The higher shoot dry matter per unit of root dry matter accumulation (DRR-46 and DRR-42) is the indication better water and nutrient acquisition capacity and such cultivar are considered as efficient in dry matter partitioning. The variation in dry matter partitioning across varieties was also reported by Mahajan *et al*., (2012) and Baishya *et al*. (2015); while variation in contribution of source and sink to rice yield was reported by Lubis *et al*. (2003). The root and shoot dry matter was remained more or less equal with 60-67 % in shoot and 33 to 40 % in root in bhalum-1. This may be considered as inefficient in portioning of dry matter or might be due to higher nutrient need which was not fulfilled by soil nutrient reserve (both inherent and externally applied). Due to this constraint of nutrients the plant not able to express the entire potential of above ground growth. The variation in dry matter accumulation across nutrient endowment was reported in Amanullah and Inamullah (2016), Shahane *et al.* (2018).

Among the yield attributes studied, panicle length, filled grain/panicle and total grains/panicle was found significantly different among the studied varieties; while panicle/plant and unfilled grains/panicle remain on par across rice varieties (Table 2). The filled grain/panicle across the varieties varies across 27 to 40; while same for total grain was 37 to 52, respectively.

All growth of all rice varieties was suboptimal in pot experiment and this can be seen from the growth and yield attributing characters (Table 1 and 2). This suboptimal growth of rice is explained by poor soil fertility, washing out of soluble nutrient sources (urea for nitrogen), fixation of reactive nutrient (phosphorus applied through soluble fertilizer) thereby making them less available for plant growth, less effect of lime application in terms of acidity management and low soil organic matter as soil were selected by removing top 4-5 cm layer of organic matter to account the inherent nutrition supplying capacity of acidic soil. In entire crop growth duration no any toxicity symptoms of Fe and Mn toxicity symptoms (Rengel, 2015) were observed indicating that, their toxicity will not a hurdle for crop growth (Brajendra *et al*., 2017) in present experiment (acidic soil). The use of organic manure and soil rich in organic manure in heavy rainfall area will serve for crop nutrition both as source and moderator of inherent nutrient supplier. As well as organic sources are easily and timely available with farmers and mostly do not involve much cost. This might be the reasons for the low rate of adoption of chemical fertilizer based modern agriculture along with recognizing the potential for of organic farming in Meghalaya.

The results of our experiment showed that, DRR-46 and Bhalum-1 rice varieties were found superior with applied chemical fertilizers. The use of chemical fertilizers was conditioned in selected location in Meghalaya by weather factors (rainfall) and soil factor (soil acidity). The growth of all selected varieties was suboptimal in mineral soil indicating the role of soil inherent organic matter added through forest or wild vegetation grown in off season.

**Table 1: Growth attributes of different rice varieties**

| *Treatment* | *Height (cm)* | | *Tillers /plant* | | *Shoot dry matter accumulation (g/plant)* | | *Root dry matter accumulation (g/plant)* | |
|---|---|---|---|---|---|---|---|---|
| | *60 DAS* | *At harvest* | *60 DAS* | *At harvest* | *60 DAS* | *At harvest* | *60 DAS* | *At harvest* |
| DRR-46 | 49.2 | 63.6 | 6.3 | 5.0 | 6.35 | 9.23 | 2.21 | 3.43 |
| IURON-514 | 62.8 | 74.3 | 3.7 | 3.0 | 5.44 | 7.93 | 3.33 | 4.18 |
| Bhalum-1 | 60.6 | 71.5 | 5.7 | 5.0 | 5.83 | 8.63 | 3.81 | 4.25 |
| DRR-42 | 48.5 | 61. 7 | 3.3 | 2.3 | 3.93 | 6.37 | 2.09 | 2.39 |
| LSD (P= 0.01) | 2.42 | 1.87 | 2.21 | 1.89 | 1.09 | 0.87 | 0.53 | 0.36 |

**Table 2: Yield attributes of different rice varieties**

| *Treatments* | *Panicles/plant* | *Panicle length (cm)* | *Filled grains (No.)* | *Unfilled grains (No.)* | *Total grain (No.)* |
|---|---|---|---|---|---|
| DRR-46 | 4.0 | 17.3 | 40.3 | 12 | 52.3 |
| IURON-514 | 3.3 | 15.3 | 29.7 | 9 | 38.7 |
| Bhalum-1 | 3.3 | 16.4 | 36.0 | 11 | 47.0 |
| DRR-42 | 2.0 | 15.1 | 27.4 | 10.3 | 37.7 |
| LSD (P= 0.01) | NS | 1.08 | 7.25 | NS | 8.44 |

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