INFLUENCE OF BANANA LEAVES IN ASSOCIATION WITH INORGANIC POTASSIUM FERTILIZER ON THE NUTRIENT CONTENT AND UPTAKE OF BRRI DHAN49

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ABSTRACT

An experiment was done at the Soil Science Department, Bangladesh Agricultural University (BAU) to study the jointed use of banana leaves with inorganic potassium fertilizer on the development and yield of BRRI dhan49 placing Randomized Complete Block Design (RCBD) with eight treatments and three replications. The treatments were T1: control (no fertilizer), T2: RFD (Recommended Fertilizer Dose), T3: (50% K from banana leaves+50% K from MoP), T4: (60% K from banana leaves+40% K from MoP), T5: (70% K from banana leaves+30% K from MoP), T6: (80% K from banana leaves+20% K from MoP), T7: (90% K from banana leaves+10% K from MoP), T8: (100% K from banana leaves). The uppermost potassium content in grain (0.33%) and straw (1.30%) were gained in the treatment T8. The bottommost potassium content in grain (0.26%) and straw (1.08%) were logged in the control. At the same time, the highest potassium uptake by grain (19.46 kg ha−1) and straw (89.06 kg ha−1) were attained in the treatment T8 and the lowest potassium uptake by grain (8.67 kg ha−1) and straw (51.40 kg ha−1) were documented in the control. Total (grain+straw) peak (108.52 kg ha−1) potassium uptake was found in T8 treatment and lowest (60.06 kg ha−1) was found in control. It can be endorsed to cohesive use of 50% K from banana leaves+50% K from MoP on nutrient content and uptake of BRRI dhan49.

KEYWORDS

nutrient content, nutrient uptake, banana leaves, potassium fertilizer, grain, straw, BRRI dhan49.
Chokravarti stated that K application tended to increase grain N content and total N uptake by the crop, while P content was little affected (Chokravarti, 1989). Gradually higher content and uptake of K caused from increasing levels of K supply. Therefore, the present inquiry was assumed to study the effect of joined use of banana leaves with inorganic fertilizer on nutrient content and uptake by BRRI dhan49.

2. MATERIALS AND METHODS

2.1 Experimental site and soil

The experiment was run at the Soil Science Field laboratory of Bangladesh Agricultural University. The soil goes to the AEZ 9 (Old Brahmaputra Floodplain).

### Table 1: Taxonomical characteristics of Soil

| Order          | Inceptisol          |
|----------------|---------------------|
| Sub-order      | Aquert              |
| Sub-group      | Aeerie Haplaquept   |
| Soil series    | Sonatala            |

### Table 2: Morphological characteristics of Soil

| Morphology          | Characteristics       |
|---------------------|-----------------------|
| Location            | Soil Science Field Laboratory, Bangladesh Agricultural University, Mymensingh |
| AEZ                 | Old Brahmaputra Flood plain |
| Land type           | Medium high           |
| General soil type   | Non-calcareous Dark Grey Flood plain |
| Parent material     | Old Brahmaputra river borne deposits |
| Topography          | Fairly level          |
| Drainage            | Moderately well drained |
| Flood level         | Above flood level     |
| Vegetation          | Rice crop grown year round |

Source: Detailed Soil Survey, BAU Farm, Mymensingh, 1978.

2.2 Climate

Monthly record of air temperature, rainfall, relative humidity and sunshine hours of BAU Soil Science farm during the whole experimental period (August-December, 2014) have shown in Table 2.

### Table 2: Weather data regarding monthly average temperature, rainfall, relative humidity and sunshine hours day-1 at the experimental site during the experimental period (August-December, 2014)

| Month      | Air temperature (°C) | Rainfall (mm) | Relative humidity (%) | Sunshine (hours day-1) |
|------------|----------------------|---------------|-----------------------|------------------------|
| August     | Max. 31.4 Min. 26.3 | Mean 29.7     | 317.4                 | 85.7 3.7               |
| September  | Max. 32.4 Min. 26.3 | Mean 29.4     | 171.6                 | 85.0 4.4               |
| October    | Max. 31.8 Min. 23.2 | Mean 27.5     | 15.3                  | 83.6 7.15              |
| November   | Max. 29.9 Min. 18.1 | Mean 23.4     | 0.0                   | 82.8 6.23              |
| December   | Max. 23.9 Min. 13.6 | Mean 19.1     | 0.0                   | 86.7 3.99              |

Source: Weather Yard, Department of Irrigation and Water Management, Records of Climatological Observations (Monthly), Bangladesh Agricultural University, Mymensingh.

2.3 Land preparation

The land was organized as to prerequisite of BRRI dhan49 farming.

2.4 Rice crop (BRRI dhan49)

BRRI dhan49 was taken as a test crop in this experiment. The regular grain yield of the variety usually lies between 5 to 5.5 t ha-1. This variety is somewhat resilient to pests and diseases particularly stem rot, sheath blight and leaf blight. The seedlings were collected from Soil Science Farm, Bangladesh Agricultural University, Mymensingh.

2.5 Layout of the experiment

The experiment was placed in a Randomized Complete Block Design (RCBD) with 3 replications.

2.6 Treatments

There were 8 treatments out of which one was fully recommended dose of fertilizers. The treatment groupings used for the experiment were as follows:

1. T1 = Control (No fertilizer)
2. T2 = 100% Recommended Fertilizer Dose
3. T3 = 50% K from banana leaves + 50% K from MoP
4. T4 = 60% K from banana leaves + 40% K from MoP
5. T5 = 70% K from banana leaves + 30% K from MoP
6. T6 = 80% K from banana leaves + 20% K from MoP
7. T7 = 90% K from banana leaves + 10% K from MoP
8. T8 = 100% K from banana leaves

2.7 Manures and Fertilizer application

Air dried Banana leaves were united @ 30 kg ha-1 (equivalent 50% K), 36 kg ha-1 (equivalent 60% K), 42 kg ha-1 (equivalent 70% K) 48 kg ha-1 (equivalent 80% K), 54 kg ha-1 90% K) 60 kg ha-1 as per treatments at 15 days before transplanting of the rice seedlings. The banana leaves were mixed thoroughly with the soil. Suggested nitrogen @ 100 kg ha-1 from urea was applied in three equal split as per treatment. The first dose of urea was applied at 15 days after transplanting. The remaining doses of urea were top dressed at 32 days (active tillering stage) and 56 days (panicle initiation stage) after transplanting. P, K and S were applied @ 20, 60, and 12 kg ha-1 from triple superphosphate, muriate of potash, and gypsum individually in all the plots except as basal dose. The amount of N, P and K content in banana leaves also abridged from the endorosed N, P and K fertilizer dose applied to the soil. Sources and rate of nutrients and chemical fertilizers for rice (BRRI dhan49) is offered in Table 1. Chemical compositions of the banana leaf litter used is presented in Table 2.

### Table 1: Sources and rate of nutrients and chemical fertilizers for rice (BRRI dhan49)

| Nutrients name nutrient | Rate (kg ha-1) | Source | Fertilizers (kg ha-1) (kg/ha) |
|-------------------------|---------------|--------|-----------------------------|
| N                       | 100           | Urea   | 217                         |
| P                       | 20            | TSP    | 95                          |
| K                       | 60            | MoP    | 120                         |
| S                       | 12            | Gypsum | 66                          |

2.8 Transplanting of rice seedlings

The seedling of BRRI dhan49 was transplanted on 23rd August, 2014 upholding plant spacing of 20cmx20cm. Three healthy seedlings were relocated in each hill.

2.9 Intercultural operations

Intercultural processes like irrigation, weeding, insect and pest control were done for ensuring and maintaining the normal growth of the crop.

2.10 Harvesting

The crop was reaped at full maturity on December 7, 2014. The harvested crop of each plot was hustled distinctly and transported to the threshing floor. Grain and straw yields were noted plot wise and voiced as t ha-1 on 14% moisture basis.

2.11 Assortment and groundwork of plant samples

Grain and straw yields were recorded plot wise and articulated as sun dry basis. Grain and straw samples were retained for chemical analysis.
2.12 Chemical analysis of grain and straw samples

2.12.1 Preparation of sample

The illustrative grain and straw samples were dehydrated in an oven at 65°C for about 24 hours before they were crushed by a grinding machine. The prepared sample was then stored in paper bags and lastly they were reserved into a desiccators until analysis.

2.12.2 Digestion of plant samples for K determination

Plant samples of 0.5g (grain and straw separately) were transported into 100 ml digestion vessel. Ten ml of a mixture (HNO₃ : HClO₄ = 2:1) were added into the vessel. After heating for a while the flasks were heated at a temperature slowly raised to 20°C. Heating was stopped when the dense white fume of HClO₄ happened. After cooling, the contents were boiled into a 50 ml volumetric flask and the volume was completed with distilled water. The digests were used for the calculation of K.

2.13 Determination of K from plant samples

5 mL of digest samples for grain and 2 mL for the straw were taken and thinned to 50 ml volume to make the wanted concentration. The K was determined from the extract by using flame photometer.

2.14 Statistical analysis

The collected data were scrutinized statistically by F-test was done to observe the treatment effects and Duncan’s Multiple Range Test (DMRT) was done for the mean variances (Gomez and Gomez, 1984).

3. Results and Discussion

3.1 Potassium content in BRRI dhan49 grain

Results explicitly presented in Figure 1 showed that potassium content in grain of BRRI dhan49 varied suggestively due to application of inorganic fertilizer with organic manures. K content in the grain varied from 0.26 to 0.33%. The highest K content was originated in treatment T1 (50% K from banana leaves + 50% K from MoP) which was statistically alike to the treatment T2 (60% K from banana leaves + 40% K from MoP). The results perceived in treatment T3 (Recommended Fertilizer Dose) and treatment T4 (50% K from banana leaves + 30% K from MoP) were statistically undistinguishable and the values were 0.32 and 0.30% respectively. Treatment T5 (80% K from banana leaves + 20% K from MoP) and treatment T6 (90% K from banana leaves + 10% K from MoP) were statistically identical and the values were 0.29 and 0.28% respectively. The lowest value of K content in grain (0.26%) was recorded in treatment T1 (control). It was observed that K content in grain increased due to various treatments used with mutual application of organic manures and inorganic fertilizers (MoP) (Singh et al., 2001; Trivedi and Verma, 1996; Anmal and Muthiah, 1997; Mathad et al., 2002).

K content in rice straw was knowingly exaggerated due to diverse treatment. It ranged from 1.08 to 1.30% (Figure 2). The highest K content in straw (1.30%) was chronicled in treatment T4 (50% K from banana leaves + 50% K from MoP) which was statistically similar with the T5 (60% K from banana leaves + 40% K from MoP). The lowest value of K content (1.08%) was estimated in the treatment T1 (control). K content was increased somewhat in rice straw due to application of organic and inorganic fertilizers (MoP) and the result was statistically significant. The K contents of rice straw were always higher than those of grain in all treatments (Mitra et al., 2001; Pal et al., 2000). A group researcher exposed that K content both in grain and straw were increased due to joint application of organic manures and inorganic fertilizers (Singh et al., 2001). Varma described that incorporation of organic manures improved the concentration of K in rice grain and straw (Varma, 1991). A group researcher advocated that application of Kincreased soil K availability. K contents in grain and straw (Krishnappa et al., 1990).

3.2 Potassium content in BRRI dhan49 straw

In case of straw, K uptake varied from 51.40 to 89.06 kg ha⁻¹. The highest value was originated in treatment T3 (50% K from banana leaves + 50% K from MoP) which was statistically identical to treatment T4 (60% K from banana leaves + 40% K from MoP) and the value were 89.06 and 88.57 kg ha⁻¹ respectively (Table 4). Treatment T1 (Recommended Fertilizer Dose) and treatment T5 (70% K from banana leaves + 30% K from MoP) were statistically identical in respect of K uptake and the value were 85.29 and 83.33 kg ha⁻¹ respectively. The lowest K uptake (51.40 kg ha⁻¹) by straw was eminent.
in the treatment $T_4$ (control) (Chokravarti, 1989); Krishnappa et al., 1990; Doikova et al., 1999; Roy and Mathur 1989; Ghosh et al., 1994).

### Table 5: Potassium uptake in rice straw of BRRI dhan49 as influenced by banana leaves and chemical fertilizers

| Treatment | K Uptake (kg ha$^{-1}$) by rice straw |
|-----------|--------------------------------------|
| $T_1$     | 51.40g                               |
| $T_2$     | 85.29bc                              |
| $T_3$     | 89.06a                               |
| $T_4$     | 86.57ab                              |
| $T_5$     | 83.33cd                              |
| $T_6$     | 81.22d                               |
| $T_7$     | 77.37e                               |
| $T_8$     | 67.63f                               |
| CV(%)     | 4.27                                 |

The figure having common letter(s) in a column do not differ significantly at 5% level of significance by DMRT.

### Table 6: Total potassium uptake of BRRI dhan49 as influenced by banana leaves and chemical fertilizers

| Treatment | K Uptake (kg ha$^{-1}$) by rice straw |
|-----------|--------------------------------------|
| $T_1$     | 60.06f                               |
| $T_2$     | 102.55b                              |
| $T_3$     | 108.52a                              |
| $T_4$     | 103.89b                              |
| $T_5$     | 98.13c                               |
| $T_6$     | 97.19c                               |
| $T_7$     | 89.79d                               |
| $T_8$     | 78.97e                               |
| CV(%)     | 5.41                                 |

The figure having common letter(s) in a column do not differ significantly at 5% level of significance by DMRT.

### 3.4 Total Potassium uptake by BRRI dhan49

The total K uptake by BRRI dhan49 ranged from 60.06 to 108.52 kg ha$^{-1}$. The highest total K uptake (108.52 kg ha$^{-1}$) was logged in the treatment $T_5$ (50% K from banana leaves + 50% K from MoP) (Table 6). The lowest value of total K uptake (60.06 kg ha$^{-1}$), was noted in the treatment $T_1$ (control). Application of both organic manures (banana plant leaves) and inorganic K fertilizer significantly increased the total K uptake over control treatment, and it is completely buoyed (Pandey et al., 1999; Upadhyay, 1995; Mitra et al., 2001).

4. **CONCLUSION**

It may be settled from the results that the application of banana leaves with chemical fertilizers have a constructive impression on nutrient contents and nutrient uptake of rice. Amongst the treatments, $T_5$ (50% K from banana leaves + 50% K from MoP) had a better performance on nutrient contents and nutrient uptake in contrast to chemical fertilizers alone. Consequently, banana leaves with inorganic fertilizer will be rewarding as addition of organic source of potassium in rice farming.

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### AUTHOR'S CONTRIBUTION

Md. Abdul Mannan conducted the research and analyzed the data. Md. Abul Hashem and Md. Harun-or Rashid designed and supervised the experiment. Md. Sohanur Rahman contributed in research conception, presentation, data analysis, searching journal for publication and finally manuscript processing & writing of this article. This article was read and approved by all authors for final Publication. Fahkhar Uddin Talukder and Nahid Kaisar helped in research conduction and manuscript writing.

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