Influence of Vigore and tab-sil (SiO₂) on Productivity and Profitability of Transplanted Rice (Oryza sativa L.) under Southern Dry Zone of Karnataka

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ABSTRACT

A field experiment was conducted during Kharif 2015 and 2016 at Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka to study the effect of different sources of nutrients on growth and yield of transplanted rice. The experiment was laid out in RCBD having eight treatments and replicated thrice. The results of the study indicates that application of RDF with Tab-sil 100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT recorded significantly higher panicle number (436 m⁻²), panicle weight (3.8 g), grain yield (7092 kg ha⁻¹) and straw yield (7696 kg ha⁻¹) followed by application of RDF with Tab-sil 100 % Silicate Tabs (SiO₂) @ 5 kg ha⁻¹ at 50 DAT and found significantly superior over the other treatments. Higher net returns and B:C ratio was obtained with the application of 100 % RDF + Tab-sil 100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT (Rs. 73,764 ha⁻¹ and 2.34) and lower net returns and B:C ratio was recorded in control plot (Rs. 33,486 ha⁻¹ and 1.80, respectively).

KEYWORDS
Transplanted Rice, Vigore, Tab-sil, Productivity, Profitability, B:C

INTRODUCTION

Rice (Oryza sativa L.) is one of the oldest and widely grown food crops of the world. It is also the major source of nutrition for more than half of the rice eating population. In India, it is grown in an area of 43.79 million hectares with production of 112.9 million tons of milled rice and the productivity of 2578 kg ha⁻¹ (Anon, 2018). In Karnataka, it occupies in an area of 10.91 lakh ha with a production of 29.67 lakh tone of milled rice and the productivity of 2843 kg ha⁻¹ (Anon, 2016). Deficiency of micro nutrients and imbalance use of fertilizer resulted decreasing organic carbon content of soil and in turns resulted
lower productivity. In recent year, the application of nanotechnology has led to the production of granulated and liquid silicon fertilizers with high bio availability. Vigore is a nano-technology product which includes all the nutrients required for complete and healthy development of the plant. It is an eco-friendly product and nontoxic for human, animals and plants as it has been prepared from substances found in nature by using infinite decimal doses and with the process of denomination and potentiality which increase effectiveness and remove toxicity. Vigore was applied 5-10 days after transplanting of rice @ 625 g ha\(^{-1}\) as broadcast.

Adequate supply of silica is essential for rice plant through the entire growth period particularly in and after the stage of panicle primordial formation. Silicon promotes photosynthesis keeping the leaf erect and prevents fungal and insect injury and also alleviates lodging. It also increases the supply of oxygen to the rice plant roots. This alleviates the excessive amount of ferrous iron and also toxicity of H\(_2\)S (Singh et al., 2017). Hence, there is necessity to evaluate the effectiveness of Vigore and Tab-sil products along with recommended dose of fertilizer for maximization of rice yield.

**Materials and Methods**

A field experiment was conducted during Kharif 2015 and 2016 at Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka to study the effect of different sources of nutrients on growth and yield of transplanted rice. The experimental soil was red sandy loam in texture, neutral in reaction (pH 6.45) with electrical conductivity 0.28 dSm\(^{-1}\). The soil had medium in available nitrogen (278 kg ha\(^{-1}\)), medium in available phosphorus (26.0 kg ha\(^{-1}\)) and medium in available potassium (185.0 kg ha\(^{-1}\)). The amount of rainfall received during the crop growth period was 370.6 mm and 307.3 mm during both the year of study. The experiment consists of eight treatments viz., T\(_1\): 100% recommended dose of fertilizer (RDF) i.e. 100 kg N + 50 kg P\(_2\)O\(_5\) + 50 Kg K\(_2\)O ha\(^{-1}\), T\(_2\): 100% RDF + Vigore application @ 625 g ha\(^{-1}\) as basal, T\(_3\): 100% RDF + Vigore application @ 625 g ha\(^{-1}\) as basal application + Spray @ 1.25 g litre\(^{-1}\) at panicle stage, T\(_4\): 100% RDF + Tab sil-silicate Tabs SiO\(_2\) (effervescent tablet with silicate) @ 2.5 Kg ha\(^{-1}\) (25 DAT), T\(_5\): 100% RDF + Tab sil-silicate Tabs SiO\(_2\) (effervescent tablet with silicate) @ 5.0 Kg ha\(^{-1}\) (50 DAT), T\(_6\): 100% RDF + Tab-sil + Silicate tabs SiO\(_2\) (effervescent tablet with silicate) @ 2.5 Kg ha\(^{-1}\) at 25 DAT and 2.5 Kg ha\(^{-1}\) (50 DAT), T\(_7\): 100% RDF + 10 t FYM ha\(^{-1}\) + 20 kg ZnSO\(_4\) ha\(^{-1}\), T\(_8\): Without NPK (Control) were tested in randomized block design with three replications. The fertilizer was applied as per the treatments i.e., 50 % N applied as basal dose, 25 % at maximum tillering and 25 % at panicle initiation stage + 100 % P\(_2\)O\(_5\) and 100 %K\(_2\)O at the time of sowing. Vigore was applied at 5 days after transplanting rice @ 625 g ha\(^{-1}\) as broadcast method. The vigore and Tab-sil were applied as per treatment indicated in the treatment details. The data on yield and yield parameters like panicle number m\(^{-2}\), panicle weight (g), grain and straw yield (kg ha\(^{-1}\)) was recorded at harvest and the economics were also worked out. The data collected on yield and yield parameters were subjected to statistical analysis as per statistical procedure given by Sundararajan et al., (1972).

**Results and Discussion**

**Effect of vigour and Tab-silon yield and yield attributes of transplanted rice**

The data on panicle number m\(^{-2}\), panicle weight (g), grain and straw yield (kg ha\(^{-1}\)) of rice differed significantly due to different sources of nutrients on growth and yield of
transplanted rice and presented in Table 1. Application of 100 % recommended dose of fertilizer (100:50:50 Kg NPK ha⁻¹) with Tab-sil100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT resulted higher panicle number (436m⁻²) followed by application of RDF with Tab-sil100 %+ Silicate Tabs (SiO₂) 5 kg ha⁻¹ at 50 DAT (404m⁻²) compared to other treatments in the study. Lower panicle number was observed with the plot receiving no NPK (322m⁻²). Application of 100 % RDF + Vigore application @ 625 g/ha as basal application + Spray @ 1.25 glitre⁻¹ at panicle stage produced higher panicle weight (4.0 g) followed by application of 100 % RDF with Tab-sil100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT (3.8 g) and lower panicle weight was observed with the plot receiving no NPK (3.1 g). Increase in panicle weight and number were mainly due to higher growth attributes owing to improvement in availability of plant nutrients through improved root system and higher uptake of nutrients from soil by improving photosynthesis efficiency of plant. These results are in conformity with Singh et al., (2017).

### Table 1. Yield components of transplanted rice as influenced by different sources of nutrients

| Treatment | Panicle number m⁻² | Panicle weight (g) |
|-----------|--------------------|--------------------|
|           | Kharif 2015 | Kharif 2016 | Mean | Kharif 2015 | Kharif 2016 | Mean |
| T₁        | Recommended fertilizer dose of the region (RDF) (100-50-50 kg NPK/ha) | 405 | 369 | 387 | 3.7 | 2.9 | 3.3 |
| T₂        | T₁ + Vigore application @ 625 g/ha as basal application at 50 DAT | 425 | 396 | 411 | 3.7 | 3.0 | 3.4 |
| T₃        | T₁ + Vigore application @ 625 g/ha as basal application + Spray @ 1.25 g/ litre at panicle stage | 396 | 432 | 414 | 4.3 | 3.7 | 4.0 |
| T₄        | T₁ + Tab sil- RDF 100 % + silicate Tabs SiO₂ (effervescent tablet with silicate) 2.5 kg/ha (25 DAT) | 408 | 415 | 412 | 3.6 | 3.3 | 3.5 |
| T₅        | T₁ + Tab sil- RDF 100 % + silicate Tabs SiO₂ (effervescent tablet with silicate) 5.0 kg/ha (50 DAT) | 357 | 450 | 404 | 3.4 | 2.8 | 3.1 |
| T₆        | T₁ + Tab sil-RDF 100% + Silicate tabs SiO₂ (effervescent tablet with silicate) 2.5 kg/ha at 25 DAT and 2.5 kg/ha (50DAT) | 396 | 476 | 436 | 4.1 | 3.5 | 3.8 |
| T₇        | RDF (100-50-50 kg NPK/ha) + 10 t FYM/ha + 20 kg ZnSO₄/ha | 410 | 406 | 408 | 3.4 | 3.3 | 3.4 |
| T₈        | Without NPK (Control) | 339 | 304 | 322 | 3.4 | 2.7 | 3.1 |

S. Em. + 6.79 8.19 -- 0.04 0.05 --
C. D. at 5 % 20.58 24.9 -- 0.13 0.16 --
### Table 2
Grain and straw yield (kg ha\(^{-1}\)) of transplanted rice as influenced by different sources of nutrients

| Treatment | Grain yield (kg/ha) | Straw yield (kg/ha) |
|-----------|---------------------|---------------------|
|           | Kharif 2015 | Kharif 2016 | Mean | Kharif 2015 | Kharif 2016 | Mean |
| T<sub>1</sub> | Recommended fertilizer dose of the region (RDF) (100-50-50 kg NPK/ha) | 5503 | 6000 | 5752 | 6305 | 6953 | 6629 |
| T<sub>2</sub> | T<sub>1</sub> + Vigore application @ 625 g/ha as basal application at 50 DAT | 5690 | 6367 | 6029 | 6402 | 7524 | 6963 |
| T<sub>3</sub> | T<sub>1</sub> + Vigore application @ 625 g/ha as basal application + Spray @ 1.25 g/ litre at panicle stage | 5943 | 6533 | 6238 | 6573 | 7439 | 7006 |
| T<sub>4</sub> | T<sub>1</sub> + Tab sil- RDF 100 % + silicate Tabs SiO\(_2\) (effervescent tablet with silicate) 2.5 kg/ha (25 DAT) | 6028 | 6733 | 6381 | 6923 | 7591 | 7257 |
| T<sub>5</sub> | T<sub>1</sub> + Tab sil- RDF 100 % + silicate Tabs SiO\(_2\) (effervescent tablet with silicate) 5.0 kg/ha (50 DAT) | 6167 | 6833 | 6500 | 7587 | 7800 | 7694 |
| T<sub>6</sub> | T<sub>1</sub> + Tab sil-RDF 100% + Silicate tabs SiO\(_2\) (effervescent tablet with silicate) 2.5 kg/ha at 25 DAT and 2.5 kg/ha (50DAT) | 6883 | 7300 | 7092 | 7043 | 8350 | 7696 |
| T<sub>7</sub> | RDF (100-50-50 kg NPK/ha) + 10 t FYM/ha + 20 kg ZnSO\(_4\)/ha | 5733 | 6433 | 6083 | 6362 | 7397 | 6879 |
| T<sub>8</sub> | Without NPK (Control) | 4083 | 4133 | 4108 | 4734 | 5124 | 4929 |
| S. Em. ± | 135.2 | 194.9 | -- | 265.6 | 384.5 | -- |
| C. D. at 5 % | 410.0 | 591.2 | -- | 805.5 | 1166.2 | -- |
Table 2 Economics of transplanted rice as influenced by different sources of nutrients

| Treatment                                                                 | Cost of cultivation (Rs. ha⁻¹) | Gross returns (Rs. ha⁻¹) | Net returns (Rs. ha⁻¹) | Benefit:Cost ratio |
|---------------------------------------------------------------------------|-------------------------------|--------------------------|------------------------|-------------------|
| T₁  Recommended fertilizer dose of the region (RDF) (100-50-50 kg NPK/ha) | 42100                         | 105290                   | 63190                  | 2.50              |
| T₂  T₁ + Vigore application @ 625 g/ha as basal application at 50 DAT    | 43763                         | 110390                   | 66627                  | 2.52              |
| T₃  T₁ + Vigore application @ 625 g/ha as basal application + Spray @ 1.25 g/ litre at panicle stage | 44588                         | 113820                   | 69232                  | 2.55              |
| T₄  T₁ + Tab sil- RDF 100 % + silicate Tabs SiO₂ (effervescent tablet with silicate) 2.5 kg/ha (25 DAT) | 48850                         | 116610                   | 67760                  | 2.39              |
| T₅  T₁ + Tab sil- RDF 100 % + silicate Tabs SiO₂ (effervescent tablet with silicate) 5.0 kg/ha (50 DAT) | 55100                         | 119388                   | 64288                  | 2.17              |
| T₆  T₁ + Tab sil-RDF 100% + Silicate tabs SiO₂ (effervescent tablet with silicate) 2.5 kg/ha at 25 DAT and 2.5 kg/ha (50DAT) | 55100                         | 128864                   | 73764                  | 2.34              |
| T₇  RDF (100-50-50 kg NPK/ha) + 10 t FYM/ha + 20 kg ZnSO₄/ha             | 47600                         | 111086                   | 63486                  | 2.33              |
| T₈  Without NPK (Control)                                                | 42100                         | 75586                    | 33486                  | 1.80              |

Application of 100 % recommended dose of fertilizer (100:50:50 Kg NPK ha⁻¹) with Tab-sil100 % Silicate Tabs (SiO₂) 2.5 kg/ha at 25 DAT and 2.5 kg/ha at 50 DAT resulted significantly higher grain and straw yield (7092 and 7696 kg/ha⁻¹, respectively) followed by application of RDF with Tab-sil100% + Silicate Tabs (SiO₂) 5 kg/ha at 50 DAT (6500 and 7694 kg/ha⁻¹, respectively). The lower grain and straw yield was recorded in control plot (4108 and 4929 kg ha⁻¹, respectively) during both the year of study. However, increase in rice yield with silicon tablet application along with 100% RDF might be due to increased availability of silicon in soil solution. The lower yield in control plot without silicon might be due to leading to fixation loss of native silicon in submerged conditions which is unavoidable to meet out the Silicon requirement by the crop (Singh et al., 2017).

The increase in yield with silicon application could be due to beneficial effect of decreasing...
mutual shading by improving leaf erectness, decreasing susceptibility to lodging and preventing manganese and iron toxicity. Increase water use efficiency observed with the application of Silicon, probably might be due top retention of excessive transpiration. During reproductive stage, silicon is preferentially transported into the flag leaves and interruption of silicon supply at this stage is determinates for spikelet fertility (Ma et al., 2006). Silicon application increased grain yield by increase of panicle number and panicle weight stated by Chen et al., 2011.

**Effect of vigour and Tab-silon economies of transplanted rice**

The data on economics on response of different sources of nutrients on transplanted rice are presented in Table 3. Application of 100 % recommended dose of fertilizer (100:50:50 Kg NPK ha⁻¹)with Tab-silon 100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT resulted higher net returns (Rs. 73,764 ha⁻¹) and B:C ratio (2.34) followed by T₁ + Vigore application @ 625 g/ha as basal application + Spray @ 1.25 g/litre at panicle stage (Rs. 69,232 ha⁻¹ and 2.55 respectively). Higher net returns and benefit: cost ratio was mainly due to higher yield as compared to other treatments in the study. Based on the study it could be concluded that application of 100 % RDF with Tab-sil100 % Silicate Tabs (SiO₂) 2.5 kg ha⁻¹ at 25 DAT and 2.5 kg ha⁻¹ at 50 DAT are benefitted to improve growth, yield components, grain and straw yield and profit in transplanted rice by providing better availability of nutrients and water use efficiency.

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