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RESEARCH ARTICLE

Rice husk ash : A prospective tool for soil acidity management in homestead vegetable cultivation

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SUMMARY

Due to the high cost of traditional liming materials, it is necessary to use organic sources that are readily available, inexpensive, environmentally acceptable, and adaptable as liming agents and fertilizer for vegetable production. Therefore, focus is placed on using rice husk ash, which is significantly more readily available and less expensive in Kerala, as a soil ameliorant. Furthermore, it contains a lot of potassium and silica.Si has reportedly been shown to have various benefits in addition to increasing yield, such as improving nutrient availability, lowering nutrient toxicity, and reducing biotic and abiotic stress in plants. The lime application will be simplified due to the utilization of rice husk ash in place of lime. In order to determine the impact of rice husk ash (RHA) on soil acidity management in homestead vegetable cultivation, the tomato variety VellayaniVijai was used as the test crop in the current study. There were six treatments, each of which was replicated three times. The highest number of fruits (29.3) and yield per plant (0.855 kg plant^{-1}) were recorded in T_6 (Soil test based recommended dose of fertilizers + Rice husk ash @ 125 % lime as per soil test). According to the findings, rice husk ash can be used as a substitute source of lime for vegetables. RHA acted as an excellent source of Si and K and decreased the uptake of iron in all of the treatments where it was applied as a soil ameliorant, resulting in an increase in the available Si and K content in the soil.

Key Words : Rice husk ash, Soil acidity, Homestead, Vegetable cultivation, Soil ameliorant

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Kerala's vegetable farming faces significant fertility challenges due to the acidity of the soil. For better crop productivity, acidic soils must be amended with lime. By lowering hazardous concentrations of Fe, Al, and Mn, liming not only increases soil pH but also has an impact on the solubility and availability of the majority of plant nutrients and aids in the control of soil-borne illnesses. Due of the high cost of conventional liming materials, organic sources that can be used as liming agents and fertilizer for vegetable production need to be inexpensive, locally available, environmentally friendly and adaptable. Rice

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husk ash can be effectively utilized as a cheap and environment friendly soil ameliorant (Okon *et al*., 2005). As a by-product of rice mills and biomass gasifiers, rice husk ash is widely available for industrial use. It isrich in silica and potassium, and also extremely cheap (Mini and Lekshmi, 2021). Beyond increasing yield, silicon offers numerous other benefits for plants, such as increasing nutrient availability, reducing nutrient toxicity, and reducing biotic and abiotic stress (Nagula *et al.*, 2016). Due to the concentration of industrial output in cities, the volume of residue creates a serious disposal issue. The usage of rice husk ash in various sectors of the economy has been the subject of extensive investigation. The majority of these investigations, though, have been carried out in laboratories, and the scientific information they have produced has not yet been converted into technologies that are suitable for mass manufacturing. The advantages of rice husk ash on the growth of crops in the field have been investigated, and it was discovered that it can improve pH and nutrient availability as well as hydro-physical qualities. The features of the rice husk ash and the soil, the amount of rice husk ash used, and how the rice husk ash interacts with the soil all play a role in how strong these effects are. To find the ideal doses of rice husk ash to be utilized for particular applications, scientific investigations are needed. Lime application will be easier due to the usage of rice husk ash as a lime alternative. Therefore, using tomato as a test crop, the current study was conducted to assess the role of rice husk ash (RHA) in managing soil acidity in homestead vegetable cultivation.

MATERIAL AND METHODS

Experiment was conducted at Onattukara Regional Agricultural Research Station, Kayamkulam during 2022 to evaluate the effect of rice husk ash on soil amelioration and to find out the optimum dose for vegetables. The experiment consisted of six treatments replicated thrice. Tomato variety VellayaniVijai was used as the test crop for the experiment. The objectives of the study were to evaluate the effect of rice husk ash (RHA) in soil acidity management in homestead vegetable cultivation and to find out the optimum doses of rice husk ash for vegetables. The treatments were T_1 (recommended dose of fertilizer and lime as per POP), T_2 (recommended dose of fertilizer and rice husk ash @ lime in T_1), T_3 (soil test based RDF and lime based on pH),T_4 (soil test based RDF + rice husk ash @ 100 % lime in T_3), T_5 (soil test based RDF + rice husk ash @ 75 % lime in T_3) and T_6 (soil test based RDF + rice husk ash @ 125 % lime in T_3).

RESULTS AND DISCUSSION

Rice husk ash was procured from local sources as it is cheaply available in large quantity as an industrial by product fromrice mills. Rice husk ash was characterized before the start of the experiment and found that it is alkaline in pH and contains macro and micro nutrients (Table 1).

Table 1: Characterisation of rice husk ash

Parameter	Value
pH	8.21
N (%)	0.12
P (%)	0.19
K (%)	0.3
Ca (%)	0.27
Mg (%)	0.12
S(%)	0.13
SiO2 (%)	68.9
Fe $mgkg^{-1}$	26.4
Cu $mgkg^{-1}$	12.7
Zn $mgkg^{-1}$	37.9
Mn $mgkg^{-1}$	15.5
B $mgkg^{-1}$	18.9

Effect of rice husk ash application on soil pH :

Various treatments significantly influenced the pH and the highest pH was recorded in T_6 (Table 2). Results indicated that in the case of vegetables, rice husk ash can be used as an alternate source of lime. Use of rice husk ash can increase the pH and nutrient availability and can affect the hydro-physical properties of soil. Soil ameliorating property of RHA may be attributed to the presence of oxides of basic cations like K, Na and Mg

Table 2 : Effect of rice husk ash on soil pH

Treatment	pH
T_1 -*RDF and lime as per POP	5.39
T_2 - RDF and rice husk ash @ lime in T_1	5.30
T_3-**STB RDF and lime based on pH	5.44
T_4-STB RDF + rice husk ash @ 100 % lime in T_3	5.34
T_5- STB RDF + RHA @ 75 % lime in T_3	5.23
T_6-STB RDF + rice husk ash @ 125 % lime in T_3	5.48
C.D. (P=0.05)	0.120

*RDF-Recommended dose of fertilizer **STB- Soil test based

which helps to increase the pH of the soil (Sandrini, 2010).

Effect of rice husk ash on yield and yield attributes of tomato :

The highest number of fruits (29.3) and yield per plant (0.855 kg plant^{-1}) were recorded in T_6 (Soil test based recommended dose of fertilizers + Rice husk ash @ 125 % lime as per soil test) and it was at par with T_3 (soil test based RDF and lime based on pH). The highest B: C ratio (2.7) was also recorded in T_6 (Table 3). This maybe due to the improved nutrient availability and assimilation of nutrients resulting inincreased number of fruits and yield. Devi (2017) reported an increase in nutrient availability due to increase in pH with the use of rice husk ash as a soil ameliorant. Prakash *et al.* (2007) observed similar results with the use of RHA which helped to increase the yield in rice and attributed to the Si supplying power of RHA.

Table 3: Effect of rice husk ash on yield and yield attributes of tomato

Treatment	No. of fruits per plant	Yield per plant (kg)	B:C ratio
T_1	20.8	0.654	2.20
T_2	22.8	0.673	2.33
T_3	27.6	0.812	2.42
T_4	26.4	0.775	2.38
T_5	20.3	0.645	2.11
T_6	29.3	0.855	2.57
C.D.(P=0.05)	1.73	0.052	0.126

Effect of rice husk ash on total uptake of potassium, silica and iron:

There was significant increase in the uptake of K and Si due to the application of rice husk ash and the highest uptake of K and Si were recorded in T_6 (Fig. 1).

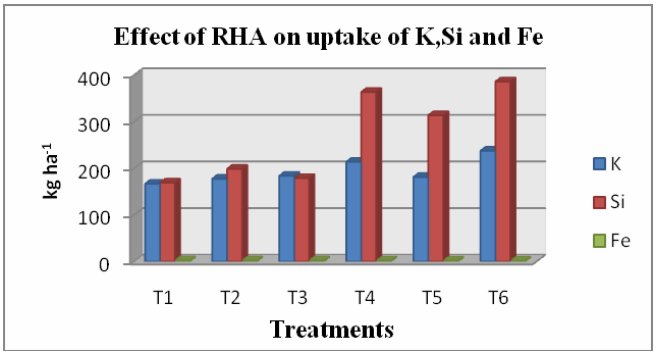

Fig. 1: Effect of rice husk ash on total uptake of potassium, silicon and iron

This may be due to the supply of K and Si from the rice husk ash. Similar results have been reported by Pati *et al.* (2016) who suggested that with the provision of Si itresulted in silicification of the cell wall and increased the K concentration in grain and straw in rice. Chanchareonsook *et al.* (2002) also reported that the application NPK fertilizer in combination with Si significantly increased total N, P, and K uptake of rice.

The treatments had a notable influence on the iron uptake (Fig.1). The treatment T_6 recorded the lowest Fe uptake and was superior to all other treatments in reducing the Fe uptake in the plant. This is in accordance with the findings of Ma (2004) who reported that Si can increase the oxidizing capacity of roots, which converts ferrousiron into ferriciron and reduced Fe uptake by the plant. Also it can be attributed to the reduction of uptake of iron by the plant and improvement of antioxidant enzyme activity as suggested by Chalmardi *et al.* (2014).

Conclusion :

In the case of home stead vegetable cultivation rice husk ash can be used as an alternate source of lime. Application of rice husk ash @ 125 % lime as per soil test was effective as lime in managing soil acidity in the homestead vegetable cultivation. Since rice husk ash is a cheaper source of soil ameliorant, it helped to reduce the cost of cultivation and increased the net income compared to RDF and lime treated plot. The results showed an increased yield of the crop in plots where RHA was given, which helped to increase the BC ratio further. It can be concluded that application of RHA as soil ameliorant is economically superior to conventional lime application in homestead vegetable cultivation.

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