

Research Application Summary

Response of NSIC RC23 as influenced by combined use of organic and inorganic fertilizers

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Abstract

The demand for rice increases with increasing population, yet the yield of aerobic rice keeps declining when grown continuously. These unstable yields of aerobic rice are attributed to water and nutrient stresses Justifiable rice production cannot do away with inorganic fertilizers completely, for they have significant effect on crop yield once applied appropriately. They hold nutrients that replenish soil health and ultimately improve growth components of crops. Organic fertilizers though release nutrients slowly, provide additional advantage on soil fertility by improving physical, biological and chemical soil properties. Combined application of organic and inorganic fertilizers results in positive results when applied at appropriate amount and time in aerobic rice production system . To ascertain this, a field study was conducted to determine the effect of applying organic and inorganic fertilizers as sole and combined treatments on the growth components and panicle length of NSIC Rc23 under aerobic production system. Treatments were: (1) Control, (2) RRIF (120-45-60 kg N, P₂O₅, and K₂O/ha), and (3) 50% RRIF+RROF. Organic fertilizers were incorporated into the soil one week before planting. Application of inorganic fertilizers was done in splits accordingly. The application of Sole inorganic fertilizers significantly produced tallest plants at maturity. Results from application of inorganic fertilizers alone and fertilizer combinations generated same results on number of days to maturity. Fertilizer combinations and sole inorganic fertilizers generated comparable results on attainment of 50% flowering and panicle length , however, results from 50%IF + RROF were inferior. Sole inorganic fertilizers (100% RRIF) and fertilizer combinations (100% IF + RROF) are recommended for enhancement of growth attributes and panicle length in NSIC Rc23 under aerobic rice production.

Key words: Aerobic rice, growth attributes, nutrient management, panicle length

Résumé

La demande du riz augmente avec l'augmentation de la population, mais le rendement du riz aérobie continue de baisser lorsqu'il est cultivé en continu. Ces rendements instables du riz aérobie sont attribués à des stress hydriques et nutritifs Une production du riz justifiable ne peut pas éliminer complètement les engrains inorganiques, car ils ont un effet significatif sur le rendement des cultures une fois appliqués de manière appropriée. Ils contiennent des nutriments qui reconstituent la santé du sol et améliorent finalement les composants de croissance des cultures. Les engrains organiques, bien que libérant lentement les nutriments, offrent un avantage supplémentaire sur la fertilité du sol en améliorant les

propriétés physiques, biologiques et chimiques du sol. L'application combinée d'engrais organiques et inorganiques donne des résultats positifs lorsqu'elle est appliquée en quantité et au moment appropriés dans le système de production du riz aérobie. Pour vérifier cela, une étude sur le terrain a été menée pour déterminer l'effet de l'application d'engrais organiques et inorganiques en tant que traitements uniques et combinés sur les composants de croissance et la longueur de la panicule de NSIC Rc23 dans un système de production aérobie. Les traitements étaient : (1) Contrôle, (2) RRIF (120-45-60 kg N, P₂O₅ et K₂O/ha) et (3) 50 % RRIF+RROF. Les engrais organiques ont été incorporés au sol une semaine avant la plantation. L'application d'engrais inorganiques a été faite en fractions en conséquence. L'application d'engrais inorganiques Sole a produit de manière significative les plantes les plus hautes à maturité. Les résultats de l'application d'engrais inorganiques seuls et de combinaisons d'engrais ont généré les mêmes résultats sur le nombre de jours jusqu'à maturité. Les combinaisons d'engrais et les seuls engrais inorganiques ont généré des résultats comparables sur l'atteinte de 50 % de floraison et de longueur de panicule, cependant, les résultats de 50 % IF + RROF étaient inférieurs. Les engrais inorganiques seuls (100 % RRIF) et les combinaisons d'engrais (100 % IF + RROF) sont recommandés pour améliorer les attributs de croissance et la longueur de la panicule dans NSIC Rc23 dans le cadre d'une production du riz aérobie.

Mots clés : riz aérobie, attributs de croissance, gestion des éléments nutritifs, longueur de la panicule

Introduction

Aerobic rice is a new promising rice production system where rice is grown aerobically, supplemented with irrigation where rainfall is insufficient. Generally, upland rice varieties are low yielding compared to lowland rice varieties (Bouman *et al.*, 2002). However, farmers are facing difficulty to supply optimum amounts of fertilizers to crops due to increasing costs of mineral fertilizers. On the other hand, it is affordable for farmers to produce their own organic fertilizers from available free organic materials, and once properly managed can be combined with little inorganic fertilizers for efficient production of aerobic rice.

In an attempt to revise the way rice is grown, there is need to keep in view deteriorating soil health, decreasing available resources and increasing cost of production. This calls for boosting rice production with minimal and user friendly effects on natural resources. Currently, fertilizer recommendations followed by farmers in rice production were established under continuously submerged conditions. Adoption of aerobic rice production may therefore require different fertilizer management techniques (Singh *et al.*, 2014). In consideration of the above observations, this study on improving aerobic rice production through fertilizer management strategies was conducted to generate ideas on how growth attributes of aerobic rice and panicle length can be improved under scarce resources with appropriate technology.

Methodology

Treatments were laid out in a randomized complete block design (RCBD) with three replications. The treatments were: Control (No fertilizers), Recommended rate of inorganic fertilizers (RRIF-120-45-60 kg N, P₂O₅, and K₂O/ha), and 50% RRIF + RROF-(6t/ha). Organic fertilizers were incorporated into the soil a week before planting in the respective plots. Inorganic fertilizers were applied in splits. Data generated on parameters and yield were analyzed using SIRICHAI and Comparison among means was done using DMRT at 0.05 level of significance probability level.

Results and Discussion

Plant height at maturity (cm). Sole application of inorganic fertilizers produced significantly tallest plants with plant heights of 93 cm. These were followed by plants treated with half rate of inorganic fertilizers combined with organic fertilizers with the mean of 78 cm. Plants under control treatment had the shortest plants with the mean height of 42 cm. Riyato (2003) stated that plant height increases when the amount of applied inorganic fertilizers increases. Increase in plant height in response to combined application of organic and inorganic fertilizers is due to enhanced availability of macro and micro nutrients. These results agree with the findings of Mohammad *et al.* (2003) who reported that use of organic manures in combination with mineral fertilizers boosted plant growth and yield. Availability of nutrients enhanced plant height through boosting nutrient uptake from soil by cation exchange capacity. The reduced plant height of plants treated with half rate of inorganic fertilizers combined with organic fertilizers (78 cm) possibly due to reduced amount of nutrients in inorganic fertilizers which could not enhance nutrient uptake by cation exchange.

Number of days to 50% flowering. Plants treated with sole inorganic fertilizers and half rate of inorganic fertilizers combined with organic fertilizers recorded significantly the shortest duration to attain 50% flowering. The untreated plants recorded the longest duration of 80 days. The observed shortest duration to the attainment of 50% flowering was attributed to higher amount of nutrients in inorganic fertilizers (nitrogen, phosphorus and potassium) as they are highly soluble and readily available for plant absorption, thus, initiate floret primordial. Late attainment of 50% flowering was due to limited nutrient as evidenced in the control plots.

Number of days to maturity. Number of days to maturity of NSIC Rc23 ranged from 109 to 111 days. Plants treated with inorganic fertilizers alone, full and half inorganic fertilizers with organic fertilizer combinations matured earlier with an average mean of 109 days. Untreated plants matured later with mean of 111 days . According to (<http://www.cropnutriton.com/home>) application of high level of nitrogen, phosphorus and potassium boosts early attainment of maturity in plants. Plants supplied with adequate nitrogen grow rapidly and produce large amounts of succulent, green foliage to full maturity due to enhanced manufacture of structural and genetic materials. These results reveal the need for combining organic with mineral fertilizers for ideal growth conditions of plants. According to IRRI (<http://www.knowledgebank.irri.org>), late maturity was probably due to nutrient stress in untreated plots which retarded the manufacture of structural and genetic materials since nitrogen is a crucial component of DNA which enables growth and reproduction.

Panicle length (cm). Panicle length were not significantly different amongst the various fertilizer treatments. Indeed, application of inorganic fertilizers alone and half rate of inorganic fertilizers combined with organic fertilizers generated plants with comparable panicle length with means of 21 and 20 cm respectively. Fageria (2000) as cited by Naing *et al.* (2010) reported that nitrogen increases rice grain yield by increasing panicle number and length and tillering which results in high value of spikelets. Structure of panicle has direct relationship with grain yield since panicle structure determines grain weight. Increase in panicle size due to increase in spikelet number promotes spikelet number per unit area and yield potential of the crop (Sheehy *et al.*, 2001). Panicles that are too long hinder light interception, thus, reducing photosynthesis rate of leaves underneath the panicles and supply of assimilates to grains. Compacted panicles put up larger number of spikelets, however, too much compactness depresses grain quality on secondary branches due to variations in length, width and amylose content on panicle (Sheehy *et al.*, 2001).

Table 1. Plant height, number of days to maturity and attainment of 50% flowering as well as panicle length as affected by fertility management techniques for NSIC RC 23

Treatments	Plant height	Number of days to maturity	Number of days to 50% flowering	Panicle length
Control-	42 _d	111 _a	80 _a	19 _{cde}
(RRIF)	93 _a	109 _b	74 _c	21 _{abc}
1/2(RRIF)IF+RROF	78 _b	109 _b	75 _c	20 _{abcd}

RRIF-Recommended rate of Inorganic Fertilizers (120-45-60kgN, P₂O₅, K₂O,kg/ha)

RROF--Recommended rate of Organic Fertilizes (6 t/ha)

Conclusion

Application of sole inorganic fertilizers had the best effect on plant height compared to other treatments. Fertilizer combinations generated comparable results on number of days to maturity and attainment of 50% flowering as well as on panicle length. However, results from sole application of inorganic fertilizers were superior. However, application of half the recommended rate of inorganic fertilizers combined with organic fertilizes can still enhance growth attributes of NSIC Rc23, thus saving farmers from high costs of applying high rates of inorganic fertilizers alone.

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