

RESPONSE OF MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERISTICS OF RICE (*ORYZA SATIVA L.*) TO INORGANIC FERTILIZER (NPK) APPLICATION: A REVIEW

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ABSTRACT

*Nitrogen, Potassium and Phosphorous (NPK) are important macro nutrients which are essential for improving the morphological and physiological characteristics of crops. Application of NPK fertilizers to rice (*Oryza Sativa L.*) crops plays a significant role in enhancing the yield and growth attributes of rice such as an increase in grains, large number of spikelets per panicle, biomass weight, straw yield and nutrient concentration.*

KEYWORDS: *NPK and Rice (*Oryza sativa L.*)*

INTRODUCTION

The macronutrients, nitrogen, phosphorus and potassium (NPK) are classified as essential nutrients for growth and development of crops, without them the crop development is impaired. There deficiency is manifested through various ways, including reduction in yields of crops. In rice, the role of NPK fertilizer is manifested in various ways, viz., increase in the number of spikelets, panicles and grains. Nitrogen is used by plants for lots of leave growth and good green color, Phosphorous is used by plants to help form new roots, make seeds, fruits and flowers. It helps in fighting diseases. While potassium helps plants to make strong stem and keep growing fast. Therefore, combining NPK in fertilizing rice (*Oryza Sativa L.*) will definitely produce a promising yield.

Djomo *et al.*, (2017) while working on different doses of NPK fertilizer (20:10: 10) and (23:10:05) on rice observed that application of the fertilizer at the rate of (0 kg; 180kg; 200kg; and 220kg) produces a significant impact on rice. They conclude that with regard to the output application of (20:10: 10) at the rate of 200 kg recorded significant yield. Halima *et al.*, (2017) carried out a pot experiment with the aim to ascertain the response of rice to application of N and P fertilizer. The sources of the fertilizer were $(\text{NH}_4)_2\text{SO}_4$ and $\text{Ca}(\text{H}_2\text{PO}_4)$ respectively. The outcome of the result shows that number of tillers, biomass weight and grain yield were increased significantly. They suggested that field trial should be conducted for further documentation. Riste *et al.*, (2017) found out that application of recommended dose of NPK (60:30:30) to a local rice cultivar registered in a significant increase in grain yield up to 36.51qha^{-1} and straw yield of 60.90qha^{-1} . Abulhamid *et al.*, (2016) perform an experiment on three varieties of rice to evaluate the response of the varieties to NPK fertilization. According to the outcome of their research there was a significant varietal difference to fertilizer response, they observed that the variety sadamota gave higher yield by producing more panicles and large number of spikelets per panicle due to moderate application of NPK (40kg, 15kgP, and 24kgP). Lukman *et al.*,(2016) noted a

significant effect of combine application of cow dung and NPK on the growth and yield of rice.

They suggested that a judicious use of cow dung and NPK fertilizer could be a useful practice for better performance of rice. Gebrelibanos and Fisseha (2016) performed an experiment to investigate the response of rice yield parameters to timing of nitrogen (N) application. They discovered that application of various doses of N at different growth stages produces a significant result on yield of rice. They summarized the outcome of their research as “Rice yield and yield components were significantly affected by time of nitrogen application.” However, they also stated that rice crop phenology and panicle length were not affected by timing of nitrogen application. Azwan *et al.*, (2016) conducted an experiment to ascertain the effect of NPK and chicken manure on growth and yield of rice TR-9 variety. They reported that NPK at the rate of 60:30:30 kg ha⁻¹ produce the highest percentage of productive tillers (71.62%) and 1000 grain weight (24.73g) while chicken manure at the rate of 20t ha⁻¹ produce the highest plant height and other growth parameters, they also found out that the combine application of NPK and chicken manure to BRIS soil have significantly increased soil nutrients and the organic carbon content of the soil which signify that the soil can promote crop growth. Muhammad *et al.*, (2016) investigated the effect of NPK application at various levels on yield and quality of two rice hybrids.

The result reveals that application of 162-120-70 kg NPK ha⁻¹ improved the yield and other attribute of the crop. Chhay *et al.*,(2015) reported that nitrogen fertilizer application increases Rice growth and yield. They discovered that fertilizer application in the nursery produces more vigorous seedlings with higher nutrient concentration. Md Safiqul Islam *et al.*, (2015) investigated the response of rice to application of green manure and nitrogen and reported thus: “application of different nitrogen levels (0, 40, 50 and 120kg ha⁻¹) with green manure had a significant effect on the growth and yield of transplanted amma rice. Wanyama *et al.*, (2015) reported that the major limiting nutrients in lowland rice is nitrogen and that the application of 65kg N in the study area significantly increase yield component of rice and consequently the grain yield. They reported that improving nitrogen supply can support yield target of 2.8t ha⁻¹ in the soils of the study area while P and K can support yield target of about 9 t ha⁻¹ Dakshina *et al.*,(2014) reported that grain yield of rice was increased by 11.5% and 6.3% as a result of increased in recommended doses of nitrogen from 100% (120kg ha⁻¹) to 125% and 15%. They further went on to say that increase in P and K doses from 100% to 124% (P from 60 to 75 and K from 40 to 50 kg ha⁻¹) also improved grain yield significantly. According to their observation the energy use efficiency of K was also high. They finalized by saying that grain quality milling characteristics were remarkably influenced by N P and K doses.

Amarasinghe *et al.*,(2014) while investigating the response of some traditional rice cultivars to fertilizer application observed various significant response to the fertilizer by the crop. Umar *et al.*, (2013) investigated the effect of four nitrogen rates (0, 20,40and 60kg ha⁻¹) on the growth of a variety of rice and reported a significant effect of N on all the growth parameters except days to 50% flowering. Yosef (2013) reported an increased on plant height, stem diameter, total tiller, percentage barrier, tiller percentage, and yield increased in rice crop with N and P fertilizer application. Juan and Francisco (2013) conducted an experiment with the objectives to determine the effect of increasing N rates on plant nutrients composition and N rate apparent recovery in rice cultivated soils. The result indicates that N rate affected dry matter production, P, K and Mg concentrations in plants. They observed that in some of the soils of the study area the concentrations of P and K decrease, when N was added and they attribute it to the chemical properties of the soils. They reported that the nitrogen apparent recovery was not affected by the N rate and accounted for 49% and 41 % for 80 and 160 kg N ha⁻¹ respectively. Debiprasad *et al.*, (2011) investigated the effect of organic and inorganic sources of nitrogen on rice attribute and discovered that application of recommended doses of fertilizer brought about a significant increase in growth

attributes of rice (total tillers, dry matter production, and leave area index). They stated that application of nitrogen through inorganic sources brought about significant improvement in grain and straw yield of rice. Sumreen *et al.*, (2011) studied the response of different cultivars of rice to NPK levels and concluded that the application of NPK fertilizer increase yield and grain nutrient ratio and economic return respectively. Ehsan *et al.*, (2009) investigated the response of fine rice to NP fertilizer and weed management practices the result obtained reveal that the grain yield of rice increased significantly with N and P application at the rate of (100 and 80kg ha⁻¹). They attributed increased in yield as a result of increased in number of tillers. Muhammad *et al.*, (2008) while investigating the growth and yield response of fine rice to split application of nitrogen discovered that higher number of grain per panicle and 1000 grain weight was significantly increased when 70kg ha⁻¹during puddling +35kgha⁻¹ N at 20DAT and 35kgha⁻¹ at 40DAT was added. Manzoor *et al.*,(2006) investigated the response of different rates of N application on super BASMATIC rice and found out that increasing levels of N significantly affect the yield to a certain thresh hold above which the yield reduces. Base on their report application of 175kgN ha⁻¹ recorded the maximum yield while at the rate of 200kg N ha⁻¹ and above the yield decline. Indira (2005) after performing an experiment discovered that the growth characters, yield parameters and grain nitrogen of rice increased significantly with the application of sulfur containing nitrogen fertilizer. Krishnakumar *et al.*,(2005) observed that NPK fertilizer registered significant yield of hybrid rice in an official seal of Tamil Nadu. They equally observed that application of 150:50:50 kg N, P₂O₅ and K₂O recorded the highest phosphorous and K uptake. Awan *et al.*,(2003) investigated the response of rice to different NPK levels.

The outcome of the experiment reveals that crop yield and maximum paddy yield were significantly improved with the application of 120-100-75 kg h⁻¹ NPK. They also reported that harvest index was higher at control, while N physiological efficiency and N efficiency decrease with increasing N levels. They also reported a decrease in the P physiological efficiency index while P fertilizer efficiency increased with increasing P levels. Ranjha *et al.*, (2001) reported that application of NPK and Zn at the rate of 120:80:60 and 20kg ha⁻¹ along with FYM at 12 Mg ha⁻¹ increased all the growth parameters of rice.

CONCLUSIONS

The use of inorganic fertilizer (NPK) plays a vital role in improving the growth and productivity yields of crops. Most of the literature cited in this work reported a positive role of NPK fertilizer nutrients. This shows how important the nutrients are to crop. With the growing increase in farming activities, the nutrients in the soil are depleted by crop hence the need to replenish the nutrients as soon as they are removed. One way to do that is by addition of conventional fertilizers. The local farmers should be encouraged to use fertilizers to boost crop yields.

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