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RESEARCH PAPER

Effect evaluation of balanced fertilizer use in maize (*Zea mayz* L.) through yield attributes, crop efficiency and energy relationships in subtropical floodplain soils

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Abstract : The balanced use of fertilizers is important for achieving economically optimal crop yield. Therefore, a field experiment at 5 different on-farm (farmer's field) locations were conducted during *Kharif*-2010 to assess the effect of balanced fertilizer use in maize (*Zea mayz* L.) grown in maize-wheat cropping sequence in an irrigated subtropical floodplain soils. The fertilizer treatments thus replicated at different locations includes 100 per cent NPK (T_1), 100 per cent NPK+30.0 kg S ha^{-1} (T_2), farmers' practice (FP) of fertilizer application (T_3), FP+30.0 kg K_2O ha^{-1} (T_4), FP+ 30.0 kg S ha^{-1} (T_5) and FP+30.0 kg K_2O ha^{-1} +30.0 kg S ha^{-1} (T_6) to investigate their effect on yield, yield attributes, crop efficiency and energy relationships associated with fertilizer application. The results revealed significantly ($p=0.05$) higher plant height, cob length, test weight (1000-grain weight) and maize grain yield in T_2 plots as compared to either of compared treatment. The plots receiving 100 per centNPK (T_1) yielded 19.1 per cent higher maize grain yield than T_3, however, the yield difference was 28.0 per cent when T_3 was compared with T_2, demarcating the synergistic effect of S application to maize. Even, the maize yield in FP plots (T_6) receiving S and K application coupled with >60 per cent higher NP application rate than 100 per cent NPK was 11.9 per cent lower than T_2 plots, emphasizing the need of N application at maize sowing that farmer's generally omit. The energy relationships associated with fertilizer application revealed total output energy of 133.8 x 10^3 MJ ha^{-1} in T_2 plots as compared to 104.5 x 10^3 MJ ha^{-1} in FP (T_3) plots, with 4.9 x 10^3 MJ ha^{-1} higher use of total input energy in FP plots than T_2 plots. The energy use efficiency (15.6) and energy productivity (0.625 kg MJ^{-1}) further exhibited higher response in T_2 plots as compared to either of the compared treatment. The production efficiency also exhibited similar trend to that of maize yield and exhibited highest in T_2 (50.8 kg ha^{-1} d^{-1}) and lowest in T_3 (39.7 kg ha^{-1} d^{-1}). The economics of fertilizer application assessed through average gross and net-returns and economic efficiency further demarcates the credibility of balanced fertilizer application in maize. Present results thus summarized that application of S conjointly with 100 per cent NPK application favours plant growth and thereby ensures highest economic maize yield with low energy input.

Key Words : Economic efficiency, Input-output energy, Production efficiency, Yield attributes

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INTRODUCTION

Farmer's generally confined themselves to nitrogen (N) and phosphorus (P) application and skips sulphur (S) and potassium (K) application in crop production, and therefore, had to face economic loss due to reduction in crop yield. Among the major elements, K has been reported to be the most crucial for normal plant growth, since it has been playing a vital role in various metabolic activities *viz.*, photosynthesis, carbohydrates, starch formation and enabling crop plant to develop tolerance to drought conditions besides enhancing plant ability to resist attack of pest and diseases. It is been reported to be absorbed by plants in large amount than any other element (Brady, 1990) and plays an important role in increasing crop yield and improving the product quality (Mengel and Kirby, 1987). According to Saha *et al.* (2010)

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