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A Review : Effect of Integrated Nutrient Management on Various Growth and Quality Parameters in Sorghum

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Abstract

Several studies have found that using chemical fertilisers on a regular basis has a negative impact on soil health and productivity by altering the physical, chemical, and biological aspects of the soil. Organic sources, on the other hand, provide all vital nutrients to plants, but they are insufficient to meet the nutritional needs of the country's crops. In this case, an optimum proportion of organic and inorganic sources should be combined to improve crop quality, crop yield, and soil productivity. This article reviews study that evaluate the effect of integrated nutrient management on crop yield, quality and soil productivity.

Key words :

Growth and Yield

A study was conducted by Choudhary *et al*. (2005) at Palampur (Himachal Pradesh) to see the effect of nutrient management practices on the productivity of sorghum and found consistent increase in yield with increasing level of NPK from 50 to 150 per cent of recommended coupled with 10 t ha^{-1} FYM. The study of Kagne *et al*. (2008) showed positive effects of fetilisers, organic manures and bio-fertilizers on growth and yield of sweet sorghum under rainfed conditions of Akola (Maharashtra). Application of vermicompost (2.5t ha^{-1})+ *Azospirillium* + phosphorus solubilising organisms + recommended NPK through inorganic sources resulted in higher productivity which was attributed to better nutrient availability from vermicompost, nitrogen fixation by *Azospirillium* and solubilization of phosphorus by phosphorus solubilising organisms. In clay loam soils of Coimbatore (Tamil Nadu), Jayanthi *et al*. (2002) observed significant response of integrated nutrient management on yields of sorghum. Significantly better plant height, green and dry fodder yields obtained with the application of 50% of RDF+ FYM @10t ha^{-1}+ vermicompost @10t ha^{-1}. In clayey loam soils of Raipur (Chhattisgarh) significantly superior green and dry fodder yields of sorghum recorded with application of 100 per cent recommended dose of fertilizer along with biofertilizers (Deva, 2015). In nitrogen deficient soils of Lucknow (Uttar Pradesh), Singh *et al*. (2015) observed that the yield attributing characters, grain and straw yields in dual purpose sorghum crop significantly improved with application of 50% of recommended fertilizer dose along with organic nutrient sources over others and statistically at par with 100 per cent of recommended dose of fertilisers.

Crop Quality

Nutrient management study also influences the quality of the produce with respect to nutritional composition. In clay loam soils of Coimbatore (Tamil Nadu), Jayanthi *et al*. (2002) recorded significantly superior results of quality parameters in in fodder sorghum. Significantly better crude protein content and yield was obtained with application of 50% of RDF+ 10t ha^{-1} FYM + 10t ha^{-1} vermicompost which was

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statistically at par with 100% RDF. A study conducted in sandy loam soils of Dehradun (Uttrakhand) revealed that the combined application of organic and inorganic nutrients in improved the quality of sorghum crop. Significantly higher crude protein content and yield recorded with application of 50% RDF + vermicompost + *Azotobacter* (Singh and Pallavi 2019). Significant better effect on crude protein content of rainfed sorghum were also obtained by Rao *et al*. (2007) with the application of 5t FYM ha^{-1} + 50 per cent recommended dose of fertilizers in sandy clay loam soils of Rajasthan at Pali-Marwar. Tiwana and Chaudhary (2009) at Ludhiana (Punjab) observed higher In Vitro Dry Matter Digestibility (IVDMD) in irrigated sorghum when crop was grown with 75 per cent recommended dose of N through fertilizer + 25 per cent N through farmyard manure or vermicompost compared to the application of 50 per cent recommended dose of N through fertilizer + 50 per cent nitrogen through farmyard manure or vermicompost and 100 per cent recommended dose of fertilizer alone. Application of *Azotobacter* + 75 per cent nitrogen phosphorus + recommended potassium and zinc + phosphorus solubilising organisms in oat resulted in higher grain crude protein yield grown under red and lateritic soil conditions of Sriniketan (West Bengal) by Jena *et al*. (2017). Patil *et al*. (2018) at Tirupati (Andhra Pradesh) also reported a significant improvement in quality parameters of sorghum with the conjoint use of 75 per cent recommended dose of fertilizers, poultry manure (2t ha^{-1}), *Azospirillium* and phosphorus solubilising organisms @5 kg ha^{-1}. Sharma *et al*. (2004) at Jorhat (Assam) observed that the combined application of 50% RDF+ vermicompost @5t ha^{-1}+ FYM@ 2.5t ha^{-1} in sandy loam soils significantly increased the crude protein content in sorghum. This might be because of organic sources that result in slow release of nutrients which prevents losses of nutrients and promotes the uptake of nutrients which eventually increases the crude protein content.

Nutritional Uptake

The study of Meena (2009) reported a significant increase in nitrogen, phosphorus and potassium uptake with the integrated use of inorganic fertilizers and bio-fertilizers in single cut forage sorghum under sandy loam textured soil in arid conditions of Udaipur (Rajasthan). Available nitrogen, phosphorus and potassium contents in soil was also increased due to solubilisation of unavailable form of nutrients by the action of microbial population. Choudhary and Gautam (2007) in sandy clay loam soils of New Delhi indicated a significant increase in the uptake of nitrogen and phosphorus with the application of FYM @10 t ha^{-1}, biofertilizer and inorganic sources of nutrients (40 kg N ha^{-1} +40 kg P_2O_5 ha^{-1}) in sorghum. Higher uptake of N and P might be due to improved and effective plant root system and enhanced concentration of nutrients in soils. Higher uptake of macronutrients was observed in finger millet with the combined use of FYM, bio-fertilizers, $ZnSO_4$, borax, 100 per cent recommended NPK by Roy *et al*. (2018) under clay loam soil conditions of Ranchi (Jharkhand). The findings of Aditi *et al*. (2019) at Navsari (Gujarat) also reported higher uptake of macro and micronutrient in rainfed forage sorghum with the combined application of 100 per cent recommended NPK with bio compost and bio-fertilizer. Use of bio-fertilizers enhanced the microbial population which resulted in solubilization of organic form of nutrients present in soil and further uptake by the crop plants. In sandy loam soils of Agra (Uttar Pradesh) Pandey (2018) significant and consistent improvement in uptake of nutrients was observed in sorghum. Highest NPK uptake was recorded with 75% recommended NPK +5 t ha^{-1} FYM +20 kg ha^{-1} sulphur.

Soil Properties

Kumar and Dhar (2006) in clay loam soils at Jhansi (Uttar Pradesh) found out that the application of 50% RDF + 5t ha^{-1} FYM + 5 t ha^{-1} vermicompost significantly improved the soil organic carbon content available N (221.5 kg ha^{-1}), P (21.9 kg ha^{-1}) and K (257.8 kg ha^{-1}). Integrated use of inorganic fertilizers and bio-fertilizer (*Azospirillium* + phosphorus solubilising organisms) in sorghum improved available nitrogen and phosphorus stock available in red sandy loam soil of Hyderabad (Andhra Pradesh) (Divya *et al*. 2017). The integrated nutrient management study conducted by Jain *et al*. (2018) in sorghum at Gwalior (Madhya Pradesh) concluded that both micro and macro nutrients availability increased for crop due to better effect on soil physical, chemical and biological properties due to the application of organic manures.

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