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Nutrition in banana

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ABSTRACT : Banana requires large quantities of nutrients for sustaining its production apart from its growth and development. As banana is a large plant with bigger size of the leaves, it exhausts major and minor elements from the soil in larger quantities and the soils require a continuous replenishment of nutrients. Banana being an exhaustive crop, proper manuring and fertilizer application has to be done for obtaining good yields, with better quality fruits. The inorganic nutrients are absorbed by the plants in readily assimilable form whereas the organic manures take time for distribution of nutrients as they need to undergo decomposition in soil. Application of inorganic fertilizers in split doses along with organic manures in combination with biofertilizers in an integrated manner is the best practice for sustaining production, yield and quality in banana as the indiscriminate usage of inorganic fertilizers deteriorates the soil health through volatilization and mineralization and causes loss of nutrients through leaching besides polluting the environment.

KEY WORDS : Nutrition, Banana, Inorganic, Organic, Integrated nutrient management

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India is the world's largest producer of banana and it is being grown in an area of 8.03 lakh ha with an annual production of 297.25 lakh MT and its productivity is 37.0 MT ha⁻¹ (NHB, 2014). For the growth and development of banana, it requires high quantities of nutrients and adequate application of nutrients is necessary to ensure the good yield with superior quality of produce. Bananas are heavy feeder of nutrients (Jones, 1998) and thus need to balanced nutrition for optimum growth and fruit production, and in turn potential yields. To establish a crop yielding of 50 t ha⁻¹ year⁻¹, banana removes about 189:29:778 kg ha⁻¹ of NPK (Twyford and Walmsley, 1968). These nutrients have to be replenished in order to maintain soil fertility and to permit continuous production of high yields. This is achieved by applying organic manures and mineral fertilizers in combination with biofertilizers which supply nutrients in readily available form. Banana responds positively to organic manures which improve physical, chemical and biological properties of the soil but heavy

organic manuring is required to equalize chemical fertilization in banana (Lahav, 1973). Chemical fertilizers have some deleterious effects on fruit quality besides adverse effects on soil, water and environmental conditions (Dutta *et al.*, 2010). Therefore, the literature pertaining to the nutrition of banana has been reviewed.

Inorganic nutrients:

Banana requires relatively large quantity of nutrients for higher growth, yield and quality owing to its larger size and rapid growth rate. Mineral nutrients constitute an important part of plants and play a major role in plant growth and development. The inorganic nutrients are rapidly absorbed by the plants in the readily assimilable form.

Growth and yield characters:

Athani and Halumani (2000) obtained highest bunch weight in banana cv. RAJAPURI (AAB) supplied with 180:108:225g NPK plant⁻¹. Bhalerao *et al.* (2008)

recorded highest plant height, pseudostem girth, bunch weight and yield along with minimum crop duration in Grand Naine banana with the supplementation of potassium @ 300g plant⁻¹ i.e., 200g K₂O in 2 split doses at the time of planting and 165 days after planting during vegetative phase and remaining 100g K₂O plant⁻¹ during reproductive phase. Nalina *et al.* (2009) recommended 165:52.5:495g NPK plant⁻¹ applied in 4 split doses to obtain higher plant growth in terms of pseudostem height, girth, number of functional leaves, shorter phyllochron, maximum leaf area coupled with minimum crop duration and good yield in banana cv. ROBUSTA (AAA).

Kuttimani *et al.* (2013) noted an improvement in the number of roots, root volume, corm circumference and corm volume with the application of 100 per cent RDF to banana. Application of 100 per cent recommended fertilizer dose to banana has improved the growth parameters (pseudostem height, number of leaves, leaf area and leaf area index) along with considerable increase in yield and its components (Kuttimani *et al.*, 2013). Fertilization of banana cv. GRAND NAINÉ with 110:30:330g of NPK plant⁻¹ crop cycle⁻¹ has shown higher growth characteristics along with enhancement of yield (Abu Nayyer *et al.*, 2014). Sangeeta *et al.* (2014) observed higher values for yield and its components when banana cv. GRAND NAINÉ fertilized with 175:105:220g NPK plant⁻¹. Sub surface drip fertigation of 100 per cent RDF as WSF (WSF-Urea, 13:40:13, KNO₃) + LBF to banana has registered highest NPK concentration in index leaf at various stages of crop growth (Yuvaraj and Mahendran, 2015).

Quality parameters:

Nalina *et al.* (2009) noticed an increment in total soluble solids content in the fingers of banana cv. ROBUSTA (AAA) obtained with the supplementation of 165:52.5:495g NPK plant⁻¹ applied in 4 split doses. Improvement in quality and its attributes like TSS, titrable acidity, ascorbic acid content, reducing and non reducing sugars along with sugar:acid ratio in banana can be obtained with the application of 100 per cent RDF (Somasundaram *et al.*, 2014). Abu Nayyer *et al.* (2014) noted higher values for TSS, titrable acidity, total sugars and pulp:peel ratio in Grand Naine banana with 110:30:330g NPK plant⁻¹ application.

Organic nutrients:

Organic farming or organic agriculture is an

approach which largely avoids or excludes the use of chemical fertilizers, pesticides, insecticides, fungicides and plant growth regulators (artificially made) and encourages the use of natural resources like compost, FYM, green manuring and biofertilizers etc.

Application of inorganic fertilizers though increases the yield substantially but could not able to sustain the fertility status of soil (Bharadwaj and Omanwar, 1994) and have caused several undesirable consequences in the fragile soil eco-system, leading to gradual decline in productivity. The use of inorganic fertilizers is costlier and also pollutes the environment through the process of denitrification and volatilization and soil-water through leaching. Heavy organic manuring is required to equalize chemical fertilization (Lahav, 1973).

Growth and yield characters:

Anil *et al.* (2004) reported that application of VAM combined with *in situ* vermiculture has registered highest plant height, girth, number of leaves and leaf area in banana cv. RAJAPURI. Application of FYM @ 10kg plant⁻¹ + neem cake @ 1.25kg plant⁻¹ + vermicompost @ 5kg plant⁻¹ + wood ash @ 3.75kg plant⁻¹ has recorded an yield of 73.15 t ha⁻¹ in banana cv. GRAND NAINÉ (Sangeeta *et al.*, 2014). Manivannan and Selvamani (2014) recommended 55:15:165g NPK plant⁻¹ + 12.5kg FYM + 3kg vermicompost + 1.0kg neem cake + 100g VAM + 50g PSB + 50g *Azospirillum* plant⁻¹ to obtain highest plant height, total number of leaves emerged, leaf area, lesser phyllochron, minimum crop duration coupled with highest yield and its attributes in banana cv. POOVAN.

Quality parameters:

Athani and Halumani (2000) recorded highest TSS, titrable acidity, TSS:acid ratio, reducing and non-reducing sugars and total sugar content in the fruits of banana cv. RAJAPURI (AAB) with *in situ* – vermicomposting @ 1,25,000 worms ha⁻¹. Sangeeta *et al.* (2014) noted an increase in TSS, reducing and non – reducing sugars along with total sugar content in Grand Naine banana with the application of FYM @ 10kg plant⁻¹ + neem cake @ 1.25kg plant⁻¹ + vermicompost @ 5kg plant⁻¹ + wood ash @ 3.75kg plant⁻¹.

Integrated nutrient management:

Integrated nutrient management is a new approach for utilization of available resources (organic, inorganic

and microbial inoculants) in an integrated manner for sustainable production. It is estimated that banana removes 320kg N, 32kg P₂O₅ and 925kg K₂O ha⁻¹ year⁻¹ to produce 50 tonnes of banana (Lahav and Turner, 1983). Integrated nutrient management is found to be beneficial for maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining desired crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner (Bhalerao *et al.*, 2009). Biofertilizers such as *Azospirillum* and PSB are used in crops as soil application which results significantly increase in yield of crop with lower soil pH and make dissolution of bound forms of phosphate to available form. *Trichoderma* spp frequently enhances root growth and development, crop productivity, resistance to abiotic stresses and the uptake and use of nutrients (Gary *et al.*, 2004).

Growth and yield characters:

Bhalerao *et al.* (2009) reported that application of 100 per cent RDF (200:40:200g NPK plant⁻¹) combined with 10kg FYM + 25g PSB + 25g *Azospirillum* plant⁻¹ has registered highest plant height, pseudostem girth, minimum days to flower, days to harvest and higher number of hands and fingers bunch⁻¹ along with highest bunch weight and yield in banana cv. GRAND NAINÉ. Hazarika *et al.* (2011) recommended the application of 100 per cent recommended dose of fertilizer + VAM + *Azospirillum* + PSB + *Trichoderma harzianum* for obtaining higher number of fingers hand⁻¹, highest finger length and girth in Grand Naine banana. Sheeba and Bindu (2012) observed highest plant height, higher number of hands and fingers bunch⁻¹ along with highest bunch weight and yield with the supplementation of vermicompost enriched with urea @ 10kg plant⁻¹ to banana cv. NENDRAN.

Application of 165:52.5:495g NPK plant⁻¹ along with wellgro soil @ 40 per cent w/w of chemical fertilizers has registered highest pseudostem girth, minimum days for phyllochron, highest number of functional leaves, leaf area, leaf area index and shorter crop duration coupled with highest bunch weight and yield in banana (Kuttimani *et al.*, 2013). According to Patil and Shinde (2013) better growth characteristics, yield and early cropping in banana cv. ARDHAPURI can be obtained when inorganic fertilizers @ 50:80:50g NPK plant⁻¹ along with 50g *Azotobacter* + 50g PSB + 250g VAM plant⁻¹ were applied. Somasundaram *et al.* (2014) noted an

improvement in yield and its attributes by the application of 100 per cent recommended dose of fertilizers + 40 per cent wellgro soil to banana. Inorganic fertilizers @ 200:100:300g NPK plant⁻¹ when applied with 50g VAM + 50g *Azospirillum* + 50g PSB + 50g *Trichoderma harzianum* plant⁻¹ has registered an yield of 75.35 t ha⁻¹ in banana (Hazarika *et al.*, 2014). Abu Nayyer *et al.* (2014) observed higher values for plant height, pseudostem girth, number of leaves and number of functional leaves plant⁻¹ as well as yield in Grand Naine banana when inorganic fertilizers @ 100 per cent RDF of NPK were applied along with 50g *Azospirillum* + 50g PSB + 50g *Trichoderma harzianum* plant⁻¹.

Quality parameters:

Abu Nayyer *et al.* (2014) noted an increase in finger length and diameter, TSS, minimum titrable acidity and maximum total sugars content in the fingers of banana plants cv. GRAND NAINÉ obtained with the application of 100 per cent RDF of NPK + 50g *Azospirillum* + 50g PSB + 50g *Trichoderma harzianum* plant⁻¹. Fertilization of banana plants with 75 per cent RDF of NPK + 2 per cent liquid organic manure spray has registered maximum TSS, minimum titrable acidity, maximum reducing and non-reducing sugars content in banana (Somasundaram *et al.*, 2014). Manivannan and Selvamani (2014) recorded highest TSS, ascorbic acid and total sugars content along with higher acid: sugar ratio in banana cv. POOVAN when 50 per cent recommended dose of fertilizers (through inorganics) applied with 12.5kg FYM + 3kg vermicompost + 1.0kg neem cake + 100g VAM + 50g PSB + 50g *Azospirillum* plant⁻¹.

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