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EFFECT OF SUB SURFACE DRIP FERTIGATION ON POST HARVEST SOIL NITROGEN PHOSPHOROUS AND POTASSIUM RANGE OF BANANA *CV.* RASTHALI

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ABSTRACT

Field experiment was carried out at AICRP- Water Management block, Agricultural College and Research Institute, Madurai during 2010 - 2011 to study the effect of subsurface drip fertigation on growth, yield, quality and economics of banana cv. Rasthali. Banana requires high levels of nutrients for proper growth and production. It is estimated that a crop of fifty two tones in one hectare removes 320 kg of N, 32 kg of $P_2O_5$and 925 kg K_2O every year. The frequent supply of nutrients with irrigation water in fertigation treatment significantly increased NPK uptake over drip irrigation. The uptake was higher under 100 per cent fertigation rate compared to other fertigation rates. The uptake of nutrients was higher for sucker grown banana plant compared with tissue culture plants due to greater accumulation of dry matter.

INTRODUCTION

Banana (*Musa sp)* is the fourth most important global food commodity after rice, wheat and milk in terms of gross value of production. It is a giant perennial herb that thrives in humid tropics and subtropics. It is grown in more than 130 countries across the world. India is the largest producer of banana in the world with the production of 97.38 mt of banana from an area of 8.25mha. Among the horticultural crops, banana contributes the maximum to the agricultural gross domestic product (GDP) of India to the tune of 1.99 per cent. Tamil Nadu has the largest area of (0.96 lakh ha) under banana and stands first in production with 50.99 lakh tonnes (Neelam Patel and Rajput, 2009). Commercial banana production system is largely dependent on irrigated system, while rainfed farming is very little and negligible. India, endowed with diverse agro-climatic conditions, has encouraged the cultivation of different varieties catering to local needs. Banana varieties *viz*., Poovan, Dwarf Cavendish, Rasthali, Robusta, Red banana, Nendran, Monthan, Neypoovan, Hill banana, Karpooravalli, Nadan and Grand Naine have assumed the status of commercial cultivation Hiraman (2000). Banana requires high amount of nutrients for proper growth and development and for optimum production, the nutrient requirements are 20 kg FYM, 200g N, 60-70g P, 300g K plant^{-1}. Banana crop removes 7-8 kg N, 0.7-1.5 kg P_2O_5 and 17-20 kg K_2O for producing one metric tonne yield. More amounts of nitrogen and potassium are required for its growth and production compared to phosphorus. Application of borax and zinc sulphate at 50g each per plant during third month after planting and foliar spray of boric acid at 0.2 percent and zinc sulphate at 0.5 percent during the fourth and sixth month after planting is normally recommended for better bunch development and quality fruits. Subsurface drip irrigation (SSDI) is an efficient means for applying water and nutrients below the surface soil to conserve water and to minimize run off and control of weeds. Irrigation water use for crops can be reduced by 35–55 per cent using SSDI compared to traditional forms of irrigation as well as managing nitrogen through fertigation was very effective with SSDI Freed (1966). Further, under subsurface drip irrigation, when fertigation is combined, nutrient use efficiency could be as high as 90 per cent compared to 40-60 per cent in conventional fertilizer application methods (Bar-yosef, 1999). Adoption of subsurface drip fertigation system may also help in increasing yields and quality parameters due to improved irrigation, nutrients and energy use efficiencies.

MATERIALS AND METHODS

The experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments consisted of T_1-Surface irrigation with soil application of recommended dose

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of fertilizers, T_2- Subsurface drip fertigation of 100 per cent RDF (P as basal, N and K through drip as urea and white potash), T_3- Subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3), T_4- Subsurface drip fertigation of 100 per cent RDF (50% P and K as basal, remaining N, P and K as WSF), T_5- Subsurface drip fertigation of 75 per cent RDF (P as basal, N and K through drip as urea and white potash) + LBF, T_6- Subsurface drip fertigation of 75 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) + LBF, T_7- Subsurface drip fertigation of 75 per cent RDF (50% P and K as basal, remaining N, P and K as WSF) + LBF, T_8- Subsurface drip fertigation of 100 per cent RDF (P as basal, N and K through drip as urea and white potash)+LBF, T_9- Subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) + LBF, T_{10}- Subsurface drip fertigation of 100 per cent RDF (50% P and K as basal, remaining N, P and K as WSF)+LBF and T_{11}-Subsurface drip irrigation with LBF alone (no inorganic). The recommended dose of fertilizers for banana is 200:35:300 g NPK plant^{-1}. Banana cv. Rasthali was used as the test crop. Subsurface drip irrigation was scheduled once in three days and fertigation was given once in six days starting from 15 days after planting to 300 days after planting. The observations on growth parameters, yield attributes, yield and quality parameters at periodical intervals were recorded. Further, resource use efficiency and economics were also calculated. The nutrient mobility in soil was estimated by analyzing available NPK. The soil samples were taken at the emitting point and 15 cm away from the emitting point of the same lateral. The soil samples were also collected from 0-25, 25-50 and 50 – 75 cm depth of profile (vertical) between the drippers.

RESULTS AND DISCUSSION

Subsurface drip fertigation on post harvest soil NPK

The efficient use of fertilizers is necessary for optimum growth and yield. Hence, knowledge about the availability of nutrients in the soil is very essential. A clear understating of specific requirement of the crop during various stages of growth will substantially reduce the possible wastage of applied nutrients and improve the potentiality of the plant and nutrient use efficiency. In general, the treatments with subsurface drip fertigation of 100 per cent RDF levels resulted in higher availability of nutrients compared to surface irrigation with soil application of recommended dose of fertilizers. The increased availability of nutrients may be due to split application of fertilizers under drip fertigation that resulted in reduction in loss of nutrients thereby making them available continuously to the crop compared to soil application where these nutrients found to leach out to deeper layers and become unavailable to the crop. Similar findings of higher available NPK with drip fertigation over soil application of nutrients were also reported by Bhardwaj *et al.* (1996) in apple. Further it was also observed that drip fertigation treatments in combination with liquid biofertilizers (T_5 to T_{10}) registered numerically higher soil available NPK compared to the treatments without biofertilizers. The beneficial role of bio fertilizers in increasing soil available NPK was confirmed earlier by Kajal *et al*. (2008) and Madumathi (1987)

Table 1. Effect of subsurface drip fertigation on post harvest soil available NPK (kg ha^{-1})

Treatment	Nitrogen	Phosphorus	Potassium
T_1	150.42	11.20	168.15
T_2	166.38	10.50	179.90
T_3	169.63	11.00	172.63
T_4	162.85	10.70	176.71
T_5	150.72	10.40	150.70
T_6	152.25	10.30	158.25
T_7	158.45	10.70	162.64
T_8	171.38	11.60	181.32
T_9	173.53	12.90	175.45
T_{10}	175.86	11.80	180.67
T_{11}	136.64	7.80	145.14
SE d	4.38	0.41	5.81
CD(0.05)	9.12	0.86	12.08

Available nitrogen (Table 1)

The soil available nitrogen was significantly influenced by the fertigation treatments. Subsurface drip fertigation of 100 per cent RDF (50% P and K as basal, remaining N, P and K as WSF)+LBF (T_{10}) recorded higher soil available nitrogen (175.86 kg ha^{-1}) but it was on par with subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) (T_9), subsurface drip fertigation of 100 per cent RDF (P as basal, N and K through drip as urea and white potash) + LBF (T_8) and subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) (T_3). The treatment subsurface drip irrigation with LBF alone (No inorganic) (T_{11}) recorded lower soil available nitrogen content (150.42 kg ha^{-1}).

Available phosphorus (Table 1)

Drip fertigation treatments significantly influenced the soil available phosphorus. Among the treatments, subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) + LBF(T_9) was found to record higher soil available P (12.90 kg ha^{-1}). The treatment subsurface drip irrigation with LBF alone (No inorganic) (T_{11}) registered lower soil available P (7.80 kg ha^{-1}).

Available potassium (Table 1)

Drip fertigation treatments had a favourable influence on soil available potassium. The highest soil available K (181.32 kg ha^{-1}) was recorded under subsurface drip fertigation of 100 per cent RDF (P as basal, N and K through drip as urea and white potash) +LBF (T_8) and this was on par with subsurface drip fertigation of 100 per cent RDF as WSF (WSF – Urea, 13: 40: 13, KNO_3) + LBF (T_9), subsurface drip fertigation of 100 per cent RDF (50% P and K as basal, remaining N, P and K as WSF)+ LBF(T_{10}), subsurface drip fertigation of 100 per cent RDF (50% P and K as basal, remaining N, P and K as WSF) (T_4) and subsurface drip fertigation of 100 per cent RDF (P as basal, N and K through drip as urea and white potash) (T_2). The lowest soil available potassium was observed in the treatment subsurface drip irrigation with LBF alone (No inorganic) (T_{11}) (145.14 kg ha^{-1}).

Conclusion

The efficient use of fertilizers is necessary for optimum growth and yield. Hence, knowledge about the availability of nutrients in the soil is very essential. A clear understating of specific requirement of the crop during various stages of growth will substantially reduce the possible wastage of applied nutrients and improve the potentiality of the plant and nutrient use efficiency. In general, the treatments with subsurface drip fertigation of 100 per cent RDF levels resulted in higher availability of nutrients compared to surface irrigation with soil application of recommended dose of fertilizers. The increased availability of nutrients may be due to split application of fertilizers under drip fertigation that resulted in reduction in loss of nutrients thereby making them available continuously to the crop compared to soil application where these nutrients found to leach out to deeper layers and become unavailable to the crop.

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