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Effect of Water Soluble Fertilizers through Fertigation on Soil Available N, P, K and Yield of Bt Cotton

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A B S T R A C T

Field experiment was carried out during *kharif* season of 2013-14 at research farm, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to find out the influence of water soluble fertilizers through fertigation soil available N, P, K and yield of Bt cotton. The experiment has five treatments and four replications comprising of T_1- Recommended dose of fertilizers through soil application, T_2- Recommended dose of fertilizers through fertigation (conventional), T_3-100 % RDF through soluble fertilizers by fertigation, T_4- 80 % RDF through soluble fertilizers by fertigation and T_5- 60 % RDF through soluble fertilizers by fertigation. The soil available N, P and K were significantly higher in treatment supplemented with application of 100 per cent RDF through soluble fertilizers by fertigation over 100 per cent RDF through conventional fertilizers. Yield was significantly maximum in application of 100 per cent RDF through soluble fertilizers by fertigation than other treatments.

Introduction

Cotton (*Gossypium sp*.) is one of the most important commercial cash crop and important fiber crop of global significance cultivated in more than seventy countries. Cotton is a multipurpose crop that supplies five basic products such as lint, oil, meal, seed and hulls and is popularly known as "King of Fiber". In India, cotton is grown in ten states. Maharashtra, Gujarat and Andhra Pradesh occupy 75 % of the total cotton area in India and 72 % of overall cotton production in the country. The nutrient management in cotton is a complex phenomenon due to its simultaneous production of vegetative and reproductive structures during the active growth phase. Cotton requires sufficient quantity of macro and micro nutrients to achieve the maximum seed cotton yield. Fertilization must always supply and maintain an optimum level of nutrients within the root zone for good growth and harvesting of potential yield of crops. Injection of fertilizers into irrigation water gives a better crop response than either band or broadcasting. Fertigation gives flexibility of fertilization, which enables the specific nutritional requirement of the crop to be met at different stages of its growth. Split application of fertilizers ensures required nutrients in right time and in right quantity for getting higher yield with minimum loss of nutrients. For effective fertigation, the fertilizers used should be 100 per cent water soluble so as to leave no residues in the micro irrigation system that might clog the system. Soluble fertilizer that dissolved easily in water and are immediately available for plant species. The water soluble nitrogen, phosphorus and potassium fertilizers play major role in growth and development of cotton. The hypothesis of the investigation was application of water soluble fertilizer through fertigation may influence yield and availability of nutrients.

Materials and Methods

Field experiment was conducted at research farm, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2013-14. The soil of the experimental site was Vertisols which was slightly alkaline (7.85 medium inorganic carbon (5.50 g kg^{-1}), low in available nitrogen (156.00 kg ha^{-1}), low in phosphorus (8.90 kg ha^{-1}) and very high in potassium (744.20 kg ha^{-1}). The experiment was laid out in randomized block design with three replications and five treatments comprising **T_1-** Recommended dose of fertilizers through soil application, **T_2-** Recommended dose of fertilizers through fertigation (conventional), **T_3-**100 % RDF through soluble fertilizers by fertigation, **T_4-** 80 % RDF through soluble fertilizers by fertigation and **T_5-** 60 % RDF through soluble fertilizers by fertigation. The available N, P and K from soil were determined by using standard procedures. Seed cotton and stalk yield was also computed.

Results and Discussion

Available nitrogen

The availability of nitrogen varied from 142.20 to 198.30 at square formation, 145.50 to 185.60 at flowering, 135.00 to 173.40 at boll bursting and 126.30 to 157.55 kg ha^{-1} at harvest of Bt cotton (Table 1). The maximum nitrogen availability was recorded with T_3 treatment receiving 100 per cent RDF through soluble fertilizer at all stages of growth of cotton. In general, among the different treatments, T_3 has shown significantly higher nitrogen availability in soil followed by T_4, T_2, T_5 and T_1 treatments. The availability of nitrogen decreased with advancing growth stages of Bt cotton. The reduction in available nitrogen was more from boll bursting to harvesting stage. The available nitrogen was significantly higher under application of soluble fertilizer through fertigation as compared to soil application similar findings were reported by Bharambe *et al.*, (1997), Reddy and Aruna (2010), Nalayini *et al.*(2012) and Kurwade *et al.*, (2012).

Available Phosphorus

The Phosphorus availability in soil was decreased with advancement of crop growth period and it varied from 8.42 to 15.70 at square formation, 8.11 to 14.31 at flowering, 8.06 to 13.08 at boll bursting and 7.90 to 10.02 kg ha^{-1} at harvest stage of Bt cotton (Table 2).

The treatment 100 per cent RDF through soluble fertilizer (T_3) showed significantly higher soil nitrogen availability at different stages of Bt cotton followed by T_4 treatment. In general, all the treatments receiving soluble fertilizer through fertigation recorded higher available phosphorus as compared to soil application of fertilizers. Phosphorus availability to Bt cotton was maximized by applying soluble fertilizers through fertigation in splits. These results are in agreement with the findings of Bharambe *et al.*, (1997), Reddy and Aruna (2010) and Kurwade *et al.*, (2012).

Table.1 Effect of soluble fertilizers through fertigation on available nitrogen (kg ha^{-1}) in soil at various growth stages of Bt cotton

Treatment	Square formation	Flowering	Boll Bursting	At Harvest
T_1- Recommended dose of fertilizers through soil application	142.20	148.50	135.00	126.30
T_2- Recommended dose of fertilizers through fertigation (conventional)	186.20	168.30	156.48	142.58
T_3- 100 % RDF through soluble fertilizers by fertigation	198.30	185.60	173.40	157.55
T_4- 80 % RDF through soluble fertilizers by fertigation	190.33	181.50	164.30	152.00
T_5- 60 % RDF through soluble fertilizers by fertigation	182.00	167.20	154.00	137.20
SE±	5.99	4.50	4.59	2.09
C.D.(P=0.05)	18.20	13.87	13.19	6.40
Grand mean	179.80	170.22	156.63	143.12

Table.2 Effect of water soluble fertilizers through fertigation on available Phosphorus (kg ha^{-1}) in soil at various growth stages of Bt cotton

Treatment	Square formation	Flowering	Boll Bursting	At Harvest
T_1- Recommended dose of fertilizers through soil application	8.42	8.11	8.06	7.90
T_2- Recommended dose of fertilizers through fertigation (conventional)	13.30	12.26	10.48	8.68
T_3- 100 % RDF through soluble fertilizers by fertigation	15.70	14.31	13.08	10.02
T_4- 80 % RDF through soluble fertilizers by fertigation	14.32	13.20	12.11	9.18
T_5- 60 % RDF through soluble fertilizers by fertigation	12.96	11.97	10.20	8.43
SE±	0.42	0.332	0.2529	0.002
C.D.(P=0.05)	1.27	1.025	0.77	0.007
Grand mean	12.94	11.97	10.78	8.84

Table.3 Effect of soluble fertilizers through fertigation on available potassium (kg ha^{-1}) in soil at various growth stages of Bt cotton

Treatment	Square formation	Flowering	Boll Bursting	At Harvest
T_1- Recommended dose of fertilizers through soil application	656.30	602.48	570.68	560.48
T_2- Recommended dose of fertilizers through fertigation (conventional)	718.90	688.36	664.00	620.47
T_3- 100 % RDF through soluble fertilizers by fertigation	765.39	738.40	711.26	676.28
T_4- 80 % RDF through soluble fertilizers by fertigation	739.50	722.33	678.00	644.68
T_5- 60 % RDF through soluble fertilizers by fertigation	690.00	667.33	652.00	596.00
SE±	12.54	15.85	16.40	8.58
C.D.(P=0.05)	37.39	46.90	49.66	25.58
Grand mean	714.40	683.78	655.18	619.58

Table.4 Effect fertilizers through fertigation on seed cotton yield (q ha^{-1}) of Bt cotton

Treatment	Seed cotton yield (q ha^{-1})	Stalk yield (q ha^{-1})
T_1- Recommended dose of fertilizers through soil application	15.87	24.70
T_2- Recommended dose of fertilizers through fertigation (conventional)	19.62	29.44
T_3- 100 % RDF through soluble fertilizers by fertigation	22.21	36.24
T_4- 80 % RDF through soluble fertilizers by fertigation	21.36	32.66
T_5- 60 % RDF through soluble fertilizers by fertigation	17.20	27.28
SE±	0.57	1.29
C.D.(P=0.05)	1.78	4.03
Grand mean	19.25	30.06

Available Potassium

The data presented in Table 3 revealed that the treatment T_3 recorded significantly higher potassium in soil over rest of the treatments at all the advancing growth stages of Bt cotton. The potassium availability varied from 656.30 to 765.39 at square formation, 602.48 to 738.40 at harvesting, 750.68 to 711.26 at boll bursting and 560.48 to 676.28 at harvest stage of Bt cotton. The lowest available potassium was observed in treatment T_1 (soil application). The status of available potassium showed decreasing trends towards maturity. The availability was increased with more number of split applications of RDF than the present method of application. The similar results were quoted by Barambe *et al.*, (1997) and Kurwade *et al.,* (2012).

Seed cotton and stalk yield

In the present investigation, seed cotton and stalk yield differed significantly with different treatments of fertilizers (Table 4). Significantly higher seed cotton and stalk yield was recorded with receiving 100 per cent RDF through soluble fertilizers (22.21 and 36.24 qha^{-1}) and statistically at par with T_3 treatment. The lowest seed cotton and stalk yield was registered in treatment receiving 100 % RDF through soil application. The higher seed cotton yield in treatment having 100 per cent RDF through soluble fertilizers could be attributed to the availability of nutrients throughout the crop growth and its higher uptake by the crop. These results are in conformity with the findings of Nalayini *et al.*, (2012), Hosamani *et al.*, (2013), Bharambe *et al.,* (1997) and Patil *et al.*, (2004).

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