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Effect of Water-Soluble fertilizers through fertigation on growth, yield component and yield of Bt cotton

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Abstract
Field experiment was conducted during *kharif* season of 2013-14 to study the effect of water soluble fertilizers through fertigation on growth, yield component and yield of Bt cotton at research farm, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was carried out in randomized block design with five treatments and four replications. The treatment consists 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 growth and yield component like plant height, number of leaves, leaf area, number of bolls, seed and stalk yield of cotton significantly improved with application of 100 per cent RDF through soluble fertilizers by fertigation into six splits followed by 80 per cent RDF through soluble fertilizers.

Keywords: Soluble fertilizers, fertigation, yield, Bt cotton

Introduction
Cotton 'king of apparel fiber' is an important cash crop and it supplies a major share of raw material for the textile industry. Cotton plays a key role in the national economy in terms of both employment generation and foreign exchange earnings. It contributes more than 14 per cent of annual value addition of industrial production and more than 30 per cent of total exports and 4 per cent of its Gross Domestic Product (GDP). India is the third largest producer of cotton in the world with 12.19 million hectares area, 242.5 bales of production with 467 kg ha^{-1} productivity. India ranks first in area and productivity is far below the world average of over 600 kg ha^{-1} (Anonymous, 2010) [1]. Maharashtra is one of the major cotton growing state having 39.32 lakh hectares with the production of 82 lakh bales. However, Productivity of cotton in Maharashtra is 335 kg lint per hectare which is very low as compared to Tamil Nadu (697 kg ha^{-1}), Andhra Pradesh (505 kg ha^{-1}) and Gujarat (665kg ha^{-1}). With the introduction of hybrid varieties, the use of chemical fertilizers is the "kingpin" in the present system of agriculture. Scientific use of fertilizers assumes vital importance for sustainable agriculture. Efficient use of fertilizers play back to the farmers more profit per unit investment. Fertigation is the most effective and convenient mean of maintaining optimum fertility levels and water supply according to specific needs of each crop and types of soil resulting in higher yields and better quality of crops. Fertigation offers advantages of saving in fertilizers as well as increase in fertilizer use efficiency (Nakayama and Bucks, 1986) [4]. 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 paper deals with the study of the effect water soluble fertilizers through fertigation on growth, yield component and yield of Bt. cotton.

Material and Methods
A field experiment was conducted during *kharif* season of 2013-14 to study the effect of water soluble fertilizers through fertigation on growth, yield component and yield of Bt cotton at research farm, Department of Soil Science and Agricultural Chemistry,

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The initial soil pH was7.85,EC-0.18 dSm^{-1},organic carbon-5.50 g kg^{-1},calcium carbonate-61.20 g kg^{-1},available nitrogen-156.00 kg ha^{-1},phosphorus - 8.90 kg ha^{-1},and potassium-744.20 kg ha^{-1}.The soil was clayey in texture. The field experiment was carried out on Bt cotton crop (Variety Rashi-2) in *kharif* season during year 2013-14. The experiment was laid out in randomized block design with five treatments and four replications. The details of treatment are 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.

Results and Discussion

Plant height

The data on plant height of Bt cotton at various growth stages influenced by water soluble fertilizer through fertigation are presented in Table 1. The application of soluble fertilizer through fertigation favourably influenced the height of cotton at various growth stages. Plant height varied in the range of 29.65 to 41.05 cms, 31.80 to 49.03 cms, 60.30 to 68.43 cms and 72.93 to 89.05 cms at square formation, flowering, boll bursting and harvest of Bt cotton, respectively. With the advancement of growth of cotton, increasing trend in plant height was observed. The treatment T_3 (100% RDF through soluble fertilizer) showed significantly more plant height at different stages of Bt cotton followed by T_4, T_2, T_5 and T_1 treatments, respectively. The application of soluble fertilizer through fertigation treatments recorded significantly higher plant height at all growth stages over soil application of fertilizers.The balanced application of fertilizer through fertigation into six splits resulted in increase in plant height. These results are in compliance with the finding of Rasker *et al.* (2001) [7] and Reddy and Aruna (2010) [8].

Number of leaves

The leaves count was taken at square formation, flowering and boll bursting stages of Bt cotton and the data are presented in Table 2. It was found that the number of leaves ranged from 19.25 to 27.65 at square formation, 31.85 to 43.90 at flowering and 56.50 to 64.00 at boll bursting stage of Bt cotton. Maximum number of leaves per plant with T_3 treatment received 100 per cent RDF through soluble fertilizers through fertigation into six splits at all growth stages of Bt cotton.

However, the treatment T_3 (100 per cent RDF through soluble fertilizers) are at par with T_4 (80 per cent RDF through soluble fertilizers).

The application of soluble fertilizers through fertigation into six splits proved significantly to increase number of leaves per plant over soil application of recommended dose of fertilizer. Reddy and Aruna (2010) [8] reported that maximum number of leaves per plant with more splits was the result of efficient utilization of applied nitrogen and potassium through fertigation than band placement. These results are in line with the findings of Nalayini *et al.* (2012) [5].

Leaf area

The result on leaf area as influenced by the application of soluble fertilizers through fertigation at various growth stages of Bt cotton are presented in Table 3. There was continuous build up of leaf area in Bt cotton with advancing growth stages. The results also indicated that the application of soluble fertilizers through fertigation into splits significantly influenced leaf area of Bt cotton at various growth stages over soil application of fertilizers. Leaf area varied from 872.20 to 244.30 cm^2, 1320.50 to 1740.72 cm^2 and 2585.00 to 3190.50 cm^2 at square formation, flowering, and boll bursting stage of Bt cotton. The highest leaf area was recorded with T_3 (100 per cent RDF through soluble fertilizers) followed by T_4 (80 per cent RDF through soluble fertilizers) at all stages of growth in Bt cotton during the year of experimentation. The increase in leaf area per plant with increasing age of the plant with soluble fertilizer through fertigation observed in the present study was in accordance with the findings reported by Veerpurthiran *et al*. (2005) [9].

Number of bolls

The number of bolls per plant is important yield parameters, as it gives a rough estimate of probable yield. The data on number of bolls per plant as influenced by different treatment during the year of experimentation are presented in Table 4. The number of bolls varied in the range of 66.96 to 85.11. The highest number of bolls $plant^{-1}$ (85.11) was observed in treatment T_3 (100% RDF through soluble fertilizers) while lowest number of bolls $Plant^{-1}$ (66.96) was noticed in T_1 treatment (100 per cent RDF through soil application). Shrinivasan (2003) registered the highest number of bolls per plant by application of recommended levels of fertilizers by skipping basal and applying all the nutrients in two splits. Cotton being an intermediate crop with long duration, application of fertilizers in later stages might have helped in inducing more number of bolls per plant. These results are in agreement with Bharambe *et al.* (1997) [2], Reddy and Aruna (2010) [8] and Nalayini *et al.* (2012) [5].

Seed cotton yield

The data on seed cotton yield (q ha^{-1}) as influenced by different treatment are synthesized in Table 5. The result revealed that the seed cotton yield varied in the range of 15.87 to 22.21q ha^{-1}. The highest seed cotton yield (22.21 q ha^{-1}) was registered under T_3 treatment (100 per cent RDF through soluble fertilizers) followed by T_4 treatment (21.36 q ha^{-1}) which was statistically at par with T_3 treatment. The treatment T_1 (100% RDF through soil application) recorded lowest seed cotton yield (15.87 q ha^{-1}) of Bt cotton. The influence of different treatments on seed cotton yield followed the order $T_3 > T_4 > T_2 > T_5 > T_1$.

Thus, the result suggested that the application of soluble fertilizers through fertigation into six splits would be effective for obtaining maximum yield of cotton. Enhancement in yield in cotton crop due to scientific scheduling of fertilizer through drip over soil application of fertilizer has been reported by Nalayini *et al.* (2012) [5].

Hosamani *et al.* (2013) [3] reported that increased in seed cotton yield with 125 per cent RDF might be due to significantly higher number of good opened boll per plant, total number of boll harvested per plant, mean boll weight, amount of dry matter accumulation in reproductive parts and leaf area upto harvest. These results are in compliance with the finding of Bharambe *et al.* (1997) [2], and Patil *et al.* (2004) [5].

Cotton Stalk yield

The data on stalk yield of Bt cotton at harvest are presented in Table 5.The cotton stalk yield varied from 24.70 to 36.24 q ha^{-1}. The stalk yield was highest (36.24 q ha^{-1}) with the

treatment T_3 (100 per cent RDF through soluble fertilizer). The lowest stalk yield (24.70 q ha^{-1}) was recorded in treatment T_1 (100 per cent RDF through soil application). The influence of different treatments on cotton stalk yield followed the order: $T_3 > T_4 > T_2 > T_5 > T_1$. The similar results were also reported by Bharambe *et al.* (1997) [2], Reddy and Aruna (2010) [8] and Nalayini *et al.* (2012) [5].

Table 1: Effect of soluble fertilizers through fertigation on plant height at various growth stages of Bt cotton (cm $plant^{-1}$).

Treatment	Square formation	Flowering	Boll bursting	At Harvest
T_1- Recommended dose of fertilizers through soil application	29.65	31.80	60.30	72.93
T_2- Recommended dose of fertilizers through fertigation (conventional)	34.65	42.40	63.85	80.38
T_3- 100% RDF through soluble fertilizers by fertigation	41.05	46.33	68.43	89.05
T_4- 80% RDF through soluble fertilizers by fertigation	39.30	49.03	64.40	81.08
T_5- 60% RDF through soluble fertilizers by fertigation.	31.80	40.75	62.55	77.00
SE±	1.30	1.62	1.29	0.50
C.D.(P=0.05)	4.02	5.00	3.90	1.50
Grand mean	35.29	42.06	63.90	80.0

Table 2: Effect of soluble fertilizers through fertigation on number of leaves $plant^{-1}$ at various growth stages of Bt cotton.

Treatment	Square formation	Flowering	Boll bursting
T_1- Recommended dose of fertilizers through soil application	19.25	31.85	56.50
T_2- Recommended dose of fertilizers through fertigation (conventional)	24.65	37.60	63.00
T_3- 100% RDF through soluble fertilizers by fertigation	27.65	43.90	64.00
T_4- 80% RDF through soluble fertilizers by fertigation	26.70	41.00	63.75
T_5- 60% RDF through soluble fertilizers by fertigation	23.15	33.75	59.75
SE±	1.29	2.11	1.21
C.D.(P=0.05)	4.00	6.50	3.74
Grand mean	24.28	37.62	61.40

Table 3: Effect of soluble fertilizers through fertigation on leaf area $plant^{-1}$ (cm^2) at various growth stages of Bt cotton.

Treatment	Square formation	Flowering	Boll bursting.
T_1- Recommended dose of fertilizers through soil application	872.20	1320.50	2585.00
T_2- Recommended dose of fertilizers through fertigation (conventional)	1096.63	1530.90	2744.28
T_3- 100% RDF through soluble fertilizers by fertigation	1244.30	1740.72	3190.50
T_4- 80% RDF through soluble fertilizers by fertigation	1190.30	1680.44	3080.30
T_5- 60% RDF through soluble fertilizers by fertigation.	985.80	1395.20	2683.20
SE±	26.14	29.43	53.63
C.D (P=0.05)	80.55	90.71	165.27
Grand mean	1077.84	1533.55	2876.65

Table 4: Effect of soluble fertilizers through fertigation of number of bolls per plant of Bt cotton

Treatment	No. bolls/plant
T_1- Recommended dose of fertilizers through soil application.	66.96
T_2- Recommended dose of fertilizers through fertigation (conventional).	47.35
T_3- 100% RDF through soluble fertilizers by fertigation	85.11
T_4- 80% RDF through soluble fertilizers by fertigation	77.85
T_5- 60% RDF through soluble fertilizers by fertigation	70.92
SE±	1.15
C.D.(P=0.05)	3.56
Grand mean	69.63

Table 5: 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

Conclusion

The application of 100 per cent RDF through soluble fertilizers by fertigation into six splits significantly enhanced plant height, number of leaves, leaf area, number of bolls, seed and stalk yield of cotton followed by 80 per cent RDF through soluble fertilizers.

References

1. Anonymous. Cotton advisory board, Cotton Corporation of India 2010. www.cot.corp.gov.in.
2. Bharambe PR, Narwade SK, Oza SR, Vaishnava VG, Shelke DK, Jadhav GS, *et al*. Nitrogen management in cotton through drip irrigation. J Indian. Soc. Soil Sci 1997;45(4):705-709.
3. Hosamani V, Halepyati AS, Shashikumar M, Santosh UN, Natraja M, Manu TG, *et al*. Quality, uptake of nutrients and economics of irrigated Bt cotton (*Gossypium hirsutum* L.*)* as influenced by macro nutrients and liquid fertilizers. G.J.B.A.H.S.I 2013;2(1):29-32.
4. Nakayama FS, Bucks DA. Trickle irrigation for crop production: Design, operation and management, Elsevier, Amsterderdam. The Netheriands 1986, 223.
5. Nalayini SP Raj, K Sankarranarayanan. Drip fertigation of major, secondary and micronutrients for enhancing the productivity of extra long staple Bt cotton. J Cotton Res. Dev 2012;26(2):186-189.
6. Patil VC, Halemani HL, Hallikeri SS, Nandagavi RA, Bandiwadder TT, Kalibhavi CM, *et al*. Comparative performance of cotton hybrids and variety under drip irrigation. International Symposium on "Strategies for sustainable cotton production –A Global Vision" Vol.No.2, Crop Production, Held on 23, November, UAS, Dharwad, Karnatka 2004.
7. Raskar BS, Bhoi PG, DD Pawar. Effect of planting technique and water soluble fertilizers on pre-monsoon cotton under drip irrigation. J Indian Soc.Cotton Improv 2001;26(3):138-143.
8. Reddy SB, E Aruna. Effect of irrigation levels through drip on growth, yield and quality of cotton. J Cotton Res. Dev 2010;23(1):56-59.
9. Veerputhiran R, Kandasamy OS, Singh SDS, Chinnusamy C. Influence of drip irrigation and nitrogen fertigation on growth and yield of hybrid cotton. J Ecobiology 2005;17**(**4):329-355.