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Effect of foliar application of boron, salicylic acid and potassium nitrate on yield and quality of watermelon (*Citrullus lanatus*) in alfisols of *Konkan*

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Abstract
A field experiment on "Effect of Foliar Application of Boron, Salicylic Acid and Potassium Nitrate on Yield and Quality of Watermelon (*Citrullus lanatus*) in Alfisols of Konkan" was conducted with Randomized Block Design comprising eight treatments replicated thrice at Department of Agronomy, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Dist. - Ratnagiri during Rabi 2017-2018. Application of RDF + foliar application of 0.5 per cent potassium nitrate significantly increased the yield and quality parameters viz. TSS, reducing sugar, total sugar and anthocyanin. Hence, on the basis of result obtained from the present investigation it can be concluded that foliar application of RDF + foliar application of 0.5 per cent potassium nitrate significantly increased the yield and quality of watermelon.

Keywords: Foliar, boron, salicylic acid, potassium nitrate, yield, quality, watermelon, TSS

Introduction
Watermelon (*Citrullus lanatus*) is one of the most famous and cheap fruit vegetable crop consumed in Maharashtra as well as India during summer season. The fresh fruit is relished by many people across the world because it is known not only to be low in calories but highly nutritious, sweet and thirst-quenching (Mangila *et al*, 2007) [7]. In India watermelon is grown in various types like garden land, riverbeds, mix-cropping. Watermelon is grown popularly in Konkan region especially during Rabi season due to its short duration, minimum tillage and water requirement, better profit within short period. The growth and yield of watermelon is highly influenced by fertilizer application, the dose depend on the soil type, climate and system of planting. Among the several factors controlling the yield and profit from crops, plant nutrient is an important factor. An optimum N, P and K nutrition is essential for the better growth of watermelon. Fruit size is the main yield contributing character in watermelon. Apart from size, yield in terms of the weight of fruit and quality are important. Fruit yield and quality of watermelon could be boosted by providing higher dose of macro and micronutrients. Nitrogen helps to improve the utilization of P_2O_5, K_2O and other elements. It promotes the leaf, stem and vegetative growth. Phosphorous stimulates early root development and growth and helps to establish seedling quickly. It gives act the rapid and vigorous start to plants. It also improves the quickly of produce. Potassium helps in translocation of sugar, carbohydrates, increases disease resistance in plants and contract the injurious effect of excess nitrogen. These nutrient elements are necessary not only for crop yield but for the maintenance of soil nutrients and quickly produce. Therefore, in order to eliminate deficiency, improve yield and quality of fruits more emphasis is given to these elements. An optimum N, P and K and foliar spraying of micronutrient is essential for the good growth of watermelon and salicylic acid (SA) plays vital role as plant growth regulator providing promising role in plant development and adopts defense mechanism to abiotic stresses. SA applied exogenously with various methods and concentrations (0.1–10 mM) activates protective mechanisms enhancing resistance to water deficit. It was found that SA improves leaf water status under water deficit conditions (Raskin 1992; Seneratna *et al*. 2000) [10, 12]. Foliar feeding is an effective method supplying nutrients during the period of intensive plant growth when it can improve plants minerals status and increase crop yield. Boron is important in pollen germination and pollen

tube growth, which is likely to increase fruit set. Therefore, fertilization may increase yield, particularly when plants are grown on sandy soil with low content of available boron, as shown by (Wojeik *et al*, 2005) [16]. Watermelon flowers are viable for a short period so that it is most important that supply of boron is not limiting during pollination. Fruit yield and quality of watermelon could be boosted by providing proper dose of macro and micronutrients. Pear shaped fruit can also be caused by poor pollination that leads to restricted growth at the stem end because of the absence of developing seeds. Poor pollination can be minimized by foliar spray of micronutrients like boron.

Materials and Methods: A field trial was laid out at Department of Agronomy Farm, College of Agriculture, Dapoli, Dist- Ratnagiri, during Rabi season 2017-2018 in the month of second fortnight of December to end of March. The site was located on the 17.4 0N latitude and 73.10E longitude. It is in the tropical region having an elevation of 250 m above the mean sea level and the soil type was lateritic soil. The field experiment was laid out in a randomized block design comprising of eight treatments with three replications. Gross plot size was 6.0 m × 3 m. The seed variety used for sowing was NS-295 with the spacing of 1.8 m x 1 m. The treatments comprised of T_1 (Absolute control), T_2 (RDF), T_3 (RDF + Foliar Application of 0.1% Boron through Borax), T_4 (RDF + Foliar Application of 0.2% Boron through Borax), T_5 (RDF + Foliar Application of 0.1% salicylic acid) T_6 (RDF + Foliar Application of 0.2% Salicylic Acid), T_7 (RDF + Foliar Application of 0.25% Potassium Nitrate) and T_8 (RDF + Foliar Application of 0.5% Potassium Nitrate). RDF for watermelon is 100:50:50 NPK. Half dose of N and full dose of P and K was applied at the time of sowing and remaining 50% N given after 30 DAS. FYM @ 15 t ha^{-1} was applied 30 days before sowing to all the treatments and Salicylic acid, Boron and Potassium nitrate were sprayed at 30, 45 and 60 DAS. The research trial was carried out under 25-micron black silver polythene mulch. In order to study the effect of various treatments on yield and yield contributing characters, pertinent observations were recorded from time to time. Total soluble solids were recorded with the help of hand refractometer and values were worked out and expressed in ^{0}B (A.O.A.C.1975). Anthocyanin from watermelon fruit was estimated by using ethanolic HCl 95% ethanol: 1.5 N HCL (85:15) method mentioned by Ranganna (1986) [9]. The total sugar and reducing sugar were estimated on fresh weight basis using Lane and Eynon (1923).

Result and Discussion

Yield and yield attributes

It is evident from the data that the treatment T_8 receiving RDF + foliar application of 0.5 per cent potassium nitrate showed maximum weight of fruit (4.82 kg plot^{-1}) which was significantly higher as compared to the absolute control (2.69 kg plot^{-1}) and remained at par with the treatments T_2, T_3, T_4, T_5, T_6 and T_7. From the table 1, it is seen that the average weight of fruit increased with balanced and better utilization of potassium nitrate. Similar results were reported by Sawaratkar (2014) [11] for the var. Augusta (3.72 kg). Okur and Yagmur (2004) [4] showed parallel results in watermelon that highest fruit weight (4.63 kg) was obtained by application of 120:80:240 kg N: P_2O_5: K_2O ha^{-1} along with micronutrients. Kolekar *et al*. (2013) [5] reported that the treatment receiving application of 125 per cent RDF and 125 per cent manure recorded the highest weight of watermelon.

Table 1: Effect of foliar application of salicylic acid, boron and potassium nitrate on yield and yield attributing characters of watermelon.

Tr. No.	Treatments	Average weight of fruit plot^{-1}	Number of fruit vine^{-1}	Total Yield t ha^{-1}
T_1	Absolute control	2.69	1.62	15.44
T_2	RDF	3.92	1.77	25.57
T_3	RDF + Foliar Application of 0.1 % Boron through Borax	3.98	1.78	28.66
T_4	RDF + Foliar Application of 0.2 % Boron through Borax	3.70	1.85	33.42
T_5	RDF + Foliar Application of 0.1 % salicylic acid	4.46	1.87	35.68
T_6	RDF + Foliar Application of 0.2 % Salicylic Acid	4.10	1.93	37.72
T_7	RDF + Foliar Application of 0.25 % Potassium Nitrate	4.18	2.03	40.09
T_8	RDF + Foliar Application of 0.5 % Potassium Nitrate	4.82	2.11	41.42
	Mean	3.98	1.87	32.25
	S.E.±	0.49	0.06	2.45
	C.D. (P=0.05)	1.48	0.19	7.40

It was observed that the treatment T_8 receiving RDF + foliar application of 0.5 per cent potassium nitrate showed maximum number of fruits vine^{-1} (2.11) which was found at par with treatment T_6 and T_7. Similar results obtained by Deswal and Patil (1984) and they revealed that the application of 50 kg K_2O ha^{-1} showed maximum (2.10) fruits per vine in watermelon. Kolekar *et al*. (2013) [5] reported that application of 100 per cent RDF and 100 per cent manure showed maximum (2.22) fruits per vine in watermelon. The results implicit that the fruit yield was significantly affected due to foliar application of boron, salicylic acid and potassium nitrate. The significantly higher yield (41.42 t ha^{-1}) was recorded by the treatment T_8 receiving RDF + foliar application of 0.5 per cent potassium nitrate, which was at par with the treatment T_7 (RDF + foliar application of 0.25 % potassium nitrate), T_6 (RDF + foliar application of 0.2 % salicylic acid) and T_5 (RDF + foliar application of 0.1 % salicylic acid). The treatment T_2 receiving recommended dose of fertilizer showed 25.57 tones ha^{-1} yield which was significantly higher than the treatment T_1 *i.e.* absolute control (15.44 tones ha^{-1}) but, treatment T_3 receiving RDF + foliar application of 0.1 per cent boron through borax and T_4 receiving RDF + foliar application of 0.2 per cent boron through borax showed numerically higher yield i.e. (28.66) and (33.42) tones ha^{-1}, respectively over treatment T_1 and T_2. Similar results were reported by Vasanthkumar *et al*. (2012) [15] in watermelon genotype NS-246 (38.60 t ha^{-1}) and NS-295 (36.01 t ha^{-1}) which recorded maximum fruit yield. Okur and Yagmur (2004) reported that yield of watermelon was increased with the increasing dose of potassium.

Table 2: Effect of foliar application of boron, salicylic acid and potassium nitrate on total soluble solids, reducing sugar, total sugars and anthocyanin content of watermelon

Tr. No.	Treatments	TSS (^{0}brix)	Total Sugar (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Anthocyanin mg 100^{-1}g
T_1	Absolute control	8.77	7.03	3.18	3.85	2.64
T_2	RDF	9.57	7.20	3.23	3.96	2.99
T_3	RDF + Foliar Application of 0.1 % Boron through Borax	10.23	7.67	3.83	3.84	3.22
T_4	RDF + Foliar Application of 0.2 % Boron through Borax	10.30	8.09	3.87	4.22	3.43
T_5	RDF + Foliar Application of 0.1 % salicylic acid	10.10	7.13	3.70	3.43	3.16
T_6	RDF + Foliar Application of 0.2 % Salicylic Acid	10.17	7.30	3.78	3.52	3.24
T_7	RDF + Foliar Application of 0.25 % Potassium Nitrate	10.53	8.19	3.85	4.34	3.37
T_8	RDF + Foliar Application of 0.5 % Potassium Nitrate	11.00	8.79	4.20	4.59	3.63
	Mean	10.08	7.68	3.71	3.97	3.21
	S.E.±	0.24	0.23	0.20	0.33	0.14
	C.D. (P=0.05)	0.75	0.71	0.61	1.00	0.44

Quality parameters

The highest TSS of watermelon fruit *i.e.* 11.00 ^{0}Brix was observed in the treatment T_8 receiving application of RDF + foliar application of 0.5 per cent potassium nitrate which was found to be at par with the treatments T_7 (RDF + foliar application of 0.25 % potassium nitrate) and T_4 (RDF + foliar application of 0.2 % boron through borax). The data revealed that the application of elevated foliar application of boron, salicylic acid and potassium nitrate influenced the TSS of watermelon. Similar results were shown by Khade *et al*. (1995) in which the application of potash @100 kg ha^{-1} K_2O along with 120 kg ha^{-1} N recorded maximum TSS of fruit (9.92 ^{0}Brix). Higher amount of available soil nutrients increased absorption of plant nutrients; hence the value of total soluble solids in fruit juice was increased. Vasanthkumar *et al*. (2012) [15] studied on different type of genotype in watermelon and reported that the genotype NS -295 showed maximum (9.69 ^{0}Brix) TSS. The highest TSS of watermelon fruit (10.42 ^{0}Brix) was recorded by Kadu (2015) [2] in the treatment K3 in which 75 kg ha^{-1} K_2O was applied through soil.

The effect of foliar application of boron, salicylic acid and potassium nitrate on the total sugar content in watermelon fruit was observed to be significant. The treatment T_8 received RDF + foliar application of 0.5 per cent potassium nitrate recorded maximum (8.79 %) total sugar which was significantly higher than other treatments and remained at par with the treatments T_7 received RDF + foliar application of 0.25 per cent potassium nitrate and T_4 received RDF + foliar application of 0.2 per cent boron through borax (8.09 %). Vasanthkumar *et al*. (2012) [15] reported that genotype NS-295 showed 8.27 per cent total sugar in watermelon fruits. Kolekar *et al*. (2013) [5] reported 7.11 per cent total sugar present in watermelon fruits. Shivashankaramurthy *et al*. (2007) found that the increased potassium levels significantly increased the total sugar content in leaves and fruits in gherkin.

The treatment T_8 received RDF + foliar application of 0.5 per cent potassium nitrate exhibited significantly higher values (4.20 %) of reducing sugar over all the treatments which was found to be at par with treatment T_7 (3.85 %), T_6 (3.78 %), T5 (3.70 %), T_4 (3.87 %) and T_3 (3.83 %). From the data, it can be observed that regarding to the foliar application of boron, salicylic acid and potassium nitrate, the highest non reducing sugar content (4.59 %) in watermelon fruit was recorded significantly in the treatment T_8 received RDF + foliar application of 0.5 per cent potassium nitrate which was found at par with treatment T_7 (4.34 %), T_4 (4.22 %) and T_3 (3.84%).

The data presented in table 2 showed that the treatment T_8 receiving application of RDF + foliar application of 0.5 per cent potassium nitrate showed significantly highest total anthocyanin content (3.63 mg 100g^{-1}) over all the other treatments and was at par with the treatment T_3 RDF + foliar application of 0.1 per cent boron through borax (3.22mg 100^{-1}g), T_4 RDF + foliar application of 0.2 per cent boron through borax (3.43mg 100^{-1}g), T_6 RDF + foliar application of 0.2 per cent salicylic acid and T_7 RDF + foliar application of 0.25 per cent potassium nitrate (3.37mg 100^{-1}g). This might be due to the appropriate and balanced foliar application of potassium nitrate to the crop. Potash plays important role in activation of several enzymes which promotes the anthocyanin pigmentation (Tisdale *et al*., 1995) [14]. Similar results were also obtained by Kadu (2015) [2] in which the anthocyanin content varied from 2.46 to 3.90 mg 100 g^{-1} in various treatment combinations. Khyadagi *et al*. (2012) [4] in chilli cultivars found that anthocyanin content in chilli cultivars at dry stage ranged between 0.54 to 3.21 mg 100 g^{-1}.

Conclusion

Considering yield and quality of watermelon, RDF + foliar application of 0.5 per cent potassium nitrate is found to be suitable for watermelon in Alfisols of Konkan.

References

1. Deswal IS, Patil VK. Effects of N, P and K on the fruit of watermelon. J. of Maharashtra agric. Univ. 1984; 9(3):308-309.
2. Kadu JB. Effect of soil application of potassium and foliar spray of zinc and boron on yield and quality of watermelon [*Citrullus lanatus* (Thunb.)]. A M.Sc. (SSAC) thesis submitted to Dr. B. S. K. K.V, Dapoli, 2015.
3. Khade VN, Patil BP, Jadhav SN, Khanvilkar SA, Bhosale SS. Effect of irrigation, mulch, nitrogen and potassium on fruit yield and economics of watermelon. J. Maharashtra agric Univ. 1995; 20(1)40-43.
4. Khyadagi K, Jawadagi R, Walf SY. Evaluation of chilli cultivars (*Capsicum annuum* L.) for qualitative parameters at different maturity stages. The Asian Journal of Horticulture. 2012; 7(2):488-492.
5. Kolekar AB, Murumkar SB, Shinde PP. Effect of spacing, fertilizer and manure levels on watermelon (*Citrullus lanatus*) grown with drip and black polythene under lateritic soils of Konkan. J. Agric. Res. Technol., 2013; 38(2):182-187.

6. Lane, Eynon. Determination of reducing sugar by Fehling′s solution with methylene blue as internal indicator. J. Soc. Chem, India. 1923; 39(3):16-20.
7. Mangila E, Tabiliran FP, Naguit MRA, Malate R. Effects of organic fertilizer on the yield of watermelon. 2007, Pp.27-35.
8. Okur B, Yagmur B. Effect on enhanced potassium doses on yield, quality and nutrient uptake of watermelon. IPI regional workshop on potassium and fertigation development in West Asia and North Africa., Rabat, Morocco, 2004.
9. Ranganna S. Manual of analysis of fruit and vegetable products. Tata Mc. Graw- Hill publishing Company Ltd., New Delhi, 1986.
10. Raskin K. Role of salicylic acid in plants. Ann. Rew. Plant Physiol. Plant Mol, 1992.
11. Sawaratkar SM. Evaluation of F1 hybrids of watermelon (*Citrullus lanatus* Thunb.) under Konkan agro-climatic conditions. A M.Sc. (Horti) thesis submitted to Dr. B. S. K. K. V., Dapoli, 2014.
12. Seneratna T, Touchell D, Bunn E, Dixon K. Aceta salicylic acid (Asprin) and salicylic acid induce multiple stress tolerance in bean and tomato plants. Plant Growth Regul. 2000; 30:157-161.
13. Shivashankaramurthy TC, Nagegowda VB, Farooqui AA. Influence of nitrogen, phosphorus and potassium on the yield and quality of gherkin. Indian J. Hort. 2007; 64(2):228-230.
14. Tisdale SL, Nelson WL, Beaton JD, Havlin JL. Soil fertility and fertilizers published by Prentice, Hall of India Private Limited, New Delhi, 1995.
15. Vasanthkumar AM, Shirol Ravindra Mulge, Thammaih N, Prasad Kumar. Genotype x environmental interaction in watermelon (*Citrullus lanatus* Thunb) genotype for yield and quality traits. Karnataka J. Agric, Sci. 2012; 25(2):248-252.
16. Wojeik P. Response of Primocane-fruiting polana red raspberry to boron fertilization. J. Plant Nutri. 2005; 28:1821-1832.