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## Effect of soil and foliar supplementation of Nitrogen, Boron and Salicylic acid on growth and yield of cucumber (*Cucumis sativus* L.) in alfisols of Konkan

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### Abstract

The field experiment was conducted to evaluate the “Effect of soil and foliar supplementation of nitrogen, boron and salicylic acid on growth and yield of cucumber (*Cucumis sativus* L.) in alfisols of Konkan (M.S.)” at Research and Education Farm, Department of Agricultural Botany, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) during the Summer season of 2018. The experiment was laid out in Randomized Block Design (RBD) comprising ten treatment combinations replicated thrice, where the effect of soil and foliar supplementation of nitrogen, boron and salicylic acid either alone or in combinations applied along with the recommended dose of fertilizers (135:60:30 NPK kg ha<sup>-1</sup>) and an absolute control (to judge the fate of native nutrients) were studied. The study further revealed that the treatment receiving the application of recommended dose of fertilizer (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of nitrogen through urea (1%) + Soil application of boron through borax @ 2 kg ha<sup>-1</sup> + Foliar spray of salicylic acid (0.2%) was recorded the highest fruit yield (231.22 q ha<sup>-1</sup>) and yield attributing characters like number of fruits per vine (7.00) and weight of fruit i.e., 1.98 kg per vine as well as growth parameters viz. vine length (407.00 cm) and number of branches per vine (14.22) of Cucumber in alfisols of Konkan (M.S.).

**Keywords:** Cucumber, boron, yield, quality, Konkan

### 1. Introduction

Cucumber (*Cucumis sativus* L.), a native of Asia and Africa, is popular vegetable among cucurbitaceous family. It is grown for its edible tender fruits in almost all over world under tropical and subtropical conditions and in all parts of India for last three thousand years. It is said to be the native of northern India (Pursglove, 1969) [19]. Nutritionally 100g of edible portion of cucumber contains 96.3 g moisture, 2.5 g carbohydrates, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 10 mg calcium, 0.4 g fiber and traces of vitamin C and iron. The fruits of cucumbers possess various medicinal properties e.g. cooling effect, prevents constipation, checks jaundice and indigestion (Nandkarni, 1927) [15].

Cucumber is one of the quickest maturing vine crops, requiring warm weather throughout growth. The optimum temperature for its growth is in 18 °C and 28 °C. Loam, silt loam and clay loam soils are considered best for getting high yield. Soil pH between 5.5 and 6.7 is favourable for its cultivation.

Nitrogen is also major element of nucleic acid, co-enzyme and it is involved in many metabolic processes viz., cell division, photosynthesis, protein synthesis and expansion of shoot and root growth in plants and has active role during vegetative growth (Tripathy *et al.*, 1993) [23]. It encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant (Bloom, 2015 and Hemery, 2016) [5, 10].

In 1923, it was first time reported that B is essential for cell structure of plants (Warrington, 1923) [24]. The possible roles of B include sugar transport, cell wall synthesis, lignification, cell wall structure integrity, carbohydrate metabolism, ribose nucleic acid (RNA) metabolism, respiration, indole acetic acid (IAA) metabolism, phenol metabolism, and as part of the cell membranes (Parr & Loughman, 1983; Ahmad *et al.*, 2009) [18, 1].

Salicylic acid (SA; 2-hydroxybenzoic acid) is an endogenous growth regulator of phenolic nature, which is normally produced in plants in very small quantities (Raskin, 1992) [20] and participates in the regulation of physiological processes in plants (Shakirova *et al.*, 2003) [21].

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Exogenous application of SA may influence a range of diverse processes in plants, including stomatal closure, ion uptake and transport (Gunes *et al.*, 2005) [19], membrane permeability (Barkoskyand Einhellig, 1993) [21], as well as photosynthetic and growth rates (Khan *et al.*, 2003) [11].

The foliar spray of nutrients and plant growth regulators enhance the nutrient uptake (Kuttamani and Velayutham, 2011) [12]. Most plants absorb foliar applied urea rapidly and hydrolyze the urea in the cytosol (Witte *et al.* 2002) [25]. As cucumber is one of the important summer sown economic crop of Konkan and foliar fertilization may provide a new approach to improve cucumber quality and productivity and such no work on foliar application has been done on summer grown cucumber in lateritic soils of Konkan, the present study on "Effect of foliar supplementation of nitrogen, boron and salicylic acid on growth, yield of cucumber (*Cucumis sativus* L) in Alfisols of Konkan" is proposed to be undertaken. The details regarding the material used and the methods followed during the course.

## 2. Material and Methods

The experiment was conducted at Department of agricultural Botany, College of Agriculture; Dapoli is situated in the tropical region on 17° 45' N latitude and 73° 11' E longitude. The town is located at altitude of 800 ft. (240m) and 8 km from Arabian sea having hot and humid climate with well-expressed three seasons *viz.*, Summer (March to May), Rainy (June to October) and Winter (November to February). The region receives very high rainfall (above 3000 mm, annually) on lateritic soil, which is a member of fine, mixed, isohyperthermic family of Fluventic Ustropepts (Bhattacharjee *et al.*, 1978) [4]. The soil was moderately acidic in reaction and having normal electrical conductivity, moderately high in organic carbon, low in available nitrogen and very low and very high in available phosphorus and available potassium, respectively.

The experiment was laid out in Randomized Block Design with ten treatments and replicated thrice. The treatment comprised *viz.* T<sub>1</sub>-Absolute control, T<sub>2</sub>-135:60:30 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O only, T<sub>3</sub>-RDF+ Foliar spray of nitrogen through urea @ 1%, T<sub>4</sub>-RDF + Foliar spray of boron through boric acid @ 0.5%, T<sub>5</sub> -RDF+ Soil application of boron through borax @ 2 kg ha<sup>-1</sup>, T<sub>6</sub> -RDF + Foliar spray of salicylic acid @ 0.2%, T<sub>7</sub> -RDF + Foliar spray of boron @ 0.5% + Foliar spray of salicylic acid @ 0.2%, T<sub>8</sub> -RDF + Foliar spray of nitrogen @ 1% + Foliar spray of boron @ 0.5% + Foliar spray of salicylic acid @ 0.2%, T<sub>9</sub>-RDF + Foliar spray of nitrogen through urea @ 0.1% + Soil application of boron @ 2 kg ha<sup>-1</sup> + Foliar Spray of salicylic acid @ 0.2%, T<sub>10</sub> -RDF + Foliar boron through Amrashakti @ 2%. After the preparation of plots, FYM was added @ 15 t ha<sup>-1</sup> as common to all treatments except control. Nitrogen @ 135 kg ha<sup>-1</sup> was applied in two splits *viz.*, first dose of 50 per cent N before sowing and second dose of 50 per cent at 30 days after sowing in the pertinent treatments. Phosphorus @ 60 and potassium @ 30 kg ha<sup>-1</sup> were applied in a single dose before the time of sowing in the pertinent treatments. For foliar application, nitrogen through urea @ 1%, boron through boric acid @

0.5%, salicylic acid @ 0.2% and Amrashakti @ 0.2% solutions for foliar application were prepared by dissolving the respective weight of chemical in respective quantity of water by continuous stirring and were applied during early morning using a Knapsack Sprayer at 30 and 60 Days after sowing (DAS).

The Cucumber cv. Sheetal released by Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli in 1984; was sown at 15 March 2018 by dibbling method with spacing of 4.0 m x 3.0 m. Biometric observations to assess the effect of treatment on the growth and development of crop were recorded at an interval of 30 DAS, 60 DAS and at harvest stage The height of the plant was measured in cm with the help of measuring tape. Number of branches per plant was recorded by counting the main and the lateral branches collectively of the five observational plants and the average number of branches per vine were worked out. Treatment wise five observation plants were harvested separately and the number of fruits per vine was counted and the mean of these five plants was recorded. The weight of individual fruit of each observational plant measured on mono pan electronic balance. The fruits collected from each net plot were weighed and fruit yield per plot was recorded which was subsequently expressed on hectare basis.

## 3. Results and Discussion

### 3.1 Yield and yield attributing characters of cucumber

Application of recommended dose of fertilizer (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of Nitrogen through Urea 1% + Soil application of Boron through Borax @ 2 kg ha<sup>-1</sup>+ Foliar spray of Salicylic acid 0.2% (*i.e.* treatment T<sub>9</sub>) recorded the maximum fruit yield (231.22 q ha<sup>-1</sup>). Increase in yield of plant might be due to foliar application of boron which is involved in development of cell wall, cell differentiation and root and shoot elongation. It is also involved in ovary developments, seed development and maturity of crop plant. This may be attributed to greater photosynthetic activity, resulting the increased production and accumulation of carbohydrates and favourable effect on retention of flowers and fruits, which might have increased number and weight of fruits (Patidar *et al.* 2017 and Brown 1979) [17, 6]. In case of yield attributing characters, number of fruits T<sub>9</sub> where there was application of recommended dose of fertilizer (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of Nitrogen through Urea (1%) + Soil application of Boron through Borax @ 2 kg ha<sup>-1</sup>+ Foliar spray of Salicylic acid (0.2%) recorded the highest number of fruits per vine (7.00) and also T<sub>9</sub> recorded highest weight of fruit (1.98 kg) per vine. The number of fruits per vine is closely associated with growth parameters like length of vine etc. which can be contributed to nutrient availability and its uptake; this might have favourable effect in increasing, chlorophyll content in leaves resulting in better synthesis of carbohydrates and build up for more new cells which might have increased the number of fruits per plant (Maynard, 1962) [13]. Similarly, the application of boron takes part in active photosynthesis, which ultimately helps towards increase in number of cucumber fruits. The similar results were also found by Ghayal (2016) [8].

**Table 1:** Effect of soil and foliar application of nutrients on yield and yield attributing characters

Tr. code	Treatments	Fruit yield (q ha <sup>-1</sup> )	No. of fruits vine <sup>-1</sup>	Wt. of fruit (kg) vine <sup>-1</sup>
T <sub>1</sub>	Control (No Fertilizer)	58.53	1.29	0.49
T <sub>2</sub>	Recommended Dose of Fertilizer 135:60:30 NPK kg ha <sup>-1</sup>	85.21	3.74	0.70
T <sub>3</sub>	RDF+ Foliar spray of urea (1%)	153.41	4.38	1.28

T <sub>4</sub>	RDF+ Foliar spray of boric acid (0.5%)	170.73	4.64	1.44
T <sub>5</sub>	RDF+ Soil application of borax @ 2 kg ha <sup>-1</sup>	144.95	4.36	1.27
T <sub>6</sub>	RDF+ Foliar spray of salicylic acid (0.2%)	175.31	5.14	1.51
T <sub>7</sub>	RDF+ Foliar spray of boric acid (0.5%) + Foliar spray of salicylic acid (0.2%)	206.16	5.38	1.82
T <sub>8</sub>	RDF+ Foliar spray of urea (1%) + Foliar spray of boric acid (0.5%) + Foliar spray of Salicylic acid (0.2%)	216.87	5.95	1.88
T <sub>9</sub>	RDF+ Foliar spray of urea (1%) + Soil application of borax @ 2 kg ha <sup>-1</sup> + Foliar spray of salicylic acid (0.2%)	231.22	7.00	1.98
T <sub>10</sub>	RDF + Amrashakti @ 2%	129.96	4.29	1.00
	S.E. +	17.20	0.91	0.30
	C.D. (P=0.05)	51.10	2.70	0.90

### 3.2 Growth parameters

Growth parameters such as vine length and number of branches of plant significantly affected due to the soil and foliar supplementation of nitrogen, boron and salicylic acid. Treatment T<sub>9</sub> which receiving recommended dose of fertilizer (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of nitrogen through urea 1% + Soil application of boron through borax @ 2 kg ha<sup>-1</sup>+ Foliar spray of salicylic acid 0.2% showed superiority over control in both parameters i.e highest vine length (407.00 cm) and number of branches (14.22) per vine at harvest stage. Gharib (2006) [7] observed that the application of salicylic acid (SA) at low concentration increased photosynthetic activity in basil and marjoram which enhanced their plant height, number of inter-nodes, number of branches and leaves as well as leaf area, fresh and dry weights. Basavarajeswari *et al.* (2008) [3] reported that out of nine different foliar treatments the application of boric acid at 100 ppm resulted in maximum plant height, maximum number of primary branches (18.30), plant length and fruit yield (30.50 tonnes ha<sup>-1</sup>) of tomato than control. The results are in agreement with Meena *et al.* (2017) [14], Naik (2016) [16], Torane (2014) [22] and Ghayal (2016) [8].

### 4. Conclusion

Considering the growth parameters *viz.*, vine length and number of branches; yield parameters *viz.*, number fruits vine<sup>-1</sup> and weight fruit vine, fruit yield of cucumber of variety Sheetal, the application of RDF (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of nitrogen through urea (1%) + Soil application of boron through borax @ 2 kg ha<sup>-1</sup>+ Foliar spray of salicylic acid (0.2%) had recorded the highest favourable parameters and found to be superior and beneficial in lateritic soils of Konkan from the view point of getting higher fruit yields and maintaining the soil fertility.

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