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Effect of boron and plant spacing on quality of tomato (*Solanum lycopersicon* L.) Cv. Pusa ruby

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Abstract
Different factors affect the successful production of tomato crop but boron and plant spacing is the most important factors for vegetative growth, plant population and flowering, fruiting per unit area is also important and responsible for increasing the quality of tomato entitled "Effect of boron and plant spacing on quality of tomato (*Solanum lycopersicon* L.) Cv. Pusa ruby" have been conducted at the research farm of AKS University, Sherganj Satna. During Kharif season of 2015-16. Under irrigation to assess the response of tomato to boron (B) fertilizer rates and spacing's. The treatments consisted of four levels of boron (0 kg, 1 kg, 2 kg and 3 kg/ha) and three levels of spacing's (row to row 90 cm. and plant to plant 50, 60, 170 cm.). Experiment was laid out in Randomized block design with three replications. The results of the experiment showed application of boron use of spacing's had significantly. Influence on the most parameters such as TSS quality of tomato @ 2 kg/ha of boron. Experiment comprises of three spacing's *viz.*, 90 x 50 cm, 90 x 60 cm and 90 x 70 cm had significantly. Increase on the most parameters such as TSS quality tomato on wider spacing's 90 x 60 cm.

Keywords: Tomato (*Solanum lycopersicon* L.), boron, spacing, quality & Pusa ruby

Introduction
Tomato (*Solanum lycopersicon* L.) is one of the most widely grown vegetable in the world and ranked first in preserved and processed vegetables. It is said to be native of Western South America and belongs to family Solanaceae. The genus Solanum consists of annual or short lived perennial herbaceous plants. Tomato is a typical day neutral plant and is mainly self-pollinated but a certain percentage of cross-pollination also occurs. Tomato is very popular because of its high nutritive value and diversified use. Its food value is very high as it contains vitamins A, B, C and calcium. Nutritional value of red tomatoes (raw) per 100 g contains 18kcal energy, 4.0 g carbohydrates, and 2.6 g sugars, 1.0 g dietary fiber, 0.2 g fat, 1.0 g protein, 95 g water, 13 mg vitamin C (Zhang *et al.*, 2009) [4]. Boron deficiency affects the growing points of roots and youngest leaves. The leaves become wrinkled and curled with light green colour. Its deficiency affects translocation of sugar, starch, nitrogen and phosphorus, synthesis of amino acids and proteins (Stanley *et al.*, 1995) [3], Deficiency of Boron causes restriction of water absorption and carbohydrate metabolism which ultimate affects the fruit and seed formation and thus reduces yield. In fertilizer schedule, an inclusion of Boron often decides the success and failure of the crops. A visible symptom of deficiency (0.3µm) is initiated on young leaves as internal chlorosis later leading to necrosis. A positive correlation was observed between B and flower bud, number of flower and weight of fruit in tomato. Boron is also an important micronutrient that is easily leached from the soil and its deficiency can occur in tomatoes grown under heavy rainfall conditions. Boron deficiency appears as thickened, wilted, or curled leaves and the cracking and rotting of fruit, or roots. Adequate B levels help to maintain leaf K levels in tomato during fruit development. There is less incidence of diseases and pests and sometimes has the advantage of staking. Mechanically harvested and processing tomatoes should be planted at close spacing.

Materials and Methods

The present research works "Effect of boron and plant spacing on quality of tomato (*Solanum lycopersicon* L.) Cv. Pusa ruby*"* have been undertaken in the Department of Horticulture, AKS University, Satna (M.P.) during 2015-2016. Experiment has been conducted at the farm of AKS University, Satna M.P. (80°21' to 81°23' east longitude and 23°58' to 25°12' north latitude). The experimental plot was located about 2000 meters East of AKS University, Campus. The experiment was arranged in a factorial randomized block design with 12 treatment splitted in two factorial *i.e.,* four levels of boron and three plant spacing with 3 replications. The randomized of the treatment was done with the help of random number table as shown in the plant of layout *viz.*, Crop - Tomato**,** Design - Factorial Randomized block design, Replication - 3, Treatment - 12**,** Total No. of plots - 36, Plot size (meter) - 2.75×2.75, Distance between replications - 0.75 m., Distance between plots - 0.5 m, Distance between row to row - 90 cm., Distance between plant to plant - 50, 60 and 70cm. Net experimental area - (8.25×33) =272.25 $m.^2$.

Table 1: Details of Treatments

Factor - A		Factor - B	
(Four levels of phosphorus)	**Treatment symbol**	**(Three plant spacing)**	**Notations**
0 kg./ha.	B_0	90 x 50 cm.	S_1
1 kg./ha.	B_1	90 x 60 cm.	S_2
2 kg./ha.	B_2	90 x 70 cm.	S_3
3 kg./ha.	B_3		

Results

The present research work entitled "Effect of boron and plant spacing on quality of tomato (*Solanum lycopersicon l.*) Cv. Pusa ruby*"* have been undertaken in the Department of Horticulture, AKS University, Satna (M.P.) during 2015-2016. Data on different parameters were analyzed statistically and results have been presented in table's no.2.0 and figures no. 1.0 the result of the present study has been presented in parameters under the following heads.

Total soluble solid (TSS) percent

Data collected in connection total soluble solid percent as affected by different levels of boron and plant spacing have been displayed in table No. 2.0, graphically represented in Fig. No. 1.0**.** And 2.0. Critical analysis of data portrayed in above table obviously indicated that application of boron @ 2kg/ha caused beneficial response on TSS% and treatments were differed significantly. Maximum TSS% *i.e.* 5.79 was recorded when boron was applied @ 2kg/ha. An examination of data presented in above table indicated that use of different plant spacing's proved to be beneficial and TSS% affected significantly due to use of S_2 plant spacing.

Table 2: The showing TSS% of tomato as influenced by levels of boron plant spacing

TSS%	
Levels of Boron	**TSS%**
B_0 (0 kg/ha)	5.40
B_1 (1 kg/ha)	5.41
B_2 (2 kg/ha)	5.79
B_3 (3 kg/ha)	5.49
S.Em±	0.07
CD (P=0.05)	0.22
Plant spacing	
S_1 (90x50 cm)	5.44
S_2 (90x60 cm)	5.70
S_3 (90x70 cm)	5.43
S.Em±	0.06
CD (P=0.05)	0.19

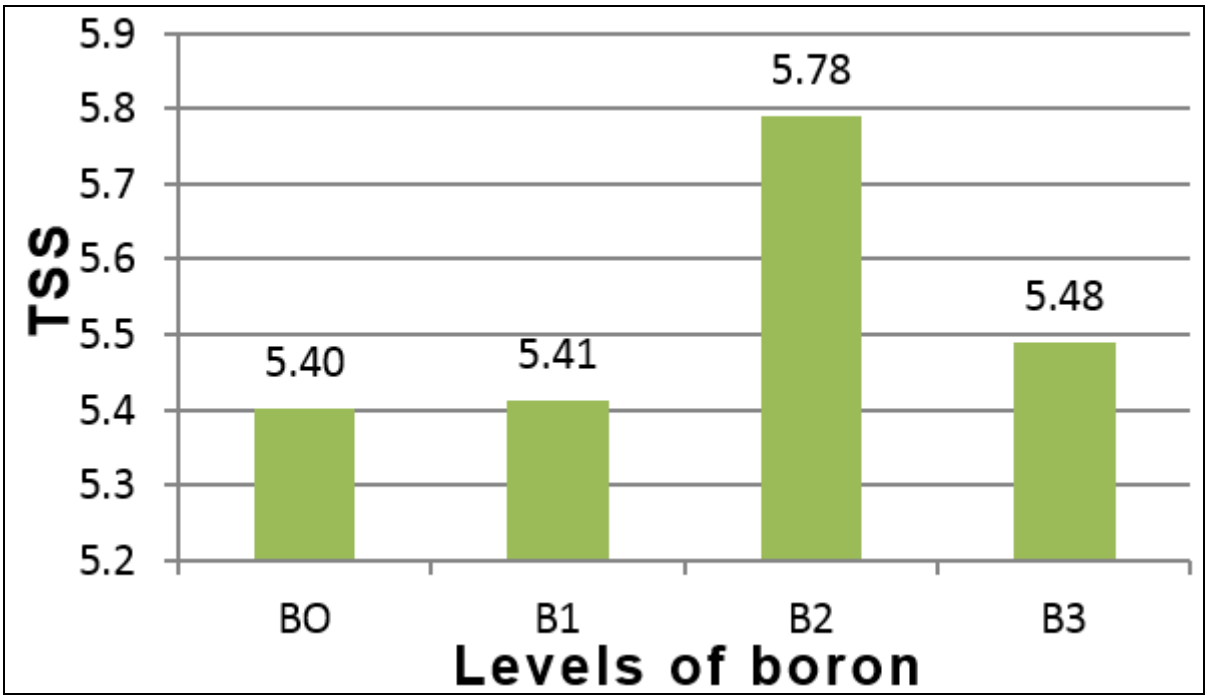

Fig 2: TSS% of tomato as influenced by different levels of boron

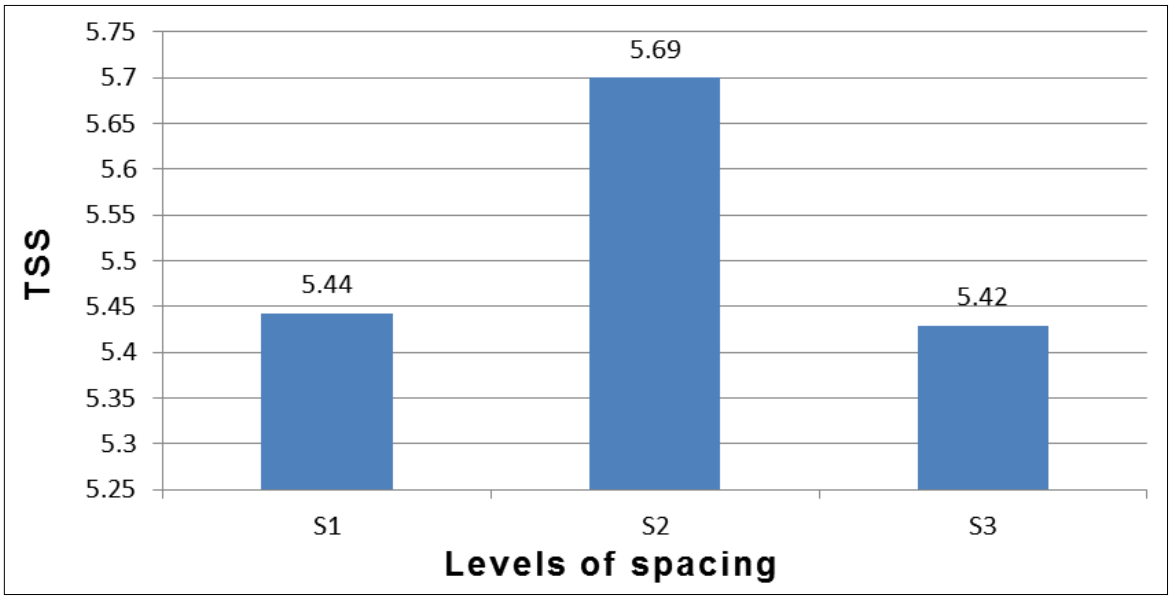

Fig 3: TSS% of tomato as influenced by different plant spacing

Discussion

The result of the present experiment entitled "Effect of boron and plant spacing on quality of tomato (*Solanum lycopersicon* L.) Cv. Pusa ruby" as presented in the preceding is quality component of tomato under study.

Effect of Boron

The increasing level of boron only up to 2kg/ha increase the TSS in tomato fruit significantly Thereafter at 3 kg/ha, the declining founds was noticed, At 2kg/ha The maximum TSS 5.79% was found. The higher TSS in tomato fruits may be due to the fact that increased boron synthesized more carbohydrate content to higher TSS value and therefore fruits were richer in minerals contents Oyinlola and Chude (2004) [1].

Effect spacing

The total soluble solids (TSS) content increase up to maximum (5.70% TSS due to widest plant spacing (90×60cm) this may be due to the fact that widely space plants obtained, more nutrients soil moisture and sunlight thereby synthesized more carbohydrate through leaves. The higher carbohydrate content is directly related higher TSS value and there for fruit were richer in minerals content. This observation is inconfannity of Singh and Parmar (2004) [2].

Summary and Conclusions

The experiment was carried out at the Horticulture field, AKS University, Satna during 2015-16 to study the effect of boron *viz.* - 0kg (control), 1kg, 2kg and 3kg and three plant spacing *viz.*, 90×50 cm, 90×60 cm and 90×70 cm on tomato. The experiment was laid out in a Randomized Block Design (with factorial concept) with three replications. The plot size was 7.56m2 (2.75m × 2.75m). Altogether 12 treatment combinations were there in the experiment. Quality parameters - The increasing levels of boron only up to 2 kg/ha increase the total soluble solid (TSS) significantly, The widest spacing (90×60cm) gave the significantly higher TSS 5.70 over the closer spacing (90×70 cm. and 90×50 cm.), Under closest (90×50 cm.)

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