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Short communication

Response of lemon cv. Baramasi to foliar feeding of nutrients

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ABSTRACT

An experiment was conducted at during 2009 consisting of ten treatments to evaluate the effect of foliar feeding of nutrients on lemon cv. Baramasi. The experiment consisted of different levels of K_2SO_4, (4, 6 and 8%), borax (0.5, 0.75 and 1.0%) and $CaCl_2$ (0.5, 0.75 and 1.0%) sprayed on first and last week on May. Foliar applications decreased the fruit cracking and improved the fruit characters as compared to control. Foliar spray of K_2SO_4 @ 8% proved to be most effective in managing this malady and also improving the fruit quality.

Key words: Lemon, nutrient sprays, fruit cracking, quality.

Among the acid citrus fruits, lemon is a leading premier citrus crop. Lemon has potential to bear in many flushes making it long lasting crop having round-year availability of the fruits and longer shelf-life. However, malady like fruit cracking and poor fruit quality has decreased its area and production over last few years due to poor nutrition. It has been explained that citrus fruit splitting as one of the most exasperating problems experienced by the citrus fruit growers. Although, lemon is grown commonly in India but its quality and yield is far behind from the well managed farms and other citrus growing countries of the world. There is a need to develop well established production technology to increase the production of this crop substantially by using non-conventional approaches alone or in combination with conventional approaches. The use of foliar feeding of nutrient is a new and innovative approach to check fruit cracking and enhance quality.

The research was carried out with the objective of evaluating the effect of foliar feeding of nutrients on reducing fruit cracking and improving quality in lemon. The orchard experiment was conducted at the Punjab Government Progeny Orchard and Nursery, Attari, Amritsar during 2009 under randomised block design consisting of ten treatments replicated thrice. In the trial, eight-year-old lemon trees, uniform in size and vigour, free from attack of diseases and pests were selected. Different concentrations of the nutrients, *viz*. K_2SO_4, borax and $CaCl_2$ were applied exogenously to mature fruit trees of lemon. The physico-chemical analysis of fruits was carried out at Department of Horticulture, Khalsa College, Amritsar. The different treatment applied were T_1= Untreated (control), T_2= K_2SO_4 (4%), T_3= K_2SO_4 (6%), T_4 = K_2SO_4 (8%), T_5 = borax (0.5%), T_6 = borax (0.75%), T_7 = borax (1.0%), T_8 = $CaCl_2$ (0.5%), T_9 = $CaCl_2$ (0.75%), and T_{10} = $CaCl_2$ (1.0%). The plants were sprayed during forenoon. Each year two sprays were given during May at an interval of 15 days. First spray was given on 10th May and second on 25th May. The plants received the recommended fertilizer dose and irrigation at interval of 10-15 days as recommended by Punjab Agril. University, Ludhiana. The total number of fruits present on the tree was counted on 11th June when first observation on fruit cracking was recorded. Cracked fruits were counted regularly at weekly interval. These were picked out and the dropped fruits were removed. The percentage of cracked fruits was calculated on the basis of total number of fruits initially present on the tree. The observations on fruit length and breadth were measured with Vernier calipers. The chemical characters like TSS, acidity and ascorbic acid were estimated as per standard procedures outlined by AOAC (1). Potassium content of peel was estimated by flame photometer, while calcium was determined by atomic absorption spectrophotometer.

Data in Table 1 show that T_4 (K_2SO_4 @ 8%) proved to be the most effective treatment for minimizing the fruit cracking in lemon (14.17%), however, control treatment registered the maximum fruit cracking (33.26%). Boron application was also found effective. The decline in cracking of fruits due to boron treatments may be attributed to its physiological role in synthesis of pectin substances in cells. Boron is responsible for increasing the elasticity of cell membranes and prevents the breakdown of vegetative tissues. Boron also improved the translocation of sugar and synthesis of cell wall material. Thus, this decrease in fruit cracking might be the result of borate bridging with cell wall constituents, thus giving elastic response to it as advocated by Singh *et al*. (4) in litchi. Zhang and Zhu (6) also reported that borax spray reduces the

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Table 1. Effect of nutrient sprays on fruit cracking and quality of lemon cv. Baramasi.

Treatment	Fruit characters									
	Fruit cracking (%)	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Juice (%)	TSS (%)	Acidity (%)	Ascorbic acid (mg/100 ml of juice)	K content in peel (%)	Ca content in peel (%)
T_1	33.26 (35.17)*	4.26	4.00	50.00	40.01	6.88	5.00	40.05	0.62	1.11
T_2	17.50 (24.69)	4.61	4.36	56.73	41.15	7.29	5.55	47.78	0.73	1.04
T_3	15.87 (23.41)	5.21	5.08	61.80	49.03	7.36	5.98	48.83	0.76	1.03
T_4	14.17 (21.97)	5.36	5.18	67.23	45.76	7.70	5.68	43.49	0.78	1.02
T_5	20.77 (27.06)	4.66	4.08	59.03	47.16	7.26	5.18	42.53	0.66	1.12
T_6	18.10 (25.16)	5.06	4.61	65.10	46.63	7.50	5.78	44.62	0.68	1.14
T_7	17.62 (24.78)	5.11	5.01	64.15	44.98	7.66	6.08	41.06	0.68	1.14
T_8	21.97 (27.94)	4.85	4.55	53.36	41.76	6.96	5.33	42.08	0.69	1.16
T_9	20.01 (26.45)	4.86	4.75	54.97	42.30	6.97	5.47	43.99	0.71	1.16
T_{10}	18.90 (25.74)	4.96	4.93	56.53	44.68	7.10	5.89	46.68	0.71	1.18
CD at 5%	4.06	0.14	0.20	3.09	3.09	0.15	0.14	1.93	0.04	0.05

*Transformed values

fruit cracking to great extent. They further advocated that uncoordinated growth between the outer dermal tissue and the inner parenchyma caused cracking. The inner parenchyma grows faster during the rapid growth period, whereas the epidermis grows slowly or stops developing. It was stated that interspaces in the cutin serve as a break through point for cracking. A combination of internal turgor forces caused by the rapid inner growth acting on the fruit surface and the loss of skin elasticity caused fruit cracking. However, spray of borax maintained this coordination and water balance in the fruit resulting in decreased cracking.

Reduction in fruit cracking on account of calcium application may be due to strengthening of the rind. It is also suggested that surface applied calcium and chloride ions penetrate through open lenticels and move by diffusion in the intercellular space. Chloride is thought to be absorbed by the cortex and epidermal cells, whereas the main amount of calcium is localized in the cell wall, possibly bridging in the plasmalema thus strengthening the cell walls (Wieneke, 5). The higher capacity in binding exogenous calcium in the cell wall of pericarp suggests higher concentration of negatively charged structural component, *i.e.* glacturonic acid residues which can be one of the material bases for cracking resistance (Zhong *et al*., 7). It was further suggested that availability of such nutrients in the early stage of fruit ontogeny is important for cracking resistance.

The treatment T_4 also proved to be best treatment for maximizing the fruit size (5.36 cm and 5.18 cm) and weight (67.23 g). Fruits from the untreated plants registered minimum fruit size (4.26 cm and 4.00 cm) and weight (50.00 g). The fruit elongation and increase in breadth might be due to the cell division in the beginning and enlargement in the later stages as stated by Singh *et al*. (4) in apple. Increase in fruit weight with potassium application could be due to the fact that potassium increases the photophosphorylation and dark reaction of photosynthesis which led to accumulation of more carbohydrates and also enhancing the translocation of photosynthates, which mobilize the stored material from leaves and stem towards the fruit.

All the chemical treatments produced significant effect on the juice content of lemon fruits in comparison to control. The data clearly depicts that the fruits harvested from the trees sprayed with 6% K_2SO_4 retained maximum juice content (49.03%). Similar findings have also been reported in Baramasi lemon by Josan *et al*. (2). The higher moisture content in the fruits resulted in higher juice content. The maximum TSS (7.66%) was recorded under treatment T_7 and minimum (6.88%) when trees were devoid of these foliar sprays. The total soluble solids increased with every increase in foliar spray of nutrients. Similar increase by application of nutrient sprays has been advocated by Josan *et al*. (2) in Baramasi lemon.

A significant increase in acidity was recorded with the increasing level of foliar spray. This finding was in accordance with earlier findings of Josan *et al*. (2). Increase in ascorbic acid content may be due to the fact that growth regulators increased the osmotic pressure by cell expansion which led to the accumulation of organic acid. Application of K_2SO_4 might have led to increase in the potassium content of peel. Boron sprays also increased the calcium content of fruit. Reduction in the level of calcium was observed under K_2SO_4 treatments, while $CaCl_2$ spray increased the calcium content in of the peel. Similar results were observed by Lavania *et al*. (3).

The study revealed that foliar spray of 8% K_2SO_4 proved to be most effective in managing the fruit cracking and enhancing the fruit quality in lemon.

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