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Sheikh M.K., Manjula N.

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Effect of chemicals on control of fruit cracking in pomegranate (*Punica granatum* L.) var. Ganesh

M. K. Sheikh and N. Manjula

College of Agriculture, Bijapur, Karnataka State (India)

Abstract. During drought period, strengthened tissue develops in xylem and phloem and loss their ability to divide and enlarge. If after a dry spell (April-May) water supply is increased the meristematic tissue quickly resumes growth but the strengthened tissue does not, and owing to differential growth rate, tissues ruptures appear. Hypertrophy of lenticels may be caused or promoted greatly by retarded transpiration accompanied by plentiful water supply to the regions of hypertrophy. Heavy summer rains (April-May) causes fruit cracking if the plants were previously under severe water stress, because the skin get hardened and the arils are filled-up with water. If 25% available soil moisture is maintained during summer, then fruit cracking will be less. Calcium is a cell binding material, and spraying of calcium chloride (1 kg/100 l water) or calcium ammonium nitrate (2 kg/100 l of water) reduces fruit cracking. Dry heat accomplished by dry hot wind at the time of fruit ripening in pomegranate was the main cause of cracking: during the rapid flesh growth, temperatures higher than 38ºC combined with less than 60% humidity favoured cracking. Sharp fluctuation in day and night temperatures coupled with heavy irrigation after dry spell also cause cracking. Nutrients like boron, zinc, calcium, copper, molybdenum manganese and potash are involve in physiological processes during fruit growth period, and theirs deficiencies cause cracking. Boron and copper help to increase the growth rate by stimulating enzymatic action in the peripheral tissue which otherwise could not be due to their inherent deficiency in the area. Boron application may probably help in translocation of sugars and synthesis of cell wall.

I – Introduction

Pomegranate (*Punica granatum* L.) belonging to the family Punicaceae is one of the most favourable fruits of tropical and sub tropical regions. The fruit is a native of Iran and is extensively cultivated in Mediterranean regions since ages, especially in Spain, Morocco, Egypt and Afghanistan. It is also grown to some extent in Burma, China, Japan, United States of America, Russia, Bulgaria and Southern Italy.

In India it is cultivated in States like Maharashtra, Gujarat, Rajasthan, Tamil Nadu, Uttar Pradesh, Haryana, Andhra Pradesh and Karnataka. Maharashtra, accounts for maximum area (about 4500 ha), particularly in Ahmednagar, Solapur, Satara, Sangali, Pune Wardha districts. In Karnataka, pomegranate is cultivated on an area of 3000 ha with an annual production of 13536 tonnes (Anon 1990). In Karnataka it is grown mainly in Bijapur, Bagalkot, Tumkur, Kolar, Belgaum, Dharwad and Bangalore.

The versatile adaptability, hardy nature, drought resistance, low cost of maintenance, steady yield and good keeping quality, and the therapeutic value of pomegranate are the main features of its spread at a wide scale. The cultivars grown in India are Alandi, Dholka, Kabul, Kandhari and Ganesh. Ganesh is a prolific bearer with medium size fruits with soft seeds, pinkish red arils, sweet juice and agreeable taste.

Pomegranate losses due to fruit cracking are quit high. The fruit have this problem due to improper water management and deficiency of micronutrients.

II – Materials and methods

The following treatments were imposed: Control, Boric acid 0.2%, Boric acid 0.4%, Ferrous sulphate 0.5%, Ferrous sulphate 1%, Calcium chloride 0.5%, and Calcium chloride 1% as foliar spray. Observations recorded were: percentage of cracked fruits, mean healthy fruit weight, yield of healthy fruits per plant and mineral content of cracked fruits.

III – Results and discussion

The data on percentage of cracked fruit, mean weight of fruit and yield of healthy fruits per plant, mineral content of cracked fruits are presented here (Tables 1 and 2).

Table 1. Effect of chemicals on control of fruit cracking in Ganesh pomegranate

Treatments	Percentage of cracked fruits			Mean fruit weight of healthy fruits (g)			Yield of healthy fruits/plant (kg)		
Control	25.45	31.43	28.44	223.83	225.00	224.17	20.69	19.31	20.00
Boric acid 0.2%	3.14	3.51	3.33	213.33	221.67	217.50	34.33	33.68	34.05
Boric acid 0.4%	6.89	7.23	7.06	231.67	228.33	230.00	26.85	26.24	26.54
Ferrous sulphate 0.5%	8.32	8.49	8.40	190.00	200.00	195.00	23.45	25.46	24.46
Ferrous sulphate 1.0%	6.57	7.67	7.12	201.67	208.33	205.00	28.66	29.34	29.00
Calcium chloride 0.5%	5.46	5.55	5.51	198.33	203.33	200.83	30.14	31.14	30.64
Calcium chloride 1.0%	5.33	5.65	5.19	200.00	208.33	204.17	31.23	32.93	32.08
SEm±	0.44	1.48	0.91	5.51	4.91	3.54	1.73	0.83	0.84
CD at 5%	1.33	4.54	2.69	16.92	15.08	10.48	5.31	2.55	2.48

Table 2: Effect of chemicals on mineral content of cracked fruits in Ganesh pomegranate

Treatments	P (% DW)	K (% DW)	Ca (% DW)	Mg (% DW)	S (% DW)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	Mo (ppm)	B (ppm)
Control	0.040	1.57	1.22	0.13	0.08	135.37	3.16	13.50	6.67	5.70	0.82
Boric acid 0.2%	0.130	1.54	1.11	0.19	0.04	57.67	4.33	8.67	6.00	8.17	6.00
Boric acid 0.4%	0.040	1.42	0.61	0.13	0.09	47.67	3.33	17.00	6.00	1.55	10.00
Ferrous sulphate 0.5%	0.061	2.02	2.55	0.14	0.11	67.67	5.00	16.67	7.17	5.17	11.08
Ferrous sulphate 1.0%	0.080	1.86	1.81	0.14	0.14	78.50	4.50	15.50	2.67	26.00	8.67
Calcium chloride 0.5%	0.060	2.31	3.35	0.14	0.04	83.70	8.50	16.00	2.17	0.95	11.67
Calcium chloride 1.0%	0.120	1.94	1.62	0.16	0.03	59.67	8.50	11.17	4.75	5.50	12.83

Two year pooled data of percentage of cracked fruits show that all the tried chemicals reduced the percentage of cracked fruits. Pre-harvest spray of 0.2% boric acid resulted in the lowest percentage of cracked fruits (3.33%) against 28.44% in control. This is followed by 5.51% in calcium chloride spray. Among the concentration of boric acid, the lower concentration 0.2% was better than the higher. The spray of ferrous sulphate resulted in fruit cracking in a range of 7.12 to 8.4%. Skok (1958) observed that boron in general improved translocation of sugars and synthesis of cell wall material. Bramlage and Thompson (1963) have also reported that boron

increased methyl esterase activity in apple. Misra and Khan (1981) reported that the role of boron application may probably due to translocation of sugars and synthesis of cell wall material and increase in methyl esterase activity which was enhanced due to application of 2,4,5 T in litchi cv. Rose scented. The maximum reduction was noted with 0.4% boric acid. The direct application could meet the requirement of Boron.

Effect of chemicals on fruit cracking, healthy fruit weight, yield per plant and mineral content in Ganesh pomegranate shows that pre-harvest spray of boric acid, did not affect the mean fruit weight of healthy fruits. However, the other treatments significantly reduced the mean fruit weight. The two year pooled data show that there was a significant increase in the yield. The highest yield (34.05 kg/plant) was recorded in the trees sprayed with 0.2% boric acid, followed by 32.08 kg/ha with 1% calcium chloride spray as against 20 kg per plant in the control treatment. The data shows that boron content of cracked fruits shown an increase due to chemical spray. The highest content was noted in 1% calcium chloride spray followed by 0.5% calcium chloride and 0.5% ferrous sulphate respectively. Even in boric acid treatment, boron content was higher than in the untreated trees. So was the case with the content of phosphorus and manganese. Sharma (1983), Sharma and Ray (1987) and Sharma and Dhillon (1987) reported that cracked litchi fruits contain higher nitrogen, potash and phosphorous, but lower calcium, zinc than the normal fruits. There was no difference in pH and TSS in cracked fruits and normal fruits.

With regards to phosphorus, potash, calcium, sulphur, zinc, the contents were higher in all cracked fruits of treated trees, except with the boric acid treatment. Sulphur content also increased in all treatments except in 1% calcium chloride. The iron content decreased in all treatments. Copper and molybdenum content also decreased with the exception of treatments with 0.5% ferrous sulphate and 0.2% boric acid.

Randhawa *et al.* (1958), reported that cracking occurs after heavy rainfalls, followed by a period of drought. Nutrients like potassium, calcium, zinc, copper, molybdenum and manganese are involved in some physiological processes during the fruit growth period, and their deficiency results in fruit cracking. Misra and Khan (1981) found that spraying of 0.4% boric acid at pit hardening gave the maximum reduction of cracked litchi fruits. Bohlmann (1962) also opined that application of boron in boron deficient area also check the cracking of apple fruit, the physiological role of boron is due to synthesis of pectic substance in plants. Agrios (1967) suggested that drought, nutrient deficiency and virus are possible cause for net like and ring like cracking in pear fruits. The spray of Bordeux mixture, calcium chloride and NAA would control fruit cracking in pear.

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