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## Effect of Lime and Irrigation on the Yield Performance of Pomelo (*Citrus grandis*) in the Hilly Region

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**Abstract:** Field experiments were conducted to evaluate the response of pomelo to different levels of lime (0, 2, 4 and 6 kg/plant) along with irrigation water (500 liters/plant). Application of lime and irrigation had significant effect on fruit yield and other yield contributing characters in both the years. Lime had a positive response on the fruit weight, fruit size and number of fruits/plant. Irrigation during dry season (December to April) reduced premature fruit drop and increased fruit set significantly. Use of 500 liters of irrigation water (50 L/plant/15 days) significantly increased the fruit weight, fruit size and fruits yield than non-irrigated plants. Lime as well as irrigation improved the fruit qualities (like % TSS, colour, juiciness, flavour and taste). The combined application of lime (6 kg/plant and irrigation (500 liters/plant) produced fruit weight, fruit size and number of fruits/plant significantly higher than the control. Higher economic return was observed from the combined effects of lime and irrigation with increasing level.

**Key words:** Pomelo, lime and irrigation, yield performance

### Introduction

Pomelo (*Citrus grandis*) is one of the major and largest citrus fruit in Bangladesh. It is very rich in vitamin-C and good source of minerals and vitamin-A. It grows well and adaptable to wide range of soils. Ideal pH for citrus is considered between 5.5 and 7.5. But evidence shows that with suitable management it can be grown with success in acidic soil (pH 4.5). It was observed that premature drop of fruits, leaves and die-back of twigs can be easily controlled by applying lime cultivation of citrus. In the Chittagong Hill Tracts December to April is the driest part of the year and majority of plant species suffer from moisture scarcity during this period. So use of irrigation water is very beneficial.

Irrigation is of vital importance of citrus orchard and is considered as one of the most critical cultural operations. The fruit size usually gets reduced if moisture deficiency occurs frequently when developing fruits are on the tree during spring and summer months. Chapman (1968) found that inadequate supply of calcium causes small and deformed fruit size. De Villiers and Boyer (1961) also reported that profuse blossoming and excessive drop of young and mature fruits are frequently occurred due to imbalance use of calcium. Application of lime could increase the availability of calcium, phosphorus and potassium resulting uptake of more nutrient elements by the plant. It was reported that lime reduced the acidity of citrus and increased the sweetness of fruits (Bose and Mitra, 1990). In this context, the present investigation was

undertaken to find out the effect of lime and irrigation for maximizing yield and quality of pomelo.

### Materials and Methods

Field experiments were conducted at the Hill Tracts Agricultural Research Station, Ramgarh, Khagrachari during 1997-98 and 1998-99 to find out the response of lime and irrigation for higher quality and yield of pomelo. The experimental soil was acidic as is evident from the analytical data (Table 1). The experiment was laid out in randomized complete block design with four replications. Four levels of lime (0, 2, 4 and 6 kg/plant) and two levels

Table 1 Physical and chemical properties of experimental soil

Properties	Values	Critical level
Textural class	Silty loam	-
Sand (%)	12.00	-
Silt (%)	60.00	-
Clay (%)	28.00	-
Organic matter pH	1.4	-
	4.5	-
Exchangeable bases (meq%)		
Ca	1.4	2.0
Mg	0.56	0.8
K	0.15	0.2
Available nutrient ( $\mu\text{g/ml}$ )		
NH <sub>4</sub> +N	0.47	15.0
P	12.0	14.0
S	7.0	14.0
B	0.12	0.20
Cu	1.0	1.0
Fe	96.0	10.0
Mn	16.0	5.0
Zn	1.0	2.0

of irrigation (0 and 50 L/plant/15 days) were taken in the study as treatment combinations. Thirty two plants of same age were randomly selected for conducting the investigation. A blanket dose of nitrogen, phosphorus, potassium and sulphur @ 1000: 900: 800: 500: g/plant were used as urea, triple superphosphate, muriate of potash, gypsum, respectively. Lime was applied (CaO) to the plants at a time by pegging method. Total amount of fertilizers were divided into two splits. First installment was applied at the beginning of the monsoon. The second one was applied at the end of rainy season. Fifty liters of water was uniformly applied to the plants by ring placement method twice a month at 15 days interval from December to April during dry season. Necessary cultural operations were performed in due time. Ten randomly selected fruits were harvested from every plant for data recorded. Various qualitative characters of pomelo were tested by organoleptic method. Collected data on different parameters were compiled for statistical analysis.

**Results and Discussion**

**Effect of lime:** Weight of fruit, fruit size, number of fruits and weight of segments significantly responded to lime (Table 2). But other fruit characters like rind thickness (peel), number of segments (fragments) and weight of rind did not show positive response to application of lime. With the increasing rates of lime weight of fruit, fruits size and number of fruits/plant were increased significantly.

The significantly larger fruit weight, fruit size and higher number of fruits per plant recorded in 6 kg lime/plant which was markedly differed over all other rates of lime. It has been observed that maximum yield (number of fruits) could be obtained from acid soil by raising the pH up to 5.5 and 6.0 through liming. This finding was in agreement with the findings of Patiram *et al.* (1987, 1989 and 1990). Use of lime with increasing rates significantly increased the sugar (% TSS) content (Table 2). The significant improvement of availability of nutrients in acid soils due to application of lime were reported by Berglund and Eriksson (1985) and Kennedy (1986) which corroborated with findings.

**Effect of irrigation:** The results revealed that irrigation had a significant effect on the yield and yield attributes of pomelo (Table 2). Irrigation during dry season initiated fruit set and significantly reduced the early fruit drop. Application of water (50 L/plant/15/days) during dry season significantly increased the fruit weight, fruits size and number of fruits/plants and increased 36% fruit yield over non-irrigation plants. It was reported that rapid growth, fruit set and fruit size could be hampered if the soil was not properly irrigated. Mantel (1977), Bieleorai (1978) and Goell (1986) found that irrigation influenced both early vegetative growth and yield of citrus fruits and the tree receiving irrigation at 20 days interval had a higher fruits density (number/unit canopy).

Table 2: Yield and yield contributing characters of pomelo as influenced by lime

Lime Kg/plant	Wt. of fruit (Kg)	Fruit size (cm)		Weight of rind (g)	Thickness of rind (cm)	No. of segments	Wt. of segments	No. of fruit set/plant	No. of fruit/drop/plant	No. of fruit/plant	% TSS
		Length	Diameter								
0	0.95	11.08	10.56	398	1.53	14.69	50.37	101	12.70	88	5.52
2	1.08	13.35	12.01	418	1.52	14.33	58.14	172	11.33	161	6.44
4	1.60	14.67	12.97	414	1.46	14.05	69.10	196	9.72	187	6.91
6	2.33	16.15	13.99	395	1.53	13.81	90.33	135	7.32	228	7.18
LSD(0.05)	0.12	0.56	0.28	NS	NS	NS	4.20	10	0.26	11	0.10
Effect of irrigation											
Irrigation	1.73	14.99	12.94	396.0	1.37	14.29	73.0	192.64	6.32	186.32	6.33
Non-irrigation	1.08	12.64	11.89	418.0	1.65	14.15	61.5	137.34	18.22	119.12	5.94
LSD(0.05)	0.09	0.39	0.21	NS	NS	NS	2.97	7.22	0.32	8.34	0.07

Table 3: Qualitative characters of pomelo

	Lime kg/plant	Pulp colour	Firmness	Juiciness	Quality	Taste
Irrigation	0	Light pink	Hard	Low	Poor	Bitter
	2	Light pink	Soft	Low	Good	Sour
	4	pink	Soft	Medium	Good	Sweet
	6	Deep pink	Very soft	High	Excellent	Very sweet
Non-irrigation	0	Whitish	Hard	Low	Poor	Bitter
	2	Light pink	Hard	Medium	Poor	Sour
	4	Pink	Soft	Medium	Good	Sweet
	6	Pink	Soft	High	Good	Sweet

Table 4: Yield and yield contributing characters of pomelo as influenced by lime and irrigation

50 L water/plant t 15 days	Lime Kg/ plant	Wt. of fruit (Kg)	Fruit size (cm)		Weight of rind (g)	Thickness of rind (cm)	No. of segments	Wt. of segments	No. of fruit set/ plant	No. of fruit/ drop/plant	No. of fruit/ plant	% TSS
			Length	Diameter								
Irrigation												
	0	1.05	12.04	11.05	406	1.58	82	53	105	11.20	94	6.17
	2	1.19	14.53	12.50	407	1.23	87	61	120	10.03	110	6.45
	4	1.80	15.94	13.66	399	1.38	88	71	215	6.32	209	7.25
	6	2.69	17.44	14.56	401	1.30	89	102	255	2.23	253	7.56
Without irrigation												
	0	0.85	10.13	10.13	400	1.47	98	47	103	21.40	82	5.60
	2	0.98	12.17	11.52	402	1.80	102	54	110	17.80	92	6.05
	4	1.32	13.40	12.27	396	1.54	119	66	121	15.66	106	6.40
	6	1.43	14.87	13.42	404	1.76	89	78	127	13.92	113	6.77
LSD(0.05)		0.18	0.99	0.56	NS	NS	NS	5.94	0.67	18.45	16.67	0.14

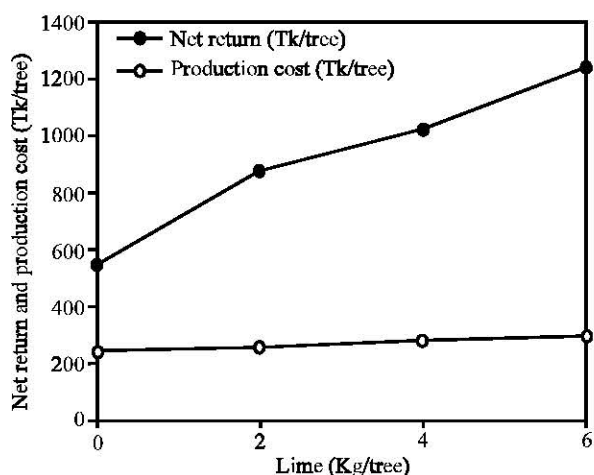


Fig. 1: Net return and production cost as influenced by lime

**Combined effects of lime and irrigation:** The yield and yield contributing were characters highly influenced by combined use of lime and irrigation (Table 4). Increasing rates of lime with irrigation showed noticeable effects on fruit weight, fruit size and fruit yield per plant. But non-edible portions like rind weight and thickness and number of segments did not give significant response to lime and irrigations. Six kg lime with 500 liters of water per tree significantly increased fruit weight, fruit size and number of fruit/plant and reduced the fruit dropping substantially. On the other hand, control treatment (without lime and irrigation) showed poor performance on fruit yield and other fruit characters. The significant increases of fruit weight (2.69 Kg), fruit size (17.44 x 14.56 cm<sup>2</sup>) and number of fruits (253.67/plant) were recorded in 6 kg lime with 500 liters of water/plant as compared to all other treatment combinations and increase fruit yield 67% over control. Use of lime and irrigation with maximum level also improved other qualitative characters like pulp colour, juiciness, flavour and taste (Table 3) considerably.

**Economic benefits:** It was revealed that application of lime with increasing rates showed higher economic benefit as

compared to cost of production per plant (Fig. 1). The highest monetary return was obtained from 6 kg of lime per plant applied with irrigation water. The data also showed the increasing trend of economic return when production cost declined. The lowest economic benefit was observed from control.

So, farmers of hill region should be encouraged to grow more pomelo orchards commercially using 6 kg lime/plant with 500 liters of irrigation water (50 L/plant/15 days) to mitigate nutritional imbalance as well as getting higher economic return.

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