

Effect of management practices on the growth and yield of three varieties of jujube

M. Akther, T. Haque, M.A. Rahim and M.S. Alam¹

Department of Horticulture, ¹BAU-GPC-FTIP, Bangladesh Agricultural University, Mymensingh

Abstract: An experiment was carried out at the BAU Germplasm Centre (GPC) of Bangladesh Agricultural University, Mymensingh during the period from September 2010 to February 2011 to examine the effect of management practices on the growth and yield of jujube (BAU Kul-1, BAU Kul-2 and Apple Kul). The experiment consisted of two factors viz. management and variety. The experiment was laid out in Randomized Complete Block Design with three replications. Results revealed that, canopy volume, weight of individual fruit and total harvested fruit per plant were found maximum in BAU Kul-1 with pruning + manuring + irrigation. Maximum Numbers of leaves was found in BAU Kul-2 with manuring. The yield per hectare was the highest (10808.97t/ha) from BAU Kul-1 with the found of pruning + manuring + irrigation whereas the lowest (206.11 t/ha) was obtained from the Apple Kul with control.

Key words: Jujube, variety, management, growth, yield

Introduction

Jujube is one of the important fruits grown and available everywhere in Bangladesh. It is commonly known as 'boroi' in Bangladesh, and is one of the most ancient common fruits of India (Yamdagni, 1985). There are about 6691.23 ha lands under jujube trees with a total production of 76040 tons in Bangladesh (BBS, 2009). The jujube plant is quick growing, early bearing and yields a heavy crop every year. There exists a great variability in fruit, stone, quality, nutritive value, harvesting period and yield potentialities of jujube varieties. The cultivated varieties in Bangladesh are Apple kul, BAU Kul-1, BAU Kul-2, Dhaka-90, Narikeli, etc. The production of jujube is known to be influenced greatly by pruning, fertilization and irrigation along with other management practices. Pruning is essential to maintain vigor in the trees and to maintain fruit productivity, quality and size. Pruning should therefore induce the emergence of a maximum number of secondary and tertiary on vigorous shoots. This can be done by pruning at the right time and with the right intensity depending upon location and cultivar. Pruning is done regularly after fruits are ripened and harvested. Flowering, fruit set, maturity, growth and fruit yield is greatly influenced by pruning time. Fertilization is one of the most important intercultural operations that affect directly to the yield of jujube. For getting optimum yield, the plants are required to be fertilized at right time. On the other hand, jujube does not need irrigational water through out the year but when it does, fairly heavy irrigation must be provided (Singh, 1968).

The time of irrigation is, therefore, very important for maximization of yield. Research works related to the effect of pruning, time of fertilization and irrigation on the yield and quality of jujube were done in limited in Bangladesh. Considering the above facts, the present study was under taken to examine the effect of management practices on the growth and yield of jujube.

Materials and Methods

This chapter deals with the materials and methods that were used in carrying out the experiment. The present study was conducted to investigate the effect of management practices on the growth and yield of three varieties of jujube at the BAU Germplasm Centre of Fruit Tree Improvement Programme (GPC-FTIP), Bangladesh Agricultural University, Mymensingh during the period from September 2010 to February 2011. High yielding cultivar namely BAU Kul-1, BAU Kul-2 and Apple Kul

were used in this study. It includes a short description of experimental site, duration of the experiment, soil, climate, materials used for the study, treatments and layout, and application of fertilizer, intercultural operations, and methods of assignment of different treatments, harvesting, and collection of data, chemical analysis and statistical analysis. The experimental area is situated in the subtropical zone, characterized by heavy rainfall during Kharif season (April to September), and scanty in Rabi season (October to March). The soil of the experimental area is sandy loam type and belongs to the Old Brahmaputra Flood Plain Alluvial Tract (UNDP, 1988). The experimental site was a medium high land and the pH of the soil was 6.7. The experiment was done on 3 years old jujube plant of BAU Kul-1, BAU Kul-2, and Apple Kul which were previously planted. The two factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications; the total number of plant was $8 \times 3 \times 2 = 48$. Planting was in hexagonal systems giving spacing of 4m \times 4m. The experiment consisted of two factors, details of which are described below:

Factor A. Management practices on i) Pruning, ii) Manuring, iii) Irrigation, iv) Pruning + Manuring, v) Manuring +Irrigation, vi) Irrigation + Pruning, vii) Pruning + Manuring+Irrigation, viii) Control

Factor B: Varieties on i) BAU Kul 1, ii) BAU Kul 2, iii) Apple Kul. Canopy volume was calculated at 30 days interval starting from September, 2010 to January, 2011. Canopy volume (m³) = $4/3a^2b$, where a = half of the height, b = average of east-west and north-south plant spread was expressed in m³. The data collected from the experiment were statistically analyzed. The mean values of all treatments were calculated and the analysis of variance for most of the characters was accomplished by F variance test. The significance of difference among the treatment means was evaluated by least significance difference (LSD) test at 5% and 1% levels of probability (Gomez and Gomez, 1984).

Results and discussion

Canopy Volume (m³): The effect of treatments on canopy volume was found to be statistically significant. The highest canopy volume (20.13 m³) was found in the treatments of pruning + manuring + irrigation and the lowest canopy volume (11.14 m³) was found in the treatments of control (Table 1). Canopy volume was increased possibly due to the readily available nutrients

that might have encouraged more vegetative growth and development. Significant variation was observed in case of canopy volume (m^3) due to variety. The maximum canopy volume ($18.27 m^3$) was found in the variety of BAU Kul-1 at 150 DAT and the minimum canopy volume ($13.62 m^3$) was found in the varieties of Apple Kul at 150 DAT (Table 2). The Combined effect of variety and treatments

on canopy volume was found to be statistically significant. The maximum canopy volume ($24.83m^3$) was found in the variety and treatment combination of BAU Kul-1 with pruning + manuring + irrigation and the minimum canopy volume ($10.10m^3$) was found in the variety and treatment combination of Apple Kul with control (Table 3).

Table 1. Main effect of treatments on canopy volume (m^3)

Treatments	Canopy volume(m^3)				
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT
T ₁	12.87	14.06	15.51	15.33	15.98
T ₂	12.65	14.93	14.97	17.32	18.39
T ₃	10.97	12.74	14.86	15.71	16.78
T ₄	10.58	13.13	13.21	14.20	15.15
T ₅	11.77	11.19	10.87	11.83	12.96
T ₆	8.76	9.82	10.79	11.90	13.00
T ₇	13.57	16.17	19.00	20.05	20.13
T ₈	7.06	8.05	9.09	10.17	11.14
LSD at 1%	0.5979	0.4676	0.5678	0.4395	0.6467
Level of significance	**	**	**	**	**

Table 2. Main effect of variety on canopy volume (m^3)

Variety	Canopy volume(m^3)				
	30 DAT	60DAT	90 DAT	120 DAT	150 DAT
V ₁	14.35	15.82	16.25	17.25	18.27
V ₂	9.89	11.03	12.66	13.70	14.43
V ₃	8.84	10.68	11.70	12.74	13.62
LSD at 1%	0.382	0.299	0.363	0.281	0.413
Level of significance	**	**	**	**	**

Table 3. Combined effect of treatments and variety on canopy volume (m^3)

Combination	Canopy volume(m^3)				
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT
T ₁ V ₁	17.10	18.37	19.50	20.37	21.20
T ₁ V ₂	7.57	8.60	12.40	9.87	10.93
T ₁ V ₃	13.94	15.23	14.63	15.77	15.83
T ₂ V ₁	18.04	19.00	20.43	21.57	22.47
T ₂ V ₂	13.33	11.07	8.77	13.50	14.72
T ₂ V ₃	6.59	14.72	15.73	16.90	18.00
T ₃ V ₁	13.16	14.50	19.33	20.13	21.10
T ₃ V ₂	11.17	13.17	15.60	16.47	17.53
T ₃ V ₃	8.60	10.57	9.65	10.53	11.73
T ₄ V ₁	14.08	18.63	16.37	17.47	18.60
T ₄ V ₂	9.74	11.53	12.27	13.33	14.07
T ₄ V ₃	7.94	9.23	11.00	11.80	12.80
T ₅ V ₁	16.18	14.83	11.83	12.83	13.93
T ₅ V ₂	9.66	10.53	11.47	12.50	11.33
T ₅ V ₃	9.47	8.23	9.33	10.17	13.63
T ₆ V ₁	9.72	10.73	11.77	12.90	14.00
T ₆ V ₂	8.61	9.60	10.57	11.43	12.47
T ₆ V ₃	7.95	9.13	10.03	11.37	12.53
T ₇ V ₁	20.52	23.52	22.77	23.73	24.83
T ₇ V ₂	10.61	11.53	19.73	20.87	21.87
T ₇ V ₃	9.58	13.47	14.50	15.57	13.70
T ₈ V ₁	6.68	7.70	8.73	9.83	10.80
T ₈ V ₂	8.47	9.47	10.53	11.63	12.53
T ₈ V ₃	6.05	7.00	8.03	9.07	10.10
LSD at 1%	0.210	0.164	0.199	0.154	0.227
Level of significance	**	**	**	**	**

T₁ = Pruning; T₂ = Manuring; T₃ = Irrigation; T₄ = Pruning + Manuring; T₅ = Manuring + Irrigation; T₆ = Irrigation + Pruning; T₇ = Pruning + Manuring + Irrigation; T₈ = Control, V₁ = BAU Kul-1; V₂ = BAU Kul-2; V₃ = Apple Kul, ** = Significant at 1 % level of probability; DAT = Days After Treatment

Number of leaves/plant: The effect of treatments on no. of leaves/ plant was found to be statistically significant. The highest no. of leaves/ plant (1582.14) was found in the treatments of manuring and the lowest no. of leaves/ plant (761.37) per plant was found in the treatments of irrigation + pruning (Table 4). No. of leaves/plant was increasing day by day in all the treatments. The effect of variety on no. of leaves/ plant was found to be statistically significant.

The highest no. of leaves/ plant (1548.33) was found in the variety of BAU Kul-2 at 150 DAT and the lowest no. of leaves/ plant (1059.68) was found in the variety of BAU Kul-1 at 150 DAT (Table 5). No. of leaves/plant was increasing day by day in all the varieties. These might be due to the plant varieties character. The Combined effect of variety and treatments on no. of leaves/ plant was found to be statistically significant. The highest no. of leaves/

plant (2430.00) was found in the variety and treatments combination of BAU Kul-2 with manuring and the lowest no. of leaves/ plant (536.44) was found in the variety and

treatments combination of BAU Kul-2 with irrigation + pruning (Table 6).

Table 4. Main effect of treatments no. of leaves/plant of jujube plant

Treatments	No. of leaves/plant				
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT
T ₁	1125.11	1493.88	1270.00	1493.33	143670
T ₂	1517.22	1585.00	1535.52	719.37	1582.14
T ₃	888.22	1153.89	895.55	1056.51	1005.96
T ₄	1070.00	814.44	886.66	1215.62	1510.66
T ₅	876.89	837.22	1293.33	1362.59	989.62
T ₆	607.89	492.22	550.00	741.48	761.37
T ₇	1227.78	1203.33	1206.65	1514.44	1275.33
T ₈	907.77	818.89	1201.11	890.33	1257.03
LSD at 1%	33.2142	7.9311	37.8470	23.0795	176.7944
Level of significance	**	**	**	**	**

Table 5. Main effect of variety no. of leaves/plant of jujube plant

Variety	No. of leaves/plant				
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT
V ₁	828.29	961.04	926.66	1028.68	1059.68
V ₂	1343.83	1219.99	1392.48	1553.59	1548.33
V ₃	910.70	968.54	995.41	1165.36	1074.05
LSD at 1%	21.227	5.069	24.188	14.750	112.990
Level of significance	**	**	**	**	**

Table 6. Combined effect of treatments and variety on no. of leaves/plant of jujube plant

Combination	No. of leaves/plant				
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT
T ₁ V ₁	1550.00	1628.33	1690.00	1773.33	1831.77
T ₁ V ₂	692.00	1320.00	1370.00	1416.67	1472.22
T ₁ V ₃	1133.33	1533.33	750.00	1290.00	1006.11
T ₂ V ₁	1900.00	1666.67	1473.33	2130.00	2200.00
T ₂ V ₂	2006.67	1930.00	2033.22	2235.00	2430.00
T ₂ V ₃	416.67	1200.00	906.64	890.00	913.78
T ₃ V ₁	1300.00	1353.33	923.33	1222.88	1026.66
T ₃ V ₂	724.67	1251.67	850.00	976.67	976.11
T ₃ V ₃	640.00	856.67	913.33	970.00	1015.11
T ₄ V ₁	1200.00	950.00	1026.67	1396.67	1654.44
T ₄ V ₂	1033.33	765.00	830.00	1383.54	1434.44
T ₄ V ₃	976.67	728.33	803.33	866.67	1443.11
T ₅ V ₁	960.67	998.33	1983.33	2082.00	1135.00
T ₅ V ₂	766.67	820.00	856.67	912.88	962.22
T ₅ V ₃	903.33	693.33	1040.00	1092.88	871.66
T ₆ V ₁	376.67	413.33	456.67	624.44	536.44
T ₆ V ₂	733.33	816.67	883.33	893.33	934.33
T ₆ V ₃	533.33	820.00	1166.67	813.23	1264.44
T ₇ V ₁	1366.67	743.33	1240.00	1523.33	712.22
T ₇ V ₂	1278.33	1501.67	1266.67	1316.44	1374.22
T ₇ V ₃	1266.67	1323.33	1306.67	1606.67	942.22
T ₈ V ₁	756.33	820.00	1553.33	964.44	1572.33
T ₈ V ₂	690.67	593.33	666.67	900.00	726.66
T ₈ V ₃	376.67	470.00	526.67	700.00	1021.00
LSD at 1%	11.655	2.783	13.281	8.099	62.040
Level of significance	**	**	**	**	**

Number of harvested fruits per plant: Different degrees of treatments had significant effect on the number of harvested fruits per plant. The treatments of pruning + manuring + irrigation produced the highest number of fruits (87.44) per plant, while the lowest (27.11) was obtained from that of control. Number of harvested fruits per plant was significantly increased by all treatments. (Table 7). Number of harvested fruits per /plant varied significantly due to the influence of variety. The highest

number of fruits per plant (71.68) was obtained from BAU Kul -1, whereas the lowest (20.55) was obtained from that of Apple Kul. These might be due to the plant varietal character (Table 8). Combined effect of variety and treatments on number of fruits per plant was significant. Considering harvested fruit, it was found that variety of BAU Kul-1with pruning + manuring + irrigation produced the maximum fruits (115.67). On the other hand, Apple Kul with control resulted the minimum fruits (4.67) per plant (Table 9).

Table 7. Treatments effect on growth and yield of jujube

Treatments	Harvest fruit	Individual fruit wt per plant (g)
T ₁	42.62	72.33
T ₂	46.11	71.89
T ₃	54.66	74.66
T ₄	55.33	72.89
T ₅	38.87	72.11
T ₆	38.64	75.44
T ₇	87.44	106.44
T ₈	27.11	73.223
LSD at 1%	3.3853	3.0478
Level of sign.	**	**

Table 8. Varietal effect on growth and yield of jujube

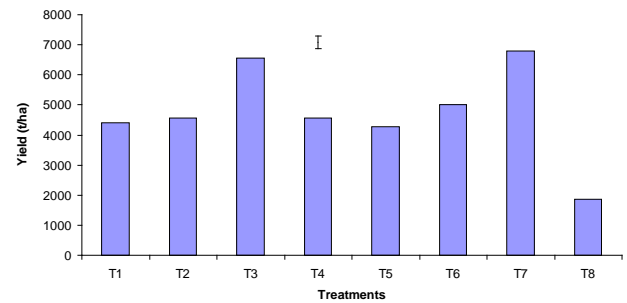
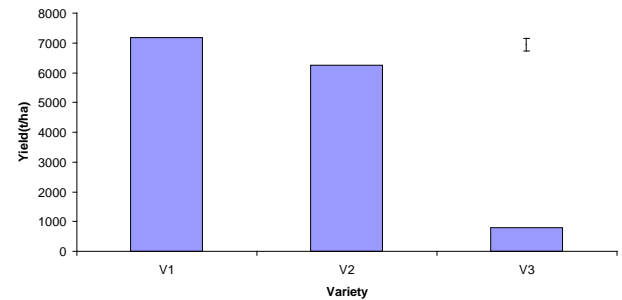
Variety	Harvest fruit	Individual fruit wt per plant(g)
V ₁	71.68	88.62
V ₂	54.32	92.37
V ₃	20.55	39.25
LSD at 1%	2.164	1.948
Level of sign.	**	**

Table 9. Combined effect of treatment and variety on growth and yield of jujube

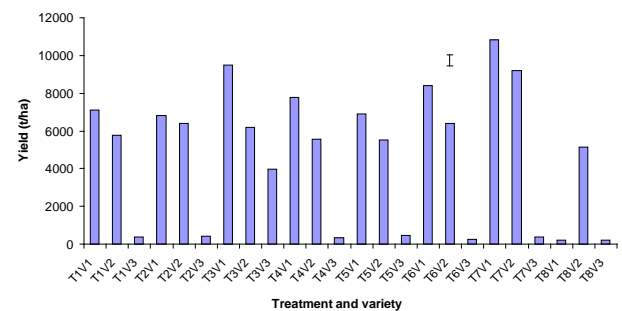
Combination	Harvest fruit	Individual fruit wt per plant(g)
T ₁ V ₁	61.67	100.67
T ₁ V ₂	52.88	99.00
T ₁ V ₃	13.33	17.33
T ₂ V ₁	65.00	99.67
T ₂ V ₂	58.33	97.33
T ₂ V ₃	15.00	17.00
T ₃ V ₁	106.67	105.00
T ₃ V ₂	48.33	19.00
T ₃ V ₃	9.00	100.00
T ₄ V ₁	110.00	100.00
T ₄ V ₂	46.67	99.67
T ₄ V ₃	9.33	19.00
T ₅ V ₁	53.33	101.00
T ₅ V ₂	51.67	97.33
T ₅ V ₃	11.63	18.00
T ₆ V ₁	56.44	106.33
T ₆ V ₂	50.00	101.33
T ₆ V ₃	9.50	18.67
T ₇ V ₁	115.67	105.33
T ₇ V ₂	80.00	109.33
T ₇ V ₃	66.67	104.67
T ₈ V ₁	4.67	18.67
T ₈ V ₂	46.67	90.00
T ₈ V ₃	30.00	17.67
LSD at 1%	1.188	1.070
Level of sign.	**	**

Individual fruit weight (g): Individual fruit weight varied significantly due to the influence of treatments. The maximum individual fruit weight (106.44g) was recorded in the treatments of pruning+manuring+irrigation and minimum number of individual fruit weight (41.55g) was found in the treatments of manuring (Table 7). Effect of varieties on the number of total fruit/plant was found to be statistically significant. The highest individual fruit weight (92.37g) was obtained from the variety of BAU Kul-2 and the minimum individual fruit weight (39.25g) was found in the variety of Apple Kul (Table 8). The Combined effect of variety and treatments was found to be significant in all respects. The maximum individual fruit weight (109.33g) was observed in the variety and treatments combination of

BAU Kul-2 with pruning + manuring + irrigation and the minimum individual fruit weight (17.00g) was obtained from the variety and treatments combination of Apple Kul with manuring (Table 9).

**Fig.1.** Effect of treatments on the yield of jujube. Vertical bar indicates LSD at 0.01 levels**Fig.2.** Effect of variety on the yield of jujube. Vertical bar indicates LSD at 0.01 levels

Yield per hectare (t/ha): The effect of treatments on yield per hectare was found to be statistically significant (Appendix III). The highest yield per hectare (6783.00t/ha) was observed in the treatments of pruning + manuring + irrigation and the lowest yield per hectare (1850.61t/ha) was observed in the treatments of control (Fig 1). Effect of varieties on the yield per hectare was found to be statistically significant. The maximum yield per hectare (7190.57t/ha) was obtained from the variety of BAU Kul-1 followed by BAU Kul-2 and Apple Kul and the minimum yield per hectare (792.13t/ha) was found in the variety of Apple Kul (Fig 2).

**Fig.3.** Combined effect of treatments and variety on the yield of jujube. The vertical bar indicates LSD at 0.01 levels.

Combined effect of variety and treatments on yield per hectare was significant. It was found that variety BAU Kul-1 along with pruning + manuring + irrigation produced the highest yield per hectare (10808.97t/ha). On the other hand, Apple Kul with control resulted the lowest yield per hectare (206.11t/ha) (Fig 3).

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