J. Hortl. Sci.
Vol. 9(1):31-37, 2014

Effect of spacing and pruning on growth, yield and quality of cv. Deanna fig (*Ficus carica* L.)

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ABSTRACT

The effects of tree spacing (5x2m, 5x2.5m, 5x3m, 5x3.5m and 5x4m) and pruning (8 buds/cane, 6 buds/cane and 4 buds/cane) on vegetative growth, physiological parameters, fruit yield and quality were studied in fig (*Ficus carica* L.) cv. Deanna in the 3rd and 4th year of its growth during the period 2010-12. It was observed that with increase in tree spacing, growth parameters like leaf number, shoot length, internode length, tree-spread, tree height and tree circumference, along with fruit yield both in terms of fruit number and fruit weight per tree, declined gradually under different pruning levels. Increase in pruning level from 8 buds/cane to 4 buds/cane resulted in increased leaf number, shoot length and internode length. Yield characters, viz., fruit number/tree, fruit weight/tree, fruit number/hectare and fruit weight/hectare were marginally influenced by pruning. However, interaction effects of pruning and spacing were found to be non-significant. Consistently declining trends in photosynthesis rate and stomatal conductance, along with increase in leaf water potential value were observed with increase in spacing. Effects of spacing were more conspicuous than those of pruning. Best results for maintenance of vigour and fruit yield were observed under a spacing of 5x2m or 5x2.5m, and 4 buds/cane pruning. Although there was reduction in average fruit size under closer spacing when compared to wide spacing, fruit quality attributes like TSS and acidity were not affected by various treatments. Effects of closer spacing on growth and yield parameters were more pronounced in the 3rd year as compared to the 4th year, showing better response to treatments in young trees. Fruit yield calculated on per hectare basis showed highest fruit number of 116500-133750 and 274500-299500, and fruit weight of 54.5-62.0 and 158.77-173.30 quintals/ha, respectively, during the 3rd and 4th year of planting under closer spacing of 5x2m and 4 buds/cane pruning.

Key words: *Ficus carica*, fig Deanna, growth, pruning, fruit quality, spacing, yield

INTRODUCTION

Fig (*Ficus carica* L.), a native of Middle East and Western Asia, belongs to the family Moraceae. It is a deciduous tree growing well in warm and dry climatic conditions. Its fruits are considered nutritionally important because of their, abundant richness in mineral, vitamin and antioxidant content. Fruits, as well as plants other parts like latex, bark, leaves and roots, are known for their medicinal properties (Fergusion *et al*, 1990; Nath *et al*, 2008). The fig is mainly cultivated in California and Arabia, besides countries like Italy, Turkey, Spain, Greece and Portugal. In India, it is considered to be a minor fruit, and, its cultivation has not received as much importance as other cultivated fruit crops. However, over the last few years, commercial cultivation of fig has received wide attention in several Indian states, including Karnataka, because of its high economic value, low input requirement and easy crop-maintenance. At present, the total area under fig cultivation in India is estimated to be about 1000 hectares, of which 400 hectares are grown in Maharashtra (Singhal, 1998). However, its productivity is low due to insufficient scientific information on its growth behaviour and production under Indian conditions. Pruning and maintenance of optimum tree-spacing are important management practices for realizing potential growth and productivity in perennial horticultural crops. Pruning encourages efficient canopy management for optimal utilization of available sunlight, and helps break apical dominance thus allowing lateral bud growth (Roper *et al*, 1993; Schilletter and Richey, 2005; Marini, 2009). However, beneficial effects of pruning largely depended upon pruning intensity and time. Similarly, tree-spacing is vital factor for effective utilization of available land by helping accommodate a reasonable number of trees, efficient utilization of soil nutrients and better interception of sunlight,

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thus facilitating easy harvest. Investigations made in the past have shown a good response of pruning and tree-spacing for improving growth and productivity of many fruit crops like apple (Palmer *et al*, 1992), mango (Das and Jana, 2012), grapes (Turkington *et al*, 1980) and ber (Saini *et al*, 1996). In the present investigation, an attempt was made to study the effects of different levels of pruning and tree-spacing on growth, yield and fruit quality of a commercially important fig cv. Deanna, with an objective to develop specific recommendations.

MATERIAL AND METHODS

The study was conducted at the Experimental Farm of Indian Institute of Horticultural Research, Hesarghatta, Bengaluru, in the commercially important fig cv. Deanna during two consecutive seasons of the years 2010-2011 and 2011-2012. Trees selected were of uniform age, grown at five different spacings viz., T_1 = 5.0m x 2.0m; T_2 = 5.0m x 2.5m; T_3 = 5.0m x 3.0m; T_4 = 5.0m x 3.5m and T_5 = 5.0m x 4.0m. In each spacing treatment, row-to-row distance was kept constant (5.0m). Each spacing treatment was subjected to three levels of pruning: P_1 = 8 buds/cane, P_2 = 6 buds/cane, and P_3 = 4 buds/cane, by retaining the required number of buds. Pruning was performed in September in both the years. The experiment was laid out in Factorial Randomized Block Design, with 4 replications under each treatment. Treatments were imposed in 3rd and 4th years orchard life of fig plants. During experimentation, average minimum and maximum temperatures ranged between 13.2-20.3°C and 26.2-30.6°C, respectively, and average relative humidity at 8.30 AM and 1.30 PM were 66.7-84.5% and 41.3-63.6%, respectively. Standard package of practices was adopted for maintenance of trees during experimentation.

At 60 days from pruning, periodic observations on morphological characters such as leaf number, shoot length and internode length, were recorded. Observations on tree height, trunk circumference and tree-spread (North to South and East to West) were also made at fruiting stage. Data on physiological attributes like photosynthesis rate, stomatal conductance and leaf water potential were recorded on fully expanded leaves at 60 days from tree-pruning. Leaf water potential was measured with Dew Point Micro Voltmeter (Wescor, USA) after cutting leaf discs of uniform diameter (1cm), and values were expressed as -MPa. Photosynthesis rate and stomatal conductance were recorded *in situ* in 5 replicates, on LICOR Portable photosynthesis system (model LI 6400XT, LiCor, USA) at 10-11 AM. Data were replicated 4 times. At harvest, fruit number and fruit weight per tree were recorded. Average fruit weight was calculated by dividing fruit weight per tree with fruit number per tree under various treatments. Data on fruit yield were computed on per hectare basis regarding fruit number and fruit weight (quintals). Besides, 10 fruits/tree were picked randomly and used for determination of fruit quality parameters such as total soluble sugars (TSS) and titrable acidity (TA). TSS was estimated using hand ERMA refractrometer. TA was determined by AOAC (1990) method using phenolphthalein as the indicator.

All the data were subjected to standard statistical analyses as per Steel and Torrie (1980) and means were evaluated by least significance difference (LSD) at 5% level for interpretation of the results.

RESULTS AND DISCUSSION

Growth parameters

Shoot regeneration post pruning was observed 2 weeks during the 3rd year and after 3 weeks during the 4th year of planting under different tree-spacings. This indicated that the response to pruning was faster in younger trees. Tree spacing did not exert any influence on days taken for induction of new shoots in the pruned tree.

In general, leaf production, shoot length and internode length were higher in the 3rd year, than in the 4th year, of planting under different pruning and spacing treatments (Table 1). With increase in tree spacing, leaf production, shoot length and internode length under various pruning levels declined gradually, while, with increase in pruning level from 8 buds/cane to 4 buds/cane, the above growth parameters increased, independent of tree spacing. Maximum leaf production, shoot growth and internode length were witnessed under closer spacing of 5x2m or 5x2.5m, and, under 4 buds/shoot pruning regimen (Table 1).

Tree spread (E-W or N-S), tree height and tree circumference, irrespective of pruning intensity, decreased by 8.7-20.9%, 17.1-29.9% and 14.3-21.3%, respectively, under wider spacing compared to closer spacing during both the years, and, the decline was higher in the 3rd year than in the 4th year of planting (Table 1). Pruning treatments under various tree spacings declined in E-W and N-S tree-spread, and, the effect was more prominent under 4 buds/cane pruning level. However, the effects of pruning on tree spread, tree height and tree circumference were non-significant. Tree spread (N-S), tree height and tree circumference were seen to be maximum in trees grown under 5x2m or 5x2.5m spacing, subjected to 4 buds/cane pruning, during both the years. Non-significant interaction effect was observed between pruning and spacing for these growth characters in both the years. Mano and Hamada (2005) and Mano *et*

Table 1. Effect of spacing and pruning on growth in fig cv. Deanna

	3rd year from planting				4th year from planting			
	P1	P2	P3	Mean	P1	P2	P3	Mean
Leaf number								
T1	18.46	18.02	20.00	18.83	11.26	12.37	13.47	12.37
T2	17.42	15.95	20.87	18.08	11.76	12.51	12.13	12.13
T3	15.90	15.05	18.07	16.34	12.41	10.58	12.43	11.81
T4	16.12	14.12	15.43	15.22	11.06	11.61	12.65	11.77
T5	13.52	13.52	14.25	13.70	10.63	11.33	11.90	11.29
Mean	16.28	15.29	17.72		11.42	11.68	12.52	
S: **, CD (5%): 1.86; P: **, CD (5%): 1.44; PxS: NS, CD (5%): —; CV:13.75					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 13.73			
Shoot length (cm)								
T1	63.86	59.57	71.80	65.08	28.03	33.18	40.26	33.82
T2	52.82	43.77	78.32	58.30	29.94	29.44	28.30	29.23
T3	46.12	41.60	61.07	49.60	28.49	29.90	25.00	27.80
T4	45.82	31.15	33.65	36.87	22.95	26.76	33.08	27.60
T5	31.88	26.56	34.41	30.95	21.33	25.08	28.85	25.09
Mean	48.10	40.53	55.85		26.15	28.87	31.10	
S: **, CD (5%): 11.21; P: **, CD (5%): 8.68; PxS: NS, CD (5%):—; CV: 28.23					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 35.47			
Internodal length (cm)								
T1	3.44	3.31	3.60	3.45	2.27	2.61	2.95	2.62
T2	3.04	2.73	3.74	3.17	2.47	2.28	2.26	2.34
T3	2.85	2.48	3.42	2.92	2.25	2.84	2.07	2.39
T4	2.80	2.18	2.16	2.38	2.16	2.28	2.65	2.36
T5	2.30	1.99	2.51	2.27	1.99	2.19	2.42	2.20
Mean	2.89	2.54	3.07		2.23	2.44	2.47	
S: **, CD (5%): 0.39; P: **, CD (5%): 0.30; PxS: NS, CD (5%): —; CV: 16.60					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 25.21			
Tree spread (E-W) (cm)								
T1	201.25	195.00	197.50	197.92	211.25	227.25	205.00	214.50
T2	206.25	176.25	205.00	195.83	236.25	197.50	211.75	215.17
T3	207.50	170.00	190.00	189.17	242.00	178.75	208.75	209.83
T4	205.00	178.75	176.25	186.67	231.25	210.00	176.25	205.83
T5	181.25	148.75	161.25	163.75	206.25	191.25	190.00	195.83
Mean	200.25	173.75	186.00		225.40	200.95	198.35	
S: NS, CD (5%): —; P: NS, CD (5%):—; PxS: NS, CD (5%): —; CV: 21.52					S: NS, CD (5%): —; P: *, CD (5%): 23.23; PxS: NS, CD (5%): —; CV: 17.47			
Tree spread (N-S) (cm)								
T1	226.25	256.25	233.75	238.75	248.75	267.50	238.75	251.67
T2	237.50	190.00	238.75	222.08	258.75	216.25	213.75	229.58
T3	212.50	197.50	202.50	204.17	252.50	241.25	193.75	229.17
T4	217.50	188.75	160.00	188.75	236.25	192.5	213.75	214.16
T5	191.25	171.25	188.75	183.75	226.25	203.75	215.00	215.00
Mean	217.00	200.75	204.75		244.50	224.25	215.00	
S:*, CD (5%): 36.28; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 21.21					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 20.79			
Tree height (cm)								
T1	204.00	214.00	206.25	208.08	191.25	208.00	195.50	198.25
T2	201.75	170.00	212.50	194.75	191.25	160.00	188.75	180.17
T3	180.00	166.25	177.25	174.50	189.25	161.00	186.00	178.75
T4	183.25	159.00	169.00	170.58	184.00	164.25	168.25	172.17
T5	171.50	157.50	162.25	163.75	172.75	161.00	175.75	169.83
Mean	188.10	173.35	185.55		185.80	170.85	182.85	
S: **, CD (5%): 21.03; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 13.99					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 14.21			
Trunk circumference (cm)								
T1	24.75	27.25	26.50	26.17	29.25	32.00	30.25	30.50
T2	27.25	24.00	27.25	26.17	31.00	28.75	31.25	30.33
T3	24.00	23.37	24.87	24.08	30.50	26.87	30.50	29.29
T4	24.50	21.75	21.12	22.46	30.50	27.25	25.00	27.58
T5	23.75	20.75	22.25	22.25	29.25	25.75	27.75	27.58
Mean	24.85	23.42	24.40		30.10	28.12	28.95	
S: *, CD (5%): 3.12; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 15.60					S: NS, CD (5%): —P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 13.87			

S-Spacing; P-Pruning; ** $p \leq 0.001$; * $p \leq 0.05$
Spacing treatments: T1, T2, T3, T4 and T5;Pruning treatments: P1, P2 and P3

al (2011) earlier reported a beneficial effect of closer spacing on tree vigour and yield in fig.

Physiological parameters

Leaf water potential under various pruning levels increased from -2.69 MPa to -2.45 MPa with increasing tree spacing, but was unaffected by pruning in different tree spacings. Maximum leaf water potential values [ranging from 2.39-2.54 (-MPa)] were recorded under wider spacing of 5x4m, and minimum [ranging from 2.67-2.72 (-MPa)] under closer spacing of 5x2m during the 3rd year of tree growth (Table 2). Leaf water potential values did not show much variation during the 4th year under various treatments.

Photosynthesis rate and stomatal conductance in the pruned trees declined from 15.25 to14.54 μmol/m^2/s and 0.19 to 0.16 mol/m^2/s, respectively, in trees at closer spacing of 5x2m, to 13.71-13.09 μmol/m^2/s and 0.13-0.14 mol/m^2/s in trees at 5x4m spacing. Maximum photosynthesis rate was recorded in trees subjected to 8 buds/cane pruning level, whereas, stomatal conductance was highest under 6 buds/cane pruning intensity in closely-spaced trees (5x2m) (Table 2).

From the above results, it is evident that pruning and spacing had marked influence on growth and productivity on fig. Closer tree-spacing of 5x2m or 5x2.5m, especially, in young trees (3 years old) with 4 buds/cane pruning, resulted in better growth and higher fruit yield. Closer spacing also led to a reduction in average fruit weight, without compromising on fruit quality. Maintenance of optimum tree-space is well-documented as promoting growth and yield in perennial crops by reducing inter-tree competition for soil-derived resources like water and nutrients (Policarpo *et al*, 2006) and by increased light penetration (Johnson and Robinson, 2000 and Policarpo *et al*, 2006). However, results presented in the present study are in contrast to this, revealing a possibility of absence of inter-tree competition under closer spacing. Such closer spacing is ideal for better and efficient interception of available sunlight. Inter-tree competition and declined light penetration under dense planting are expected only in the event of overlapping root system and higher canopy-spread in the growing trees. In the present study, the trees were young enough (3 years old) to have an overlapping root system and/or a vigorous canopy, therefore, chances of inter-tree competition and

Table 2. Effect of spacing and pruning on physiological parameters in fig cv. Deanna

	3rd year from planting					4th year from planting			
	P1	P2	P3	Mean		P1	P2	P3	Mean
Leaf water potential (-MPa)									
T1	2.72	2.69	2.67	2.69	T1	1.98	1.96	1.80	1.91
T2	2.54	2.41	2.58	2.51	T2	2.06	1.77	1.80	1.88
T3	2.57	2.54	2.52	2.54	T3	1.90	1.95	1.90	1.92
T4	2.52	2.48	2.49	2.49	T4	1.83	1.77	1.87	1.82
T5	2.54	2.39	2.42	2.45	T5	1.67	2.02	1.87	1.85
Mean	2.58	2.50	2.53		Mean	1.89	1.90	1.85	
S: **, CD (5%): 0.08; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 3.55					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 14.89				
Photosynthesis rate (μmol/m^2/s)									
T1	15.25	14.87	14.54	14.88	T1	10.17	11.58	11.12	10.96
T2	13.73	13.63	12.88	13.41	T2	10.74	10.76	10.98	10.83
T3	13.06	12.79	12.36	12.73	T3	10.91	11.05	10.71	10.89
T4	13.57	13.28	12.42	13.09	T4	11.55	11.33	11.87	11.58
T5	12.92	12.64	13.26	12.94	T5	11.77	12.06	11.55	11.79
Mean	13.71	13.44	13.09		Mean	11.03	11.36	11.25	
S: **, CD (5%): 0.74; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 6.71					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 9.00				
Stomatal conductance (mol/m^2/s)									
T1	0.16	0.19	0.18	0.18	T1	0.25	0.21	0.21	0.22
T2	0.18	0.17	0.15	0.17	T2	0.17	0.21	0.21	0.20
T3	0.17	0.17	0.17	0.17	T3	0.19	0.22	0.21	0.21
T4	0.12	0.14	0.16	0.14	T4	0.20	0.20	0.22	0.21
T5	0.15	0.13	0.15	0.14	T5	0.20	0.20	0.18	0.19
Mean	0.16	0.16	0.16		Mean	0.20	0.21	0.21	
S: **, CD (5%): 0.02; P: NS, CD (5%): —; PxS: NS, CD (5%): —; CV: 13.33					S: NS, CD (5%): —; P: NS, CD (5%): —; PxS: NS, CD (5%): ——; CV: 15.00				

S-Spacing; P-Pruning; $^{**}p\leq0.001$; $^{*}p\leq0.05$

Table 3. Effect of spacing and pruning on fruit yield in fig cv. Deanna

	3rd year from planting					4th year from planting			
	P1	P2	P3	Mean		P1	P2	P3	Mean
Fruit number/tree									
T1	116.50	127.00	133.75	125.75	T1	274.50	268.75	299.50	280.91
T2	109.50	74.00	138.25	107.25	T2	298.50	246.75	239.75	261.66
T3	87.25	85.75	114.50	95.83	T3	239.50	232.00	265.75	245.75
T4	62.50	33.00	47.25	47.58	T4	255.75	221.50	258.00	245.08
T5	49.25	19.75	37.50	35.50	T5	229.00	266.25	236.00	243.75
Mean	85.00	67.90	94.25		Mean	259.45	247.05	259.80	
S: **, CD (5%): 42.16; P: NS, CD (5%): —;					S: NS, CD (5%):—; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 62.10					PxS: NS, CD (5%): —; CV: 21.22				
Fruit weight (kg)/tree									
T1	5.44	6.01	6.19	5.88	T1	15.87	14.91	17.33	16.03
T2	4.83	3.28	6.18	4.76	T2	17.37	13.70	14.28	15.12
T3	3.78	4.01	4.81	4.20	T3	14.65	13.48	15.71	14.61
T4	3.55	2.12	2.66	2.77	T4	15.23	13.07	15.61	14.63
T5	2.62	1.06	2.17	1.95	T5	14.07	15.99	14.03	14.70
Mean	4.04	3.29	4.40		Mean	15.44	14.23	15.39	
S: **, CD (5%): 1.93; P: NS, CD (5%): —;					S: NS, CD (5%):—; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 59.84					PxS: NS, CD (5%): —; CV: 20.30				
Fruits number/ha									
T1	116500	127000	133750	125750	T1	274500	268750	299500	280916
T2	87600	59200	110600	85800	T2	238800	197400	191800	209333
T3	58109	57110	76257	63825	T3	159507	154512	176989	163669
T4	35688	18843	26980	27170	T4	146033	126476	147318	139942
T5	24625	9875	18750	17750	T5	114500	133125	118000	121875
Mean	64504	54405	73267		Mean	186668	176052	186721	
S: **, CD (5%):30355; P: NS, CD (5%): —;					S: **, CD (5%):35094; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 18.18					PxS: NS, CD (5%): —; CV: 7.35				
Fruit weight (quintals)/ha									
T1	54.46	60.11	61.96	58.84	T1	158.77	149.11	173.30	160.39
T2	38.68	26.27	49.51	38.15	T2	139.03	109.65	114.28	120.99
T3	25.22	26.72	32.10	28.01	T3	97.61	89.82	104.66	97.36
T4	20.29	12.13	15.22	15.88	T4	86.97	74.65	89.14	83.59
T5	13.12	5.31	10.89	9.77	T5	70.35	79.99	70.18	73.51
Mean	30.35	26.11	33.93		Mean	110.55	100.64	110.31	
S: **, CD (5%): 14.11; P: NS, CD (5%): —;					S: **, CD (5%):18.53; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 56.85					PxS: NS, CD (5%): —; CV: 20.98				

S-Spacing; P-Pruning; $^{**}p\leq0.001$; $^{*}p\leq0.05$

obstruction to available sunlight by the tree canopy, are less expected. Better light interception under closer spacing could be an important factor in contributing to positive growth and higher yield as is evident from increase in photosynthesis rate and stomatal conductance. Also, higher negative-water-potential values evident under closer spacing help ensure better tree growth by facilitating faster absorption / translocation of available water from soil under the influence of transpiration pull. Results obtained in the present study also showed that effects of closer spacing on growth and yield were less pronounced during the 4th year compared to that in the 3rd year of planting. This indicated that age of the tree is vital for effects of closer spacing in fig. Mano and Hamada (2005) and Mano *et al* (2011) reported that closer spacing in fig was beneficial to tree-vigour and yield in fig. It will be interesting to see trees under the present spacing perform in the subsequent years of growth. Numerous studies show that pruning induces vegetative growth (Naor and Gal, 2002; Davenport, 2006; Albert *et al*, 2010; Claude *et al*, 2005; Marini, 2009). Pruning-induced vegetative growth is in line with these findings. Fruit-size reduction under close spacing can be explained by the observation of Policarpo *et al* (2006) who stated that partitioning of assimilates between the vegetative and reproductive parts was sensitive to high-density planting, and greater diversion of photosynthates to the vegetative parts at the expense of reproductive growth caused fruit-size reduction.

Table 4. Effect of spacing and pruning on fruit quality in fig cv. Deanna

	3^{rd} year from planting					4^{th} year from planting			
	P1	P2	P3	Mean		P1	P2	P3	Mean
Average fruit weight (g)									
T1	47.33	44.58	49.25	47.05	T1	58.91	56.75	58.83	58.16
T2	42.58	42.83	45.66	43.69	T2	59.66	58.16	62.08	59.97
T3	48.58	43.91	46.83	46.44	T3	60.66	57.58	58.75	59.00
T4	60.66	59.00	65.66	61.77	T4	60.08	59.41	60.91	60.14
T5	60.66	57.83	63.25	60.58	T5	61.08	60.33	59.25	60.22
Mean	51.96	49.63	54.13		Mean	60.08	58.45	59.96	
S: **, CD (5%): 7.88; P: NS, CD (5%): —;					S: NS, CD (5%):—; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 18.42					PxS: NS, CD (5%): —; CV: 11.12				
Total Soluble Solids (^{o}B)									
T1	12.13	13.20	13.98	13.10	T1	20.00	19.68	19.48	19.72
T2	14.51	13.66	13.71	13.96	T2	18.78	19.66	19.30	19.25
T3	14.15	13.69	14.58	14.14	T3	19.61	20.49	19.85	19.98
T4	14.43	14.66	14.16	14.42	T4	19.58	19.26	19.80	19.55
T5	14.85	15.41	14.81	15.02	T5	19.80	20.66	20.10	20.19
Mean	14.01	14.12	14.25		Mean	19.55	19.95	19.70	
S: NS, CD (5%):—; P: NS, CD (5%): —;					S: NS, CD (5%):—; P: NS, CD (5%): —;				
PxS: NS, CD (5%): —; CV: 11.54					PxS: NS, CD (5%): —; CV: 6.89				
Acidity (%)									
T1	2.31 (0.16)	2.42 (0.18)	2.31 (0.16)	2.35 (0.17)	T1	2.89 (0.25)	2.89 (0.25)	2.89 (0.25)	2.89(0.25)
T2	2.24 (0.15)	2.36 (0.17)	2.36 (0.17)	2.32 (0.16)	T2	2.95 (0.26)	2.95 (0.26)	2.88 (0.25)	2.93(0.26)
T3	2.35 (0.17)	2.27 (0.16)	2.32 (0.16)	2.31 (0.16)	T3	2.83 (0.24)	2.83 (0.24)	2.88 (0.25)	2.85(0.24)
T4	2.27 (0.16)	2.39 (0.17)	2.32 (0.16)	2.33 (0.16)	T4	2.89 (0.25)	2.83 (0.24)	2.95 (0.26)	2.89(0.25)
T5	2.32 (0.16)	2.32 (0.16)	2.24 (0.15)	2.29 (0.16)	T5	3.06 (0.28)	3.00 (0.27)	3.18 (0.30)	3.08(0.28)
Mean	2.30 (0.16)	2.35 (0.17)	2.31 (0.16)		Mean	2.92 (0.26)	2.90 (0.25)	2.95 (0.26)	
S: NS, CD (5%): —; P: NS, CD (5%): —;					S: NS, CD (5%):—; P: NS, CD (5%): —;				
PxS: NS,CD (5%): —; CV: 8.62					PxS: NS, CD (5%): —; CV: 7.19				

S-Spacing; P-Pruning; $^{**}p\leq0.001$; $^{*}p\leq0.05$

Fruit yield

Fruit number and fruit weight per tree were considerably influenced by tree-spacing and pruning during the 3^{rd} and 4^{th} year of planting. The effects were pronounced during the 3^{rd} year. Yield and yield attributes were superior during the 4^{th} year than in the 3^{rd} year of planting under different spacing/pruning treatments. This shows that production efficiency is low when trees are still young during the 3^{rd} year, but their response to pruning and spacing treatments was better (Table 3).

Under different in-row tree spacing during the 3^{rd} year, fruit number and fruit weight per tree increased with increase in pruning levels from 8 buds/cane to 4 buds/cane. However, during the same year, increased tree-spacing, on averaging over pruning, resulted in gradual decline in these yield characters. Maximum fruit number and fruit weight on per tree basis was recorded under closer spacing of 5x2m or 5x2.5m, and in trees subjected to 4 buds/cane pruning during the 3^{rd} year. During the 4^{th} year of tree growth, the trends with respect to effects of pruning and spacing on fruit weight and fruit number were the same as observed in the 3^{rd} year, but treatment effects were non-significant (Table 3). The differential responses to pruning and tree-spacing during the 3^{rd} and 4^{th} year of tree growth could be due to the difference in tree age. Fruit yield, calculated per hectare, showed fruit number in the range of 116500-133750 and 274500-299500 and fruit weight in the range of 54.5-62.0 and 158.77-173.30 q/ha, respectively, during the 3^{rd} and 4^{th} year of planting under closer spacing of 5x2m and under 4 buds/cane pruning. Data on yield was found to be highly significant for different spacings, whereas, the interaction effects were found to be non-significant. This could be due to a lesser influence of pruning on yield. However, this is apparent with higher values for coefficient of variance. Results indicated that closer spacing, with 5x2m and 4 buds/cane pruning, was relatively more beneficial in fig cultivation (Table 3). Mano and Hamada (2005) and Mano *et al* (2011) also reported closer spacing in fig to be beneficial for yield.

Fruit quality

Average fruit weight, in general, was higher in the 4^{th} year compared to that in the 3^{rd} year of tree growth under various pruning and spacing treatments. Average fruit weight in the 3^{rd} year was higher under wider spacing compared to closere spacing, and, 4 buds/cane pruning levels produced fruits with higher average fruit weight (45.7-65.7g). In the 4th year, with increased tree spacing, average fruit-weight showed only marginal increase under various pruning levels (Table 4). Effects of pruning and spacing in the 4th year were found to be non-significant. Fruit quality attributes like TSS and acidity were not influenced by tree spacing or pruning in both the years. This indicated that fruit quality attributes are not disturbed by pruning/spacing treatments. Further, TSS and acidity in fruits under various pruning and spacing levels were, in general, higher during the 4th year than in the 3rd year of tree growth (Table 4). Interaction effects of pruning and spacing on fruit quality attributes were non-significant. Mano *et al* (2011) also reported no difference in fruit quality in trees grown under closer or wider spacing.

ACKNOWLEDGMENT

Thanks are due to Director, Indian Institute of Horticultural Research, Bangalore, for providing necessary facilities, and, Dr. P. Sampath Kumar and Dr. T. Sakthivel for providing support and guidance from time to time.

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(MS Received 27 November 2013, Revised 17 May 2014, Accepted 03 June, 2014)