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Studies on the Effect of Pruning on Flowering Behaviour of Mango *cv*. Alphonso

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Abstract: *Knowledge of those aspects that motivate fruit growers towards more fruit production is necessary in order to implement policies to stimulate fruit production. To predict future fruit production of cultivar Alphonso in Konkan region as well as throughout the country of India based on such knowledge from experts, and based on historic data, the present field experiment was undertaken in the Department of Horticulture, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri during the year 2009-2010. The experiment was carried out in FRBD design with three replications, seven treatments and the three pruning methods. The results reveal that pruning the tree on past season growth wood (M_3 method) increases early emergence, more numbers of vegetative shoot and higher shoot length and girth. This is useful to regain the vegetative growth when the tree gets exhausted due to higher yields, while that of pruning on current season shoots (M_1 method) in the first and third week of October resulted in the early emergence of inflorescence, flowering, better fruit set and yield. Besides, the pruning on 50% current season shoots (M_2 method) showed better results. These methods provide a good alternative to more traditional forecasting methods.*

Keywords: *Alphonso mango, pruning, flowering, fruit setting, yield.*

INTRODUCTION

Mango (*Mangifera indica* L.) belongs to family Anacardiaceae, universally considered as the finest tropical fruit of the world. It is national fruit of India and has been called in the orient "King of Fruits". It is the third widely produced fruit crops of the tropics after banana and citrus. Alphonso is one of the premium mango variety in India and has great export potential. Konkan is the major and famous mango producing region on the West Coast of Maharashtra accounting for about 10 per cent of the total area under mango in India, out of which almost 90 per cent area is covered by the choicest mango cultivar Alphonso. The warm and humid climate, annual rainfall (3000-4000mm), well drained lateritic soils and rain free season from November to May prevalent in Konkan region are ideal for Alphonso mango cultivar particular. The demand of this variety is increasing day by day in the internal as well as external trade. The main reasons of low productivity are alternate bearing, malformation, fruit drop and insect pest and disease attack. Besides, the poor yield of mango orchards is the main problem due to dense canopies with poor availability of photosynthetic active radiation (PAR), infestation of pest due to shade conditions and lack of proper ventilation, problem of excessive growth with long slender upright branches having narrow branch angle resulting in low and delayed fruiting. Therefore, pruning is the major horticulture

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practice to overcome these problems. Pruning maintains a good balance between the growth and fruiting. The cutting of branches and twigs induces simultaneous accumulation of ethylene, ascorbic acid, abscissic acid, cytokinins and sudden lowering of gibberellins, all these lead to profuse flowering (Madhava Rao, 1988) [3]. Based on the advantages and view of these facts, the pruning methods carried in present investigation could provide a sound alternative to more traditional forecasting methods.

MATERIAL AND METHODS

The experiment was conducted at plot No.28, in the Department of Horticulture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli during 2009-10 by Factorial Randomized Block Design with two factors *viz*., pruning methods-M_1 (Light pruning on current season), M_2 (50% Current season growth) and M_3 (Past season growth) and seasons *viz*., T_1–October (first week), T_2–October (Third week), T_3–November (first week), T_4–November (Third week), T_5–December (first week), T_6–December (Third week) and T_7 (Control) with overall eighteen combinations, which were replicated three times. The two plants per treatment per replication were taken and twenty shoots were tagged per plant. After pruning, emergences of new shoots were recorded after 15 days interval and onward. The number of vegetative shoot counted on tagged shoots and average were calculated. Number and time of emergence of inflorescences/shoots appeared were recorded at timely interval and the flowering intensity was recorded by observing the number of branches flowered.

Date of full development of inflorescences was recorded at weekly interval. The fruit set at pea nut stage was counted on selected 20 panicles in all directions and average fruit set was calculated. Fruit retention at harvest stage of fruit was counted and recorded. The yield of the mango fruits per tree in number as well as kilogram per hectare was recorded by counting the number and weighing of fruits. The quality aspects viz. sensory qualities, TSS (^{o}Brix), acidity (%) and Total sugars (%) were estimated. The data were analyzed statistically as per Panse and Sukhatme, 1985 [6] using FRBD and valid conclusions were drawn only on significant differences between treatment mean at 0.05% and 0.01% level of significance.

RESULTS AND DISCUSSION

Growth Parameters

Days required for emergence of vegetative shoots

The results presented in Table 1 reveal that the highest days (12.33 days) required for emergences of vegetative shoots were observed in the pruning in third week of November (T_4) on past season wood (M_3), while the lowest days (8.33) required for emergences of vegetative shoots were recorded the treatment where pruning was carried out in the first week of October (T_1) on the 50% current season wood (M_2). Among treatments, T_4 was required highest number of days (11.67 days) for emergences of vegetative shoots and which was significantly superior over all the treatments.

Among the interactions, pruning the shoots on past seasons wood in the third week of November (M_3T_4) was superior over rest of the interactions. This might be due to, the pruning operations reduces the number of growing points of trees, increase the supply of available nitrogen and other nutrients to the growing points which remain on the tree and thus increase in number of cells. The present findings are in conformity with the findings of Sant Ram (1996) [8] who found the maximum new shoots in month of September-October and production of new shoot was found essential to maintain continuity of vigour and provide terminal bud for panicles emergence.

Numbers of vegetative shoot

The results presented in Table 1 as regards to numbers of vegetative shoot reveal that the highest numbers of vegetative shoots (3.58) recorded on past season shoots (M_3) where carried out in the first week of October (T_1) while lowest (1.02) numbers of vegetative shoot were observed in control treatment. Among the pruning methods, M_3 was superior over M_1 and M_2 methods of pruning. Among the treatments, T_1 produced more numbers of vegetative shoot (3.14) and was significantly superior over all the treatments while T_7 (control) had shown lowest numbers of vegetative shoot. Among the interaction, M_3T_1 and M_3T_6 was superior over rest of the interactions. The production of more

Table 1
Effect of season and methods of pruning on days required for emergence of vegetative shoots, numbers of vegetative shoots and leaves per shoot in mango cv. Alphonso

	Days required for emergence of vegetative shoots				*Numbers of vegetative shoot*				*Number of leaves per shoot*			
Treatments	*Methods of pruning*				*Methods of pruning*				*Methods of pruning*			
	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*
T_1	11.50	8.33	11.40	10.41	3.07	2.77	3.58	3.14	8.50	12.38	7.23	9.37
T_2	10.50	9.33	10.17	10.00	3.37	2.63	2.48	2.83	7.69	11.34	7.42	8.82
T_3	12.00	9.17	11.17	10.78	2.01	3.08	2.74	2.61	9.16	9.03	9.27	9.15
T_4	11.33	11.33	12.33	11.67	1.60	2.20	1.44	1.75	5.81	7.55	7.57	6.98
T_5	12.17	8.90	10.67	10.58	2.77	1.42	2.36	2.18	11.66	9.94	7.95	9.85
T_6	10.50	9.33	11.67	10.50	2.59	1.61	3.44	2.55	8.10	8.76	10.07	8.98
T_7	0.00	0.00	0.00	0.00	1.02	1.02	1.02	1.02	6.42	6.42	6.42	6.42
Mean	9.71	8.06	9.63	9.13	2.35	2.10	2.44	2.29	8.19	9.35	7.99	8.51
	Method	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*	
S.Em. (±)	0.16	0.24	0.42		0.13	0.20	0.35		0.41	0.63	1.09	
C.D. (P = 0.05)	0.46	0.70	1.22		0.39	0.59	1.03		1.19	1.82	3.16	

numbers of shoot of pruned trees might be due to the higher vigour of trees. This suggest that the total numbers of vegetative shoot emerged per shoot depended upon the magnitude of the climatic response. The present findings are in accordance with those reported by Oosthuyse (1994) [4] recorded highest number of new shoots after pruning in mango.

Numbers of leaves per shoot

The results presented Table 1 further reveal that the highest (12.38) numbers of leaves per shoot were recorded the pruning was carried out on 50% current season shoots growth (M_2) in the first week of October (T_1) while the lowest (5.81) numbers of leaves per shoot were observed in lightly pruned shoots on current season growth (M_1) in the third week of November (T_4). Among the pruning methods, M_2 was significantly superior over M_1 and M_3. Among the treatments, T_5 produced more numbers of leaves (9.85) per shoot and was significantly superior over all the treatments. Among the interaction, M_2T_1 produced more numbers of leaves (12.38) per shoot and was superior over rest of the interactions. This might be due to the varietals difference and the condition in which the varieties grown.

Days required for full development of shoot

The results presented in Table 2 reveal that the highest days (93.21) required for full development of vegetative shoots were observed in the pruning which was carried out in the third week of December (T_6) on past season wood (M_3), while the lowest days (64.47) required for full development of vegetative shoots were recorded the treatment where pruning was carried in the first week of October (T_1) on the past season wood (M_3). Among the pruning methods, M_3 was superior over M_1 and M_2 methods.

Among treatments, T_7 (control trees) was significantly superior over all the treatments. The interaction data indicated that M_3T_6 was significantly superior over the other. The present findings are in accordance with the findings reported by Oosthuyse (1994) [4] found that in the unpruned trees (control), shoots development was delayed.

Vegetative shoot length (cm)

The results presented in Table 2 as regards to vegetative shoots length (cm) reveal that the highest vegetative shoots length (20.55cm) observed on past season wood (M_3) which was carried out in third week of December (T_6), while the lowest length (10.91 cm) of vegetative shoots were recorded in lightly pruned on current season shoots (M_1) which was carried out in third week of December (T_6). Among treatments, T_5 had given highest vegetative shoots length (15.92 cm) while T_7 (control) had shown lowest vegetative shoots length (12.95 cm). Among the interactions, pruning the shoots on past season wood in the third week of December (M_3T_6) was superior over the other. The increased length of shoot after pruning might be due to the availability of longer effective growing season and high pruning vigour. Kaewnate *et al.* (2003) [1] recorded that Rad variety of mango had a greater length of shoots than the Nam Doc Mai variety after different methods of pruning.

Shoot girth (cm)

The results presented in Table 2 further reveal that the highest shoot girth (2.50 cm) was observed in lightly pruned on current season shoots (M_1) which was carried out in first week of October (T_1) and the lowest (1.04 cm) shoot girth was recorded on lightly pruning on current season shoot pruning method (M_1) which was carried out in first week of December (T_5). Among the pruning methods, M_1 was significantly superior over other. Among the treatments, T_1 was significantly superior over other. The interaction data indicated that M_1T_1 was superior over the other. The maximum girth of new shoots might be due to high foliage which consequently resulted high vigour in pruned trees. The present findings are in accordance with those reported by Lal *et al*. (2000) [2] they observed length and girth of emerging shoots were more in first, second and third order pruning trees than in fourth and fifth order treatment.

Flowering Parameters

Days required for emergence of inflorescence

The results presented in Table 3 as regards to days required for emergence of inflorescence reveal that the highest days (94.67) required for emergence of inflorescence in control trees. *i.e.* no pruning operation followed, while that of the lowest days (21.33) required for emergences of inflorescence

Table 2
Effect of season and methods of pruning on days required for full development of shoot, shoot length (cm) and shoot girth (cm) in mango cv. Alphonso

	Days required for full development of shoot				*Length of shoot (cm)*				*Girth of shoot (cm)*			
Treatments	*Methods of pruning*				*Methods of pruning*				*Methods of pruning*			
	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*
T_1	84.49	72.50	64.47	73.82	16.63	14.60	14.93	15.39	2.50	2.01	2.15	2.22
T_2	89.83	76.40	88.33	84.86	14.14	13.63	17.22	15.00	2.08	2.12	1.93	2.04
T_3	88.50	67.02	84.17	79.89	14.08	13.28	13.68	13.68	1.58	1.54	2.02	1.71
T_4	87.24	69.06	86.83	81.04	13.73	13.19	16.30	14.41	1.69	1.69	1.71	1.70
T_5	85.00	68.00	83.37	78.79	15.01	14.82	17.92	15.92	1.04	1.81	1.56	1.47
T_6	72.33	82.50	93.21	82.68	10.91	14.52	20.55	15.33	1.12	1.51	1.91	1.51
T_7	89.67	89.67	89.67	89.67	12.95	12.95	12.95	12.95	1.66	1.66	1.67	1.66
Mean	85.29	75.02	84.29	81.53	13.92	13.85	16.22	14.66	1.67	1.76	1.85	1.76
	Method	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*	
S.Em. (±)	1.17	1.80	3.11		0.32	0.49	0.85		0.08	0.12	0.21	
C.D. (P = 0.05)	3.41	5.21	9.03		0.93	1.42	2.46		0.23	0.35	0.62	

were recorded in the treatment where pruning was carried in the first week of November (T_3) and on the past season wood (M_3). Among the pruning methods, M_1 was significantly superior over other methods. Besides, the method M_2 had required lowest days for emergence of inflorescences as compared to M_1 method.

Among the treatments, T_1 was significantly superior over all the treatments. The interaction data indicated that M_1T_1 was superior over rest of the interactions, except control. The comparatively observations indicated that the lowest days for emergence of inflorescence after pruning were required to the treatments T_6, T_3 and T_4 as compared to the control trees. This might be due to the cutting of branches; twigs induced simultaneous accumulation of ethylene, ascorbic acid, abscissic acid, cytokinins and sudden lowering of gibberellins, all these lead to the flowering. The present findings are in accordance with those reported by Ravishankar (1987) [7] who found that the shoots of Alphonso pruned later in September and October produced flower, emphasizing the significance of timing of the pruning treatment.

Days required for maximum flowering after emergence of inflorescence

The results presented in Table 3 as regards to number of days required for maximum flowering in days reveal that the highest number of days required for maximum flowering in days (29.59) were observed on 50% current season shoots (M_2) carried out in first week of October (T_1) and the lowest days (8.00) were required on the past season wood (M_3) which was carried out in third week of October (T_2). Among the pruning methods, M_2 was significantly superior over other methods.

Among the treatments, T_1 was superior over all the treatments and T_6 had shown lowest number of days (18.01) required for maximum flowering .The interaction data indicated that, M_2T_1 was superior over rest of the interactions. The present findings are in accordance with those reported by Oosthuyse (1997) [5] who shown that the flowering intensity was increased by winter pruning due to enhanced number of inflorescence developed on terminal shoots.

Table 3
Effect of season and methods of pruning on days required for emergence of inflorescence, days for maximum flowering and fruit yield (kg) per plant in mango cv. Alphonso

	Days required for emergence of inflorescence				*Days for emergence to maximum flowering*				*Fruit yield (kg) per plant*			
Treatments	*Methods of pruning*				*Methods of pruning*				*Methods of pruning*			
	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*	M_1	M_2	M_3	*Mean*
T_1	94.67	86.50	86.30	89.16	28.91	29.59	26.53	28.35	53.83	39.50	31.60	41.65
T_2	91.67	81.50	26.67	66.61	27.60	23.66	8.00	19.75	33.77	45.38	7.50	28.88
T_3	63.00	66.83	21.33	50.39	28.56	24.25	9.00	20.60	27.25	47.40	0.83	25.16
T_4	59.00	64.50	65.05	62.85	27.38	24.55	26.33	26.09	21.80	20.60	9.30	17.23
T_5	76.13	72.00	65.29	71.14	29.50	28.59	26.17	28.09	15.05	22.57	6.35	14.65
T_6	63.50	65.30	0.00	42.93	25.19	28.84	0.00	18.01	21.93	20.67	0.00	14.20
T_7	100.0	100.0	100.0	100.0	27.57	27.57	27.57	27.57	9.83	9.83	9.83	9.83
Mean	78.28	76.66	52.09	69.01	27.82	26.72	17.66	24.06	26.21	29.42	9.34	21.65
	Method	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*		*Method*	*Treatment*	*Interaction*	
S.Em. (±)	4.58	7.00	12.13		1.39	2.12	3.67		1.66	2.54	4.40	
C.D. (P = 0.05)	13.28	20.29	35.14		4.02	6.15	10.65		4.82	7.36	12.76	

Fruit yield per tree (kg)

The results presented in Table 3 further reveal that the highest (53.83 kg) yield per tree in kg were recorded on lightly pruning on current season shoots (M_1) carried out in first week of October (T_1), while that of the lowest (0.83 kg) yield per tree in kg were recorded on 50% current season wood (M_2) which was carried out in first week of November (T_3). Among the pruning methods, M_1 was superior over rest of the methods and method M_2 was at par with M_1 method.

Among the treatments, T_1 was superior over rest of the treatments while T_7 (control) had shown lowest fruit yield (kg). The interaction M_1T_1 was significantly superior over rest of the interactions. The pruning treatments exhibited maximum yield over control. The similar results were reported by Sant Ram (1996) [8] in Dashehari under Tarai condition.

CONCLUSION

Thus, it can be concluded that the pruning of shoot up to the past season growth increase the early emergence of shoots, more number of vegetative shoots, higher shoot length and girth. This is be useful to regain the vegetative growth when the tree will exhausted due to higher yields, while that of the pruning of current season shoots in the first and third week of October resulted in the early emergence of inflorescence, flowering and yield.

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