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Effect of spacing and severity of pruning on yield of drumstick cv. PKM-1

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ABSTRACT

The experiment was conducted at horticulture research farm under middle Gujarat agro-climatic zone –III (AES-II) during the 2005, 2007 and 2008. The experiment was laid out in split plot with four replications. Treatment involved three levels of spacing *i.e.* S_1 = 2 x 2 m, S_2 = 2 x 3 m and S_3 = 3 x 3 m and two different levels of pruning *i.e.* P_1 = 90 cm from ground level and P_2 = 120 cm from ground level. The wider planting distance (3 x 3 m) with pruning at 90 cm from ground level gave significantly maximum plant height (cm), number of branches per plant, length of branches (m), diameter of branches (cm), average weight of pod (g), average length of pod (cm), diameter of pod (cm), number of pods per plant, yield of pods per plant (kg), yield of pod (t/ha) and total soluble solids (%).

Key words : Drumetick, Spacing, Pruning

INTRODUCTION

The vegetables are considered as 'protective supplementary food' as they contain large quantity of minerals, vitamins and essential amino acids, which are required for normal functioning of human metabolic processes. The important minerals, calcium, phosphorus and iron, which are generally lacking in cereals while, they are available in abundant quantities in vegetables (Shanmugavelu, 1989). It is small to medium sized tree. The flowers are white and appear in large panicles while the fruits are triangular. Some varieties found in south India grow pods longer than one meter. It is normally cut back one meter or less annually and allowed to regrow. It is a sun and heat loving plant. Its pods have long been popular as a traditional herbal treatment for diabetes in the middle east and also used as pain killer for joints in human beings.

Spacing plays an important role in maintaining adequate plant population. Establishment of appropriate row spacing for maintaining the optimum plant population per unit area is the most pre-requisite to obtain maximum yield for any field crops. Moreover, row spacing provides space for easy interculturing, weeding and application of fertilizers in the field. Appropriate row spacing also renders scope for a better growth and development of crops, which reflects in higher crop production. The optimum pruning provides better condition for light, nutrition and moisture for plant growth, which results in timely commencement of reproductive phase and thus, formation of more fruits.

MATERIALS AND METHODS

The experiment was conducted at horticulture research farm under middle Gujarat agro-climatic zone – III (AES-II) during year 2005, 2007 and 2008. The experiment was laid out in split plot with four replications. Treatment involved three levels of spacing *i.e.* S_1 = 2 x 2 m, S_2 = 2 x 3 m and S_3 = 3 x 3 m and two different levels of pruning *i.e.* P_1 = 90 cm from ground level and P_2 = 120 cm from ground level. FYM 10 tones per hectare while, 90 g nitrogen, 15 g phosphorus and 30 g potash per plant was applied every year. Nitrogen was given in two split-first after pruning and second in October month.

RESULTS AND DISCUSSION

The data presented in Table 1 indicated that wider planting distance (3 x 3 m) showed significantly higher plant height in the year 2005 (4.25 m) and in pooled (5.21 m), but it was non significant in the years 2007 and 2008. Pruning at 90 cm from ground level of drumstick significantly increased plant height in the year 2007 and 2008, while it was non significant in the year 2005 and in pooled data. Interaction effect between spacing and pruning was non significant.

Pruning at 90 cm from ground level of drumstick recorded significantly higher number of branches (8.88) in wider spacing (3 x 3 m) in pooled while, it was lower (6.21) in closer spacing. The middle distance (2 x 3 m) was statistically at par with wider spacing. When the plants were pruned at the height of 120 cm from ground level caused significantly higher number of branches in all the years and in pooled (8.21) as compared to 90 cm pruning height from ground level. All the interaction effects were found non significant.

The data presented in Table 2 revealed that there were no any significant effect of spacing in arising of length of branch, but only 2007 year found significant. When the plants pruned at 90 cm from ground level showed maximum length of branches in 2005 and 2007 year and in pooled (3.45, 5.10 and 4.72 m, respectively).

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Table 1 : Effect of spacing and severity of pruning on plant height (m) and number of branches per plant in drumstick cv. PKM-1

Treatments	Plant height (m)				Number of branches per plant			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
Spacing								
S_1 = 2 x 2 m	3.26	5.04	6.06	4.79	4.62	7.19	6.81	6.21
S_2 = 2 x 3 m	4.10	5.32	5.88	5.10	6.17	8.19	8.88	7.75
S_3 = 3 x 3 m	4.25	5.44	5.94	5.21	6.98	8.55	11.13	8.88
S. E. ±	0.134	0.231	0.197	0.110	0.075	0.152	0.444	0.442
C.D. (P=0.05)	0.462	NS	NS	0.328	0.258	0.525	1.538	1.734
C. V. %	9.76	12.41	9.33	10.76	3.56	5.38	14.06	10.20
Pruning								
P_1 = 90 cm	4.03	5.56	6.38	5.32	5.42	7.60	8.04	7.02
P_2 = 120 cm	3.71	4.97	5.54	4.74	6.43	8.35	9.83	8.21
S. E. ±	0.128	0.136	0.178	0.149	0.116	0.170	0.408	0.152
C.D. (P=0.05)	NS	0.436	0.571	NS	0.371	0.545	1.305	0.442
C. V. %	11.44	8.96	10.37	10.27	6.79	7.40	15.81	12.01
Interaction								
S x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x S	NS	NS	NS	NS	NS	NS	NS	NS
Y x S x P	NS	NS	NS	NS	NS	NS	NS	NS

NS- Non significant

The spacing and pruning interaction was found non significant but the interaction effect of Y x S x P wasfound significant, when the plant pruned at 120 cm from ground level in wider spacing (3 x 3 m) recorded maximum length of branch (6.13 m) followed by 90 cm pruning height treatment from ground level in 2008 year in closer spacing (Table 2.1).

The diameter of branch was found significantly higher in the wider spacing (3 x 3 m) in all the three years as well as in pooled. The lower pruning height (90 cm) recorded significantly more diameter of branch (5.52 cm) as compared to higher level of pruning height *i.e.* 120 cm

Table 2 : Effect of spacing and severity of pruning on length of branches (m) and diameter of branches in drumstick cv. PKM-1

Treatments	Length of branches (m)				Diameter of branches (cm)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
Spacing								
S_1 = 2 x 2 m	2.97	3.76	5.38	4.04	3.96	4.79	5.02	4.59
S_2 = 2 x 3 m	3.37	5.49	5.31	4.73	4.77	5.93	5.65	5.45
S_3 = 3 x 3 m	3.42	5.51	5.75	4.90	5.15	6.11	6.10	5.79
S. E. ±	0.153	0.124	0.197	0.290	0.179	0.141	0.150	0.091
C.D. (P=0.05)	NS	0.429	NS	NS	0.621	0.489	0.519	0.271
C. V. %	13.30	7.12	10.15	9.98	10.96	7.12	7.59	8.45
Pruning								
P_1 = 90 cm	3.45	5.10	5.63	4.72	4.84	5.88	5.83	5.52
P_2 = 120 cm	3.07	4.74	5.33	4.38	4.42	5.33	5.35	5.03
S. E. ±	0.060	0.109	0.159	0.067	0.110	0.112	0.075	0.058
C.D. (P=0.05)	0.193	0.348	NS	0.195	0.352	0.359	0.241	0.169
C. V. %	6.43	7.67	10.03	8.86	8.24	6.92	4.67	6.61
Interaction								
S x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x S	NS	NS	NS	NS	NS	NS	NS	NS
Y x S x P	NS	NS	NS	Sig.	NS	NS	NS	NS

NS-Non significant

Table 2.1 : Interaction effect of Y x S x P (Pooled) on length of branches (m) in drumstick cv. PKM-1

Treatments	P_1	P_2
Y_1S_1	3.15	2.80
Y_1S_2	3.55	3.20
Y_1S_3	3.65	3.20
Y_2S_1	3.75	3.77
Y_2S_2	5.70	5.28
Y_2S_3	5.85	5.17
Y_3S_1	5.88	4.88
Y_3S_2	5.63	5.0
Y_3S_3	5.38	6.13
S. E. ±	0.202	
C.D. (P=0.05)	0.585	
C. V. %	8.86	

from ground level. All the interaction effects were found non significant.

It might be due to the less competition for light, nutrients and moisture under the wider spacing so, plant was more vigorous in terms of branching. The results are in accordance with the findings of Baswana and Saharan (1993), Patel *et al.* (1994) and Yadav *et al.* (2003).

The data presented in Table 3 indicated that average weight of pod found significantly more in wider spacing (3 x 3 m) *i.e.* 41.71 g/pod in pooled while it was lower in closer spacing *i.e.* 33.63 g/ pod in pooled. When the plants pruned at 90 cm from ground level recorded higher average pod weight (39.58 g) as compared to 120 cm pruning height from ground level. All the interactions were found non significant.

The average length of pod was found non significant in 2005 as well as in pooled but it was found significant in the year 2007 and 2008. Longer pod length (46.92 cm) was observed in wider spacing as compared to closer spacing (40.50 cm). Pruning height was found effective in increasing length of pod and longer pods (45.58 cm) were recorded in lower pruning height *i.e.* 90 cm from ground level as compared to 120 cm pruning height. The interaction effects were found non significant.

The diameter of pod presented in Table 4 indicated that there was no any significant effect of spacing in all the three years while, it was significant in pooled data. The maximum diameter of pod (1.22 cm) was observed in wider spacing (3 x 3 m). When the plants pruned at 90 cm from ground level caused more pod diameter (1.22 cm) as compared to 120 cm pruning height at ground level (1.12 cm). All the interaction effects were found non significant.

The significantly higher number of pods per plant (546.42) were recorded in pooled at wider distance (3 x 3 m) as compared to closer planting distance (2 x 2 m). The pruning effect was found non significant for getting higher number of pods in pooled as well as in 2005 and

Table 3 : Effect of spacing and severity of pruning on average weight of pod (g) and average length of pod (cm) in drumstick cv. PKM-1

Treatments	Average weight of pod (g)				Average length of pod (cm)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
Spacing								
S_1 = 2 x 2 m	31.38	35.38	34.13	33.63	41.25	42.38	37.88	40.50
S_2 = 2 x 3 m	37.25	38.75	38.88	38.29	41.75	49.50	44.25	45.17
S_3 = 3 x 3 m	40.38	43.75	41.00	41.71	43.50	49.13	48.13	46.92
S. E. ±	1.452	0.633	1.378	0.700	1.357	1.116	0.800	1.370
C.D. (P=0.05)	5.026	2.192	4.767	2.079	NS	3.861	2.770	NS
C. V. %	11.31	4.56	10.25	9.05	9.10	6.71	5.21	7.13
Pruning								
P_1 = 90 cm	38.42	40.67	39.67	39.58	43.42	48.17	45.17	45.58
P_2 = 120 cm	34.25	37.92	36.33	36.17	40.92	45.83	41.67	42.81
S. E. ±	0.963	0.769	0.699	0.472	0.925	0.640	0.832	0.466
C.D. (P=0.05)	3.082	2.192	2.236	1.371	NS	2.048	2.661	1.354
C. V. %	9.19	6.78	6.37	7.48	7.60	4.72	6.64	6.33
Interaction								
S x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x S	NS	NS	NS	NS	NS	NS	NS	NS
Y x S x P	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non significant

Table 4 : Effect of spacing and severity of pruning on diameter of pod (cm) and number of pods per plant in drumstick cv. PKM-1

Treatments	Diameter of pod (cm)				Number of pods per plant			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
Spacing								
S_1 = 2 x 2 m	1.03	1.13	1.14	1.10	255.00	617.88	555.63	476.17
S_2 = 2 x 3 m	1.20	1.19	1.18	1.19	306.13	632.88	593.38	510.79
S_3 = 3 x 3 m	1.21	1.24	1.20	1.22	316.25	675.38	647.63	546.42
S. E $\pm$	0.051	0.036	0.028	0.023	19.038	14.811	16.465	9.735
C.D. (P=0.05)	NS	NS	NS	0.068	NS	NS	56.977	28.925
C. V. %	12.55	8.62	6.75	9.57	18.41	6.52	7.78	9.33
Pruning								
P_1 = 90 cm	1.22	1.22	1.22	1.22	297.25	640.92	629.08	522.42
P_2 = 120 cm	1.08	1.15	1.13	1.12	287.67	643.17	568.67	499.83
S. E $\pm$	0.022	0.028	0.015	0.030	9.493	13.355	6.299	13.592
C.D. (P=0.05)	0.071	NS	0.047	6.60	NS	NS	20.150	NS
C. V. %	6.74	8.09	4.39	NS	11.24	7.21	3.64	6.87
Interaction								
S x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x S	NS	NS	NS	NS	NS	NS	NS	NS
Y x S x P	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non significant

2007 while, it was significant in the year 2008. The significantly more number of pods (629.08) were found in lower pruning height (90 m from ground level). The interaction effect was found non significant. This may be due to the tree pruned heavily had less competition among the individuals as compared to lightly pruned trees. These findings are in conformity with that of Kandolia and Bhuva (1996) in phalsa, Gupta and Godara (1989) in ber.

The data presented in Table 5 indicated that the significantly higher yield (24.74 kg/ tree) was observed as compared to closer spacing treatments in pooled data. There was not any significant effect in yield of pods per plant (kg) when plant pruned at the height of 90 or 120 cm from ground level in the year 2005, 2007 and in pooled

Table 5 : Effect of spacing and severity of pruning on yield of pods per plant (kg) and yield of pods (t/ ha) in drumstick cv. PKM-1

Treatments	Yield of pods per plant (kg)				Yield of pods (t/ ha)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
Spacing								
S_1 = 2 x 2 m	10.90	23.29	21.84	18.67	27.25	58.22	54.59	46.69
S_2 = 2 x 3 m	12.72	25.23	21.78	19.91	21.21	42.05	36.29	33.18
S_3 = 3 x 3 m	13.59	30.71	29.91	24.74	15.09	34.31	33.37	27.59
S. E. $\pm$	0.253	1.063	1.087	1.142	0.496	2.013	1.730	2.197
C.D. (P=0.05)	0.876	3.679	3.760	4.483	1.718	6.966	5.986	8.623
C. V. %	5.77	11.39	12.54	11.92	6.63	12.79	11.81	12.31
Pruning								
P_1 = 90 cm	12.78	26.32	25.50	21.53	21.82	44.66	43.20	36.56
P_2 = 120 cm	12.03	26.50	23.52	20.68	20.55	45.05	39.64	35.08
S. E. $\pm$	0.382	0.517	0.307	0.444	0.904	1.055	0.547	0.498
C.D. (P=0.05)	NS	NS	0.982	NS	NS	NS	1.751	1.445
C. V. %	10.67	6.78	4.34	6.75	14.79	8.15	4.58	8.34
Interaction								
S x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x P	NS	NS	NS	NS	NS	NS	NS	NS
Y x S	NS	NS	NS	NS	NS	NS	NS	NS
Y x S x P	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non significant

Table 6 : Effect of spacing and severity of pruning on total soluble solids (%) of drumstick cv. PKM-1

Treatments	Year			
	2005	2007	2008	Pooled
Spacing				
S_1 = 2 x 2 m	11.48	11.79	11.66	11.64
S_2 = 2 x 3 m	11.85	11.84	11.88	11.85
S_3 = 3 x 3 m	12.26	12.23	12.30	12.26
S.E. ±	0.192	0.177	0.170	0.104
C.D. (P=0.05)	NS	NS	NS	0.309
C. V. %	4.58	4.18	4.04	4.27
Pruning				
P_1 = 90 cm	12.07	12.16	12.14	12.12
P_2 = 120 cm	11.66	11.74	11.75	11.72
S.E. ±	0.142	0.080	0.176	0.080
C.D. (P=0.05)	NS	0.257	NS	0.232
C. V. %	4.14	2.33	5.11	4.03
Interaction				
S x P	NS	NS	NS	NS
Y x P	NS	NS	NS	NS
Y x S	NS	NS	NS	NS
Y x S x P	NS	NS	NS	NS

NS-Non significant

and law yield under narrow spacing. But larger numbers of plants under minimum row spacing have contributed to attaining the maximum yield. These findings are in accordance with the results of Baswana and Saharan (1993) and Trivedi and Vyas (2000).

The data presented in Table 6 indicated that total soluble solids of drumstick pulp was found non significant in all the three years result but it was significant in pooled data. The significantly higher TSS (12.26 %) was recorded in wider spacing as compared to closer spacing (11.64 %). When the plants pruned at 90 cm height from ground level gave more TSS (12.12 %) as compared to plant pruned at 120 cm height from ground level (11.72 %) in pooled data. All the interaction effects were found non significant.

The data presented in Table 7 indicated that maximum gross realization (Rs. 144450) was obtained in treatment S_1P_1 (2 x 2 m planting distance and pruning at 90 cm height from ground level) with maximum net return (Rs. 102550) and higher CBR (1 : 4.63)

Table 7 : Economics of different pruning treatment on drumstick cv. PKM-1

Sr. No.	Treatment combination	Pod yield (t/ ha.)	Gross realization (Rs.)	Total cost of cultivation (Rs.)	Net return (Rs.)	CBR
1.	S_1P_1	48.15	144450	22129	102550	1 : 4.63
2.	S_1P_2	45.23	135690	22129	93790	1 : 4.23
3.	S_2P_1	33.46	100380	17623	64130	1 : 3.64
4.	S_2P_2	32.91	98730	17623	62480	1 : 3.55
5.	S_3P_1	28.07	84210	14354	59910	1 : 4.17
6.	S_3P_2	27.11	81330	14354	57030	1 : 3.97

Rate : Selling price of Drumstick pod- Rs. 3/ kg

while Plant pruned at 90 cm from ground level was significantly higher (25.50 kg) in the year 2008. All the interaction effects were found non significant.

The yield of pods (t/ ha) was significantly higher (46.69 t/ha) in closer distance (2 x 2 m) as compared to wider spacing in all the years and in pooled. The high density planting of drumstick gave 19.10 tones more yield as compared to wider spacing. There was no much more effect of pruning height for getting the yield of pod but when the plants pruned at the height of 90 cm from ground level gave 1.40 tones more yield than 120 cm pruning height. All the interaction effects were found non significant. It might be due to the higher uptake of plant nutrients increased yield attributes and ultimately yield under wider spacing. Mainly due to increased inter plant competition for nutrients, water, light and space in closer spacing, ultimately attributed less growth and development, less values in yield attributing characters

The farmers of middle Gujarat agro climatic zone-III are advised to plant the drumstick cv. PKM-1 crop at the spacing of 2.0 x 2.0 m and prune the plants starting from second year at 90 cm height from ground level during the month of May for obtaining higher yield (48.15 t/ ha) and net return (Rs. 102550) with CBR (1 : 4.63).

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