

Original Research Article

Effect of Severity and Time of Pruning on Growth, Flowering and Fruit Set of Hasta Bahar in Acid Lime

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ABSTRACT

An experiment was carried out to evaluate effect of severity and time of pruning on growth and flowering of hasta bahar in acid lime in Factorial Randomized Block Design with two factors, time with three levels viz., 1st September, 15th September and 1st October and severity with three levels viz., 5 cm, 10 cm and 15 cm with overall 9 treatment combinations and replicated three times. In time of pruning, pruning at 1st September found significantly superior in regards to plant height, mean spread, canopy volume and leaf area. While, pruning at 15th September found significantly superior in regards to flowers per meter shoot, fruit set per cent. In severity pruning, pruning with 15 cm found significantly superior in regards to plant height, mean spread, canopy volume, leaf area, While pruning with 10 cm found significantly superior in regards to days for flowering from pruning date, flowers per meter shoot, fruit set per cent. Pruning with 10 cm severity at 15th September time was found significantly superior in regards to flowers per meter shoot, fruit set per cent.

Keywords

Severity of pruning, Time of pruning, Growth, Flowering, Fruit set, Hasta bahar, Acid lime

Introduction

Citrus is considered as most important fruit crops with their wholesome nature, multifold nutritional and medicinal values have made them so important. The important commercial products of acid lime are lime oil and ascorbic acid, which are used for flavouring. It is used in preparing refreshing drinks, preserved products like pickle, syrup, marmalade and squash. For induction of hasta bahar in acid lime by the application of chemicals may affects on the health of the plant and produce more dead wood. These should be always easy to define correct time of application but not according to calendar dates and application of the chemicals is also somewhat difficult in rainy season. The climatic conditions

during certain period vary from year to year and cause shifts in the development stage. This is more dealing with different places. Pruning at bearing stage may help to induce a good healthy shoots which will provide maximum fruit bearing area. Therefore this work was planned to study the effect of severity and time of pruning on growth, flowering and fruit set of hasta bahar in acid lime.

Materials and Methods

The experiment was carried out in Acid lime orchard during the year 2014-15 at All India Co-ordinated Research Project on Citrus (AICRP on Citrus), Dr. Panjabrao

Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in Factorial Randomized Block Design with two factors time with three levels *viz.*, 1st September, 15th September and 1st October and severity with three levels *viz.*, 5 cm, 10 cm and 15 cm with overall 9 treatment combinations and replicated three times. The observations were recorded at various parameters *viz.*, per cent increase in height of plant, mean spread and canopy volume, leaf area, days for flowering from pruning date, flowers per meter shoot, fruit set per cent.

Results and Discussion

Per cent increase in height of plant over initial

The data presented in Table 1 indicated that, the difference in per cent increase in height of plant over initial was found to be significant at different severity of pruning. The maximum per cent increase in height of plant (9.68 %) was observed in 15 cm pruning and minimum (6.98 %) in 5 cm pruning. Severity of pruning increased the increasing per cent increase in height of plant may be due to lesser competition among the fever shoots that arise on the plant receiving heavy pruning than the trees under light pruning. These results are in close conformity with the finding of Nath (1994) in Assam lemon, Tayde and Ingle (1997) in Nagpur mandarin and Ingle *et al.*, (2005) in acid lime.

The difference in per cent increase in height of plant over initial was significantly influenced at different time of pruning. The maximum per cent increase in height of plant (9.28 %) observed on 1st September and minimum (7.60 %) on 1st October. The increasing per cent increase in height of plant was maximum when the pruning was done on 1st September as compare to the 15th

September and 1st October. These results may be due to the availability of proper temperature (24 to 33°C) and humidity (65 to 90 %) for better growth of the acid lime plant. These results are corroborated with the finding of Nath (1994) in Assam lemon and Sandhu *et al.*, (1992) in ber. Interaction effect due to severity and time of pruning was found non-significant.

Per cent increase mean spread over initial

The data presented in Table 1 shown the difference in per cent increase in spread of plant over initial was found significant at different severity of pruning. The maximum per cent increase in spread of plant (9.65 %) was found in 15 cm pruning and minimum (7.60 %) in 5 cm pruning. Increase in spread of plant may be attributed due to lesser competition among the fever shoots that arise on the plant receiving heavy pruning than the trees under light pruning. Similar results are reported by Nath (1994) in Assam lemon, Tayde and Ingle (1997) in Nagpur mandarin and Ingle *et al.*, (2005) in acid lime.

The data from Table 1 shown the difference in per cent increase in spread of plant over initial was significantly influenced by time of pruning. The maximum per cent increase spread of plant (10.19 %) was found in 1st September and minimum (7.20 %) in 1st October. The increase spread in mean spread of plant over initial mean spread was maximum when the pruning was done in the 1st September as compare to the 15th September and 1st October pruning. These results may be due to the availability of proper temperature (24 to 33°C) and humidity (65 to 90 %) for better growth of the acid lime plant. These results are close conformity with the finding of Nath (1994) in Assam lemon and Sandhu *et al.*, (1992) in ber.

Per cent increase canopy volume of plant

Table 1 revealed that, per cent increase in canopy volume over initial was by influenced severity of pruning. The maximum per cent increase in canopy volume of plant (31.92 %) was found in 15 cm pruning and minimum 23.99 % in 5 cm pruning. Severity of pruning influenced on per cent increase in canopy volume of plant may be due to lesser competition among the fever shoots that arise on the plant receiving heavy pruning than the trees under light pruning treatments. These lines are agree with report of Nath (1994) in Assam lemon, Tayde and Ingle (1997) in Nagpur mandarin and Ingle *et al.*, (2005) in acid lime.

The data from Table 1 indicated that, the difference in per cent increase in canopy volume of plant over initial was found to be significantly influenced by different time of pruning. The maximum per cent increase in canopy volume of plant (10.19 %) was found when pruning on 1st September and minimum (7.20 %) on 1st October. The increase in canopy volume of plant over initial was maximum when the pruning was done in the 1st September as compare to the 15th September and 1st October pruning. This result may be due to the early pruning treatments in acid lime. These results are close conformity with the finding of Nath (1994) in Assam lemon and Sandhu *et al.*, (1992) in ber. Interaction effect due to different severity and time of pruning was found non-significant.

Leaf area

Data revealed that on leaf area was significantly influenced by severity of pruning treatments. Maximum leaf area (20.34 cm²) was observed when tree pruned at 15 cm severity which is at par with 10 cm severity (19.39 cm²) and minimum leaf area

(18.02 cm²) recorded in 5 cm pruning. These result are corroborated with report of Nath (1994) in Assam lemon, Tayde and Ingle (1997) in Nagpur mandarin and Ingle *et al.*, (2005) in acid lime.

The data from Table 1 revealed that, the time of pruning had significant effect on leaf area. Significantly maximum leaf area (19.87 cm²) was found on 1st September which is at par with 15th September (19.35 cm²) and minimum leaf area (18.54 cm²) was recorded on 1st October. Interaction effect of severity and time pruning was found to be non-significant effect on leaf area.

Days required for flowering from pruning date

Perusal of data in Table 2 revealed that days required for flowering was significantly by severity of pruning.

The minimum days (46.21 days) for flowering was observed in 10 cm pruning and maximum days (53.81 days) for flowering observed 5 cm pruning. The duration for flowering was recorded under medium pruning which may be due to more nutrient availability in the branches or shoots. These results are in accordance with findings of Bajwa *et al.*, (1977) in ber and Khan and Symal (2004) in kagzi lime.

The data pertaining to the influence of time of pruning on days for flowering indicated that the time of pruning had significantly influenced by on time of pruning. The minimum days (43.92 days) required for flowering when plant pruned on 1st October followed by 15th September (49.50 days) and maximum days (57.03 days) for flowering on 1st September. The interaction effect of severity and time pruning was found non-significant on days for flowering.

Table.1 Effect of severity and time of pruning on growth

Treatments	Per cent increase in height of plant over initial (%)	Per cent increase in mean spread over initial (%)	Per cent increase in canopy volume over initial (%)	Leaf area (cm ²)
(A)Time of pruning				
A ₁ (1 st September)	9.28(3.05)	10.29 (3.19)	32.88 (34.99)	19.87
A ₂ (15 th September)	7.82 (2.80)	8.51 (2.92)	27.12 (31.98)	19.35
A ₃ (1 st October)	7.60 (2.76)	7.20 (2.68)	23.61 (29.07)	18.54
F test	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.12	0.12	0.33	0.34
CD at 5 %	0.37	0.36	1.00	1.01
(B)Severity of pruning				
B ₁ (5 cm)	6.98 (2.64)	7.60 (2.76)	23.99 (29.33)	18.02
B ₂ (10 cm)	8.05 (2.84)	8.64 (2.94)	27.69 (31.75)	19.39
B ₃ (15 cm)	9.68 (3.11)	9.65 (3.11)	31.92 (34.40)	20.34
F test	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.12	0.12	0.33	0.34
CD at 5 %	0.37	0.36	1.00	1.01
Interaction effect (A x B)				
A ₁ B ₁	7.84 (2.80)	9.08 (3.01)	28.49 (32.26)	18.55
A ₁ B ₂	9.01 (3.00)	10.18 (3.39)	32.55 (34.79)	20.09
A ₁ B ₃	10.99 (3.32)	11.31 (3.36)	37.59 (37.81)	20.97
A ₂ B ₁	6.80 (2.61)	7.52 (2.74)	23.56 (29.04)	18.23
A ₂ B ₂	7.64 (2.76)	8.37 (2.89)	26.57 (31.01)	19.28
A ₂ B ₃	9.04 (3.01)	9.64 (3.10)	31.24 (33.98)	20.54
A ₃ B ₁	6.31 (2.51)	6.21 (2.49)	19.92 (26.51)	17.27
A ₃ B ₂	7.49 (2.74)	7.38 (2.72)	23.97 (29.31)	18.82
A ₃ B ₃	8.99 (3.00)	8.01 (2.83)	26.94 (31.27)	19.53
F test	NS	NS	NS	NS
SE (m)±	0.21	0.21	0.58	0.58
CD at 5 %	-	-	-	-

Table.2 Effect of severity and time of pruning on flowering

Treatments	Days for flowering from pruning date	Flowers per meter shoot	Fruit set (%)
(A)Time of pruning			
A ₁ (1 st September)	57.03	135.18	41.81 (40.29)
A ₂ (15 th September)	49.50	146.55	45.23 (42.26)
A ₃ (1 st October)	43.92	103.25	33.35 (35.27)
F test	Sig.	Sig.	Sig.
SE (m)±	0.85	0.87	0.40
CD at 5 %	2.54	2.63	1.21
(B)Severity of pruning			
B ₁ (5 cm)	53.81	112.11	36.31 (37.05)
B ₂ (10 cm)	46.21	143.89	44.51 (41.85)
B ₃ (15 cm)	50.42	128.99	39.57 (38.98)
F test	Sig.	Sig.	Sig.
SE (m)±	0.85	0.87	0.40
CD at 5 %	2.54	2.63	1.21
Interaction effect (A x B)			
A ₁ B ₁	60.48	117.55	37.90 (38.00)
A ₁ B ₂	52.57	150.87	45.95 (42.68)
A ₁ B ₃	58.03	137.11	41.60 (40.16)
A ₂ B ₁	51.85	128.11	40.51 (39.53)
A ₂ B ₂	46.75	164.66	51.15 (45.66)
A ₂ B ₃	49.90	146.89	44.04 (41.58)
A ₃ B ₁	49.11	89.99	30.52 (33.54)
A ₃ B ₂	39.11	116.44	36.45 (36.45)
A ₃ B ₃	43.33	103.33	33.08 (35.11)
F test	NS	Sig.	Sig.
SE (m)±	1.47	1.51	0.70
CD at 5 %	-	4.56	2.10

Flowers per meter shoot

It is apparent from the data presented in Table 2 that the severity of pruning significantly influenced on flowers per meter shoot. The maximum flowers (143.89) per meter shoot were observed in plant pruned at 10 cm severity followed by 15 cm severity (128.99). Minimum flowers (112.11) per meter shoot were observed in 5 cm pruned plant. The increased flowers per branch due to 10 cm pruning might be due to removal of excess shoots and movements

of assimilates to fewer growing points. The tree subjected to light and severe pruning produce lower number of flowers per branch. These findings are in arguments with the finding of Nanthakumar and Balakrishnan (1986) in ber, Arora and Yamdagni (1985) in sweet lime, Ingle *et al.*, (2001) in acid lime and Khan and Syamal (2004) in Kagzi lime.

The data regarding time of pruning indicated that flowers per meter shoot were significantly influenced by time of pruning.

The maximum flowers (146.55) per meter shoot were found in trees pruned on 15th September followed by 1st September (135.18). The trees pruned on 1st October produced minimum flowers (103.25) per meter shoot.

Increased flowers per meter shoots when trees pruned on 15th September may be ascribed as due to better climatic condition and lesser flowers per meter shoot bore when tree pruned on 1st October due to delay pruning. Similar results were also reported by Arora and Yamdagni (1985) and Dhillon *et al.*, (1964) with medium pruning in sweet lime. Ingle *et al.*, (1999) maximum sex ratio (Staminate and hermaphrodite flowers) was observed in acid lime.

Interaction effect of severity and time of pruning on flowers per meter shoot of acid lime was found significantly maximum flowers (164.66) observed in tree pruned on 15th September at 10 cm severity followed by 1st September at 10 cm severity (150.87). However, minimum flowers (89.99) observed in pruning on 1st October at 5 cm severity.

Fruit set percentage

Perusal of data from Table 2 revealed that the severity of pruning significantly influenced on fruit set per cent in acid lime. The maximum fruit set (44.51 %) was found in trees pruned at 10 cm severity followed by 15 cm pruning (39.57 %). Minimum fruit set per cent (36.31%) was observed in 5 cm severity. The increased fruit set per cent due to medium pruning might be due to removal of excess shoots and movements of assimilates to fewer growing points as well as the increased fruit set in pruned trees might be due to more nutrient and adequate moisture to the fruits in the remaining shoots of the pruned trees. These findings are in

arguments with the finding of Nanthakumar and Balakrishnan (1986) in ber, Arora and Yamdagni (1985) in sweet lime, Ingle *et al.*, (2001) in acid lime and Khan and Syamal (2004) in Kagzi lime.

A peep of Table 2 indicated that the fruit set per cent was significantly influenced by time of pruning. Maximum fruit set (45.23 %) was found in trees pruned on 15th September followed by 1st September (41.81 %). The minimum fruit set (33.35 %) observed when trees pruned on 1st October. Increased fruit set by 15th September could be due to increased flower production and availability of proper temperature (16 to 34°C) and humidity (40 to 70 %) which favors higher fruit set in hasta bahar of acid lime. These findings are in arguments with the finding of Nanthakumar and Balakrishnan (1986) in ber and Khan and Syamal (2004) in kagzi lime.

Interaction effect of severity and time of pruning on fruit set per cent of acid lime was found significantly maximum fruit set (51.15 %) observed in tree pruned on 15th September at 10 cm severity, followed by 1st September at 10 cm severity (45.95 %). However, minimum fruit set (30.52 %) observed in pruning on 1st October at 5 cm severity.

In time of pruning, pruning at 1st September found significantly superior in regards to plant height, mean spread, canopy volume and leaf area. While, pruning at 15th September found significantly superior in regards to flowers per meter shoot, fruit set per cent. In severity pruning, pruning with 15 cm found significantly superior in regards to plant height, mean spread, canopy volume leaf area. While pruning with 10 cm found significantly superior in regards to days for flowering from pruning date, flowers per meter shoot, fruit set per cent.

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References

- Arora, R. K. and R. Yamdagni, 1985. Effect of different levels of pruning on flowering, fruit set, final retention and fruit quality in sweet lime. *Prog. Horti.* 17(1): 1-4.
- Bajwa, G. S., H. S. Sandhu and J. S. Bal, 1986. Effect of different pruning severity on growth and bearing of ber. *Indian J. Hort.* 43: 203-206.
- Dhillon, J. S., K. K. Singh and J. C. Bakhshi, 1964. Investigation on flowering and fruiting problems in sweet lime. V. Effect of pruning and trunk ringing on flower type, fruit set, fruit drop and yield. *Punjab Hort. J.* 4: 80-87.
- Ingle, H. V., R. B. Athawale, G. S. Tayde and G. B. Pakhare, 2001. Effect of severity of pruning on growth, yield and quality of old acid lime trees. *Agric. Sci. Digest*, 21(1): 65-66.
- Ingle, H. V., S. G. Zambre and B. B. Shinde, 2005. Effect of severity of pruning on growth, yield and quality of old acid lime trees. *Agric. Sci. Digest*, 25(2): 127-129.
- Ingle, H. V., S. G. Zambre and B. B. Shinde, 1999. Citriculture. *Proc. Int. Symp.* 23-27: 397-401.
- Khan, M. and M. M. Syamal. 2004. Effect of pruning on flowering and fruit setting of Kagzi lime. *Indian J. of Hort.* 61(2): 171-172.
- Nanthakumar, S. and K. Balakrishnan, 1986. Effect of pruning on growth, flowering and yield of lime cultivar. *Madras Aaril. J.* 85: 322-324.
- Nath, J. C. 1994. Effect of pruning intensity on growth, yield and quality of Assam lemon. *Haryana. J. Hort. Science.* 23(4): 281-285.
- Sandhu, I. P. S., G. S. Dhaliwal and M. P. Singh, 1983. Effect of pruning on yield, fruit quality and fruit maturity in ber. (*Ziziphus mauritiana* Lamk.) cv. Umran. *J. Res. Punjab agric. Univ.* 20 (4): 135-138.
- Tayde, G. S. and H. V. Ingle, 1997. Studies on the effect of severity of pruning on growth, yield and quality of Nagpur mandarin. *Proc. National Sympo. Citriculture.* Nov. 17-19: 185-187.