The Bioscan 11(2): 1355-1359, 2016 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

INFLUENCE OF SHOOT PRUNING FOR CROP REGULATION AND IMPROVING FRUIT YIELD OF GUAVA

KAMAL RAM MEENA, SUTANU MAJI*, SANJAY KUMAR AND SHASHANK VERMA
Department of Applied Plant Science (Horticulture),
Babasaheb Bhimrao Ambedkar University, Lucknow - 226 025, Uttar Pradesh, INDIA
e-mail: majisutanu@gmail.com

KEYWORDS
Crop regulation
Fruit yield
Growth
Guava
Shoot pruning

Received on :
30.03.2016

Accepted on :
26.04.2016

***Corresponding author**

ABSTRACT
The present experiment was carried out with an objective to regulate the cropping as well as to increase fruiting of guava cv. Lalit in off season. Ten years old plants of guava cv. Lalit planted at 6x6 m spacing were selected for the research work laid out in randomized block design with thirteen treatments replicated thrice. The selected plants were pruned in different shoot length(15, 30, 45 and 60 cm from tip) and in different months (April, May and June) having unpruned plants as control. The investigation revealed that treatment T_8 (pruning in May at 45 cm length) caused the highest increase in new shootlet length (1.83 cm) at 15 days after pruning(DAP) followed by T_4 (30 cm pruning in April) and the lowest (0.31cm) was recorded in control (T_0) which followed a similar trend to 120 DAP. Similarly, T_8 also caused early shootlet emergence and flowering as well as more canopy spreading. The shoot pruning at 45 cm in May (T_8) also showed heavy fruiting (52.91 kg/plant, 14.71 t/ha) than the normal fruiting in control (22.84 kg/plant, 6.35 t/ha). Therefore, 45 cm shoot pruning in May was found to be the best for good off season production of guava.

INTRODUCTION

Guava (*Psidium guajava* L.) a member of family Myrtaceae is a highly prolific and remunerative fruit crop which performs well under wide range of soil and agro-climatic conditions. Fruits are good source of energy (51calories/100g edible portions), Vitamin A (12g/100g), Vitamin C (200-300mg/100g of pulp), Sugars (9g/100g) and minerals like Sodium (2g/100g), Potassium (417mg/100g), Calcium (1g/100g) and Iron (1g/100gm) (Mitra and Sanyal, 2004). Apart from use as table fruit, guava is processed commercially into jam, jellies and other products. Though, the fruit yield is high in rainy season (Rathore and Singh, 1974., Singh *et al*.,2000), but, poor in quality (Maji and Das, 2013 and 2014) due to insipidness (Singh *et al*., 1996) and infestation of pests (Rawal and Ullasa, 1988) in comparison to winter season which tasted very good being superior in quality. Guava bears on current season growth (Singh *et al*., 2000), thus, several methods have been tried to induce new vegetative growth during rainy season so that bumper crop is to be obtained in subsequent winter season (Shigeura and Bullock, 1976.,Singh *et al*., 2000). Farmers often practice shoot pruning and bending as a tree management strategy to increase new shoot number and induce off- season flowering. Among the several practices, shoot pruning may be helpful in managing tree size and improving fruiting (Haropinder and Bal, 2006). Lal (1983) also indicated that the yield of guava cv. Sardar was improved by pruning. Pruning and chemical regulations are popular for off season fruiting. Pruning and hydrogen cyanamid were found to modify the production strategy of guava (Quijada *et al*., 1999). But, mode of pruning is varied in different region of crop growing (Salah, 2005) and can produce the highest bud emergence of guava by using severe and moderate pruning. (Haropinder and Bal,2006) stated that pruning treatments (10cm & 20cm) on guava cv. Allahabad Safeda during rainy season produced maximum fruit size, palatability rating, TSS and Vitamin C. However, Serrano *et al*. (2008) reported that the light pruning increased the number of productive branches and number of fruits per branch of guava cv. Paluma.Therefore, pruning of guava is one of the most important practices that influence the vigour, productivity and quality of the fruits (Gadgil and Gadgil, 1933). Chemicals were found to be one of the best methods for off-season production but to consider the health and environmental hazards chemicals should be avoided. On the other hand, pruning might be the safest way to offseason production by avoiding chemicals. Crop regulation itself established as very profitable practice for guava cultivators (Maji *et al*., 2015). Thus, keeping these views the present experiment was aimed at offseason production of quality guava fruits by means of shoot pruning at different time and at different length.

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedker University, Lucknow, Uttar Pradesh, India. Ten year old plants of Guava cv. Lalit planted at 6x6 m spacing were selected for the research work.The experiment was laid out in randomized block design with

thirteen treatments replicated thrice *i.e.* thirty nine plants of uniform in growth and in good physical condition were selected. The selected plants were pruned in different shoot length and in different months. The shoot length (15, 30, 45 and 60 cm) was measured from the tip of shoots for pruning in April, May and June according to the treatment combinations. Unpruned plants were treated as control. All the leaves and suckers were removed from the plants. The plants were managed with judicial application of farm compost and watering properly.The plants were sprayed with cupper oxychloride (3g/lt) immediately after pruning to protect against disease attack.The observations were recorded for its change in vegetative growth like plant height, canopy spreading, basal circumference, shootlet number, length of new shootlet, flowering, fruiting and fruit yield. Branches from all directions of the plants in each replication were marked for taking observations. The basal diameter of trunk and shoot were also marked with colour so that the basal circumference and diameter could be taken at same place at each stage of observation. The canopy spreading was measured with measuring tape in each direction from the centre of canopy and then expressed as East – West and North – South direction. The observed data were analysed statistically with one way ANOVA as stated by (Sahu and Das, 2014) in Office Excel worksheet. The treatment effects were compared at 5% level of significance by reviewing their mean values.

RESULTS AND DISCUSSION

It was clear from Table1 that the length of newly emergence shoots after pruning was varied at different days (starting from 15 days after pruning (DAP) to 120 DAP) under different treatments. At 15 DAP, all the treatments showed higher increase in shootlet length compared to unpruned control plants. The treatment T_8 (pruning in May at 45 cm length) caused the highest increase in length (1.83 cm) at 15 DAP followed by T_4 (30 cm pruning in April) and the lowest (0.31cm) in control (T_0). Similar pattern of increase in length of shootlet was also observed upto 120 DAP when recorded at 15 days interval and maximum length was recorded under plants which were pruned at 45 cm length in May (T_8) whereas, the lowest was recorded at control (T_0). In general, the pruning treatments increased the length of newly emerged shootlets as compared to the new shootlet emerged in the control plants. The pruning of shoots might influence the crop to shift the metabolites from flowering to new vegetative growth which increased the length of newly emerged shootlets under pruned trees. Whereas, in control plants the metabolites are utilized for the flowering, fruiting and as well as for new shoot growth. For which, the increase in length of shootlet was lower in control treatment than the pruning treatments. The May pruning was also found as the best treatment for increasing length of new shootlet in the work of Singh *et al*. (2001).

Increase in plant spread in both directions (East – West and North - South) was recorded at 30 days interval from 30 days after pruning to 120 DAP (Table 2). At 30 DAP, the increase plant spread (East -West) was recorded maximum (8.50cm) in T_8 (45 cm pruning in May) which was statistically at par with T_2 (15cm pruning in May) followed by T_4 (30cm pruning in April) and the lowest in control. Similarly, T_8 also showed maximum increase in spreading at 60 DAP and the lowest in control. This trend continued upto 120 DAP significantly. At each stage, it was interesting to observe that except T_8 all the pruning treatments showed a very close increase in plant spreading (East -West).

Table 2 also clearly revealed that increase in plant spread at North - South direction was maximum under T_7 (45cm pruning in April) followed by T_2 (15cm pruning in May). In all cases increase in plant spread (North - South) was minimum under unpruned control (T_0). Interestingly, the treatment T_8 which was found as the best in shootlet length and plant spread at East – West direction but, not in increase in spread at North – South direction. The canopy spreading in both the direction was measured higher in pruned plants than the control. The higher increase in length of shootlet led to the increase in canopy spreading also. The canopy spreading in East- West direction was found better than the North – South direction because of orientation of sunlight (Maji *et al*., 2015).

The improvement of vegetative growth in respect of diameter of new emerged shootlet was found significantly better with pruned plants as compared to unprund control (Fig. 1).

Table 1: Effect of shoot pruning on length of shootlet (cm) of guava after pruning

Treatment	Days after pruning (DAP)							
	15 DAP	30 DAP	45 D	60 D	75 D	90 D	105 D	120 D
T_0- Control	0.31	1.57	2.84	5.10	6.27	7.70	9.21	10.88
T_1 – 15 cm pruning in April	1.04	4.61	8.07	10.99	12.42	14.33	16.67	19.67
T_2 - 15 cm pruning in May	1.13	3.66	6.06	7.91	9.47	12.22	16.47	20.25
T_3 - 15 cm pruning in June	1.07	2.62	4.62	6.69	8.95	11.43	14.09	17.12
T_4 - 30 cm pruning in April	1.36	4.35	8.01	10.44	12.13	14.43	16.64	20.82
T_5 - 30 cm pruning in May	1.26	3.93	6.20	8.02	9.69	12.24	15.28	18.27
T_6 - 30 cm pruning in June	1.05	2.48	4.47	6.36	9.86	12.46	15.39	17.80
T_7 - 45 cm pruning in April	1.21	3.76	5.43	7.83	9.65	12.18	15.40	17.95
T_8 - 45 cm pruning in May	1.83	7.96	10.84	15.94	17.87	19.93	21.91	24.32
T_9 - 45 cm pruning in June	1.11	2.58	4.69	6.67	9.28	12.46	15.53	17.47
T_{10} - 60 cm pruning in April	1.13	4.45	8.94	10.09	11.57	13.71	16.05	19.52
T_{11} - 60 cm pruning in May	1.16	3.65	5.83	7.82	9.69	12.33	15.72	17.85
T_{12} - 60 cm pruning in June	1.11	2.51	4.63	6.66	9.20	12.12	14.72	17.16
SEm (±)	0.118	0.352	0.447	0.2	0.889	0.955	1.175	1.842
CD (p=0.05)	0.24	0.73	0.92	0.41	1.83	1.97	2.43	3.80

Table 2: Effect of shoot pruning on increase in canopy spreading.

Treatment	Increase in spreading in East-West direction (cm) Days after pruning (DAP)				Increase in spreading in North-South direction (cm) Days after pruning (DAP)			
	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP
T_0- Control	2.00	4.50	8.50	13.50	2.50	5.50	9.50	14.50
T_1 – 15 cm pruning in April	6.50	12.00	16.50	22.00	5.50	10.00	15.50	20.00
T_2 - 15 cm pruning in May	8.50	14.50	18.00	23.50	6.00	11.50	18.50	24.00
T_3 - 15 cm pruning in June	6.50	11.50	16.50	20.50	4.50	9.50	14.50	18.20
T_4 - 30 cm pruning in April	7.20	11.50	16.00	21.50	4.50	9.50	14.00	18.50
T_5 - 30 cm pruning in May	6.20	10.50	15.50	20.20	4.50	8.50	13.50	19.20
T_6 - 30 cm pruning in June	6.20	10.20	15.50	20.00	5.50	9.20	14.50	18.50
T_7 - 45 cm pruning in April	4.10	10.20	14.00	18.00	7.20	15.20	20.50	26.50
T_8 - 45 cm pruning in May	8.50	17.20	24.50	30.50	5.20	10.50	16.20	22.00
T_9 - 45 cm pruning in June	6.50	11.00	16.20	21.50	5.20	10.00	16.50	20.20
T_{10} - 60 cm pruning in April	5.00	12.00	18.20	24.00	4.50	9.50	15.00	18.50
T_{11} - 60 cm pruning in May	4.50	10.00	15.20	19.00	4.50	8.50	14.20	18.50
T_{12} - 60 cm pruning in June	6.00	11.20	16.50	20.00	5.50	10.50	16.20	21.20
SEm (±)	0.390	0.623	0.347	1.317	0.244	0.231	1.086	1.653
CD (p=0.05)	0.81	1.28	0.72	2.72	0.50	0.48	2.24	3.41

Table 3: Effect of shoot pruning on new shoot emergence, flowering and fruit yield of guava

Treatment	Time of shoot emergence	Time of flower emergence	Flower no per shoot	Fruit yield per plant (kg)	Fruit yield per ha. (t/ha)
T_0- Control	17.58	51.33	6.00	22.84	6.35
T_1 – 15 cm pruning in April	13.17	43.67	7.00	30.76	8.55
T_2 - 15 cm pruning in May	13.50	41.67	7.67	38.21	10.62
T_3 - 15 cm pruning in June	13.25	46.33	7.67	30.32	8.43
T_4 - 30 cm pruning in April	11.92	44.00	10.67	37.74	10.49
T_5 - 30 cm pruning in May	12.58	43.67	12.33	43.21	12.01
T_6 - 30 cm pruning in June	13.67	47.67	7.33	35.36	9.83
T_7 - 45 cm pruning in April	12.17	32.67	8.83	34.57	9.61
T_8 - 45 cm pruning in May	13.58	47.67	13.67	52.91	14.71
T_9 - 45 cm pruning in June	13.00	47.67	8.00	29.52	8.21
T_{10} - 60 cm pruning in April	13.33	43.33	9.67	33.00	9.17
T_{11} - 60 cm pruning in May	13.83	44.67	10.00	39.09	10.87
T_{12} - 60 cm pruning in June	12.92	47.67	9.67	31.02	8.62
SEm (±)	0.653	7.120	1.089	2.604	0.724
CD (p=0.05)	1.35	14.69	2.25	5.37	1.49

However, the increase in basal diameter varied with different intensity of pruning and at different months of pruning. Among different pruning treatments the 45cm pruning in May (T_8) was found to be the best followed by T_7 (45cm pruning in April) at 30 DAP. Similar result was also found at 60 and 90 DAP. T_8 was found as better for improving diameter of new shootlet at all stages upto 120 DAP and diameter of new shootlet at unpruned control plant was the lowest at all stages.

Increase in basal circumference of main trunk of plant was also recorded at 30, 60, 90 & 120 DAP and it was depicted in Fig. 2. At 30 DAP, the increase in basal circumference was maximum under T_2 (15cm pruning in May) and T_{10} (60cm pruning in April). Similar pattern of growth was also found at 60 DAP. At later stage of growth *i.e.* at 90 & 120 DAP the increase was maximum under T_7 (45cm pruning in April). But, the increase was very close to each other among the several pruning treatments. The shift of metabolites as discussed earlier also influences the increase of circumference. Similar kind of observation was also reported by Lotter (1990) when experimented on Fan Retief Guava cultivar.

Early emergence of new shootlet after pruning was observed (Table 3) in case of pruned plants as compared to unpruned control plants. It was recorded that early emergence of shootlet with 11.92 days was observed in treatment T_4 (30cm pruning in April) followed by T_{11} (60cm pruning in May). Whereas, late emergence of new shootlet was recorded under control T_0 (17.58 days).

Table 3 also showed that pruning treatments caused early flowering. Among the treatments, T_7 (45cm pruning in April) took minimum days (32.67 days after pruning) for flowering followed by T_2 while, other treatments took more days (above 45 days after pruning). The flowering appeared very late (51.33 days) in control plants. It is a general tendency to produce new shoot after pruning as soon as possible in any crop. But, the response is different according to the intensity and time of pruning. Although, Mohammed *et al*. (2006) reported early sprouting and flowering in 60 cm pruning, but in our experiment we have found that 45cm pruning in May caused early shootlet emergence as well as early flowering which was accordance with the work of Lotter (1990) who reported that severe pruning *i.e.* pruning in more length had bad effect on crop performance including crop size, shoot character,

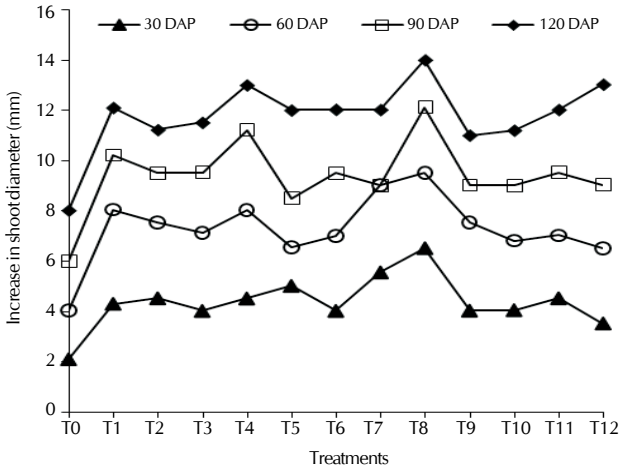

Figure 1: Effect of shoot pruning on increase in diameter of shoot

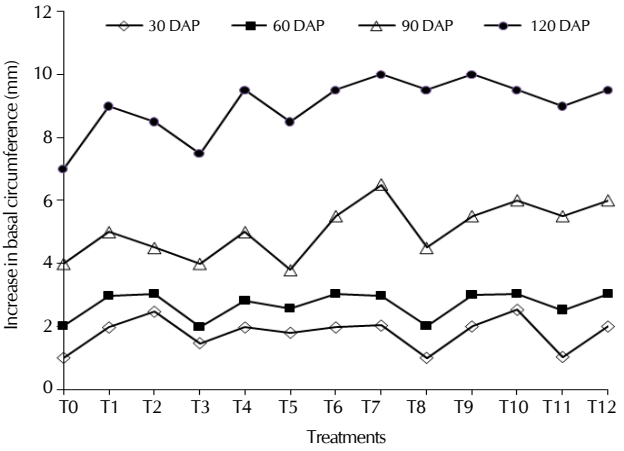

Figure 2: Effect of shoot pruning on increase in basal circumference of trunk

flowering and fruiting. Although, T_7 showed early flowering but, it did not produced maximum flower per shootlet. It was the treatment T_8 (45cm pruning in May) which produced the highest number of flowers per shootlet (13.67) followed by T_5 (12.33) flower per shootlet and the minimum number of flowers per shootlet was recorded under unpruned control.

The fruit yield per plant and projected yield per hectare was calculated on the basis of matured harvested fruits per plant and average fruit weight. The fruit yield was determined by accommodating 278 plants per hectare as the spacing was 6mx6m.The data presented in Table 3 showed that 45cm pruning in May produced much higher fruit yield (52.91 kg/plant and 14.71 t/ha) than the other treatments. The unpruned control plants showed the lowest yield of 22.84 kg/plant and 6.35 t/ha. Better performance of shoot pruning was also reported by Murali *et al*. (2015) in cashew nut and Das (2014) in litchi.

Guava bears on current season growth. The pruning treatments induced new shootlet production at higher rate than control which increased flower production. Thus, more flower production resulted higher fruit yield also. Due to pruning the treated crops shifted their metabolites and food reserve for the next season production which caused more fruit yield in the plants under pruning treatments (Shigeura and Bulloc, 1976; Singh *et al*., 1997; Lopez *et al*., 1982; Quizada *et al*., 1999; Singh *et al*., 1996; and Maji *et al*., 2015) during winter.The study clearly revealed that shoot pruning at 45 cm from tip in the month of May (T_8) was better for luxurious growth, early flowering and very good fruit yield in winter season in guava cv. Lalit in the subtropical dry climate like Lucknow.

REFERENCES

Das, B. 2014. Impact of shoot pruning on root distribution pattern of litchi (*Litchi chinensis* Sonn.). *The Bioscan*. **9(1):** 51-53.

Gadgil, D. R. and Gadgil, V. R. 1933. A survey of the marketing of fruit in Poona. *GokhaleInsti. Politi. Eco*. Publication. p. 3.

Lal, S. 1983. Effect of pruning on crop regulation in guava (*Psidium guajava* L.) cv. Lucknow-49. *Progressive Horticulture*. **7(3):** 60-62.

Lopez, G. J., Manica, V. I., Koller, O. C. and Ribold, I. J. 1982. Effect of six pruning period on the yield of guava in Novo Hamburgo, Rio, Grande do sd, brazil. *Proceedings Tropical Region American Society for Horticultural Science*. **25:** 259-262.

Lotter, De, J. V. 1990. Vegetative and reproductive habit of the guava (*Psidium guajava* cv. Fan Retief) in relation to pruning methods. *Acta Horticulture*. **275:** 27.

Maji, S. and Das, B. C. 2014. Crop regulation in guava.National Seminar- cum - *Workshop on Physiology of Flowering in Perennial Fruit Crops*. pp. 33-34.

Maji, S., Das, B. C. and Sarkar, S. K. 2015. Efficacy of some chemicals on crop regulation of Sardar guava. *ScientiaHorticultura*e. **188:** 66-70.

Maji, S. and Das, B. C. 2013. Use of bio-regulators and chemicals for effective cropregulation in guava.*100th Indian Science Congress. 2013. Section I- Agriculture and Forestry Science*. p. 319.

Mitra, S. K. and Sanyal, D. 2004. *Guava. ICAR Publication, Pusa*, New Delhi. pp. 13-18.

Mohammed, S., Sharma, J. R., Kumar, R., Gupta, R. B. and Singh, S. 2006. Effect of pruning on growth and cropping pattern in guava cv. Lucknow- 49. *Haryana J. Horticultural Science*. **35(3-4):** 211- 212.

Murali, K., Prasanna Kumar, P. and Aneesa Rani, M. S. 2015. Effect of tertiary shoot pruning and foliar spray ofnutrients on flowering and yield of cashew (*Anacardium occidentale* L.) under high densityplanting system.*The Bioscan*. **10(1):** 411-415.

Quijada, O., Araujo, F. and Corzo, P. 1999. Effect of pruning and hydrogen cyanamide on bud break, flowering, fruit yield and quality of guava (*Psidium guajava* L.) in the municipality of mara, state of zulia.Revi.*de la Facultad de Agro. Universidad del Zulia*. **16(3):** 276-291.

Rathore, D. S. and Singh, R. N. 1974. Flowering and fruiting in three cropping pattern of guava. *Indian J. Horticulture*. **34:** 331-336.

Rawal, R. D. and Ullasa, B. A. 1988. Management of fruit diseases of guava (*Psidium guajava* L.) through fungicidal sprays. *Indian J. Agricultural Sciences*. **58:** 950-952.

Sahu, P. K. and Das, A. K. 2014. *Agriculture and Applied Statistics. Kalyani Pub*. **II:** 163-208.

Salah, A., El-D. M. 2005. Effect of pruning on growth, flowering and fruiting of some guava cultivars. *M.Sc. Thesis, Faculty of Agriculture,* Cairo University.

Serrano, L. A. L., Martins, M. V. V. I., Lima, De. M., Marinho, C.S. and Tardin, F. D. 2008. Effect of pruning time and intensity on Paluma' guava trees in Pinheiros, ES, Brazil. *Revista Brasilia de Fruit*. **30(4):**

994-1000.

Shigeura, G. T. and Bullock, R. M. 1976. Management of guava: cycling fruit set for continuous production. *Proceedings Tropical Region American Society for Horticultural Science*. **24:** 166.

Singh, B. P., Singh, G. and Singh, A. K. 1996. Changes in postharvest quality of guava affected by pre-harvest application of crop regulation. *Singapore J. Primary Industries*. **24:** 1-9.

Singh, G., Pandey, D., Rajan, S. and Singh, A. K.1996. Crop regulation in guava through different crop regulation treatments. *Fruit*. **51:** 241-246.

Singh, G., Rajan, S., Pandey, D. and Singh, A. K. 1997. Effect of soil moisture stress on water relation by plant and cropping behaviour in guava (*Psidium guajava* L.). *Indian J. Agricultural Sciences*. **67:** 303-306.

Singh, G., Singh, A. K. and Rajan, S. 2001. Influence of pruning date on fruit yield of guava (*Psidium guajava* L.) under subtropics. *J. Applied Horticulture*. **3(1):** 37-40.

Singh, G., Singh, A. K. and Pandey, D. 2000. Effect of cropping pattern on fruiting behaviour of guava (*Psidium guajava* L.) tree. *Annals of Agriculture Research*. **21(2):** 175-182.

Singh, G., Singh, A. K. and Verma, A. 2000. Economic evaluation in guava (*Psidium guajava* L.). *Indian J. Agricultural Sciences*. **70:** 226-36.

Singh, H. J. and Bal, J. S. 2006. Effect of pruning and growth regulators on physico- chemical characters of guava during rainy season planted at different spacing. *International J. Agricultural Science*. **2(2):** 533-537.