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Beneficial impact of shoot pruning on reproductive and yield characteristics of guava (*Psidium guajava* L.) in New Alluvial Zone of West Bengal

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ABSTRACT

In the present investigation, 50% vegetative growth on terminal shoots were pruned during mid-August and mid-September on 22 varieties of guava in a factorial design in Bidhan Chandra Krishi Viswavidyalaya's Horticultural Research Station, West Bengal, during 2018-2019 to investigate the impact of shoot pruning on reproductive as well as yield characteristics of guava. According to experimental findings, minimum days for axillary bud emergence (10.33days) was observed in Safed Jam pruned during August, maximum number of axillary bud (27.00) emerged in SRD-1 pruned during August. Maximum number of sprouted bud (22.33) sprouted in China pruned during September. Minimum days for flower bud emergence (63.33days) was recorded in Kohir Safeda pruned during August. Maximum fruit set percentage (85.14%) recorded in Hissar Surkha and Kafri pruned during August. Finally, it can be concluded that 50% shoot pruning in months of August and September successfully promote vegetative as well as reproductive growth of guava.

Keywords: Axillary bud emergence, flower bud appearance, guava, reproductive characters, shoot pruning

Guava, also recognized as 'Apple of Tropics' is one of the most significant fruit plants in India. This tree bears abundantly and is fairly hardy. Guava is originated to Tropical America, which stretches from Peru to Mexico and over time, they gained economic significance in a number of nations. The plant can adapt to a larger range of environmental circumstances. The importance of guava cultivation is due to the fact that this fruit crop is resistant and amenable to several soil types as well as weather conditions. This plant is capable of surviving in light soil with a pH value in the range of 4.5 and on the soils having a pH value up-to 8.2. On the current season's growth, the guava bears a single bloom or cymes of two to three flowers in the axil of four or five pairs of leaves. The fruits produced during rainy season are of less desirable quality, have pest infestation and limited shelf life (Sarkar *et al*., 2005). However, fruits grown throughout the winter season are of desirable quality with a great demand in the local as well as distant market (Shukla *et al*., 2009). The well-defined periods are Ambe bahar, which blooms between February and March ripens during the rainy season, and Mrig bahar, which blooms between June and July, ripens during the winter and then Hasth bahar that flowers during October, ripens during February-April. Through-out India, as opposed to Ambe and Hasth bahar, Mrig bahar is preferable. As a result, it is mandatory to control the flowering in such a way so that maximum flowering can be obtained in Mrig bahar. Guava fruits are available during winter and rainy season. The winter season fruits regarded as high quality fruit. So, different practices such as thinning of flowers, shoot pruning, root pruning as well as root exposure, bending of shoots, withholding irrigation, spraying of urea and other hormones are followed to convert the plant more productive so that it can bear excellent fruits.

One of the most crucial procedures that affects the fruit's vigour, productivity and quality is guava pruning. In order to control tree growth, keep up higher fruit yield of desirable size and quality and improve the existing planting system, canopy management must be used to manipulate tree development (Singh *et al*., 2001). Pruning with discretion at the proper time also improves the quality of the fruit (Kaur, 2010). Among the different practices, shoot pruning is a better technique for enhancing winter crop in guava. Pruning is the practice of removing certain tree parts, particularly shoots, buds, limbs and roots, or of nipping away terminal portion. This is used to improve a plant's productivity as well as fruit quality. Fruit trees can produce fruits on shoots from the current season growth in axillary buds. Guava trees should be pruned regularly to maintain their health and yield as well as to increase the quantity and quality of their fruit. Numerous researchers have indicated that

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guava pruning increases fruit quality and output (Singh and Singh, 2001; Jadhav *et al*., 2002; Dhaliwal and Singh, 2004). The guava fruit is produced on the young, growing branches of the current year, thus the trees need to be pruned regularly each year to remove the old, unproductive wood and make space for the new growth. The growth of an unpruned tree weakens, resulting in decreased fruit size, quantity and quality. In order to achieve fruiting with greater quality and more output throughout the winter season, some refinement in the shoot pruning technique is required so that blooming and fruit setting may be controlled. Therefore, keeping these points in consideration, the current research was undertaken to investigate the impact of shoot trimming on guava plant's ability to blossom and produce quality fruit.

MATERIALS AND METHODS

This current research was undertaken at Bidhan Chandra Krishi Viswavidyalaya's Horticultural Research Station, Mondouri, West Bengal during the year of 2018-2019. The experimental site is located at 23.5°N latitude and 89°E longitude, having altitude of 9.75m from MSL. Twenty two cultivars were used during the experiment which were planted seven years ago in this particular research station. The plants were all uniform, healthy and devoid of pests as well as diseases and of seven years old. Throughout the experiment, every single tree were administered the same cultural practices in order to more exactly analyse the impacts of different treatments. Randomly 10 shoots were selected in each tree for imposing the treatments. The 50% of vegetative growth on pencil thick terminal shoots were pruned on 15th day of the month of August and September. Days to axillary bud emergence was measured from date of shoot pruning to date of axillary bud appearance. Total number of axillary buds was counted from each pruned shoot after shoot pruning. Total number of sprouted buds was counted from each pruned shoot. Days to flower bud appearance was measured from date of shoot pruning to date of flower bud emergence. Total number of flower buds from the tagged shoots was counted on each tree. For each opened flower number of fruit set was observed on tagged shoots. Fruit set percentage in each shoot was calculated according to the following equation:

$$\text{Fruit set (\%)} = \frac{Number\ of\ fruit\ set}{Total\ number\ of\ flower\ buds} \times 100$$

An electronic balance was used to weigh the fruit, and the result was expressed in grammes. According to the conventional technique outlined for Factorial Design stated by Panse and Sukhatme (1967), the data about the growth, yield as well as quality components of fruit and plants were statistically analysed.

RESULTS AND DISCUSSION

Results depicted in Table 1 apparently showed that comparatively minimum days for axillary bud emergence (10.33days) was observed in August pruning on Safed Jam and Kohir Long followed by Arka Amulya, Khaja whereas maximum days for axillary bud emergence (16.67days) was recorded in September pruning on Arka Kiran and SRD-1 followed by Hissar Safeda, Kohir Red, Baruipur Local. August pruning resulted earlier emergence of axillary bud (11.49days) while September pruning resulted late emergence of axillary bud (15.15days). Similar finding was observed by Basu *et al*. (2007). They declared that pruning severity encouraged early vegetative bud emergences. Maximum number of axillary bud emergence (27.00) was recorded in August pruning on SRD-1 followed by Kohir Long, Kafri, Mohammad Khaja while minimum number of axillary bud emergence (8.33) was recorded in September pruning on Lalit followed by Sweta, Safed Jam. Because pruned branches have more food material stored and accessible during the appearance of new growth, this could explain the difference in the frequency of axillary bud emergence. Identical result was also observed by Dhaliwal and Kuar (2003) and Gokavi *et al*. (2019). Among the varieties maximum number of bud sprouting (17.67) was recorded in SRD-1 and minimum number of bud sprouting (8.50) was recorded in Lalit. September pruning resulted maximum number of bud sprouting (14.68) while August pruning resulted minimum number of bud sprouting (13.14). The data was supported with research evidences of Bhagawati *et al*. (2015). The researchers declared, in half shoot pruning, nutrient availability and light interception is more.

The data represented in Table 2 showed that minimum days for flower bud emergence (63.33 days) was recorded in August pruning on Kohir Safeda followed by Allahabad Safeda, China, Kohir Red whereas maximum days for flower bud emergence (72.33 days) was recorded in September pruning on Kafri followed by Philipines, Arka Amulya, Kohir Long. Basu *et al*. (2007) reported a conclusion that was similar, stating that early vegetative bud appearance was favoured by more severe pruning. Highest number of flower buds per shoot (47.00) was observed in September pruning on China followed by Kafri (44.00) and lowest no. of flower buds per shoot (16.67) was recorded in September pruning on Lalit followed by Sweta (23.00). A similar finding where shoot pruning affectthe no. of flower buds on each tree was observed by Lal *et al*. (2000), Kindo (2005), Hariom and Shant (2015). September pruning showed highest no. of flower buds per shoot (32.39) while August pruning showed lowest no. of flower buds per shoot (28.30). Among

Table 1: Impact of shoot pruning on days taken to axillary bud emergence, no. of axillary buds per shoot emergence and no. of sprouted buds per shoot

Variety (Days)	Axillary bud emergence per shoot emergence			No. of axillary buds per shoot			No. of sprouted buds		
	August	September	Mean	August	September	Mean	August	September	Mean
Lalit	11.33	14.33	12.83	8.67	8.33	8.50	8.67	8.33	8.50
Allahabad Safeda	12.33	14.67	13.50	11.00	12.33	11.67	11.00	11.67	11.33
Lucknow 49	11.67	15.67	13.67	10.33	14.33	12.33	10.00	13.00	11.50
Sweta	11.67	15.67	13.67	10.00	11.00	10.50	8.67	10.67	9.67
Philipines	11.33	13.67	12.50	11.33	13.00	12.17	11.33	12.33	11.83
China	11.33	15.33	13.33	12.00	25.00	18.50	12.00	22.33	17.17
Kohirsafeda	11.67	14.33	13.00	13.67	16.67	15.17	12.00	15.67	13.83
ArkaAmulya	10.67	14.67	12.67	13.33	14.33	13.83	12.33	13.00	12.67
HissarSurkha	11.33	13.33	12.33	13.00	13.33	13.17	12.00	12.67	12.33
Safed Jam	10.33	15.67	13.00	15.33	11.00	13.17	14.33	10.67	12.50
HissarSafeda	11.33	16.33	13.83	14.00	21.67	17.83	12.67	18.33	15.50
ArkaMridula	11.33	14.67	13.00	16.67	19.67	18.17	15.67	17.33	16.50
Arka Kiran	12.67	16.67	14.67	16.33	13.00	14.67	13.00	12.67	12.83
Kohir Round	11.67	14.33	13.00	14.33	20.33	17.33	13.00	16.67	14.83
Kohir Red	11.67	16.33	14.00	17.33	14.00	15.67	16.00	13.33	14.67
SRD-1	12.67	16.67	14.67	27.00	16.00	21.50	20.00	15.33	17.67
Kohir Long	10.33	14.33	12.33	17.67	17.00	17.33	15.33	15.33	15.33
Kafri	11.67	14.67	13.17	17.67	22.33	20.00	15.00	20.00	17.50
Mohammad Khaja	11.33	15.67	13.50	17.67	19.00	18.33	14.33	17.33	15.83
DudhKhaja	11.33	15.33	13.33	16.00	17.00	16.50	14.00	15.00	14.50
Khaja	10.67	14.67	12.67	15.67	18.33	17.00	12.67	16.33	14.50
Baruipur Local	12.33	16.33	14.33	17.00	16.67	16.83	15.00	15.00	15.00
Mean Time of Pruning	11.49	15.15		14.82	16.11		13.14	14.68	
	SEm(±)	**LSD(0.05)**		**SEm(±)**	**LSD(0.05)**		**SEm (±)**	**LSD(0.05)**	
Variety	0.25	0.72		1.189	3.350		1.006	2.834	
Time of pruning	0.08	0.22		0.359	1.010		0.303	0.854	
Variety × Time of pruning	0.36	1.01		1.682	4.737		1.423	4.007	

Table 2: Impact of shoot pruning on days taken to flower bud emergence, no. of flower buds per shoot and no. of fruit set per shoot

Variety	Flower bud appearance (Days)			No. of flower buds per shoot			No. of fruit set per shoot		
	August	September	Mean	August	September	Mean	August	September	Mean
Lalit	64.67	69.67	67.17	18.67	16.67	17.67	13.67	11.33	12.50
Allahabad Safeda	64.33	70.67	67.50	25.33	25.00	25.17	20.00	18.33	19.17
Lucknow 49	65.00	71.33	68.17	20.33	27.33	23.83	15.33	20.67	18.00
Sweta	65.33	71.33	68.33	19.00	23.00	21.00	14.67	17.67	16.17
Philipines	66.67	71.67	69.17	27.00	27.00	27.00	20.67	21.00	20.83
China	64.33	69.67	67.00	27.00	47.00	37.00	21.67	36.00	28.83
Kohirsafeda	63.33	69.33	66.33	26.00	34.33	30.17	21.67	26.67	24.17
ArkaAmulya	65.67	71.67	68.67	26.00	29.67	27.83	21.67	22.00	21.83
HissarSurkha	66.33	71.00	68.67	22.67	28.67	25.67	19.33	21.00	20.17
Safed Jam	66.33	71.00	68.67	30.00	25.00	27.50	24.00	18.00	21.00
HissarSafeda	66.00	71.33	68.67	27.33	40.00	33.67	22.67	29.33	26.00
ArkaMridula	66.33	71.33	68.83	33.67	38.33	36.00	28.00	28.00	28.00
Arka Kiran	65.67	70.67	68.17	30.67	29.00	29.83	25.67	20.33	23.00
Kohir Round	66.67	69.67	68.17	32.00	36.67	34.33	26.33	27.00	26.67
Kohir Red	64.33	70.67	67.50	31.67	30.00	30.83	26.33	21.67	24.00
SRD-1	65.00	71.33	68.17	40.33	34.67	37.50	33.67	26.33	30.00
Kohir Long	65.67	71.67	68.67	34.00	33.67	33.83	27.00	25.00	26.00
Kafri	66.33	72.33	69.33	31.33	44.00	37.67	26.67	32.33	29.50
Mohammad Khaja	65.33	71.33	68.33	30.00	38.33	34.17	23.67	28.00	25.83
DudhKhaja	65.00	69.33	67.17	30.00	33.33	31.67	25.00	24.33	24.67
Khaja	65.67	69.33	67.50	27.33	37.00	32.17	22.67	26.33	24.50
Baruipur Local	66.00	70.67	68.33	32.33	34.00	33.17	25.67	24.00	24.83
Mean Time of Pruning	65.46	70.77		28.30	32.39		23.00	23.88	
	SEm(±)	**LSD(0.05)**		**SEm(±)**	**LSD(0.05)**		**SEm(±)**	**LSD(0.05)**	
Variety	0.325	0.915		2.089	5.884		1.853	5.217	
Time of pruning	0.098	0.276		0.630	1.774		0.559	NS	
Variety × Time of pruning	0.459	1.294		2.955	8.322		2.620	7.379	

Table 3: Impact of shoot pruning on fruit set percentage per shoot and fruit weight

Variety	Fruit set percentage per shoot			Fruit weight(g)		
	August	**September**	**Mean**	**August**	**September**	**Mean**
Lalit	73.54	67.98	70.76	142.46	137.96	140.21
Allahabad Safeda	78.59	73.32	75.96	138.29	131.58	134.94
Lucknow 49	75.02	75.50	75.26	146.55	138.80	142.68
Sweta	76.83	76.79	76.81	157.13	151.48	154.31
Philipines	76.36	77.88	77.12	164.12	164.25	164.19
China	80.09	76.54	78.32	137.74	145.70	141.72
Kohirsafeda	82.95	77.00	79.97	136.65	135.55	136.10
ArkaAmulya	83.36	74.13	78.75	141.48	140.57	141.03
HissarSurkha	85.14	72.74	78.94	165.19	162.88	164.03
Safed Jam	79.73	71.97	75.85	138.57	139.55	139.06
HissarSafeda	81.73	73.21	77.47	152.66	148.66	150.66
ArkaMridula	82.81	73.04	77.93	105.66	103.88	104.77
Arka Kiran	83.66	70.03	76.84	151.10	150.05	150.58
Kohir Round	82.06	73.44	77.75	98.28	97.79	98.03
Kohir Red	82.97	71.32	77.14	106.70	103.80	105.25
SRD-1	83.29	76.49	79.89	115.27	113.69	114.48
Kohir Long	79.59	74.20	76.90	91.09	91.24	91.17
Kafri	85.14	73.51	79.32	124.76	122.80	123.78
Mohammad Khaja	78.39	72.95	75.67	128.27	125.86	127.06
DudhKhaja	83.35	72.50	77.93	140.49	138.21	139.35
Khaja	82.58	71.39	76.99	130.52	129.76	130.14
Baruipur Local	79.38	70.64	75.01	130.68	129.66	130.17
Mean Time of Pruning	80.75	73.48		133.80	131.99	
	SEm(±)	**LSD(0.05)**		**SEm(±)**	**LSD(0.05)**	
Variety	1.395	3.929		2.352	6.624	
Time of pruning	0.421	1.185		0.709	N/S	
Variety × Time of pruning	1.973	5.556		3.326	N/S	

varieties highest no. of fruit set per shoot (30.00) was observed in SRD-1 while minimum number (12.50) was recorded in Lalit. September pruning resulted in maximum number of fruit set (23.88) whereas August pruning resulted minimum number of fruit set (23.00). Identical outcome was reported by Mahesh *et al*. (2016). The researchers stated, light pruning increases the reproductive growth and severe pruning increases vegetative growth. In the winter, half-shoot pruning produced the highest fruit yield.

Results presented in Table 3 showed that highest fruit set percentage per shoot (79.97%) was recorded in Kohir Safeda and minimum fruit set percentage per shoot (70.76%) was recorded in Lalit. August pruning resulted maximum fruit set percentage per shoot (80.75%) while September pruning resulted minimum fruit set percentage per shoot (73.48%). Highest fruit weight (164.19 g) was observed in Philipines while lowest (91.17 g) was recorded in Kohir Long. August pruning resulted maximum fruit weight (133.80 g) while September pruning resulted minimum fruit weight (131.99 g). The severity of pruning determined the fruit weight of guava plant. The size as well as weight of fruit significantly rise in the winter due to an increase in photosynthates caused by an increase in leaf number and area. This result was supported by Singh *et al*. (2001) and Tamang *et al*., 2021.

CONCLUSION

In the present experiment, 50% vegetative growth of pencil thick terminal growth was pruned during mid-August and mid-September respectively on 22 varieties of guava in a factorial design. Based on the results of the aforementioned experiment, it can be summarized that 50% shoot pruning in the months of August and September has a favourable impact on vegetative and reproductive growth, including the appearance of new buds, new shoots, the quantity of flower buds as well as the percentage of fruit set. As a consequence, the pruning

method may be successfully used to the commercial exploitation of guava in the winter for both domestic and international markets.

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