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Effect of Pruning Height on Growth Parameters of Mulberry and Rearing Performance of PM X CSR_2 Silkworm Cross Breed

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A B S T R A C T

Sericulture is one of the most promising agricultural crops in India and played a vital role in increasing the income of the farmers, the present experiment was conducted at Department of Sericulture, UAS, GKVK, Bengaluru during the year 2020-21 by introducing different pruning techniques to the V-1 mulberry variety. For this study six treatments were laid out in RCBD with four replications. The results revealed that, mulberry pruned at 150 cm above the ground level was recorded highest shoot height (95.60 cm), number of shoots (23.35), number of leaves (162.35) and leaf yield (479.25 g/ plant) per plant at 60 days after pruning (DAP). Further, the leaf harvested from V-1 mulberry and fed to PM × CSR2 silkworm hybrid, revealed maximum V instar fifth day larval weight of 19.77 g/10, effective rate of rearing (ERR %, (98.50 %)), spinning percentage (97.75 %), silk productivity (cg/day) (2.24), cocoon weight (7.46 g/5 cocoon), shell weight (1.26 g/5), shell ratio (17.32 %), were in 30cm above the ground level pruned treatment followed by 45 cm above the ground level. As the pruning height increased, from 30-150 cm the cocoon parameters were decreased.

Introduction

India has distinction of being the only country producing all five kinds of commercially exploited natural silks namely, Mulberry, Eri, Muga, Oak Tasar and Tropical Tasar. However, mulberry silk contributes for about 70 per cent of the countries raw silk production. India is the second largest producer of silk in the world with an annual silk output of 35820 MT, of which mulberry raw silk aggregated to about 25239 MT during 2019-20 (Anonymous, 2020).

Leaf yield of mulberry depends on growth and development of mulberry variety, agronomical and cultural practices, incidence of diseases, pests and

weather conditions. Weather influence on the mulberry leaf yield either through its direct effect on the plant physiology or through changing the other responsible factors for leaf production. The growth pattern of mulberry plant depends up on agro climatic conditions (Gangwar and Rai, 1997).

Mulberry leaf is the sole food for silkworm, *Bombyx mori* L. and gets all its nutritional requirements from mulberry leaf. The quality and quantity of leaf has direct influence on silkworm health and the quantity of cocoon produced.

The quality and quantity of mulberry leaf was influenced by the nutrition and periodic pruning (Dandin and Giridhar, 2014; Vanitha and Narayanaswamy, 2019). Pruning is one of the cultural activity includes methodical removal of certain branches with an objective of giving proper size and shape to increase the leaf quality and yield (Bhaskar *et al.*, 2020). This cultural practice plays a vital role in maintaining the vigorous of young shoot and foliage with optimum biochemical constituents improving both quality and quantity of mulberry leaf.

The introduction of V-1 mulberry variety, led to the farmers switch over to whole shoot harvest which serves as pruning. Repeated pruning for the same plant cause adverse effect on quick establishment and produce poor quality leaf. Therefore, existing shoot height can be altered with different heights to reduce the risk and production of quality mulberry leaf. Therefore, V-1 mulberry variety with different spacing are already adopted and maintained as tree by farmers.

The pruning height and quality of leaf produced in the shoots will definitely help for successful silkworm rearing. It is further reported that, pruning height has marked effect on utilizing stored nutrition in the stem help for growth and shoot height which showed positive relation with yield and quality of mulberry leaves (Dandin and Giridhar, 2014; Thangamalar, *et al*., 2018).

Materials and Methods

A field experiment was conducted during 2020-21 in well-established Victory- 1(V-1) mulberry garden planted with a spacing of 4’ x 4’ under protective irrigated condition was selected for the experimentation. The experiment was laid out in RCBD with six treatments, each treatment replicated four times. The treatment details are given below.

T_1: Mulberry pruning at 30 cm height

T_2: Mulberry pruning at 45 cm height

T_3: Mulberry pruning at 60 cm height

T_4: Mulberry pruning at 90 cm height

T_5: Mulberry pruning at 120 cm height

T_6: Mulberry pruning at 150 cm height

Collection of leaf sample

Leaf sample was drawn from labeled five mulberry plants per treatment per replication for recording observations on various growth, yield and quality parameters on 30, 45 and 60 days after pruning (DAP).

Growth parameters of mulberry

Shoot height (cm)

The shoot height of five labeled plant was measured from where shoot emerge to the tip of fully opened leaf of all the shoots (Five randomly selected mulberry plants) and mean was calculated.

Number of shoots and leaves per plant

Number of shoots and leaves per plant were counted manually from randomly selected mulberry plants. Mean number of shoots and leaves were calculated.

Internodal distance (cm)

The internodal distance was measured between two nodes on the main shoot of the plant by using a scale.

Leaf area (cm2/plant)

The area of third fully opened leaf from the top was determined by multiplying the length with the breadth and then with a constant factor 0.69.

The product was then multiplied with number of green leaves per plant to get the leaf area per plant (Satapathy *et al.,* 1991).

Yield per plant (g) and yield per hectare per year (kg)

To know the effect of pruning heights on leaf yield, five leaf samples were drawn from each induvial plant at an interval of 30, 45 and 60 DAP and calculated leaf yield (g/plant) and also estimated leaf yield per ha (kg/ha).

Silkworm rearing parameters

Larval weight (g)

Weight of 10 larvae was recorded on fifth day of fifth instar in all the treatments of each replication and mean was computed.

Silk productivity (cg/day)

Silk productivity was calculated as follows.

$$\text{Silk productivity} = \frac{\text{Shell weight (g)}}{\text{V instarlarvalduration (days)}}$$

Effective rate of rearing (%)

The number of cocoons harvested at the end of rearing in each treatment, replication wise were documented and the ERR was calculated by using formula.

$$\text{ERR (\%)} = \frac{\text{Number of cocoons harvested}}{\text{Total number of worms reared}} \times 100$$

Cocoon weight, Shell weight (g/5) and Shell ratio (%)

After the cocoon harvest, cocoons weight and shell weight was recorded from each treatment with respective replications and was computed.

The shell ratio was calculated by the formula

$$\text{Shell ratio (\%)} = \frac{\text{Weight of cocoon shell}}{\text{Weight of cocoons}} \times 100$$

Single cocoon filament length (m) and filament denier

Three cocoons from each replication were taken and reeled individually on a single cocoon reeler (eprouvette). The average filament length of three cocoons of each replication was calculated and recorded. From the same lot filament denier was computed.

Results and Discussion

The experimental results on effect of pruning heights on shoot height, number of shoots and number of leaves per plant of V-1mulberry registered significant difference between days after pruning (30, 45 and 60) and pruning height of 30, 45, 60, 90, 120 and 150 cm. The data revealed that, the maximum and minimum shoot height (28.63 and 21.08., 61.68 and 49.25 and 95.60 and 68.10 cm), number of shoots (17.25 and 2.80., 19.80 and 3.45 and 23.35 and 4.15) and number leaves per plant of 77.55 and 12.60., 128.45 and 30.75 and 162.35 and 55.30 was registered for T_6 and T_1 where mulberry was pruned at an height of 150 and 30 cm above the ground level respectively. The data also confirmed that, increase in pruning height was positively increased shoot height, number of shoots and number of leaves per plant of V-1 (Table 1).

Mohamed Tom *et al.,* (2013) noticed the effect of three pruning heights *viz.*, 5 cm, 20 cm and 40 cm on growth of five *Morus* species from the ground

level. The results showed high, values in *Morus alba* with respect to number of branches per plant. The pruning height of 40 cm from the ground level has recorded significantly higher coppic growth than 20 cm and 5 cm.

The present experimental data was in agreement with the findings of Kasiviswanathan *et al.*, (1979) who reported that, growth and development of leaves were faster in stepwise shoot harvest compared to bottom pruning. Further, Lakshminarasimappa, (2007) also confirmed that, pruning at 90 cm above ground level to M-5 mulberry variety gave maximum number of leaves per plant (308.13 and 601.10)

The leaf area of V-1 mulberry was significantly influenced by the pruning heights at 30 and 120 cm., 30 and 150 cm, 45 and 120 cm and 45 and 150 cm above the ground level. As per the data, the significant difference was noticed between T_1 and T_5 (95.69 and 73.64), T_1 and T_6 (95.69 and 70.59), T_2 and T_5 (93.13 and 73.64) and T_2 and T_6 (93.13 and 70.59). Further, maximum leaf area of 95.69, 176.23 and 188.52 cm^2 was recorded in T_1 (30 cm above the ground level) on 30, 45 and 60 DAP followed by T_2, T_3, T_4, T_5 and T_6. As the pruning height increased from 30 - 120 cm above the ground level there was a decreased in leaf area.

Effect of different pruning heights on leaf yield of V-1 mulberry revealed that, the leaf yield of V-1 mulberry was significantly influenced by different pruning heights. Significant difference was noticed among different pruning heights. Maximum leaf yield of 170.03, 379.07 and 479.25 g/ plant and 1142.29, 2546.93 and 3220.09 kg/ ha leaf yield was recorded in T_6 (150 cm above the ground level) on 30, 45 and 60 DAP followed by T_5, T_4, T_3, T_2 and T_1 (Table 2).

Murali (1999) studied that, two pruning methods *viz.*, middle pruning was recorded maximum leaf area per plant compared to bottom pruning and also by Pawan *et al.*, (2017) were observed the effect of time and severity of pruning on growth, yield and quality parameters in mulberry.

The present findings was in parity with findings of Krishnamurthy *et al.*, (1986) who found increase in stump height, the growth and leaf yield increased due to more reserve food. Maximum leaf yield was obtained when plants pruned at 40 cm above the ground level. Further, Fotadar *et al.*, (1995) revealed the effect of different pruning heights on Kanva -2 mulberry noticed increased in leaf yield with higher pruning heights. Repeated bottom pruning caused progressive reduction in the leaf yield.

Table.1 Effect of pruning heights on shoot height (cm), number of shoots per plant and number of leaves per plant in V-1mulberry

Treatment	Shoot height			Number of shoots/ plant			No. of leaves/ plant		
	30 DAP	45 DAP	60 DAP	30 DAP	45 DAP	60 DAP	30 DAP	45 DAP	60 DAP
T_1	21.08	49.25	68.10	2.80	3.45	4.15	12.60	30.75	55.30
T_2	23.15	52.43	71.25	3.15	3.75	5.20	18.28	34.25	69.60
T_3	24.00	52.50	74.43	3.90	4.45	5.30	18.45	37.20	70.10
T_4	25.10	53.30	74.65	6.25	6.85	7.18	25.50	52.20	79.10
T_5	26.70	56.78	85.93	13.40	14.20	17.25	68.95	99.20	143.15
T_6	28.63	61.68	95.60	17.25	19.80	23.35	77.55	128.45	162.35
F – test	*	*	*	*	*	*	*	*	*
S. EM ±	1.20	1.97	4.85	0.64	0.80	0.68	3.15	6.55	7.26
C.D @5	3.61	5.95	14.63	1.93	2.43	2.04	9.49	19.74	21.89

Table.2 Effect of pruning heights on leaf area (cm^2), leaf yield per plant (g) and leaf yield per ha (Kg/ year) in V-1mulberry

Treatment	Leaf area			Leaf yield/ plant			Leaf yield/ha/year		
	30 DAP	45 DAP	60 DAP	30 DAP	45 DAP	60 DAP	30 DAP	45 DAP	60 DAP
T_1	95.69	176.23	188.52	20.09	67.71	121.77	135.00	454.94	818.15
T_2	93.13	143.16	157.86	41.03	102.47	151.95	312.53	688.51	1281.13
T_3	87.97	133.38	148.20	46.52	113.89	190.67	271.64	765.24	1020.92
T_4	85.85	117.53	138.00	54.26	164.75	247.26	364.55	1106.95	1661.34
T_5	73.64	113.30	137.13	162.24	264.66	381.9	1090.11	1778.25	2565.95
T_6	70.59	88.69	121.36	170.03	379.07	479.25	1142.29	2546.93	3220.09
F – test	*	*	*	*	*	*	*	*	*
S. EM ±	5.91	9.53	9.63	5.38	19.85	22.96	36.21	133.40	154.32
C. D.@ 5%	17.81	28.74	29.04	16.24	59.84	69.22	109.15	402.12	465.19

Table.3 Effect of pruning heights on rearing parameters of PM X CSR2 cross breed

Treatment	Larval weight (g)	Silk productivity (cg/day)	ERR (%)	Cocoon weight(5/g)	Shell weigh (5/g)	Shell ratio (%)	Filament length (m)
T_1	20.60	2.49	99.15	7.60	1.26	17.33	847.40
T_2	19.48	2.39	96.32	7.40	1.22	16.82	810.56
T_3	19.31	2.37	95.89	7.32	1.21	16.85	800.72
T_4	19.05	2.37	93.12	7.05	1.20	16.63	792.00
T_5	19.00	2.33	92.50	6.99	1.19	16.61	758.25
T_6	18.82	2.30	91.00	6.98	1.17	16.27	718.17
F – test	*	*	*	*	*	NS	NS
S. EM ±	0.29	0.03	1.57	0.14	0.01	0.41	33.33
C.D @5	0.87	0.09	4.68	0.41	0.04	1.23	83.92

Siddiqui *et al.,* (1998) also suggested that, pruning is necessary to regulate shape and check vertical growth of plant, divert the energy of food plants from reproductive growth to vegetative growth and to increase the quantity and quality of foliage. The same trend was noticed in the present study as the pruning height increased from 30 – 150 cm above the ground level there was an increase in leaf yield of 20.09 -170.03., 67.71 - 379.07 and 121.77 – 479.25 g/plant at 30, 45 and 60 DAP, respectively

Silkworms fed with mulberry leaves harvested from the plant pruned at 30 cm above the ground level resulted significantly higher larval weight. Lower larval weight was recorded in plant pruned at 150 cm above the ground level.

The effective rate of rearing (ERR %, 99.15), silk productivity (cg/day) (2.49 cg/day), cocoon weight (7.60 g/ 5 cocoon), shell weight (1.26g/ 5 shell), shell ratio (17.33 %), filament length and denier was in T_1 where mulberry pruned at 30 cm above the ground level and fed to the silkworm and minimum was noticed in T_6(150 cm above the ground level). It was concluded from the data increased pruning heights with bacterial inoculation resulted decreased cocoon parameters as reflected in the experimental data (Table 3).

Dilip *et al.*, (2009) according to them pruning heights and time of leaf harvest influence on larval weight and economic parameters of silkworm fed with M-5 mulberry grown by UAS Seri suvarna technology under rain fed condition. The pruning height *viz.*, 0, 30, 60 and 90cm with two normal shoot harvest at every 60 days interval revealed maximum larval weight (3.74g). Krishnaswami *et al.*, (1973) observed that the growth and development of silkworm larvae and economic characters of cocoon get affected by feeding leaves with low quality level. They also suggested that the health and developments of silkworm is closely related to quality and also quantity of leaf fed. It is essential to feed plenty of high quality mulberry leaves to avoid flacherie. The same type of result was observed in present study.

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