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Growth and Yield Performance of Mulberry (*Morus* Spp.) Cultivar V-1 as Small Tree in Karnataka

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Abstract

A field experiment was conducted at College of Sericulture, Chintamani, Karnataka during 2016 -2021 to assess the effect of three spacings (2.4 x 1.2 m; 2.4 x 1.8 m and 2.4 x 2.4 m) and three stump heights (0.5, 1.0 and 1.5 m) on growth and yield of mulberry cultivar V-1 trained as small tree under irrigated condition. The experiment was laid out in split plot design having nine combination treatments with three replications. The experimental plot was maintained with package of practices recommended for the cultivation of bush mulberry under irrigated condition, after making suitable modifications. Data on eight growth and yield parameters were collected from all the five crops of 3rd, 4th and 5th year after plantation. Plant height, number of shoots / plant, longest shoot length, total shoot length, number of leaves / plant and leaf yield / plant were increased with the increase in spacing while plant height, longest shoot length, number of leaves / plant, leaf yield / plant and leaf yield / ha / yr were increased with increase in stump height. Among the nine treatment combinations, 2.4 x 1.2 m spacing with 0.5 m stump height, 2.4 x 1.2 m spacing with 1.0 m stump height and 2.4 x 1.2 m spacing with 1.5 m stump height showed marginal differences between them and higher leaf yield / ha / yr (49754, 51176 and 51219 kg, respectively) in fifth year of plantation, which may increase further by about 10 per cent in succeeding three years. Effect of spacing on the leaf yield was very high compared to the effect of stump height. In view of the reduction in leaf quality with low stump height (0.5 m) and inconvience to shoot harvest in high stump height (1.5 m), it is concluded that, 1.0 m stump height is optimum. Accordingly, 2.4 x 1.2 m spacing with 1.0 m stump height are found suitable for the cultivation of mulberry cultivar V-1 as small tree under irrigated condition.

Keywords : Tree mulberry, Spacing, Stump height, Leaf yield, V-1 cultivar

Mulberry (*Morus* Spp.) is an important commercial crop and its various species and varieties are being cultivated in different parts of the world for foliage to practice sericulture. Due to its wider adaptability to different agro-climatic conditions and cultural practices, varied cultivation methods have been evolved and being practiced in India. It is being cultivated more commonly as low bush in plains of South India and West Bengal and as small tree (in block plantations) in temperate and sub-tropical regions. Maximization of its quality leaf production per unit area of land and silkworm cocoon production per unit quantity of leaf are essential for organizing sericulture on sound economic lines. Plant geometry and crop geometry are important factors in crop production (Reddy and Reddi, 2006) and hence, mulberry planting geometry plays a vital role in enhancing yield and quality of its leaf (Vinodkumar Yadav *et al.,* 2020).

Of late, two major problems were encountered in bush mulberry cultivation *viz*., difficulty to adopt mechanization for intercultural operations and to cultivate it with limited water resource. The problem of mechanization was addressed by suggesting wider spacing like paired row system of plantation and 3M plantation (Bogesha and Jayaram, 2015). By understanding the importance of mulberry cultivation as treesin rainfed condition, CSR & TI, Mysore (Dandin and Sengupta, 1988); (Bindroo and Verma, 2014) and also Department of Sericulture, Government of Karnataka (Anonymous, 2015) recommended

general techniques to promote rainfed sericulture. Later, realizing the benefits of tree cultivation, many innovative seri-farmers, who were facing the shortage of irrigation water and scarcity of labourers have converted their existing closer spacing mulberry plantations into wider spacing plantations by uprooting the extra plants of the row and even the extra row, along with increasing the stump height. Consequently, some other farmers developed new small tree plantations. These farmers have been adopting varied cultivation practices as per their own knowledge, convenience and experience (Megharaj *et al*., 2021). By selecting farmers fields, investigations on leaf productivity and rearing performance of tree mulberry (Vanitha, 2018 and Vanitha & Narayanswamy, 2018), effect of intercropping in tree mulberry cultivation (Rajegowda *et al*., 2020) have been carried out. In 2020, CSR & TI, Mysore initiated an experiment on development of an agronomical package for tree mulberry cultivation for wide acceptance among the seri-farmers of Southern India with farmers' participatory mode, in farmers fields (Anonymous, 2020).

The perusal of literature clearly indicated that, there is no specific recommended package of practices for the cultivation of mulberry cultivar V-1 as small tree in irrigated condition by research institutes. It may be due to long gestation period which increases the overall time needed for experimentation. Keeping this in view, field experiments were undertaken to investigate the leaf and cocoon yield from V-1 mulberry cultivar, trained as small tree with three spacings and three stump heights in eastern dry zone (Zone 5) of Karnataka during 2016 - 2021. The present report is an outcome of this investigation dealing with the growth and yield performance of V-1 mulberry cultivar.

Material and Methods

Investigations were carried out for five years during 2016 - 2021.

Experimental Site, Design and Layout

The field experiment was conducted in the College of Sericulture, Chintamani. Geographically, it is located in eastern dry zone (Zone-5) of Karnataka. The physico-chemical properties of the soil in experimental site were as follows: sandy clay loam with acidic pH (5.16), low organic carbon (0.3%), electrical conductivity of 0.20 dS m^{-1}, medium level of available nitrogen (426, 45 kg ha^{-1}), phosphorus (36.70 kg ha^{-1}) and sulphur (14.60 mg kg^{-1}), normal level of exchangeable calcium (12.75 c mol (p^{+}) kg^{-1}) and exchangeable magnesium (2.75 c mol (p^{+}) kg^{-1}) and high availability of potassium (631 kg ha^{-1}).

The experiment was set up in arable land of 2000 sq m, in split plot design with three levels of spacing as main plot treatments (S1- 2.4 x 1.2 m; S2 - 2.4 x 1.8 m and S3 - 2.4 x 2.4 m) and three levels of pruning height as sub plot treatments (H1 - 0.5 m; H2 - 1.0 m and H3 - 1.5 m) which resulted in nine treatments *viz*., S1H1, S1H2, S1H3, S2H1, S2H2, S2H3, S3H1, S3H2 and S3H3 and these were replicated thrice. As per the layout, land was divided into three blocks, each measuring a convenient size of 40 x 12 m which served as three replications. Each block was further divided into three plots, each measuring 12 x 12 m to impose three main treatments. In each main plot, three levels of sub treatments were imposed with complete randomization. The layout included two meter border between each main plot and one meter border all along the experimental plot. Within each main plot, mulberry saplings were planted in six rows in different interplant spacing. The number of plants in each replication of S1H1, S1H2 and S1H3 were 66; S2H1, S2H2 and S2H3 were 42 and S3H1, S3H2 and S3H3 were 36 and the total number of plants in experimental plot was 432.

Planting, Training and Pruning of Plants as Small Trees

First Year : Before the onset of monsoon, the land was prepared and plantation was made in June 2016. Required number of pits of 60 x 60 x 60 cm size were dug and filled with FYM one week before planting the saplings. To each pit, eight month old, uniform sized one sapling of V-1 was planted and the plot was irrigated with drip system regularly. After planting, the saplings were staked with eucalyptus sticks for

supporting the saplings to grow straight. In the first year of establishment, during the month of February 2017, main stem of saplings was pruned to three different heights (H1, H2 and H3) as per the treatment. Only top three new shoots were allowed to grow and after 10 days of shoot growth, they were bent slightly to widen the angle of branching. These primary shoots were pruned (after 4 months) at the beginning of second year schedule.

Second Year and Third Year onwards : Second year onwards five regular prunings were given along with the five harvest schedule at an interval of 50-70 days along with the rearing of silkworm. In second year (June 2017) the primary shoots were pruned (I harvest) at a length of 15-20 cm from their base and from these three branches, a total of 6-8 shoots were allowed to grow. During second pruning (II harvest), shoots were pruned at a length of 10-15 cm from their base. From all these strong shoots, 12-18 shoots were allowed to grow and weak ones were removed.

During III harvest, shoots were pruned again at a length of 10-15 cm and a total of 25-35 strong shoots were allowed to grow by removing the weak ones. In the next pruning (IV harvest), only about 10 cm length of shoot was left in each of the branch and then 45-60 shoots were allowed to grow for the next harvest. In the last pruning (V harvest) of the year, shoots were cut at their base leaving only one bud bringing the crown height to 45-50 cm above the stump. Care was taken to allow that bud to sprout and to maintain 45 to 60 shoots per tree.

Subsequent prunings in third year and onwards were made following the step-up and step-down method of pruning as suggested by Thimma Reddy *et al*. (2017). A general view of the established experimental garden is shown in Fig. 1 and small trees of three stump heights are shown in Fig. 2.

Manure and Fertilizer Application and Green Manuring

There is no specific recommendation of manure application for tree mulberry cultivation under irrigated condition from research institutes. Hence, the quantity of FYM and chemical fertilizers (NPK) recommended for the paired row system of cultivation of V1 mulberry under irrigated condition with five shoot harvests were followed with suitable modifications keeping in view, the population density and rate of biomass production in first and second year of tree mulberry plantation. The quantity of FYM and chemical fertilizer (NPK) applied per plant and the time application in first, second, third year and onwards are presented in Table 1.

One green manure crop was grown as intercrop every year regularly, either with II or III mulberry crop when the N-E monsoon showers were received (October - November), green manure crop cowpea / diancha / sunhemp was sown and incorporated into the soil after 45 days of its growth. Ploughing was carried out easily in all spacing by tractor or tiller drawn implements after every harvest. Other intercultural operations such as digging around the plants, removing of weak shoots and application of manures were carried out manually.

Observations Recorded

Mulberry plants in tree form attained proper growth with considerable biomass only after two years and hence, data on growth and yield parameters were

Fig. 1 : A view of the experimental plot with different spacings and pruning heights (Growth after 25 Days of pruning)

Fig. 2: Small trees of experimental plot with 0.5, 1.5m and 1m Stump heights under S1 spacing

TABLE 1

Quantity and time of application of manure and fertilizer in tree mulberry garden under different spacing

Year	FYM per plant / crop (kg)			Nitrogen (NH_4+ or NO^{-3}) per plant /crop (g)			Phosphorus (P_2O_5) per plant / crop (g)			Potassium (K_2O) per plant / crop (g)		
Spacing	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
First year												
FYM @ 15mt/ha/yr in two equal split dose NPK @100:50:50kg/ha/yr in two equal split dose	1.63	2.51	3.00	10.90	17.14	20.00	5.45	8.57	10.00	5.45	8.57	10.00
1st dose of FYM was applied to the pit before one week of planting the sapling; 1st dose of NPK was applied after one month of planting; 2nd dose of FYM within two weeks of pruning and 2nd dose NPK in fourth week after pruning												
Second year												
FYM @ 20mt/ha/yr in five equal splits NPK @ 200:100:100kg /ha / yr in five equal splits	0.69	1.09	1.27	8.72	13.71	16.00	4.36	6.86	14.40	4.36	6.86	14.40
FYM was applied within two weeks of every pruning/harvest and NPK was applied in fourth week after every pruning												
Third year and onwards												
FYM @ 20mt/ha/yr in five NPK @ 350 : 140 : 140 kg / ha / yr in five equal splits	0.69	1.09	1.27	15.27	24.00	28.00	6.11	9.60	11.20	4.36	6.86	14.40
FYM was applied within two weeks of every pruning/harvest and NPK was applied in fourth week after every pruning												

S1: 2.4 x1.2m S2: 2.4 x 1.8m S3: 2.4 x 2.4m

recorded from third year onwards. Every year, five crops were harvested during 2018-19, 2019-20 and 2020-21. Data on four growth parameters *viz.*, plant height (m), number of shoots per plant, longest shoot length (m), total shoot length (m) and three leaf yield related parameters *viz*., number of leaves per plant, leaf area index (LAI) and leaf yield per plant (kg) were recorded from five labeled plants of each treatment on 60th day after pruning by following the standard procedures and average was considered for analysis. The total leaf yield obtained from net plot was recorded as the leaf yield and expressed in g / plot and converted to the leaf yield per hectare in metric tonnes for each treatment combination. The data recorded on various parameters were subjected to statistical analysis using analysis of variance (ANOVA) with SPSS statistical software package version 26.

RESULTS AND DISCUSSION

Yield of a crop is mainly the manifested effect of high yielding varieties associated with proper package of practices. Yield potentiality of a variety is a genotypic character which is influenced by the micro environment created by various agronomic practices and inputs (Reddy and Reddi, 2006). The mulberry cultivar V-1, selected for the present study is highly productive cultivar as bush under irrigated condition. It is also reported as a better choice for cultivation as tree under rainfed as well as irrigated conditions to harvest good quality leaves (Ahalya, 2020).

Main Effect of Spacing

The data indicated a significant effect of spacing on all the four growth parameters (Table 2) and also in all the four leaf yield related parameters studied

TABLE 2

Mean values (of five crops) on growth parameters of V1 trained as small tree under different spacing and pruning heights

Treatment	Plant height (m)			Shoots per plant (No.)			Longest shoot length (m)			Total shoot length (m)		
Main treatment Spacing (S)	3rd year	4th year	5th year	3rd year	4th year	5th year	3rd year	4th year	5th year	3rd year	4th year	5th year
S1 (2.4 x1.2m)	2.533	3.097	3.174	33.91	50.07	53.40	1.532	2.296	2.386	24.58	38.02	39.90
S2 (2.4 x 1.8 m)	2.588	3.253	3.456	35.20	52.69	56.60	1.588	2.392	2.445	25.49	39.88	41.87
S3(2.4 x 2.4m)	2.639	3.408	3.822	35.78	53.58	57.67	1.642	2.478	2.521	26.03	41.12	42.80
SEm±	0.003	0.008	0.001	0.236	0.196	0.138	0.02	0.005	0.002	0.002	0.141	0.072
CD at 5%	0.011	0.033	0.005	0.927	0.768	0.541	0.008	0.020	0.006	0.008	0.554	0.284
Sub treatment Pruning height (H)												
H1(0.5m)	1.969	2.754	3.166	38.67	55.64	61.82	1.469	2.304	2.357	28.24	44.09	46.45
H2 (1.0m)	2.559	3.319	3.536	34.40	52.78	56.56	1.557	2.376	2.457	25.04	39.57	41.89
H3 (1.5m)	3.232	3.684	3.750	31.82	47.91	49.29	1.735	2.486	2.538	22.83	35.35	36.23
SEm±	0.003	0.008	0.003	0.161	0.120	0.262	0.003	0.003	0.003	0.003	0.081	0.136
CD at 5%	0.009	0.024	0.010	0.497	0.370	0.807	0.008	0.010	0.009	0.008	0.250	0.419
Interaction (S x H)												
S1 x H1 (2.4 x1.2 m; 0.5m)	1.921	2.703	2.795	36.87	53.13	58.73	1.424	2.223	2.276	27.07	41.94	44.33
S1x H2 (2.4 x1.2 m; 1.0 m)	2.512	3.231	3.309	33.33	50.47	53.27	1.502	2.281	2.389	24.25	37.74	39.93
S1 x H3 (2.4 x1.2 m; 1.5 m)	3.166	3.357	3.417	31.53	46.60	48.20	1.670	2.382	2.494	22.43	34.38	35.44
S2 x H1 (2.4 x 1.8 m; 0.5 m)	1.973	2.744	3.163	38.73	55.67	62.00	1.471	2.297	2.355	28.27	43.83	46.56
S2 x H2 (2.4 x 1.8 m;1.0 m)	2.552	3.317	3.466	34.60	53.20	57.47	1.553	2.387	2.457	25.12	39.99	42.32
S2 x H3 (2.4 x 1.8 m; 1.5 m)	3.239	3.697	3.741	32.27	49.20	50.33	1.740	2.491	2.524	23.07	35.82	36.74
S3 x H1 (2.4 x 2.4 m; 0.5 m)	2.013	2.817	3.542	40.40	58.13	64.73	1.514	2.393	2.442	29.37	46.50	48.46
S3 x H2 (2.4 x 2.4 m; 1.0 m)	2.614	3.410	3.833	35.27	54.67	58.93	1.616	2.458	2.525	25.74	41.00	43.42
S3 x H3 (2.4 x 2.4 m;1.5 m)	3.291	3.998	4.092	31.67	47.93	49.33	1.796	2.584	2.604	22.98	35.85	36.53
SEm±	0.005	0.013	0.005	0.279	0.208	0.454	0.005	0.006	0.005	0.005	0.141	0.236
CD at 5%	0.016	0.041	0.017	0.861	0.641	1.398	0.015	0.018	0.016	0.015	0.433	0.726

The Mysore Journal of Agricultural Sciences

TABLE 3

Mean values (of five crops) on yield related parameters of V1 trained as small tree under different spacing and pruning heights

Treatment	Leaves per tree (No.)			Leaf area index (LAI)			Leaf yield per tree (kg)			Leaf yield per hectare (kg)		
Main treatment Spacing (S)	3rd year	4th year	5th year	3rd year	4th year	5th year	3rd year	4th year	5th year	3rd year	4th year	5th year
S1 (2.4 x1.2 m)	447	691	725	3.918	6.017	6.438	1.665	2.709	2.921	28899	47026	50716
S2 (2.4 x 1.8 m)	463	725	761	2.958	4.184	4.836	1.713	2.841	3.098	19975	32875	35453
S3(2.4 x 2.4 m)	473	748	778	2.455	3.279	4.086	1.753	2.920	3.230	15283	25343	27648
S.Em±	2.224	2.567	1.315	0.013	0.013	0.016	0.008	0.007	0.006	85.54	102.1	154.44
CD at 5%	8.734	10.08	5.165	0.050	0.053	0.062	0.031	0.026	0.024	335.85	400.7	606.4
Sub Plot Pruning height (H)												
H1(0.5 m)	513	802	845	3.383	4.879	5.623	1.678	2.729	3.003	20848	34235	37252
H2 (1.0 m)	455	720	762	3.076	4.490	5.176	1.718	2.802	3.106	21463	35367	38157
H3 (1.5 m)	415	643	659	2.870	4.111	4.562	1.744	2.878	3.141	21847	35643	38408
S.Em±	1.433	1.476	2.472	0.009	0.008	0.015	0.005	0.006	0.009	67.38	60.96	103.21
CD at 5%	4.415	4.548	7.617	0.029	0.023	0.045	0.017	0.018	0.028	207.62	187.82	318.0
Interaction (S x H)												
S1 x H1 (2.4 x1.2 m; 0.5 m)	492	762	806	4.230	6.497	7.004	1.611	2.629	2.866	27972	45641	49754
S1x H2 (2.4 x1.2 m; 1.0 m)	441	686	726	3.871	5.992	6.437	1.671	2.718	2.948	29004	47177	51176
S1 x H3 (2.4 x1.2 m; 1.5 m)	408	625	644	3.652	5.560	5.872	1.712	2.780	2.950	29721	48262	51219
S2 x H1 (2.4 x 1.8 m; 0.5 m)	514	797	846	3.209	4.508	5.348	1.680	2.746	3.008	19435	31776	34806
S2 x H2 (2.4 x 1.8 m; 1.0 m)	457	727	769	2.923	4.197	4.948	1.734	2.837	3.120	20066	33281	35456
S2 x H3 (2.4 x 1.8 m; 1.5 m)	420	651	668	2.741	3.848	4.213	1.754	2.901	3.165	20425	33569	36098
S3 x H1 (2.4 x 2.4 m; 0.5 m)	534	845	881	2.709	3.631	4.516	1.744	2.813	3.133	15137	20099	27197
S3 x H2 (2.4 x 2.4 m;1.0 m)	468	745	789	2.436	3.280	4.143	1.750	2.852	3.250	15319	25287	27839
S3 x H3 (2.4 x 2.4 m; 1.5 m)	418	652	664	2.219	2.925	3.600	1.765	2.954	3.307	15394	25642	27908
S.Em±	2.482	2.556	4.282	0.016	0.013	0.026	0.009	0.010	0.016	116.71	105.6	178.76
CD at 5%	7.647	7.877	13.19	0.051	0.040	0.079	0.029	0.031	0.049	359.6	325.32	550.80

(Table 3) in all the three years. Among the three spacings studied, in widest spacing (S3) plant height (2.639, 3.408 and 3.822 m), number of shoots (35.78, 53.58 and 57.67), longest shoot length (1.642, 2.478 and 2.521 m), total shoot length (26.03, 41.12 and 42.80 m), number of leaves / plant (473, 748 and 778) and leaf yield per plant (1.753, 2.920 and 3.230 kg) were found maximum in all the three years, which may be due to sparse plant population and reduced competition for resources between the plants. There is also an increasing trend over the years in all the above said parameters which may be due to improvement in canopy size every year. On the other hand, leaf area index (3.918, 6.017 and 6.438) and leaf yield per hectare (28899, 47026 and 50716 kg) were found highest in S1, while they were found lowest in S3 (2.445, 3.279 and 4.086) and (15283, 25343 and 27648 kg) respectively. Jyothi Biradar *et al*. (2015) have recorded high positive correlation between plant height, number of branches per plant, total shoot length, intermodal distance and number of leaves per plant with leaf yield per plant.

The present study clearly indicated the large differences in leaf yield between three spacings studied. It is an established fact that yield of a crop is the result of final plant population and the full yield potential of individual plant is achieved under wider spacing and hence, establishment of optimum plant population is essential to get maximum yield. Under conditions of sufficient soil moisture and nutrients, higher population is necessary to utilize the other growth factors efficiently (Gopal Chandra De, 1995). As the leaf yield per hectare per year was comparatively very high in three stump height combinations under spacing S1, it could be inferred that, optimum spacing for tree mulberry cultivation with V-1 under irrigation is 2.4 x 1.2 m.

Main Effect of Stump Height

The stump height also showed significant effect on all the four growth parameters and leaf yield parameters studied in all the three years. Plants with highest stump height (H3) recorded maximum plant height (3.232, 3.684 and 3.750 m), longest shoot length (1.735, 2.486 and 2.538 m), leaf yield per plant (1.744, 2.878 and 3.141 kg) and leaf yield per hectare (21847, 35643 and 38408 kg) in all the three years. It is observed that plant height, longest shoot length, leaf yield per plant and leaf yield per hectare were found increased with the increase in stump height while number of shoots per plant, total shoot length, number of leaves per plant and LAI decreased with increase in stump height. In a study on optimizing the management practices in mulberry for intensive fodder production in humid tropics of Kerala (Raj *et al.*, 2015) have recorded increased biomass with increase in pruning height and opined that the increase in biomass production with increasing pruning height was possibly due to more reserve material in taller stocks that stimulated vigorous growth. The present study also indicated that compared to the spacing effect on leaf yield, the stump height effect was less. Further, there is a narrow difference in leaf yield between the three stump heights and hence any of these three stump heights could be adopted. However, the stump height of 1.0 m is more convenient in field operations. Further, Thangamallar *et al*. (2018) have also reported better growth and yield of V-1 mulberry when pruned to a height of 90 cm compared to 50 cm and 150 cm.

Interaction Effect of Spacing (S) and Stump Height (H)

The data clearly indicated that, interaction effect of three spacing and three pruning heights were also significant on all the parameters studied. Among the nine combinations in all the three years, leaf yield per tree was maximum in S3H3 (1.765, 2.954 and 3.307 kg / plant) and minimum in S1H1 (1.611, 2.629 and 2.866 kg / plant). But, the leaf yield per hectare was maximum in S1H3 and minimum in S3H1 in all the three years.

It is observed that, leaf yield / ha increased in varied percentages over the years in all the nine combinations of spacing and stump height and reached almost maximum level in fifth year. In high yielding combinations S1H1, S1H2 and S1H3 the leaf yields were 49754, 51176, 51219 kg / ha / yr, respectively.

The Mysore Journal of Agricultural Sciences

Year wise leaf yield from 2nd year to 5th year with probable yield of 6th to 9th year after plantation is depicted in Fig.3. It is clear that, rate of increase in yield from 2nd year to 3rd year and 3rd year to 4th year is very high and it narrows down from 4th year to 5th year. Leaf yield may increase further with 5, 3 and 1 per cent after 6th, 7th and 8th year and stabilizes 9th year onwards. While studying mulberry cultivation as high bush and small tree in hilly regions, Dandin and Sengupta (1988) have observed that full potential of yield can be experienced only from 5th year and there will be 5 - 10 per cent increase in the yield every year in wider plantation till 8th year. The present study also indicated that the maximum yield of 55 MT could be obtained on 8th year, mainly in S1H1, S1H2 and S1H3 combinations. The differences in leaf yield between three high yielding combinations (S1H1, S1H2 and S1H3) are marginal and hence, any one of these three combinations can be adopted. However, S1H2 is a more preferred combination than S1H1 and S1H3 as there is a possibility of decrease in leaf quality in S1H1 and it is difficult to harvest shoots in S1H3.

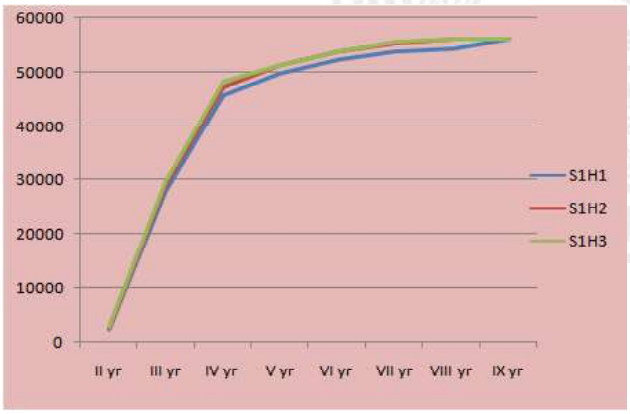

Fig. 3: Rate of increase in leaf yield (kg/ha) from 2nd year to 9th year after plantation in three treatment combination under spacing (S1)

In two other previous studies, higher yield potentiality of V-1 cultivar as small tree have been recorded but with different spacings and stump heights. Vanitha (2018) in a study on tree mulberry conducted at farmers field of Kolar district have recorded 3409 ± 1171 g leaf yield per tree under 10' x 10' spacing with pruning height of 5' which is comparable to the leaf yield (3307 g) obtained in S3H3 combination of spacing and pruning height of the present study. Sudhakar *et al*. (2018a) have recorded the leaf yield of 67072 kg / ha / yr in 8' x 3' spacing with 3' stump height which is very high compared to the maximum leaf yield of 51219 kg / ha / yr recorded under S1H3 treatment of the present study. After comparing the performance of V-1 cultivar under 8'x 3', 8'x 5'and 10' x 10' spacings, they have also opined that, tree mulberry farming under 8' x 3' spacing supplemented with 50 per cent reduced dose of fertilizers, manure and limited water supply is ultimate to the South Indian farming community. In another report, Sudhakar *et al.,* (2018b) have also suggested a series of spacings for tree mulberry cultivation such as 4' x 8' / 5'x 8' / 4' x 10' / 5' x 10' for large farmers and 4' x 6' / 5' x 6' for small and medium farmers with pruning height of 1' to 1.5' from the ground. In another study on intercropping with tree mulberry plantations of V1 mulberry at farmers fields with 10' x 10' spacing, Rajegowda *et al*., (2020) have recorded leaf yield of 7955.82 kg / ha / crop when intercropped with cowpea and 7809.35 kg / ha / crop in sole mulberry crop.

From the present study, it is concluded that effect of spacing on leaf yield of V-1 mulberry cultivar is higher than that of stump height. Leaf yield per hectare decreases with the increase in spacing and increases with the increase in stump height in tree mulberry cultivation. The differences in leaf yield among three combinations (S1H1, S1H2 and S1H3) of 2.4 x 1.2 m spacing with 0.5 m, 1.0 m and 1.5 m stump height, is marginal. However, from the point of maintaining leaf quality and easy harvesting of shoots, 2.4 x 1.2 m spacing with 1.0 m stump height is a better option for the cultivation of V-1 mulberry cultivar as tree under irrigated condition.

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