**Effect of planting geometry and intercropping on growth attributes, leaf yield, quality of mulberry (Morus alba) and its economics under irrigated, Gangetic alluvial soil conditions**

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**ABSTRACT**

A field experiment was conducted under irrigated condition to study the effect of planting geometry and intercropping on growth characters, leaf yield and quality in newly evolved, triploid, high yielding, recommended and popular S 1635 mulberry (Morus alba L.) along with intercrop yield and additional net profit. The plants were established through saplings in seven different spacing with variable number of plants / ha and were maintained through recommended package of practices for irrigated garden. Four different suitable intercrops, one in each season and one green manure crop in July September were taken up annually in mulberry for judicious utilization of space, time, nutrients and also for soil enrichment.

Significant differences were observed among the treatments in all the parameters studied. Growth attributes and leaf quality were improved along with soil nutrient status in paired row system, particularly in (90cm + 120cm) × 60cm spacing. Besides, it registered almost similar leaf yield (29 488.98kg/ha/year) compared to 60cm × 60cm spacing (control) in spite of 42.9% less plant population (15 873/ha) over control (27 777/ha), higher leaf yield / plant (0.37kg) and optimum intercrop yield as well as additional net profit of ₹35 368/ha/year (₹5974.00 more over control).

Hence, this paired row spacing [(90cm + 120cm) × 60cm] may be useful and recommended to the farmers for mass practice in the cultivation of S 1635 mulberry with four intercrops and one green manure crop / year at least up to three years which did not adversely affect mulberry under irrigated condition. In addition, there is also a scope for partial mechanization which enables to reduce manpower requirement as well as economy in cultivation.

**Key words:** Economics, Intercropping, Irrigated mulberry, Leguminous green manure, Morus alba, Planting geometry

Out of 178 000 ha mulberry plantation in India, West Bengal, being the third silk producing state, has about 11 948 ha mulberry plantation and contributes only 9.6% (1 758.68 million tonnes raw silk production out of 18 370 million tonnes in India) raw silk production in the country during 2008–09 (Anonymous 2009). Sericulture plays a vital role for the development of rural economy, self-employment and reduces migration to urban areas. The major production of raw silk takes place in 35–40% irrigated area of Gangetic alluvial soil conditions of Malda, Murshidabad, Birbhum and Nadia districts of West Bengal. The leaf of mulberry (Morus alba L.) is the sole food of silkworm (Bombyx mori L.). It is a perennial deep rooted plant, generally cultivated in 60cm × 60cm spacing for under irrigated condition. But the appropriate spacing for newly evolved triploid mulberry S 1635 is not known for its better exploitation when the leaf productivity is at the tune of 35–40 million tonnes/ha/year.

Moreover, due to severe climatic fluctuation in West Bengal, out of five, 2–3 cocoon crops (July, September and at times April) either fail or become unprofitable and show variation in leaf yield in different seasons (Anonymous 2003). In contrast, the leaf production is reduced and becomes scarce during November and February due to low temperature and humidity in winter when it is congenial for silkworm rearing (Anonymous 1990).

Plenty of works done on planting geometry in agricultural crops revealed that wider spacing (60cm × 20cm) increased sweet corn yield, nitrogen uptake, net returns and benefit:cost ratio than conventional system (Kar et al. 2006 and Thavaprakaash et al. 2005). Ahmad et al. (2007) reported that intercropping (cowpea and Sesbania) of forage sorghum with legumes at wider spacing (45cm spaced double-row strips with 15cm space between the rows in a strip) contributed...
more production and profit than monocropped sorghum and 30 cm × 30 cm spacing. Padhi et al. (2010) observed that early 
duration pigeonpea intercropping with finger millet at 2:4 row ratio was found superior in productivity, economics 
and energy output over other spacing. In mulberry, few works on planting geometry were 
reported. Ramakant et al. (2001) observed highest leaf yield 
along with better protein, sugar, N, P and K uptake in S 36 
mulberry under paired row system [(90 cm + 180 cm) × 60 cm) 
of plantation in comparison with 60 cm × 60 cm, 90 cm × 
90 cm, 180 cm × 60 cm and others, while much wider spacing 
was found detrimental because of quick drying and cracking 
of soil. Krishnaswamy et al. (1970), Rahaman et al. (1999) 
and Doss et al. (2000) opined that wider spacing improved 
leaf quality, i.e., protein, sugar, moisture, rearing performances 
as well as ERR% and digestibility.

But there was no report available on planting geometry 
required for S 1635 mulberry with suitable intercropping for 
judicious utilization of space, time and nutrients available 
towards additional income and to overcome the crop loss. 
Therefore, the objective of the present study was to ascertain 
the appropriate planting geometry of newly evolved, triploid, 
high-yielding, recommended and popular S 1635 mulberry 
(Morus alba L.) with suitable intercropping on growth 
characters, leaf yield, leaf quality and intercrop yield as well 
as additional net profit until it adversely affects mulberry.

MATERIALS AND METHODS

The experiment was undertaken during 2007–10 at 
Berhampore, Murshidabad (West Bengal), under irrigated, 
Gangetic alluvial soil conditions. The physico-chemical 
characteristics and nutrient status of soil before and after 
completion of each year were studied and the references for 
analytical methods have been cited. The initial soil was 
sandy loam, pH 7.97 (Jackson 1973), EC 0.15 dS/m and 
contained available 224 kg/ha nitrogen (Subbiah and Asija 
1956), 31 kg/ha phosphorus and 378 kg/ha potassium (Jackson 
1973). Mulberry S1635 (a triploid, high yielding) was 
rumoured in the following same different spacing 
treatment in the experimental field in RBD with three 
replications under irrigated condition (Ullal and 
Narasimhanna 1987). The seven different treatments 
(spacings) and plant population/ha in parentheses are:

T1 (control) : 60 cm × 60 cm (27,777), T2: 90 cm × 90 
(12,345), T3: (90 cm + 150 cm) × 60 cm (13,888), T4: (60 
+ 120 cm) × 60 cm (18,518), T5: (60 cm + 150 cm) × 60 
(15,873), T6: (90 cm + 120 cm) × 60 cm (15,873) and T7: 
(90 cm + 150 cm) × 30 cm (27,778).

The recommended dose of FYM @ 20 million tonnes 
and NPK @336:180:112 kg/ha/year, in five equal splits for 
mulberry and NPK/ha for respective intercrop [greengram 
(Vigna radiata) var. B1 (seed rate: 12 kg/ha and NPK 
@20:40:20 kg)] in May–July, cowpea (Vigna sinensis) var. 
BC1 (seed rate: 12 kg/ha and NPK @ 25:70:50 kg) in 
September–November. Toria (Brassica campestris L. var. 
toria Duth) var. B54 (seed rate: 5 kg/ha and NPK @ 
50:25:25 kg) in November–February and Amaranth leafy 
vegetable (Amaranthus blitum var. oleracea) preferably 
champa notey (seed rate: 2.5 kg/ha and NPK@50:50:50 kg) 
in March–April and one green manure crop sunnhemp, 
(Crotalaria juncea) in July–September (seed rate: 25 kg/ha 
and 25 kg super phosphate/ha) were applied followed by 
irrigation. The green biomass of green gram (5 million tonnes/ 
ha) and cowpea (6 million tonnes/ha) after crop harvest and 
green biomass of sunnhemp (4 million tonnes/ha) were also 
incorporated in soil.

The data on plant height, no. of leaves/plant, leaf area (Satpathy et al. 1992), LAI, leaf-shoot 
(%), total and per plant leaf yield in mulberry, intercrop yield 
and weight of green bio-mass of green manure, greengram 
and cowpea were recorded in all the five seasons (July, 
September, November, February and April) consecutively 
for three years. Leaf moisture (oven drying method), 
photosynthesis (Likor 6200 photosynthetic meter), total 
chlorophyll (Aron 1949), total soluble protein (Lowry et al. 
1951) and total soluble sugar (Morris 1948) were also studied 
accordingly.

Season-wise as well as three years pooled data were 
statistically analyzed (Panse and Sukhatme 1967). Analysis 
of variance was done for five seasons of three consecutive 
years. The overall mean of each of the seven treatments and 
critical difference value (P=0.05) for treatments, season × 
treatment and year × treatment and CV(%) as well as 
economic gain were calculated.

RESULTS AND DISCUSSION

Effect of planting geometry on soil nutrient status

The overall soil nutrient status was found to be improved 
after first year of experiment. Maximum available N 
was found in T5 and T6, followed by T3 and T7. P 
was obtained in T5 and T6, followed by T3 and T4 and K 
was found in T5, followed by T5. After second year, the available 
nitrogen and phosphorus content in soil were marginally 
reduced and potassium content in soil remained almost similar 
or increased (T2, T3 and T4) over initial status. After third 
year, the available nitrogen and phosphorus content in soil 
were marginally reduced over initial status except T5 which 
was at par or marginally more in case of phosphorus. 
Potassium content remained almost similar or increased in 
T2, T3 and T4 over initial status (Table 1). Year-wise 
comparison indicated that overall available nitrogen, 
phosphorus and potassium contents in soil were found to be 
slightly reduced or remained almost similar in most of the 
treatments during second and third year over first year which 
did not reflect in leaf yield. However, year-wise leaf yield 
was increased in all the treatments (Fig 2).
Effect of planting geometry on growth attributes, yield of mulberry leaf and intercrops

Three years pooled data revealed that the effect of the treatments was found to be significant on plant height, number of branches/plant, number of leaves/plant and leaf area index (LAI) except leaf area which was at par. Maximum plant height was observed in paired row system of plantation, particularly in T₆, followed by T₅ compared to T₁ and T₇, having almost similar no. of plants. Highest branches/plant was found in T₂, followed by T₆ (paired row) over T₁ and T₇. Maximum number of leaves/plant was obtained in T₂, followed by T₃ over T₁ and T₇. The maximum leaf area was obtained in T₅, followed by T₃ over T₁ and T₇. Maximum LAI was registered in T₁, followed by T₇ over other paired row spacing (Table 2).

The effect of the treatments was found significant on leaf yield, while S × T and Y × T interactions were at par. Maximum leaf yield was registered in T₁, followed by marginally lower leaf yield in T₆, while T₄ registered significantly lower leaf yield over T₂ ie control (Table 2). The result also indicated that the congenial environment influenced maximum leaf production in particular season (July), followed by April, September, November and February which also supported the earlier findings (Anonymous 2003) irrespective of treatments and age of the plants (Fig 1). Maximum leaf yield was registered in July (27%), followed by April (22.07%), September (20.3%), November (19.28%) and February (11.35%). Year-wise leaf yield indicated a significant increasing trend among the treatments which registered 6.09% increase in second year over first year and 22.69% in third year over second year (Fig 2).

It is interesting to note that the effects of the treatments and S × T interaction were found significant on leaf yield/plant (Table 2, Fig 3). Seasonal and year-wise variation in leaf yield/plant were observed, of which it was maximum in July (0.43kg), followed by April (0.35kg), September (0.32kg), November (0.31kg) and February (0.18kg) which correlates the trend of production and increase in leaf yield as a whole in July (42.57%), April (34.86%), September (32.0%), November (30.71%) and February (18.14%) in various seasons as well as in year-wise annual leaf yield of mulberry. In respect of treatments, overall maximum leaf yield/plant was observed in T₂, followed by T₃. However, minimum leaf yield/plant was observed in T₇, followed by T₁.

Table 1 Effect of planting geometry on soil nutrient status

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Available N (kg/ha)</th>
<th>Available P (kg/ha)</th>
<th>Available K (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>I yr</td>
<td>II yr</td>
</tr>
<tr>
<td>T₁(c)</td>
<td>224</td>
<td>233</td>
<td>196</td>
</tr>
<tr>
<td>T₂</td>
<td>233</td>
<td>205</td>
<td>207</td>
</tr>
<tr>
<td>T₃</td>
<td>243</td>
<td>196</td>
<td>199</td>
</tr>
<tr>
<td>T₄</td>
<td>233</td>
<td>205</td>
<td>200</td>
</tr>
<tr>
<td>T₅</td>
<td>308</td>
<td>196</td>
<td>193</td>
</tr>
<tr>
<td>T₆</td>
<td>308</td>
<td>187</td>
<td>182</td>
</tr>
<tr>
<td>T₇</td>
<td>243</td>
<td>196</td>
<td>188</td>
</tr>
</tbody>
</table>

Table 2 Effect of plating geometry on growth attributes, mulberry leaf yield, intercrop yield and net profit (average of three years)

<table>
<thead>
<tr>
<th>Treatment (no. of plants /ha)</th>
<th>Plant height (cm)</th>
<th>No. of branches/plant</th>
<th>No. of leaves/plant</th>
<th>Leaf area (cm²)</th>
<th>LAI</th>
<th>Leaf yield (million tonnes/ha/year)</th>
<th>Leaf yield (kg/plant)</th>
<th>Intercrop yield (million tonnes/ha/year)</th>
<th>Net profit (₹/ha/ year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ (control) (27 777)</td>
<td>131.76</td>
<td>7.23</td>
<td>134.72</td>
<td>166.85</td>
<td>6.15</td>
<td>30.76</td>
<td>0.22</td>
<td>9.04</td>
<td>29394</td>
</tr>
<tr>
<td>T₂</td>
<td>136.92</td>
<td>9.43</td>
<td>200.18</td>
<td>168.59</td>
<td>4.12</td>
<td>25.42</td>
<td>0.41</td>
<td>11.75</td>
<td>30466</td>
</tr>
<tr>
<td>T₃</td>
<td>137.38</td>
<td>8.95</td>
<td>182.75</td>
<td>174.10</td>
<td>4.35</td>
<td>26.42</td>
<td>0.38</td>
<td>10.92</td>
<td>37211</td>
</tr>
<tr>
<td>T₄</td>
<td>132.19</td>
<td>8.08</td>
<td>147.24</td>
<td>168.79</td>
<td>4.56</td>
<td>27.68</td>
<td>0.30</td>
<td>10.93</td>
<td>42040</td>
</tr>
<tr>
<td>T₅</td>
<td>139.48</td>
<td>8.43</td>
<td>160.19</td>
<td>177.94</td>
<td>4.45</td>
<td>26.77</td>
<td>0.34</td>
<td>10.73</td>
<td>37089</td>
</tr>
<tr>
<td>T₆</td>
<td>140.30</td>
<td>9.04</td>
<td>176.03</td>
<td>172.44</td>
<td>4.78</td>
<td>29.49</td>
<td>0.37</td>
<td>9.71</td>
<td>35368</td>
</tr>
<tr>
<td>T₇ (27 778)</td>
<td>133.20</td>
<td>6.67</td>
<td>123.89</td>
<td>172.06</td>
<td>5.83</td>
<td>27.10</td>
<td>0.20</td>
<td>11.55</td>
<td>39031</td>
</tr>
<tr>
<td>CD (P= 0.05) (SxY)</td>
<td>5.44</td>
<td>0.60</td>
<td>12.82</td>
<td>10.73</td>
<td>0.55</td>
<td>4.21</td>
<td>0.03</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td>CD (Y×T)</td>
<td>NS</td>
<td>NS</td>
<td>15.17</td>
<td>NS</td>
<td>0.65</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

T₁, 60cm × 60cm; T₂, 90cm × 90cm; T₃, (90cm +150cm) × 60cm; T₄, (60cm +120cm) × 60cm; T₅, (60cm +150cm) × 60cm; T₆, (90cm +120cm) × 60cm, T₇, (90cm +150cm) × 30cm
where almost similar number of plant population was there. It was further observed that all the treatments of wider spacing, ie 90cm × 90cm (T2) and paired-row system (T3–T6) registered maximum leaf yield/plant over recommended spacing (60cm×60cm) confirmed that more spacing contributed more leaf yield/plant.

The effect of the treatments was found significant on intercrop yield, whereas S × T and Y × T interactions were at par (Table 2). Maximum greengram yield was obtained in T3, followed by T4 and T7 in July, maximum bio-mass yield of green manure (Crotalaria juncea) in T2, followed by T7 in September, maximum cowpea yield in T3, followed by T4 in November, maximum toria in T4, followed by T7 in February and maximum amaranth leafy vegetable was obtained in T2, followed by T7 in April (Fig 4). Overall highest annual average yield of intercrop was registered in T2, followed by T7. However, lowest intercrop yield was obtained in T1. It was also observed that though intercrop yield was marginally increased (+8.3%) in second year over first year, but it was drastically reduced by 15.98% in third year compared to second year production due to reduction of space slowly caused by the growth and age of mulberry stumps and canopy development of mulberry (Fig 5).
**Effect of planting geometry on leaf quality**

Effect of the treatments was found to be at par with leaf moisture (%) and highest was obtained in T₆, followed by T₃. The effect of the treatments was significant on photosynthesis. Maximum photosynthesis was obtained in T₃, followed by T₆ and least in T₁. Highest photosynthesis was observed in November, followed by February and least in April. There was an increasing trend (14.54%) in photosynthesis observed in third year over second year. The rate of photosynthesis was higher in paired row system in comparison with 60cm × 60cm spacing. The effect of the treatments was significant on total chlorophyll content in leaf. Maximum chlorophyll content was registered in T₆, followed by T₃ and least in T₁ (Table 3). Highest chlorophyll content was observed in third year, followed by July and least in February. Year-wise improvement in chlorophyll content by 12.39% was observed in third year over second year and paired row spacing registered maximum chlorophyll than 60cm × 60cm spacing.

Treatment effect was found significant on total soluble protein (TSP) content in leaf. Maximum TSP content in leaf was observed in T₉, followed by T₃ and least in T₁ which confirmed that the leaf produced from 60cm × 60cm spacing contained low TSP than paired row system. Highest TSP content in leaf was observed in September, followed by April and least in November and 7.4% more TSP was observed in third year over second year. However, TSP was found minimum in 60cm × 60cm and maximum in paired row spacing. The effect of the treatments was found significant on total soluble sugar (TSS) content in leaf. Maximum TSS was observed in T₃, followed by T₆ and least in T₅. There was no such specific trend found in TSS content among the paired row system and 60cm × 60cm spacing, though of course, all paired rows, especially T₃ and T₆, as well as 60cm × 60cm spacing registered maximum TSS (Table 3).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Leaf moisture (%)</th>
<th>Photosynthesis (µmol/m²/s)</th>
<th>Total chlorophyll (mg/g f. wt)</th>
<th>Total soluble protein (mg/g f. wt)</th>
<th>Total soluble sugar (mg/g f. wt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>78.42</td>
<td>6.12</td>
<td>2.17</td>
<td>28.07</td>
<td>35.55</td>
</tr>
<tr>
<td>T₂</td>
<td>78.35</td>
<td>8.18</td>
<td>2.34</td>
<td>29.83</td>
<td>35.11</td>
</tr>
<tr>
<td>T₃</td>
<td>78.66</td>
<td>9.22</td>
<td>2.50</td>
<td>30.44</td>
<td>36.54</td>
</tr>
<tr>
<td>T₄</td>
<td>78.28</td>
<td>8.95</td>
<td>2.40</td>
<td>30.49</td>
<td>35.07</td>
</tr>
<tr>
<td>T₅</td>
<td>78.88</td>
<td>9.11</td>
<td>2.39</td>
<td>29.28</td>
<td>34.86</td>
</tr>
<tr>
<td>T₆</td>
<td>78.82</td>
<td>9.17</td>
<td>2.68</td>
<td>30.35</td>
<td>35.73</td>
</tr>
<tr>
<td>T₇</td>
<td>78.38</td>
<td>9.13</td>
<td>2.34</td>
<td>30.40</td>
<td>35.69</td>
</tr>
<tr>
<td>CD (P=0.05)</td>
<td>NS</td>
<td>1.23</td>
<td>0.15</td>
<td>0.81</td>
<td>0.99</td>
</tr>
<tr>
<td>CV(%)</td>
<td>1.81</td>
<td>6.15</td>
<td>12.18</td>
<td>5.34</td>
<td>5.39</td>
</tr>
</tbody>
</table>

**Effect of planting geometry on economic gain**

Overall maximum net profit of ₹42,040/ha/year was obtained in T₆, followed by T₇ (₹39,031/ha/year) and T₃ (₹37,211/ha/year) considering S 1635 mulberry and intercrop production in four seasons, value of sale proceeds, effect of green manuring in one season and net profit including all expenditure (Tables 1, 4).

It was further observed that paired row system of plantation ([90cm+120cm] × 60cm), ie T₆ registered almost similar leaf yield, ie 29,488.98kg/ha/year with control, ie 60cm × 60cm spacing (with 15,873 plant population/ha, ie 42.9% less than 60cm × 60cm spacing), 0.37kg leaf yield/plant (0.15 kg/plant more than 60cm × 60cm spacing) and net profit of ₹ 35,368/ha/year (₹ 5,974 more over 60cm × 60cm spacing) in comparison with leaf yield of 30,764.19 kg/ha/year in 27,777 plant population/ha, 0.22kg leaf yield/plant and net profit of ₹ 29,394/ha/year in 60cm × 60cm spacing under irrigated condition. T₄ ([60cm + 120cm] × 60cm) though registered highest net profit of ₹ 42,040/ha/year but produced significantly lower leaf yield, ie 27,679.79 kg/ha/year, 0.30kg leaf yield/plant in spite of higher number of plant population (18,518 plants/ha) over T₆, hence it will not be beneficial to the sericulturist.

The reason for better performance in paired row system of plantation particularly T₆ ([90cm+120cm] × 60cm) might be due to availability of more space in between the rows, helps the plants to grow in a better manner by rational utilization of organic and chemical fertilizer as well as by growing and incorporating the leguminous biomass of intercrops and green manure plants which helps in proper assimilation and availability/consumption of nutrients through better uptake as well as due to less competition because of lower number of plants (42.9% less plant population in T₆ than control i.e. 60cm × 60cm spacing).

The result corroborated the findings on better sweet corn yield in wider spacing (60cm × 20cm) by Kar et al. (2006), better baby corn yield with radish or coriander in wider planting geometry (60cm × 19cm) applying INM practices by Thavaprakaash et al. (2005), better production of forage sorghum with forage legumes, ie, cowpea or Sesbania in wider spacing (15cm × 45cm) by Ahmad et al. (2007), better production of early duration pigeonpea with finger millet intercropping at 2:4 row ratio and for medium

**Table 3 Effect of planting geometry on leaf quality (average of three years* and two years data)**
Table 4  Effect of planting geometry on overall net profit (₹/ha/year) through intercropping in mulberry (season-wise average of three years)

<table>
<thead>
<tr>
<th>Treatment (no. of plants/ha)</th>
<th>July</th>
<th>September</th>
<th>November</th>
<th>February</th>
<th>April</th>
<th>Mean of five crops</th>
<th>Addl. Annual net profit with mulberry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(₹)</td>
<td>(₹)</td>
<td>(₹)</td>
<td>(₹)</td>
<td>(₹)</td>
<td>(₹)</td>
<td>(₹)</td>
</tr>
<tr>
<td>T1  (27 777)</td>
<td>22 345</td>
<td>15 828</td>
<td>16 717</td>
<td>9 179</td>
<td>24 114</td>
<td>5 879</td>
<td>29 394</td>
</tr>
<tr>
<td>T2  (12 345)</td>
<td>12 615</td>
<td>9 436</td>
<td>26 700</td>
<td>8 274</td>
<td>34 373</td>
<td>6 093</td>
<td>30 466</td>
</tr>
<tr>
<td>T3  (13 888)</td>
<td>25 590</td>
<td>11 251</td>
<td>36 044</td>
<td>13 522</td>
<td>34 593</td>
<td>7 365</td>
<td>37 211</td>
</tr>
<tr>
<td>T4  (18 518)</td>
<td>25 494</td>
<td>13 522</td>
<td>34 373</td>
<td>18 435</td>
<td>34 076</td>
<td>8 408</td>
<td>42 040</td>
</tr>
<tr>
<td>T5  (15 873)</td>
<td>26 123</td>
<td>11 260</td>
<td>36 044</td>
<td>7 365</td>
<td>29 800</td>
<td>7 442</td>
<td>37 089</td>
</tr>
<tr>
<td>T6  (15 873)</td>
<td>25 462</td>
<td>13 177</td>
<td>26 164</td>
<td>11 599</td>
<td>29 702</td>
<td>7 074</td>
<td>35 368</td>
</tr>
<tr>
<td>T7  (27 778)</td>
<td>24 534</td>
<td>13 055</td>
<td>31 751</td>
<td>13 669</td>
<td>34 084</td>
<td>7 806</td>
<td>39 031</td>
</tr>
</tbody>
</table>

Cost of cultivation (₹/ha): Mulberry, 38 990/crop; greengram, 5 200/crop; sunnhemp, 7 078/crop; cowpea, 5 687/crop; toria, 4 140/crop; Amaranth leafy vegetable, 4 500/crop.

duration 2:8 row ratio by Padhi et al. (2010). Besides, similar result was also obtained by Ramakant et al. (2001), who recorded highest leaf yield, better sugar and protein content in leaf in S36 mulberry under paired-row system (90cm+120cm) × 60cm and better leaf quality in wider spacing was obtained by Krishnaswamy et al. (1970) in popular mulberry and by Rahaman et al. (1999) as well as Doss et al. (2000) in S 1635 mulberry.

Thus, it is inferred from the above study that the paired row system of S 1635 mulberry with (90cm + 120cm) × 60cm spacing along with four suitable intercrops (greengram in May–July, cowpea in September–November, Tonia in November–February and Amaranth Leafy Vegetable in March–April) until it adversely affects mulberry and one green manure crop sunnhemp (Crotalaria juncea) in July–September per year may be recommended to the farmers for mass practice to achieve sustainable quality leaf yield, better net profit and improvement in soil nutrient status with a scope for partial mechanization under irrigated condition.

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