Evaluation of agronomic characters of mulberry varieties in South East Queensland

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Abstract

Ten mulberry varieties consisting of *Morus nigra*, *Morus alba*, *Morus macroura* cv. Shahtoot, and the weeping mulberry were identified as planting material in South East Queensland. Cuttings from each variety were raised in poly bags in a glasshouse for 18 weeks. In the glasshouse all varieties survived except the shahtoot and the weeping mulberry. The plants from the remaining eight varieties (LV1 to LV8) were transplanted into the field on raised plastic mulch beds at a row by tree spacing of 4 m ? 2 m. A completely randomised design with eight varieties and three replications was used. Irrigation was applied through a drip system. All transplanted varieties had 100% survival in the field. Agronomic characters, plant height, growth rate, leaf mass, stem diameter, internodal length, and number of branches, were measured from transplanting to twenty weeks growth period. LV5 and LV6 exhibited faster growth, higher leaf mass, larger stem diameter, longer internodal length and fewer branches. LV2 also showed similar trends to LV5 and LV6. LV4 and LV8 showed slower growth rates with low leaf mass, smaller stem diameters, more branches and shorter internodal lengths followed closely by LV1. Significant variation among varieties apparent at the early stage of plant growth would be useful for selection of mulberry cultivars for silk production.

Key Words

Mulberry, variety, growth, evaluation

Introduction

Mulberry planting material was located and sourced from various locations in South East Queensland. Sericulture is practised widely in Asian countries, with China and India the two largest producers of raw silk. The annual world production of raw silk in 1999 was reported to be about 88,000 tonnes (1). The demand for high quality silk is increasing while the production is decreasing. Recently, in many developed countries there has been a renewed interest in silk production due to its unique natural properties, cultural significance and its use in the fashion business (2, 4) and thus opportunities exist for Australia to enter the world silk trade (3). Australian environmental conditions are very suitable for sericulture development including silkworm rearing and mulberry cultivation for silkworm food. The most important benefit of sericulture is that it can be practiced on small to medium sized land holding in rural areas, either as a subsidiary or main occupation. To meet the silk needs both domestically and internationally, a sericulture research project funded by RIRDC is being conducted at the University of Queensland, Gatton Campus.

The mulberry belongs to the genus *Morus* of the family *Moraceae*. There are 24 species of *Morus* and one subspecies with at least 100 known varieties (5). The mulberry trees can grow in a wide range of climatic, topographical and soil conditions. These are widely spread throughout all regions from the tropics to the sub-arctic and from sea level to altitudes as high as 4000 m (6). Mulberry performance is dictated by the agroclimatic conditions, the soil type and condition in which the plant is cultivated (7,8). Characterisation and evaluation of mulberry is important for silkworm production (9). No data is available in Australia on the value of domestic mulberry cultivars for silk production even though mulberry trees have been grown for over a hundred years. The main objective of this study was to evaluate a range of local mulberry varieties for their potential for silkworm production.

Materials and Methods

The study commenced in August 2001 at the University of Queensland, Gatton Campus in Lockyer Valley, Queensland. The field soil is of heavy dark cracking clays with slope of less than 1%. It receives an average rainfall of 763 mm which is summer dominant whilst evaporation rate is high, about double the average rainfall. Summer months are warm to hot with maximum temperature of 20-33?C although heat waves can reach 41?C. Minimum winter temperature of 6-10?C is reached and frosts are possible from May to September. Mulberry planting material was located and sourced from various locations in South East Queensland. Ten varieties were identified and selection was based on physical characters such as leaf, stem, fruit, vigour and health. Planting material was taken from branches ranging from 5 to 15 mm in diameter. The cuttings from these 10 varieties were placed in five litre poly bags filled with potting media of pine bark, saw dust, sand in ratio of 2.5:0.75:3 and osmocote fertiliser and propagated in a glasshouse for 18 weeks. All varieties survived except the shahtoot and the weeping mulberry. The remaining 8 varieties (LV1 to LV8) were transplanted into the field on raised plastic mulch beds at a row by tree spacing of 4 m ? 2 m. Variaties LV1, 2, 3, 4, 6, 7, 8 belong to Morus nigra and LV5 to Morus alba. Water was applied through a drip system. A completely randomised design with eight varieties and three replications was used. Plots consisted of ten plants.

Agronomic characters, plant height, growth rate, dry leaf mass, stem diameter, number of branches and internodal length were determined. Diameter was measured 400 mm from the ground. Leaf samples were taken for the 3rd and 4th fully developed leaves from the top of the plant. Internodal length was the overall height divided by the number of internodes. Two samples per plot were taken for all parameters except leaf mass where two leaves were sampled from each of the ten plants in a plot. The fresh leaves were oven dried at 60?C for 72 hours to determine the average mass of a dry leaf (7). Data were subjected to analysis of variance. Means were compared by Tukey’s Simultaneous Test at the 5% level of probability.

Results

Means of agronomic characters of mulberry varieties at twenty weeks after transplanting are shown in Table 1. LV5 and LV6 were significantly taller (3.02 and 3.10 m respectively) than other varieties. LV4 and LV8 were the shortest (2.05 and 2.14 m respectively). There were significant differences in height of about 1 m between the two extreme varieties. Stem diameter for LV5, LV6 and LV7 varieties was largest (28 mm) and LV4 was smallest (16 mm). Other varieties ranged between 22 and 25 mm in diameter. Leaf mass was highest for LV2 (2.82 g) and LV5 (2.75 g) and LV8 was lowest (2.22 g). Generally, varieties with the highest growth tended to have highest leaf mass. Branch number was highest for LV7 (9.4) and LV8 (9.3). LV6 had 1.8 branches which was the lowest of all varieties. The rest of the varieties had between 2 to 5 branches. LV3 and LV5 had longer inter-nodal lengths of 46.2 and 47.1 mm respectively. LV1 and LV9 recorded lower lengths of 37.2 and 38.3 mm. Internodal length for other varieties was intermediate.

Plant height up to 8 weeks after transplanting showed little variation among varieties (Fig. 1). Thereafter, differences in plant height became significant and increased with time. Among all the varieties, the growth rate of LV5 an LV6 was highest at 15.3 and 14.5 mm/day, respectively (Fig. 2). LV4 and LV8 had the lowest growth rates of 8.5 and 8.1 mm/day, respectively. Other varieties were intermediate in growth rate.

Table 1: Agronomic characters of mulberry varieties at twenty weeks after transplanting

Variety	Plant Height (m)	Stem Diameter (mm)	Inter-nodal Length (mm)	Avg No. of Branches	Leaf Mass (g)
LV1	2.60 abc*	25 ab	37.2 c	4.7 abc	2.45 bc
LV2	2.72 abc	25 ab	42.1 b	2.3 bc	2.82 a

LV3	2.80 abc	22 ab	46.2 a	2.8 bc	2.74 ab
LV4	2.05 c	16 b	41.2 bc	4.3 abc	2.55 abc
LV5	3.02 a	28 a	47.1 a	4.8 abc	2.75 ab
LV6	3.10 a	28 a	40.7 bc	1.8 c	2.75 ab
LV7	2.76 abc	28 a	44.7 ab	9.4 a	2.62 abc
LV8	2.14 bc	23 ab	38.3 bc	9.3 a	2.22 c

*Means followed by the same letter are not significantly different according to Tukey's Simultaneous Tests at 5% probability.

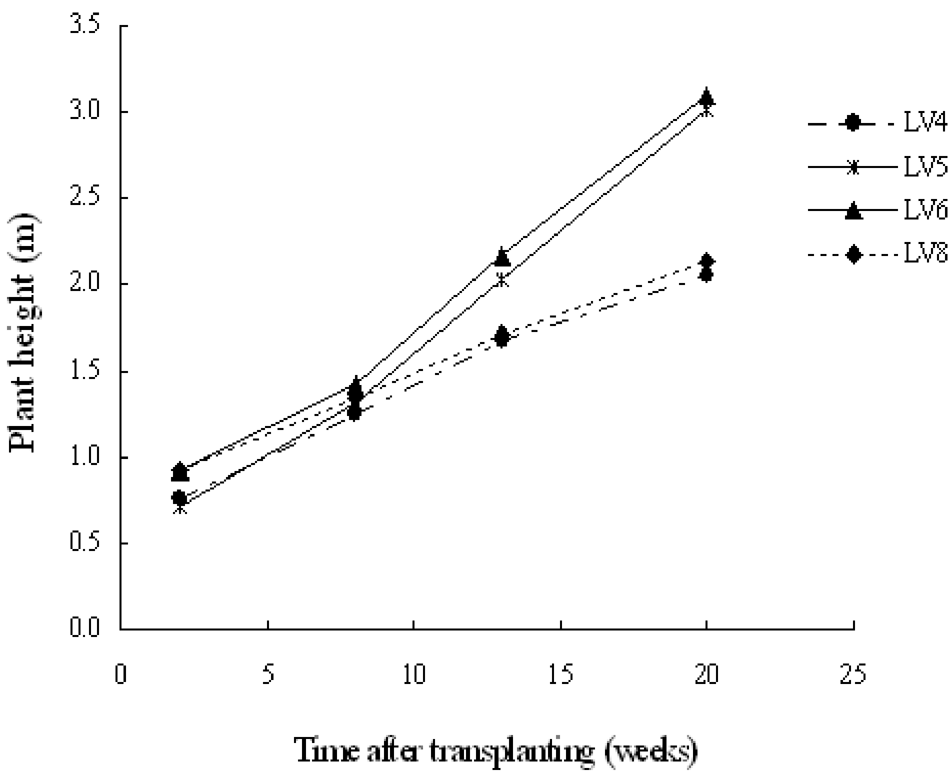

Fig. 1: Mulberry growth after transplanting for the two fastest and two slowest varieties

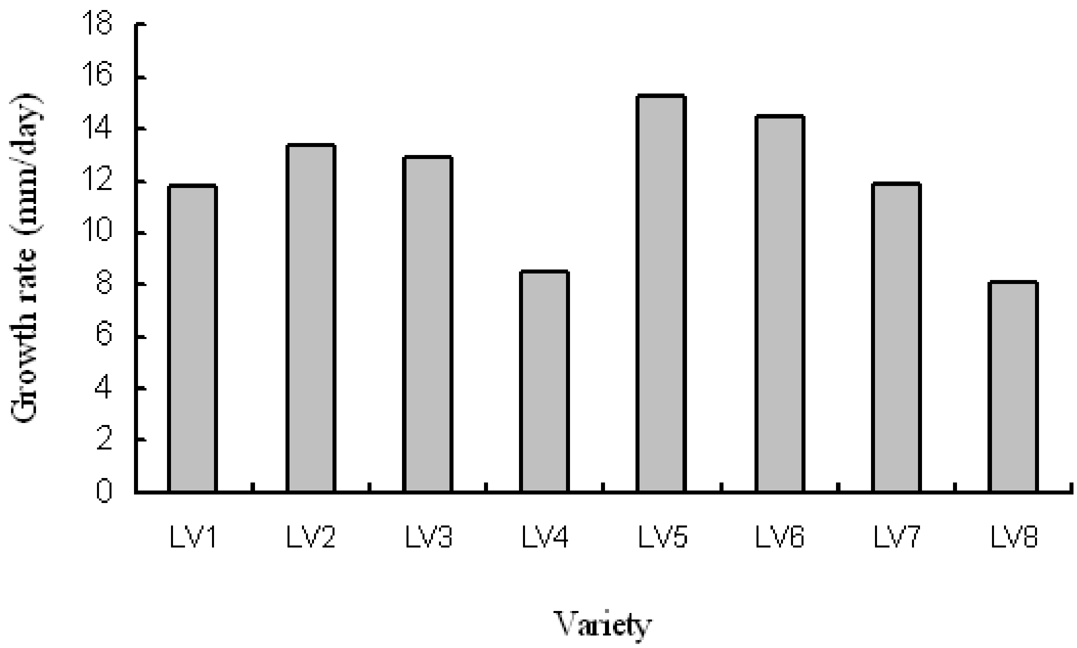

Fig. 2: Average growth rate of mulberry varieties during the first twenty weeks after transplanting

Conclusion

Initial investigations showed LV5 and LV6 to have faster growth, higher leaf mass, larger stem diameters, longer internodal lengths and fewer branches. LV2 also showed similar trends to LV5 and LV6. LV4 and LV8 showed slower growth rates with low levels of leaf mass, smaller stem diameters, more branches and shorter internodal lengths followed closely by LV1. Significant variation among varieties is apparent even at this early stage of growth. It appears that these characters would be useful for selection of mulberry cultivars for sericulture. The characterisation and evaluation process would identify mulberry cultivars suitable for Australian agro-climatic conditions and as feed for silkworms.

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