

Assessment of Biomass Production of *Mucuna pruriens* (L.) DC. at Different Shade Levels

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Abstract

The study was conducted to assess the yield of *Mucuna pruriens* under four different shade levels viz., T₁—0% (open), T₂—25%, T₃—50% and T₄—75%. The significant variation existed among treatments with highest leaf biomass of 714.66 g in T₁ followed by T₂ (580.66 g), T₃ (393.66 g) and T₄ (283.38 g). Number of leaf production, twig biomass and seed yield followed the same pattern which was directly proportional to intensity of light. Root yield was more in 75% shaded condition. Maximum total biomass per plant was produced in T₁ (3597.66 g) followed by T₂ (2691.00 g), T₃ (1492.66 g) and T₄ (963.66 g).

Key words : *Mucuna pruriens*, Shade levels, Biomass production.

Before the dawn of modern era, herbal drugs were the only source available to mankind the world over, for health care. The World Health Organization (WHO) estimated that 80% of the population of developing countries still relies on traditional medicines, mostly plant drug, for their health care needs (1). But advances in science have lead to the production of synthetic chemicals. However, due to their high cost of production, difficulties involved in the synthesis, and due to side effects resulting from continual use, the emphasis is now back on traditional and indigenous medicinal plants, and their products in pure form. India is a veritable emporium of medicinal plants and there is a vast potential for export of medicinal plants from India (1). People of Kerala have traditionally been using plant based medicine. Kerala Forest Research Institute (1993) conducted an extensive study and identified 300 plants found in Kerala forest, which had commercial use as medicinal plantas. *Mucuna pruriens* (L.) DC. (Syn. *M. prurita* Hook), commonly called as cowitch, is one of the popular medicinals of India and constitutes more than 200 indigenous drug formulations. It is an annual, herbaceous climber belonging to family *Fabaceae*. It is called atmagupta in Sanskrit, gonca, kaune or kivacc in Hindi, turachi avare or nasuginnikayi in Kannada, Nayikoma in Malayalam and Punaikkali in Tamil. It is

widespread over most of the subcontinent and found in bushes, hedges and dry deciduous, low forests throughout the plains of India (2, 3). All parts of *Mucuna* possess valuable medicinal properties (4—6) and there is a heavy demand for *Mucuna* in Indian drug markets. After the discovery, that seed contains L-dopa, an anti-Parkinson's disease drug, its demand in international market has increased many folds (7). The genus *Mucuna* consists of about one hundred species of annual and perennial legumes. *Mucuna pruriens* originated in southern China and eastern India. It is now found all over the world. In India it is found at the foothills of the Himalayas, plains of West Bengal, Madhya Pradesh, Rajasthan, Gujarat, Karnataka, Kerala and Tamil Nadu (8). *Mucuna pruriens*, after harvest of pods, can be used as green fodder, or processed as dry season hay (9). In general, *Mucuna* crop does not have much fungal or pest problem. However, it is susceptible to mosaic virus, vine rot disease and may have leaf spot attack towards maturity (10). It is resistant to root knot nematodes (11). Light availability is an important factor in making a plant community and it is an important factor to be considered for commercial exploitation of useful species. Number of researches is going on to understand the effect of various intensities of light or shade on the growth and productivity of many plants.

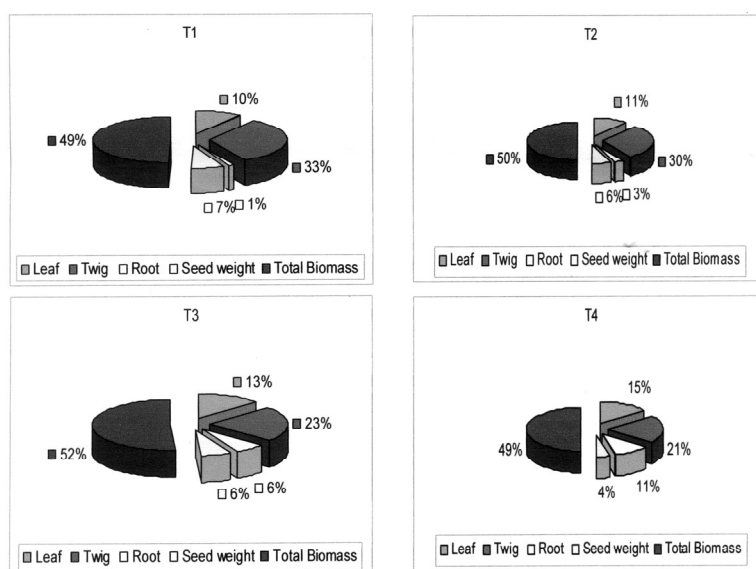


Figure 1. Effect of shade on allocation of biomass.

However systematic works on *Mucuna pruriens* which has multiple uses is scanty. If a crop has to be included under plantation or in to agroforestry system, information on yield performance under different shade conditions are of paramount importance. Hence an attempt was made to standardize the optimum level of shade required by *Mucuna pruriens* to produce maximum biomass. The present study was aimed to increase yield of *Mucuna pruriens* (L.) DC. (both vegetative and reproductive biomass) under different shade conditions.

Methods

The study was undertaken in Kerala Agricultural University, Thrissur. After 5 weeks of sowing, selected seedlings were transplanted to different levels of shade condition, prepared by using shade net of 25, 50, 75 and 0% (open condition/control). In which, the following treatments were used. T₁—Open or 0% shade level, T₂—25% shade level, T₃—50% shade level, T₄—75% shade level.

Seedling were planted in CRD (complete randomized design) with three replication, (10 seedlings in a replication i.e., 30 seedlings under each shade condition/treatment). Proper plant caring procedure was

carried out for its optimum growth. Irrigation was given during hot summer days. After bud initiation each inflorescence was tagged and further information at inflorescence level was recorded. Mature pods were harvested from plants keeping its identity, and sun dried. Number of leaves at maturity was also counted. For calculation of total biomass under different treatments, plants were harvested by cutting at the base to determine shoot biomass and roots were uprooted to know root biomass. Above ground, biomass was separated into twigs and leaves. Both fresh weight and dry weight were recorded. Different components of biomass were summed up to get total biomass (yield) produced under different shade condition.

Results and Discussion

With respect to leaf biomass it was observed that significant variation exist among treatments with highest leaf biomass of 714.66 g in T₁ followed by T₂ (580.66 g), T₃ (393.66 g) and T₄ (283.38 g) (Figs 1 and 2). All the treatments significantly varied for number of leaf production. Highest number of leaf production was noticed in open condition followed by 25 and 50% shade conditions. Least number of leaves per plant was observed in 75% shaded plants. Earlier studies on *Mucuna pruriens* confirmed the produc-



Figure 2. *Mucuna pruriens* grown under different levels of shade ; A — General view of the experimental plot, B—25% shade level, C—50%, D—Open/0% shade.

tion of maximum leaves under open condition (12). Highest twig biomass was observed in open condition followed by 25, 50 and 75% shade. All the treatments varied significantly (Table 1). Effect on shade levels on shoot growth varies with the nature of species (13).

In the present study highest root biomass was accumulated in 75% shade followed by 50 and 25% and least root biomass production was in open condition. Variation between T₃ and T₄) and between T₁ and T₂ differed significantly. Root length followed similar pattern as root weight. It showed negative re-

Table 1. Effect of shade levels on biomass production and seed yield per plant. Figures with similar letters as superscript do not differ significantly. *Significant at 0.05 level. Original means are given in parentheses.

Treatment	Leaf weight (g)	Twig weight (g)	Root weight (g)	Root length (g)	Seed weight (g)	Total biomass (g)
1 T ₁	26.72 ^a (714.66)	48.75 ^a (2376.60)	9.84 ^c (97.00)	8.48 ^c (72.00)	22.50 ^a (506.40)	59.97 ^a (3597.66)
2 T ₂	24.09 ^b (580.66)	40.29 ^b (1623.7)	12.29 ^b (151.30)	9.74 ^b (95.00)	18.31 ^b (335.34)	51.87 ^b (2691.00)
3 T ₃	19.84 ^c (393.66)	25.84 ^c (667.66)	13.66 ^a (186.70)	11.81 ^a (139.66)	9.34 ^c (187.30)	38.63 ^c (1492.66)
4 T ₄	16.83 ^d (283.38)	19.95 ^d (398.33)	14.38 ^a (207.00)	12.03 ^a (145.33)	8.66 ^d (74.95)	31.04 ^d (963.66)
<i>F</i> test	*	*	*	*	*	*

lation with sunlight. Root yield was more in 75% shaded condition and it is agreement with earlier studies (13) that the root biomass was superior under shade for *Mucuna pruriens*. The higher root growth in *Pinus* species, when grown under full shaded conditions may be due to higher allocation of biomass due to stress or limiting light (14). There was significant variation among different treatments with respects to seed yield. Highest mean was found in open condition followed by 25 and 50% shade. Lowest seed yield per plant was observed in 75% shaded level.

There was significant effect of shade on total biomass production in all the treatments. At the end of this study, maximum total biomass was produced by the seedlings grown in T₁ (3597.66 g) followed by T₂ (2691.00 g) and T₃ (1492.66 g). The lowest total biomass of 963.66 g per plant was observed in seedlings grown in 75% shade level (T₄). More biomass in *Hibiscus syriacus* when grown under shaded condition has been reported (15). This may be due to high growth rate in open condition as the more availability of light increased the photosynthetic production.

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