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# FODDER AND BIOMASS PRODUCTION OF *PRUNUS, CELTIS* AND *GREWIA*[1]

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*Abstract*

Fodder and biomass production was evaluated in three broad leaf tree species (*Prunus cerasoides, Celtis australis* and *Grewia oppositifolia*) at 550 m elevation (Garhwal Himalaya). The number of leaves, leaf turn over rate and leaf area were found to be heighest in *C. australis* followed by *G. oppositifolia* indicating their higher fodder production potential. The rate of biomass production was recorded maximum in *G. oppositifolia*.. *P. cerasoides* accumulated more dry matter in the roots than the shoots whereas in other two species shoot growth dominated over the root growth.

## Introduction

The demand of fuel, fodder, fibre and timber on forest resources is increasing at an enormous rate and has necessitated assessment of their productivity potential. The adaptation and productivity of trees varied according to the environmental conditions and it can be better understood when intensification investigations at primary level of biological organisation are resorted to (Ramakrishan 1978), particularly the morphological and physiological processes which form a basis for productivity. Therefore, present study was undertaken to estimate the biomass and fodder production potential of three important fuel, fodder, fibre, timber producing trees *Prunus cerasoides* D. Don, *Celtis australis*, Linn and *Grewia oppositifolia* J. R. Drumond ex Burret in view of their use in agroforestry and social forestry programmes.

## Materials and Methods

Seeds of *Prunus cerasoides*, D.Don., *Celtis australis* Linn. and *Grewia oppositifolia* J.R. Drumond ex Burret were collected from their natural habitat and were grown in seedling trays containing 1:2 mixture of farmyard manure and garden soil at Srinagar, Garhwal (550 m). Uniform seedlings at 3-4 leaf stage were transplanted and reared properly. Five plants of each species were uprooted at 30 days intervals to

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record observations on number of leaves, fresh and dry weight of each plant parts separately. The leaf area were measured by automatic protable leaf area meter (Model LI-3000, LI-COR, USA). The parameter - specific leaf area (SLA), leaf weight ratio (LWR) were calculated (Evans 1972).

## Results and Discussion

The total leaf area as well as leaf number produced per plant were found to be maximum in *C. australis,* less in *G. Oppositifolia* and least in *P. Cerasoides* predicting their potential to produce fodder (Fig. 1). In *P. cerasoides* and *C. australis* the leaf production gradually increased with age of the seedlings whereas *G. oppositifolia* was found to be sluggish in the rate of leaf production. In case of *P. cerasoides,* the number of leaves continued to increase from December to April and the area from October to June. In *C. australis* the leaf production continued to increase upto September, whereas the leaf area reached maximum in November. *G. oppositifolia* starts forming new leaves at a faster rate in February which continued till July and leaf area from March upto October. On an average *C. australis* produced two leaves per day (leaf turn over rate), in *G. oppositifolia* it was 1.2 and *P. cerasoides* only one leaf produced per day making thereby the highest fodder production potential of *C. australis*.

Out of the three species studied, fully grown plants of *C. australis* are autumn deciduous, *P. cerasoides* in winter deciduous and *G. oppositifolia* is a semi-deciduous having maximum leaf fall in the beginning of spring season. The longivities of leaves was 285 days in *C.australis* 315 days in *P. cerasoides* and 330 days in *G. oppositifolia.* However, the higher longevity of leaves of P. cerasoides and G. oppositifolia (at the mature stage) compensated for their lower leaf turn over rate resulting that these tree species can produce fodder for longer period during winter season which is considered to be lean period of fodder availability. The variation in leaf production and leaf expansion rates at comparable age, were more season dependent. The leaf production of all the three species is positively correlated with air temperature but the effect of temperature seems to be more in case of leaf production of *G. oppositifolia* ($r = 0.8166$). Similar trend of response was observed on the plants studied elsewhere (Kozlowski 1971). The data recorded in respect of the LAR and LWR also supported the superiority of *C. australis* from the fodder production point in view (table 1). Variation in SLA was found minimum in *P. cerasoides*, a little more in *C. australis* and high in *G. oppositifolia* (table 1). This character was dependent more on the growing season than on the age of the plants (Ledig 1974), however, the effect of age was more prominent on LWR than on LAR. Similarly Evans (1972) reported SLA is a measure of environmental influence on the leaf area expansion. The biomass, in terms of dry weight, per plant increased with age in all the species. The plants of *P. cerasoides, C. australis* and *G. oppositifolia* accumulate 0.122, 0.34 and 1.04 g dry matter per plant within one month growth and 26.4, 18.2 and 28.3 g/plant at the end of one year respectively.

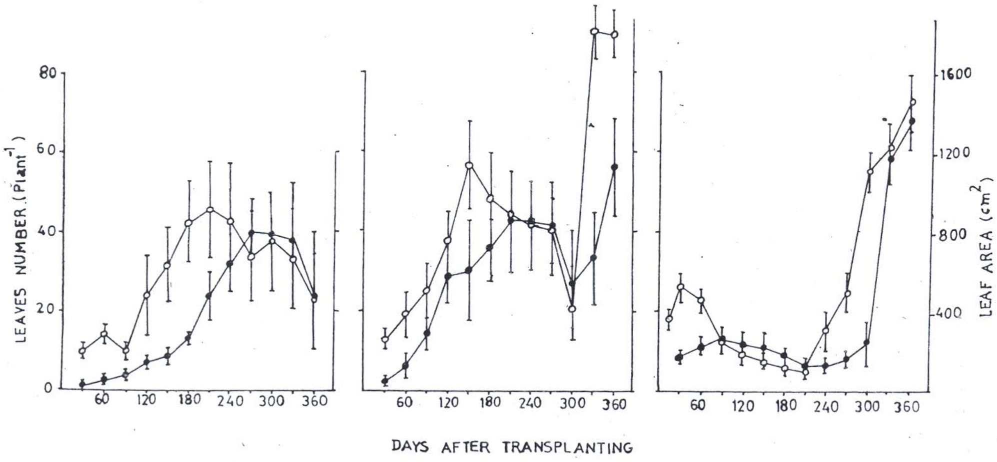


Fig. 1. Average number of leaves (O) and leaf area (O) per plant of P. cerasoides (a), C. australis (b) and G. oppositifolia (c)

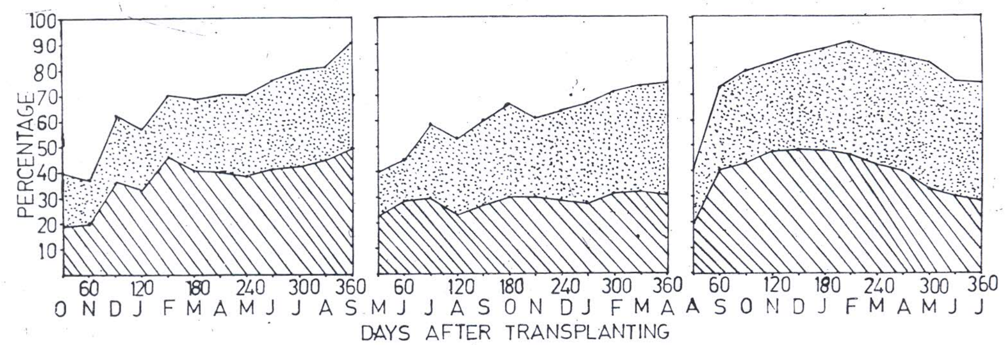


Fig. 2. Per cent dry matter weight of P. cerasoides (a), C. australis (b) and G. oppositifolia (c) in different parts. Leaves ( ). Stem ( ), root ( ).

**Table 1 :** Morpho-physiological characters of *P. cerasoides, c.australis and G. oppositifolia*

| Age (Days) | *P. cerasoides* | | | | | *C. australis* | | | | | *G. oppositifolia* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LAR | LWR | SLA | Dry weight (gm) | Root: Shoot | LAR | LWR | SLA | Dry weight (gm) | Root: Shoot | LAR | LWR | SLA | Dry weight (gm) | Root: Shoot |
| 60 | 129 | 0.62 | 208 | 0.38 | 1.03 | 90 | 0.56 | 160 | 1.30 | 1.74 | 50 | 0.27 | 186 | 4.55 | 1.24 |
| 120 | 81 | 0.43 | 146 | 2.16 | 1.33 | 133 | 0.47 | 240 | 5.10 | 0.74 | 35 | 0.17 | 197 | 7.02 | 1.37 |
| 180 | 63 | 0.31 | 214 | 3.90 | 1.44 | 75 | 0.34 | 222 | 9.55 | 0.80 | 19 | 0.12 | 151 | 8.47 | 1.21 |
| 240 | 49 | 0.29 | 167 | 13.13 | 1.13 | 66 | 0.34 | 180 | 12.80 | 0.83 | 13 | 0.13 | 96 | 10.88 | 0.93 |
| 300 | 37 | 0.21 | 179 | 20.88 | 1.16 | 39 | 0.29 | 134 | 13.75 | 0.78 | 18 | 0.17 | 102 | 14.21 | 0.68 |
| 360 | 17 | 0.09 | 190 | 26.40 | 1.16 | 63 | 0.29 | 211 | 18.26 | 0.59 | 48 | 0.25 | 195 | 28.39 | 0.52 |
| Aver age- | 62.6 | 0.32 | 184 | 11.14 | 1.21 | 74.3 | 0.38 | 191.2 | 10.13 | 0.91 | 30.5 | 0.18 | 154.5 | 12.25 | 0.99 |
| CD at 5% | 20.3 | 0.03 | 8.37 | 0.75 | 0.10 | 15.5 | 0.04 | 64.8 | 0.35 | 0.16 | 5.9 | 0.08 | 11.30 | 0.49 | 0.04 |

The maximum dry matter production was observed in *G. oppositifolia* followed by *P. cerasoides* whereas the higher dry matter accumulation in these trees differed according to the season. The percent dry matter accumulation in different plant parts (Fig. 2) indicates that more dry matter accumulated in stem portion in *G. oppositifolia* and *C.australis,* whereas in *P. cerasoides* the maximum dry matter partitioned in roots. The partitioning of dry matter in under ground and above ground parts (root : shoot ratio) apparently indicating the fact that *G. oppositifolia* and *C. australis* accumulated more dry matter in the shoots. These observation indicated the adaptability and productional potential difference in trees and can profitability be considered for evaluation of trees for different environmental conditions.

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