# Leaf growth in pollarded and unpollarded *Populus euramericana* (Dode) Guinier

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This paper deals with effect of pollarding in *Populus euramericana* trees planted along the roadsides of Tribhuvan University Campus. Five stands of different ages (one, three, five and seven years) after pollarding, and control (unpollarded) were studied. Leaf area of trees one year after pollarding was the largest, and that of unpollarded one had the smallest leaf area. The others were in the order of 1yr < 3yrs < 5yrs < 7yrs < Unpollarded trees.

**Keywords:** *Populus euramericana*, pollarding, leaf area, photosynthesis.

Plants exhibit various aspects of leaf dynamics. The amount of distribution of foliar surface is a pre-requisite for reliable estimation of the primary productivity of the forests.

Evans (1972) laid emphasis on the study of leaf expansion and dry matter increase with time. Bazaz and Harper (1977) have shown the use of demographic techinque to study population of leaves in case of *Linum usitatissimum* L. Such a study may lead to a more comprehensive understanding of plant growth. Accoding to Kunda and Tigersted (1999) net photosynthesis was positively correlated by whole plant dry weight and leaf area in *Azadirachta indica.*

*Populus euramericana* are hybrid of *Populus deltoides* Marsh from America and *Populus nigra* L. It was introduced in Nepal in 1965 from Pakistan by E. J. B. Rana and K. B. Chitrakar (Jackson 1987). It a deciduous tree with simple and alternate leaves and has a tendency to produce heavy branches. Its growth rate is high. The species has been planted elsewhere along the roadsides of Kathmandu Valley. Breaking of branches and the main trunk even in moderate wind has, quite often, caused a serious damage to life and property along the roadsieds of Kathmandu valley. As pollarding seem to be the only option to minimise such loss, the present paper attempts to study the effect of pollarding on leaf area of *P. euroamericana.*

## Materials and method

### Sites

The study site is situated within Tribhuvan University Campus (lat. 27° 40' N to 27° 41' N along 85° 16' to 85° 18' E respectively) and adjoining area where *P. euramericana* have been planted. The area has mean maximum temperature 29.6° C and mean minimum temperature 2.0° C. Rainfall during monsoon is 1450.9 mm.

### Collection of materials

The leaves were collected from the base, middle, upper portion of branches of five trees of each category. From these branches altogether 45 different sized leaves were randomly plucked in July 1999 and composited together and preserved carefully for study of leaf area.

### Determination of leaf area

For the determination of leaf area, the technique described by Sestak *et al.*, (1971) was used. The length of the leaf was measured through the midrib while the breadth was measured trough the broad maximum expanded portion of leaf. The leaf area was measured with the help of a graph paper counting the squares that completely overlapped by leaf. Then Kemp's constant was calculated as:

Kemp's Constant = L x B / Square Area

Sestak *et al.* (1971), used the coefficient (Kemp's Constant) 1.226 to 0.612 for different shaped leaves but, since the leaf shape of the *Populus euramericana* was different from the Sestak's form, the Kemp's Constant was calculated separately. It was found to be 0.6816, 0.6643, 0.6487, 0.6328 and 0.6246 (Fig : 1) for one year, three year, five year, seven year after pollarding and unpollarded trees respectively. To find out the leaves area, the following formula was used:

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Area of leaf = ( L x B) x Kemp's constant value ( sq. cm. )

where,
L and B is the length and breadth of leaf respectively.

## Result

Results indicated that the largest leaf area was recorded at one year after pollarding in compare to the others. The leaves area were 271.07 cm. sq., 203.18 cm. sq., 93.17 cm. sq., 67.04 cm. sq., and 62.08 cm. sq. (Fig: 2) for one, three, five, seven and unpollarded trees respectively. The leaf area (337.82%) found in one year old pollarded trees were larger than that of the unpollarded and other trees. The result of five observations showed that maximum leaf area was found in one year pollarded than other (three years, five years, seven years and unpollarded trees).

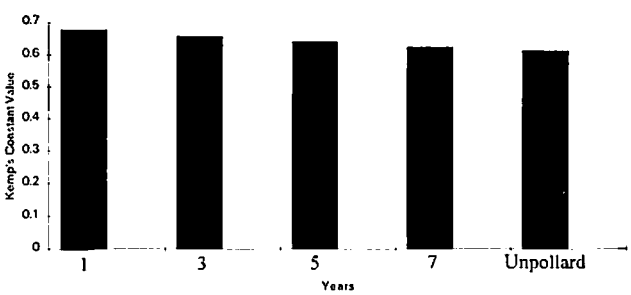


**Fig 1: Value of Kemp's constant for different trees**

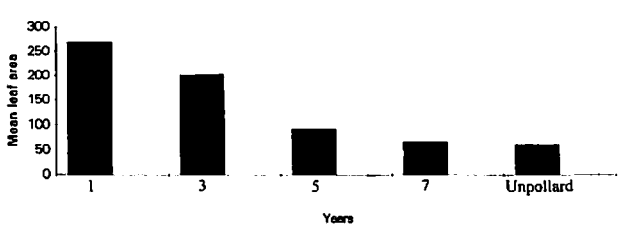


**Fig 2: Mean leaf area for different trees**

## Discussion

Photosynthetic rates are age-dependent in both the evergreen and deciduous species, and then decline gradually until senescence (Caldwell *et al* 1981; Fraser and Bidwell 1974; Samsuddin and Impens 1979). The seasonal capacity for photosynthesis in angiosperms varies among species, which have different patterns of leaf development (Kramer and Kozlowski 1979). The pattern of increase in leaf area of *Populus euramericana* during rainy season (premonsoon and monsoon period) can be explained by pattern of photosynthesis.

People in Kathmandu have put on negative remarks about the habit of *P. euramericana.* The species is very very prone to wind and is readily uprooted even in moderate wind speed causing a great loss of life and properties. This has been attributed to the higher height attainment of trees. Concerned authorities are also not aware of the results and process of pollarding, and their ecological and economical benefits. It is thought that pollarding caused 'environmental effect'. But the present findings proved that the conception was wrong.

New branches of *P. euramericana* emerged after pollarding has high growth rate and bear larger leaves than the unpollarded ones. Large leaf area increases the rate of photosynthesis and balanced the amount of atmospheric oxygen by absorbing carbon dioxide produced by various means. The poles obtained by frequent pollarding could be of good use.

At places such as roadsides, wasteland and near industrial areas where the amount of ambient $CO_2$ is high, planting of *P. euramericana* as a carbon sink should be encouraged. But, the plantation should be followed by frequent pollarding to maintain 1/3rd of its original height. This encourages the production of more new shoots in the next season. With a dense crown cover it gives a beautiful look to the environment. The result has shown that such new branches have larger leaf area. With this, the amount of $CO_2$ absorption is increased thereby increasing the photosynthetic rate.

The time period for pollarding may vary according to the tree species. In teak (*Tectona grandis*) the pollarding and harvest of trees should be done between 30 - 40 years (Karmacharya 1989). In the case of *P. euramericana* it is revealed that the pollarding should be done at 5-8 yrs cycle. West (1998) had also reported that the height growth of *Pinus radiata* was little affected by pruning or thinning treatment.

Pollarding of populus trees are not disadvantageous from the ecological and economical prespective. In this regard, further study for different tree species should be initiated because it is quite clear that growth rate of different species have got different values.

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