

## GROWING TREES WITH AGRICULTURAL CROPS

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**Introduction.** Pakistan is largely an arid and semi-arid land with two thirds of it under mountains and deserts. Agriculture is practiced over about 47.5 million acres, of which about 33.5 million are irrigated, mostly by canals. Production forests cover barely 1.5% of the total land area. So the country is short of timber and fire-wood: Wood and wood products—mostly pulp and paper—worth 550 million rupees are imported every year on the average. And the scarcity of firewood forces the rural people to use anything combustible as fuel—animal dung, agricultural waste, leaves and twigs. And in towns, firewood prices are generally out of the reach of the common man. This scarcity is likely to be exacerbated as gas reserves dwindle and oil generated thermal power becomes more expensive.

In this scenario, what should be the strategy to increase the supply of timber and firewood? The most obvious recourse is to increase production over state-owned lands. Towards this end, considerable efforts are being made. But such areas are small and are often burdened with heavy rights of user. Massive extension programmes are being launched in the moist mountains to educate the farmers to plant forest trees on sloping land, instead of farming them. But progress is slow due to poverty and because newly planted areas are difficult to protect from grazing.

Efforts are also being made to persuade the farmers to plant forest trees on their farmlands. This practice is often criticized on the grounds that trees cast shade, compete with farm crops for water and nutrients, attract birds which eat grain, serve as alternate hosts for insect pests, and impede the flow of water when trees are planted too close to water channels. Can trees be grown in conjunction with agriculture crops in such a manner that economic benefits from both will be more than from agricultural crops alone? Can belts of trees, oriented suitably against the predominant wind direction in areas subject to hot, dry winds, increase crop production? To answer some of these questions, two experiments were started under a PL-480 grant made through the Pakistan Agricultural Research Council—one at the Pakistan Forest Institute, Peshawar (North West Frontier Province) and the other at Aslam Model Farm Mir Pur Khas (Sind Province).

**Peshawar experiment.** At Peshawar, *Dalbergia sissoo* (shisham), *Eucalyptus citriodora*, *Populus deltoides* 63/51, and *Salmalia malabarica* (semal) were planted at the Pakistan Forest Institute in February, 1978, in JRCB design with

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four replications, size of plot 444 m<sup>2</sup>, trees planted at 4.3 x 4.3 m spacing. The Pavan variety of wheat was sown in the plots on 5-11-1979. The average grain yields with the different species were as follows:

| Species    | Grain yield, kg/ha |
|------------|--------------------|
| Shisham    | 2762               |
| Semal      | 2609               |
| Eucalyptus | 2563               |
| Poplar     | 1700               |

The yields varied from 1700 kg/ha and no tree species had a significant effect on them.

The area was again sown to wheat in December, 1980 and the average grain yields recorded in May, 1981 were as follows:

| Species    | Yield of grain<br>kg (ha) | Reduction as compared<br>to previous<br>year (%) |
|------------|---------------------------|--|
| Shisham    | 1996                      | 20   |
| Semal      | 1802                      | 31   |
| Eucalyptus | 1590                      | 38   |
| Poplar     | 1532                      | 10   |

Yields under shisham are significantly (.05 level) higher as compared to those under the other tree species. As compared to 1980, the yields are less by 28, 31, 38 and 10%, respectively, for shisham, semal, eucalyptus and poplar.

**Aslam Model Farm Experiment.** This experiment is located in an irrigated plain contiguous to the Thar desert. Its latitude is 25° 40' N and longitude 69° 10' E. Local people are of the opinion that crops in the area are adversely affected by westerly winds coming from the sea and easterly winds coming from the desert—80 and 50 km away, respectively.

Four shelterbelts of *E. camaldulensis* were planted in January, 1980 over an area of 1000 x 630 m. Each belt was 630 m long, and comprised 3 rows of trees, spaced two metres apart. Trees in the row were planted at one metre spacing. The distance between belts varied from 182 to 196 metres. The belts were planted across the predominant wind direction. In April, 1981, the average heights of the various tree rows were as follows:

| Belt number | Row number          |     |     |
|-------------|---------------------|-----|-----|
|             | 1                   | 2   | 3   |
|             | (average height, m) |     |     |
| 1           | 4.9                 | 4.5 | 4.7 |
| 2           | 4.2                 | 3.5 | 3.7 |
| 3           | 3.0                 | 3.1 | 3.0 |
| 4           | 3.8                 | 3.5 | 3.7 |

From January to March, 1981, wind velocities on the farm were as follows:

| Month    | Average wind velocity, km/hour |        |
|----------|--------------------------------|--------|
|          | at 30 cm                       | at 6 m |
| January  | 2.8                            | 5.9    |
| February | 2.8                            | 6.0    |
| March    | 4.8                            | 7.9    |

and wind direction was as follows:

| Month    | Wind direction, % hours towards a particular direction |    |   |    |   |    |    |    |
|----------|--|----|---|----|---|----|----|----|
|          | N  | NE | E | SE | S | SW | W  | NW |
| January  | 7  | 23 | 3 | 5  | 5 | 20 | 3  | 34 |
| February | 12   | 19 | 7 | 6  | 2 | 23 | 8  | 23 |
| March    | 12   | 12 | 5 | 5  | 5 | 36 | 11 | 14 |

The Pavan variety of wheat was sown in the area in November 1980. When the crop was ripe—in March 1981—four transects were selected at random, from south to north, between successive belts. On each transect, in each 10 m interval along the transect, one plot (1 x 1 m) was taken at random for determination of yield of grain and straw. In this manner, yields were recorded for 300 plots, each one m<sup>2</sup>. The yields of grain and straw, grams per 1 m<sup>2</sup> plot were as follows:

|         | Grain | Straw |
|---------|-------|-------|
| Average | 487   | 555   |
| Maximum | 745   | 845   |
| Minimum | 205   | 200   |

Distance from the tree belt had no significant effect on yield of either grain or straw.