

Andean alder - *Alnus acuminata*



Andean alder (*Alnus acuminata* H.B.K.) is a fast growing tree well adapted to New Zealand conditions. It has a variety of uses ranging from landscaping and soil improvement to large scale timber production and agroforestry-fodder production systems.

The genus *Alnus* belongs to the Betulaceae family (birches and alders) and is mostly distributed in the Northern Hemisphere. Andean alder is the southernmost species of the genus *Alnus*. Alders are generally well known as ruderal trees of moist, stream-side habitats. Their fast growth rates, attractive deciduous foliage and nitrogen-fixing capacity make them species of choice for landscaping and soil protection on river banks and other humid terrain.

This species differs from most other alders in several respects. It generally has faster growth rates, attains a larger size and is tolerant to drier sites. These attributes suggest that this species has greater potential than other alders.

Growth form and habit

The Andean alder is a tall, broad-leaved deciduous to semi-evergreen tree of up to 35 m height and 1 m in

diameter. More frequently it attains heights of 10-15 m with 30-40 cm diameter. Shape is variable depending on genetic type and environmental conditions. Specimens vary from tall, single-stemmed trees with large, round crowns to multi-stemmed, twisted trunks with irregular crowns. In dense stands, trees are self-pruning, leading to well formed smooth trunks. Andean alders have large (8-14 x 10-18 cm) coarse leaves with serrate margins. They are deciduous in late autumn (April-May in Otago), or only for a short period in early spring, depending on genetic stock. Flowers are borne in catkin-like The genus *Alnus* belongs to the Betulaceae family (birches and alders) and is mostly distributed in the Northern Hemisphere. Andean alder is the southernmost species of the genus *Alnus*. Alders are generally well known as ruderal trees of moist, stream-side habitats. Their fast growth rates, attractive deciduous foliage and nitrogen-fixing capacity make them species of choice for landscaping and soil protection on river banks and other

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Figure 1: Good quality stand of self-sown Andean alder in the Bolivian Andes. The stand is 18-20 years old with trees averaging 20 m high and 30 cm diameter.

Genetic variability and selection

The species has been in New Zealand since the late 1970s. Since 1989, more than 120 new accessions have been introduced, allowing for selection of better types. Small to medium plant/environment trials have been set up in some 60 localities around New Zealand by Crop & Food Research and the New Zealand Tree Crops Association. Several trial plantations have also come into production in Colombia and Costa Rica, providing further information on the performance of Andean alder (Rojas et al. 1978; Beer 1980).

Because of the large range of genetic types available it is important to select those most appropriate to the required use. Descriptors including leaf type and longevity (duration with leaves); leaf palatability; bole size and shape; branching pattern; wood quality; speed of growth; resistance to disease; tolerance to drier, colder or warmer environments; and abundance of flowering should be studied to decide which accession will be most suitable.

Growing environment

Andean alder's natural range is from southern Mexico (approximately 17EN) to 28ES latitude in NW Argentina, following the Central American mountains and the Andes. This enormous range explains its genetic variability. Although it likes humid cloud forests, Andean alder is not restricted to sites besides streams, as its northern relatives are. In its southernmost enclaves, this tree forms monospecific stands over whole mountainsides. It ranges from rainfalls higher than 2000 mm to around 350 mm, with mean annual temperatures between 8 and 18EC and minimum winter temperatures of at least -10EC.

Heavy frosts after October or before May (as in some sites in Central Otago) may damage growing points. In drier environments it prefers southerly aspects. Slightly acid soils are preferred (pH 4.6-7), but because of its nitrogen-fixing capability, Andean alder can thrive in almost skeletal soils, such as river gravels. With enough precipitation, Andean alder grows well in clay soils, such as completely eroded yellow-brown earths, which it can improve by incorporating organic matter and nutrients.

Cultural practices

Seedlings grow easily from seed (83-95% survival), but seedlings can be variable in performance and appearance. The ability to strike cuttings depends on genetic stock and environmental conditions. Six-month to one-year old seedlings with good roots (root trainers or pots) can be planted in the field during autumn until the end of winter in drier sites, and through most of the year elsewhere. In favourable conditions, cuttings can be planted straight into the ground. Irrigation may be necessary in drier sites (e.g. Central Otago) until roots can reach deeper levels. Plants, which are highly palatable, need protection from herbivores such as sheep,

rabbits and hares. Weeds must be kept under control to attain good growth rates in the first years. Weed mats or weed removal in a 1 m diameter circle is advisable.

Spacing depends entirely on intended timber or ecological use. Widely spaced trees tend to have large branches at a low level, while closer spacing improves the length of the trunk if timber is desirable. Shelter belts can be planted at 1 m spacing. Interplanting with other trees, for fruit or timber, has potential given Andean alder's narrow, deep rooting habit and soil-improving capability. Pruning or coppicing regimes have not been worked out in New Zealand although there is some experience in Colombia. Initial planting density recommended in Colombia for timber is 1500 trees/ha using 20-30 cm naked root seedlings. After three to four months, dead trees are replaced and deformed trees are form-pruned. Weeds are controlled once after six to 12 months, after which no further work is required. Pruning is claimed to be unnecessary with these planting densities as trees are self pruning. Thinning may be done at six and 12 years leading to a final density of 300 trees/ha and providing firewood (Table 1). Final harvest may be between 20 and 30 years depending on site conditions and seed provenance.

Table 1: Suggested thinning regime for agroforestry (from Rojas et al. 1978). Slightly less thinning is recommended for forestry.

| Age (years) | Trees/ha | Mean diameter (cm) | Uses |
|-------------|---------------|--------------------|----------------|
| 0 | 1500 | - | Non commercial |
| 2.5 | 900 | - | Non commercial |
| 5.5 | 750 | - | Non commercial |
| 7.5 | 600 | 12-15 | Posts, pulp |
| 9.5 | 450 | 15-19 | Posts, pulp |
| 12 | 300 | 20-25 | Wood, crates |
| 15 | 200 | 25-30 | Wood, crates |
| 20-30 | Final harvest | 40-50 | Saw logs |

Pests and diseases

In the Andes, Andean alder is attacked by several species of caterpillar. Such damage has not yet been noticed in New Zealand. Some individuals seem to suffer from black soot fungi and selection is needed to encourage the more vigorous resistant types found at Invermay.

Growth rates and harvesting rotations

One of the appealing aspects of Andean alder is its rapid growth rate. In addition to speed of biomass production, rapid growth means vigour and health, and implies a greater speed of nitrogen fixation. Nitrogen is found in high levels (2.4-3.7%) in dry, decomposing Andean alder leaf litter (Beer 1980). Biomass production also means large plantations can act as carbon sinks.

Speed of growth is not unique to the species, nor uniform within the species. However, when combined with its other characteristics, it makes the species interesting indeed. Pines may grow faster than Andean alder, but do not fix nitrogen or shed their leaves in winter and are not palatable to stock. In the first 10 years Andean alder growth rates may be as high as managed, improved radiata pine plantations. Further growth rates in unmanaged, unimproved stands quickly fall back. Timber volumes and growth rates in managed Colombian and Costa Rican plantations show that these growth rates can continue for the full rotation cycle.

Rapid growth and prolific wind dispersed seed may sound like a recipe for uncontrolled spread. However Andean alder's high palatability and shade intolerance reduce the risk of it spreading to undesirable locations.

Uses and processing

Andean alder is a multi-purpose tree suited for low input, sustainable management of many agro-ecosystems. This species of alder, as well as having soil improvement characteristics, has the benefits of larger size, faster growth rates and reduced water dependence (to some degree *Alnus incana* and *A. cordata* can also grow in dry situations Ledgard 1978). In many situations these characteristics, along with the ability to fix nitrogen, give it an edge on comparable species such as poplars or pines.

This species is useful as a component of shelter belts, and as a companion plant because it makes nutrients available for other species. Its large leaves and handsome shape make it attractive for amenity planting where fast growth is required. Deep roots reduce interference with crops grown within its shelter. Its palatable, nitrogen-rich leaves provide a welcome source of fodder.

Appropriate pruning can maintain branches within easy reach. In a pastoral agroforestry setting, Andean alder has similar advantages to other trees (nutrient recycling, reducing wind speed and erosion, adding a timber value at the end of the cycle), but again adds fertility, palatability and deciduous leaves which favour grass growth. Its fast growth and good burning properties also make Andean alder a good source of firewood. Planted in closer stands, Andean alder is an efficient timber and pulp producer in specific environments. Because of its deciduous palatable foliage, Andean alder attracts birds

and native fauna. Any of its uses can be combined with beehives so bees can forage for pollen during the winter. Bark is rich in tannins and can be used to tan leather. Leaves, macerated in alcohol, are used in frictions for rheumatism.

Andean alder has been ranked amongst the timber species of major importance for Argentina. It is considered of better quality than radiata pine. It produces perfectly loggable trunks up to 5 m long by 40 cm diameter. Its wood is soft to medium hard, with a specific weight of 0.25-0.51, uniformly grayish-white to uniformly reddish with a soft, slightly silvery lustre, fine and homogeneous texture and straight and inconspicuous grain.

The large variation in specific weight is reflected in significant variation in elasticity and strength, with higher weights being more resistant. It is a stable wood which can be dried rapidly. Untreated wood is not durable outdoors, but it is ideal for impregnation by preservatives (such as tanalising) thanks to its good absorption and penetration. Prices for Andean alder in New Zealand are uncertain, but, as a comparison, sawn logs sold in Costa Rica for US\$42/m³, only slightly less than the price for *Cupressus lusitanica* cypress. The economic potential of Andean alder for forestry is thought by some to be equivalent to that of pines and eucalypts.

Future prospects

Andean alder has been planted at many sites in New Zealand. Lack of good management has led to failures and has affected growth at some sites, but results from areas with minimum good management have been promising. Andean alder provides another option to improve sustainability, reclaim degraded land and shelter other crops and pastures, and thus has potential to be widely planted. As a timber tree, its prospects are dependent on growers establishing a strong marketing capability, both in New Zealand and for export. Research on best growing and processing techniques, and selection of better types should continue to improve future opportunities. Andean alder is a general purpose wood,

somewhat like radiata pine. Its value should increase as people realise its value to the environment (i.e. buying Andean alder could be perceived as more environmentally friendly than pine or tropical hardwoods).

Sources of plants

New Zealand Tree Crops Association nurseries.

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