

# Choosing the right supporting stakes

To ensure durability and stability, a mesh tree guard must be fastened to one or more good quality stakes. The useful life of the stakes depends on the material, on their cross-section and on many other factors including soils, climate and the exposure of the planting site. Four types of stakes with different quality characteristics can be used.

## Basic materials

The performance of a tree guard mainly depends on its durability and resistance to wind, and therefore on the quality of the stakes used.

Four types of stakes made of metal, bamboo or wood can be used to fix and support mesh tree guards.

### Metal stake

Metal stakes are serrated steel reinforcement bars (rebar) 65 cm to 100 cm in length with a constant diameter of 4 mm (Photo 74). They come in packs of 100, which weigh around 8 kg on average. We recommend storing them in a dry place because the non-galvanised steel from which they are made will rust in the rain.

They are thin, and therefore compact, but sturdy, and do not bend during installation. They are durable (more than 10 years) and can be readily reused if handled with gloves when they get rusty.

The top 5 cm is curved to fit over the tree shelter. The curved ends prevent injuries to workers in the event of a fall, make installation easier without potential injury to the hands, and hold the tree guard firmly in place around the plant, preventing animals and wind from lifting it and tearing it away.

Rebars with bevelled bottom ends are recommended because they are easier to drive through thick fibre mulch mats<sup>(4)</sup>.

Metal stakes are used to anchor lightweight rabbit guards (Ø 4 mm, L 70 cm) and hare guards (Ø 4 mm, L 80 cm) on stony ground, in windy parklands (Photo 75) and in vineyards, and when re-establishing tree cover along abandoned roads or railways. They are not recommended for forest use (Photo 76) because they are a hazard for subsequent mechanised weeding around young trees or log hauling unless they are removed beforehand.

**74 - Metal stakes are faster to install than wood or bamboo, but they must be removed when no longer needed.**

**75 - Metal stakes are curved at the top to hold the tree guard firmly in place around the plant.**

**76 - Serrated (Ø 8 to 12 mm) steel rebars (L 150 cm) are much more expensive than wooden stakes and are a hazard for people and machines if they are not removed when no longer needed.**



74



75



76



77



78

## Bamboo stake

Bamboo stakes are cheap, lightweight, easy to transport and install, but not very durable. They provide temporary support (1 to 3 years) for lightweight mesh rabbit guards (Ø 6-8 mm, L 60 cm) and hare guards (Ø 6-8 or 8-10 mm, L 90 cm).

They are also used in addition to wooden stakes, especially on windy sites (Ø 8-10 mm, L 120 cm or Ø 10-12 mm, L 150 cm), and to stake out planting rows (Ø 5-6 mm, L 50 cm) or mark trees during weed clearing (Ø 22-24 mm, L 300 cm).

Bamboo stakes are classified by length and diameter at the largest end (the end driven into the ground, **Photo 79.1**) and are made of extra-hard Chinese bamboo (**Tip 7**) from 6-8 mm to 10-12 mm in diameter and 60 cm to 150 cm in length. They are sold in bales of 100, 250, 500, 1000 or 2000 (**Photo 78**).

### Tip 7 - Choosing the right bamboo stakes

Botanically speaking, bamboos are giant, very fast-growing grasses. A bamboo stem is a lignified culm, i.e., a hollow tube partitioned at the leaf nodes.

To fulfil their role, bamboo canes must be inexpensive, sturdy, and durable:

- they are made from the prime Chinese variety known as Tonkin cane (*Pseudosasa amabilis tenuis*), which is extra hard and perfectly straight. Thai bamboo, although sturdy, is not uniform and more suitable for training house plants;
- the hollow centre (or lumen) of the cane is narrow. The thick "wood" ensures resistance to twisting (**photo 77**);
- the diameter of the small end must be at least equal to 60 % of the diameter of the large end.

## Wooden stake

Split or sawn wooden stakes are often used to support tree guards protecting trees from roe deer damage.

They are sold with pointed ends and delivered in bundles. They must not have been treated with preservatives (even for temporary protection) or surface coatings (paint, shellac). They are made from hard woods such as chestnut and locustwood (False acacia).

### Chestnut

Chestnut wood (*Castanea sativa Mill.*) is easy to split and therefore often used for stakes with a triangular (**Photo 80**), rectangular (**Photo 81**) or trapezoid cross-section (L 150 cm, C 9-11).

They last for 3 to 5 years on average. Wood with a high tannin content is resistant to pathogens but deteriorates in bad weather (rotting where the soil is in contact with the air). The smaller the cross-section of the stake, the faster it will rot (**Photo 82**).

The stake may snap at ground level and drag the tree guard and the tree down with it as it falls (**Photo 83**). Debarked stakes are recommended to help control chestnut blight<sup>(5)</sup>.

**Table 7 - Mechanical characteristics of chestnut and locustwood**

	Chestnut	Locust
Mean density at 12 % (g/cm <sup>3</sup> )	0.59	0.74
Modulus of elasticity in bending (N/mm <sup>2</sup> )	8 500	13 600
Flexural strength (N/mm <sup>2</sup> )	71	140
Impact resistance (Nm/cm <sup>2</sup> )	5.7	12.4

From the French Timber Council (CNDB) - [www.cndb.org/?p=fiches\\_essences](http://www.cndb.org/?p=fiches_essences)

<sup>(4)</sup> If using metal stakes with no points, starter holes will need to be punched through the mulch mat with a rod two or three times larger in diameter.



79.1



79.2

77 - The thick "wood" and narrow lumen prevent twisting.

78 - Bamboo stakes imported from China are usually packaged in batches of 1 000.

79 - The larger end (79.1) is driven into the ground. The diameter of the small end (79.2) must be equal to at least 60 % of the diameter of the large end.

## Locustwood

Locustwood stakes (also called False acacia: *Robinia pseudacacia* L.) are sawn on 4 sides along the grain of the wood. They are square in section (22 x 22 mm, L 80 to 150 cm; 28 x 28 mm, L 210 cm) (Photo 84) and naturally more durable than chestnut (5 to 7 years).

They are more resistant to hammering and bending (Table 7) and sturdier when driven into stony ground. Nowadays, they are mainly

imported from Eastern Europe (Hungary, Romania, etc.). Local supplies are hard to find because stands are sparse and small in area.

False acacia (Locust Tree) is one of the few species that naturally (in the raw state and with no chemical treatment) meets NF EN 335 standard class 4 criteria<sup>(6)</sup>. The wood can be continuously exposed to humidity, both in and above the ground. Traces of sapwood on the surface may be tolerated (Photo 85.2).

80 - Split, debarked and pointed 1.5 m chestnut stakes, with a triangular 9 - 11 cm cross-section, sold in bundles of 50.

81 - Irregular cross-sections are characteristic of sawn chestnut stakes.

82 - The smaller the cross-section of a chestnut stake, the faster it will rot.

83 - Chestnut stakes that are too thin will quickly rot, making the tree guard unstable and compromising the future of the tree.

<sup>(5)</sup> Chestnut trees are attacked by a fungus, *Cryphonectria parasita* (formerly *Endothia parasitica*), commonly known as "chestnut blight", which is found in bark and causes dieback in infected trees.

<sup>(6)</sup> This standard relates to the durability of wood and defines the basic characteristics of 5 categories of biological pathogen risks to help determine which woods are most suited to different conditions: the higher the index, the better the resistance.



80



81



82



83.1



83.2



84



85.1



85.2

## The most popular: locustwood and chestnut

Stakes and posts are produced by manufacturers who have the right equipment for handling, debarking, splitting and/or sawing and sharpening.

They may purchase roadside logs (raw wood posts sold by the stacked m<sup>3</sup>), or harvest standing coppice wood at least 20 to 25 years old, with trunks that are straight and free of defects such as ring shake or canker stain.

The finished products are sold singly to parks and gardens contractors, nursery growers, forestry or agricultural cooperatives, wholesalers and more rarely to retailers.

The round, split or sawn posts are delivered by the truckload, on pallets or in bundles. They are mainly sold for use in vineyards, livestock farms (fencing) and parks and gardens. Prices are highly variable and depend on the type of product and the quantities ordered.

Since posts are finished products, the VAT rate in France is 20 %, not the 10 % rate for firewood.

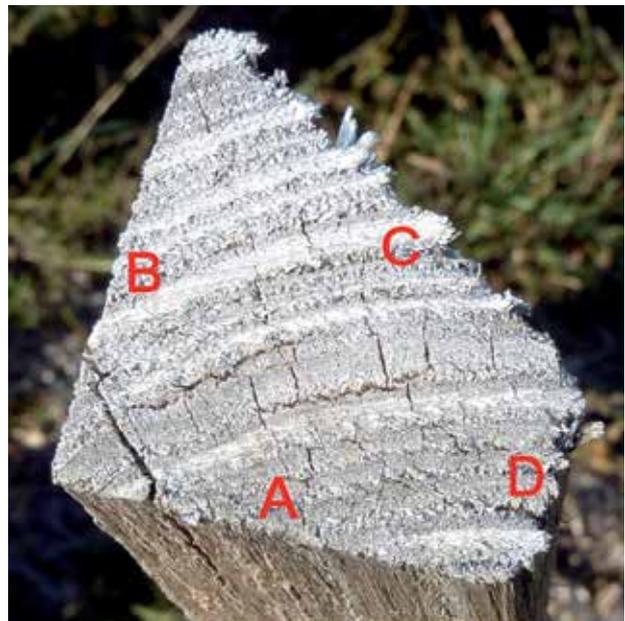
## Wooden post

Wooden posts (large-sized stakes) are used as supports for individual tree fences, wooden fences, and/or barbed wire fences protecting forest trees from red deer and field trees from livestock.

Quality criteria include straightness, size and uniformity (in length and circumference), absence of deterioration (especially ring shake, rot and insect boreholes), absence of sapwood, few knots (these must be healthy and small in size). The end to be driven into the ground must be sharpened to a point (always at the largest end).

Several kinds of posts are currently available on the market (Photo 91). They last from 10 to 15 years:

- natural wood: chestnut posts, which may be round (Photo 87) or split or sawn in half (Photo 88) or in quarters; round or sawn locustwood posts (Photo 89), split oak posts (with no sapwood), round larch posts. Natural posts are not treated by impregnation and are therefore not toxic to animals likely to gnaw the wood (except locustwood, which is naturally highly toxic to equines);
- treated wood: milled round pine (Photo 90) or spruce. These are brittle woods that must be treated by impregnation (with products that are often toxic to the environment) to ensure durability.



86



87



88

## Quality criteria

### Size (Ø and C)

The products on the market have different cross-sections: round stakes in bamboo or wood, wooden stakes or posts sawn or split into two or four with a square or rectangular cross-section. Unlike diameter and circumference classes, which allow stakes of uniform size to be bundled, palletted or packaged, this parameter is rarely mentioned (except for square-section locustwood stakes).

Although there are no standards for classifying stakes, actual practice has imposed various commercial rules.

Diameter (Ø) is used to specify the greatest thickness of a bamboo stake (diameter at the large end, which is driven into the ground) or the width measured at mid-length of a chest-

nut, larch or treated pine post with a cylindrical or rounded cross-section.

Circumference (C) is a term commonly employed by professionals in the sector to define the perimeter of split or sawn chestnut, locustwood or oak stakes and posts. The circumference of a post is the sum of the widths of all of its sides (perimeter) measured at mid-length (**Photo 86**).

To suit the demands of market practice, lower and upper size limits have been defined for each product category. Each diameter or circumference limit corresponds to a different class of marketable diameter or circumference size.

A 9-11 cm circumference class means that the company sells uniform batches of stakes with a circumference of 9 cm to 11 cm, thus varying by a margin of 2 cm.

**84 - Sawn locustwood stakes have a characteristically uniform cross-section (22 x 22 mm).**

**85 - Wooden stakes must be straight and well seasoned (85.1). A small amount of sapwood is tolerated, but only on the surface (85.2).**

**86 - The perimeter of a stake corresponds to the sum of the widths of all of its sides (A+B+C+D).**

**87 - Pallet of 180 round chestnut stakes (Ø 6-8 cm, L 180 cm).**

**88 - Pallet of 150 sawn chestnut stakes (C 24-30 cm, L 180 cm).**

**89 - Pallet of 120 sawn locustwood stakes (Ø 8-10 cm, L 180 cm).**

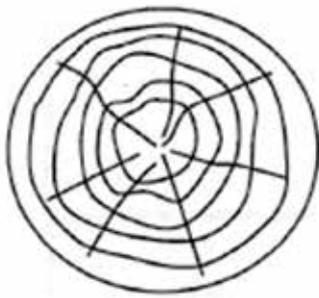
**90 - Pallet of round stakes of milled, treated pine (Ø 6-8 cm, L 200 cm).**



89



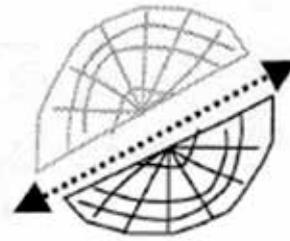
90



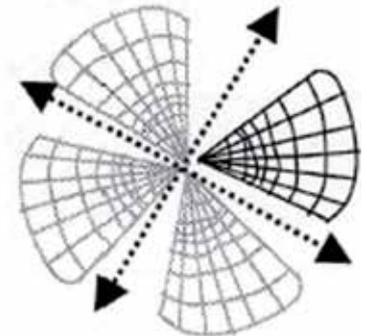
Milled round post



Round post



Round post sawn or split into two



Round post sawn or split into four



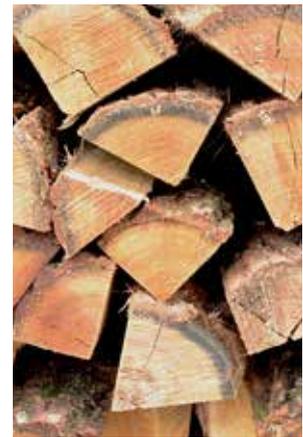
91.1



91.2



91.3



91.4

The recommended thickness depends on length:

- bamboo stakes are classified by their diameter at the widest end, in mm (min Ø: 6 mm - max Ø: 16 mm): 6-8 (L 60 or 90 cm), 8-10 (L 90, 120 cm), 10-12 (L 150 cm), 12-14 (L 150, 180 cm), and 16-18 (L 210 cm);
- round, debarked chestnut (more rarely locustwood) posts are classified by their diameter measured at mid-length in cm (min Ø: 3 cm - max Ø: 10 cm): 3-5, 4-6, 6-8, and 8-10 (L 150-160 to 300 cm, every 20-25 cm);
- round, treated pine or spruce or larch posts are classified by their (constant) diameter in cm (min Ø: 5 cm - max Ø: 8 cm): 5 (L 200, 250 cm), 6 (L 200, 250 cm), 7 (L 200, 250, 300 cm), and 8 (L 200, 250, 300 cm);
- split, debarked chestnut stakes are classified by their circumference in cm, measured at mid-length (min C: 9 cm - max C: 22 cm) : 9-11 cm, 11-13 cm, 13-15, 14-16 cm, and 18-22 (Photo 73) (L 70-80 to 220 cm, every 20-25 cm). The cross-sections are approximate;
- sawn locustwood stakes are classified by their square cross-section (constant), expressed in mm: 22 x 22 (L 80, 100, 110, 135, 150 cm), 28 x 28 (L 200, 210 cm);
- sawn or split chestnut, locustwood or oak posts are classified by their circumference at mid-length, in mm (min C: 24 cm - max C: 40 cm): 24-30 (L 180 cm), 27-33 (L 200, 250 cm), 30-40 (L 200, 250 cm).

## Length (L)

The dimensions of a stake will depend on the height of the tree shelter or fence to be installed and on the substrate into which it will be driven (Table 8). The recommended length of a stake is defined by the height of the tree shelter or individual fence plus the portion of the stake to be driven into the ground.

Stakes with a large cross-section should be chosen to ensure sturdier, more long-lasting protection. They must be driven firmly into the ground, especially in loose soils, to keep them from leaning.

After sub-soiling or disking, or in sandy or gravelly soil, stakes must be driven to the ploughing depth plus an additional 10 cm to 20 cm to keep them from leaning (and to ensure the long-term stability of the tree shelter or fence). A 175 cm stake (recommended length) may therefore need to be driven in to a depth of 40 to 50 cm.

**91 - Different cross-sections of wooden posts (from CTBA 2003, modified).**

**91.1 - Milled round treated pine posts (Ø 6 cm, L 200 cm).**

**91.2 - Round chestnut posts (Ø 8-10 cm, L 200 cm).**

**91.3 - 1/2 round sawn chestnut posts (Ø 9-11 cm, L 180 cm).**

**91.4 - Sawn locustwood posts (Ø 8-10 cm, L 180 cm).**

## Choosing stakes for different types of tree guards

▼ **Table 8 - Quality criteria and prices (2012/13 season) of supports according to type of tree guard**

ANIMAL DAMAGE		CHARACTERISTICS OF THE MESH TREE GUARD			Mesh	RECOMMENDED (or possible) TYPES OF TREE GUARD according to wind conditions and soil (stony, mulched, etc.).	Estimated dealer price (€, excl. VAT)
SPECIES	Maximum height of damage on the tree	Standard height of the tree shelter	Diameter of the tree shelter	Weight range <sup>(7)</sup>			
Rabbit	< 60 cm	50 cm	Any Ø	Light	All mesh sizes	2 bamboo stakes L 60 cm Ø 6-8 mm	0.06 - 0.08
						1 bamboo stake L 60 cm Ø 6-8 mm + 1 curved metal stake L 70 cm Ø 4 mm <sup>(8)</sup>	0.18 - 0.21
						2 curved metal stakes L 70 cm Ø 4 mm	0.30 - 0.34
Hare	< 70 cm	60 cm	Any Ø	All weight ranges	All mesh sizes	2 bamboo stakes L 90 cm Ø 6-8 mm	0.10 - 0.12
						1 bamboo stake L 90 cm Ø 6/8 mm + 1 curved metal stake L 80 cm Ø 4 mm <sup>(8)</sup>	0.22 - 0.25
						2 curved metal stakes L 80 cm Ø 4 mm	0.34 - 0.38
Roe deer	< 150 cm	120 cm	14 - 15 cm	Standard or medium	Fine mesh or double mesh	1 locustwood stake L 150 cm S 22 x 22 mm	0.45 - 0.48
						1 chestnut stake L 150 cm C 9/11 cm	0.47 - 0.53
						1 locustwood stake L 150 cm S 22 x 22 mm + 1 bamboo stake L 120 cm Ø 8/10 mm <sup>(8)</sup>	0.55 - 0.60
			20 - 30 cm	Standard or medium	Fine mesh or double mesh	1 locustwood stake L 150 cm S 22 x 22 mm	0.45 - 0.48
						1 locustwood stake L 150 cm S 22 x 22 mm + 1 bamboo stake L 150 cm Ø 10/12 mm <sup>(8)</sup>	0.59 - 0.64
						2 locustwood stakes L 150 cm S 22 x 22 mm	0.90 - 0.96
			30 - 33 cm	Medium	Ultra-wide mesh	2 chestnut stakes L 150 cm C 11-13 cm	1.64 - 2.20
						1 locustwood stake L 150 cm S 22 x 22 mm	0.45 - 0.48
						1 chestnut stake L 150 cm C 11-13 cm	0.82 - 1.10
		15 cm	Heavy	Reinforced double mesh	1 chestnut stake L 150 cm C 18-22 cm	1.57 - 1.80	
					1 locustwood stake L 150 cm S 22 x 22 mm	0.45 - 0.48	
					1 locustwood stake L 150 cm S 22 x 22 mm + 1 bamboo stake L 150 cm Ø 12-14 mm <sup>(8)</sup>	0.63 - 0.68	
		20 - 30 cm	Heavy	Reinforced double mesh	2 locustwood stakes L 150 cm S 22 x 22 mm	0.90 - 0.96	
					1 chestnut stake L 150 cm C 18-22 cm	1.57 - 1.80	
					1 locustwood stake L 150 cm S 22 x 22 mm	0.45 - 0.48	
					1 locustwood stake L 190 cm S 28 x 28 mm	1.00 - 1.08	
					1 chestnut stake L 175 cm C 13-15 cm	1.30 - 1.42	
					1 locustwood stake L 190 cm S 28 x 28 mm	1.00 - 1.08	
150 cm	20 cm	Heavy	1 chestnut stake L 180 cm C 18-22 cm	1.92 - 2.20			
			1 chestnut stake L 180 cm C 18-22 cm	1.92 - 2.20			
			1 chestnut stake L 180 cm C 18-22 cm	1.92 - 2.20			
	20 cm	Ultra-heavy	2 locustwood stakes L 190 cm S 28 x 28 mm	2.00 - 2.16			
			1 round chestnut post L 180 cm Ø 4-6 cm	3.20 - 3.40			
			1 round chestnut post L 180 cm Ø 4-6 cm	3.20 - 3.40			
Red deer	< 200 cm	180 cm	20 cm	Medium or heavy	Reinforced double mesh	2 locustwood stakes L 210 cm S 28 x 28 mm	2.20 - 2.38
						2 chestnut stakes L 220 cm C 18-22 cm	2.35 - 2.69
						2 locustwood stakes L 210 cm S 28 x 28 mm	2.20 - 2.38
		30 - 33 cm	All weight ranges	All-mesh	2 round chestnut posts L 250 cm Ø 6-8 cm	2.36 - 2.54	
					2 round treated pine posts L 250 cm Ø 5-6 cm	4.80 - 5.20	
					2 round treated pine posts L 250 cm Ø 5-6 cm	4.80 - 5.20	

<sup>(7)</sup> Mesh weight in grams per m<sup>2</sup> is a realistic criterion for reliable comparisons of different tree shelter models. There are five weight ranges: light (< 150 g/m<sup>2</sup>), standard (± 200 - 250 g/m<sup>2</sup>), medium (± 250 - 300 g/m<sup>2</sup>), heavy (± 400 - 450 g/m<sup>2</sup>), and ultra-heavy (> 500 g/m<sup>2</sup>).

<sup>(8)</sup> On windy sites, a bamboo stake is used in addition to a wooden stake to improve the stability and maintain the oval section of a mesh tree guard.