



**Probio Carbon Bonsai Products
- their use and application**

Introduction

These products were specifically developed for bonsai cultivation by Dr. Karen O'Hanlon, C.E.O. of Probio Carbon Ltd. This document describes the Bonsai product range and offers some guidance on how best to use them to maximise the benefit to your bonsai.

They are:

- **Danú** (Danú is the mother Earth/tree goddess in Irish mythology)
- **Marú** (Marú means death or kill in Irish)
- **Enriched Carbon Feed (Biochar)** (pyrolysed Olive stone)
- **Mara** (cold pressed seaweed), (Mara means sea in Irish)
- **lasc** (enhanced fish extract), (lasc means fish in Irish)

Each product has been developed to utilise specific bacteria chosen for their beneficial properties which are well suited to the development, refinement, and care of bonsai.

The bacteria species predominantly employed are *Bacillus subtilis*, *Bacillus simplex*, *Bacillus amyloliquifaciens*, *Pseudomonas fluorescence* and *Rhizobia*.

Before using any of the liquid Probio Carbon products it is advisable to gently shake the container to mix the components, which may have settled out during transportation or storage.

Probio Carbon liquid products are all diluted with water before use. As the bacteria are sensitive to Chlorine in tap water, it is preferable (but not essential) to use rainwater or tap water that has been allowed to stand for 24 hours. Some hobbyists who have the facility, choose to use tap water that has been purified via a dechlorination filter, or a Reverse Osmosis system.





Danú was developed to promote plant health, immunity to disease and resistance to insect attack without excessive growth. Experience has shown that it can promote back budding even in Japanese White Pines (which are usually reluctant to do so), and shorter internodes in some deciduous species.

Danú is supplied in two formulations: liquid and dry. Originally Danú was developed in the liquid formulation. Because it contained an unstable bacterium, Rhizobia, as well as the more stable *Bacillus subtilis*, and *Pseudomonas fluorescens*, it was difficult to export outside the EU. Latterly it has become easier to ship liquids plus a dry more stable form has been developed to overcome any possible limitations. Consequently, it can now be shipped around the world. The advantage of liquid Danú is that the bacteria is already active and colonises the root ball on immediate contact. However, being a 'live' product, it must be used immediately after opening the bottle.

The optimum time to use Danú is at the repotting stage, however it can be applied at any time, but ideally in spring. It can also be used in late summer too, as a booster before the onset of winter. Some hobbyists also choose to give a mid-season boost, making a total of three applications over the growing season.

An advantage of the dry Danú product is that it's more stable and can be used up to 12 months after opening when stored correctly. This allows more flexibility when using it at repotting time as not all bonsai require repotting at the same time as the dry product can be used over an extended period after opening. It does however take a little longer to activate the bacteria and to populate the root ball, and bacterial cell numbers are lower per pack than the liquid product.

A good strategy is to use dry Danú (maximum flexibility) at the repotting stage and the liquid Danú in late summer as a booster when repotting is not required.

Storage of liquid Danú

On receipt of liquid Danú it should be stored at approx. 4 °C, preferably in a refrigerator. It ideally should be used within 4 months from the date of manufacture, expiry being 6 months. It should all be used within one week of opening when stored correctly, preferably immediately.

Dilution and Application of the liquid Danú

To avoid over dilution of the bacteria, it is recommended that this product, supplied as a 250 ml bottle, is diluted to between 5 and 10 litres with water. Many hobbyists prefer to use at the lower dilution rate by diluting one 250ml bottle to 5 litres i.e., add the bottle's contents to 4750ml water and mix thoroughly.

The Danú solution can be applied as a root drench using a watering can with a fine rose, but this can be a little wasteful. Some hobbyists prefer the more economical method of using a pressure sprayer and apply the solution directly onto the entire root surface of the bonsai.

Alternatively, the bonsai can be dunked in a bath of the solution until saturated and then allow it to drain back into the bath. To avoid cross contamination do not use the dunking method if applying to any diseased trees.

Link to the application and benefits of liquid Danú: <https://www.youtube.com/watch?v=nAt2Pzgg5qw&t=2072s>

Storage of dry Danú

This product has been developed to increase the stability of the Rhizobia component of Danú. The three bacteria are inoculated onto a substrate mixture of Peat, coir, wood biochar and seaweed and allowed to dehydrate.

It should be stored in a dry, cool place or refrigerator ideally at approx. 4 °C. Unlike the liquid form it has a much longer shelf life and can be used up to 12 months from its date of manufacture after opening, if stored correctly.

Application of dry Danú

This product comes in a dry powder/fibrous form and is sprinkled evenly over the surface roots of the bonsai.

The bonsai is then watered evenly, but gently to rehydrate and activate the dry Danú, thus allowing it to penetrate the root ball.

Link to the application of dried Danú: <https://www.youtube.com/watch?v=bscmUivuJBM&t=9s>

Marú



Marú was developed to act primarily as a systemic fungicide, but because of licensing and registration constraints it cannot be labelled as such. It is supplied in liquid form and is applied as a foliar spray. It contains 3 Bacilli strains, simplex, amyloliquifaciens and subtilis. Rhizobia is also included to strengthen the response of Bacillus subtilis to fungal pathogens.

Storage of Marú

On receipt Marú should be kept in a refrigerator at approx. 4°C. Marú has an expiry date of 12 months from manufacture when stored correctly but is best used before 6 months.

Application of Marú

To apply, dilute 25ml to 1 litre (1:40) using water. Since two further applications are required, it is advisable to use 1/3 of the supplied bottle(s) at a time. The solution is applied as a foliar spray and allowed to dry. Allow to settle for 4-5 days, do not water overhead during this time. Repeat the process two more times, leaving a two-week gap between applications.

Promising results have been obtained in combating mildew, peach leaf curl, needle cast, cedar hawthorn rust, box blight, and "red spot" Gall.

A good strategy is to apply it to spring foliage and again in late summer as a booster for the winter.



Probio Carbon Enriched Carbon Feed (Biochar)



Probio Carbon Enriched Carbon Feed (Biochar) is a form of charcoal produced from pyrolysed (heat treated) and granulated Olive stones that have then been inoculated with beneficial growth promoting *Bacillus subtilis*. It is not to be confused with other biochars, which may not have been pyrolysed at the optimum temperature in an oxygen free atmosphere or inoculated with beneficial bacteria.

The internal structure of biochar (charcoal) is a little like honeycomb and has an extremely high surface area, this being conducive to the growth of beneficial bacteria. It also sequesters (removes) carbon dioxide from the atmosphere and adsorbs it to the soil (1 kg. takes 3.5 kg of carbon dioxide from the atmosphere).

The benefits are:

- improved soil nutrient availability by increasing the cationic exchange capacity in the soil
- improved soil water retention
- increasing soil pH
- helps combat diseases such as Fusarium

Probio Carbon Enriched Carbon Feed combines the benefits of both biochar and the plant growth promoting benefits of *Bacillus subtilis*.

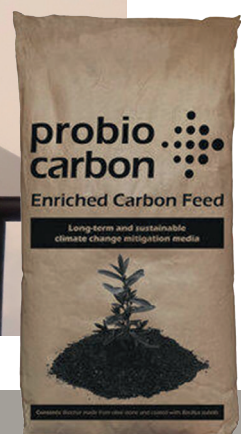
Storage of Probio Carbon Biochar

Because this product has been inoculated with *Bacillus subtilis* it is recommended to store it in a cool, dark, dry place and use within 3 years of purchase.

Application of Biochar

Biochar is best added into the soil mix when repotting. The current recommendation is to use 5-10 % by volume.

It can also be spread on the soil surface and then lightly raked in. Be aware that being a dry product, it is light and may be easily washed off the soil surface. Spraying/ dampening the product with water before use may help to alleviate this. When applying to the soil surface it is best to ensure that the soil level is below the rim of the pot to avoid run off when watering.



Mara



Mara is produced from the finest seaweed harvested from the Atlantic coast of Ireland . The gentle cold pressing technique, as opposed to hot extraction, preserves the natural beneficial ingredients of the seaweed. Probio Carbon seaweed extract also contains our biochar which aids fertilisation of the soil medium. Seaweed extract is often incorrectly referred to as a fertiliser, but it is in fact a growth promoting bio stimulant (phyto-hormone).

Storage of Mara

On receipt Mara is best kept in a cool, dark place, ideally in a refrigerator at approx. 4°C. Ideally use within 4 months of opening and is best before 6 months of manufacture. It has a shelf life of 12 months from manufacturing when stored correctly.

Application of Mara

Mara is diluted at a rate of 10ml to 1 litre (1:100) with water for trees in refinement or 20ml per litre for trees in development. Apply once every two weeks during the growing season.

It can be applied as a root drench or foliar spray every 2 weeks during the growing season. This product contains added beneficial biochar. However, initial experience with users showed that when using a pressure sprayer for foliar feeding it could partially block the nozzle of the sprayer. The product has been since modified to minimise this issue.



lasc is our fish hydrolysate bonsai food. Originating from the Northwestern Irish coast and with an NPK value of 3.5/2/1.5, lasc is a 100% Irish organic feed/ bio stimulant which benefits from the addition of our biochar to increase the organic matter, cationic exchange capacity and microbial activity in the soil.

lasc promotes root development and general vigour and disease/ stress resistance in treated plants. In common with all Probio carbon products, it contributes to the colonisation of the root zone with beneficial bacteria, which is the backbone of good plant health.

Storage of lasc

lasc should be stored in a dark, cool place, ideally in a refrigerator at approx. 4°C.

It is best used within 6 months from the date of manufacture but has an expiry date of 12 months when stored correctly.

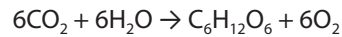
Application of lasc

lasc is diluted with water at a rate of 10ml per litre (1%) for trees in refinement or 20ml per litre (2%) for trees in development. Apply at a maximum frequency of every two weeks throughout the growing season. Because of its nitrogen content we do not recommend foliar application.



Useful things to know

It's a common misconception that fertiliser is a plant food. The plant produces its own food from the basic nutrients carbon, oxygen, and hydrogen by the process of photosynthesis. During photosynthesis in green plants, light energy is used to convert water and carbon dioxide into sugar, which acts as a food source for the plant.



Fertilisers consist predominantly of macro nutrients such as N, P and K. They may also contain micronutrients such as iron, manganese, copper, boron, zinc etc. The purpose of these other micronutrients is not to provide food, but to enhance the efficiency of the photosynthesis process in the production of healthy plant tissue.

Although photosynthesis takes place in the presence of carbon dioxide, water and light, another factor affecting the rate at which it takes place is temperature. The optimum temperature is in the range 24°C to 34°C. As temperature rises or falls so does the rate of photosynthesis, such that at below approx. 7°C and above approx. 45°C the rate is almost zero and there will be little plant growth. Similarly bacterial activity typically ceases at below 5°C and above 60°C. It's logical to assume that adding organic fertilisers at these extremes would be pointless since there would be little bacterial activity to break them down into usable nutrients.

Probio Carbon products are organic in nature and therefore to preserve their properties it is advisable to use organic fertilisers and additives. Unlike trees in the wild, bonsai live in an enclosed environment, therefore the exclusive use of chemicals may result in the reduction and eventual disappearance of the beneficial bacteria and mycorrhiza, which are essential for the healthy growth of pines especially.

In order not to harm the beneficial bacteria and their environment it would also be advisable not to use chemical fungicides or insecticides. Probio Carbon products have been developed to promote the plants natural resistance to fungal and insect attack. To combat some insect attacks such as Vine Weevil, the use of nematodes and chitin may be a useful alternative to chemicals.

Links to further reading and viewing:

<https://www.youtube.com/watch?v=3p1XdsYMy7w&t=234s>

<https://horticultureconnected.ie/news/bonsai-in-ireland-a-very-bright-future/>

<https://www.youtube.com/watch?v=odDIWaifdhU&t=3336s>

<https://player.fm/series/bonsai-mirai-asymmetry/fungi-and-bacteria-with-karen-ohanlon>

