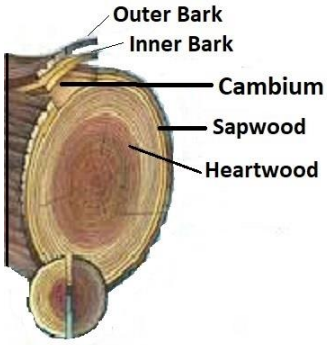
Hot Callous Pipe Grafting by Ernie Grimo, Photos by Armando

Hot callous pipe grafting is based on the premise that the cambium of most trees is easily awakened from dormancy even in the winter. Cambium is a cloak as thin as a plastic sheet that surrounds the trunk and every branch on trees, but it is not on the tree surface. It is located between the inner bark and the sapwood. This thin tissue of stem cells is responsible for adding new thin layers of cells on the inner bark and a thicker layer on the sapwood. Once set the inner bark and sapwood are unable to divide and produce new cells, only the cambium can do that, and it continues to do so provided its needs of moisture and warmth are met. The cambium produces all new diameter growth and healing from tree damage and cuts that takes place, grafting included.



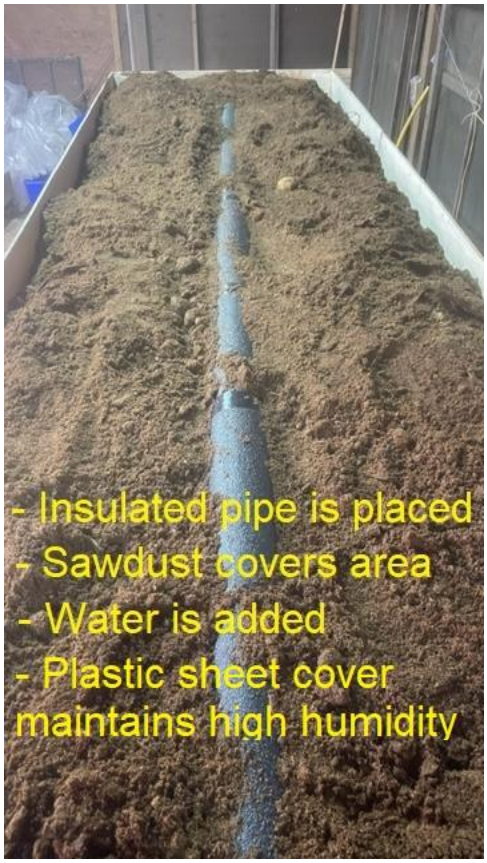
Since the cambium can be activated on any part of the tree without affecting the rest of it, we can set the proper temperature and humidity to meet the needs of the cambium on only the portion needed. In our case it would be the place where we want the union to form. For the buds on the scion to remain dormant as well as the rest of the rootstock, they must not be in the heated pipe.

My hot callous pipe was made from a 3” x 12’ drainpipe that is cut in half lengthwise. Both halves of the pipe were covered with 3” pipe insulation also cut in half lengthwise. A heating cable that can reach 26°C (80°F) was positioned on the bottom of the pipe half. It was difficult to find a heating cable that would go up to 26°C. Most heating cables for de-icing roofing and preventing water pipes from freezing shut off when they reach 10°C. I was able to get 12’ heating cables that would shut off at 70°C, and so with a thermostat they could be set to turn off when 26°C is met and then turn on again when the inside of the pipe cooled to 25°C. I found these cables at a business called Canstal Heat Trace Solutions.

Since a heating cable expands and contracts from the heating and cooling cycle, it should not be fastened firmly to the pipe. We covered the pipe with a mixture of sand and Perlite as a heat sink and to hold moisture to maintain high humidity inside the pipe. We decided that sand can act as an abrasive too, so we decided in the future to use a mixture of Perlite and Vermiculite to cover the cable and ¾ of the bottom half pipe. A cloth sheet about 12” inches wide and 12 feet long was used to cover the mixture and prevent other material from mixing with it.

We placed the prepared pipe on the barn floor where it was about 4°C (40°F.). 120 trees were grafted 1-24 hours sooner and stored in the barn with the roots in boxes, covered with peat moss to prevent drying out until they could be placed on the pipe. The trees were arranged crosswise on the pipe from both sides almost touching with only the grafted portion centred on the pipe. The roots and scion bud(s) would be outside of the pipe where it was cold. Grafts were made with this in mind. Any scion buds that were too close to the graft area were removed.

The pipe can accommodate both bare root and trees potted in small pots up to 4” x 4” in size. For larger pots, the pipe would need to be raised up.



To control the temperature, an Inkbird thermostat sensor was placed inside the pipe among the trees but protected from free water touching it. The temperature was set to 27°C (80°F.) with a one degree differential. An improperly placed temperature sensor could allow the cable temperature to go higher than the set temperature and that could cause the graft to die from overheating. That can happen if the sensor gets wet or is placed by accident outside of the pipe. A wet sensor will not sense the correct temperature.

There is a chance that a cable fire will take place, so precautions need to be taken. A normal circuit breaker may not trip in time. A GFCI circuit interuter can be used to prevent possible cable fires but it can false trip when a 5 miliamp differential occurs. To prevent a false trip situation a GFEP circuit interupter will trip when 35 milliamps is detected. A GFEP circuit breaker can be installed in your electric panel or a plug in unit like the one pictured can be used with the thermostat plugged into it and the GFEP plugged into the power source.

GFEP ground fault protector

After 21-25 days the trees are removed from the pipe. The sucker growth from the rootstock is removed and the trees are either potted and placed in a greenhouse to continue into growth or stored in mass beds of peat moss or sawdust at cold above freezing condition (4-8°C) to be planted in spring after frost danger is passed.

Cover removed revealing sucker growth

Trees covered and boxed in peat moss for winter storage

This system is suitable for grafting many species of temperate fruit and nut plants, including hard to graft species like beech.

Heartnut hot callous pipe cleft graft after day 24.