

Inoculating logs with mushroom plugs from Nicola Krämer, www.shiitake.de

Inoculating with mushroom plugs is a good way to grow mushrooms in the garden. You can do it at any time of the year. A pre-requirement is the availability of very fresh logs of the right type.

What do you need for an inoculation with mushroom plugs?

You need a drill, an 8 mm wood drill bit, a hammer and suitable logs. If the plugs are a bit soft (because the mycelia inside has grown fast) or if the wood is very fresh, you may find it easier to use a slightly larger drill bit (9 mm). It helps to seal the cut ends of the logs with latex milk or latex binder, best of all directly after cutting the wood. This prevents the logs from drying out. Do not use tree wax for this purpose!

You can inoculate approx. 4 logs with 50 plugs. If you use more plugs per log then the mycelia will grow faster. The table shows the wood types that can be used and the recommended sizes of the logs:

Mushroom type	Wood type	Approx. wood length	Approx. wood diameter
Oyster mushroom	Poplar, copper beech , willow, ash, alder, hornbeam, mountain ash maple, apple, cherry, birch, horse chestnut	ca. 35 cm	ca. 20 cm
Pompom	Oak, copper beech, walnut, apple	ca. 35 cm	ca. 20 cm
Reishi	Oak, maple, elm, birch, alder, ash	ca. 35 cm	ca. 20 cm
Golden oyster mushroom	Poplar, copper beech , ash, alder, willow, maple (oak)	ca. 35 cm	ca. 20 cm
Nameko	Copper beech, poplar, oak, birch, willow, fruit trees	ca. 35 cm	ca. 20 cm
Pink oyster mushroom	Poplar, copper beech , ash, alder, willow, maple, elm, birch	ca. 35 cm	ca. 20 cm
Velvet foot collybia (Flammulina velutipes)	Copper beech, willow , oak, birch, ash, alder, poplar, maple, elm, horse chestnut, walnut (robinia)	ca. 35 cm	ca. 20 cm
Conifer tuft.	Douglas fir , spruce, pine, also for inoculating tree stumps	ca. 35 cm	ca. 20 cm
Changeable agaric mushroom	Copper beech, poplar, birch , hornbeam, oak, ash, alder, maple, willow, horse chestnut, lime	ca. 35 cm	ca. 20 cm
Piopino	Poplar, willow , (alder, lime, copper beech)	ca. 35 cm	ca. 20 cm
Blue oyster mushroom	Poplar , copper beech, oak, fruit trees (conifers)	ca. 35 cm	ca. 20 cm
Elm oyster mushroom	Copper beech , poplar, oak, willow, elm, lime, maple	ca. 35 cm	ca. 20 cm
Shiitake mushroom	Common oak, sessile oak, hornbeam , copper beech, apple, maple, chestnut (birch, alder, red oak, hazel)	60 -120 cm	10 - 15 cm

Wood types in **bold** = very good yield

(would type in brackets) = not fully suitable, may lead to reduced yield

Wood quality and the best time of year to inoculate

It is very important that the logs are still moist and that there are no signs of foreign fungus growth at the time of inoculation. Accordingly, the logs should not be stored for more than 3 months after felling the trees, they should appear healthy and the bark should be undamaged, fully attached to the log and not start to peel off. However, in to avoid the natural anti-fungus defences of the trees, you should store the logs for at least 4 weeks after felling. In general, you can inoculate logs at any time of the year, but you should protect them from heavy frost after inoculation. particularly in the first six weeks. So the best time to inoculate is spring because wood is then readily available from the routine winter felling.

Number of plugs and inoculation

The plugs do not degrade when we send them through the post. In addition you can store the closed bags of plugs for several weeks in the refrigerator if necessary. However, it is best to use up the plugs fairly quickly if possible..

Logs of approx. 35 - 40 cm need about 12 - 15 plugs per log. Shiitake is grown on thinner logs and then you need 12 - 15 plugs per running metre (according to the log diameter).

Drill holes space regularly around the whole log with a sharp wood drill; the depth of the hole should be about 5 cm. Don't drill slowly! If the wood gets overheated during drilling, this can lead to the formation of a varnish-like coating inside the hole which cannot easily be penetrated by the mycelia!. Now knock the plugs into the holes with a hammer. They should have tight fit in the hole. The mycelia is present throughout the plugs, so it is not important if the mycelia coating on the outside of the plugs falls off when you bang them in.

Notes on storage after inoculation (so-called maturing phase)

After inoculation the logs should be put in a covered pile in the garden. If you are inoculating in winter you can store them in a room until spring (cellar, garage or similar).

Storing inside (Winter inoculation): if you are inoculating in autumn or winter you can first put the logs for maturing in a frost free room. However, you should put them outside again at the very start of spring if possible. In order to prevent the logs from drying out within the room, you should wrap them up well in plastic sheet or plastic bags. It is not essential to put straw in the bags, especially if you are only inoculating a small number of logs.

Storing in the garden (best method): Put down a few wooden laths or fruit boxes on the earth or grass (but not on stones or concrete) in a shadowy and moist corner of the garden. Then pile the logs on the laths and cover them up with straw or cardboard. Then cover the pile completely with a dark plastic sheet (see Figure). You must also puncture the plastic sheet with holes for air circulation (approx. 4 holes per m² of area). Make sure that the mycelia is protected against frost, especially during the first 6 weeks. All types of inoculated logs are frost resistant after the maturing phase.

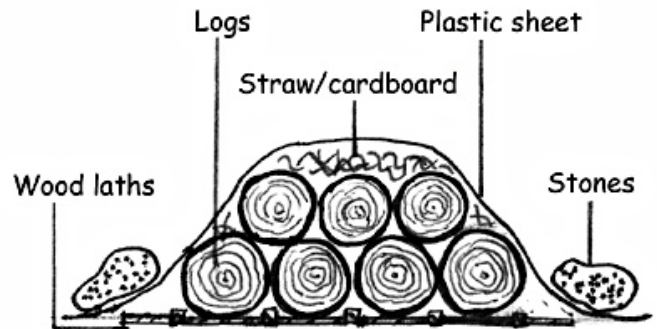


Figure: Section through a covered log pile

The inoculated logs must now stay for several months in the covered pile (approx. 5-6 weeks for most mushroom types, for shiitake more like 12 weeks). The storage temperature should not exceed 30°C, since the mycelia could otherwise be damaged (do not store the logs in the greenhouse in the middle of summer). When storing the logs in the garden, you should check the moisture content from time to time, i.e. if you can see cracks in the cut ends, water the logs and cover them up again in the pile after drying off the bark. If the logs are too moist, you should improve the air circulation to prevent mould from growing on the bark. If you store the logs inside, you should aerate the plastic sheet and the storage room from time to time

After maturing for a while, white mycelia should appear on the cut ends of the logs and should appear fresh. In the case of shiitake the colour can tend towards chocolate brown. The maturing phase is finished when the mycelia is clearly visible. However the mycelia is only visible if the logs are moist enough and can disappear again if the logs become too dry. When the maturing phase is finished, the logs should be moved to their permanent location in the garden.

Permanent location in the garden

Logs with a length of about 35 – 40 cm should be buried vertically in a shadowy place which is protected from wind to about 1/3 of their length in nutritious earth, which you can enrich with compost. If the logs are significantly longer than 60 cm, you can cut them into shorter pieces after the maturing phase before burying. The freshly cut ends are the ends you should bury in the ground. You can scatter wood chips or bark around the logs to make sure that mushrooms growing close the ground are not dirtied with earth when it rains.

Important: the shiitake logs should not be cut shorter or buried in the ground, they should remain full length (see below).

Protects all logs against slugs, for example with a slug fence. Unfortunately, slugs like all kinds of mushrooms. All log types are left outside throughout the year.

Harvesting the fruiting bodies

After burying in the earth, the logs need a bit of time before the first mushrooms appear. The logs should be kept moist with rainwater or a watering can. In the case of quite thick logs, it can help to drill 1-3 big holes (min. 15 mm diameter) in the cut ends which makes it easier for water (rainwater or irrigation) to penetrate the wood. The time needed until the first mushrooms appear depends on the wood type and mushroom type. If you are fortunate, oyster mushrooms inoculated on soft woods can already appear 6 months after burying in the earth. But it can also take longer. In the case of shii-take you may need to wait until 24 months have elapsed (for example with oak logs of larger diameter).

The first mushrooms commonly appear close to the place of inoculation. You may even find that only 1-2 mushrooms appear initially. The mycelia penetrates the wood over several years. You need patience at the beginning. It may take a while until the first harvest but then the logs can yield mushrooms for a period of 4-5 years or longer (according to the thickness of the wood). The wood is only fully consumed when it collapses because it is completely rotten.

Because theoretically other mushroom types could grow on the logs, check with the first harvest that the mushrooms are the correct, edible variety that you want to grow. You can compare the appearance with the photos of the mushrooms on our website. Note: Young mushrooms can have a slightly different colour to mature mushrooms.

Special notes for shii-take logs

Inoculated shii-take logs do not need any contact with the earth and the mycelia does not grow into the soil. After the maturing phase (i.e. after approx. 12 months), the logs should be stored vertically e.g. against a fence, a tree or a wall. It is important that rainwater gets the logs. The logs stay there in the winter as well.

In order to accelerate the growth of shii-take mushrooms after the maturing phase, submerge the mature logs completely in cold water for 24 – 48 hours (bath tub or water butt, weight down the logs to avoid floating). If the logs are longer than the depth of the water, turn them round after 24 hours so both ends get wet. The growth of

mushrooms is accelerated by the cold shock of the water. In addition, bang each of the logs 3 to 4 times strongly with the cut end on a paving stone or concrete (without breaking the log). This also accelerates mushroom growth.

The first signs of mushrooms growing should appear about 14 days after this treatment. After the first signs, mushroom growth is typically fast and you can harvest them a few days later. The logs then need a recuperation phase of approx. 6-8 weeks, then you can repeat the water immersion treatment. Shiitake mushrooms can come anyway without this treatment, especially in rainy periods.