**Propagation of cactus and other succulents:**

**Cactus cuttings:**

Most Opuntia are the most easy type of cactus to propagate from cuttings. It's possible to take cuttings all year, BUT you will get the best results in the period from mid May to mid July. It's most safe to take your cuttings in dry weather, or there are a risk that the wound will be attacked by fungus. The cutting is cut of with at sharp clean knife (which you clean it with alcohol). The cuttings must dry in at least 10 days before planting, in during the 10 days they make a callus which is a hard surface that protect the wound from fungus and insects, I place the newly made cuttings in empty clean pots, which is stood on a shelf in the greenhouse. When the cuttings has callused it can be planted 1/3 into the soil in the cactus bed, or in a pot with [cactus soil](http://www.bennyskaktus.dk/propagat_UK.htm#soil#soil). You should not water in the days after planting, only a careful misting in the morning is necessary, after a while almost all species will quickly develop roots. You can of course not avoid water when the cuttings are planted outside, but as it's usually is very hardy types of Opuntia you plant outside it's not a problem, as long as the wound has a good callus

If you make cuttings late in the season, (after August 1st.) you can store these in the empty pots until next spring and plant them around May 1st. This method is what I do with many "back-up" cuttings, as they don't take up much space in the greenhouse.
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**NB!** [*Cylindropuntia*](http://www.bennyskaktus.dk/Picpage9.htm) must dry at least 20 days before planting, as they are slow to grow callus!!

**Sowing seeds of Cactus and other succulents:**

**When is it a good time to sow Cactus and other Succulent seeds?**

All year, with "fair" temperatures and long days (13 - 14 hours), the day and heat can be provided with artificial light and heater.

**How to do it?**

The seeds are sown in top of a pot with DRY [cactus soil mix](http://www.bennyskaktus.dk/propagat_UK.htm#soil_cac#soil_cac), and are sprayed with a fungicide (like Chinosol) then they are covered with a layer of silica sand (sandblasting sand) (size 0,8 to 1,4 mm). The pots are placed in a box and covered by a sheet of class, the box is stored in a warm and sunny place in greenhouse (DO NOT WATER!!) after a 2 weeks the pots get a good soak in rain water which is added a little fungicide. When the soil is wet, (this is easy to see on the surface of the sand), they are again covered by a sheet of glass and placed in a warm and sunny place (fluctuating temperatures from 20C to 30C is good for most species) for 2 -3 weeks.
Those pots without any germinated seeds after 2 - 3 weeks are allowed to get dry dry with out the glass, and after being dry for 2 - 3 weeks they get soaked again, for another try. If I don't get any germination the second time I store the seed pots dry beneath the tables in the greenhouse, and i give them water the following year, sometimes I have had seeds that took four year to germinate (NINE years is the record for an Opuntia seed!!!!).

The seedlings does not need to be transplanted until they almost touch each other, this may take from one to many years.

Photo Benny Moeller Jensen ©2002-2005
This picture is a picture of two year old seedlings of Aztekium hintonii, it will take many years until it's necessary to transplant those!

Photo Benny Moeller Jensen ©2002-2005
This picture is of two year old seedlings of a Echinocereus hybrid (Echinocereus triglochidiatus var. mojavensis x E. albispinus (462A x 86)). They do badly need to be transplanted.

**NOTE!**
It's a very good idea only to sow half of your seeds, in that way you will not loose all your seeds or seedlings in case something goes wrong, that could be fungus, bacteria or virus in the soil, drought or too much water. Cactus seed stay viable for many years, and some species are even better if they are old before they will germinate!

Another easy and reliable way to sow the seeds can be seen at [this site](http://www.kaktus.dk/seed.html), it's well illustrated, and anyone can learn to sow seeds like this!

**Special treatment for sowing Pediocactus and Sclerocactus:**

[*Pediocactus*](http://www.bennyskaktus.dk/Picpage3_3.htm), [*Sclerocactus*](http://www.bennyskaktus.dk/Picpage12.htm) and other species with a hard seed coat, (*Opuntia*, [*Maihuenia*](http://www.bennyskaktus.dk/Picpage10.htm#Maihuenia), etc.) can be a little difficult to germinate, but there are several ways that can be tried so you can get the seeds to germinate. I would recommend that you only sow half of your seeds in one way, and then sow the rest of the seeds in another way, or even try all three ways. The ways to get better germination of those "stubborn" species are like this:

**1.**
Rinse the seeds with water and sow them in sterile cactus soil in a glass, (the glass and the soil can get "nuked" in the Micro oven!), the seeds get covered by a thin layer of sand blasting sand. and sprayed with a fungicide, then the glass is closed with some "Vita Wrap". The glass is placed in a sunny place at around 35C during the day and around 15 to 20C during the night. Those seeds that do not germinate after 2 or 3 weeks, are removed from the glass and cleaned with water and fungicide, then the hilum can be pricked of with a needle or a sharp knife. and sown in a new glass the same way as first time.

**2.**
**The "baggie" method:**
for this method you need the following things:

Photo Benny Moeller Jensen ©2002-2005
Paper towel in GOOD QUALITY (this is very important!).
Fungicide of some kind (I use the Danish brand Atamon, which is normally used when you pickle vegetables or making marmalade, ½ the spoon Atamon pr. liter).
Seeds (washed in the water with fungicide)
plant labels.

Photo Benny Moeller Jensen ©2002-2005

The cleaned seeds are sown on a piece of kitchen roll paper that are folded three times, the last fold is unfolded, and the paper getting moistened with fungicide, the seeds are sown and the last fold closed again.

Photo Benny Moeller Jensen ©2002-2005

The "envelopes" with seeds are put in a plastic bag, that are not closed but just folded. The plastic bag is stored at 15 to 20C during the night and at 35C during the day. Check the "envelopes" **EVERY DAY** and if you see a seed that are germinating it must be transplanted to a pot with moist sterile [cactus soil](http://www.bennyskaktus.dk/propagat_UK.htm#soil#soil) (Micro oven again, or just pour boiling water gently in the soil, and wait until soil is room temperature before you plant the germinating seed!!), spray with fungicide and cover the seed with sand blasting sand. The pot must be covered by glass or "Vita Wrap" for some days, and its important that the soil don't get dry for a while. Those seeds that do not germinate in 2 or 3 weeks is treated like in number 1. or you could try to put the plastic bag in the freezer once or twice!!!

Here is a picture of seedling of Navajoa fickeisenii in a 7 x 7 cm pot, only one year after the seeds were sown in the "envelopes". Photo Benny Moeller Jensen ©2002-2005

**3.**
The seeds are sown during the winter, and like all other alpine plants placed in an open frame that is in a sunny and not too wet place, and in place that will get hot in the spring. with a little luck the seeds will germinate a few each year in a few years!

**Soil:**

Soil mixes is usually a very difficult topic, as most growers have their own blend!, which is good as the soil must fit to the growing conditions of the grower.
I have learned that it's is an advantage to add normal garden loam to the soil, specially when it soil for sowing cactus and other succulents. Garden loam contains good bacteria and fungi, but this kind of soil could also contain "bad" bacteria, fungus, slugs, or other decease. If you don't know if your soil is good or bad then it's for the best to leave the garden loam in the garden. So if you are in doubt about your soil, you better don't use it or bake the soil in your own or in the Micro own.

**Samples of soil mixes for cactus and succulents:**

Here are some examples of soil mixes, I would suggest you try for your self to see which blend is suitable for your growing conditions!

**Cactus soil for sowing:**
2 parts coarse, gritty sand with large particles. (sieved through a 5 - 6 mm riddle)
1 part garden loam (sieved through a 5-6 mm riddle)
1 part peat which fertilized and with lime. (sieved through a 5-6 mm riddle)
3 parts Leca pearls (2-4 mm)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

**Cactus mix with garden soil:**
2 parts coarse coarse, gritty sand with large particles.
1 part ordinary plain peat. (sieved through a 5-6 mm riddle)
1 part peat which fertilized and with lime. (sieved through a 5-6 mm riddle)
4 parts garden loam (sieved through a 5-6 mm riddle)
5 parts Leca pearls (2-4 mm)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

**Cactus soil mix without peat:**
(sieved through a 5-12 mm riddle)
Coarse, gritty sand with large particles, maybe added some extra gravel, or Leca pearls (2-4 mm). (LECA = Lightweight Expanded Clay Aggregate)

**Soil mix for Cactus:**
1 part [standard soil mix](http://www.bennyskaktus.dk/propagat_UK.htm#Standar#Standar) with out fertilizer.
1 part Leca pearls (2 to 4 mm)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

**Cactus soil for larger plants i large pots, and for plants that are very sensitive for moisture, such as *Pediocactus*, *Sclerocactus*, *Navajoa*, *Toumeya*, *Ariocarpus* and like.**

1 part of your favorite cactus soil mix.
1-2 parts Leca pearls (2-4 mm) or use small pebbles, pumice or anything that will make the soil "loose" (LECA = Lightweight Expanded Clay Aggregate)

**Standard soil mix for most alpine plants:**
24 liter coarse coarse, gritty sand with large particles. (sieved through a 10 - 12 mm riddle)
12 liter peat which fertilized and with lime. (sieved through a 5-6 mm riddle)
12 liter ordinary plain peat. (sieved through a 5-6 mm riddle)
12 liter leca pearls (2 to 4 mm) (Do not buy Leca sand 0 to 2 mm, it's useless!!!)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

If the soil are for other plants than Cactus I add some fertilizer to the mix, I use a natural fertilizer called Aminix, but you could also use Osmocote instead! for the above mix I use one liter Animix fertilizer. **(Remember NO Fertilizer if the soil is for Cactus!!!)**

**Soil mix for woodland plants and peat-bed-plants:**
1 part [standard soil mix](http://www.bennyskaktus.dk/propagat_UK.htm#Standar#Standar), with fertilizer and lime.
2 parts ordinary peat

**Sowing of alpine plants and other plants that can be grown together with the hardy cactus and Yucca plants:**

The only difference in sowing alpines and cactus is that the alpines are sown in the winter, and that the pots are stood outside in the sun, rain, snow, sleet, frost and  thaw. (Cactus need to be sown in a closed warm and humid place to germinate.)

When I sow alpine plants I always use square pots 9 x 9 x 10 pots (or 10 x 10 x 11 for seeds of bulb plants), the seeds are sown on the surface of the soil, and cover the soil with a thick layer of silica sand (sandblasting sand) (0,8 to 1,4 mm) I do NOT cover the seed with the soil mix!!

Most of the alpine seeds are sown in January - February, but some species get better germination if they are sown when it's warmer (approximately 20C). Other species gets better germination if the seed are "old" (a lot of *Aquilegia* and most of Penstemon species germinate better if the seeds are one year old!) You can learn more about seeds and germination in the book

**"Seed Germination in Theory and Practice"**

There are three volumes at approximately US$ 20,- each including postage, they can be bought from the author:

Norman C. Deno
139 Lenor Drive
Pennsylvania State College
PA16801
U.S.A.

But if you don't want to bother with the science, just sow the seed as explained above and wait until spring, and you will always end up with some seedlings (I do that most of the times, unless I have bought some very expensive seeds!)

**How to propagate Yucca:**

Yucca plants are quite easy to propagate, both by [cuttings](http://www.bennyskaktus.dk/propagat_UK.htm#yucca_cuttings#yucca_cuttings) and by [seeds](http://www.bennyskaktus.dk/propagat_UK.htm#yucca_seed#yucca_seed). I frequently use both methods when I propagate Yucca plants. The various species of Yuccas are mostly propagated by seeds, and old hybrid and selected forms are propagated by cuttings. In the winter of 2003-2004, the Dutch in vitro lab: [Succulent Tissue Culture (STC)](http://www.succulent-tissue-culture.com) will try to propagate one of the old classic hybrids from the late 19th. century, namely [Yucca 'Karlsruhensis'](http://www.bennyskaktus.dk/Y_karl.htm) which was made by the German nursery man Graebner in 1899. [STC](http://www.succulent-tissue-culture.com) has also received one of my favorite plants a [Yucca hybrid (Yucca recurvifolia x Yucca glauca complex)](http://www.bennyskaktus.dk/192B.htm) both plants grow quite slow and I have not been able make more than a few cuttings in the past 6 years. If [STC](http://www.succulent-tissue-culture.com) have success in propagating Yuccas in vitro, they will get more of the hybrids made by [Carl Sprenger](http://www.bennyskaktus.dk/sprenger.htm) in the early 20th. century, so those great plants get more available for gardeners.

**Propagate by Seeds:**

Yuccas are very easy to sow, normally I get quite good germination (often between 50 and 100%). The seeds are long lived and can be stored for at least 4-5 years at room temperature.

3 seeds from [*Yucca nana*](http://www.bennyskaktus.dk/Y_nana.htm), collected by Fritz Hochstätter at the Type location, 2075 m. in southern Utah (fh 1178.11)
Photo by Benny Moeller Jensen ©1999-2005

I have sown MANY Yucca seeds over the past 12 years, and in 2004 I did change my procedure of sowing; now I sow all my seeds like this:

The soil I sow in is my own yucca sowing soil mix:

2 parts coarse, gritty sand with large particles. (sieved through a 5 - 6 mm riddle)
1 part garden loam (sieved through a 5-6 mm riddle)
1 part peat which fertilized and with lime. (sieved through a 5-6 mm riddle)
3 parts Leca pearls (2-4 mm)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

In May the seeds were sown on top of the soil in square 9 x 9 x 10 cm plastic pots, finally the seeds are covered by a 3 - 5 mm layer of Silica sand (sandblasting sand) ( 0,8 - 1,2 mm). The pots are then placed in a small mini greenhouse, which is placed in a south facing windowsill, the soil is watered from below with water which is added Chinosol The soil were kept moist (NOT WET) for two - three weeks, after this time the ventilations are open fully for a week and then I removed "greenhouse". The seedlings will be grown in the seed pot inside the house until next spring when they will transplanted into 3,5 liter pots for a year, and after that again transplanted into 10 liter pots or larger pots, until they are at least 3 years old, at this age they are usually large enough to be planted in the garden.

After I changed the procedure I have got much better germination (between 65 and 96%) and there have only died one seedling (of approximately 500-600 seedlings!).

My "old" procedure was as follows:

I sow Yucca seeds in late spring or early summer, at a time when the temperature are around 20C to 30C in the daytime, and not too cold in the nights (above 13C), here in Denmark the best time is late May or early June. I have not tried sowing indoors under lights in the winter, but will try so in the winter of 2003-2004.

The soil mix I use for Yucca seeds is made of:
2 parts coarse, gritty sand with large particles. (sieved through a 5 - 6 mm riddle)
1 part garden loam (sieved through a 5-6 mm riddle)
1 part peat which fertilized and with lime. (sieved through a 5-6 mm riddle)
3 parts Leca pearls (2-4 mm)  (or use small pebbles, pumice or anything that will make the soil "loose") (LECA = Lightweight Expanded Clay Aggregate)

The seeds are sown on top of the soil in 3,5 liters rose pots that are 18 or 20 cm tall,  finally the seeds are covered by a 3 - 5 mm layer of Silica sand (sandblasting sand) ( 0,8 - 1,2 mm). The pots are then placed in my unheated greenhouse and kept moist for two - three weeks, and if they do not germinate I let the pot get dry for two or three weeks and try again, and if they still haven't germinated, I put the pot aside for next year, and try again the same way. If there are pots with both seedlings and the seeds which have not germinated, I look for the ungerminated seeds and store them in paper bags (a coffee filter, or whatever you can find) until next year and then sow them again.

The seedlings will be grown in the seed pot for at least a year, after that they are transplanted into 10 liter pots or larger pots, until they are at least 3 years old, at this age they are usually large enough to be planted in the garden.

4 month old seedlings of [*Yucca nana*](http://www.bennyskaktus.dk/Y_nana.htm), grown from seeds collected at  Limestone Cliffs, 2040 m., Utah, (fh 1179.52).
The seeds were sown June 1st. 1999, the photo is from October 1999.
Photo by Benny Moeller Jensen ©1999-2005.


18 month old seedlings of *Yucca nana*,
Grown from seeds collected by Fritz Hochstätter on the Type locality, 2075 m. in southern Utah (fh 1178.11).
Photo by Benny Moeller Jensen ©1999-2005.

**Propagate by Cuttings:**

Most Yucca species can be propagated by cuttings, the acaulescent species by rhizomes and the arborescent species by cutting a branch of the plant.
**From rhizomes:**
I make cuttings in late spring so the plants can get good roots before the winter. I dig down beside the plant and cut of the rhizome with my grafting knife or my pruning shears. Let the cutting dry for a few days, then plant it in a well drained slightly moist soil and is not watered the first days. if it's a cutting with out leaves the rhizome is planted horizontally, just below the surface.
**From stem:**
The easiest species are *Yucca elephantipes*, [*Yucca aloifolia*](http://www.bennyskaktus.dk/Y_aloi.htm), [*Yucca gloriosa*](http://www.bennyskaktus.dk/Y_glori.htm) and [*Yucca recurvifolia*](http://www.bennyskaktus.dk/Y_recur.htm), I have read that they may be a little faster to get roots if the cut is treated with rooting hormone, but I haven't tried this my self. The cutting must dry a few days, then plant it in a well drained slightly moist soil.

Sometimes you will need a lot of patience, before the cuttings respond. So if seeds is available it's often faster by seeds.

**Happy propagation to everyone.**