FENOCAN
PHYTOGENETICS

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HEMP
CULTIVATION & HARVEST
GUIDE

Hemp is a fantastic plant with the potential to revolutionize economies in many ways. More farmers than ever are turning to hemp cultivation as a lucrative way to grow a durable crop.

Much of hemp's success comes from its sustainability and versatility, as it can grow nearly anywhere in the world, in many types of soil, even in short growing seasons or in dry regions, and helps purify soil.

Additionally, it is often cheaper and more environmentally friendly compared to other crops because it requires no or hardly any harmful pesticides.

Despite the labour necessary to bring in a good harvest, cultivating CBD hemp gives a much higher return than growing for hemp fibre and hemp seeds. However, growing hemp for CBD requires very different conditions and more tedious labour practices.

Cultivating CBD hemp does not come without its risks, especially when lacking the required experience and know-how. Also, growing hemp is a labour-intensive process that includes clearing weeds and maintaining the crop as it grows. Furthermore, the delicate hemp seeds need to be cared for prior to sowing. In addition, harvesting can be critical and time-consuming.

The nascent nature of the industry means that there are few standard practices for harvesting CBD hemp.

We at FENOCAN continually experiment with new cultivation and curing methods and practices. The backbone of our entire breeding program is trial and testing, be it in the laboratory or in the field. We are glad to share our knowledge and experience with growers.

This cultivation guide has primarily been prepared for the temperate zone of the northern hemisphere.

Please note that in certain jurisdictions, the cultivation of hemp is subject to restrictions and may require prior notification and/or registration with the competent authorities. Also, maximal allowed THC levels in hemp may vary from jurisdiction to jurisdiction.

This document is not meant to promote the growing of Cannabis sativa L. in any way and is solely intended for authorized and/or licensed growers in jurisdictions where the cultivation of hemp is explicitly allowed.

For questions we remain at your disposal, feel free to contact us under contact@fenocan.com.

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1. Seed Storage

Cannabis seeds are best stored in a cold place until it's time to germinate. Rapid temperature variations will destroy the genetic integrity of your seeds.

Seed storage temperature: 6° C

Seed germination temperature: 24° C

The ideal temperature to store seeds is around 6 to 8° Celsius.

Furthermore, seeds should never be exposed to direct sunlight and should be kept in a dark, dry place. Excess light and humidity can lead to premature germination. Ideally, 10% or less seed humidity is recommended.

2. Seed germination

Our varieties are highly sensitive to the sun's photoperiod, and we do not recommend sowing starts in the field earlier than 15th May for outdoor production. We consider a mid-seeding date, meaning 16th May to 10th June, is most ideal for outdoor hemp growing.

In order to give your seeds a head start you can germinate them 2½ - 4 weeks before transplanting them in the field by using greenhouses for starting plants, eventually with lighting and/or heating support. If sowing seed after the beginning of June, supplemental light and/or heating is unnecessary in most regions of the northern hemisphere.

Let the seeds geminate in well-draining potting soil, ideally in a light supplemented greenhouse with between 16-18 hours of light. Keep temperatures above 20°C, and between 24-30°C for fast and consistent germination rates.

Of course, hemp seeds can also be planted directly into the field ground (which is general practise for fibre hemp or similar 'industry use') with an automatic sowing machine. Please note that a cold soil may have a negative impact on seed germination. Seeds will not germinate in sub 16°C soil temperatures. An early seeding date prior to 15th May has generally resulted in lower germination rates and a higher mortality rate due to cold soils causing seedling pathogens.

Exposure to natural sunlight from soil emergence produces strong, healthy, and hardened off plants, If growing autoflower varieties, plants will thrive with as many hours of light as possible.

For germination, we use 72 or 50 cell vegetable starter trays with 7-8 cm deep holes. For supplemental lighting we recommend about 40 watts per square meter of greenhouse space utilized by trays, or about 5 watts per tray.

Four people can reliably plant 3'900 seeds per hour, or 31'200 seeds per 8h/day. 120'000 seeds will take 3-4 days to sow with 4 people working. Vacuum seeders are relatively inexpensive and will make larger farm operations far more feasible, but can be complicated and may require an expert to operate (e.g.: www.visser.eu/seeding-machines/.

Plant seeds 0,6 - 0,7 cm deep in fertile, well-draining potting soil and cover lightly. Water trays in gently, soil should be moist but not wet. Over watering can cause seeds to rot, while underwatering will prevent the seeds from germinating. Remain vigilant in maintaining proper moisture content until seeds germinate, as this is the most critical period of the entire season. Extreme variances will cause germination rates to plummet. Maintain a consistently moist environment.

Seeds should germinate in 5-10 days, under ideal environmental conditions, with a 90-95% germination rate. If conditions are less ideal it can take longer. We suggest waiting 14-20 days before disposing of any ungerminated seed.

Supply water to the plants as necessary and be gentle on fresh seedlings as stalks are developing. Misting the soil is the safest means of water supply. Once seedlings have emerged, temperatures can be lowered (min. 15°C). For fastest vegetative growth maintain around 60-70% relative humidity.

Do not expose young seedlings to freezing or above 37°C temperatures. During the plant growing period the trays may need to be watered multiple times a day to prevent roots from drying out. Check them frequently, especially during heat waves. If plants begin to yellow it is recommended to apply a nitrogen rich foliar feed prior to transplanting. Follow all fertilizer labels to prevent nutrient burns.

3. Field preparation

Preparing your field should be based around particular conditions. Many fields that have not been worked for quite some time may require a deep plowing to begin then subsequent disking and harrowing to smooth out the rest of the field. The end product of all of your field preparation should be a soft soil that does not have any chunks larger than 2,5-5cm in diameter. This will ensure a consistent fill in your beds when you form them. We highly recommend having your soil tested for pesticide, herbicide, pH levels, and mineral content before planting or amending. Soil pH, mineral deficiencies, and residual chemicals from previous farm use may cause serious growth issues. Contact your local agronomist or land grant university extension service for testing options. Plants will grow best in soils with a pH between 6-7.

We suggest to transplant in rows with 1-1,5 meters between plant stems and 1-2 meters between rows. This is optimal when using plastic mulch and drip tape, with a waterwheel planting apparatus (or something similar) for transplanting starting into the field the first week of June. What you decide should be determined by your planting date, weed management program (i.e. the width of your implements), and harvesting equipment. If planting July 1 spacing can be cut to 1 meter between plants and 1,5 meters between rows or 0,6 meters between plants and 1,20 meters between rows for later dates. Many farmers also opt to leave an empty row every 8 or so to facilitate the harvesting process. If you have good soil, preparing the ground for mulch/drip tape and transplanting will be similar to the creation of fine seedbeds for most other crops.

We recommend using a Plastic Bed Mulch Former with a fertilizer hopper. This implement forms the beds to adjustable heights from 20-30 centimeter, lays the drip tape, spreads an even amount of fertilizer specifically in your rows, and stretches the plastic into position, making the field ready for planting. Drip tape is highly recommended for watering, with emitters spaced every 3,5 - 5,5 meters. If you have the equipment to refrain from using plastic mulch we highly recommend it, but without proper weeding implements or a large workforce your fields may become over-run.

Our plant nutrient program has had great success using about 75% dry amendments before planting, and 25% heavily filtered liquid nutrients which we run through our drip lines. If putting the fertilizer directly in rows under plastic we recommend about 1’100 kg of all-purpose fertilizer per hectare, and 2’200 per hectare if broadcast spreading. We use a product with 7% Calcium, but any fertilizer with similar numbers will

suffice. If planting July 1 or later cut fertilizer needs in half. Ensure calcium is in your dry amendments for stronger plants.

4. Transplanting

Transplant when seedlings are well established, have woody stems, roots stick out from the bottoms of their containers, and ideally when starts are 15 - 25 cm tall. This usually takes 2-4 weeks after germination, depending on conditions. We plant plugs directly into the field, which works best for mechanized planters. Moving your plants into their final destination before they become oversized will lessen transplant shock and help prevent premature flowering, which lowers yield.

When planting time starts, water the beds in for 24 hours beforehand. For planting we strongly recommend using a water wheel planting apparatus or some form of mechanized planter. Most come with a reservoir to water in the starts as you plant them, and we recommend mixing mychorizae, vitamin b1, liquid kelp, and a nitrogen fertilizer into the hopper to lessen transplant shock. A crew of three is able to plant 2-4 hectares per day at a fast pace, but with larger planters and workforce higher rates are possible. We recommend walking your fields behind planters to ensure all plants are properly placed in their holes.

Seedlings will need careful attention for their first few days in the soil as their roots are only as big as the plug they are in. If you are using drip tape or some other kind of automated watering system, ensure water is reaching the plugs. Starts can dry out extremely quickly and die if their plugs are not getting moisture. Once their roots have expanded they will require less watering and attention.

5. Autoflower basics

If you are growing any of our daylight neutral (autoflower) varieties, please read these directions carefully. Improper plant care will diminish yield extensively. These varieties are not suitable for the inattentive or inexperienced grower.

5.1 Field preparation for Autoflower

We suggest to plant in rows with 1,00 meter spacing between plants and 1,20 meter spacing between rows. Amend with 1’100 kgs of all purpose fertilizer per hectare directly applied under plastic or about 2’200 per hectare if broadcast spreading.

5.2 Germinating Autoflower seed

Autoflower varieties are extremely sensitive in their early stages of life and require constant attention. We plant our seed in degradable plugs in 50 cell trays. These plugs allow for easy removal and minimal transplant shock. Seeds are planted 0,65 cm deep and covered lightly with soil.

Like all seed, water in gently and ensure constant moisture. Do not over-water. Keep temperatures above 20°C, and between 24-30°C for fastest germination rates. During all hours of darkness, and when temperatures allow, we apply a light treatment on our autoflower seedlings. We use a minimum of 10k watts in a 30x30m greenhouse.

5.3 Transplanting Autoflower

The most important step in growing autoflowering varieties is transplanting seedlings when roots reach the bottoms of plugs, usually within 7 days of soil emergence. If roots become bound inside plugs, plants will flower regardless of how young they are. 10 centimeter tall colas are cute but unproductive, so be vigilant about checking plug bottoms for roots! If plants are deprived of light, they will grow tall and spindly, and may break during transplant or in the elements.

Water in your field for at least 24 hours before transplanting. We strongly recommend using Vitamin B1 (Super Thrive, Thrive Alive, etc.) and liquid mycorrhizae mixed into a water wheel planter or other planting apparatus' reservoir during transplanting. These additions can help reduce transplant shock and lessen the chances of pre-flowering.

6. Watering

Once plants are established in the field, water as necessary. Every field/environment has different requirements. Your soil conditions and microclimate will dictate appropriate watering times and amounts. In our well drained, sandy loam R&D field, we water once per week for 6-8 hours in the early season, but during the peak heat of summer we give each plant up to 4-8 liters 2-4 times per week. If you have 5'000 plants per hectare you will need between 50'000 and 150'000 liters per hectare, per week.

It can also be a good idea to purchase a moisture meter and check moisture levels across your field as some areas may drink much faster than others. Adjust your watering area and schedule as necessary. Be aware, soggy plant roots cause stress and root fungal issues, so pay careful attention to ensure they are not over watered. If plants are wilting despite proper soil moisture levels, it may be wise to discontinue watering until your soil dries. In general, pH levels of your water are nominally important when growing in soil/field environments, but if you notice nutrient deficiencies in your plants it may be a good idea to check your water. Ideally pH should sit between 6-7.

7. Fertilizing

We use a liquid kelp to stimulate growth, a liquid micro-nutrient solution, and lots of mycorrhizae at all stages. If you need additional nitrogen during the vegetative stage (through early July), beyond the dry amendments, you can run organic liquid fish or other nitrogen containing fertilizers through the drip lines. We also recommend that a liquid Cal-Mag supplement be incorporated into several feedings throughout vegetative growth to increase plant strength. Follow fertilizer labels to prevent nutrient burns and filter liquid fertilizers thoroughly before running through irrigation systems to prevent clogged lines.

At the onset of flowering, we recommend a liquid bloom fertilizer, high in potassium and phosphorous, that you should start running through your lines in the middle of July. For mid-July plantings, you may want to allow plants to take in soil nutrients for several weeks before feeding blooms. Under normal June planting conditions, continue feeding bloom up until the end of August/beginning of September before switching to straight water during the plants' last weeks of field life. If you are running autoflower varieties feeding can be beneficial but not necessary and can be commenced at the first onset of flower clusters.

8. Field upkeep

Walk fields consistently throughout the season, pull weeds around stalks, remove dead material, and mow between rows when feasible. We highly recommend getting to know your plants as catching issues in an early stage is the best way to prevent crop loss. If you notice areas of stunted growth, nutrient deficiencies, or poor plant health, it may be beneficial to ask for expert consultation.

9. Common Cannabis Pests and Pathogens

Familiarize yourself with the pests and pathogens below. While large crop loss has been uncommon, it is always wise to be prepared. Germinating seed in a clean environment is a great place to start, and definitely spend time out in the field checking your plants. In many jurisdictions, there are currently no pesticides, herbicides, or fungicides approved for use on hemp, so we cannot suggest any to use. Our strains have proven themselves resistant to most fungal pathogens, but nature will prevail when conditions are unfavourable.

Also, please note that most hemp derived cannabinoids are further processed in to the food or pharmaceutical industry. Therefore, processors usually look for hemp biomass which is free from any pesticides, herbicides, fungicides or heavy metals. Your biomass will achieve a higher price and thus will be easier to sell if it fulfils these conditions.

10.1 Common insects

Broad Mites
Invisible to the naked eye, between 0.1mm and 0.2 mm, high risk for crop loss.

Hemp Russet Mites
Invisible to the naked eye, about 0.17mm, high risk for crop loss.

Spider Mites
Small but visible, especially by their spider like webs, low risk for loss outdoor.

Aphids
In general about 1mm, visible, low to medium risk for loss, depending on population.

Whiteflies
About 2mm, visible, low to medium risk depending on population.

Thrips
Visible, with a low to medium risk of crop destruction, common.

Ants
Excessive populations in fields can consume plant stems and destroy plants.

Termites
Can burrow out the inside of stems and kill plants.

Symphylans
Visible, but small, consume roots causing stunted plant growth.

10.2 Common Fungal Pathogens

Root Rot
Pythium and Phytopthera cause sudden wilting of plants and are often symptoms of overwatering or soil that does not dry out.

Powdery Mildew
White fuzz that can cover leaves and flowers rendering them unfit for the fresh cut flower maker. Can be a symptom of poor airflow in plants.

Bud Rot
Botrytis/mold that grow in and on flower clusters, can cause huge crop loss. Occurs when maturing flowers become overly saturated with moisture and are unable to dry out.

10.3 Animal predators

If you do not have a physical barrier around your field you are at risk of damage from all livestock, deer, pigs, chicken, and the occasional Human. Also, gophers and voles have been known to wreak havoc on roots. Consult growers or farmers in your area for threat levels and remedies. Some of our farmers have been forced to construct fences around their field perimeters to deter large mammals.

11. Residual Field Chemicals

If you are cultivating on land that was previously sprayed with pesticides and herbicides, be aware the soil may be contaminated with growth regulators that have adverse effects on cannabis for years after. If large amounts of your plants display strange growth patterns, this may be the cause. Consult a soil agronomist or horticulture expert for remedies. We strongly urge growers to dispose of these plants as extraction may accumulate high levels of toxins. Most importantly, get your soil tested!

12. Flowering

At the onset of flower, it is important to survey field conditions often, checking individual plants for stressful conditions, animal predation, and overall health. All of our varieties, except autoflowers, will begin to flower in mid-July. This will be a particularly important time to examine plants and provide proper irrigation. During this time, plant growth will explode (often increasing in size from 50%-100% over the course of 3-4 weeks). Flower clusters are not likely to be visible until the end of July or first week of August. Autoflowers will show signs at 1 month after germination. At this point we switch to a bloom feed (high phosphorous and potassium, lower nitrogen) in the middle of July.

For strictly biomass producers we recommend discontinuing watering at the end of August and allowing the plants to field dry before harvest if plants are on track for September finishing.

13. Hermaphroditic Traits, Male Phenotype, Cross-pollination

Be on the lookout for female plants that exhibit excessively spindly flower formation, as these have a higher likelihood of generating hermaphroditic pollen sacs and creating seeds in your crop and your neighbours'. With feminized hemp seed, usually around 1 plant out of every 4'000-10'000 will exhibit either hermaphroditic traits or seldomly even full-blown male phenotypes. In general, this is largely mediated by environmental stress. You will also find occasional plants that produce pollen sacs on the lower nodules looking almost like bananas. These plants will release pollen when mature and fill your flower with seed. Spray down with water, or place in plastic bag when disposing. Change clothing if contacted with pollen and wash before touching plants again. Be

vigilant on checking your plants, as it is not only your flower that may be damaged by pollen. We walk our fields weekly throughout flower stage.

The possibility of cross-pollinating another farmer's crop or being pollinized by another provides the most critical reason for exclusively using feminized seed and/or female clones. Cross-pollination (or simply pollination) is one of the most economically damaging events that can occur in cannabis farming if the goal is to produce seedless flowers or high quality biomass for extraction purposes. Pollen can easily travel more than 10 km, so if possible, make sure there are not farmers working with regular hemp seed in such range.

14. Harvesting

How and when you decide to harvest must be based upon your individual situation. If your starts were planted in the field in June, around 25% of plants will show signs of maturation in the beginning of September, 45% in the middle of September, and 30% at the end of September. This number can vary dependent upon your planting date and the nitrogen levels in your soil. Mid to late July and later planting dates, as well as heavy nitrogen levels in soil/feeding regimen, can push plants to mature much later. Autoflowers should all finish around 77 days after emergence.

If you are limited on space, you will need to stagger your harvest to match filling and emptying cycles. If you have limited people start harvesting early, as factoring in time to hang the product to dry is also crucial. Be prepared: plants can grow very large, and when wet, become heavy. Single plants may weigh over 50 kgs with water weight and have had entire walls of hanging flowers collapse.

If growing for biomass we recommend harvesting as late as possible for high CBD production, but if tackling many hectares in poor weather, with a limited drying space or workforce, choosing when to harvest to prevent losses will be at your discretion. There are companies that manufacture combines and specific attachments for harvesting hemp. If you have the budget and a lack of manpower, this is a good option. These machines often bundle the wet material.

If growing autoflowers in a dry region, chopping your plants and allowing them to field dry may be an option. While terpene loss is high, CBD levels have shown negligible losses when plants are sundried. This technique may also be available for full season growers, but once again only in areas with dry climates will allow for mold free drying.

15. Drying & Curing

The choice of the right drying & curing method can depend on whether the purpose is to produce flower or biomass.

We recommend having around 1’000 m2 of dry room space per hectare for hanging whole plants, depending on the room height. In an 8 meters tall facility, you can go up to 5 meters high. Hanging can be done by scissor lift. If stem and leaf matter is removed less drying space is needed, but this also requires a huge amount of time and labour.

For fresh cut flower and full spectrum extract, dry plant material at temperatures below 30°C, in low humidity and light conditions for best terpene and cannabinoid content.

Temperature and humidity control with dehumidifiers, heaters/AC units, and fans is optimal. We recommend 18°C and 40% relative humidity. Excessive humidity in dry rooms can cause mold outbreaks. When flower is dry, i.e. when the large stems that hold it snap easily, we buck the flower off the stem and stow in airtight containers.

For biomass, product can be dried as quickly as possible, but temperatures above 95°C can cause loss of cannabinoids and terpenes. Check in your area and find out if there are drying facilities for rent if you have large volumes of material. If your climate allows you may be able to dry whole cut plants directly in the field and mulch product for sales.

We generally do not recommend shredding the whole plant including stems, but rather to remove as much stem material as possible, especially the main stem. Please note that the weight percentage of flower in relation to the entire plant is usually around 25% only, depending on the variety and environmental factors it can be even lower. This means that if the entire plant is shredded vs. only the flower, the reduction of Cannabinoids in weight percentage may be up to 4x, significantly impacting the value per kgs of biomass accordingly.

16. Hemp biomass yield & cost/profit per hectare/ton simulation

Cultivation of hemp for cannabinoid production can be very lucrative, however, land prices and labour cost vary. The current rate for cannabinoid-rich biomass is about CHF 3.- per percent of CBD per Kg. Those who grow a variety of hemp with an average 12 percent CBD content could make CHF 36'000 per ton. Considering that a hectare produces an average of around 2 tons of biomass, CBD farmers can earn around CHF 72'000 per hectare.

1) Assumptions

12%	CBD content in biomass as end product
1.00	Cost per seed in CHF
3.00	Market price per % CBD per Kg hemp biomass ("X")
1:1	CHF:USD

2) Yield calculations

Plant Spacing in meters	Plants per Ha	Estimated yield per plant in grams*	Yield per Hectare in Kg	Gross revenue per Ha CHF X per % per Kg CBD	Seed Cost per Ha in CHF	Seed Cost in Percentage of Gross Revenue
1.50	4'444	450	2'000	72'000	4'444	6.17%
1.25	6'400	380	2'432	87'552	6'400	7.31%
1.00 x 1.25	8'000	360	2'880	103'680	8'000	7.72%
1.00	10'000	300	3'000	108'000	10'000	9.26%
0.75	17'778	160	2'844	102'400	17'778	17.36%
0.65	23'669	130	3'077	110'769	23'669	21.37%

**Estimated yield per plant is an average estimate and depends on variety, sowing time various environmental factors.*

3) Cost calculation example per hectare/ton

Assumptions

Planting time: 1st June (1 x 1.25m rows)

Descpription	Cost per Ha in CHF
Land lease	5’000
Seed	8’000
Drip line	1’250
Plastic	750
Fertilizer	1’500
Field Preparation	500
Misc.	500
Lab analysis	1’250
Labour	2’500
Harvest & Drying	Highly variable depending on harvest method
Total costs per Ha in CHF	**21’250**
Gross profit per Ha in CHF	**82’430**
Total costs per Ha in % of Gross revenue	**20.50%**
Total gross margin	**83.67%**
Cost price per ton in CHF	**7’378**
Gross profit per ton in CHF	**28’622**