



HEMP CULTIVATION MANUAL

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PREFACE

Dear cultivator,

We present you with a manual on hemp cultivation. Through this publication, HempFlax wants to inform arable farmers about the various aspects of hemp cultivation. To a large extent, the information in this manual is based on information and experiences of arable farmers and hemp growers in particular.

HempFlax did not just solely build on the practical experience of sustainable hemp cultivation for this manual. To provide you with the best possible service, we've also processed information from studies, such as from the Hilbrands Laboratory in Assen (The Netherlands) and, of course, from the PAGV (Applied Arable and Vegetable Research).

HempFlax asks you to primarily view this guide as a booklet with rules of thumb for hemp cultivation. This publication is not a guarantee for a successful harvest. HempFlax does not consider itself liable for the execution of the general advice we provide in this manual.

Hemp cultivators who are in doubt if the recommendations in this manual apply to their specific business situation are requested to contact the cultivation support. Naturally, HempFlax is more than happy to assist you, also if you have other questions about hemp cultivation. Our cultivation support team always aims to provide tailor-made advice to arable farmers who are choosing hemp.

HempFlax has the fullest confidence that hemp growers can achieve a successful harvest using this manual. Our cultivation support team will gladly contribute to this success, convinced that you can expect a satisfactory result.

Kind regards,

The HempFlax Cultivation Support Team

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INTRODUCTION

Hemp or *Cannabis sativa*, is an ancient crop. Hemp has been cultivated since 4000 BC in its country of origin, China. At the time, the Chinese used cannabis for medical purposes as well as for producing clothing and paper. For centuries, hemp and wood formed the two main raw materials for the shipping industry. The sails and rigging of the Viking ships as well as the vessels explorer Christopher Columbus used for crossing the world's oceans were made of cannabis (canvas). The hemp plant was therefore partly responsible for discovering America. Without cannabis, Western Europe would not have had its Golden Age. The United East India Company was the foundation of Western prosperity thanks to its typical Dutch hemp cultivation and its global merchant shipping business.

Hemp was largely driven out of the American and European fields in the 1930s. This took place in 1937 after the USA labelled cannabis as a prohibited plant. After centuries of serving as a fibre crop and yielding economic returns, hemp was suddenly marked as detrimental to public health. The ruling parties issued a law that would eradicate the hemp plant. This anti-hemp lobby was led by oil barons and other stakeholders in the booming oil extraction industry. Supported by politicians, these industrials paved the way for the development of the petrochemical and the plastics industry. Products such as nylon and other synthetic fibres then rapidly replaced the role of hemp.

Less than sixty years later, in the late 1990s, hemp was rediscovered as a renewable raw material source. The current environmental problems led to a renewed interest in hemp. Why would we unnecessarily pollute our environment using synthetic substances when we could make products from natural fibres?

Hemp can make a valuable contribution to a better planet if we use hemp as a fibre source. Hemp cultivation produces a lot of oxygen and reduces CO₂. The plant remains within its ecological cycle when it's composted. When hemp is burned, its fumes end up in the atmosphere from which it has taken up CO₂ during its growth phase. This keeps the environmental balance intact.

Today, hemp is not only processed in paper but also in medicine, clothing, nutrition, cars, building and insulation material, as well as in body care products and animal care. Farmers are now growing hemp again throughout most of Western Europe. By breeding certain cannabis varieties, the presence of the intoxicating component - THC - is reduced to almost zero.

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1 THE CULTIVATION

This chapter describes the technical aspects of hemp cultivation. The planting plan, the fertilization, seedbed aggregation, sowing and harvesting are explained in succession. These cultivation recommendations are not a guarantee for a successful cultivation, they only serve as cultivation support.

1.1 THE PLANTING PLAN

Hemp is viewed as a suitable preceding crop, as it suppresses weeds and leaves a good topsoil structure. Hemp has a suppressing effect on the soil fungus *Verticillium dahliae* and the Columbia root-knot nematodes (*Meloidogyne chitwoodi*). Hemp also suppresses the northern root-knot nematode (*Meloidogyne hapla*), full resistance has even been found for some breeds. Hemp is a host plant for nematodes from the *Pratylenchus*-family. Older literature compared the propagation of this nematode to the propagation of *Pratylenchus* on potatoes.

Hemp's harvest time is around late July, early August. An early harvest gives the *Pratylenchus* less of a chance. Keep the soil black as soon as it is released. Nematodes will then fail to complete their life cycle and will hardly propagate.

Hemp is very sensitive to water flooding and thrives best on a good soil structure. Hemp provides a good soil structure but requires it as well. Compacting topsoil will quickly lead to severe inhibition of growth.

For optimal growth, the soil requires a pH value of at least 5.

1.2 FERTILIZATION

Hemp requires fairly precise fertilization. A fertilization scheme that is too high or too low will lead to lower yields. The total Npk requirement per hectare is 110 kg of Nitrogen (N), 80 kg of phosphate (P) and 140 kg of potassium (K). The following sections will clarify the nitrogen, phosphate and potassium requirements individually.

1.2.1 NITROGEN

A low application of Nitrogen, for example 80 kg N/ha, terminates growth prematurely and maximum yields will not be achieved. Applying a Nitrogen level of 200 kg N/ha will result in the plants competing for light. This results in significantly fewer plants per square meter and a lower yield. **The best plant density and yield ratio is achieved by a Nitrogen application of 110 kg N/ha excluding soil resources.**

1.2.2 PHOSPHATE AND POTASSIUM

Fertilization recommendations for arable farming are usually formulated based on a large number of trials. In the case of phosphate and potassium, the recommended quantities depend on the crop, the condition of the soil and the multi-annual crop cycle in which the crop is planted. In the case of hemp, the recommendation is based on crop abstraction. **At an average yield, a fertilization application between 80 kg P/ha and 140 kg/ha is needed.**

1.3 SEEDBED AGGREGATION

Seedbed aggregation is extremely important for successful hemp cultivation. HempFlax stresses that hemp is sensitive to the soil structure, requiring a correct cultivation aggregation. The best way to prepare the seedbed is treating it like cultivating sugar beets. The structure should absolutely not be too coarse, but also not too fine, which would cause the soil to drift rapidly. The seedbed should also be level and compressed. Harvesters will leave traces when the seedbed is not compressed enough and then the hemp cannot be harvested optimally. Hemp seed is delicate in form and carries little energy in itself. Therefore, it needs to grow fast and uninhibited. The soil type and weather conditions determine the way in which the soil should be prepared for seeding.

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1.4 SEEDING

Even though hemp grows well at low temperatures, HempFlax recommends not seeding the crop too early. Preferably, the soil should have a temperature between 10° and 12° Celsius. A week later won't matter much and is still better than a week too early under poor conditions. Seeding early does not automatically lead to a higher stem yield.

The first two weeks after seeding are crucial for the cultivation. Hemp should emerge fast, between 10 and 14 days. Then, the crop can easily conquer emerging weeds and the growth is off to a good start.

To achieve the correct plant density, 35 kilograms of seed per hectare is required. The maximum seed depth should not exceed 2-3 cm. Also seed at a uniform depth! Deeper and irregular seeding results in a lower yield. You can sow hemp seed with a pneumatic seeder or a hoe press drill machine. Row spacing should be similar to that of grain. A rule of thumb is to calibrate the seeder to fewer kilograms per hectare, about 32 kg/ha in order to sow the desired quantity of 35 kg.

Note: The correct calibration is machine-dependent. Therefore, regularly check the seeding rate during seeding.

1.5 CROP CARE

The crop requires no further care. Hemp grows so fast that weeds have no chance to develop. Hemp has not demonstrated any impact from diseases. Additionally, the usage of crop protection products and further care of hemp after sowing is prohibited when hemp is used as greening payment. In case of problems, such as poor emergence or stunted growth, HempFlax recommends you contact the cultivation support team as soon as possible. How to reach the HempFlax cultivation support team is explained at the end of this manual.

1.6 HARVESTING

Hemp can be harvested from late July, early August. This depends on the climate and the purpose of hemp cultivation- will the crop be grown for the seed, the leaves, the fibre or for all purposes? Below two harvesting methods will be explained, one for separately harvesting the top and the rest of the plant and one for harvesting the entire plant.

1.6.1 METHOD 1

With this method, the top, which contains the seed and the leaf, is harvested separately from the rest of the hemp plant. The top is cut from the stem with a combine-jaw and subsequently processed in the combine, separating the seed from the rest. It's also possible to catch the leaves that end up in a tipper through a shredding construction. The general settings for the combine can be found in table 1. It's important that the combine is cleaned properly during the threshing of hemp as the hemp tends to cake on. More information about the harvester can be found on www.hempflax.com. Information about the harvesting technique can be found under the heading Equipment.

The 'hemp stem' is harvested after the top has been harvested. This harvesting method is further explained in section 2.6.2.

Reel speed	Approximately 1 km/h faster than the driving speed
Fan speed	950 rpm
Threshing cylinder speed	900 rpm
Top sieve	10 mm
Bottom sieve	5 mm

Table 1 General combine settings for threshing hemp

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1.6.2 METHOD 2

The hemp stem or the entire plant is harvested by means of a chopper or combine that is suitable for hemp. The length at which the hemp is cut is about 60 cm; the cutterhead should be set for this in combination with the feed rollers. The hemp then ends up on a swath.

After the mowing, the product must on a swath for 10 to 14 days for drying and retting. This simplifies the processing procedure in the factory. The clippings should be turned twice during the drying period by using a straw walker. This separates the crop at a low speed, drying it evenly. It's important that the PTO shaft speed does not exceed 350 rpm. The swath gets too wide if the crop is rotated at a higher rpm. This results in riding over the crop when the crop is turned next. Additionally, the high turning intensity separates the wood from the fibre, resulting in unnecessary yield loss. The driving speed when turning the swath is approximately 6 km per hour.

The clipping swaths can be raked into a larger swath when the hemp is dry enough in order for more efficient baling. Check to see if the hemp is dry enough by breaking its stem. Take a tuft of hemp stems and break this. The hemp is dry enough when the hemp truly breaks (actual separation). If the hemp just cracks, the product is still too damp.

The hemp is then pressed into square bales each weighing approximately 400 kg. It's important that the cutting device is disabled when baling to prevent damage to the machine.

HempFlax wishes you a bountiful crop season.

2 CONTACT DETAILS HEMPFLAX B.V.

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