

Industrial Hemp (*Cannabis sativa*) Variety selection and Seeding in Western Australia

24 May 2022

In Western Australia, Industrial hemp is defined as *Cannabis sativa* where the leaves and flowering parts do not contain more than 1.0% tetrahydrocannabinol



(THC). Industrial hemp does not have the psychoactive effect normally associated with medicinal, prohibited or marijuana varieties, nor is it grown for cannabinoids.

Industrial hemp has many uses. The astute grower will first consider what product they are interested in or can legally and physically produce, and then select genetic material suitable for that purpose.

Industrial Hemp varieties are broadly classified into the following:

- **Varieties for grain production** including processing for human consumption or for oil. These varieties often grow no higher than 1.5 metres in the 6 to 8 weeks prior to initiation of flowering. Flowering is normally initiated by daylight hours shorter than that variety's critical daylength.
 - A variation on grain types are **dual purpose varieties**, where after the seed is harvested by conventional headers, the remaining stubble is harvested and processed for fibre.
 - **Varieties for fibre** often grow over 3 metres tall and are not able to be harvested by most conventional cropping machinery. These varieties are less dependent on flowering as growers are not interested in saving seed.
 - **Varieties for high biomass production for livestock** (currently under investigation).

Hemp variety selection considerations

Before planning to grow a crop, consider the following:

1. What product is most profitable and easy or you to grow – this may be a seed crop or for fibre, or another crop including cattle fodder.
2. Select the appropriate variety to suit the location, farming practices, and water or rain availability in the growing season.
3. Variety selection is dependent on latitude adaptation, length of vegetative cycle, height at maturity, seed yield, oil content, biomass yield, fibre content and regulatory requirement.

Are you licenced to grow Industrial Hemp?

In WA, all people or businesses intending to grow, harvest, transport and process industrial hemp in its various forms, must be [licenced](#).

Purchasing Seed

Growers should buy seed from an accredited supplier. In WA, several industry groups import and sell quality seed.

Consideration should be given to the following:

- **Select varieties that have been tested in your environment against other varieties.** DPIRD publishes [trial data](#) from across the northern and southern regions, annually. Variety breeding, trials and comparisons are still in early stages of development, so ensure the advice given regarding variety selection is the best you can obtain.
- **Purchase seed from tested parents.** In WA, seed for sowing may only be sold from parent plants that are low in THC. Ensure you receive the **crop analysis certificate** from the merchant prior to purchase - seed (and plants) are highly variable in their genetics and whilst seed from one parent is easily tested, pollen from the other parent may come from a higher THC plant. Plants that exhibit THC levels above 1% will be destroyed.
- If you are looking to **import seed** into WA, read [information on importation of seed](#).
- **Purchase seed that has been tested for germination.** Germination should be 80% or better. Prior to seeding, the grower should test the seed germination at home again. If the germination rates differ markedly, there may have been a problem in seed storage and emergence percent may be lower than expected. See notes below on how to test for germination at home, seed storage, and emergence rates.
- **The seed merchant should give surity that the seed has been stored in dry, cool conditions.** Seed must be stored at less than 4°C and with moisture content less than 10% to ensure higher germination.
- Hemp plants are open pollinated - **seed from your own harvest in the previous season should not be used** incase it has crossed with other hemp plants grown in the area. When this happens, there is a possibility that the levels of THC in

Calculate the Seed Germination Rate at home

Sometimes it is best to test the seed to ensure the germination rate is still acceptable.

- Place some absorbent paper in a shallow container and dampen it with water. Ensure there is no free water in the container.
- Place 25 seeds on the damp paper and place the container in a warm spot, but not in sunlight. On top of the refrigerator is ideal.
- Leave the seeds to germinate for 4-5 days and count the number of seeds that shoot.
- Multiplying the number of shot seeds by four (4) will give the germination percent.
- Use this figure in the calculation of seeding rate per hectare (see below).

the new crop may be higher than the allowed 1%. In this case, the grower will be required to destroy the crop.

Varieties for outcomes

Hemp normally flowers after being exposed to light periods that reach a critical day length, unless an Indeterminate variety is selected. This allows hemp to grow in non-conventional locations.

Hemp has adapted to a wide range of latitudes and can possess large variability in its sensitivity to day length. Timing of transition from vegetative growth to flowering is key for high yield and acceptable fibre quality.

Varieties may be adapted to higher latitudes (for example, Hobart at 42.88°S) and to perform differently to those selected for latitudes (for example, Manjimup at 34.24°S or Kununurra at 15.77°S.)

Plant Breeders Rights

Some varieties may have Plant Breeders' Rights (PBR). It is illegal for seed from these varieties to be sold without permission from the seed producer or company owning the PBR. Fresh supplies from seed suppliers must be sought each season.

Sowing the Crop

Sowing date

In tropical WA, hemp seed sowing should occur between May and June to allow the crop to flower from July to August, and be harvested before the onset of the wet season. The time taken from sowing to flowering ultimately limits vegetative growth, biomass, and seed yield. Trials carried out in the Ord River Irrigation Area indicate the ideal seeding time for hemp in the north of WA would seem to be almost six months later than it is for southern crops where the change in growing season day length stimulates flower initiation. This is due in part to the high soil temperatures experienced in the 'wet season'. In the tropics, the transition to shorter day lengths has less effect on initiating flowering in most common varieties. This ultimately limits vegetative growth, biomass, and seed yield. Varieties adapted to tropical regions are desirable in these situations with an extended vegetative growth period before flowering. In southern Western Australia, trials suggest hemp crops should be sown from October to December to allow the crop to flower in January or February, and be harvested before the onset of cooler weather in March or April. The time taken from sowing to flowering ultimately limits vegetative growth, biomass, and seed yield.

Soil Temperatures

Soil temperatures at 10cm depth at seeding should be near 20°C. Seedlings survive well at or below a soil temperature of 30°C. Data from [local DPIRD weather sites](#) may give you this information.

Seed bed preparation

A fine, firm, well-prepared flat seedbed is required for fast, uniform germination of hemp seed. Weed control at this point is critical as the small emerging hemp seedlings may not compete well with weeds.

Short Cut to calculating Seeding Rates

New growers may not know or understand some of the parameters discussed in the above calculations. To simplify these calculations a grower should discuss the appropriate seeding rate with seed suppliers and other growers.

However here is a 'ballpark' figure for targeted seeding rates given average figures for seed size and germination rates.

Crop	Seed Crop	Fibre Crop
Target plants per Square metre	100	200
1000 seed weight	18 gm	18 gm
Germination rate	75%	75%
Establishment rate	75%	75%
Target Seeding Rate Kg/ha	32 kg/ha	64kg/Ha

Given the above average figures and the formula, here is a demonstration of calculating the approximate seeding rate.

1. Multiply the target plant density (**100**) by the 1000 Seed Rate (**18**) and multiply by **100 = 180000**
2. Multiple the Germination Rate (**75**) by Establishment Rate (**75**) = **5265**
3. Divide line 1 (**1800000**) by line 2 (**5265**)
4. **Target Seeding Rate = 32 kg/ha**

Calculating Seeding Rates

Grain crops usually require up to 100 plants per square metre at maturity. However due to the plants' propensity to branch, many good crops may be grown with lesser establishment rates in ideal conditions. For fibre production, higher plant density up to 200 plants per square metre is recommended. The higher seeding rate discourages branching and supports taller crops and longer fibre lengths.

Choosing the correct seeding rate (kg/ha of seed) is critical to a productive crop. A grower will need to balance the cost of seed purchase against the cost of loss of crop productivity due to poor choices or poor opportunities by the grower.

The calculation of an appropriate seeding rate for a variety of industrial hemp is a simple but critical calculation. Large variations in the germination rate of seed (often from 95% germination down to 25% germination in the laboratory) will affect the density of your crop and then the yield of the crop.

The establishment rate of the small plants is linked to germination rate. Even if all the plants germinate in the soil, there are other factors that limit the small seedling from emerging through the soil. We will touch on some of these factors later.

To calculate the seeding rate, the grower will need the following information.

- **Target plant density** (plants per square metre) - This varies with the type of crop being grown. For example, up to 100 plants/m² for seed crops and 200 plants/m² for fibre crops.

- **Thousand seed weight in grams** - Seeds vary in their average size and weight and thus the number of seeds sown per square metre will vary with the seed weight. Ask the seed merchant for the test results or calculate your own figure.
- **Germination rate (%)** of the seed should be supplied by the seed vendor or calculate your own. Germination rate is expressed as a percentage. Between 80 – 100 % is excellent, 60 – 80% is an acceptable germination rate. Ask the seed merchant for test results or calculate your own.
- **Establishment rate (%)** is the number of plants that establish in the paddock as compared to the target rate. Establishment rate is measured as a percent number of seeds that survive germination and grow. This may vary from site to site using the same seed. It is dependent on a host of effects including weeds, pests and diseases, soil types, irrigation or rainfall or depth of seeding. It is common to lose 20-40 percent of seeds through poor emergence and is considered a 'hidden' loss.

Calculating Seeding Rate per Hectare

To calculate the appropriate seeding rate, using the 1000 seed weight, target plant density, germination rate and establishment rate, the following formula will assist.

$$\text{Seeding Rate(kg/ha)} = \frac{\text{Target Density (plants per metre}^2\text{)} \times 1000 \text{ seed weight (gm)} \times 100}{\text{Germination rate}\% \times \text{Establishment rate}\%}$$

Depth of Seeding

Seed should be sown at 10 to 20 mm depth, with good seed to soil contact for best results. Sowing with soil compaction wheels, or lightly set press wheels behind the seeder will assist in improved germination. Excessive compaction may have an adverse effect on emergence especially on crusting or heavy soils. Seed sown too deeply will have difficulty evenly germinating, and if sown too shallow will risk not germinating at all.

Fertiliser

All soil should be tested for levels of Nitrogen, Potassium and Phosphorous by a commercial soil testing laboratory. All the proposed phosphorous (P) and potassium (K) fertiliser should be sown at the same time as the seed, ideally to one side of the seed. Half of the nitrogen (N) should also be sown with the seed. The other half (approximately 100kg) of nitrogen should be broadcast on the crop three to four weeks later.

Machinery

The crop can be planted through conventional seeders or air seeders at the required sowing rate. As the seed is generally soft it should be handled carefully, and the sowing gear set up to reduce crushed grain. Air pressure in air seeders should be kept to a low figure to reduce the risk of seed damage.

Seed storage

The germination rate of seed deteriorates over time, especially at higher temperatures with high humidity and seed moisture. Stored seed should be kept under refrigerated conditions less than four (4) degrees Celsius with moisture content of less than 10% to maintain their viability.

Additional information

- [Recent crop variety trials.](#)
- [Growing of industrial hemp in Western Australia](#)

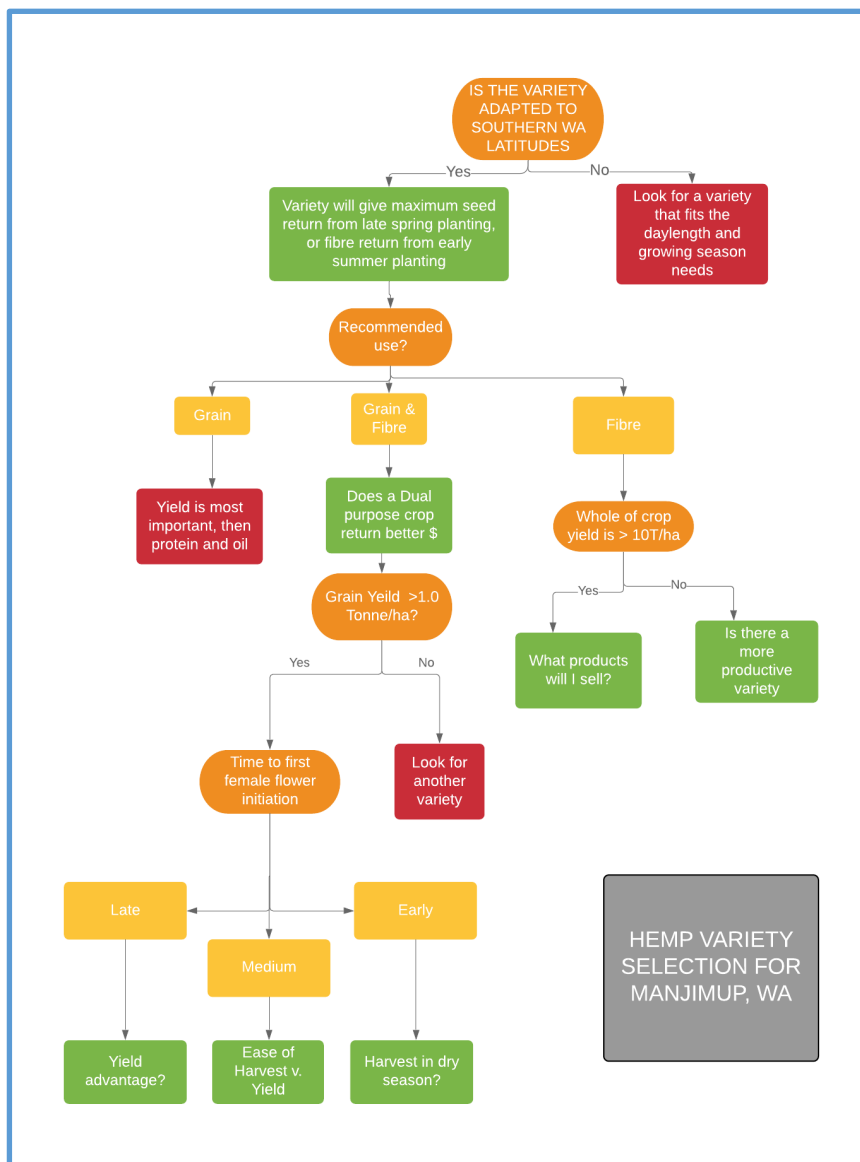


Figure 1 Variety selection map for Industrial Hemp

Contact

Don Telfer - Project Leader Industrial Hemp

Important disclaimer

The Chief Executive Officer of the Department of Primary Industries and Regional Development and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

Copyright © Department of Primary Industries and Regional Development, 20__