Ecofibre Industries Operations Pty Ltd

Industrial Hemp Fibre Production Guide

Production Office and Research Farm
"Carrington" Golden Hwy 1970 Jerry's Plains Rd,
Hunter Valley, Jerry's Plains, NSW 2330
Tel: +61 2 65 764273

Head Office
PO Box 1227 Maleny, Queensland 4552 Australia
Tel: +61 7 54999249
email: admin@ecofibre.com.au www.ecofibre.com.au
ABN 27 140 245 263

Hemp is a 4 m tall annual, daylight sensitive, fibrous plant. It is a summer crop, grown for Fibre, Grain & Oilseed in many countries. There are over 2,000 lines, with low THC.

Hemp *Cannabis sativa* L is an annual crop that grows to 2–4 m plus, in the 3-4 month summer growing season. It is grown because of the high quality of the fibre, oil, meal and grain. The reproductive phase (flowering) is turned on by day length. There are more than 2000 industrial varieties, all of which have a low THC (hallucinogen) content of less than 1%.

Soils and Land Preparation

- Deep, free draining, loamy soils, well aerated with pH of 6.2-7
- Good moisture and nutrient holding capacity
- Hemp is not suited to compacted soils or waterlogged areas
- Seed bed should be loose but firm, to ensure a fast, uniform germination of hemp seed – with good seed/soil contact, just like lucerne. Maximum sowing depth is 50mm and deep ripping is recommended where compaction and plough pans exist.
- Raised beds and controlled traffic systems are best for heavy clay soil.
- Direct drilling and zero tillage systems are also being tested.

Picture 1: flat, well prepared ground

Planting

- Planting time depends on variety, latitude and climatic conditions,
- Sowing from September through to November gives maximum dry matter fibre production potential.
- Early spring sown crops are more likely to outgrow weed competition, than later summer sown crops
- Flowering is initiated by the start of shorter days during late summer (usually late February).

Picture 2: Good establishment with close rows and high plant density

Sowing

- The seed is round and slightly smaller than sorghum
- Hemp usually has 40-60,000 seeds per kg, depending on variety
- Sow through modified combines, precision planters or air seeder's, at sowing rates of 40 - 60 kg/ha, with narrow 150mm row spacing is desirable, for uniform stalk diameter and minimal self-thinning. (150 seeds/m^2 reduces to 80-100 seedlings established and 60 plants/m^2 by harvest time)
- Seed should be placed at 10 – 45 mm depth, with good seed - soil contact, (may need a light roller/press & depth wheels preferred)
- With adequate soil temperature (15+ ^{0}C) and moisture, seedlings emerge within 4 – 7 days

Male and Female plants

- Seeds produce either male or female plants (50/50%)
- Male plants flower a few weeks before females and continue to flower for only a short time from the onset of female flowering

Picture 3: Male flowering

Picture 4: Female flowering

Crop Nutrition

- Grows best in a nutrient-rich, well-drained, well-structured, silty clay/sandy loam soils, with high organic matter.
- A 12T/ha Hemp crop requires 150 kg N, 60 kg P and 150 kg K, then in descending order: Ca, Si, Mg and micronutrients. Hemp can enter the rotation after a lucerne or legume/pasture, for example, to control weeds and utilise the accumulated nitrogen and organic matter.
- Soil testing is recommended. Note that much (over 50%) of the nutrients taken up by the fibre crops are returned to the soil as a leaf drop mulch and in the roots. Only the stems are removed during fibre harvest.

Moisture requirement

- To achieve a 12t crop 3-4.5 ML/ha (300-450 mm rain/irrigation) is the total water requirement over the 3-4 month growing period.
- Sufficient soil moisture in the first six weeks is essential for even plant establishment and good crop growth for initial weed suppression, establishment, and competition.
- Variables to be considered when planting irrigation areas, are soil type and depth, initial soil moisture content, soil water holding capacity, type of irrigation system, irrigation capacity and turnaround, nozzle droplet size, surface crusting, soil and air temperatures, and Evapo-transpiration rates etc.
- Planning is needed to ensure that water can be delivered when it is most likely to be needed throughout the season. Eg the critical times of establishment and peak crop growth/ height, pre flowering stages.
- **Flood irrigation is not recommended for hemp cropping**: furrow irrigation between raised beds or spray irrigation is best.

Picture 5: Crop at six-eight weeks

Picture 6: Crop at 15 weeks

Weed control

- Early spring sown crops (Sept – mid-Oct) are unlikely to lose production from summer weed competition, because hemp is a good vigorous competitor, providing moisture and nutrients are available. Weeds are likely to be shaded out after 4-6 weeks, when the rapidly growing hemp canopy closes.
- Late sown summer crops or crops in fields with a history of bad weeds may require herbicide treatment.
- Minimum Use Permits for several pre and post emergent herbicides, and for broad leaf and grass weed control, other control permits are pending.

Pest and Disease control

- Hemp is generally considered insect pest and disease tolerant: neither is likely to cause economic damage, particularly in fibre crops. There is some of concern in seed crops! Minimum Use Permits exist for the most destructive pests.
- A healthy fibre crop generally resists all diseases and pest impact. However, many of the insects and diseases that are common in irrigated and broad acre cropping systems can cause some damage to hemp fibre crops. Hemp crops should therefore be monitored carefully throughout the season. Any abnormalities should be investigated and reported. A well planned healthy crop rotation will go a long way to reducing the risk of pest and disease outbreaks.

Chemical Recommendations and Trial results

- **Seed treatment** with a broad-spectrum fungicide has increased emergence by 10% in a low disease carry-over situation. The suggestion is that fungicide seed treatment should be a standard treatment, but especially if hemp is being grown continuously, which is not recommended.
- **Weed Chemical control options**
  1. Stomp gave good pre-emergence grass and broadleaf weed control
  2. We now have good trial and commercial farm results on most of the grass post-emergent herbicides available, e.g., Verdict, Fusilade, Hoegrass and Sertin are all good post emergent grass control.
  3. Bromacide 200 (Bromxinyl) was tested for broadleaf weed control, post emergent (both summer and winter weeds), but was slightly phytotoxic, e.g., some burning and stunting especially on smaller

seedlings and in hot weather. Good on winter and summer broadleaf weeds, e.g., brassica's, spiney emex, castor oil plant, Bathurst burr, *Bidens pedosa* and Paterson's curse.

4. Treflan has caused some phyotoxicity problems also, especially in combination with water-logging and cannot be recommended at this stage, especially on sandy soils.

- **Pre harvest dessication:** Ecofibre has a permit to apply Roundup PowerMax (540 g/L) @ 2 L/ha to desiccate fibre crops at the mid-flowering stage (autumn). This requires a specialised spray rig, capable of spraying at a height of 4 m, fitted with GPS. The equipment must be able to deliver a high volume (300 L/ha) and provide adequate spray penetration into the dense crop canopy.

Various examples of local Crop Gross Margins Comparison

This table below shows how the Gross Margins of Hemp a 12T/ha Fibre production, contracted to growers at $180/T on- farm, at max 15% moisture, would return $2,120/ha income. It is estimated from several growers' case studies over the last 3 years that the margin return would be about $750/ha, as compared with Lucerne, sorghum hay and corn silage.

This budget assumes the grower only has to pay to prepare the paddock, plant the seed, fertilizer, control weeds, and water a crop for about 6 months (as per contract). Ecofibre then organises, pays for, and implements crop desiccation, raking, harvest and transport to the mill. The clean harvested hemp field, with good weed control and residual hemp leaf mulch, can then be easily direct drilled with a low input, no fertilizer needed winter forage crop for grazing or hay production. (i.e., 2 crops in 12 months are possible).

Alternatively, corn silage contracts are few and hard to come by, with more risk and inputs required, while lucerne haymaking is for a 12 months production period and require a lot more labour, water and machinery inputs throughout the year. There is also a greater risk that weather damage will reduce hay quality and quantity, as happened in the wet 2011/12 season in NSW, Australia.

Crop Gross margin Comparisons $	**Hemp Fibre**	**Lucerne Hay**	**Maize Silage**	**Sorghum Hay**
Yield T/ha	12	15	60	19
Gross Income $/ha	2,120	4,620	4,500	3,325
Total variable growing costs $/ha	1,000	970	1,651	1,000
Margin $/ha	1,120	1,550	1,909	495
Production Period	4/5 months	12 months	5/6 months	5/6 months
Other considerations				
Production risk	Low	Med-High	Medium	Low
Price fluctuations	Contract	High	Med/High	High
Cash cost of growing	Low	Medium	High	Medium
Capital investment	Low	High	High	Medium
Harvest timeliness	Flexible	Critical	Critical	Critical
Management skills	Medium	High	High	Medium
Rain/Irrigation required	3-4 ML	6+ ML	5 ML	2-3 ML

Harvesting for Fibre

- Good yields of a quality fibre stem product will be achieved if harvest starts when 50% of male plants are flowering (or when female plants have just started flowering).
- Hemp cut after this period, i.e., during female flowering will have *lignified fibres* which are more difficult to cut and process, and may lodge!

1/ Traditional Harvesting Handling Technique

- The hemp is harvested with a specialized Kemper harvesting unit set to cut stalk at 300 –700 mm long: this permits raking without tangling for quicker in field drying
- Windrows are raked to dry evenly and remove all the leaves (2-3 times),
- Moisture content of the stems should be less than 12% before it is baled.
- Bales are picked up from the field stored on farm undercover before transfer to the mill.

Traditional Harvesting

Picture 7: Traditional harvesting

Picture 8: Wind-row to dry & remove leaf

Picture 9: Turn with ro

Picture 10: Bale and store in field or shed

Picture 12: Transport to mill

Picture 11**: Loading and unloading**

2/ 'Module' Building Harvest Technique for Hemp Fibre (based on modern cotton handling technology)

A new, more cost efficient technology has been developed to reduce the number of in field passes and the overall cost of harvesting and processing. The Module Building Technique also delivers a partly processed stalk to the mill, in an "easy to feed" form, thereby greatly increasing the tonnage that can be processed in a mill daily.

- The standing hemp crop is spray-defoliated with a desiccant during the onset of female flowering, then allowed to dry standing in field, and about 3 weeks later is direct harvested, with a converted forage machine (Field Processing Unit- FPU).
- Moisture content in standing hemp crop is to be below 14%, before field processing
- The processed stalk is collected by a cotton buggy and dumped/compacted in a Module builder,
- Compacted Modules weigh about 7 T and are 11 m long (80m3). They are lifted onto a truck and taken to the mill in a specialised walking chain- bed truck.
- This technique requires different combinations of specialised equipment and is better suited to large areas of production (greater than 300 ha), such as used in the cotton industry.

Picture 15: Standing defoliated crop drying with leaf fallen on ground

Picture 16: Harvesting stubble with FPU equipment into buggy chaser bin

Picture 17: Buggy tipping into module maker

Picture 18: Modules stored in field

Picture 19: Module lifted from ground

Picture 20: Module on truck to mill