

Rules for Certification of Seed of Industrial Hemp (*Cannabis sativa*)

INTRODUCTION

OECD

Australia participates with over 50 other countries in the Organisation for Economic Cooperation and Development (OECD) Seed Schemes for the Varietal Certification of Seed Moving in International Trade. Harmonised technical standards and procedures in these Schemes for the production, processing and labelling of Certified Seed are designed to facilitate international trade in seed and contribute to the removal of technical trade barriers.

The national Government of each country participating in the OECD Seed Schemes designates a National Designated Authority to be responsible to the government for the purpose of implementing the Rules and Regulations of the OECD Seed Schemes on its behalf.

The Australian Government, represented by and acting through the Department of Agriculture, Water and the Environment (DAWE), has licensed the Australian Seeds Authority Limited (ASA) to perform all the functions of the National Designated Authority. ASA is accountable to DAWE through a range of reporting obligations and is subject to participation in performance audits by DAWE to establish compliance with licence requirements.

ASA is required under the Australian Government licence to administer the OECD Seed Schemes in Australia and appoint by contractual arrangements appropriately qualified providers of seed certification services as authorised certification agencies for the purpose of implementing operational aspects of the Rules and Regulations of the Schemes. To meet this obligation ASA has commissioned the National Association of Testing Authorities (NATA), as a peak independent authority in Australia for the accreditation of inspection bodies, to implement a national accreditation scheme for certification agencies.

Any variety must be registered before it can be eligible for certification, and there are strict requirements a variety must meet before it can be registered.

The objective of standardised rules and procedures is that a potential buyer of seed in one country can confidently buy OECD certified seed from another, knowing that the seed has been produced under the supervision of an independent third party (usually government).

Some countries require OECD certification before seed can be sold in that country. The European Union has such a requirement and so do other countries around the world.

Australian Seed Certification Scheme

The seed industry requested ASA to create this scheme for seed which may not be destined for export. The rules are very similar for the OECD seed schemes, except for a few minor differences in the requirements for post-control testing.

The rules and regulations for OECD seed Schemes can be accessed via the following link;
<https://www.oecd.org/agriculture/seeds/>

Specific standards required under the OECD Rules and Regulations to be determined by the National Designated Authority

Specific and additional standards applied in Australia are documented in:

- ASA technical standard for the accreditation of seed certification agencies implementing the OECD seed schemes in Australia; and
- ASA technical standard for the accreditation of seed certification agencies implementing the Australian seed certification scheme.

DEFINITIONS

Hemp varieties may be dioecious with separate male and female plants, unisexual hybrids with sterile male and fertile female flowers on the same plant, or monoecious with both male and female flowers on the same plant.

Dioecious

Having male and female flowers on separate plants.

Feminised

Feminised hemp seeds (FHS) produce only female plants. They are generated by the fertilisation of flowers on a dioecious female plant with pollen from the same plant or another female plant that has been induced to produce pollen (“masculinised”). Refer separate guidelines for Certified Seed Production of Feminised Hemp Seed Varieties and Hybrids.

Hybrid

The first-generation progeny of a cross between two different plants of the same species often resulting in a plant that is more vigorous or desirable than either parent.

Monoecious

Having male and female flowers on the same plant; and unisexual female hybrids.

Off-types

Plants in a seed crop which deviate in one or more characteristics from the official description of the variety.

Variant

Any seed or plant which:

- (a) is distinct within the variety but occurs naturally within the variety,
- (b) is stable and predictable with a degree of reliability compared to other varieties of the same kind, within known tolerances, and
- (c) was originally part of the variety as released.

It is not an off-type.

Although traditionally a crop with a dioecious plant type similar to open pollinated corn, many monoecious varieties of hemp (*Cannabis sativa L.*) have been developed. Hemp is sexually polymorphic and often produces many different ratios of intersexual plant types that can increase roguing requirements. Variety descriptions normally define these ratios.

In male flowers, five petals make up the calyx and may be yellow, white or green in colour. They hang down and five stamens emerge. Male plants flower ten to fourteen days earlier than female or monoecious plants. Male plants increase in height quicker than the female and monoecious plants. Male plants also have fewer leaves near the top. After pollen shedding, the male plant dies.

The flowering shoot of the female plant (and the female portion of the monoecious plant) is leafy and compact. The tiny female flower is hidden within the bract and two tiny styles emerge when the flower is ready for pollination. In monoecious plants, the female flowers on a given branch open first, followed by the opening of the male flowers on the tips of the same branch.

Monoecious varieties of hemp also contain varying numbers of intersexual plants, i.e. plants that are neither male, female nor truly monoecious. Intersexual plants may complicate inspections of industrial hemp crops since they have both female and male flowers but usually the male flowers greatly outnumber the female flowers.

Since hemp is a heavy pollinator, inspection staff may choose to take precaution when conducting the inspection by wearing a mask.

SEED CLASSES AND GENERATIONS

Breeder's Seed: determined by Breeder

Pre-Basic Seed: Produced by planting Breeder's Seed or an earlier generation of Pre-Basic seed. There may be 2-3 generations of Pre-Basic seed, as determined by the breeder.

Basic Seed: Produced by planting Pre-Basic seed. Only one generation of Basic seed is allowed.

First Generation Certified Seed: Produced by planting Basic Seed. Only one generation of First Generation seed is allowed

Second Generation Certified Seed: Produced by planting First Generation Certified Seed, but only if allowed by the breeder.

LOT SIZE

- a) Maximum 10 000 kg.
- b) A tolerance of five per cent on these maxima is permissible

PADDOCK HISTORY

Crops should not be planted on land where volunteer growth from a previous crop may cause contamination.

Crops for Basic Seed status must not be grown on land which in the preceding 5 years produced a crop of Industrial Hemp.

Crops for Certified Seed status must not be grown on land which in the preceding 3 years produced a crop of Industrial Hemp.

ISOLATION DISTANCES

Isolation distances can be large and may require additional time to verify their condition, especially when plants that may cross pollinate with the crop are found.

Isolation areas must be kept free of Industrial Hemp plants. Under optimum conditions, not more than 3 plants per square metre of harmful contaminants (species that can cross pollinate with the inspected crop) are permitted within the required isolation distance(s) adjacent to the inspected crop. Harmful contamination within the required isolation distance, depending on density, location and distance from the inspected crop, will be cause for declining certification.

The required isolation must be provided prior to flowering and crop inspection.

Isolation standards can be disregarded when there is sufficient protection from undesirable pollen sources. (e.g. glass houses)

Inspected Crop	Other Crops	Isolation Distance Required
Dioecious type Basic generation	Different varieties of industrial hemp	4800 metres
	Uncertified crop of same variety	
	Lesser Generation of same variety	2000 metres
	Same generation of same variety	3 metres
Dioecious type Certified generation	Different varieties of industrial hemp	800 metres
	Uncertified crop of same variety	
	Lesser Generation of same variety	200 metres
	Same generation of same variety	1 metre

Inspected Crop	Other Crops	Isolation Distance Required
Monoecious type Basic generation	Dioecious variety of industrial hemp	4800 metres
	Uncertified crop of same variety	
	Lesser Generation of same variety	3000 metres
	Other monoecious varieties	3000 metres
	Same generation of same variety	5 metres
Monoecious type Certified generation	Dioecious variety of industrial hemp	1000 metres
	Uncertified crop of same variety	
	Different variety of the same type of industrial hemp – monoecious or female hybrid	200 metres
	Lesser generation of same variety	
	Certified crop of same variety	1 metre

INSPECTIONS

For industrial hemp, a minimum of two inspections are required. The first inspection must be made before female flowers (pistillate) of the inspected crop are receptive and after the formation of male flowers (staminate), but preferably before pollen shed.

The second inspection of dioecious and monoecious crops must be made within three weeks after the first inspection, during the receptive stage of the female plants in the inspected crop. Second inspections usually provide the counts of impurities (such as all male plants).

Third inspections are required if off-type female flowers were reported in earlier inspections in order to verify they have been adequately rogued. The third inspection is made when off-type female flowers can be identified (more often a problem in dioecious varieties than monoecious).

The crop should be walked according to the selected travel pattern noting the isolation distance and condition, varietal purity of the crop, presence of noxious or difficult to separate

weeds or other crops. Areas of potential sources of contamination such as water runs, and areas along roadways or near seed bins etc. should be examined more closely.

It may be necessary to reduce the size of the count from 10,000 plants to 1000 for industrial hemp if the crop is planted with high seeding rates or in narrow rows making it difficult for the inspector to perform the traditional six counts of 10,000 plants/count. The number of counts will then have to increase. For example, if the count size is reduced to 1000 plants then a minimum of 15 counts should be performed for pre-basic and basic crop production, and a minimum of 10 counts for certified production. For breeder's seed production, a minimum of 20 counts should be done.

VARIETAL PURITY

Monoecious type

Varietal Purity (off-types/other varieties on average in 10,000 plants)

- a. Basic – 10
- b. Certified – 20

Varietal Purity (Dioecious male plants shedding pollen on average in 10,000 plants)

- a. Basic – 2
- b. Certified – 100

Dioecious type

Varietal Purity (off-types/other varieties on average in 10,000 plants)

- a. Basic – 10
- b. Certified – 20

SPECIES PURITY

- a. Basic seed: 1 plant in 30 sq. m
- b. Certified seed: 1 plant in 10 sq. m

CHARACTERISTICS USED TO DISTINGUISH VARIETIES

- Plant height
- Flowering type
- Flowering date
- Sex expression in dioecious types

- Degree of branching
- Stem internode length*
- Stem thickness and colour*
- Anthocyanin presence in male flowers
- Leaf size and colour*
- Avg. no. leaflets/leaf*
- Middle leaflet length and width*
- Leaf colour
- Presence and intensity of anthocyanin in leaf and leaf stalk*

*These observations should be made at the centre third of the plant

Guidelines for Certified Seed Production of Feminised Hemp Seed Varieties and Hybrids

DEFINITION OF FEMINISED HEMP SEED VARIETY

Feminised hemp seeds (FHS) produce only female plants. They are generated by the fertilisation of flowers on a dioecious female plant with pollen from the same plant or another female plant that has been induced to produce pollen (“masculinised”).

Only one class of pedigreed seed production, Certified, is recognised for FHS variety production.

The variety description of any FHS variety is of the Certified generation. FHS produced from a dioecious variety is not considered seed of the parental variety.

There are several types of FHS varieties, depending on the parental material used.

DEFINITION OF HYBRID

A hybrid is the progeny of two different phenotypes, one of which is the pollen parent and the other the seed-bearing parent. These may be FHS varieties or fully fertile hybrid varieties, depending on the seed production protocol.

DEFINITION OF TYPES OF PARENTAL GERMLASM AND PROPAGATION METHODS

Parent material may be (1) vegetative propagating material (cloned plants), (2) seed-derived dioecious female parent plants or (3) seed-derived feminised plants. In the case of non-FHS hybrids, male dioecious plants may serve as the pollen parent. Seed production protocols include maintenance of the parental germplasm and the procedures used to generate the Certified seed.

Clonal parental genotypes

Clonal parental genotypes (clones) are maintained through vegetative propagation. The Plant Breeder is responsible for the maintenance of this germplasm and must provide adequate information to positively identify each genotype.

Three mating designs are recognised:

Feminised single genotype

A single genotype is vegetatively propagated, some nodes are masculinised and the pollen from these flowers is used to fertilise the female flowers.

Feminised polycross

A number of genotypes are vegetatively propagated and then incorporated into a polycross, with an equal number of each parental genotype allowed to intercross with all other genotypes. A few nodes on each plant are masculinised. An equal quantity of seed from each parental genotype is bulked to ensure genetic stability. FHS varieties produced in this manner will be considered synthetic varieties.

Feminised hybrid

A parental genotype is vegetatively propagated, and one or more plants are masculinised. This genotype will be identified as the (male) pollen parent. Clones of a different, untreated genotype will be designated as the (female) seed parents. Seed is harvested from the clones of the non-masculinised (female only) genotype. An equal amount of seed from each seed parent is bulked to form the seed lot.

Seed-derived parent material

Dioecious hemp varieties can be used as parent seed material for FHS varieties/hybrids. All males and any monoecious off-types must be removed prior to flowering. In the case of FHS varieties, a specified number of female plants of the same or another variety must be masculinised. In the case of a hybrid variety, male plants of another variety can be used as the pollen parent.

The protocol for selecting plants to be used as pollen parents for FHS varieties must be stated in the variety description and adhered to in each seed production cycle in order to maintain varietal stability. Protocols could include treating a defined portion of randomly selected plants (e.g. every tenth plant) or having separate rows of pollen and seed parents.

Parent material can be commercial hemp varieties or material used exclusively for FHS/hybrid production approved by the ASA.

Only seed of Breeder and Foundation classes can be used to produce FHS varieties/hybrids.

Feminised parent

Feminised seed can be used as parent reproductive material (pollen parent, where masculinised, and/or seed parent) for one generation if the first generation was certified by the ASA as meeting Breeder or Foundation seed crop certification standards.

The Plant Breeder or Variety Maintainer must ensure that plants designated as pollen parents are chosen randomly and that no artificial selection is imposed when masculinising those plants.

ELIGIBILITY FOR CERTIFICATION

An application for determination of variety certification eligibility shall be made to the ASA. It shall include a description of the FHS variety/hybrid and of its parent material. Distinguishing morphological, physiological, cytological, chemical or other characteristics that establish the identity of the variety shall be provided.

There shall be a comprehensive description of the protocols for maintaining the parent material and ensuring its stability.

A sample of 500 seeds of the FHS variety/hybrid shall be sent to the certifying agency for variety verification purposes.

Supplemental molecular data supporting the identity of the variety may be submitted.

LAND/GROWTH FACILITY REQUIREMENTS

All types of FHS varieties/hybrids can be produced in a contained growth facility (growth room, greenhouse, polyhouse) or in the field.

Growth facility

The growth facility must contain only plants used in the Certified seed production. There must be a period of 60 days between successive productions of Certified seed, unless the same pollen parent is used, in which case the interval is 10 days.

Field production

Seed crops of FHS varieties/hybrids must not be planted on land which in the previous three years grew a crop of hemp.

CROP INSPECTION

For all types of FHS/hybrid production, it is the seed grower's responsibility to ensure that the crop is inspected twice by an authorised inspector, once just prior to any pollen release, and once when the pollination period is complete (all male flowers have shed their pollen).

CROP STANDARDS

Presence of male and monoecious plants

All true male (XY chromosomes) and monoecious plants must be removed from the parent material prior to the first inspection (prior to any pollen shed) for all FHS varieties.

Monoecious or male dioecious plants may be pollen parents for a hybrid variety.

Abnormal vegetative reproductive material

Any vegetative reproductive material which differs significantly in appearance from the average of the parental reproductive material, is likely a somaclonal variant ('sport') and must be removed prior to the first inspection (prior to any pollen shed).

Off-types in seed derived parental material

Plants not conforming to the norm of the variety may be considered off-types. The maximum number of off-types permitted is 1 in 100 plants of the seed parent.

Growth facility production

Growth facilities must have an isolation distance of at least 4800 m from any contaminating pollen sources. An isolation distance of 800 m is required from other growth facilities which contain different pollen parent plants. These requirements can be adjusted provided there is adequate pollen control pursuant to an agreement with the ASA.

Field production

All field production of Certified FHS/hybrids must have an isolation distance of at least 4800 m from any contaminating pollen sources.

ADDITIONAL REQUIREMENTS

Quality Management System (QMS)

An ASA recognised Plant Breeder's documented QMS is required for production of Certified seed of FHS varieties/hybrids. The QMS seed production protocols must address all the certification requirements for FHS/hybrid production, be approved by the ASA and audited by an independent third-party.

Description of Variety

Plants of each candidate variety must be grown at three different locations or facilities for confirmation that the variety conforms to the variety description and is distinguishable, relatively uniform and stable. Results from these trials, conducted under the supervision of the Plant Breeder, must be submitted as part of the application for variety certification eligibility.

Seed Varietal Purity Standards

There is insufficient information currently available to determine with any certainty the appropriate levels of varietal purity for FHS and hybrid varieties. As FHS varieties are intended to be grown in the absence of pollen, any male plants are particularly undesirable.

It may, however, be practically impossible to produce seed lots with no males and/or no monoecious plants. Until there is more detailed information the following will serve as guidelines:

- The maximum number of male (XY) individuals in a Certified seed lot of an FHS variety is 3/10,000 plants.
- The maximum number of monoecious (XX) individuals in a Certified seed lot of an FHS variety is 5/10,000 plants.
- The minimum varietal purity of a Certified seed lot of a hybrid variety is 97 percent.