

Propagation of *Cannabis sativa* for commercial production[©]

A. Casillas^a

Arizona Cannabis Society, 8376 N. El Mirage Road #2, El Mirage, Arizona 85335, USA.

INTRODUCTION

Cannabis sativa (“cannabis”) has historically been an important crop. Its potential for use is not limited to agricultural uses, but also includes chemical, medicinal, and commercial uses. *Cannabis sativa* is a semi-herbaceous, annual, dioecious flowering herb, with three subspecies: *sativa*, *indica*, and *ruderalis* (Wikipedia Contributors, 2016). There is a high emphasis and importance on plant sex, depending on crop usage. Mature plant size can range from 0.6 to 1.8 m (2 to 6 ft). The leaves are compound and decussate-opposite, with leaves having three to seven leaflets, a serrate leaf margin, and a glabrous or pubescent leaf surface. Mature plants develop a woody stem, then flower, and finally senesce. *Cannabis sativa* is native to most humid and temperate parts of the world, and its use dates to ancient times (Clarke, 2016).

Propagation of *C. sativa* includes both sexual and asexual propagation methods, two of which will be discussed. The three primary methods used for propagation of *C. sativa* are: 1) clonal propagation of leafy cuttings in sterile medium (rockwool), 2) rooting of leafy cuttings in an aeroponic machine, and 3) seed germination (Hartmann and Kester, 1975).

PROPAGATION

Seed propagation

C. sativa plants grown from seed are typically hybrids of parent cultivars that come from near isogenic lines (NILs); therefore, the offspring are variable. Also, cannabis is dioecious and sexual identification is important, depending on crop usage. Propagation via seed does not ensure the sex of seedlings. Although scarification increases germination rates, it is not necessary. Seed propagation also requires the use of viable seeds. Commercial use of seed propagation in the medical marijuana industry is not viable and is time consuming. However, for hemp production, seed propagation is the most economical and viable method (Yoshimatsu et al., 2010).

Cutting propagation of leafy cuttings

The most common propagation method is clonal propagation of leafy cuttings. Mother plants are allowed to produce several lateral shoots and, once sufficient shoots have developed, they are removed. Leafy cuttings are dipped into a gel formulation of auxin (Clonex™ gel; Hydrodynamics International Inc., Lansing, Michigan, USA) and placed in sterile medium (rockwool or peat moss pellets), and then misted regularly until roots develop in about 7-14 days. Cuttings are typically placed in a humidity dome, or “mini greenhouse.” Clonal propagation via leafy cutting has been shown to provide higher rooting success, and produces healthy and disease-free plants.

Rockwool cubes must be conditioned prior to use for cuttings. Two solutions should be formulated: the first is the conditioning solution and the second is the fertigation solution. For the conditioning solution, soak cubes in filtered water with a pH of 5.5 for 24 h prior to use. This is called “conditioning” the cube and is essential to rooting success. For the fertigation solution, soak cubes for 5 minutes in fertigation solution of 200 ppm N and 100 ppm liquid auxin (Clonex™ liquid), then set aside and allow to drain.

Cuttings should be harvested from disease-free stock plants under nonstressed conditions. Cuttings located at apical and primary lateral positions produce the most

^aE-mail: acasill2@asu.edu

uniform plants. Cuttings from secondary branch structures not as strong. Collect turgid cuttings during optimal water conditions (from non-wilted stock plants). Use isopropyl alcohol or Physan 20 to disinfect tools (pruning shears and scalpels) used for taking cuttings. Use an auxin solution with a thickening agent, such as Clonex™ gel. Environmental conditions that increase propagation success are provided by an atmosphere that reduces water loss and maintains leaf turgidity, with optimal humidity between 75 and 90%, often achieved using humidity domes or “mini greenhouses.” Ample but not excessive light and clean, moist, and well aerated rooting media should also be provided.

Aeroponic cutting propagation

Another asexual propagation method involved use of aeroponic cloning machines. The aeroponic method ensures vigorous and disease-free root growth, but is not the best method for producing healthy, vegetative plants. Plants propagated using this method tend to be susceptible to root damage during transplanting to medium, and to fluctuations in pH and EC. Commercial aeroponic cloning has been around since the late 1960s. The first aeroponic cloning machine was developed in 1983, and was called the Genesis Machine. Variations of the Genesis Machine continue to be used today.

For cuttings in an aeroponic cloning machine, a rooting water temperature of 18 to 25°C (65 to 77°F) is required for successful rooting. Intermittent misting of cuttings 3-4 times daily during the first 3 days aids in maintaining turgidity and reducing wilting damage. The use of liquid auxin at a concentration of 100 ppm in the rooting solution is crucial to rooting success. The use of unfiltered water yields rooting success as well, but not with high rates of success.

The aeroponic cloning method has its downsides as well. Aeroponic machines tend to be somewhat labor intensive, and require equipment for thoroughly cleaning the machines, along with all the mechanical components associated with the machines. Frequent replacement of the neoprene inserts is also required for a clean rooting environment, and therefore adds to the overall cost of running the machines. The machines are also susceptible to power and pump failures, which can lead to severe losses of cuttings. Cuttings grown in aeroponic machines tend to be sensitive upon transplanting as well, and are susceptible to transplant shock at a higher degree than other methods. All the factors stated above lead to overall higher start-up costs and higher operating costs, all of which need to be considered when deciding on a sustainable propagation plan.

CONCLUSION

All the methods discussed are considerably behind those used by the rest of the horticulture industry. However, these appear to be the methods with which most cannabis growers are comfortable and familiar. Every method discussed is viable in its own way. In my opinion, propagation via leafy cuttings in sterile media is the best.

Literature cited

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