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Tool and Surface Sanitation Practices in Cannabis Cultivation

Various microbial, viral, and viroid pathogens of cannabis can result in economic loss in commercial cultivation settings. While starting off with uninfected stock material is a crucial first step in combating this, tool and surface sanitation practices in the grow facility are also very important to reduce the chance of spread of any undetected, or newly environmentally acquired pathogens. While these different pathogen types vary in their physical structure and thus their susceptibility to different cleaning treatments, some best practices are generally applicable and should be applied wherever possible. Conversely, some sanitation methods have particular weaknesses, and these should be considered and understood if those methods are being employed. While not exhaustive, what follows is a brief overview of some key good – and bad – sanitation practices.

Bleach sanitation: Common household bleach, aka sodium hypochlorite, can be a highly effective broad spectrum antimicrobial and anti viral/viroid agent but only when used correctly. As with other liquid phase sanitation agents, it has an ability to get into crevices, microscopic pits, or otherwise physically hard to access parts of tools. These relatively inaccessible surface areas can otherwise potentially act as reservoirs for contaminated material and vector undesirable agents from infected to healthy material.

To be used effectively, diluted (1:10) household bleach must be made fresh at least daily. While domestic bleach stock as purchased is relatively stable at room temperature, dilutions decompose and lose activity quickly. While the exact rate of loss of activity will depend on factors such as pH, temperature, and trace materials in the diluting water, in no case should dilute bleach be considered effective for more than 24 hours – and imposing a 12 hour maximum lifespan is even better practice.

Dwell time, or the length your tool or surface is exposed to your fresh, active bleach solution, is also important. A five second dip of a tool followed by immediately shaking off, is not doing much except giving a false sense of security! While it is impossible to give a single number good for all situations, a minimum 10 minute exposure is good practice – and up to 30 minutes, where practical, is even better.

Downsides of bleach – aside from relatively lengthy dwell time, or risk that staff forget to make fresh and use yesterday's squeeze bottle – can be that some materials are damaged by repeated exposure at effective levels.

Flame sterilization: For small tools with a limited, defined plant contact area (e.g. forceps, scalpels), flame sterilization is fast and effective. The hardiest microbe or viroid can't survive even brief exposure to the hot part of a Bunsen burner flame! The low cost of such a burner, and the absolute effectiveness in only a few seconds (plus a few more for the tool to cool before being used), is why a burner is still found in every microbiology lab workstation. However, this approach won't work on plastic tools (for reasons which should be obvious!), and even on larger metal tools it may be of limited utility. Consider for example, a large pair of pruning shears. The large mass of metal in each blade will require longer flame exposure to get hot enough to destroy biological agents; and it's possible that microscopic bits of contaminated material could be further down the handles, or into the spring, in areas which won't be flamed and might therefore hold and disperse "unwanted passengers".

Bead sterilizers: Combining some of the features of flame sterilization (high temperature) with liquid agents (ability to coat all surfaces), but with infinite shelf life and little to no mess, are bead sterilizers – small electrically heated containers, usually with a stainless steel well, which is in turn filled with sand grain sized silica beads (think, uniform artificial sand). Once up to temperature, these are used by sticking the small metal tools into the hot beads, handle sticking up until needed. Required dwell times are a bit longer than direct flame, but still on the order of 30 seconds, for effective thermal destruction of most infectious materials. (The obvious exception of prions, thankfully, haven't been found in Cannabis.) Safer than open flame, these are a great way to sterilize small tools – but bear in mind the beads, while tiny, have a finite size and unlike a liquid, can't get into some particularly small pits. If these are just surface pitting on a small tool, thermal conduction out of adjacent material in contact with hot beads will do the job – but for larger tools with more complex surfaces, like our pruning shears example above, these probably won't do the job.

Autoclaving: Superheated steam exposure has been a mainstay of medical and microbial tool and reagent sterilization for a very long time – it's effective at getting into all the hidden surfaces on treated devices by nature of being vapour phase. It's useful on plasticwares (rated to the sterilization temperature, at least… not all are!) as well as glass and steel. It's not a particularly fast process though, often taking over an hour by the time the entire load gets to temperature, dwells at sterilizing conditions, and depressurizes and cools for unloading. Also, of particular concern to Cannabis cultivators – while autoclaving is effective on almost all bacterial, and some viral agents, it's not always effective against the hardiest fungal agents nor may it always be effective against naked nucleic acids (viroids).

Alcohol: 70% ethanol or isopropanol as a dip solution for small tools (often then combined with flame, not to heat the tool but to remove alcohol traces), is cheap, fast, gets into all immersed surface areas, and is quite effective against bacterial, some fungal, and many enveloped viral agents – but is much less effective against unenveloped viruses or viroids. While ease of preparation, long shelf life and low cost make it potentially attractive, use of alcohol sterilization in your practice should only be seen as an adjunct to other first line methods.

UV Light: UV light, at sufficient energy and exposure time, is highly effective at rendering biological agents inviable. Unlike some of the other methods summarized here, it's actually most effective on naked nucleic acids (viroids) and least effective on sporulated bacteria or fungal cells. While UV sterilizing lights are commonly built into biosafety cabinets, and sometimes even entire rooms, they suffer from a number of downsides. Firstly, the UV bulbs degrade over time, meaning the incident UV light flux from an old bulb isn't what it was from new – and this may not be apparent to the casual observer. Regular replacement of bulbs can address this, but they're costly. Secondly, shadows are not your friend; any crevice, backside, or otherwise shadowed section of a tool or surface not getting direct bulb exposure is getting no effect at all. Thirdly, many materials – particularly plastics – are degraded by UV exposure, becoming brittle and breaking. Fourth, operator safety issues need to be considered, as serious retinal or skin burns can occur on human exposure. As a means to constantly ensure the flat open work surface inside a safety hood is kept biologically clean by overnight / non use time application, it's a useful approach; but tools left inside such a hood can't be considered clean on their undersides (nor can the surface below said tool).

General and Concluding comments: A consideration of the foregoing material will lead to the conclusion that no one method, by itself, is likely sufficient and effective for the cultivator wishing to minimize risk of infectious agent transmission on facility tools and surfaces. Instead, a combination of methods each suited to the tool or application step it's used for, is the most effective approach. By providing layers of sanitation, risk of transmission of different known and unknown agents can be greatly reduced and should be implemented as best practices. It goes without saying that overall cleanliness is also important; a large (or even small) clump of dirt on a tool surface may effectively shield whatever is lurking underneath from otherwise effective liquid, gaseous, or incident UV radiation based sterilization which would otherwise be effective on the hidden infectious materials.