

Cannabis Crop Recommendation

By Evergreen Growers Supply

OVERVIEW:

Cannabis, or marijuana, is grown for human consumption and therefore every effort should be made to grow the crop without the use of potentially harmful pesticides. Using beneficial insects and natural fungi to eliminate pests is the best way to ensure the cultivation of a clean and quality product for customers and/or patients.

Intensive modern breeding programs for medicinal characteristics have shifted cultivation from traditional, outdoor environments toward protected, indoor environments. Choosing to work indoors gives growers the ability to grow cannabis year-round and at a faster rate, but it also leaves their crops more susceptible to damaging pests. By creating a nurturing environment for their plants and eliminating the possibility of natural predators from outside, indoor growers inadvertently create very inviting breeding grounds for devastating pests.

Because cannabis has been mostly cultivated as a field crop, indoor growers often experience “stressed” plants which attract fungal pathogens and insect pests. Growers should do what they can to minimize stress by being proactive and working to prevent pests before they become a problem.

PRIOR TO PLANTING

Taking preventative action against pests is crucial when preparing a cannabis cultivation area. Cleaning the area thoroughly with detergent is highly recommended.

Remove all old plant material, obvious fungal residue, and any non-essential apparatus from the grow area. Be sure to wash any previously used tools and clothing to avoid any cross-contamination between crops.

Climate is also a key element when preparing cannabis growing conditions. Due diligence is needed to ensure that air circulation is sufficient and regulated so that it mimics the outdoors. Care must also be taken to control the temperature and relative humidity, both for the plants well-being and to ward off pests.

If the grow area has had pest issues before, place a few pots of bush beans throughout the grow area before planting to try to prevent the issue from returning. For best results, don't buy fully grown plants from a store. Instead, plant the bush beans from seed.

If the previous crop had a history of spider mites, apply *Stratiolaelaps scimitus* to the floor, where equipment

legs touch it, where support posts enter it, at any plumbing or electrical entry points, and along the perimeter wall. Spider mites will seek protective areas like these when they're not on the plants or in the soil.

GETTING STARTED

When planting begins and the pots are first watered, a predatory soil mite such as *Stratiolaelaps* should be applied to the soil surface at a rate of 10 to 12.5 mites per square foot. These soil mites will control fungus gnat larvae in the root zone, leading to a faster growth rate and healthier plants.

Stratiolaelaps also feed on pupating thrips larvae, helping thrips management by breaking the reproductive cycle. If despite reasonable prevention the crop ends up with a spider mite problem, apply more *Stratiolaelaps* to the floor area, focusing on cracks and any other breaks in the floor where the spider mites may hide. The mites will feed on the dormant spider mites, significantly reducing the numbers that may return to the crop.

For air-rooting systems, there are not a lot of predators or pests that have adapted to this style of propagation.



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We recommend that this area has at least some *Dalotia coriaria* (Rove beetles) present at all times. This flexible beetle is an excellent flyer, tolerates virtually aquatic situations, and is always hungry. It tends to stay in the structure and resides in the drain system, so only periodic applications are needed to maintain a presence.

As soon as true leaves are present, growers should apply *Amblyseius fallacis* (“ful-A-sis”) at a rate of 2 mites per square foot. Fallacis is a spider mite generalist that’s also capable of controlling broad mites and other eriophyid (microscopic) mites. If a grower has a history of broad mites, they should double the rate of fallacis, and make sure they’re in use as soon as possible. Once the plant begins to grow the flower head, and stickiness begins, all of the predatory mites will avoid those areas.

VEGETATIVE STAGE

Prevention is typically cheaper and less stressful than reacting to problems as they occur. Start preventative measures early in the vegetative stage to get predators in place, ready for when pests arrive. Slow-release breeding sachets are a great choice once the canopy is thick enough to provide protection from direct light. For bulk release containers, sprinkle predators over the foliage of the plant, around the base of the stem, or in small containers placed amongst the branches of the plant. Establish good scouting and monitoring practices early. Map out your growing space and designate specific plants to monitor on a regular basis. Some strains are more attractive than others to pests. Make sure to include a plant of each strain being grown to more accurately identify potential problems. Yellow sticky traps should be applied at the rate of at least 1 trap for every 500 square feet. Traps placed higher than the plants will not show a representative sample of flying pests, so take care to ensure that the height of the traps does not exceed the height of the plants.

Branches above the main canopy and directly under growing lights are more likely to become infested with spider mites. Pruning will help to avoid this scenario, especially if the lights are not easily movable. Canopy management by pruning discourages spider mites, and once incorporated into the workflow, is a “free helper” for spider mite control. While pruning has many benefits for the health of the plant, for the aspect of pest control, the most important consideration is to keep the plant from growing too close to light sources. Being too close

to a light source can dry out the leaves and raise the temperature, creating the perfect conditions for a spider mite infestation.

FLOWERING STAGE

As plants move into the flowering stage, they become less able to recover from pest damage, and it becomes even more important to have robust scouting strategies in place to detect and react to problems before they threaten the health of your crop. Keep an especially close eye on the pistils and the top of the cola, as damage here can be indicative of broad mites or russet mites, too small to be seen without 30x+ magnification.

Once your plants’ buds have become sticky, beneficial insect application becomes tricky. The vermiculite carrier is very difficult to remove if it gets stuck to the bud. To avoid this, fill small containers (such as a ketchup container or Dixie cup) with the carrier material/mites and place it in the canopy, allowing the mites to crawl out onto the plant.

BENEFICIAL INSECT / PESTICIDE COMPATIBILITY

After applying beneficial insects to your crop, extreme care must be taken when using spray regimens. Strong scouting practices should reveal hotspots of pest activity before they manage to spread throughout the crop. Any hotspots found should be dealt with via spot treatment, rather than broadly spraying the whole crop. Use sprays with low residuals such as insecticidal soaps, bioinsecticides, or oil based miticides (not neem-based). Most “lighter” bioinsecticides may be used alongside beneficial insects, though there will likely be a slight to moderate reduction in predator population.

IPM PLANNING

Applying early and often is the key to using beneficial insects in a successful IPM program. Having a baseline population of predators on the crop is crucial to mitigating damage from pest outbreaks and increasing the chances of success of curative efforts to defeat them.

Most predators take one to two weeks to hatch and grow into full-fledged adults. Their adult life cycles generally last three to four weeks. Keep this in mind while planning out orders over the crop cycle. Order a week in advance. Beneficial insects are packed to order due to their perishable nature, so planning ahead will ensure a consistent delivery and application schedule.



There are two common ways of application: quick-release bulk releases and slow-release breeding sachets. Bulk release containers will have mostly adult mites. Plan to make a larger initial release and smaller maintenance releases every 4 weeks. The vast majority of mites are available in bulk release containers. Breeding sachets provide a self-contained hatchery that will consistently release predators over their lifespan. Hang one on every plant and replace after 4-6 weeks. Only a select few predators are available in breeding sachets, but they are a good companion for bulk releases.

It is important to maintain a good environment for beneficial insects once applied to the crop. Ensure good control over both temperature and humidity. Different species have different preferences, and their reproduction rate and activity levels will be determined by what their optimal conditions are. Select species that have similar environmental requirements. If they are not followed, pest reproduction will outpace predator reproduction and get out of control again.

COMMON PESTS WHEN CULTIVATING CANNABIS

SPIDER MITES

In a dry environment, spider mites are the most common and serious pest. Spider mites hate high humidity. If the plants are not battling botrytis or similar molds, try misting the affected areas on a regular schedule for a few days.

Fallacis can also be used to take preventative action against spider mites. Apply fallacis at a rate of 2 mites per square foot. This predatory mite evenly establishes itself throughout the crop, preventing spider mites under normal conditions.

Hot spot outbreaks should be treated with *Phytoseiulus persimilis* (“pur-SIM-il-us”). The optimum conditions for these predators require higher humidity as the temperature increases, but relative humidity must be kept at or above 60%. Fallacis and persimilis are compatible and do not interfere with each other, however fallacis does not do well on spider mite webbing while persimilis thrives on it.

Mesoseiulus longipes (“lohn-ji-pees”) is similar to persimilis, but can tolerate lower humidity. Longipes are

most effective in warm greenhouses or interiorscapes with artificial lighting. Release longipes at a rate of 3 per square foot, once a week, 1 to 2 times.

Another predatory mite that works best when used preventatively against spider mites is *Neoseiulus californicus* (“californicus”). Growers will see best results when californicus is allowed to build up before the spider mite populations are able to establish themselves. Californicus is tolerant of various temperatures and low humidity, but works best under warm to hot conditions. It tolerates higher temperatures and lower humidity than persimilis. When pest populations are low, californicus will feed on pollen which keeps predatory populations around the crop. While some predators will actively seek out new prey in the absence of food, most will stay on the crop and wait for the arrival of new pests.

Amblyseius andersoni (“andersoni”) is another predatory mite that can be used to control spider mites and a range of other mite pests - it’s great for broad mites as well. For best results, growers should apply andersoni when pest mite numbers are low. The predatory mites will then be able to feed on small colonies of mites and prevent them from growing and causing major damage.

Andersoni can be purchased in a shaker bottle or sachet. If using the shaker bottle, gently shaking the andersoni onto the crop near the flowers. Suggested rate is 2 to 3 predator mites per 10 square feet. Sachets should always be shaded from direct sunlight and introduced at 2 meter spacing along the crop row. Apply to any convenient location on the plant, such as a leaf petiole, twig or small branch. Duration of sachet activity is 6 weeks, though longer-lasting control may be evident if the predatory mites are established in the crop.

When growers have an established spider mite issue, *Galendromus occidentalis* (“occidentalis”) might be their best option as they feed primarily on spider mite nymphs and adults, but not eggs. Occidentalis is a very versatile predatory mite and tolerates high temperatures and low humidity well. This biological control is recommended for greenhouses with a relative humidity of 40% or less. It is native to California and has been used to control spider mites, two spotted mites, russet mites, and others. Adults eat 1 to 3 pest adults or up to 6 pest eggs per day. Apply occidentalis upon arrival, at a rate of 2 to 3 per square foot, bi-weekly, 1-2



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applications. Occidentalis needs at least 11 hours of daylight.

Stethorus punctillum is a tiny black beetle that also thrives in low humidity situations. If growers are unable to manage the climate effectively and the spider mite conditions are extreme, *Stethorus* could save the crop. It should be applied at a rate of 0.1 per square foot in extreme cases, or in moderate cases, at a rate of 0.01 per square foot. These beetles find spider mites by smell and quickly move to new infestations, leaving behind their eggs and larvae to finish the job. One advantage of *Stethorus* is that that can fly plant to plant. They are sensitive to insecticides/miticides. The stickiness of the flower head will not deter these beetles.

Another option is to help prevent these pests is Met52 EC. This contact bioinsecticide utilizes a pathogenic fungus in an emulsifiable oil for the effective control of thrips, root aphids, russet mites, broad mites and more. For best results, Met52® should be applied in early stages of population development. Met52® product efficacy is impacted by coverage and the application frequency is influenced by the environment, the manner of application (foliar or drench), and the population of the target pest.

PFR-97 can also be used to combat spider mites. It contains a naturally-occurring fungus that infects both foliage and soil dwelling insects such as whiteflies, aphids, thrips, spider mites, and other pests. Efficacy results from germination and growth of the beneficial fungus over several days, so applications should start before pest numbers have reached crisis levels. PFR-97 is most effective when application is initiated just before or at the first signs that target pests are present.

FUNGUS GNATS

Fungus gnat larvae feed on the roots of the plants and can cause decreased plant vigor and growth. These larvae can be easily identified by their black heads and white bodies. A slice of potato placed on the soil medium is a good method to monitor fungus gnat larvae populations.

Stratiolaelaps can be used to control young larvae of fungus gnats in the soil or planting media. *Stratiolaelaps* is most effective when applied before fungus gnat populations become established or when numbers are still low (below 10 per trap, per week). Two applications

of *Stratiolaelaps* per crop cycle are usually sufficient if used early in the season. The second application should be made 2 to 3 weeks after the first.

Rove beetles can also be used to control fungus gnats in the soil or planting media. Rove beetles are most effective when applications are started before fungus gnat population becomes well established or while numbers are still low (less than one seen in a trap, per week). One application of *Atheta* per crop cycle is usually sufficient if started early in the season. Because rove beetles have a longer life cycle and takes longer to establish than *Stratiolaelaps* predatory mites, they should be used along with *Stratiolaelaps* for best results.

Steinernema feltiae is a beneficial nematode product that helps provide biological control of fungus gnats. Beneficial nematodes (*Steinernema feltiae*) are microscopic worms that attack and kill targeted insects without affecting any other organisms. Within the infected insect, the beneficial nematodes continually reproduce and then spread out for long-term control. When applied to the soil, this nematode will provide several weeks of protection against pest re-infestation.

APHIDS

Aphids are attracted to soft new plant growth. Aphids themselves seldom cause permanent damage, but their excrement “honeydew” can lead to sooty mold. Honeydew also attracts ants. When aphids are an issue, eliminate any ants first. Ants “farm” aphids, so they can feed on the honeydew. They will protect the aphids from predation and sometimes actively move aphids around to “greener pastures” within the crop.

Once the ants are gone, aphids can easily be controlled by using the predatory midge *Aphidoletes aphidimyza* at a rate of 0.01 per square foot, weekly, until the aphids are eliminated. If there is a history of aphids, continue at this rate weekly for the duration of the crop. Successful use of *Aphidoletes* requires that circulation fans are turned off for six hours at release and gentle air movement at other times.

When aphid populations are high, *Aphidius colemani* alone will not provide adequate control, but they work well in conjunction with *Aphidoletes* and ladybugs to provide control. *Aphidius* species are a group of native parasitic wasps, frequently found parasitizing aphids in



greenhouses and outdoor crops. Adults are tiny (2 to 3 mm long) dark-colored wasps that do not sting. The larvae develop entirely inside the host aphid, which eventually become rigid mummies when the larvae pupate. *Aphidius* is an outstanding searcher, and can locate new aphid colonies even when aphid populations are low.

ROOT APHIDS

Root aphids are insidious and can be difficult to diagnose and observe. The predatory soil mite *Stratiolaelaps* controls root aphids and weevils, but only first and second instar larvae. Using these mites to control an existing problem would take a long time. Applying *Stratiolaelaps* when the plants are first rooted is one of the best ways to manage root aphids.

THRIPS

Thrips are tiny, slender insects capable of limited flight and cause damage similar to that of spider mites. Thrips scrape the leaf surface while spider mites pierce the leaf tissue and extract the chlorophyll.

There are different species of thrips that can cause potential damage to cannabis crops. Pests include the greenhouse thrips, western flower thrips, and onion thrips. These three are all general feeders. Some growers have also reported issues with *Oxythrips*, a pest specific to cannabis, but these are far less common than other thrips.

Yellow and blue sticky traps can be effective management tools against thrips. The trapping rate can be increased by a factor of 10 by attaching a cotton ball to the sticky trap and adding a few drops of vanilla or almond extract to the cotton ball. We also offer various lures that work the same way the cotton ball method would. Beans are also very attractive to thrips, allowing both early detection and possibly a better target.

The predatory mite *Amblyseius cucumeris* (“cucumeris”) is the best biological control to combat thrips. These mites attack the first and second instar larvae. If enough cucumeris are present they are extremely effective. Cucumeris sense the thrips emerging from the leaf, wait for them to stick their heads out, and then bite them off. The presence of *Stratiolaelaps* in the soil will effectively reduce the cycling of the thrips by up to 80%.

In moist conditions rove beetles can also help control soil stages of thrips and feed on most other small soil organisms. Rove beetles will go wherever their prey is located, whether it’s down the floor drains or at the very tops of the plants. Apply them at a rate of about 1 beetle every 10 square feet.

Other options for thrips control are Met52 or *Steinernema feltiae* (for western flower thrips). For help controlling thrips populations either the Granular or EC formulation of Met52 is suitable (see previous section on spider mites for more information about this product.) *Steinernema feltiae* is a beneficial nematode that helps provide biological control of western flower thrips. It should be applied at a rate of 50 million per 1,000 square feet. (see the previous section on fungus gnats for more information about this product)

When a thrips problem gets overwhelming, growers can try using a large tub filled with a soapy solution to attract and kill large numbers of adult thrips. The tub should be yellow or white and measure about 18 inches long, 12 inches wide and 6 inches deep. In the tub, make a solution of mostly water and a small amount of dish soap. Adding vanilla or almond extract can also help attract the pests. Adult thrips will be drawn to the tub for as long as it keeps its scent, which is usually about 3 days. If this method proves successful, growers may want to repeat the process until the thrips are no longer an issue.

BROAD MITES & HEMP RUSSET MITES

In recent years broad mites and russet hemp mites have caused many headaches for cannabis cultivators. These pests are almost exclusively found on indoor crops. Leaves and stems affected by these mites will first appear greasy and then turn bronze. Unfortunately, symptoms from these mites don’t usually show up until after plants have matured. For that reason, the number one defense against these mites is prevention.

Fallacis should be used to prevent these pests from establishing populations within the cannabis crop. Fallacis is capable of controlling broad mites and other eriophyid (microscopic) mites. As soon as true leaves are present, apply fallacis at a rate of 2 mites per square foot. If there is a history of broad mites, double the rate of fallacis, and make sure it’s applied as soon as possible. Once the plant begins to grow the flower head,



and stickiness begins, all of the predatory mites will avoid those areas.

While cucumeris is the best biological control when it comes to thrips, they can also be used as a preventative measure against the immature stage of broad mites and russet hemp mites.

If russet hemp mites are already present, *Amblyseius andersoni* is a predatory mite that can be used to control them. For best results, apply andersoni to cannabis plants when pest mite numbers are still low. The predatory mites will then be able to feed on small colonies of mites and prevent them from growing and causing major damage.

Californicus is a general mite predator that can also be used preventatively against these pests. *Amblyseius swirskii* (“swirskii”) are excellent beneficial mites that go after broad mites. They’re a good option for warmer growing areas as swirskii become inactive when temperatures drop below 59°F.

*Met52 EC and *PFR-97 can also be used to combat hemp russet mites and broad mites (see the previous section on spider mites for more information about these products).

WHITEFLY

Whitefly is not a common pest in cannabis crops, but because pests tend to adapt it is important to be on the watch for them. The whitefly is a close relative to the aphid, and both of them can cause major devastation cannabis crops. Both pests rapidly create excessive honeydew that leads to sooty mold. If any whitefly is seen on yellow sticky cards, begin releasing the parasitic wasp *Encarsia formosa* at a rate of 0.1 per square foot, weekly.

In the same family as *Encarsia*, *Eretmocerus eremicus* can also be used to control a whitefly problem. *Eretmocerus* originates in the desert regions of Arizona and California and is able to tolerate higher temperatures than *Encarsia*, but can be used together to control silverleaf and greenhouse whiteflies. *Eretmocerus* controls whiteflies by parasitizing whitefly larvae.

Delphastus could also help against a whitefly infestation. This specialized whitefly predator is in the lady beetle family but is smaller than the familiar ladybug.

Delphastus tends to feed in high density whitefly populations and prefer feeding on whitefly eggs. Optimum conditions for *Delphastus* are moderate to high temperatures of 61-90°F.

Using Molt-X®, an Insect Growth Regulator

For cannabis cultivators trying to make the switch from chemical pesticides to biological controls, * Molt-X® can work as a great bridge product for any of the target pests listed above. Molt-X® is a 3% Azadirachtin formulated Insect Growth Regulator (IGR) that offers broad spectrum insecticidal control on over 300 insect species.

Many growers who have applied powerful chemicals to fight pests in the past have experienced adverse reactions when trying to shift away from the chemicals. During this initial shifting period, pest populations tend to explode, making it very appealing for growers to resort back to chemical products at the sake of saving their crop. Molt-X® can help growers manage pests during this interim period.

Once again, it is important to always read product labels carefully to determine an appropriate application rate. Keep in mind that state laws vary in regulation of pesticides in cannabis. Contact your state pesticide regulatory agency for help in figuring out which products are allowed in your state.

TRAPPING & MONITORING TOOLS

Throughout a crop’s growth cycle there are several tools a grower can use to monitor pests. These tools give growers the information they need to accurately and affectively treat pest issues, like which pest(s) they’re dealing with and the scope of the problem.

When getting started, yellow sticky traps should be applied at the rate of at least 1 trap for every 500 square feet to tackle thrips. The height of the traps should not exceed the height of the plants.

Bush bean plants are a great monitoring system for cannabis growers as part of an integrated pest management plan for spider mites, thrips, fungus gnats, aphids and whiteflies. The ‘Strike’ and ‘Provider’ bean varieties seem to work best. To use a bush bean plant as a pest trapping or monitoring system, plant the seeds near or touching the crop. The bush bean plant is so



attractive to the target pests they will actually leave the cannabis plants and to go after it instead. This especially works well for spider mites.

If the bush bean plant shows evidence of a spider mite infestation, it can be bagged up prior to removal from the grow area. Plant a new bush bean plant and begin to monitor again. If repeated, this process will get rid of a lot of spider mites over time. This technique is especially helpful for growers cultivating cannabis mother plants.

Other plants that work well as pest monitors are yellow marigolds and white alyssum. These two plants are used to attract thrips. Eggplants can be used to attract whiteflies.

An average potato can be a very affordable tool for detecting fungus gnats in the soil. Simply slice the potato into half inch rounds and lay the slices on the soil. Leave the potato for 24 hours, and then return to check it. If there are fungus gnat larvae in the soil, they will be present on the potato. It's the larvae that cause damage to the roots of the plants, so this method helps growers save their plants before mature fungus gnats are visible and flying around the grow room.

This document was prepared in part by Applied Bio-nomics Ltd.

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