



**Pest Management Plan for CalCannabis
Cultivation Licensing**

For:

Pacific Roots Cannabis LLC

January 03, 2020

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1.0 INTRODUCTION

The State of California has required all applicants for cannabis cultivation licensing to submit a pest management plan as part of their cultivation plan. The following plan fulfills pest management planning requirements, as presented in the California Code of Regulations for Cannabis Cultivation (Cal Code Regs. tit. 3 § 8106, a.3, b.2)

*“A pest management plan that shall include, but not be limited to, the following:
(A) Product name and active ingredient(s) of all pesticides to be applied to cannabis during any stage of plant growth; and
(B) Integrated pest management protocols, including chemical, biological and cultural methods the applicant anticipates using to control or prevent the introduction of pests on the cultivation site.”* (Cal Code Regs. tit. 3 § 8106)

This pest management plan is for Pacific Roots Cannabis LLC at 631 Chambers Rd. Petrolia, CA 95558 and serves as a required pest management planning document for CalCannabis cultivation licensing. The following plan is written for a 10,000 sqft cultivation site and 4,320 sqft nursery site grown in greenhouses and/or hoopouses in beds in native and amended recycled manufactured (imported) soil. Also included is 720 sqft indoor (cloning and R&D) nursery operations.

This pest management plan is an integrated ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of management techniques. This integrated pest management (IPM) plan contains five primary components listed below. These identify protocols for individual pest, noxious weeds, and plant disease management. The practices herein are designed to pro-actively respond to the threat of pests and disease in the agricultural system.

The IPM plan has five primary components:

- 1) Monitoring
- 2) Physical Control*
- 3) Environmental Control*
- 4) Biological Control
- 5) Chemical Control

** Physical and environmental controls are combined and referred to as “cultural controls.”*

This report summarizes the management tactics within these five components which Alexander Roney of Pacific Roots Cannabis LLC has identified as their farm IPM protocols. Each section contains a description of the activity and definitions of any important terms, followed by a list of protocols in that category that will be used.

2.1 PESTS & DISEASES OF CONCERN

Below is a comprehensive list of pests and diseases of concern that the following IPM plan addresses.

| |
|---|
| Large Mammals |
| Rodents (mice, rats, moles, voles) |
| Mites and Insects |
| Broad mites - Polyphagotarsonemus latus |
| Cucumber Beetle |
| Fungus Gnat (Diptera) |
| Root Feeding Nematodes |
| Russet Mites - Aculops spp. |
| Thrips (Heliothrips haemorrhoidalis, Frankliniella occidentalis, Thrips tabaci) |
| Two-spotted spider mites, Tetranychus urticae, (and other Tetranychidae) |
| Disease |
| Powdery Mildew (fungal disease) |

3.0 MONITORING

There are two principal areas that require monitoring:

- Pests
- pH and Electrical Conductivity (EC)

3.1 MONITORING FOR PESTS

Pest monitoring protocols are stated below. A sample pest monitoring sheet is provided in Appendix A.

- **“Scouting”** is defined as: “Walking around each growing area once a week and recording pest and pathology observations in a pest monitoring sheet.”
- **“Hot spot”** is defined as: “A sub-section of the larger growing area where pests are either first observed, or where pest numbers are observed to be increasing to threatening levels.”

Pest Monitoring Protocols

| Pest Monitoring |
|--|
| Daily to Weekly scouting of growing areas for pests and pathology. |
| Records pest / pathology on monitoring sheets during scouting. |
| Maintain a seasonal record of pest monitoring sheets. |
| Use data from pest monitoring sheets to make early pest management decisions. |
| Random sampling of leaves for microscope monitoring. |
| Monitor for broad mites, spider mites, and russet mites using a microscope. |
| Use sticky cards to monitor for aphids, thrips, fungus gnats, and whiteflies. |
| For early detection and intervention of pests, "hot spots" will be flagged in the field. |

3.2 MONITORING PH & ELECTRICAL CONDUCTIVITY (EC)

Regular field and lab testing will be used to determine nutrient availability. Protocols listed below.

pH and EC Protocols

| Monitoring pH & Electrical Conductivity (EC) |
|--|
| pH will be checked on irrigation water and recorded. |
| All synthetic mixes and biological teas will have the pH monitored before being applied to the crop. |
| Shall maintain an annual record of soil test results. |
| Monitor pH weekly or monthly, or as needed. |
| Monitor EC weekly or monthly, or as needed. |
| All pH and EC meters will be cleaned between usage and calibration maintained and checked on a consistent basis. |
| pH and EC will be recorded using a calibrated meter on the farm. |
| Keep a seasonal record of pH and EC measurements. |

4.0 PHYSICAL CONTROL

Physical controls, for the purposes of this plan, are grouped into the following four categories:

- Exclusion
- Mulching
- Cover crop
- Companion plants

4.1 EXCLUSION

Exclusion means any tactic that works to keep pests *out* of your garden. These practices are grouped by their approach:

- Quarantine
- Sanitation
- Pruning
- Weeding
- Removal of plant residue
- Screens and air filters

Exclusion Protocols

| Exclusion |
|--|
| Clones and new plant material will be quarantined for at least two weeks. |
| All personnel must clean hands after (or use disposable gloves while,) handling diseased or infested plant material. |
| Growing areas will be kept pet free. |
| All tools and equipment will be sanitized after handling diseased or infested plant material. |
| To avoid spreading contamination healthy plants will be worked on before sick or diseased plants. |
| Not handle any non-infected plants after handling diseased or infested plants. |
| Plants will be pruned to improve air circulation. |
| Yellowing and injured plant leaves will be pruned. |
| Pruned plant material will be removed from the growing area to a designated waste area or facility by following the cannabis waste management plan described in the California Code of Regulations for Cannabis Cultivation (Cal Code Regs. tit. 3 § 8108) |
| Maintain weeds around plants and beds. |
| All crop residues will be removed after harvest. |
| All compost piles and plant residues will be kept 30' or more from growing areas. |
| Greenhouse doors and sides will be kept closed when possible. (Pests are least active during hot afternoon hours.) |
| Use screens or netting to keep pests out of greenhouses or growing areas. |
| Proper removal and handling of sick and diseased plants to a separate designated waste site or off-site facility. |
| Trap (minus rodenticides) |

4.2 MULCHING

The State Water Resources Control Board requires that all mulch be weed-free and the following practices will comply with that requirement. Mulching protocols listed below.

Mulching Protocols

| Mulching |
|--|
| Use a compost mulch. |
| Mulch will be maintained and replaced as needed. |
| A space will be left between mulch and the plant base to prevent moisture and molds. |

4.3 COVER CROPPING

Cover crop protocols stated below.

Cover Cropping Protocols

| Cover Cropping |
|--|
| A winter cover crop will be planted to maintain soil health during non-production months. |
| A spring cover crop may be planted if ample time is available for growth once temperatures are warm enough to maintain soil health during non-production months. |
| Legumes (nitrogen-fixers) will be part of the cover crop to help provide nitrogen back in the soil. |

4.4 COMPANION PLANTING

Companion planting protocols listed below.

Companion Planting Protocols

| Companion Planting |
|---|
| Companion plants will be used to repel pests. |
| Plant perennial companion plants. |

5.0 ENVIRONMENTAL CONTROL

Environmental controls make changes to the plant environment and fall into the following three categories:

- Nutrient management
- Irrigation
- Humidity and temperature

5.1 NUTRIENT MANAGEMENT

Nitrogen Management Plans will be recorded monthly and submitted annually per the State Water Board Regulations (State Water Resources Control Board, 2017.) SWRCB requirements are summarized below:

- Provide site description(s).
- List the sources of nitrogen used (bulk materials, dry fertilizers, and liquid fertilizers).
- Calculate monthly nitrogen use per canopy acre (dissolved in irrigation water, originating in soil amendments, and applied fertilizers).
- Describe nitrogen storage, use, and disposal practices; and procedures to limit excessive fertilizer application.

Regular field and lab nutrient management protocols stated below.

Nutrient Management Protocols

| Nutrient Management |
|---|
| Soil samples will be submitted to an agricultural testing laboratory for nutrient testing at least once per year. |
| Use lab nutrient results to inform pre-production amendment decisions. |
| Use lab nutrient results to inform mid-cycle amendment decisions. |
| Keep and maintain a annual record of soil test results. |
| Monitor pH weekly or monthly. |
| Monitor EC weekly or monthly. |
| Use pH and EC to inform fertilization decisions. |
| Keep and maintain a seasonal record of pH and EC measurements. |
| Exact fertilizer need is calculated based on lab nutrient results. |
| Use organic (non-synthetic) bulk amendments. |
| Actively amend or manage the soil to improve soil nutrient holding capacity. |
| Maintain a record of all fertilizer inputs used. |
| Maintain an annual record of nitrogen fertilizer use. |

5.2 IRRIGATION MANAGEMENT

The State Water Resources Control Board requires that you:

- Record daily water amounts used for irrigation.

- These will be calculated using a measuring device, or by calculating the irrigation system rates and duration of time watered.

Moisture monitoring should follow all irrigation activities, as well as any precipitation events. Monitoring should determine the depth and uniformity of wetness and track the soil as it dries to an appropriate point. Listed below are irrigation management and moisture monitoring protocols.

Irrigation Management Protocols

| Irrigation Management |
|---|
| Monitor soil moisture content daily or as needed. |
| Soil probes and visual detection will be used to monitor soil moisture. |
| Soil moisture sensors will be used to monitor soil moisture. |
| Irrigation decisions will be made based on soil moisture content and climate. |
| Maintain a written / physical irrigation schedule and update as needed. |
| Be responsive to plant biological factors by watering more when the plant is young. |
| Actively amend or manage the soil to improve soil water retention and drainage. |
| Irrigation monitoring device(s) will be installed to monitor daily water use. |

5.3 HUMIDITY & TEMPERATURE MANAGEMENT

Humidity and Temperature management protocols listed below.

Humidity & Temperature Management Protocols

| Humidity & Temperature Management |
|---|
| Use fans to stimulate air flow. |
| Use the principles of horizontal air flow to optimize fungal and pathogen prevention in greenhouses and grow rooms. |

6.0 BIOLOGICAL CONTROL

Biocontrol practices intentionally increase the populations of predators to combat pests and diseases. For the purposes of this plan, they are grouped into the following categories:

- Beneficial Insects
- Beneficial Microbes
- Compost Tea

6.1 BENEFICIAL INSECTS

Beneficial insects will be used throughout the growing cycle per protocols stated below.

Beneficial Insects Protocols

| Beneficial Insects |
|--|
| Use beneficial insects on crops. |
| Release beneficial insects on nursery crops. |
| Use preventative early-season releases. |
| Utilize and maintain a season-long preventative release schedule. |
| Refrain from preventative pesticide spraying. |
| Use beneficial insects as a first response to pest detection. |
| Monitor for beneficial insects as part of a regular pest scouting program. |
| Plant companion plants to attract beneficial insects. |
| Refrain from spraying any pesticide product for at least a week prior to beginning beneficial insect releases. |
| Determine degree-days required for emergence of problem pests. |

6.2 BENEFICIAL MICROBES

Beneficial microbes will be used throughout the season per protocols stated below.

Beneficial Microbes Protocols

| Beneficial Microbes |
|---|
| Inoculate growing media with mycorrhizae (<i>Glomus</i> sp.). |
| Use nematodes (<i>Steinernema</i> sp.) preventatively as a cutting/clone dunk, soil drench, or spray. |
| Use microbial sprays to prevent fungal or bacterial diseases (<i>Bacillus subtilis</i> , <i>Reynoutria sachalinensis</i> , <i>Bacillus amyloliquefaciens</i> , <i>Gliocladium virens</i> , <i>Trichoderma harzianum</i>). |
| Use beneficial microbe products (bio-fungicides) as a first response to pathogen detection. |
| Use beneficial microbe products (bio-pesticides or bio-fungicides) to address pest or pathogen problems before attempting to use a traditional pesticide product (i.e. horticultural oils, neem, insecticidal soaps, sulfur, etc.). |

6.3 COMPOST TEA

There are two types of compost tea applications: a tea extract for soil drenching, and an aerated tea for foliar spraying. Compost teas will be used based on the protocols stated below.

Compost Tea Protocols

| Compost Tea |
|---|
| Foliar spray compost tea weekly to monthly as needed throughout season. |
| Soil drench compost tea weekly to monthly as needed throughout season. |
| Maintain separate compost tea brewing equipment (tanks, pumps, etc.). |
| Maintain separate compost tea / biological spraying equipment (tanks, pumps, etc.). |

7.0 CHEMICAL CONTROL

Chemical controls are products classified as pesticides or fungicides. Products used will follow all guidelines from the California Department of Pesticide Regulation (CA-DPR) document “Legal Pest Management Practices for Cannabis Growers in California” (CA-DPR, 9 October 2017). The DPR document lists 36 active ingredients that are acceptable for use on cannabis, in addition the product must be listed for use on “Flowers & Flowering Plants” (i.e. ornamental plants, many nursery plants, cut flowers, etc.).

7.1 PESTICIDE MANAGEMENT

For the purposes of this document:

- ‘Economic thresholds’ (“ETs” and “action thresholds”) are identified as pest or disease population levels at which the cost of applying pesticides is less than the value of the crop loss they prevent.

Pesticide protocols stated below.

Pesticide Management Protocols

| Management Tactics |
|---|
| Develop and use economic thresholds for managing and making chemical control decisions. |
| Maintain separate spraying equipment for non-biological chemical pesticide products. |
| First use beneficial microbe products (bio-pesticides or bio-fungicides) to address pest or pathogen problems before attempting to use a traditional pesticide product (i.e. horticultural oils, neem, insecticidal soaps, sulfur, etc.). |
| Only spray pesticide products when wind speed is under 10 mph. |
| All employees who will be applying pesticides will have protective gear available. |
| All labels and safety data sheets for products used will be made available to employees. |

7.2 COUNTY, STATE AND EPA REQUIREMENTS

The CA-DPR and other regulatory agencies including the Environmental Protection Agency (EPA) have mandated certain practices that reduce the risks inherent with pesticide use. These practices are listed below:

Required Protocols for Chemical Control

| County, State, and EPA Requirements |
|---|
| Adhere to the CA-DPR and CAC guidelines of approved chemical pesticide products. |
| Adhere to the labeled instructions on all pesticide products. |
| Store all pesticide products together in a secure location that meets storage guidelines. |
| Contain any chemical leaks and immediately clean up any spills. |
| Apply the minimum amount of product necessary to control the target pest. |
| Prevent offsite drift. |
| Not apply pesticides when pollinators are present. |
| Not allow drift to reach flowering plants attractive to pollinators. |
| Not spray directly onto surface water or allow pesticides to drift to surface water by spraying only when wind is blowing away from surface water bodies. |
| Not apply pesticides when they may reach surface water or ground water (for example, before a rain event). |
| Only use properly labeled pesticides. If no label is available consult the CAC or CA-DPR. |
| Maintain a record of all products used (including biopesticides and biofungicides); the areas that were treated, and the volume of product used. |
| Submit pesticide use records to the county (CalAgPermits). |

7.3 INTENDED USE PESTICIDE PRODUCTS

The following products were identified by the producer as those that will most likely be used. The producer understands that pesticide use must be reported to the state monthly, and that all products must meet the standards identified by the CA-DPR.

| Product Name | Active Ingredient |
|---|--|
| Garden Fungicide (Safer Brand) | Sulfur |
| Triact 70, Neem (Natural Guard Brand), TerraNeemEC, or Triple Action Neem Oil | Neem Oil |
| Pest Out by SaferGro | Cottonseed Oil, Clove Oil, Garlic Oil, Oleic Acid, Lauric Acid, Sodium Bicarbonate |

| | |
|---|---|
| Green Cure | Potassium bicarbonate |
| Green Cleaner | Soybean Oil, Sodium lauryl sulfate, Citric acid |
| AzaGuard, Azapro, or Azasol | Azadirachtin |
| Biobit HP, Crymax, Gnatrol, Javelin, Xentari, or Foray XG | Bacillus thuringiensis |
| Preferal, or Ancora Microbial Insecticide | Isaria fumosorosea |
| Dr Zymes | Citric acid |

UPDATED AGRICULTURAL CHEMICALS LIST
 PACIFIC ROOTS CANNABIS LLC
 2021-2022

Table 1. Soil Amendments & Plant Conditioners Used by PACIFIC ROOTS CANNABIS LLC

| BRAND | PRODUCT | ACTIVE INGREDIENTS |
|----------------------------|------------------------------|-----------------------------------|
| Soilscape Solutions | Phylloscape Ful-Humic powder | humic acid |
| | Phylloscape Calcium | calcium |
| | Phylloscape Copper | copper |
| | Phylloscape Iron | iron |
| | Phylloscape Magnesium | magnesium |
| | Phylloscape Manganese | manganese |
| Albion | Metalosate Multimineral | amino acids, trace minerals |
| Southern Organics & Supply | Yucca Extract | <i>Yucca Schidigera</i> |
| Dirt MD | Dirt MD | humic acid, fulvic acid |
| Beneficial Living Products | BioSilicate | silica |
| | Bacillus blend | beneficial bacteria |
| Xtreme Gardening | Azos | beneficial bacteria |
| | MykosWP | mycorrhizae |
| Orca | Liquid Mycorrhizae | beneficial bacteria & mycorrhizae |

Table 2. Fertilizers Used by PACIFIC ROOTS CANNABIS LLC

| BRAND | PRODUCT | N | P | K | OTHER ACTIVE INGREDIENTS |
|----------------------------|------------------------|-----|---|-----|--------------------------|
| Soilscape Solutions | Rhizoscape/Rhizothrive | 1 | 0 | 3 | humic acid |
| | Soluble Kelp Powder | 1 | 0 | 12 | |
| | Phylloscape Boron | 0 | 0 | 2 | boron |
| Pacific Gro | Sea Phos | 1.7 | 7 | 0 | |
| | Oceanic hydrolysate | 2 | 1 | 0.3 | |
| Beneficial Living Products | SassaFrass | 2 | 2 | 2 | mealworm frass |

Table 3. Compounds Used in Nursery Operations by PACIFIC ROOTS CANNABIS LLC

| BRAND | PRODUCT | ACTIVE INGREDIENTS | USE |
|-----------|-----------------------------|--|-------------|
| Dyna-gro | K-L-N rooting concentrate | indole-3-butyric acid, 1-naphthaleneacetic acid | cloning |
| Hygrozyme | Horticulture Enzyme Formula | cellulase, xylanase, hemicellulase, beta-glucanase | propagation |

Table 4. Pesticides Used by PACIFIC ROOTS CANNABIS LLC

| PRODUCT | ACTIVE INGREDIENTS | USE |
|--------------------------|--|--------------------------------------|
| Lost Coast Plant Therapy | soybean oil, peppermint oil, citric acid | powdery mildew, mites & insects |
| Mammoth | corn oil, thyme oil, oleic acid | mold, mildew, mites & insects |
| The Amazing Doctor Zymes | citric acid | molds, mildew s, soft-bodied insects |
| Biological Controls | e.g., ladybugs, praying mantis, predator mites | mites & insects |

Appendix A – Monitoring Sheets

| Product | Active Ingredients | Target Pests | Application Rate |
|-----------------|--------------------|--------------|----------------------|
| Blattigel | Hydroxyflurofen | Blattigel | 0.5 g/m ² |
| Hydroxyflurofen | Hydroxyflurofen | Blattigel | 0.5 g/m ² |

Table 1: Pesticides used by PACIFIC ROOTS CRIMMABLE LTD

| Product | Active Ingredients | Target Pests | Application Rate |
|--------------------------|--------------------|--------------|----------------------|
| Just Coat Plant Therapy | Fluopyram | Fluopyram | 0.5 g/m ² |
| Mammor | Fluopyram | Fluopyram | 0.5 g/m ² |
| The Amazing Doctor Xyzes | Fluopyram | Fluopyram | 0.5 g/m ² |
| Biological Controls | Fluopyram | Fluopyram | 0.5 g/m ² |

IPM Monitoring Sheet

| Date | Site Name | Time | Crop | Growth Stage | | | | | | | |
|-------------------------------|-----------|------|------|--------------|---|---|---|---|---|----|-------|
| Weather / field observations: | | | | | | | | | | | |
| Growing Section | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| Pests | | | | | | | | | | | |
| Aphids | | | | | | | | | | | |
| Larva | | | | | | | | | | | |
| Adults | | | | | | | | | | | |
| Fungus Gnats | | | | | | | | | | | |
| Root Aphid | | | | | | | | | | | |
| Thrips | | | | | | | | | | | |
| Larva | | | | | | | | | | | |
| Adults | | | | | | | | | | | |
| Whiteflies | | | | | | | | | | | |
| Larva | | | | | | | | | | | |
| Adults | | | | | | | | | | | |
| Notes: | | | | | | | | | | | |
| Growing Section | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| Pests for the Microscope | | | | | | | | | | | |
| Broad Mite | | | | | | | | | | | |
| Russet Mite | | | | | | | | | | | |
| Spider Mites | | | | | | | | | | | |
| Notes: | | | | | | | | | | | |
| Growing Section | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| Beneficial Insects | | | | | | | | | | | |
| Rove Beetle | | | | | | | | | | | |
| Predator Mite: _____ | | | | | | | | | | | |
| Predator Mite: _____ | | | | | | | | | | | |
| Other: _____ | | | | | | | | | | | |
| Notes: | | | | | | | | | | | |