

Growstack

Grower Manual

Chris Nelson

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Hygiene

- ▶ Hygiene is paramount in growing crops in a multilevel system for food production
- ▶ The whole growing environment must be clean.
- ▶ Personnel must be clean and protected is that they do not knowingly carry bacteria, pest or disease into the growing area or contaminate the product during harvesting.
- ▶ Product must be clean

Hygiene Personal

Treat the operation as a food factory

- ▶ Follow a wash hands protocol
 - ▶ Wash with unscented bacterial soap
 - ▶ Dry hands
 - ▶ Use a Gel finish
 - ▶ Wear hair coverings including beard snood
 - ▶ Wear protective clothing with no pockets and presstud fastenings
 - ▶ Personal health important
- ▶ Personal hygiene statement and undertaking.
- ▶ Visitor and contractor control
- ▶ Develop policies and procedures to cover food safety .

Hygiene Environment control

- ▶ **Building**
 - ▶ White wall food grade material that is easily washable
 - ▶ Floor sealed and washable
 - ▶ Drainage- easy access for cleaning.
 - ▶ Air intake- filtered ? Positive air pressure?
 - ▶ Access- captive entry and exist- double doors air curtains
 - ▶ Temperature control- AC unit/ heating
 - ▶ Humidity control- how
 - ▶ Air exchanges- how many, air movement systems

Hygiene Seed

- ▶ Buy seed from a reputable source
- ▶ If dealing with enough volume send samples for seed microbiology testing
- ▶ Store in a cool environment
- ▶ Wash seed in Cl2 or CLOX and rinse. Strength and time will depend on the seed size and type. Please note products like Basil are known as jelly seeds and once wet cannot easily be re-dried.
- ▶ Dry and store clean storage - remember to maintain the batch coding to the seed

Growing Equipment

- ▶ Ebb and flood benches- check for splits in the corners watch for drips
- ▶ Clean down between crops - take the bench out of the rack
- ▶ scrub any algae and rinse off
- ▶ Apply anti bacteria spray - perhaps peroxide based product Jet 5 in UK
- ▶ Irrigation pipe work - clean monthly flush the system through with clean water and a bio film stripper - seek advise.
- ▶ After applying the chemicals please make sure to flush through the system with clean potable water.
- ▶ Flush tanks once per week

Hygiene

Growing media and growing trays

- ▶ Using inert substrate - may need treating with CL2, CLOX or Peroxide
- ▶ Types of substrate -rockwool, capillary matting, inseromat.
- ▶ Vermiculite and coir not easy to clean
- ▶ Growing trays - need cleaning after every crop
- ▶ Growing bench - needs cleaning after every crop

Hygiene Water

- ▶ Where does your water come from- borehole, reservoir, city water rain harvesting
- ▶ Use where possible potable water
- ▶ Carry out both microbiological analysis and chemical analysis.
- ▶ If contaminated then treat water prior to use.
- ▶ Water treatments options
 - ▶ Filtration
 - ▶ UV
 - ▶ Chemical
 - ▶ Reverse osmosis
- ▶ Water storage- how easy to clean
- ▶ Waste water disposal

Growing Seed

- ▶ Take measured quantity of seed
- ▶ Treat seed- pre soak to clean and where appropriate chit
- ▶ Chitting is using water to swell the seed until the peduncle is showing. Then stop the process and dry the seed enough to allow even spreading of the seed to the growing area. Remember to bubble air into the water and seed.
- ▶ Important that the identity of the seed is preserved through this process
- ▶ Record the details

Growing Media

- ▶ Depending on product
- ▶ Micro greens and baby leaf - capillary matting
 - ▶ Presoak matting overnight with mild disinfection
- ▶ Small plant production in multicell trays
 - ▶ Use inert substrate- vermiculite, inseromat confetti. Coir,
- ▶ Larger plants
 - ▶ Perlite, coir.

Growing Trays

- ▶ Depends on crop
 - ▶ Open trays- plenty of drainage holes
 - ▶ Multicell trays use those designed for ebb and flood benching
 - ▶ Larger individual pots - use those designed for ebb and flood benching

Growing Chitting

- ▶ Chitting process
 - ▶ Place a known quantity of seed into a container
 - ▶ Fill with clean potable water
 - ▶ Add chlorine tablets to 50ppm chlorine
 - ▶ Bubble air through the container making sure the seed is turning over bubbler needs to be at the bottom of the tank
 - ▶ Leave for 4 -12 hours depending of the seed type
 - ▶ Empty the bucket and refill with plain potable water
 - ▶ Run with the air bubbler for a further 4 -36 hours- dependent on the seed.
 - ▶ Take out of the water and dry the seed

Growing Drying Seed

- ▶ Place the wet seed into a stainless steel sieve over a fan.
- ▶ Cover the seed so that no seed is blown out of the container
- ▶ Stir and move the seed around regularly
- ▶ Once dry place into a clean container and label with details of batch number etc.

Growing Sowing

- ▶ Place the growing media into the tray
- ▶ Ensure the media is wet
- ▶ For peas sow by hand
- ▶ For medium sized seeds - radish etc use sugar shaker with large holes
- ▶ For small seed - mustards, lettuces - use a sugar shaker with a small hole
- ▶ For very small/ dust seed - watercress- use a shaker with the smallest aperture you can find or spread by hand.
- ▶ Spread evenly across the growing media- make sure you get to the edges.
- ▶ Spray over with water
- ▶ Place in the dark in germination or cover with black plastic.

Growing Fertiliser and pH

- ▶ Mix up the fertiliser concentrate in stock tanks 2 tank systems do not mix all in one tank as flocculation will occur and some nutrients will be lost.
- ▶ Use Nitric acid for pH adjustment if required- use protective clothing and eye protection
- ▶ Alternatively use premixed liquid feed
- ▶ Use pH probe and EC probe check tanks
- ▶ Add fertiliser for micro greens and baby leaf EC 1.2-1.5. Place the fertiliser in at the point of return water to allow to mix in the reservoir
- ▶ pH add dilute Nitric Acid in very small amounts pH 6.0-6.5
- ▶ Check with probes after thoroughly mixed and adjust accordingly
- ▶ Check 1 or 2 times per day dependent on number of waterings
- ▶ Remember if using stock tanks for fertiliser always stir well before taking concentrate

Growing Water and Water storage

- ▶ Water used must be potable
- ▶ Solution- water plus fertiliser and pH adjustment check manually 2 times per day
- ▶ Dump some water every day- depends on how much the crop is using and if the solution is contaminated
- ▶ Test the solution up to 3 times per week for microbiology- If the water turns frothy or develops a pond like smell always dump at least 25% but you may need to dump 100% and clean the reservoir
- ▶ Water can be treated with sodium hypochloride at about 2.0 ppm or Chlorine dioxide at no more than 0.3ppm. Please seek advise before carrying this out.
- ▶ UV and filters will reduce bacterial loading- seek additional advise.

Growing Propagation

- ▶ Once the seed are sown place some black plastic over the trays and place in a warm area 18C-20C. The seed must be in the dark!
- ▶ Different species seeds germinate at different rates ranging from 1 day upto 5-6 days
- ▶ Important that the seed trays are checked at least 2 times per day to make sure they are not drying out
- ▶ Once germinated allow to continue to grow in the dark until approximately 1-2 cm tall.
- ▶ When the crop is uniformly germinated and even height transfer under the LEDs

Growing settings

Propagation

- ▶ Temperature 18-20C
- ▶ Humidity 90-100 %
- ▶ Water checks 2 x day
- ▶ Complete darkness
- ▶ If crop requires long time in the dark then use solution to feed the crop

Under LEDs

- ▶ Day length 14-18 hours dependent on the crop
- ▶ Growing temperature 16- 22C
- ▶ Humidity 70%- 85%
- ▶ Air movement across the crop and general air exchanges important

Growing Under LEDs

- ▶ When the plants are placed under the LEDs they may require a little protection whilst the plants acclimatise.
- ▶ Make sure the irrigation system is working correctly
- ▶ The irrigation system must run and fill the growing bench with solution ideally 2 cm deep across the bench.
- ▶ It is important that the whole floor of the bench is level to allow even distribution of the solution. This is to ensure that all trays and plants get irrigated.
- ▶ The number of irrigations depends on the crops grown

Growing Under LEDs continued

- ▶ Check on the plants regularly
 - ▶ Watch for dry areas
 - ▶ Poor germination
 - ▶ Disease
 - ▶ Growth of the crop
- ▶ Check the surrounding humidity - 75%
- ▶ Check the colour of the plants is there any yellowing to the cotyledons of leaves

Growing Pest and Disease

- ▶ In a self contained unit it should be relatively easy to keep pests out.
- ▶ Disease can be brought in on humans, in the air, water or the seed and substrate.
- ▶ It is common to see small areas of death in the crop caused by a bad seed -this can be progressive and needs monitoring
- ▶ If the humidity is too high then white fluffy moulds can grow in the crop- remove tray and start again
- ▶ Root death- pithium, alternaria etc. remove infected tray, dump the water and clean the system- start again
- ▶ Algae not a major problem however scarid flies can breed in the algae- visual inspection important
- ▶ Pseudomonas sp- bacterial infection- slime bacteria will affect eating quality. Often first symptoms are little black dots on stems and cotyledons- check levels of hygiene

Growing Harvest

- ▶ Different crops take different lengths of time to get to the required size
- ▶ Different markets will require different sizes
- ▶ Understand what the market needs
 - ▶ Cotyledon only
 - ▶ First true leaf second/third true leaf
 - ▶ Baby head
 - ▶ Full head
- ▶ What length of stem is required

Growing

Harvest continued

- ▶ To harvest the crop- remove the trays from the growing system and harvest in a separate area
- ▶ Use clean scissors or a clean very sharp knife.
- ▶ Place the cut product into a clean container
- ▶ Sometimes the product is very wet and will need gentle drying before packing
- ▶ Pack into agreed punnets at agreed weight and label. Make sure that there is an indication of shelf life and some way of tracing the product back to seed source.
- ▶ Once harvested and/or packed place in a fridge.
- ▶ Remember only to pack one product at a time and always clean down in between products

Microbiology

- ▶ Everything that is produced is food and it is the companies responsibility to ensure that the food is safe to eat.
- ▶ Microbiological testing is the way to ensure that the products and the growing environment are free from human pathogens and spoilage organisms.
- ▶ Human pathogens Ecoli 0157, Salmonella, Listeria and spoilage organisms such as pseudomonas sp
- ▶ Please seek advise regarding control and monitoring of these issues.

Allergens

- ▶ Some crops are allergenic-people may have a reaction to these crops
 - ▶ Mustards
 - ▶ Celery
- ▶ Always check what is being grown.
- ▶ Never mix allergens with other crops
- ▶ Harvesting make sure crops are harvested and stored separately.
- ▶ If labelling products for sale make sure Allergens and the presence of allergens on site are notified on the label
- ▶ Seek advise

Disclaimer

- ▶ The advise here is subject to variation dependent on the growing conditions, the types of crops and the skills of the persons implementing the guidance notes.
- ▶ All specific references for treatments are dependent on local conditions and it is advisable to seek professional help from the company or your own specialist advisors.

Growing Packs

- ▶ To be developed.

Contact Details

Growstack Ltd
26 Broad Manor
Pocklington
York
YO42 2GB
UK

CNSolutions
67 West Hall Garth
South Cave
Brough
East Riding of Yorkshire
UK
HU15 2HA

- ▶ chris@cnsolutions.eu.com
- ▶ www.cnsolutions.eu.com