Crop Selection and Management

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INTRODUCTION:

It is important to understand the basic components of introductory plant production prior to addressing more technical and scientific issues related to plant health.
Focal points

1. Propagation Techniques
2. Crop and Variety Selection
3. Seed Propagation
4. Planting
5. Pollination
6. Greenhouse Yields
Propagation Techniques

There are two techniques:
1. Asexual
2. Sexual

Asexual Technique includes all forms of vegetative propagation such as grafting, budding, layering, air layering and micro-propagation.

Sexual propagation is the growing of plants from seeds.
Grafted Cucumbers. (asexual)
SEXUAL VERSUS ASEXUAL PROPAGATION

Seed propagation is the most common method for vegetable crop production in the region.

Raising plants from seeds has the potential to provide large numbers of uniform, high quality seedlings.

An example of asexual vegetative propagation in Jamaica is using auxiliary shoots (suckers or gormandizers) to grow tomatoes. In the process healthy suckers are selected from vigorous plants and are encouraged to grow roots by placing them in a growing media such as coir or seed germination mix. These are later planted in the greenhouse.

The practice: Saves the farmer money, but is potentially risky if contaminated plant material is replicated.
Sucker Removal (plant training and/or Propagation)

Figure 5. Removal of side branch when 2 to 4 inches long

(5.08 – 10.16 cm.)
Sucker removed for planting.
Growth after 3 weeks.
Crop and Variety Selection

It is important to continuously evaluate market demand for a particular crop species.

It is equally important to select a good cultivar of that species.

Cultivar, also called hybrid and is abbreviated using the letters “cv.”

Choose varieties that are:
1. Compatible with the production system.
2. Appealing to the market.
3. Newly developed and that meets your specific needs.
Advantages of cultivating Hybrids.

1. Stable, uniform crop.
2. Uniform fruits
3. Uniform height
4. Disease resistance
PURCHASING AND STORAGE OF SEEDS.

1. Always select high quality seeds from reputable seed companies.

2. Note that open field varieties are not bred for greenhouse conditions.

3. Check the packaging for the number of seed, test date, the percentage germination, the presence of any pesticides which might be harmful to the handler.

4. When buying seeds make sure that they were kept under cool conditions.

5. After opening packages which must be returned to storage, make sure that seeds are dry and the package contains very little air.

6. Store Seeds in the vegetable compartment within the refrigerator.
A Word on Hybrids

There are many advantages to using hybrids, one drawback to their use is that, saved seeds will not produce a “true to type” offspring of the parent plant.
Germination

“The process in which a seed develops into a seedling”

CONDITIONS NEEDED FOR GERMINATION.

WATER
AIR
TEMPERATURE
ENERGY
VIABILITY
ENZYME.

Germination cannot take place in the absence of one or more of these conditions.
SEED PROPAGATION

“Plant uniformity starts in the germination tray”
Steps for propagation of most species.

1. Calculate the number of seedlings needed per square area, and the percentage seed germination (given on the label) allocate for losses due to pest and diseases.
2. Normally 3 to 10% more seeds is used, 3% for Hybrids and 10% for non-hybrids.
3. Sanitise the propagation area, tools and supplies with 100 ppm chlorinated water.
4. Mix starter solution (if being used) into the sterile growing media.
5. Fill trays uniformly with the selected media, do not compact trays.
Steps con’td

6. Seeds are placed in the centre of the cell and covered lightly with more germination media.

7. The depth will vary depending on the size of the seed, but in general the seed is placed at a depth of 2.5 times its length. Cover all seeds to the same depth so they germinate uniformly.

8. The trays should be wet sufficiently and very gently, until water drops can be seen coming from the holes in the bottom.

9. The trays should then be wrapped completely with a black plastic (germination chamber) and placed in a cool area.
10. Check regularly to avoid etiolation, at least 3 times per day once they reach the recommended time. The germination time will depend on the crop.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Time</th>
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<tbody>
<tr>
<td>Peppers</td>
<td>6-8 days</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>4 days</td>
</tr>
<tr>
<td>Cabbage</td>
<td>3 days</td>
</tr>
<tr>
<td>Melons</td>
<td>3-4 days</td>
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</table>
11. As soon as the first seed germinates, unwrap the trays and place them on a stand until all the seeds germinate (max. 48 hrs after). Apply a light watering at this time as the trays must be kept humid.

12. After the first 48 hrs a heavy watering is required until the water droplets come from the base of the tray.

13. Keep the seedlings in an area where optimum conditions can be provided, which are 10,764 – 16,146 Lux (1000-1500 foot candles of light) and a temperature of 24- 29 Degrees Celsius (75.2 – 84.2 Degrees Farenheit).
Disease Control During Germination and Seedling Stages.

Damping-off: The term given for the death of small seedlings resulting from attack by certain fungi, primarily *Pythium ultimum* and *Rhizoctonia solani*. Damping-off causes serious loss of seeds, seedlings and young plants.

In addition there are a number of fungi, viral and bacterial diseases that are either seed-borne or can be present in the water supply.

Common water related fungi are *Botrytis cineraria* and *Phytophthora* spp.
Damping off occurs at various stages during seed germination and subsequent seedling growth.

1. Pre-emergence damping off: The seed decays or the seedling stem decays before the seedling grows through the surface of the media.

2. Post-emergence damping off: The seedling develops a stem that rots near the surface of the media and falls over.

3. The plant may also remain alive and standing, but the stem will become girdled, the plant becomes stunted and eventually dies.
Treatment for damping off disease.

Disease prevention is critical and it is important to use sterile media and fungicide sprays in an effort to eliminate pathogens during propagation.

If damping-off begins after seedlings are growing, it may be controlled by treating the area of the media with a fungicide mixture which includes metalax (trade name Ridomil) and Thiophanate Methyl ((trade name Topsin) both are applied as a drench.)
TRANSPLANTING

Always start transplanting your best seedling first.

- For tomatoes and peppers the seedling should:
  1. Be 10.2 – 15.2 centimetres (4-6 inches) tall
  2. Have 3-4 true leaves.
  3. Have a plug, which when removed from the seedling tray remains mostly intact.
- Seedlings should also have a short thick stem.
Removing Seedlings from Trays.

- Wet the germination tray completely and squeeze from the bottom to push the seedlings out.

- Hold seedling by the leaves and not by the stem.
Plant Spacing

- Always use correct spacing, especially when growing in protected structures. Example,
  Tomatoes: 2.5-3 plants per square meter/10.76 sq.ft.
  Sweet Peppers: 3 plants per square meter/10.76 sq.ft.
- Too high of a plant density results in lower yields.

Over Crowded plants:
1. Over shade each other.
2. Promote diseases as foliage is usually moist.
3. Do not allow for the easy penetration of spray applications.
Pollination

- Defined as: The transfer of pollen to the female organs of seed plants.
- If pollination is not strong, many flowers and early fruits will drop.
- If the seed embryo is not properly formed the fruit will abort.
- If pollination is poor fruit sizes will be small.
- Earlier flowers tend to give larger fruits, later flowers give smaller fruits as the levels of “Auxins” are reduced.
- Greater the number of seeds the larger the fruit.
OPTIMUM POLLINATION CONDITIONS

- Relative Humidity = 50-70%
- Temperature = 24.4° C (76°F)
- Pollen does not shed at humidity levels 90% or higher.
Fruit Sizing.

- Size reduces as plants get older, due to lower levels of Auxins needed for cell division.
- Cell division increases significantly after petal fall, the size of the fruit is largely determined at this time.
- Cell sizing is a function of translocated food to the fruit.

Any factor resulting in lower production or reduction in translocation will result in reduced fruit size.
Flower/Fruit Drop.

**Occurs when:**

**Plants are stressed.**
- Flowers are within the 1\textsuperscript{st} week of fruit set.
- High temperature inhibits the normal formation of the seed embryo and when pollination of the flower buds is poor, the plant will abort the fruit.
- There is water shortage, poor light, failure in pollination/fertilization.
- Older fruits inhibits the set and growth of younger fruits.
- Plants are too vegetative
Do you see what is wrong in this Picture?
Cat facing as a result of poor pollination
Model 5E846 uses an AA battery to drive a counterweight that, when loosely held, does an excellent job of vibrating the cluster of blossoms. Tomato flowers must be pollinated vigorously to get larger and more uniform fruit by increased seed count.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Wt.</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5E846</td>
<td>Pollinator II (Battery NOT INCLUDED)</td>
<td>0.16#</td>
<td>$14.95</td>
</tr>
</tbody>
</table>
Pollinator attached to a stick to increase reach
Electric Tooth Brush used as a Pollinator
BUMBLEBEES USED TO POLLINATE.
BUMBLEBEES FACTS.

- Increase yields up to 25% over mechanical methods.
- Save 1.5 hours of labor/371.612 m² (4000 ft²)/day by replacing mechanical pollination.
Effectiveness of pollination method.

<table>
<thead>
<tr>
<th>Pollination Method</th>
<th>Fruit/Plant</th>
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<tbody>
<tr>
<td>Elec. Vibration</td>
<td>22</td>
</tr>
<tr>
<td>Air Blast</td>
<td>19</td>
</tr>
<tr>
<td>Shaking</td>
<td>17</td>
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TIME FROM POLLINATION TO HARVEST (DAYS)

- Cucumber - 15-18
- Eggplant - 25-40
- Tomato - 42-45
- Melon - 42-46
- Pepper - 60-70
PLANT SUPPORT SYSTEM
Figure 6. Training for greenhouse tomatoes
Use of Vine Clips
TOMATO HOOKS
Tomato Reel
Leaf Pruning Done prior to Leaning and Lowering.
Tomato Vines leaned and lowered.
Figure 7. Tomato plant at left will be lowered to the position shown at right by re-tying the support string to the horizontal wire.
Tomatoes after lowering.
Greenhouse Crop Diseases.

Major Cause of Disease in Greenhouses.

*High Humidity*

*Poor air circulation*
Greenhouse Humidity.

Optimum = 50 – 70%.

Higher levels - reduced fruit set, increased disease

Lower levels – reduced fruit set
TO REDUCE EXCESS HUMIDITY.

- Increase air circulation - if outside air is 50% and inside 80%.

- For every -6.67°C (20°F) rise in temperature, air water-holding capacity doubles and the relative humidity is reduced by 50%.

- Example: if greenhouse is 15.56°C (60°F) and humidity is 90% (too high), raising temperature to 26.67°C (80°F) will lower humidity to 45% (not practical in Jamaica).
Harvesting Tomatoes.

100-110 days from seeding, then weekly for 8-10 mths.

Physiological maturity of fruit – when any color is present – “first blush”

At “first blush”, abscission layer of fruit stem is complete, (cut off from plant).

No additional water or nutrients are going to the fruit, Fruit ripens on the vine until red.
Harvesting at “First Blush”

**Advantages:**
1. Fewer Cracks.
2. Less Rot
3. Less Labor- can harvest both red and “blush” fruit at same time.

**Final Flavor:** exactly the same, if “blush” fruit are allowed to ripen indoors.
Stages of Ripening of Tomatoes.

**GREEN**
The tomato surface is completely green. The shade of green may vary from light to dark.

**BREAKERS**
There is a definite break of color from green to bruised fruit. Tannish-yellow, pink or red on 10% or less of the tomato surface.

**TURNING**
Tannish-yellow, pink or red color shows on over 10% but not more than 30% of the tomato surface.

**PINK**
Pink or red color shows on over 30% but not more than 90% of the tomato surface.

**LIGHT RED**
Pinkish-red or red color shows on over 60% but red color covers not more than 90% of the tomato surface.

**RED**
Red color shows on over 90% of the tomato surface.
HARVEST AND POST HARVEST MANAGEMENT.

- Reap early morning or late evening, when transpiration is lowest due to lower temperature.
- Reap with care to avoid bruises of fruits and damage to mother plant.
- Always use clean sharp tools for reaping.
- Never over fill crate with produce.
- Reduce field heat in produce in the shortest possible time.
- Never leave reaped produce in the sun.
- Keep produce cool during transportation.
Storage life is shortened by moisture loss and chilling injuries.

Example: Harvested sweet Peppers could be kept at 7-10°C (44.6 – 50°F) and a relative humidity of 95%, temperatures below 7°C (44.6°F) causes chilling injuries.

Storage life of 3-5 weeks can be experienced, with good management.
Reduced fruit quality and appearance.

- High Nitrogen levels and/or low light intensity results in poorly coloured and soft fruits.
- Low levels of Potassium results in poorly coloured and favoured fruits.
- Optimum levels of Calcium results in fruits with thick side walls.
Avoiding Storage Diseases.

Storage diseases may be caused by: Alternaria, Botrytis, Phytophthora rots.

Prevent rots by:
1. Early cool and avoiding cuts and bruises
2. Hot water dips.
3. Application of Antimicrobials.
“Packed to go.”
“That is all for now”