Introduction
This guide covers the principles of growing trellised semi-determinate and indeterminate tomatoes both in the field and greenhouse. Indeterminate tomato plants will carry on growing so long as they are kept healthy. In an ideal greenhouse environment this can be up to 10 months (Holland) so their yield potential is in excess of 400t/ha. The types of trellising in both field and greenhouse are numerous and beyond the scope of this guide.

This guide has been compiled with the intention of helping a prospective grower to get an idea of what is involved in growing these tomatoes. It is basic! BOOKS have been written on the subject.

Site Selection
1. Soils - Tomatoes require a good, well-drained soil for best results. Although they can be grown successfully on most soil types, heavier soils will make nutritional management easier.
2. Aspect - Take note of vegetation that may cause damming of cold air - tomatoes are very cold sensitive. Avoid bottomlands susceptible to frost - a north aspect is best.
3. Rotation - lands with a history of nematode problems or nematode susceptible crops must be avoided as must lands previously planted to solanaceous crops such as tobacco, potatoes, paprika etc. Good crop rotation is essential! Do not plant within 500m of tobacco or paprika and use a minimum of a 3 year rotation following solanaceous crops.
4. Plant rows are best orientated in a north-south direction to allow even illumination and shading of the rows.

Land Preparation
Tomatoes are best grown on raised beds. This improves root aeration, plant growth and together with a policy of organic matter enrichment and minimum till, will dramatically improve the structure of the soil. While contour ridges are essential for erosion control, ensure that they cannot cause pooling of the water between the beds.

New lands should be cross-ripped and beds made up using a tobacco ridger or similar implement. As trellising in the field is easiest with single rows of plants a bed centre-to-centre spacing of 1.2 to 1.5m is suggested. Make the beds 30cm high with a 50cm base. Large clods should be broken down to facilitate weed control through herbicide application. Fertilizer application can take place at bed making but be sure to run a tyne down the centre of the bed to mix up the fertilizer.

Cultivar Selection
Tomato cultivars are described as determinate, semi-determinate, or indeterminate. This guide deals with the semi-determinate and indeterminate as the determinate cultivars do not require trellising and have different management requirements.

Make sure that the cultivar you select fits your marketing requirements with respect to fruit size, days to harvest, harvest period and shelf life. Modern cultivars will have good shelf life but some are bred specifically for extended shelf life that is not of major concern to the Zimbabwe market.

Disease tolerance/resistance varies considerably between cultivars but should not be used as an excuse to avoid crop rotation.

Agronomy
1. Weed Control
Weeds are best prevented rather than controlled once the crop is growing. Use the stale seed bed technique where the weeds are promoted to grow before the crop is planted and then burnt off with a herbicide such as paraquat (Gramoxone). Once the crop is growing little can be done with chemicals to control weeds except for the grasses (use Fusliade or Pilot Super). Mulching with grass or other suitable organic matter will help and also has beneficial effects on water usage, soil organic matter and pest control. An opaque heavy-duty plastic is commonly used in greenhouses.
2. Nutrition
Take soil samples from the intended land at least a month before land preparation and submit to a convenient laboratory to test for N, P, K, Ca, Mg, S, and pH. Fertilizer application will be based on the results of the test. The table listed below is a guide ONLY!

**Base dressing**

<table>
<thead>
<tr>
<th>Compound C</th>
<th>500kg</th>
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</thead>
<tbody>
<tr>
<td>Single Supers</td>
<td>700kg</td>
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</tbody>
</table>

**Top dressings** (in irrigation system) after transplanting for a field crop (kg/ha)

<table>
<thead>
<tr>
<th>week</th>
<th>Potassium nitrate</th>
<th>AN</th>
<th>week</th>
<th>Potassium nitrate</th>
<th>AN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>10</td>
<td>13</td>
<td>100</td>
<td>40</td>
</tr>
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<td>3</td>
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<td>15</td>
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</tr>
<tr>
<td>7</td>
<td>50</td>
<td>40</td>
<td>19</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>9*</td>
<td>70</td>
<td>60</td>
<td>21</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>100</td>
<td>50</td>
<td>23</td>
<td>20</td>
<td>15</td>
</tr>
</tbody>
</table>

*if growing an indeterminate type, then maintain at this level so long as the crop is healthy.

In addition to the above, apply weekly sprays of a micronutrient foliar feed such as Nutrifol®. This may be applied with the weekly copper sprays (see Spray Programme).

Add calcium nitrate to the spray mix at 2g per litre from week 9 to prevent blossom-end rot.

3. Planting
Hybrid tomato seed is expensive! Plants must be grown in containerised trays and planted out into the field. While seedbeds can be used on farm, the plants are stressed during transplanting and breakage will occur. It is far more cost-effective to use a reputable nursery. Plant directly into soil at field capacity and apply irrigation to settle the soil around the roots. Water plant as for tobacco if irrigation is going to be problematic in the first week (ZESA issues). Tomatoes planted so that the cotyledonary leaves, i.e. the first 2 “simple” leaves, are just covered will get away faster than those planted shallower. Planting too deep may cause damping off problems.

Seedlings planted into a moderately heavy soil will need to be watered only every 3 to 4 days during the first 2 weeks. Thereafter irrigate as necessary.

4. Population
Population will vary according to season and cultivar. Semi-determinate cultivars such as Star 9006 should be planted at 16000 plants/ha in summer and up to 24000 plants/ha in winter. Space according to the bed layout e.g. for a 1.2m bed centre and a population of 16000, space the plants at 52cm. Contact the seed house that supplies your chosen cultivar for more information.

5. Irrigation
Best results are achieved with drip irrigation. Whilst it may cause more problems with spider mite, fruit quality will be far superior than from a crop grown under overhead irrigation. Fertilizer will have to be added to the irrigation water. See relevant section above. See your local irrigation equipment supplier for advice on types of drip tape, emitter spacing, filters, pumps etc.

Bring the land up to field capacity prior to planting

6. Trellising
Semi-determinate cultivars will require trellising up to 1.6m depending on their vigour. Check with the seed supplier to see which type you have.
Fitward Farming (Pvt.) Ltd
t/a

Emerald Seedlings

Place anchoring poles at each end of the row and place the intermediate poles 8 to 10m apart. This is best done prior to planting. As the plants grow place a single wire or string around the outside of the poles so that the plants are supported within. Wires/ string will need to be spaced 40 to 50 cm apart.

Indeterminate tomatoes are trellised to an overhead wire using a variety of systems. This is usually placed 2.2m above ground to allow easy access. Bear in mind that the weight of a mature crop of fruit can be substantial so anchor end poles well and use good quality fencing wire.

7. Pruning
While it is not practical to prune the fruit of field-grown tomatoes, indeterminate greenhouse cultivars will benefit from the practice.

Pests & Diseases

1. Pests
Cutworm - can be a problem after planting. Control with a coarse spray of pyrethroid over the top of the transplants.

Nematodes - select a nematode tolerant cultivar and avoid planting after susceptible crops.
Aphids - responsible for the transmission of a number of viruses, aphids must be controlled.

Thrips - also responsible for transmission of viruses.

White-fly - small white insects that gather under the leaf and leave a deposit of sooty mold. Avoid using pyrethroids as this will also kill the predators and promote resistance in the pest.

Spider mites - small, often red coloured mites that crawl slowly on the under side of the leaf. A web may be seen and chlorotic speckling appears when the leaf is viewed from above. The mites weave a fine web on the lower surface of the leaf.

Leaf miner - only spray if economically damaging levels of infestation occur. This pest is heavily parasitized and spraying will kill the predators.

2. Diseases
Early blight (Alternaria solani) - common in young plants grown under prolonged wet conditions. Initiates on the leaves and can spread to the stems and fruit. Spray regularly with copper as a preventative. Choose a resistant cultivar where possible (greenhouse cultivars do not often have resistance). Curatives include mancozeb (Dithane®), chlorothalonil (Bravo® 500) or difenconazole (Score®).

Late blight (Phytophthora infestans) - occurs later in the life of the plant and is prevalent in plants being harvested which have wounds that give access to the fungus. Be alert for signs of the disease (blackening on the tips of the leaves, brown water-soaked lesions) if the crop remains wet for more than 24 hours. This disease can devastate a crop extremely quickly. Regular copper sprays will help reduce the incidence of the disease. Use mancozeb (Dithane®) if conditions become suitable for the disease and spray metalaxyl (Ridomil®) if the disease occurs.

Bacterial wilt - choose a resistant cultivar.

Bacterial speck - regular preventative copper sprays will control this cosmetic disease.

Spray Programme
Always check the label and ensure that the concentration of the active ingredient is what you expect.
## Emerald Seedlings

<table>
<thead>
<tr>
<th>Note</th>
<th>Timing</th>
<th>Trade name</th>
<th>Active ingredient</th>
<th>Target</th>
<th>Rate per 100 litres mix</th>
<th>Pre-Harvest Interval</th>
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<tbody>
<tr>
<td>1.</td>
<td>transplanting</td>
<td>pyrethroid</td>
<td>pyrethroid</td>
<td>cutworm</td>
<td>see label</td>
<td>see label</td>
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<td>2.</td>
<td>weekly</td>
<td>Copper oxychloride</td>
<td>copper oxychloride</td>
<td>general disease</td>
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<tr>
<td>3.</td>
<td>scouting/weather</td>
<td>Dithane® M45</td>
<td>mancozeb</td>
<td>early blight</td>
<td>250g</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>scouting/weather</td>
<td>Ridomil® MZ 72 WP</td>
<td>metalaxyl/mancozeb</td>
<td>late blight</td>
<td>350g</td>
<td>7</td>
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<tr>
<td>5. a)</td>
<td>scouting</td>
<td>Trigard® Tamar® 600 SL</td>
<td>cyromazine/methamidophos</td>
<td>leaf miner</td>
<td>150g/ha</td>
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<tr>
<td>5. b)</td>
<td>scouting</td>
<td>Dithane® M45</td>
<td>mancozeb</td>
<td>early blight</td>
<td>250g</td>
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<tr>
<td>6.</td>
<td>scouting</td>
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<td>7.</td>
<td>scouting</td>
<td>Thiodan® 50 WP</td>
<td>endosulfan</td>
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<td>120g</td>
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<tr>
<td>8. a)</td>
<td>scouting</td>
<td>Dimethoate® 40 EC Dynamec®</td>
<td>dimethoate abamectin</td>
<td>spider mites</td>
<td>100ml</td>
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<tr>
<td>8. b)</td>
<td>scouting</td>
<td>Malathion® 50 EC Dusting sulphur</td>
<td>malathion sulphur</td>
<td>thrips</td>
<td>250ml</td>
<td>7</td>
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<tr>
<td>9. a)</td>
<td>scouting</td>
<td>Nobla® Confidor® 200 SL</td>
<td>fatty acids imidachloprid</td>
<td>whitefly</td>
<td>2%</td>
<td>50ml</td>
</tr>
<tr>
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</tr>
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**Notes:**

1. Coarse spray of pyrethroid over the top of the transplanted seedlings will control cutworm.
2. Weekly sprays of copper oxychloride or Kocide® will help prevent most common diseases. It is NOT a curative or systemic so requires a full cover spray to be effective. Start spraying 2 weeks after transplanting.
3. Use Dithane® at first signs of early blight (*Alternaria*) or when weather conditions are such that an outbreak is likely.
4. Usually occurs later in the life of the plant once harvesting has started. Spray IMMEDIATELY the disease is seen or when weather is persistently wet and plants are not drying out.
5. Spray only if crop is being adversely affected by leaf miner. This pest is heavily predated and excessive spraying will kill off the predators too. Always alternate with another chemical such as Tamar or Dynamec to reduce chance of promoting resistance. The latter are not systemic so a good full cover spray is required for control of the pest.
6. Use a full cover spray of Dimethoate® to control aphids. Alternate with another aphicide if pests persist.
7. A full cover spray of Thiodan® will control most caterpillar spp. Add wetter to get good coverage.
9. Thrips cause cosmetic scarring on the tomato fruit. Essential to add 2g/litre of sugar to the spray mix to act as a feeding stimulant.
10. a) Nobla® is usually sufficient to control whitefly if they become a problem. Use good full cover spray ensuring to spray under the leaves where the pests are found. Do not add a wetter as Nobla® is a surfactant in itself. *Never use a pyrethroid.* If problem persists alternate with Confidor® b) on a weekly basis.

Andrew Roberts
2012

*NB. This guide has been compiled in good faith using a variety of references. The author takes no responsibility for any damage and/or injuries sustained in the growing of a crop. If you are unsure of the effect of a particular treatment or practice, try it first on a small area of the crop.*
Responsible Pesticide Usage

1. All agricultural chemicals must be kept under lock and key and inaccessible to unauthorized personnel - this is a legal requirement.
2. Always read the label before use.
3. Get to know the common names/active ingredients of the chemicals being used e.g. diclorvos is the active ingredient of Dedevap®/DDVP®/Nogos®/Vapona® but the formulations may vary!
4. Where possible use systemic pesticides which will target specific pests and are much easier on the natural predators.
5. Synthetic pyrethroids (Karate/Fenvalerate etc.) are good for cutworm control and occasional use for other pests where nothing else is available. Otherwise they should be avoided.
6. Where repeated spraying is required to control a pest make sure to alternate with unrelated pesticides to avoid promoting resistance. More is NOT better! If a chemical does not work at the correct rate then use another. Likewise, do not be tempted to save money by using lower than the recommended rate – it will likely promote resistance.
7. Always comply with the PHI (pre-harvest interval) when applying pesticides.
8. Make sure the applicators are adequately protected when mixing and spraying. See the Zimbabwe Crop Chemical Handbook for requirements - it is available from ZFC.
9. Ensure that protective equipment is in good order and replaced regularly.
10. DO NOT allow applicators to eat, drink or smoke during chemical application or mixing.
11. Applicators should be checked for organophosphate levels (pseudo cholinesterase test) on a regular basis if they are being exposed to these chemicals.
12. Make sure application equipment is in good working order and replace wearing parts before they break. Spray nozzles should be replaced at least annually – they DO wear out!
13. There is no substitute for good scouting but a lot of pests can be anticipated under specific weather conditions.
14. Do not apply stickers with systemic pesticides – they inhibit the uptake of the pesticide by the plant. Use spreaders/wetters instead.