Vegetable production in a nutshell

Compiled by
L. Allemann and B.W. Young
KwaZulu-Natal Department of Agriculture
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Fertilisation

Ideally, fertiliser recommendations should be based on the results of recent soil analysis done on representative soil samples.

Where vegetable crops are to be grown for the first time, or only sporadically, or on virgin soil, the importance of submitting representative soil samples for analysis and recommendations, has to be emphasised. Analysing the soil before planting each crop, or at least annually, is recommended. Obvious or serious nutrient deficiencies or imbalances may then be corrected before planting, and any lime required could be applied.

Where vegetables have been grown intensively for some time with heavy fertiliser dressings, the soil nutrient status is likely to be more satisfactory. While annual soil analysis would still be beneficial, submitting soil samples for analysis every 2 or 3 years may be adequate. The objectives of such analyses are to correct imbalances of the major nutrients and to economise on fertiliser costs by applying only what is required for the following crop.

Notwithstanding the above, many crops are grown without the soil being analysed. A general fertiliser recommendation is then necessary.

In the high rainfall areas, the soils tend to be inherently infertile and more acid. Liming should be considered in these areas. Because of leaching or non-availability of fixed elements, fertiliser requirements are also likely to be high, unless intensive cropping with adequate fertilisation has been practised for some time.
In drier areas, lime and potassium are less likely to be needed in large quantities, if at all, but phosphorus will probably be deficient in virgin soils. Where this inherent phosphorus deficiency has been corrected by high phosphate dressings, the fertiliser requirements are expected to be relatively low.

Taking the above factors into account, an attempt has been made to give general fertiliser recommendations which cover the expected nitrogen, phosphorus and potassium requirements of the crops dealt with in the following pages.

One recommendation is made for the situation where soil fertility is likely to be high—for example, a history of intensive cropping with good fertiliser practices—and the other where the soil fertility is expected to be inadequate. Obviously, on very poor soils, crop results would be improved by even higher fertiliser application rates.
Beetroot

Climate
Cool-season crop, but growth is slow under cold conditions and plants tend to bolt in spring. Optimum temperatures for growth are 15 to 18 °C. Growth is poor at temperatures below 5 °C or above 24 °C

Soil
Sandy to loamy soils are best. Soils should not be acid. Fairly tolerant to brack or saline conditions

Cultivars
Detroit Dark Red, Crimson Globe, Early Wonder

Growth period
Two to 3 months under warmer conditions. About 4 months when cooler

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Aug–Feb</td>
<td>Aug–Apr</td>
</tr>
<tr>
<td>Warm</td>
<td>Jul–Dec, Feb–Apr</td>
<td>All year round</td>
</tr>
<tr>
<td>Hot</td>
<td>Apr–Sept</td>
<td>Feb–Oct</td>
</tr>
</tbody>
</table>

Spacing
Plant seeds 20 to 40 mm apart, later thinned to 50 to 70 mm, in rows 200 to 300 mm apart
Population
60 to 80 plants/m²

Seeding rate
About 10 kg/ha

Planting
Direct drilled. Thinnings are sometimes transplanted to fill gaps

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application Time</th>
<th>Fertile Soil</th>
<th>Infertile Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 4 and 8 weeks</td>
<td>100 + 100</td>
<td>50 + 50</td>
</tr>
</tbody>
</table>

Pests
Nematodes, cutworm

Diseases
Mainly Cercospora leaf spot

Yield (t/ha)
Conservative: 14
Average: 18
Good: 25
Brinjal (eggplant)

Climate
Warm-season crop, very sensitive to frost and cold. Optimum mean temperatures are 21 to 29 °C. Flowers may be shed at temperatures above 35 °C. Temperatures below 18 °C may be harmful.

Soil
Well-drained loamy soils with high organic matter and at least 400 mm deep are ideal, but the crop is fairly adaptable. pH (KCl) of 5.5 to 6.5

Cultivars
Black King, Black Beauty, Florida Market, Long Purple, Imperial, and Little Fingers

Growth period
Cropping may start 65 to 90 days after transplanting under favourable warm conditions. Harvesting may extend for many months, but the bulk of the crop matures over 2 or 3 months.

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Sept–Oct</td>
<td>Sept–Dec</td>
</tr>
<tr>
<td>Warm</td>
<td>Aug–Oct</td>
<td>July–Jan</td>
</tr>
<tr>
<td>Hot</td>
<td>Aug–Sept, Jan–Apr</td>
<td>Jan–Sept</td>
</tr>
</tbody>
</table>

Spacing
400 to 500 mm x 700 to 1500 mm, often planted in tram-lines
Vegetable production in a nutshell

**Population**
20 000 to 30 000 plants/ha

**Seeding rate**
140 to 200 g for seedlings, 500 g for seedbeds and 2,0 kg for direct sowing

**Planting**
Usually transplanted

**Fertiliser (kg/ha)**

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application Time</th>
<th>Fertile Soil</th>
<th>Infertile Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks (or split, 4 and 8 weeks)</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

**Pests**
Red spider mite, cutworm, American bollworm, nematodes (tip-wilters, aphids and leaf-eating beetles)

**Diseases**
Bacterial wilt, Cercospora or Alternaria leaf spot, botrytis rot

**Yield (t/ha)**
- Conservative: 10 to 15
- Average: 20
- Good: 25
Cabbage

Climate
Frost hardy. Cool, moist conditions are ideal. Optimum temperatures for growth are 15 to 18 °C, with monthly means between 5 and 24 °C. Can withstand temperatures as low as –3 °C. Great variation in tolerance to temperature extremes between cultivars.

Soil
Deep, well-drained, moisture-retentive loamy soils are preferred. Lighter soils are less satisfactory than heavier ones (fertility and moisture requirements are high). Effective rooting depth is 600 mm. Optimum pH 5.3 to 5.8. Acid saturation preferably less than 2.

Cultivars
Heat tolerant: Green Star, Hercules, Star 3001 and others
Cold tolerant: Conquistador, Green Coronet and many others

Growth period
Varies, usually 90 to 130 days from transplanting

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm</td>
<td>Jan–Mar, Aug–Sept</td>
<td>All year round</td>
</tr>
<tr>
<td>Hot</td>
<td>Feb–Apr, Jul–Aug</td>
<td>Feb–Aug</td>
</tr>
</tbody>
</table>

Spacing
350 to 500 mm x 500 to 700 mm
Vegetable production in a nutshell

Population
40,000 to 45,000 plants/ha

Seeding rate
120 to 200 g for seed trays, 300 g for seedbeds and 500 to 2,000 g for direct seeding

Planting
Usually transplanted

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application Time</th>
<th>Fertile Soil</th>
<th>Infertile Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks (or split, 3 and 6 weeks)</td>
<td>600</td>
<td>480</td>
</tr>
</tbody>
</table>

Pests
American bollworm, aphids, diamond-back moth, cabbage webworm

Diseases
Blackleg, black rot, downy mildew, cubroot, soft rot, Sclerotinia rot

Yield (t/ha)
Conservative: 30
Average: 50 to 60
Good: 80+
Vegetable production in a nutshell

**Carrot**

**Climate**
Cool-season crop which can withstand moderate frost and is fairly adaptable to high temperatures of 30 °C and higher. Liable to bolt to seed in spring if subjected to prolonged exposure to temperatures below 5 °C. Optimum temperatures for growth are 15 to 18 °C with monthly means between 7 and 24 °C.

**Soil**
Deep, loose, well-drained, sandy to loamy soils, not subject to capping. Heavy soils, more than 35 % clay, are less suitable. Depth 600 mm, although 400 mm is acceptable, particularly if planted on ridges. Optimum pH 5.0 to 6.0. Free of root-knot nematodes.

**Cultivars**
Cape Market, Fancy, Ideal Red, Kuroda and others.

**Growth period**
Usually 90 to 120 days.

**Sowing time**

<table>
<thead>
<tr>
<th>Area</th>
<th>Ideal Time</th>
<th>Possible Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Jan–Mar, Sept–Nov</td>
<td>Sept–Mar</td>
</tr>
<tr>
<td>Warm</td>
<td>Feb–May, Aug–Oct</td>
<td>Jan–Nov</td>
</tr>
<tr>
<td>Hot</td>
<td>Mar–Aug</td>
<td>Feb–Sept</td>
</tr>
</tbody>
</table>

**Spacing**
20 to 50 mm x 200 to 400 mm.
Population
80 to 150 plants/m²

Seeding rate
2 to 4 kg/ha

Planting
Direct drilled, possibly thinned

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
<th>APPLICATION TIME</th>
<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>500</td>
<td>1 000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks</td>
<td>150</td>
<td>50</td>
</tr>
</tbody>
</table>

Pests
Nematodes, American bollworm, plusia looper, aphids, cutworm, wireworm

Diseases
Leaf spot, soft rot, Sclerotinia rot

Yield (t/ha)
Conservative: 20
Average: 30
Good: 40+
Vegetable production in a nutshell

Chilli (hot pepper)

Climate
Warm-season crop damaged by cold. Optimum mean temperatures are 20 to 30 °C

Soil
Fairly adaptable. Loamy soils, well-drained to at least 400 mm, are ideal

Cultivars
Long Red Cayenne, Long Slim Cayenne, Thai Chilli, Serrano, Spitfire, Super Chilli, Skyline

Growth period
The first green fruits may be picked about 70 days after transplanting. Harvesting may continue for several months, but the bulk matures over 2 or 3 months

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Sept–Oct</td>
<td>Sept–Dec</td>
</tr>
<tr>
<td>Warm</td>
<td>Aug–Oct</td>
<td>Aug–Feb</td>
</tr>
<tr>
<td>Hot</td>
<td>Jul–Oct, Jan–Feb</td>
<td>July–Mar</td>
</tr>
</tbody>
</table>

Spacing
300 to 500 mm x 500 to 750 mm
**Population**
30 000 to 45 000 plants/ha

**Seeding rate**
150 to 200 g for seed trays; 200 to 300 g for seedbeds

**Planting**
Transplanted

**Fertiliser (kg/ha)**

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application Time</th>
<th>Fertile Soil</th>
<th>Infertile Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks (or split, 4 and 8 weeks)</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

**Pests**
Mainly nematodes and red spider mite. Also American bollworm, cutworm, aphids, beetles, thrips

**Diseases**
Virus and bacterial wilt. Also other wilt diseases, powdery mildew and various fruit spots

**Yield (t/ha)**

<table>
<thead>
<tr>
<th></th>
<th>Green</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conservative:</td>
<td>Conservative:</td>
</tr>
<tr>
<td>Green</td>
<td>5 to 7</td>
<td>1,5</td>
</tr>
<tr>
<td>Average</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Good</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>
Trailing cucurbits (butternuts, gems, hubbards, pumpkins)

Climate
Warm-season crops, very sensitive to frost and low temperatures. Optimum temperatures for growth are 18 to 30 °C, with monthly means between 10 and 32 °C. At very high temperatures (above 35 °C) male flowers sometimes predominate, resulting in fewer fruit for that period.

Soil
Well-drained loamy soils. Ideally deeper than 1 000 mm, but 450 mm is acceptable. Optimum pH 6.0 to 7.0

Growth period
Gems 85 to 95 days
Butternuts 90 to 100 days
Hubbards 100 to 115 days
Pumpkins 120 to 130 days

Storing
One to 3 months when mature

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Oct</td>
<td>Sept–Dec</td>
</tr>
<tr>
<td>Warm</td>
<td>Sept–Nov</td>
<td>Aug–Jan</td>
</tr>
<tr>
<td>Hot</td>
<td>Aug–Dec</td>
<td>Jul–Mar</td>
</tr>
</tbody>
</table>

Late plantings may be infected with virus, through insect vectors, at early growth stage, and crop will be affected adversely.
Spacing
Gems and butternuts: 300 to 500 mm x 1 200 to 1 800 mm
Hubbards and pumpkins: 500 x 2 000 to 2 700 mm

Seeding rate
Gems and butternuts: 2 to 3 kg
Hubbards and pumpkins: 4 to 6 kg

Planting
Direct seeded; usually 2 to 3 seeds per site, thinned to 1 plant. Occasionally grown in seed trays

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
<th>APPLICATION TIME</th>
<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

Pests
American bollworm, pumpkin fly, ladybird, aphids, nematodes

Diseases
Powdery mildew, leaf spot, fruit rot, mosaic

Yield (t/ha)
Conservative: 12 to 15
Average: 17 to 20
Good: 25+
Green bean (bush type)

Climate
Warm-season crop, susceptible to cold and light frost. Optimum temperatures for growth are 15 to 21 °C, with monthly means between 10 and 27 °C. Temperatures below 12 °C or above 3 °C affect fruit set and quality. Cultivars differ slightly.

Soil
Well-drained sandy to loamy soils, not subject to capping (crusting). Depth 400 mm. Optimum pH 5.3 to 6.0. Very sensitive to brack conditions. Soil must be free of root-knot nematodes.

Cultivars
Contender, Espada, Provider, Wintergreen (latter tolerates cooler conditions).

Growth period
Usually 50 to 60 days to first pick. Pick over 10 to 15 days.

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Oct–Nov, Jan</td>
<td>Sept–Feb</td>
</tr>
<tr>
<td>Warm</td>
<td>Sept–Oct, Jan–Feb</td>
<td>Aug–Mar</td>
</tr>
<tr>
<td>Hot</td>
<td>Mar–Aug</td>
<td>Feb–Sept</td>
</tr>
</tbody>
</table>

Spacing
40 to 70 mm x 450 to 600 mm
Vegetable production in a nutshell

**Seeding rate**
60 to 100 kg

**Planting**
Direct drilled

**Fertiliser (kg/ha)**

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application time</th>
<th>Fertile soil</th>
<th>Infertile soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>250</td>
<td>500</td>
</tr>
<tr>
<td>LAN</td>
<td>At 3 weeks</td>
<td>250</td>
<td>200</td>
</tr>
</tbody>
</table>

**Pests**
Nematodes, American bollworm, aphids, CMR and chafer beetles, plusia looper, red spider mite, bean flies, snails

**Diseases**
Rust, common and halo blights, Sclerotinia rot, root rot

**Yield (t/ha)**
Conservative: 5
Average: 7 to 8
Good: 11+
Green pea

Climate
Cool-season crop. Plants can withstand moderate frost, but flowers and young pods are sensitive. Optimum monthly mean temperatures are 15 to 18 °C. Growth ceases below 5 °C. Prolonged moist spells favour foliage diseases.

Soil
Cool, well-drained, medium to heavy loams are preferred, but will grow successfully on a wide range of soil types.

Cultivars
Garden peas: Cape Freezer, Dark Skinned Perfection, Green-feast, Kelvedon Wonder and Onward

Edible podded peas: Oregon Sugar Pod II is grown for its edible pods, picked before the seeds swell. Sugar Daddy is grown for its edible pods, picked after the seeds have swollen.

Growth period
Growing period is mainly determined by prevailing temperatures. Generally 100 to 120 days, picked at about 3 weeks.

Sowing time
In most areas from May to June.
In areas which experience late frost or where summers are cool, plant in July.
In cool frost-free areas plantings may start in March.
Spacing
For the fresh market, plant seeds 20 to 40 mm deep, and about 50 mm apart, in rows 600 mm apart. Planting in twin rows, spaced 200 mm apart, instead of single rows, is recommended

Seeding rate
50 to 100 kg/ha

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>Fertiliser</th>
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</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>250</td>
<td>500</td>
</tr>
<tr>
<td>LAN</td>
<td>At 4 weeks</td>
<td>75</td>
<td>25</td>
</tr>
</tbody>
</table>

Irrigation
Critical times for irrigation are at very early flowering stage and again at pod swell. Avoid any drought stress from flowering onwards

Pests
Various caterpillars are the major pests

Diseases
Ascochyta leaf, stem and pod rot under moist conditions, downy mildew, mainly on young plants, powdery mildew, mainly on bearing plants

Yield (t/ha)
Conservative: 3
Average: 5 to 6
Good: 8+
Lettuce

Climate
Cool-season crop. Optimum temperatures for growth are 15 to 18 °C, with monthly means between 7 and 24 °C. Can withstand only light frost, especially at heading stage, when lettuce is also susceptible to sun-scald. Hot, moist conditions favour head rots. Temperatures above about 30 °C tend to induce seeding. Cultivars differ greatly in tolerance to high temperatures.

Soil
Well-drained soils, from light sandy to heavy clay. Depth ideally 600 mm, but 400 mm is acceptable. Optimum pH 5.0 to 6.0.

Cultivars
Commander, Summer Gold, Emperor (tolerates higher temperatures), Victory, Greenway, Frosty, Winter Crisp, and many more.

Growth period
Usually 55 to 90 days from transplant.

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm</td>
<td>Feb–Apr, Jul–Sept</td>
<td>Jan–Oct</td>
</tr>
<tr>
<td>Hot</td>
<td>Apr–May</td>
<td>Mar–Jul</td>
</tr>
</tbody>
</table>

Spacing
300 to 400 mm x 400 to 600 mm
Vegetable production in a nutshell

Population
60 000 to 80 000 plants/ha

Seeding rate
300 to 500 g for seed trays, 500 g for seedbeds and 1 500 to 3 000 g for direct sowing

Planting
Usually transplanted, sometimes direct seeded and then thinned

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
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<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
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<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>500</td>
<td>1 000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 4 weeks</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

Pests
American bollworm, nematodes, snails, cutworm, aphids

Diseases
Downy mildew, leaf spot, soft rot, mosaic, spotted wilt

Yield (t/ha)
Conservative: 12 to 15
Average: 20 to 25
Good: 30+
Madumbie

Climate
Tropical, subtropical and temperate areas with long frost-free periods. Optimum temperature range for growth is 21 to 27 °C. High humidity preferred, with well-distributed summer rainfall of 1 000 mm and more, or supplemental irrigation

Soil
Fertile sandy to loamy soils, often planted along stream banks, but is tolerant of upland conditions. High organic content preferred, soil pH 5.5 to 6.5

Cultivar
No selections available in South Africa. Most growers store some of their crop for replanting

Seed quality
No seed corm industry presently exists

Growth period
Matures in 200 to 270 days from planting

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
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</thead>
<tbody>
<tr>
<td>Cool</td>
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</tr>
<tr>
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<td>Sept</td>
<td>Aug–Nov</td>
</tr>
<tr>
<td>Hot</td>
<td>Jul–Sept</td>
<td>Jul–Oct</td>
</tr>
</tbody>
</table>

Spacing
900 mm rows, 300 to 450 mm within rows, depending on expected growth vigour
**Population**
25 000 to 37 000 plants/ha

**Seeding rate**
Sprouted corms or cormels, mass of 25 to 75 g, total 1.5 t/ha

**Planting**
Plant in furrows to give 50 to 80 mm soil depth after covering. If water-table is high (stream banks), plant on ridges to make harvesting easier. Plant August to October

**Special practices**
Slightly ridge plants after topdressing

**Fertiliser**
If no soil analysis: broadcast lime before final soil preparation. At planting apply 1 100 kg 2:3:2(22)/ha in the row, topdress about 14 weeks later with 175 kg 1:0:1(36)/ha

**Pests**
Usually few obvious insect problems. Aphids, thrips and root-knot nematodes can be troublesome, as can red spider mite under dry conditions

**Diseases**
Leaf spots, soft rot, Sclerotium tuber rot. Dasheen mosaic virus is likely to be present

**Yield (t/ha)**
Average: 5 and 10
Good: 15+
Onion

Climate
Frost tolerant. Cool conditions during vegetative growth and hot, dry conditions nearing maturity, in early summer. Optimum temperatures for growth are 12 to 24 °C, with monthly means between 7 and 29 °C. Rainy spells in late spring and early summer reduce quality, especially keeping quality. Bulb formation is influenced by day length—grow short-day cultivars only.

Soil
Sandy to clayey soils suitable. Depth 600 mm if direct drilled or 450 mm for transplants. Optimum pH 5.0 to 6.0.

Cultivars
Granex types, Hojem, Pyramid, Texas Grano.

Growth period
180 to 230 days from sowing.

Sowing time

<table>
<thead>
<tr>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb–Mar</td>
<td>Jan–Apr</td>
</tr>
</tbody>
</table>

Early sowings tend to produce larger bulbs, but more bolters and split bulbs. Mid-February to mid-March plantings are advised for all areas.

Transplant in May (Apr–Jun).

Spacing
50 to 80 mm x 200 to 400 mm.
Vegetable production in a nutshell

Seeding rate
2 to 2.5 kg for seed trays, 3 to 5 kg for seedbeds, 6 to 8 kg for direct drilling

Planting
Usually transplanted

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application time</th>
<th>Fertile soil</th>
<th>Infertile soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>500</td>
<td>1000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 to 8 weeks</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>(or split, 4 and 8 weeks)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pests
Thrips

Diseases
Downy mildew, purple blotch, leaf mould, black mould, soft rot, bulb rot

Yield (t/ha)
Conservative: 15 to 20
Average: 25 to 30
Good: 40+

Note: Production is best under irrigation in areas where conditions are hot and dry during August to November
Potato

Climate
Sensitive to frost. Optimum temperatures for growth 15 to 18 °C, with monthly means between 7 and 24 °C

Soil
Well drained, well aerated and moisture retentive, with high fertility. Sandy loam to loamy soils are preferred; high clay content causes harvesting problems. Tolerates acid soil, pH 4.3 to 6.1. High pH promotes scab disease. Rooting depth 500 mm

Cultivars
BP1, Up-to-Date, Vanderplank, Buffelspoort, Astrid, Hoëvelder, Mnandi

Seed quality
Certified seed potatoes

Growth period
105 to 150 days

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Aug–Oct, Jan</td>
<td>Jul–Feb</td>
</tr>
<tr>
<td>Warm</td>
<td>Jul–Sept, Feb</td>
<td>Jun–Mar</td>
</tr>
<tr>
<td>Hot</td>
<td>Mar–Jun</td>
<td>Feb–Sept</td>
</tr>
</tbody>
</table>

Spacing
200 to 450 mm x 700 to 1 000 mm, depending on seed size and equipment
Vegetable production in a nutshell

Population
130 000 to 150 000 stems/ha for table potatoes; 160 000 stems/ha for seed potatoes

Seeding rate
100 to 120 x 30 kg pockets/ha

Planting
Direct

Special practices
Ridging when tuber initiation commences

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
<th>APPLICATION TIME</th>
<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>600</td>
<td>1 200</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 to 8 weeks</td>
<td>500</td>
<td>350</td>
</tr>
</tbody>
</table>

Pests
Nematodes, aphids, tuber moth, millipedes, cutworm, wireworm, black maize beetle

Diseases
Early blight, late blight, leaf roll, mosaic, common scab, bacterial wilt, soft rot, Fusarium wilt, dry rot, black dot, silver scurf, black scurf

Yield (t/ha)
Conservative: 16
Average: 28
Good: 45
Sweet pepper

Climate
Sensitive to frost or cold. Optimum mean temperatures are 20 to 27 °C. Temperatures above 32 °C may cause shedding of flowers. Growth becomes progressively poorer at temperatures below 15 °C. Sunscald can be a problem. Prolonged cloudy weather is harmful.

Soil
Fairly adaptable, provided drainage is good up to a depth of 400 mm. Humus-rich loams are preferred.

Cultivars
California Wonder, Jupiter, Pip, Florida Resistant Giant, Keystone Resistant

Growth period
First fruits attain full size (green) within 70 to 80 days after transplanting. May take 3 to 5 weeks extra to reach mature colour (red or yellow). Harvesting may extend for several months, but is generally discontinued after about 2 months when the bulk of the crop has been picked.

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Sept–Oct</td>
<td>Sept–Nov</td>
</tr>
<tr>
<td>Warm</td>
<td>Aug–Oct</td>
<td>Aug–Jan</td>
</tr>
<tr>
<td>Hot</td>
<td>Jul–Sept, Feb</td>
<td>Jul–Mar</td>
</tr>
</tbody>
</table>

Spacing
400 to 500 mm x 500 to 1 000 mm, usually in tram-lines
Population
25 000 to 45 000 plants/ha

Seeding rate
150 to 200 g for seed trays; 200 to 300 g for seedbeds

Planting
Transplanted

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
<th>APPLICATION TIME</th>
<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 4 to 8 weeks</td>
<td>225 + 225</td>
<td>175 + 175</td>
</tr>
</tbody>
</table>

Pests
Mainly nematodes and red spider mite. Also American bollworm, cutworm, aphids, beetles, thrips

Diseases
Virus and bacterial wilt. Bacterial spot, powdery mildew, other wilts and soft rot may occur

Yield (t/ha)
Conservative: 15
Average: 25
Good: 40+
Sweet potato

Climate
Very sensitive to frost and cold. Requires hot days and warm nights for optimum growth, with mean monthly temperatures of 21 to 29 °C

Soil
Sandy to loamy soils are preferred. Good drainage to at least 500 mm is essential. Heavy soils produce misshapen roots and favour root rots

Cultivars
Blesbok, Bosbok, Impala, Brondal, Koedoe, Mafutha and Ribbok

Growth period
Usually 4 to 5 months. May be harvested earlier, when tubers have attained a satisfactory size, but yields will be reduced. Where soil temperatures remain above 0 °C and top growth stays green, the crop may be left in DRY soil, and harvested as required

Sowing time

<table>
<thead>
<tr>
<th>AREA</th>
<th>IDEAL TIME</th>
<th>POSSIBLE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Nov</td>
<td>Oct–Nov</td>
</tr>
<tr>
<td>Warm</td>
<td>Nov–Dec</td>
<td>Oct–Feb</td>
</tr>
<tr>
<td>Hot</td>
<td>Jan–Mar, Aug–Oct</td>
<td>Aug–Mar</td>
</tr>
</tbody>
</table>

Spacing
Usually 300 mm apart in rows about 1 000 mm apart
Vegetable production in a nutshell

Planting material
300 to 400 mm long, healthy vine cuttings. Use virus-tested material

Population
30 000 to 35 000 plants/ha

Planting
Best on ridges, 300 to 400 mm high. The lower half of the cuttings should be covered by soil

Fertiliser (kg/ha)

<table>
<thead>
<tr>
<th>FERTILISER</th>
<th>APPLICATION TIME</th>
<th>FERTILE SOIL</th>
<th>INFERTILE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>LAN</td>
<td>At 6 weeks</td>
<td>250</td>
<td>150</td>
</tr>
</tbody>
</table>

Irrigation
Survive dry conditions when well established, but irrigation necessary for good yields

Pests
Nematodes are a major problem. Weevils, hawk moth larvae, leafminers, red spider mite and soil insects can cause damage

Diseases
Virus degeneration is the main problem. Post-harvest tuber rots of uncured tubers can cause great losses

Yield (t/ha)
Conservative: 15 to 20
Average: 30
Good: 40+
Swiss chard (often called spinach)

Climate

Cool-season crop. Does best at temperatures between 7 and 24 °C. Can withstand light frost. Under high temperatures leaves remain small and inferior. Foliage often affected by leaf spots in late summer. Tends to run to seed in spring if subjected to winter cold.

Soil

Highly adaptable, provided soils are well drained to about 500 mm.

Cultivars

Fordhook Giant, Lucullus

Growing period

First harvest may take place within 2 months. Harvesting can extend for several months, but should last for 2 to 3 months.

Sowing time

<table>
<thead>
<tr>
<th>Area</th>
<th>Ideal Time</th>
<th>Possible Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>Aug–Nov, Feb</td>
<td>Aug–Mar</td>
</tr>
<tr>
<td>Warm</td>
<td>Jul–Nov, Feb–Mar</td>
<td>Jul–Apr</td>
</tr>
<tr>
<td>Hot</td>
<td>Mar–Aug</td>
<td>Feb–Oct</td>
</tr>
</tbody>
</table>

Spacing

200 to 300 mm x 450 to 600 mm
Vegetable production in a nutshell

Population
60 000 to 80 000 plants/ha

Seeding rate
7 to 9 kg/ha for direct seeding

Planting
Generally direct seeding and later thinned to stand. Transplant easily, but cropping is delayed. Thinnings often used for transplanting

Fertiliser (kg/ha)

<table>
<thead>
<tr>
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<tr>
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<td>500</td>
<td>1 000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 4 and 8 weeks</td>
<td>225 + 225</td>
<td>175 + 175</td>
</tr>
</tbody>
</table>

Pests
Nematodes, cutworm, American bollworm, loopers and aphids

Diseases
Fungal foliar diseases, especially Cercospora leaf spot

Yield (t/ha)
Conservative: 10
Average: 20
Good: 30
Table tomato

Climate
Very sensitive to frost. Optimum temperatures for growth are 20 to 25 °C, with monthly means between 18 and 27 °C. Temperatures below 12 °C and above 35 °C affect fruit set and fruit quality detrimentally, as do prolonged cloudy conditions. Cultivars differ slightly.

Soil
Ideally soils should be well drained to a depth of at least 1 200 mm, although 600 mm depth is acceptable. Tomatoes are fairly adaptable to texture, with 15 to 35 % clay being ideal. Moderately tolerant to soil acidity; ideal pH 5,0 to 6,0. Soil should be free of root-knot nematodes.

Cultivars
Floradade, Karino, Rodade, Star 9001, Zeal, Zest

Growth period
Usually about 90 days to first pick, with a picking season of about 80 days.

Sowing time

<table>
<thead>
<tr>
<th>Area</th>
<th>Ideal time</th>
<th>Possible time</th>
</tr>
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<tbody>
<tr>
<td>Cool</td>
<td>Oct</td>
<td>Sept–Nov</td>
</tr>
<tr>
<td>Warm</td>
<td>Sept–Nov</td>
<td>Aug–Dec</td>
</tr>
<tr>
<td>Hot</td>
<td>Feb–Jul</td>
<td>Jan–Jul</td>
</tr>
</tbody>
</table>

Spacing
300 to 500 mm x 1 500 to 2 500 mm
Vegetable production in a nutshell

**Population**
12,000 to 16,000 plants/ha

**Seeding rate**
100 to 200 g for seed trays; 200 to 300 g for seedbeds; and 500 to 750 g/ha for direct seeding

**Planting**
Normally transplanted

**Fertiliser (kg/ha)**

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Application Time</th>
<th>Fertile Soil</th>
<th>Infertile Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:3:4(30)</td>
<td>At planting</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>LAN</td>
<td>At 3 and 6 weeks</td>
<td>250 + 250</td>
<td>200 + 200</td>
</tr>
<tr>
<td>KNO</td>
<td>At 6, 9 and 12 weeks</td>
<td>100 + 100 + 100</td>
<td>100 + 100 + 100</td>
</tr>
</tbody>
</table>

Ideally, the 2:3:4(30) fertiliser should be replaced with chlorine-free fertilisers

**Pests**
Nematodes, American bollworm, American leafminer, aphids, red spider mite, plusia looper, mites

**Diseases**
Early blight, late blight, grey mould, leaf mould, powdery mildew, fruit rot, soft rot, bacterial canker, bacterial spot, bacterial speck, bacterial wilt, Fusarium wilt, anthracnose, Septoria leaf spot, mosaic, spotted wilt

**Yield (t/ha)**
Conservative: 30
Average: 40 to 50
Good: 80+