Fruits and Vegetables

1. Broccoli
2. Cabbage
3. Cantaloupe
4. Carrot
5. Cauliflower
6. Celery
7. Corn
8. Cucumber
9. Hot Pepper
10. Lettuce
11. Parsley
12. Passion fruit
13. Pineapple
14. Pumpkin
15. Salad Beans
16. Sweet Peppers
17. Tomato
18. Watermelon

TECHNOLOGY PACKS

CUCUMBER

November 2015

Background

Production decisions concerning how much effort and resources to invest and which farming practices to follow, have consequences and create opportunities for the farm affecting production levels, input costs, time constraints, and the potentially size of the operation. They also may have implications for resource use and environmental quality.

Numerous information exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and climate change that impact on the environment and rural livelihoods. These issues are also closely related to the importance of the role of primary producers in increasing the earnings of all actors along the value chain in supporting the development of a commercially viable and sustainable agricultural industry.

The production of high quality and easily understood information packages is critical as this forms a basis for farmers to obtain financing from lending institutions and to efficiently increase their production through the availability of modern technology. This will also result in a reduction of rural unemployment and will greatly help in alleviating poverty and other associated social ills.

TECHNOLOGY PACKS

CUCUMBER

November 2015

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Table of Contents

Introduction

This Technological Package (Tech Pack) deals with the production and postharvest aspects of cucumber.

Also included in the Tech Pack are appendices:

- Template for cost of production
- List of recommended pesticides and application rates
- Good Agricultural Practices data record sheet.

Notwithstanding the identification of any specific pesticide for the control of pests and diseases, this decision is for the discretion of the Ministry of Agriculture Area Extension Officer and the farmer.

However, the mention of any pesticides and other products used in the Tech Pack should strictly comply with local regulations and all instructions provided by the manufacturer. Also, the use of trade names in the Tech Pack is for the purpose of citing examples and is not meant to either endorse or discredit any particular product.

Botanical Description

Cucumber (*Cucumis sativis*) belongs to the family Cucurbitaceae. The local name in Creole is Konkonm. It is a creeping vine that bears cylindrical fruits that are used as culinary vegetables. It is a good source of vitamin K, B vitamins, copper, potassium, vitamin C, and manganese.

Ecology and Environment

Cucumber can be grown year-round locally. The optimum temperature for growth is about 850F (300C), while the optimum night temperature is 65 - 70ºF (18 - 21ºC). The soil should be fertile and rich in organic matter with a pH ranging from 6.5 to 7.5.

Varieties/Cultivars

Recommended varieties are Poinsett, Vlaspik, Ureka, Cortezed and Dasher II.

Seedling Production

In order to produce strong and healthy seedlings, establish a seedling nursery, specifically for seedling production. The area should comprise two sections:

1. A seed germination section which is covered with solid roof to protect the germinating seeds from sun and rain
2. A hardening section with a transparent roof or netting that allows for the penetration of light for hardening the seedlings. Hardening protects seedlings from transplanting shock when planted in the field.

The entire nursery area should be weed free and preferably totally screened with polyvinyl insect netting to protect seedlings from any insect attack and/or transmitted insect diseases. Seeds are

sown either in seedling trays containing peat moss as the growing medium or in peat moss blocks (Plates 1 & 2).

Though seeds can be directly sown in the field, the success of germination and survivability of most seeds is not guaranteed as both soil pests and diseases can affect them. To achieve 95 - 100% seed germination and strong and healthy seedlings, seedlings produced in nurseries is the preferred option.

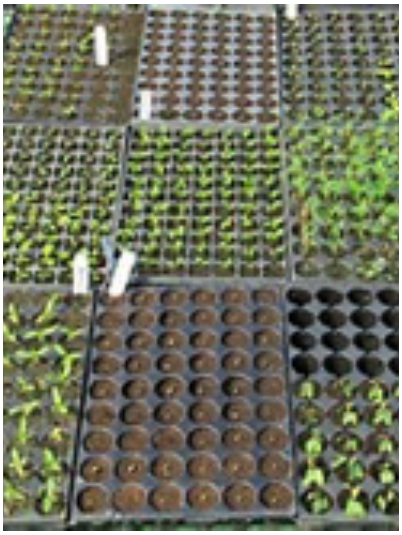

Plate 1 Seedling production in seed trays

Plate 2 Seedling production in nursery

Plate 3 Hardening seedlings

The following practices should be adopted in the production of strong healthy cucumber seedlings:

- When purchasing seed material obtain from a reputable source
- Read the label on the seed package. Ensure that the seeds are 90 - 100% viable which must be indicated on the label and is in keeping with the expiratory date
- Use seedling trays for sowing seeds. Ensure that they are sterilized by immersing into commercial bleach solution 1 tablespoon/gallon (5 cc/litre) of water
- Use peat moss as the planting medium
- Treat the planting medium with a broad spectrum fungicide, 6 ounces of Banrot in 15 gallons of water (170 g/68 litres), before placing in trays
- Seedling trays should be placed on raised platforms
- Make a planting hole in each cell and plant one seed per hole
- Water seeds to aid germination
- Spread peat moss lightly ensuring that the seeds are covered
- Cover trays with saran netting to hasten germination
- Place trays in the seed germination section of the nursery
- Remove the covering of saran netting at the first sign of germination
- Water seedlings at least twice per day

- Apply plant nutrient as a foliar spray once per week when seedlings are ½ inch (1.2 cm) in height
- Spray seedlings with insecticide and fungicide once per week for pest and disease control
- Apply fertilizer solution, Tropi-Gro 1 tablespoon/gallon (5 cc/litre) of water twice per week when seedlings are 1 inch (2.5 cm) in height
- Harden seedlings by placing them in the hardening section of the nursery for 3 hours during the early morning and late evening, for 2 - 3 days (Plate 3)
- Expose seedlings to full days of sunlight until ready for transplanting
- Transplant seedlings when they are 3 inches (7.6 cm) tall.

Land Preparation

Two types of production systems are used for growing cucumber "Open Field" or under "Protected Agriculture".

In the "Open Field" production system, the land should be manually prepared or mechanically ploughed and rotavated to give a fine tilth. Ridges should be formed 3 feet (1 m) apart or cambered beds 9 feet (3 m) wide or mounds in rows 3 feet (1 m) apart (Plate 4). Soil should be left uncovered or covered with a ground cover (preferably black plastic mulch).

Plate 4 "Open Field" land preparation

With "Protected Agriculture" the land should be manually prepared or mechanically rotavated to a fine tilth and formed into 4 foot (1.2 m) beds (Plate 5). Soil should be left uncovered or covered with a ground cover (preferably black plastic mulch).

Plate 5 Prepared land under "Protected Agriculture"

Spacing and Planting

Direct seeding is not recommended as birds, rats and insects can eat the seeds. In the "Open Field" production system, seedlings are transplanted in the field at the first new leaf stage (12 - 15 days after sowing); larger seedlings do not transplant well. In transplanting, care should be taken not to disturb the roots when removing from seedlings trays and placing in the soil because root recovery is very slow.

In the "Open Field" production system, seedlings should be spaced 3 feet (1 m) apart along the ridge giving a population of 12,000 plants/acre (30,000 plants/ha), with vines allowed to run along the ground. Alternatively, ground cover may be used to cover the ridges before planting as a weed control measure (Plate 6).

Under the protected structures seedlings are spaced along the beds 3 feet x 3 feet (1 m x 1 m) with a trellis system consisting of a twine fixed vertically to each plant vine for climbing (Plate 7).

Plate 6 Cucumber seedlings planted in the "Open Field" system

Plate 7 Cucumber seedlings planted under a "Protected Agriculture" system

Irrigation

Irrigation water, especially from streams and ponds, should be sent for analysis to ensure that the water is not polluted or saline, and of good quality for irrigation. Cucumbers can be grown year-round but perform best in the dry season due to the low incidence of pests and diseases. However, supplemental water is required for optimum production in the dry season. The amount of water and the frequency of irrigation are dependent upon weather conditions and the amount of water the soil can hold. More water and more frequent application is needed on sandy soils than on heavier soils.

Excessive application of water must be avoided on soils that drain well since nutrients such as nitrates can be leached out of the spoil. This can result in low yield. In heavier soils water logging should be avoided.

The most efficient method is to supply water using a drip irrigation system (Plate 8), particularly under "Protected Agriculture". Such a system will provide an adequate supply of water without wetting the foliage, which promotes the development of diseases. Overhead irrigation can also be used but may result in low yields due to flower drop at time of flowering. Soon after transplanting, seedlings should be watered thoroughly.

Plate 8 Drip irrigation in cucumbers

Fertilization

Specific kinds and rates of fertilizers must be determined from the results of soil and leaf analyses. Composted manure if available should be applied to the soil to help with the uptake of nutrients from inorganic fertilizers; it adds organic matter to the soil, enhances soil structure and growth of micro-organisms. All manure should be well composted to ensure that harmful microorganisms and weed seeds are destroyed.

Apply a complete fertilizer at time of transplanting at the rate of 150 lbs/acre (170 kg/ha) by band placement 2 - 3 inches (5 - 7 cm) to the side of the seedlings at a depth of 2 - 3 inches (5 - 7 cm). As vine growth increases apply nitrogen fertilizer at the rate of 50 - 70 lbs/acre (55 - 80 kg/ha). Irrigate the soil after application of fertilizer as this helps to dissolve the fertilizer and prevent root injury. With "Protected Agriculture" NPK fertilizer (20:20:20) is applied every week at the rate of 0.5 gallons/hour (2l/hr) through a drip line fertigation system.

Weed Control

Weed control is very important for producing a successful crop. At the early stages of growth it is necessary to weed until the vines are well established. Dacthal W-75 can be applied at the rate of 10 lb/acre (11 kg/ha) before transplanting, however the soil must be moist at the time of application. During the early stages of crop growth young plants should be manually weeded followed by chemical weed control with a contact herbicide; protect against herbicide drift by using a shield. Under "Open Field" and "Protected Agriculture" systems where plastic mulch is used (Plate 9), weeds are suppressed and do not require manual or chemical weed control.

Plate 9 Use of plastic mulch for weed control

Pests and Diseases

The major pests and diseases, symptoms and control/management affecting cucumber are indicated in Table 1.

Table 1 Causal agents, symptoms and control of pests and diseases of cucumber

Pest & Diseases	Symptoms	Control/ Management
 Plate 10 Leaf Miner	Leaf Miners are the larvae of various beetles, flies, moths and sawflies. The adult lays eggs on the leaf and the larvae burrow into the leaf and tunnel through it, feeding and leaving a transparent trail. If you look closely, you can often see a dark dot at the end of one of the lines.	Apply contact and systemic insecticides.
 Plate 11 Aphids	Aphids cause damage by sucking plant sap, which causes heavily infested leaves to curl and stunts plants.	Use a contact or systemic insecticide.
 Plate 12 Spider Mite	Symptom appears as pale yellow and reddish-brown spots ranging in size from small specks to large areas on the upper sides of leaves. Damage can develop very quickly and the mites can kill or seriously stunt the growth of plants.	Use a contact or systemic insecticide.

Pest & Diseases	Symptoms	Control/ Management
 Plate 13 Caterpillars	Young larvae scarify the leaves and older larvae eat irregular shaped holes of various sizes. Loopers can kill young plants if they destroy the growing point, or they can cause branching in brassicas by early feeding on the growing point.	These pests can be controlled using a contact or systemic insecticide. Before harvest, use insecticides with a short harvest interval of 5 to 7 days e.g. Dipel (Bacillus thuringiensis).
 Plate 14 Cutworms	The larvae live in the soil. They usually emerge from the soil at night and cut the seedling at the base close to the soil surface damaging the entire plant.	Apply a contact or soil insecticide.
 Plate 15 Downy Mildew caused by the fungus *Pseudoperonospora cubensis*	The symptoms are angular, chlorotic lesions on the foliage.	Chemical control with fungicides. The best method of control is the use of resistant varieties.
 Plate 16 Powdery Mildew caused by the fungus *Erisiphe cichoracearum*	Characterized by white or grey powdery spots on the surface of the leaves. The mildew spreads rapidly. Eventually, the leaves turn completely white, shrivel and die.	Control can be achieved through the use of copper and sulphur contact fungicides. Also application of systemic fungicide is highly effective.

Pest & Diseases	Symptoms	Control/ Management
 Plate 17 Angular Leaf Spot caused by the *Pseudomonas syringae pv. lachrymans* bacterium	The disease begins as water-soaked areas on the leaves which later dry and turn tan or grey. A yellow halo may surround a damaged area, or spot. Over time, the centres of the spots fall out leaving holes in the leaves. Lesions on the cucumber fruits begin as small, soft water-soaked spots and become dry, chalky and cracked.	The disease can be controlled by adopting good sanitation measures. Use fungicides containing copper. After harvesting cucurbits, do not plant another cucurbit crop for 2 years.
 Plate 18 Anthracnose caused by a fungus *Colletotrichum orbiculare*	Symptoms are water soaked brown spots on leaves and stems, spots coalesce; fruits have black sunken lesions, under moist conditions salmon-coloured spores are seen.	Can be controlled with acceptable fungicides; avoid crop care activities when foliage is wet.

Good Agricultural Practice (GAP) related to the use of pesticides, requires farmers to maintain up to date records on the application of pesticides to the crop. These records should include trade names, application rates and dates of application. During the harvesting period use pesticides with a very short harvest interval.

Harvesting/Maturity

Harvest cucumbers when they are smooth, shiny, dark green and tender and when seeds are still immature. Harvest 2 - 3 times per week using a sharp knife or secateurs. Avoid damage to the fruit whilst harvesting. The more fruits are harvested the more the vines will produce. Cucumbers should be harvested early in the morning.

Field Handling

Harvest fruit should be placed in field crates, removed from the field as quickly as possible and not allowed to stand in the sun.

Preparation for Market

Reject all fruits that show signs of over-maturity, decay, rots, soft spots, sunscald, insect damage, bruises, misshaped or mechanical damage. Fruits should be washed to remove soil and dried with a damp cloth soaked in a mild solution of commercial bleach 1 tablespoon/gallon (5ml/litre) of water.

Yields

Yields are variety dependent but can vary from 12,000 - 16,000 lb/acre (13,500 - 18,000 kg/ha).

Storage

Cucumber can be stored for a few days under ambient conditions. For longer periods, store at 50 - 55°F (10 - 12°C) and 90 - 95% relative humidity. Post-harvest diseases of cucumbers include anthracnose, bacterial soft rot, bacterial spot and rhizopus rot. Cucumbers are susceptible to chilling injury at temperatures below 50°F (10°C).

APPENDICES

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: CUCUMBER

	Input	Quantity	Units	Unit Cost	Total Cost
1.	**Seedling production**				
	Seed material				
	Seedling trays				
	Peat moss				
	Saran netting				
	Fungicide, plant nutrient, insecticide, fungicide, fertilizer (specify names used)				
	Total cost for seedling production				
2.	**Land preparation**				
	Plastic mulch				
	Trellis material				
	Other land preparation costs (e.g. equipment rental)				
	Total cost for land preparation				
3.	**Crop maintenance**				
	Water/irrigation				
	Fertilizer (specify types used)				
	Weed control (specify chemicals etc used)				
	Pest and disease control (specify chemicals etc. used)				
	Total cost for crop maintenance				
4.	**Harvest/storage**				
	Crates				
	Other materials (e.g. commercial bleach etc.)				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
5.	**Labour**				
	Seedling production				

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: CUCUMBER

	Input	Quantity	Units	Unit Cost	Total Cost
	Land preparation				
	Crop maintenance				
	Harvest/storage				
	Total cost for labour				
6.	**Rent/insurance**				
7.	**Miscellaneous costs**				
	Total cost of production				

Notes

1. It is recommended that the above data be completed on a per crop basis.

2. The cost of any fixed structures should be considered. For example if a seedling nursery is solely used for to produce cucumber seedlings in the year and is expected to last for 10 years, then one tenth of the cost of construction (plus any annual maintenance) should be added at item 7. If, however seedlings for other crops are also produced then these also need to be considered. If cucumber seedlings account for half the seedlings in a year, then the annual cost calculated as above needs to be divided by 2. Similar considerations should be given to the cost of any refrigerator, if the crop is stored at a low temperature and to an irrigation system. If the cucumber is grown under Protected Agriculture perhaps 1 -2% of the cost of the structure should be added to item 7.

3. The revenue obtained from sale of the crop should be compared with the cost of production to determine the profit/loss on the operation.

APPENDIX II: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

INSECTICIDES	APPLICATION RATE
Pronto 35 SC	3 - 5 teaspoons/gallon of water
Target	1 - 2 teaspoons/gallon of water
Pirate	½ - 1 teaspoons/gallon of water
Fastac	1 - 2 teaspoons/gallon of water
Caprid	½ - 1 teaspoon/gallon of water
Diazinon (Basudin)	¾ - 1½ pints/acre
Admiral	¼ teaspoon/gallon of water
Dipel	1½ - 2 teaspoons/gallon of water
Aza-direct	1 - 2 teaspoons/gallon of water
Cure	½ - 1 teaspoon/gallon of water
Danitol	1 - 2 teaspoons/gallon of water
Cypro	½ tablespoon/gallon of water
Dimethoate (Perfecthion, Rogor 40)	1 pint/acre
Phosvel	1¼ - 2 pints/acre
Orthene	3.2 ounces/acre
Permethrin (Ambush)	½ teaspoon/gallon of water
Padan 50 WSP	2 - 3 teaspoons/gallon of water
Lannate	1 teaspoon/gallon of water
Decis	½ teaspoon/gallon of water
Kelthane 42%	1¼ lb/acre
Orthene 75S	1 lb/acre
Malathion	½ - 1 pint/acre
Sevin	1½ lb/acre
BT (*Bacillus thruingiensis*)	Label rates
Rotenone	1 - 2 teaspoons/gallon of water
Neem X.	8 - 10 oz/gallon of water
FUNGICIDES	**APPLICATION RATE**
Bellis	2 teaspoon/gallon of water
Acrobat	2 - 4 teaspoon/gallon of water
Mancozeb (Dithane M45)	1.5 lb/acre
Cabendazim	2 teaspoon/gallon of water
Daconil	1½ - 2 pints/acre
Benomyl (Benlate)	6 oz/acre
Captan	2 - 3 teaspoons/gallon of water
Peltar	3 teaspoons/gallon of water
Manzate DF	2 - 4 teaspoons/gallon of water
Bravo	1½ - 2 pints/acre
Tri-Miltox-Forte	3 teaspoons/gallon of water
Botrilex	5 - 200 lb/acre
Kocide 101	2 - 4 teaspoons/gallon of water
Cupravit	2½ lb/acre

APPENDIX II: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

WEEDICIDES	APPLICATION RATE
DCPA (Dacthal W-75)	10 lb/acre
Diphenamide	4 - 10 lb/acre
Paraquat (Gramoxone)	1 - 2 pints/acre
Dymid 80W	5 lb/acre
Atrazine 80 (Gesaprim).	1¼ - 1½ lb/acre
Linuron (Lorox)	1 pint/acre
Prometryn (Caparol)	0.8 - 1.6 lb/acre
Sethoxydim (Poast)	1¼ - 3½ lb/acre
Clethodim (Select)	0.094 - 0.25 lb/acre
Prometryn 50WP (Geagard)	2 - 3 lb/acre
Herbicidal Oil (Stoddard Solvent, Kerosene oil)	40 - 80 gallons/acre

APPENDIX III: GOOD AGRICULTURAL PRACTICES DATA RECORD SHEET

Grower name:							
***Name of applicator**	**Date**	**Brand and product name**	**Rate**	**Size of area/no. of plants treated**	**Total application (amount of the product used)**	**Notes/target pest**	**Start/finish time**

*The applicator should be trained or, if not, supervised by a trained or certified person. Proof of training required.