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

CELERY

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exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and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

CELERY

November 2015

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Table of Contents

Introduction

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

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

Celery (Apium graveolens) belongs to the family Apiaceae. The local name in Creole is Selwi. The crop is cultivated for its leaves and used as seasoning and flavouring for soups. Celery is an excellent source of vitamin C and fibre. It's a very good source of potassium, folic acid, and vitamin B6, B1 and B2. It is also is a good source of calcium and a rich source of dietary sodium.

Ecology and Environment

The plant requires full sun and moist, fertile soil that is slightly acidic between a pH between 6.5 and 6.8. Cauliflower can be cultivated at temperatures 70°F (20°C).

Varieties/Cultivars

Main varieties are Tall Utah, Elne and Giant Pascal.

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.

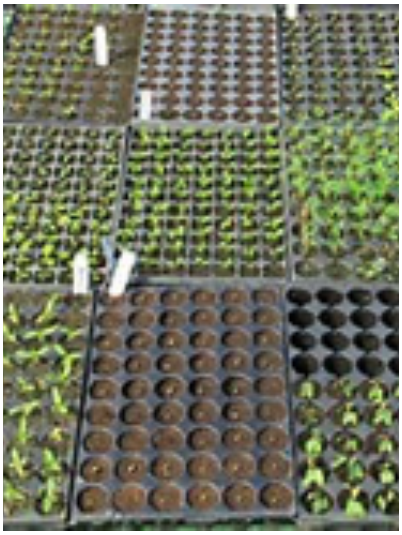

Plate 1 Seedling production in seed trays

Plate 2 Seedling production in nursery

Plate 3 Hardening seedlings

The following practices should be adopted in the production of strong healthy celery 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

There are two main systems of celery production: on raised beds or on the ground. Celery is a shallow rooted crop so land preparation should not be deep. When cultivated on the ground rotavate or fork and rake the area to obtain a fine tilth. Form beds 4 feet (1.2 m) wide and 8 inches (20 cm) high. Incorporate well rotted organic manure during land preparation for both systems of production.

Spacing and Planting

Celery seedlings should be planted in rows spaced 12 inches (30 cm) apart and at 10 inches (25 cm) apart within the row (Plates 4 and 5).

Plate 4 Planting celery seedlings

Plate 5 Celery planted in rows

Irrigation

Irrigation water, especially from streams and ponds, should be sent for analysis to ensure that the water is not polluted or saline. It must be of good quality for irrigation. Celery responds well to irrigation and therefore needs a regular supply of water particularly in the dry season. The most important thing is to keep the soil moderately moist to keep producing new leaves.

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.

Celery is a heavy feeder so adequate fertilizer must be supplied throughout the growth of the crop. Apply 150 lbs/acre (170 kg/ha) of 12:12:17+2 fertilizer before planting and three side dressings of 150 lbs/acre (170 kg/ha) at 2-week intervals. Apply 150 lbs/acre (170 kg/ha) of sulphate of ammonia with the last application of 12:12:17+2 fertilizer.

Weed Control

Early weed control is critical for successful celery production. Linuron (Lorox) or Prometryn (Caparol) are very effective in controlling most of the young emerged annual weeds that are found in the field. Sethoxydim (Poast) and Clethodim (Select) will control the grasses emerged in the crop if applied properly. Also manual weeding should be done with a hoe especially during the early stages of plant growth.

Pests and Diseases

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

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

Pest & Diseases	Symptoms	Control/ Management
 Plate 6 White Flies	Common noticeable symptoms are an abundance of white, waxy material covering leaves and fronds, a sugary substance called "honeydew" produced by the leaf-sucking insects, and excessive dark sooty mold on leaves or fronds that grows on the honeydew.	White Flies have developed resistance to many synthetic pesticides making chemical control difficult. Insecticidal soap, neem oil and botanical insecticides can be used to "knock down" heavily infested areas.
 Plate 7 Aphids	Aphids cause damage by sucking plant sap, which causes heavily infested leaves to curl and stunts plants.	Use contact or systemic insecticides.
 Plate 8 Leaf Hopper	These insects do not directly damage the crop but can transmit diseases to the plants, so their control is important.	Use contact or systemic insecticides upon the advice of the area Extension Officer.

Pest & Diseases	Symptoms	Control/ Management
 Plate 9 Leaf Miner	Leaf miners are the larvae of various beetles, flies, moths and sawflies. The adult lays their 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.	Use contact or systemic insecticides.
 Plate 10 Stink Bug	Adult Stink Bugs are green or brown, flat-topped insects that are about 1/2 inch (1 cm) long. They are shield-shaped, with a large triangle on their backs. They produce an unpleasant odor when they are threatened or killed.	Use contact or systemic insecticides.
 Plate 11 Angular Leaf Spot caused by the fungus *Pseudomonas syringae pv. lachrymans*	The symptoms first appear, on underneath surface of leaves, as water-soaked lesions that occur between the minor veins of the leaves. These lesions may exude a whitish-liquid under some conditions. As the disease progresses, the infected spots turn brown and the leaf material falls out, leaving angular holes in the leaves.	The disease can be controlled by the application of copper based fungicides every 14 days.

Pest & Diseases	Symptoms	Control/ Management
 Plate 12 Septoria Leaf Spot caused by the fungus *Septoria apiicola*	Symptoms are dark, circular to irregular in shape, and 0.1 - 1 inch (3 - 10) mm in diameter. Dark coloured fruiting bodies of the fungus, which form in the centre of leaf, give the spots a grainy appearance. As spots expand, some are restricted by leaf venation and become partially angular in shape. Lesions are surrounded by yellow or chlorotic tissue. The stalk or the petiole of the celery is also attacked. Small black spots occur in large numbers on stalks. The disease can be controlled with a fungicide.	The disease can be controlled by the application of copper based fungicides every 14 days.

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

Duration of the crop from transplanting to first harvest is 4 months but the harvest continues over a long period. Celery is harvest progressively when the stalks and leaves are large enough to use. Cut individual stalks starting with the outer leaves leaving the part of the petiole attached to the base.

Field Handling

Field crates should be covered with a damp white cloth to protect the harvested leaves from heat and evaporation during the harvesting operation. Full crates should be taken, as soon as possible, to a cooler environment for preparation.

Preparation for Market

The leaves should be crisp, clean and relatively free from discoloration. Remove all diseased, pest infected or damaged and yellow leaves.

Yields

Celery should yield around 35,000 lb/acre (40,000 kg/ha).

Storage

Celery should be stored at 32ºF (0ºC) and 95 - 100% relative humidity. Do not store with high ethylene producing commodities.

Like most leafy vegetables celery has a very short shelf life due to its high respiration rate and water loss. Methods can be adopted to reduce respiration rates and water loss from the time of harvesting the crop to the time when it is sold on the market. These will go a long way in reducing post harvest losses of celery.

APPENDICES

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: CELERY

	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**				
	Organic manure				
	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. cloths etc)				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
5.	**Labour**				
	Seedling production				
	Land preparation				
	Crop maintenance				

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: CELERY

	Input	Quantity	Units	Unit Cost	Total Cost
	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 celery 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 celery 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.

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.