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

CARROT

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exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and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

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CARROT

November 2015

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Introduction

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

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

Carrot (*Daucus carota*) belongs to the family Apiaceae. The local name in Creole is Kawòt. It is a root vegetable, usually orange in colour and is a rich source of beta-carotene, which the human body converts to vitamin A.

Ecology and Environment

Carrots grow best in full sun but tolerate some shade. The optimum growth temperature is above 65°F (18°C). The ideal soil is deep, loose and well-drained, sandy or loamy and with a pH of 6.3 to 6.8.

Varieties/Cultivars

Main varieties are Kuroda, Royal Chantenay, Chanteney Red Core, Danvers Half Long and Juliana.

Land Preparation

It is best to grow carrots on soils that are deep, loose, free of stones and high in organic matter. Roots can become twisted and forked in heavy, stony soil. Deep cultivation is also required for carrot production. The land should be ploughed and rotavated to produce a fine seedbed tilth (Plate1). Well-rotted pen manure should be incorporated during the ploughing operation. Good drainage is essential during the wet season.

Plate 1 Land Preparation

Spacing and Planting

The crop is established by direct seeding as carrot does not perform well when transplanted as seedlings. Seeds should be dusted with a fungicidal powder Fernasan (Thiram) before planting. On the flat make furrows 1 inch (2.5 cm) deep and 24 inches (60 cm) apart (Plate 2). When planting on slopes banks or ridges should be 3 feet (90 cm) and should be flattened on top to accommodate two rows spaced 9 - 12 inches (22 - 30 cm) apart. If terraces are used rows should be 9-12 inches (22 – 30 cm) apart and should be aligned across the slope along the terrace.

Plate 2 Preparation for planting

Sow seeds mixed with sand to ensure an even distribution of seed during planting and cover seeds with about ½ inch (1 cm) of soil. Thin to 1 - 4 inch (2.5 - 10 cm) spacing, depending on size of root desired, before plants are 2 inches (5 cm) tall.

Irrigation

Irrigation water, especially from streams and ponds, should be sent for analysis to ensure that the water is not too polluted or saline. It must be of optimal quality for irrigation. The soil should be kept uniformly as moist as possible to avoid soil drying out.

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 fertilizer ratio of 1: 2: 1 or rates of application of 100 lb/acre (112 kg/ha) of Sulphate of Ammonia, 300 - 400lb/acre (336 - 448 kg/ha) of Triple Super Phosphate and 100 - 150 lb/acre (112-181 kg/ha) of Muriate of Potash.

Weed Control

Carrots cannot compete with weeds. Regular hoeing and hand weeding is very tedious and expensive so use chemical weed control to cut down production costs. The practice of moulding is beneficial in keeping the tops of the root covered from sunlight to reduce green tops of mature roots.

Chemical weed control can be done using as a pre-emergence Prometryn 50WP (Gesagard) at 2 - 3 lbs/acre (2.2-3.3 kg/ha). Also after the first true leaves have developed, a post-emergence (Stoddard Solvent, Kerosene oil) can be used at the rate of 40-80 gallons/acre (449-898 L/ha).

Pests and Diseases

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

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

Pest & Diseases	Symptoms	Control/ Management
 Plate 3 Aphids	Aphids cause damage by sucking plant sap, which causes heavily infested leaves to curl and stunts plants.	On the advice of an Extension Officer, control the pest through the use of contact or systemic insecticide.
 Plate 4 Leaf Eating Caterpillar	Symptom is skeletonized or mostly consumed leaves. The caterpillar itself can often be visibly observed feeding on the leaf tissue.	On the advice of an Extension Officer, control the pest through the use of contact or systemic insecticide.
 Plate 5 Cut Worms	They cut down the young plants/ seedlings when they feed, and are capable of destroying an entire field.	Use a contact or soil insecticide around the base of the plants.

Pest & Diseases	Symptoms	Control/ Management
 Plate 6 Mole Cricket	Tunnel through soil leaving a subterranean trail.	Apply a soil insecticide to the field.
 Plate 7 Alternaria Leaf Spot caused by the fungus *Alternaria dauci*	Lesions generally appear along leaf margins and are dark brown to black with a yellow border. Spots may coalescence, girdling the petiole and killing the leaf.	Apply a broad-spectrum fungicide.
 Plate 8 Cercospora Leaf Spot caused by the fungus *Cercospora carotae*.	Infected leaves have tan to brown spots with curled leaf margins; later on they wither. As the disease progresses, the leaflets turn yellow and also with curled margins. Spots on the leaf petioles and stems become elongated and have dark-brown colour. On heavily infested plants, defoliation may occur.	Apply a broad-spectrum fungicide.
 Plate 9 Southern Blight caused by the fungus *Sclerotium rolfsii*	The disease is characterized by a soft watery decay of the taproot at or near the soil line. The disease develops rapidly, resulting in wilting and yellowing of the carrot top. White mats of mycelium develop on the carrot root and in the adjacent soil.	Apply a broad-spectrum fungicide. Harvesting the crop early, practicing good sanitation by deep ploughing and destroying crop refuse can control Southern Blight.

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

Begin harvesting carrots when they turn bright orange (normally 14 - 16 weeks after planting, depending on the variety). Because all sizes of carrots are edible they can be harvested over a long period of time. On light soils the roots can be lifted by hand by pulling. Use a fork on heavier soils.

Field Handling

After harvest roots should be taken away from the field to the preparation area for market. Roots should never be left in the sun for a considerable length of time as they can lose their cooking quality and flavour.

Preparation for Market

Freshly harvested carrots must be sorted to remove defective roots; undersized, broken, diseased, green core, split/cracked and sunburnt carrots should also be discarded. Careful handling is necessary to avoid bruising and tip breakage. Harvested roots should be topped and washed to remove dirt before it dries. Roots should be allowed to dry off in the shade. This prevents bacterial rot.

Yields

Yields vary from 12,000 - 15,000lb/acre (13,500 – 17,000 kg/ha) depending on variety.

Storage

Storage for any length of time requires refrigeration. Roots are best stored at 32ºF (0ºC) and 95% relative humidity. Some deterioration can occur in storage due mainly to some loss in sugar due to respiration. Carrots stored below 32ºF (0ºC) for prolonged periods of time are susceptible to chilling injury. Carrots exposed to ethylene during storage develop a bitter flavour. During storage, avoid mixing carrots with ethylene producing commodities.

APPENDICES

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: CARROT

	Input	Quantity	Units	Unit Cost	Total Cost
1.	**Land preparation and planting**				
	Pen manure				
	Seeds				
	Fungicide				
	Sand				
	Other land preparation costs (e.g. equipment rental)				
	Total cost for land preparation and planting				
2.	**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				
3.	**Harvest/storage**				
	Crates/baskets				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
4.	**Labour**				
	Land preparation and planting				
	Crop maintenance				
	Harvest/storage				
	Total cost for labour				
5.	**Rent/insurance**				
6.	**Miscellaneous costs**				
	Total cost of production				

2. The cost of any fixed structures should be considered. For example if a refrigerator is solely used to store carrot in the year and is expected to last for 10 years, then one tenth of the cost of purchase should be added at item 6. If, however other crops are also stored then these also need to be considered. If carrot accounts for half the produce stored in a year, then the annual cost calculated as above needs to be divided by 2. Similar considerations should be given 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.