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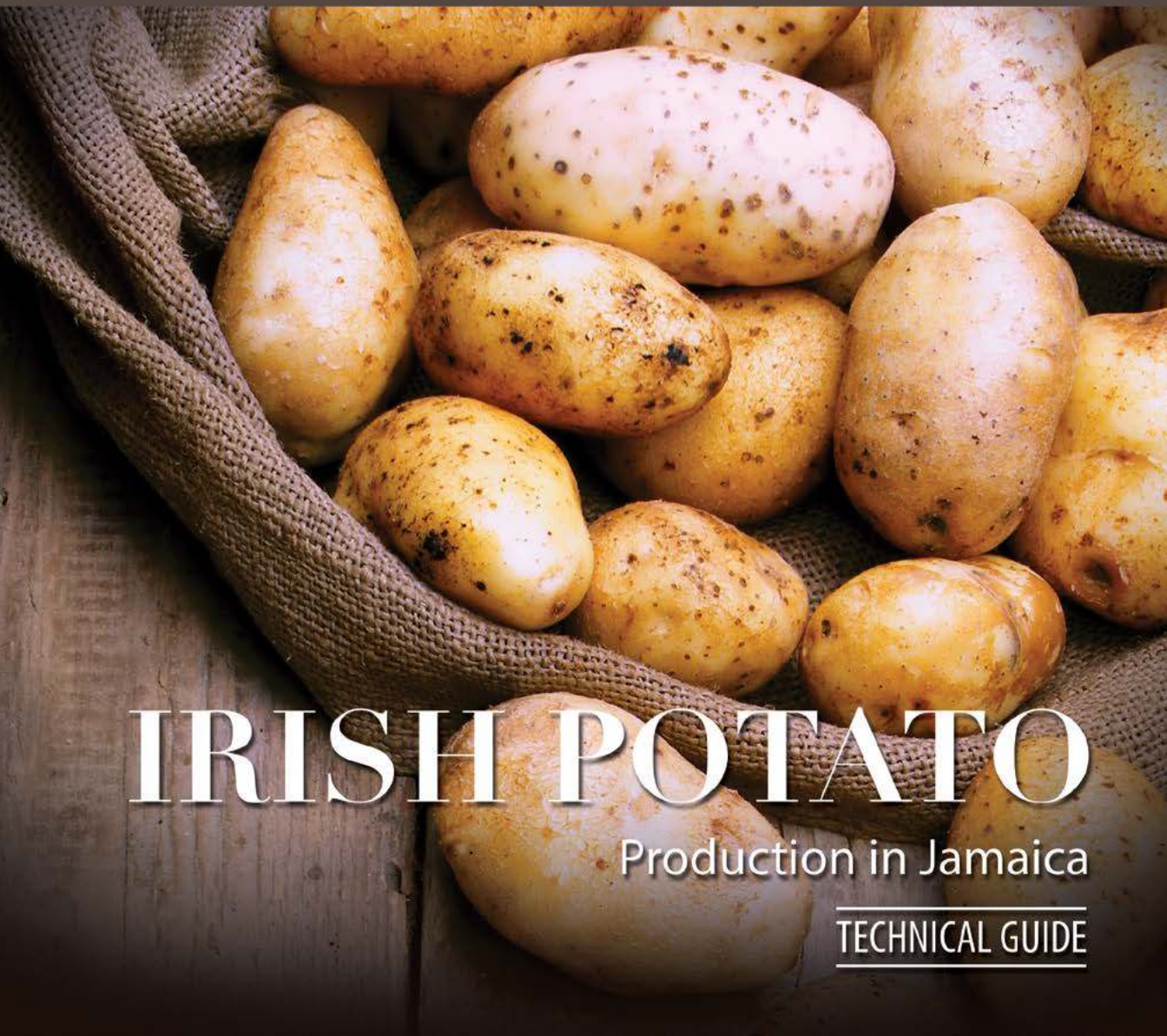

IRISH POTATO

Production in Jamaica

TECHNICAL GUIDE

Ministry of Industry, Commerce, Agriculture & Fisheries

IRISH POTATO PROGRAMME

Potato remains one of the main staples in the Jamaican diet, and continues to be a priority crop for the agriculture sector. The market demand for Irish Potato, at 15M kilograms, equates to 1200 hectares of potato production, with the assumption that farmers attain a yield of 15MT per hectare (the total acreage takes into account 30% post-harvest losses). This is needed to satisfy 100% of local demand.

In 2008, total national consumption was 12.45 million kg, with local production contributing to just 39%; however, within five years, local production reached 86.9%, thus bolstering the country's import substitution programme.

Research and the trial of new varieties; a Clean Seed programme; diversification of the sector to investigate the feasibility of production for the 'fries' market; the provision of increased access to additional production areas, as well as the training of farmers and the establishment of a producer's organization are among the deliberate strategies being pursued to achieve sustainable self-sufficiency in the Irish Potato sub-sector.

IRISH POTATO PRODUCTION IN JAMAICA

TECHNICAL GUIDE

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IRISH POTATO: Production in Jamaica | Technical Guide

GlenMais Publications

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From farm to fork, PROPEL is working to improve agricultural market systems and linkages in the Caribbean

The Promotion of Regional Opportunities for Produce through Enterprises and Linkages (PROPEL) is a sustainable economic growth project that aims to increase the value of Caribbean fresh produce accessing high value markets (HVMs) in the Caribbean and internationally by CAD $100 million over six years. PROPEL is implemented by World University Service of Canada (WUSC), a Canadian non-profit organization dedicated to providing education, employment, and empowerment opportunities for youth around the world. Established in 2015, WUSC Caribbean runs PROPEL in Jamaica, Barbados, Dominica, St. Lucia and Guyana.

The project works with private sector buyers, producers, business service providers, and other market system actors to facilitate the safe, effective, and efficient movement of fresh produce from the farm level to high value markets. PROPEL identifies the needs of HVM buyers at the local, intra-regional and extra-regional levels and then identifies producers that have the potential to meet that market demand in terms of quality and quantity of produce. Using a market systems approach, PROPEL facilitates and strengthens linkages between commercial producers and HVMs, with the aim of achieving sustainable economic growth.


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Funded by the Government of Canada | Canada

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Foreword

Five years have elapsed since the first printing of the manual Irish Potato Production in Jamaica. The manual was crafted as an essential tool to guide our productive efforts aimed at decreasing the import content of our consumption. Its unquestionable success is demonstrated by acceptable yield levels and the fact that the years 2014 and 2015 recorded over 80 per cent local contribution to our consumption.

The manual has now been reprinted, based on an increasing demand from the farming community and in an effort to stimulate greater investment in and attraction of individuals to agriculture.

The manual has undergone minor editorial changes and the inclusion of newer pesticides, but it is essentially the same as the first publication. It presents a step-by-step guide of practices, from site selection through to post-harvest and, importantly, includes a production cost estimate.

It is anticipated that the manual will continue to be the roadmap that sets the foundation for a vibrant and commercially viable Irish potato industry.

Honourable Audley Shaw, CD, MP.
Minister of Industry, Commerce, Agriculture and Fisheries

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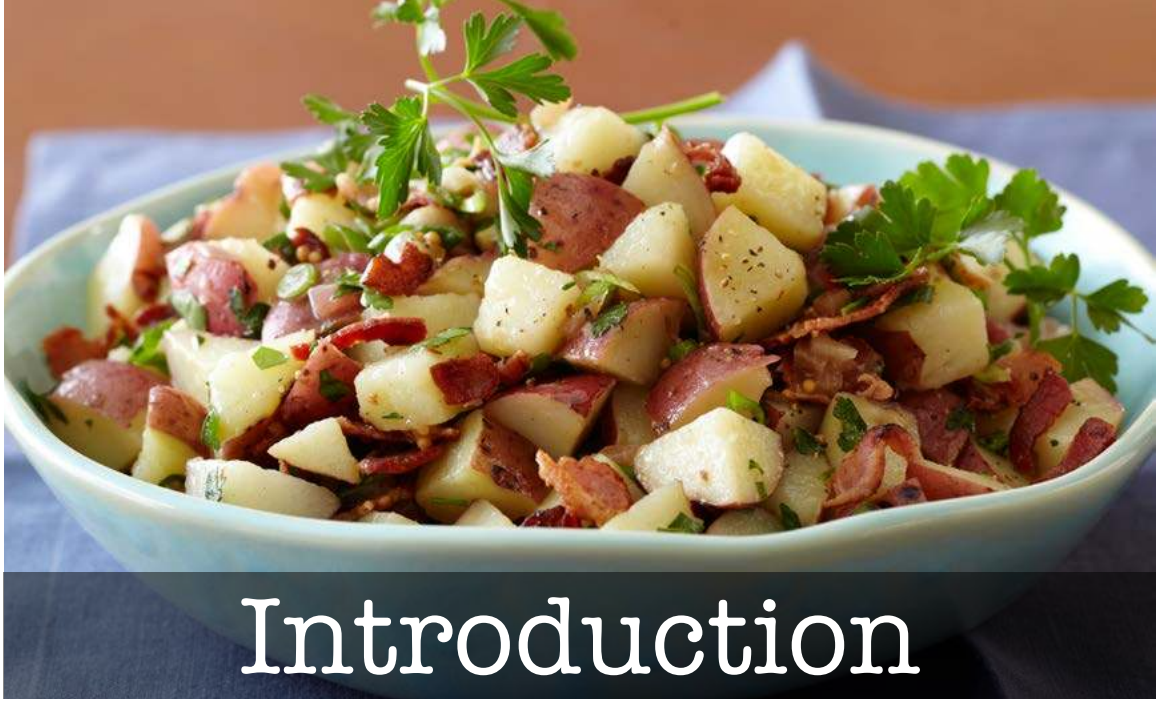

Introduction

Climate, soils and site selection are important considerations in choosing areas for Irish potato production.

Climate

The single most important consideration for Irish potato production is climate. It is a cool-season crop, growing best at temperatures 16-27°C, with its best yields obtained when an average temperature of 20°C is maintained during the growing period. It is important to note that, although day temperatures may be greater than 27°C, Irish potato cultivation is still possible if night temperatures remain at least 10°C lower than day temperatures. Hence the right climate will be dependent on a suitable location and appropriate time for growing Irish potato. (See Appendix I.)

Soils

Irish potato can be cultivated in a wide range of soil types, provided the soil is sufficiently retentive of moisture and friable enough for good root and tuber development. Soils with pH between 5 and 7 and high in organic matter are best suited. Waterlogged soils should be avoided.

Site selection

In selecting land for Irish potato production, fields that are under trees, and shadows cast by trees, must be avoided. Choose areas that are flat or gently sloping and shun areas that are prone to flooding and waterlogging. Irish potatoes must not be grown in areas where tomatoes, peppers, tobacco, Irish potato and other members of the Solanaceae family have been grown in the last three years. If this cannot be easily achieved, rotation with nonsolanaceous crops must be rigorously practised.

2

Crop Establishment

Varieties

Spunta is the variety of potato traditionally grown in Jamaica. Others include Draga, Mondial, Kennebec and Shepody, and the variety selected should be based on market requirements.

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Fig 1. Spunta variety potatoes

Site selection

In selecting land for Irish potato production, fields that are under trees, or are covered by shadows cast by trees or other obstructions must be avoided. Choose areas that are flat or gently sloping, and shun areas that are prone to flooding and waterlogging. Irish potatoes must not be grown in areas where tomatoes, peppers, tobacco, Irish potato, and other members of the Solanaceae family have been grown in the last three years. If this cannot be easily achieved, rotation with nonsolanaceous crops must be rigorously practised. Land should be cleared of all trees, shrubs, stones, rubble, etc to facilitate tillage.

Fig. 2 Site selection of flat or gently sloping fields facilitates automation of land preparation and planting

The tillage operations are:

Ploughing – the process of turning over the soil to at least 30cm (1ft) deep. This should be done one to two months (longer periods for heavier soils) before planting to allow for weathering (breakdown of the soil). During this time, some pests in the soil will be destroyed by birds and other predators.

In many cases, cross-ploughing may also be necessary to ensure that the soil is properly turned over. At this time it is advised that organic matter (5-7.5t/ha compost) be incorporated into the soil.

Harrowing – the breaking up (refining) of the 'overturned' soil into smaller soil particles.

Furrowing – this is the final stage in preparing the land before planting. During furrowing, small trenches are cut in the field going in one direction. The trenches are the furrows and the raised area between two furrows is called a bank or ridge.

Ease of access to site should also be considered in terms of bringing in inputs and taking produce to market.

Soil assessment

Soil sampling should be done at least four weeks prior to planting. The soil analysis report should include results for pH, available nutrients (both macro and micro), and organic matter. A history of cropping pattern for the last three years should also be presented.

Fig . 3 Application of fertilizer to furrows prior to planting

Crop nutrient requirements

Irish potato is a heavy user of nitrogen and potassium, requiring 235kg and 320kg per hectare, respectively. Approximately 25kg/ha of phosphorus is needed. The requirements for calcium and magnesium may be applied as foliar sprays, with 5-10kg/ha being sufficient. for the crop. Sulphur requirement is in the range of 25-60kg/ha.

The requirements for select micronutrients are boron 1-2ppm, iron 20-40ppm, manganese 30-60ppm, copper 5-20ppm and zinc 15-40ppm.

Fertilization

All phosphorus is to be placed at 5-7cm (2-3in) below the seed potato to maximize yield and reduce the likelihood of tying up iron or zinc. Apply 30% of the nitrogen and potassium to the furrows and cover prior to planting. This is to avoid direct contact of the fertilizer with the new roots and sprouts.

Four to six weeks after, add 40% more nitrogen as a side dressing, being careful to keep the fertilizers off the foliage. At tuber initiation (six to eight weeks), add the remaining nitrogen and potassium.

It is important to note that, wherever indicated (based on results of soil test), foliar application of some elements will be necessary to optimize yields and, in some cases, reduce disease (for example, boron has been shown to reduce the incidence of scab).

Seed selection and preparation

Seed potato (Figure 3) should be obtained from certified suppliers and be free from diseases. The ideal seed weight is 60-90g (2-3oz).

Fig . 4 Sprouting potato seeds

Remove apical sprout (if any) from seed, place in shallow crates two to three tuber height and expose to light. Allow for three to four strong, green sprouts (1.25cm (1/2in tall). This will allow seed to 'germinate'

faster and, if not done, will result in fewer and oversized tubers, making the potato unmarketable.

Plant population and planting

Ideally, furrows are made 75-90cm (30-36in) centre to centre. Seed potatoes are placed along the furrow at 30cm (12in) spacing, giving a population of approximately 34,500-42,000 plants/ha (14,000- 17,000 plants/acre).

Approximately 1,700 to 2,200kg of seed (planting material) is needed to plant one hectare (1,500 to 2,0001b of seed/acre).

It is strongly recommended that whole seed potatoes be used for planting to reduce the likelihood of bacterial infection.

Fig 5. Method 1

Fig. 6 Method 2 - Cut-away of soil showing 20–25cm depth of stem tuber

Method 1

When planting, seed potatoes are placed in furrows and covered with soil to a depth of 5-7.5cm (2-3in). After plants have emerged (usually within 20 to 25 days), moulding ('hilling up') is done at one to two weeks after. This is mounding soil around tubers to prevent exposure of the tubers (greening) and thereby increase yields. One or two mouldings may be necessary.

Method 2

Alternatively, tubers are covered with 50% of soil taken from adjoining sides of furrows. In this method, a larger portion – 20-25cm (8-10in) – of stem is covered (Figure 5), facilitating the production of more tubers, hence increasing yield. Additionally, weed control is optimized. A single moulding may be all that is required.

Moulding/Hilling

The process of gathering soil around tubers should begin one to two weeks after planting or when the plants are 8 to 12 inches tall and continue as frequently as necessary to prevent tuber exposure and greening.

Hilling can be done by small increments of soil (2 to 3 inches) or in more soil (covering 8-10 inches of stem) being added once or twice. The latter method is believed to stimulate increased yield.

Plant Growth

Potato growth has been divided into five (5) phases:

Sprouting

During the first phase, sprouts emerge and root growth begins.

Starch Production

During the second phase, photosynthesis begins as the plant develops leaves and branches.

Tuber Development

New tubers develop during the third phase. It is important that the soil temperatures remain below 80 °F

(26.7 °C) during this phase to facilitate tuber formation. It has been suggested that if the night temperature is low, tuber formation would continue despite day temperature of 26.7 degrees C.

Tuber Bulking

Tubers grow rapidly during the fourth phase requiring much nutrient support from the plants. It is important to maintain plant health and nutrient status while tuber bulking is occurring so that the plant will be able to meet the demand of the tubers. The availability and soil nutrient in suitable proportion and the absence of, or resistance of the plants to pests and diseases, will result in high yields of potato tubers of size representative of the variety. The maintenance of suitable soil moisture and temperature is also a factor which affects yield.

Hilling/molding or mulching is required as the rapidly expanding tubers tend to reach the soil surface and become exposed to light. This will result in greening of the skin and the development of solanine if the tubers are not covered.

Maturation

Spunta and other varieties of Irish potato grown in Jamaica mature and can be harvested between 90 and 100 days after planting. Visual evidences of maturity include the drying of the leaves, die back of the plant so that it can be pulled out by hand without dislodging the tubers. The skins of the tuber hardens, and is relatively less resistance to removal by friction such as handling compared to that of the immature tuber.

Water requirement and management

Irish Potato requires 120-240 cm/ha (20-40 inches) of water over its growing period. For irrigation purposes, this translates to 4,000-6,000 gallons per acre per day. During tuber formation and growth, the water supply should be such that a fairly constant level of soil moisture is maintained, not facilitating prolonged drought or water logged condition.

Fig. 7 Irrigation of Potato crop

Irish potatoes may be produced in areas with rainfall averaging 25-50cm (1-2in) per week. Planting should coincide with the rainy season, with the dry months coinciding with harvesting.

Under rain fed condition, during the rainy season or in anticipation of rainfall. Manual watering might be necessary in the event of prolonged drought at critical stages in the life of the plants.

3

Pest & Disease Management

Weeds

Weed management begins at land preparation. The tillage operations will control all surface weeds, and if done long in advance of planting, weeds which regrow can be controlled by application of suitable herbicides. This is the 'stale bed' technique and results in a relatively weed-free field for planting. When this technique is used, weed population is significantly reduced in the first 30-40 days of crop growth.

Pre-emergent herbicides (e.g. Dual Gold®) and selective post-emergent herbicides (e.g. Sencor®) may also be used and are effective if used in accordance with manufacturer's recommendations.

If herbicides are applied after the crop has been established, exercise caution as phytotoxic damage (herbicide burning) may occur.

Weeds can also be controlled during moulding.

Diseases

Late blight *(Phythopthora infestans)*

A commonly occurring disease wherever Irish potato is grown. It is characterized by irregular, black, water-soaked lesions with defined margins appearing on the leaf surface. The stems and tubers are also affected, exhibiting similar symptoms. The disease is more severe in very wet conditions.

Fig .8 Late blight on potato leaf

Fig 9. Late blight on stem of potato plant

Control: The timely application of suitable fungicides provides the most effective way of controlling this disease. Growers should alternate systemic and contact

chemicals to prevent the development of resistance. Some suggested fungicides are Ridomil® Gold®, Amistar®, Dithane® and Champion®, and are to be used according to manufacturer's recommendation.

Good field sanitation and open, well-ventilated fields will help to reduce moisture and hence minimize disease development.

Early blight *(Alternaria solani)*

This disease is characterized by dark brown, circular spots with defined margins and concentric markings up to 1.25cm (1/2in) on leaves or stems.

Infected tubers appear featuring black, sunken lesions with defined margins.

Fig 10 Early Blight

Control: The use of high-quality certified planting material, a proper nutrition programme and timely irrigation can slow disease development and in some cases reduce the need for chemical control. The pesticides recommended for late blight will control early blight (See Appendix II).

Fusarium wilt and rot *(Fusarium spp.)*

The diseases are caused by soil-borne fungi, which infect plants through roots, as well as infected tubers. Affected plants have discoloured stems at and below ground level. The brown discolouration of stems is accompanied by uneven chlorosis (yellowing) of leaves and wilting. Stunting and death of plants may also occur.

Affected tubers have external stem-end lesions with a pale-brown discolouration about 1.5cm (0.6in) below the skin.

Fig 11 Fusarium Rot ; tuber damage

Control: This disease cannot be effectively controlled by the application of fungicides. Plants showing symptoms of the disease should be removed from the field and destroyed. The disease is usually worse on clay soils, and affected fields should not be used for growing potatoes for three to four years.

Black leg *(Erwinia spp)*

The disease can manifest itself if too much moisture is available at planting, and there is a rise in soil temperature.

In black leg, initially the lower stems are inky black, with a slimy, foul-smelling soft rot. The leaves near the top of stems are chlorotic, curl upwards, and plants are stunted. Aerial tubers may form in axils, and in severely affected cases plants die.

Fig 12 Black Leg

Control: Obtain certified high-quality planting material, and plant whole seeds in well-drained soils. If the disease appears in the field, rogue affected plants immediately.

Pink rot *(Phytophthora erythroseptica)*

This disease is characterized by aerial tuber formation, chlorosis, marginal burning and falling of leaves. When pink rot is severe, dark necrotic stems and roots are seen (similar to black leg).

Fig 13 Pink Rot

Affected tubers, while intact, have a rubbery texture. The underlying tissue is black and may ooze a clear liquid. The tuber, when cut, will appear pink in colour and will turn to black within an hour. It is this characteristic that distinguishes it from late blight tuber infection (Also, tubers are not usually offensive smelling in the early stages). The condition is more prevalent where soil temperatures exceed 25°C.

Control: The incidence of the disease pink rot can be reduced by allowing for good soil drainage and maintenance of constant soil moisture.

Common scab *(Streptomyces scabies)*

This disease is usually confined to the tubers and appears with a rough superficial growth (callus) of the skin, thereby reducing marketability.

Control: This disease tends to be prevalent in alkaline soils and in soils which are poorly prepared. The use of resistant varieties is recommended.

Viruses

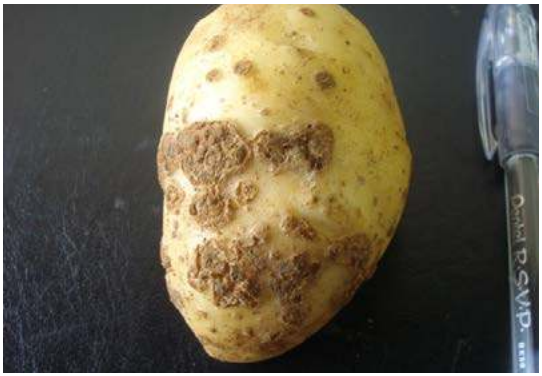

Fig 14 Common scab

Potato virus X (PVX), potato virus Y (PVY), potato leafroll virus (PLRV) and others can affect potato cultivation. Symptoms include curling of leaves, mottling, mosaic and stunting, resulting in reduced yields.

PVY on Potato

PVX on Potato

Although the viruses are usually transmitted by aphids, PVX can be transmitted by workers who have had contact with infected plants and contaminated tools. PVY and PLRV are transmitted by aphids only.

Control: All the above viruses are carried in potato tubers, hence only high-quality, certified seeds from reputable sources should be planted. Growers must ensure that tools are sanitized with 10% bleach before doing cultural practices. Scout regularly and remove infected plants from field and destroy by burning. Spraying with pesticides can also be useful to control the aphid vector, and this will reduce the spread of disease.

Bacterial wilt

Bacterial wilt is caused by the bacterium Ralstonia solanacearum formerly called Pseudomonas solanacearum. Infection of plants and tubers can occur via

- Soil, where bacteria enter weak points in the root system such as root emergence sites or wound sites caused by soil abrasion or by nematodes.
- Infected mother tubers (seed tubers).

Fig 15 Bacterial Wilt tuber damage

The bacterium spreads from infected roots or mother tubers via the vascular system to the rest of the plant. Severely affected plants will wilt and the wilting would be more pronounced during the hotter period of the day. Diseased tubers have a brown rot in the vascular ring which is identified when the tuber is sliced in half. At a more advanced stage, thick creamy mucus fills the inside of these tubers.

Insects

Broad mite

The broad mite can be a serious pest of potato and feeds on a wide range of crops. They are extremely small, clear in colour and almost invisible to the naked eye. They feed on mainly the undersides of younger foliage.

Fig 17 Broad Mite

Symptoms of broad-mite infestation include bronzing (browning), downward curling, reduced leaf size, and possible severe plant growth retardation.

Control: Early scouting is strongly recommended with regular inspection of young foliage. When the disease is observed, apply suitable miticides (e.g. Abamectin®, Pegasus®, Orchard oil) following manufacturer's recommendation. Do not allow pest population to build up, and keep fields free of weeds. Ants are known to harbour and transport broad mites and must also be controlled.

Aphids

These are soft-bodied pear-shaped insects and may be green, yellow, black, brown and red. They suck plant juices, stunting the plant and transmitting virus disease.

In severe cases, affected plants may be covered with a black substance called 'sooty mould'. The presence of ants on the plants is a good indicator of aphid infestation.

Fig 18 Aphids

Control: The field should be checked regularly for the presence of aphids, and where possible natural enemies such as parasitic wasps, ladybird beetles and praying mantises should be encouraged.

Barrier crops are useful to trap aphids, which are then killed with the use of appropriate insecticides. When introduced ahead of crop establishment, these will help to reduce virus transmission in the field. It is recommended that environmentally friendly chemicals be used. (See Appendix II).

Tomato pinworm - TPW *(Keiferia lycopersicella)*

Solanaceous crops such as tomato, potato and eggplant are the preferred host plants of tomato pinworm (TPW). Tunnelling or mining by larvae into the leaves is the most common type of injury. Initially, the mine is long and narrow but it later widens to become blotch-shaped. Older larvae may fold the leaf over itself or knit two leaves together, between which they continue to feed, causing large blotches. In severe cases defoliation will occur. Very small pinholes are left at the points of entry, which are often marked by the presence of a small amount of frass or droppings.

Fig 19 Tomato Pinworm

Eggs are laid scattered or in small groups of three to seven, mainly on the upper leaves, or on both upper and lower leaf surfaces. The egg is oval in shape and very minute, approximately 0.4mm (0.02in) long. Its colour is pearly white at first, and then becomes pale yellow before hatching.

The newly hatched larva is tiny, about 0.7mm (0.34in) long, with a black or dark brown head capsule, and a cream-colour body. During development, the larva moults four times. The fully grown larva is 6-8mm (0.3-0.4in) long and has brownish to purplish markings along the body. Tomato pinworm larvae are characteristically very active and wriggle when touched.

Pupation (the last stage before adulthood) takes place within a loosely spun cocoon in several possible locations, including under debris on the ground, just under the soil surface, or within the folds of leaves, The pupa is spindle-shaped, greenish at first, but soon changes to a dark chestnut brown colour. The adult resembles a clothes moth in size and colour. It is greyish brown in colour and is 6-8mm (0.3-0.4in) long. Adults live for about seven to nine days.

Control: Monitoring is key to detecting initial populations and preventing any build-up.

Sanitation – Thorough clean-up of an infested crop is essential to preventing, or at least minimizing, carry-over of populations to the next crop. Ensure that all crop debris is properly destroyed by burning or burying

deeply. Adults cannot emerge normally if the pupal stages are buried at least 7-9cm (2.75-3.5in) in the soil.

Physical hand removal - By regularly inspecting the crop from the very start and hand-removing and destroying infested leaves, a build-up in a population could be prevented or at least minimized.

Potato tuber moth *(Phthorimaea operculella)*

The Potato tuber moth's body length is about 10mm (0.45in) and the wingspan is about 12mm (0.5in). The larva is called potato tuberworm. Both foliage and tubers suffer extensive damage. This is caused by the larvae, which normally spend their entire lives in either one of these food sources; the only exception to this is when infested foliage is destroyed, forcing larvae to abandon it and search for tubers. Foliage-mining larvae create transparent leaf blisters and may also mine the petioles (leaf stalks). Foliar infestation may be sufficiently severe to destroy the plant. Tuber-mining larvae usually enter through the 'eyes' from eggs laid nearby, and make slender, dirty-looking tunnels throughout the tuber. An infested tuber can be identified by mounds of frass (droppings) at the tunnel entrances. High levels of tuber infestation occur in the field during summer, and stored potatoes can suffer severe damage all year round.

Fig 20 Potato Tuber Moth damage

Control: Controlling alternative weed hosts, clean harvesting of potatoes and good land preparation are required.

Chemicals: Dimethoate®, Karate®, Match®, Xentari®.

Wireworms *(Melanotys sp.)*

The larvae live and develop in the soil. They injure plants by eating the newly planted stems and by boring into stems, roots and tubers. The adult beetles are commonly called click beetles because of their ability to snap their thorax when placed on their backs or held between the fingers.

Fig 21 Wireworms

Newly hatched larvae are white but have dark brown jaws. They are about 0.16cm (1/16in) long. After about a month, they become hard and have a shiny, yellowish brown color.

The adults are reddish brown, trim, slender, hard-shelled beetles about 0.84cm (1/3in) long. This is the only stage found above ground.

The wireworms normally seen on damaged plants are from 0.6-1.9 cm (1/4-3/4 in) long, yellowish brown, cylindrical and slender. They have three pairs of short legs.

Control: Prevention of wireworm damage requires treatment before or at planting time. There are no practical or effective ways to control the pest after the crop is planted. Keep field records where damage has been severe. Avoid planting or fallowing those areas.

Click beetles, the adult wireworms, return to the same fields to lay eggs.

Chemicals: Diazinon®, Actara®, Xentari®

Cutworms *(Peridtroma saucia)*

Cutworms feed at night. During the day, they can be found under clods of soil or in cracks in the ground near injured plants. Damage early in the season includes stems cut off at or below ground level. Later, chewed foliage is the most common symptom. Tubers that are exposed on the surface or in cracks in the soil can be chewed by some cutworms.

Fig 22 Cutworm

Cutworms have a smooth appearance, three pairs of legs and five pairs of prolegs.

Armyworms *(Spodoptera spp.)*

The larvae feed at night and on cloudy days, and hide under crop debris during sunny periods. Armyworm damage to leaves can be extensive.

Fig 23 Armyworm

Mature larvae are about 3.8cm (1½in) in length, smooth-bodied, and dark grey to greenish-black in colour. They are characteried by five stripes, three on the back and two on the sides, running the length of the body. The stripes on the sides are pale orange with a white outline. The head capsule is remarkable for its honeycomb of black markings.

Control: Control weeds to prevent fall egg-laying. Control worms if one per 0.09m² (one square foot) is found. Shaking the foliage and examining the ground is an effective scouting method.

Chemical: Match®, Agree®, Diazinon®

Nematodes

Several plant parasitic nematodes are known to affect Irish potato. These are microscopic roundworms that live on or in plant roots. The symptoms they cause vary with species.

Nematodes feeding on roots reduce the vigour of plants and cause pronounced swellings (galls) and reddish-brown lesions that turn black later. Blemishes and bumps or warts are formed on the surface of infected tubers.

In general, above-ground symptoms include stunted, yellowed, chlorotic, and/or dead plants. Infected plants are likely to wilt earlier under temperature or moisture stress. Infestations may occur without causing any above-ground symptoms.

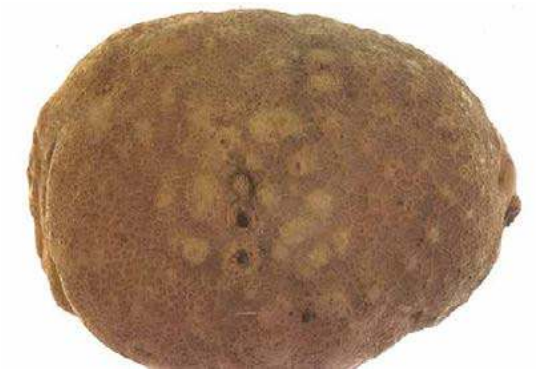

Fig 24 Nematode Damage

Control: To manage nematodes, it is important to know the species present and their population estimates. Soil samples should be taken and sent as soon as possible to a diagnostic laboratory for identification.

Preventative measures to help avert the spread of nematodes to uninfested fields include:

- using high-quality certified planting material;
- cleaning soil from equipment, tools and boots before moving between fields;
- keeping irrigation water in a holding pond so that any nematodes present can settle out and pumping water from near the surface of the pond;
- preventing/reducing movement from infested to uninfested fields; and
- composting manure to kill any nematodes that might be present before applying it to fields

4

Harvesting & Post-Harvest Management

Fig 25 Freshly Harvested Potatoes

Yield

Under rain-fed conditions and at recommended plant populations of 35,000-42,000 plants/ha (14,000-17,000 plants/acre) expected yield is 17,500-21,000kg/ha (14,000-17,000 1b/acre). (see Appendix III).

Under irrigated conditions yields of 28,000kg/ha (25,000lb per acre) are achievable.

Maturity

Irish potatoes can be harvested 90 to 100 days after planting. Signs of maturity are:

- older leaves followed by young change from green to yellow (senescence) from the growing tip down;
- drying and falling of foliage; and
- tuber skin is not easily removed upon touching.

Fig 26 Manual harvest of potatoes a fter removal of haulms and allowing for tube hardening for a 2 week period

Harvesting

Enhancing tuber dormancy and plant defoliation may be initial pre-harvest requirements. To prolong dormancy and increase the storage life of the tubers, chemicals such as Maleic Hydrazide may be applied 14-21 days before the planned harvesting date. Where the haulms of some plants persist after other evidence of tuber maturation, foliage desiccants, such as Reglone, can also be applied approximately 14 days before the planned harvest. After the foliage has completely dried, the haulms should be removed by hand, the use of tools such as machete or weed whacker. The potato should then remain in the soil for approximately 14 days to allow hardening of tubers and healing of wounds.

Harvesting is best done at early morning or late afternoon when the field is at lower temperatures. Care should be taken in harvesting to get the tubers out of the ground without cuts and bruises. A mechanical harvester or a fork can be used. Manually, the soil around the mound (and tubers) is loosened by inserting a fork. Tubers are removed by hand. Clumps of dirt clinging to tubers should be gently removed by hand.

Fig 27 Mechanical harverters are an efficient alternative to manual harvesting

Harvesting is facilitated by ensuring that the foliage has completely dried down or is removed. This may be accomplished by applying foliage desiccants such as

Fig 28 Potatoes should be transported in crates to reduce damage, and be kept dry and as cool as possible during loading, transportation, and unloading

Reglone®, two weeks prior to harvest. Alternatively, a weed whacker/machete can be used to cut the foliage. The haulms (stems and leaves) can also be pulled by hand.

After the removal of the haulms, allow potatoes to remain in the soil for two weeks to allow for tuber hardening and healing of wounds.

Harvesting can be done manually or mechanically. In manual harvesting, a fork is inserted in the trench (furrow) to the full depth and pulled backwards (45 degrees) to loosen the soil around the mound. Tubers are then taken up by hand and, in the process, clumps of soil clinging to the potato are removed by gently rubbing with the fingers. Tubers are then placed carefully in crates.

A mechanical harvester will perform a similar operation but much more efficiently.

During harvesting, great care should be taken to minimize tuber bruising and cuts as these will allow entry of disease organisms.

Harvesting is best done in the cool of the day. Do not allow buildup of field heat; at all times ensure that potatoes are promptly removed from field to shaded areas.

Grading and sorting

It is important to note that grading and sorting should be done to allow uniform size, colour, shape and varieties per container of produce placed in the market.

Together, sorting and grading facilitate market acceptance, entry, and maintain market presence.

Quality criteria for sorting and grading

- clean from adhering soil particles, other foreign matter;
- fairly well-shaped, that is not too deeply grooved or twisted, or curved;
- free from mechanical damage, for example machete wounds, broken regions or bruises;
- free from disease.

General features: elongated and symmetrical within varietal characteristics; no deformed or malformed tubers allowed; no growth cracks. Five per cent malformed or misshapen tubers is allowed.

The Jamaican market allows grading to the following two categories: baked/large: 15-20cm (6-8in); and table/normal: 7.5-14cm (3–5½).

Storage

Damage incurred during harvesting and transportation must be healed before any attempt to store. With humidity of 90% and temperature of 20-25°C, tubers should be kept for two to three weeks to ensure suberization (hardening of skin tissue). After this, and for short-term storage up to two months, potatoes are to be kept in a dark, cool and well-ventilated room.

For longer-term storage (over three months), the required temperature is 7-10°C with a relative humidity of 90-95%. If necessary, commercial sprouting inhibitors may be applied to extend storage. Potatoes must be stored in ventilated crates or bins and may be stacked no higher than 4m (13ft 4in) high.

Transportation

Transportation is often the most important factor in the marketing of fresh produce. The damage and loss incurred during nonrefrigerated transport are caused primarily by mechanical damage and by overheating.

In all cases, these general guidelines for transporting produce must be followed:

- Keep as cool as possible before and during loading, transportation and unloading.
- Keep dry.
- Move to market as quickly as possible.
- Transport in the cool of the day.
- Do not overload containers.
- Open-sided or half-boarded trucks may be fitted with a roof (white) on a frame, or fitted with canvas. The canvas will act as curtains for the open sides which can be rolled up or moved aside in sections to allow loading or unloading at any point around the vehicle.
- Closed vehicles without refrigerator should not be used to carry fresh produce.

Fig 29 Potatoes must be stored in ventilated crates or bins and may be stacked no higher than 4m (13ft 4in) high

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Appendices

Appendix A: Potato Cost of Production (0.4 Ha)

Manual Operation – New Entrant Farmer				
Activities	**Unit**	**No. of Units**	**Unit Cost J$**	**Total Cost J$**
Labour				
Clearing	Hectare	0.4	60,000.00	24,000.00
Ploughing	Hectare	0.4	140,000.00	56,000.00
Harrowing	Hectare	0.4	75,000.00	30,000.00
Bed shaping	MD	8	2,500.00	20,000.00
Organic matter application	MD	2	2,500.00	5,000.00
Applying fertilizer	MD	1	2,500.00	2,500.00
Planting	MD	10	2,500.00	25,000.00
Moulding	MD	5	2,500.00	12,500.00
Applying Fungicide*	MD	8	3,000.00	24,000.00
Applying herbicide	MD	1	3,000.00	3,000.00
Harvesting	MD	22	2,500.00	55,000.00
Subtotal				257,000.00
MATERIAL				
Seeds	50kg	10	5,500.00	55,000.00
Organic Matter	Tonne	3	2,500.00	7,500.00
TSP	50kg	2	4,000.00	8,000.00
Foliar fertilizer				6,000.00
Potassium nitrate	25kg	7	5,300.00	37,100.00
FUNGICIDES				
Mankocide	Kg	2	1,500.00	3,000.00
Amistar	50grams	6	2,000.00	8,000.00

Manual Operation – New Entrant Farmer				
Activities	**Unit**	**No. of Units**	**Unit Cost J$**	**Total Cost J$**
Phyton	250ml	1	1,800.00	1,800.00
Mancozeb	0.5kg	4	2,300.00	9,200.00
Ridomil	0.5kg	2	2,300.00	4,600.00
INSECTICIDES				
Diazinon	250ml	2	1,200.00	2,400.00
Pegasus	250ml	1	4,100.00	4,100.00
Newmectin	250ml	2	2,400.00	4,800.00
HERBICIDE				
Paraquat	Gal	1	3,800.00	3,800.00
Subtotal				155,300.00
Other Costs				
Transportation (10% of material and labour)				25,000.00
Supervision (15% of labour and material)				61,845.00
Tools (5 yrs amortized)				3,000.00
Contingencies				41,230.00`
Land charges ($15,000/ha/yr)				3,750.00
Subtotal				93.595.00
Total Cost				505,895.00
YEILD	kg	8000		
Cost/kg				63.25
Gross Return			120	960,000.00
PROFIT				454,105.00

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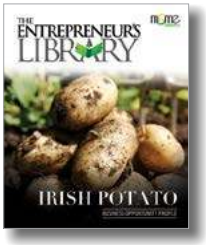

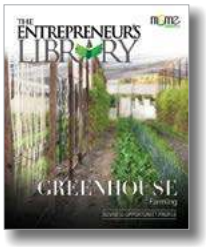

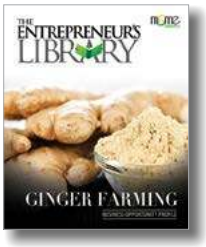

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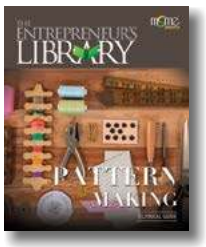

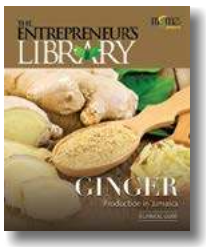

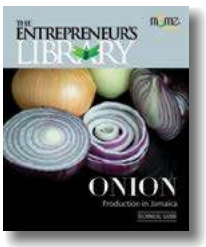

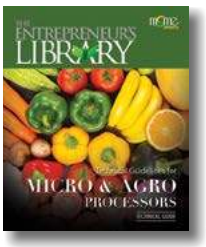

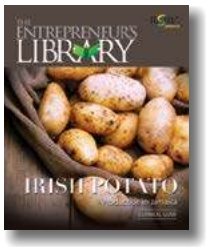

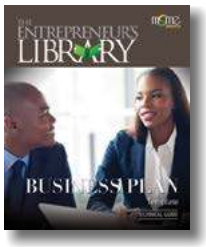

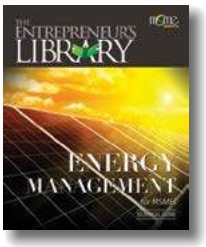

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