

TIPS ON GROWING IRISH POTATOES IN ZAMBIA



Photo Source: www.golddustfarms.com

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and edited by **ASNAPP**
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Botanical name – *Solanum Tuberosum*

Family – *Solanaceae*

Origin – South America (Peru – Bolivia area) and grown on large scale all over the World.

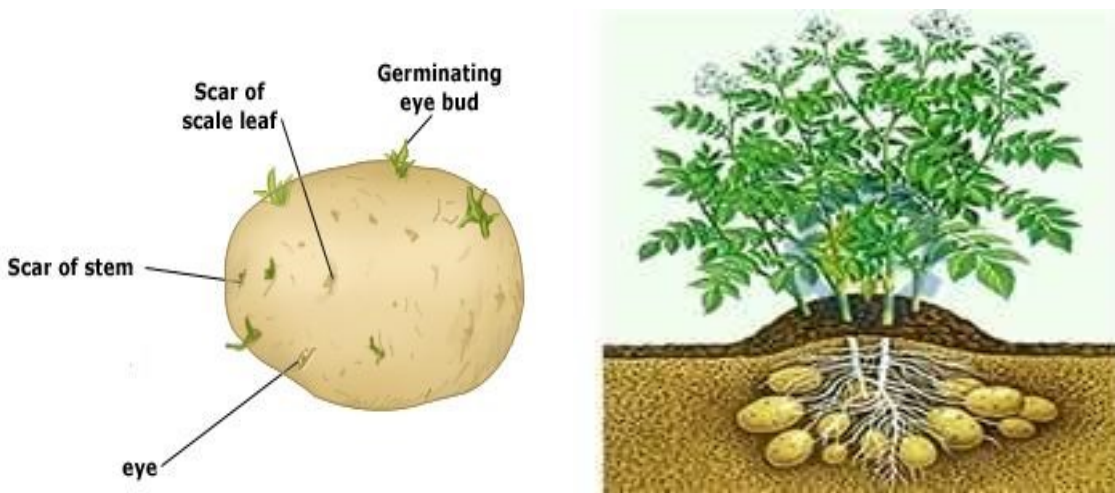
Introduction

Potatoes are an important food crop in the region. It grows better between the end of February and beginning of November. Summer crops are expensive to grow and the yields are poor, with lifting being very difficult. Under good management the crop responds well to produce a high yield.

Uses

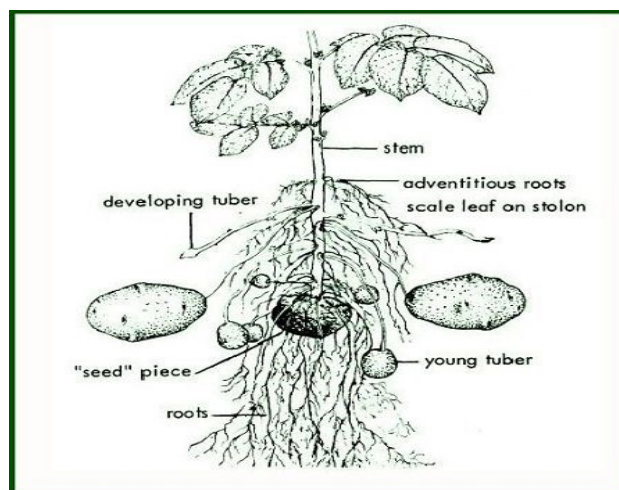
Mainly used for food: Crisps, French fries, table potatoes (boiled) and for medicinal use.

Botanical Description



A short lived perennial herb, grown as an annual producing swollen underground stem tubers when mature 0.3 – 1m in height. Roots are fine fibrous and adventitious. In other words, the roots arise from the nodes of the stem, situated in the soil.

Stems and Leaves – The stems are of two types (1) Aerial and (2) Underground.



The aerial stems are angular, green, and develop compound leaves in a spiral arrangement. Under humid conditions the leaves are broad and flat, and under arid conditions they are narrow and cupped. The underground stems consist of a stolon lead pencil and extend laterally for a distance of 4 – 10cm. The tubers arise at the end of the stolon and are short, thick and fleshy.

Flowers, Fruit and Seed - Flowers are borne in clusters terminating the stem. Individual flowers are perfect and either white, yellow, purple or striped according to variety. The fruit or seed ball is round, small, 1 to 3cm in diameter and contains 100 to 300 seeds. Seeds are used to develop new types and varieties, flowering more profuse in temperate regions of the world.

Varieties - Enviro-Flor Ltd represents **HZPC**, a company based in Holland and has growing experience of seed potatoes for more than 200 years. Varieties from **HZPC** (Table 1), tested in Zambia by Enviro-Flor Ltd, is sold under a brand name “*It's fresh*”. These varieties performed very well under Zambian growing conditions. All varieties tested are grown and released for commercial production in Zambia and is certified by the **SCCI** (Seed Control and Certification Institute).

Note: Sagitta and Sifra are currently undergoing testing at various **SCCI** research stations and will soon be released for commercial production in Zambia.

Due to the vegetative nature of potato multiplication, seed is usually given a categorization determined by number of generations from the virus tested seed multiplication.

The categories are:

- Virus Tested Seed
- Foundation Seed
- AAA
- AA
- A
- B
- Table Ware

Seed not having these categorizations is 6th generation or more and is **NOT** recommended for planting. The yield potential (production) and growing characteristics such as blight tolerance, sprouting and emergence in the field diminish with succeeding generations.

Climatic Requirements

Potato plants produce highest yields during the time of the year when average day temperatures seldom go above 21°C and nights are cool.

Cool Night

Cool night temperatures are more beneficial than cool day temperatures. The most ideal temperature for tuber formation is between 15 and 18°C. Above 20°C tuber development is reduced whilst at temperatures above 29°C few tubers are formed and those that do form are poorly developed. The best temperature at which photosynthesis takes place is around 20°C. The higher the temperature goes, the more energy is required for respiration. This use of energy prevents the build-up of starches in the tubers. As far as yield per hectare is concerned the critical period in the growth of the plant occurs when tubers begin to form. Unfavorable conditions of heat and drought alter the shape and appearance of the tubers.

Rainfall

Disease pressure is high during the rainy season and can have a detrimental effect on production. Early and Late Blight cause heavy losses in crops produced during rains. After the rainy season the first irrigated crop should also be treated against blight due to heavy dew formed at night. The dew provides good conditions for the development of blight.

The longer the growing season of the crop the higher the yield will be and the better the quality of the potatoes produced. The first and second irrigated crop have a longer growing season than the summer crop grown in Zambia.

Table 1: HZPC released varieties in Zambia

<i>HZPC released varieties in Zambia</i>	Traditional	Retail Fresh	Salad	French Fries	Crisps	Peeled	Skin Color	Fresh Color	Tuber Shape	Maturity
Baraka		Ø					yellow	cream	oval	late
Challenger							yellow	light yellow	oval/long-oval	medium late
Courage							red	light yellow	round/round-oval	medium early
Innovator							brown-russet	light yellow	oval/long-oval	medium early
Liseta							yellow	light yellow	long oval	early
Mondial							light yellow	light yellow	long oval	late
Sagitta							yellow	light yellow	oval	medium early
Sifra							yellow	crème	round-oval	late
Taurus							yellow	light yellow	round/round-oval	medium early
Victoria							yellow	yellow	oval/long-oval	medium late

Soil Requirements

The tuber yield, their shape and general attractiveness depends on the texture and physical nature of the soil. Potatoes can be grown on a variety of soils. For the best results a fertile sandy loam soil, which drains well after heavy rains and yet remains moist and cool for a long period, is required. Avoid heavy clay soils, which drain poorly and are difficult to cultivate. Virgin soil with large supplies of organic matter are suitable, provided they have been properly ploughed and brought into a fine tilth.

Fertilizers

Soil Analysis: It is recommended to have your soil analyzed by a reputable laboratory. Fertilizer recommendations can then be based on the yield you would like to achieve.

Basal Dressing: Apply 800 – 1000 kg/ha Compound 'D'. If manure is available, apply 20 – 40 tons/ha. **Or** apply **Potato Basal** (800 —1000 kg/ha) depending on the fertility of the soil and recommendations based on the soil analysis results.

Top Dressing: When plants are 20cm high, apply 150 – 200 kg/ha Ammonium Nitrate or apply 500 — 800 kg/ha **Potato Top**. Caution must be taken to avoid burning the crop.

Crop Rotation

Potatoes are one of the best crops for opening up new land. Following potatoes, maize yields have proved phenomenal as this crop tends to utilize all the residual fertilizer in the soil after harvesting the potatoes. ***Only plant potatoes in the same field every five years.***

Seed and Seed Chemical Treatment

When keeping seed for the next planting, always grade out the correct size (35/55mm) of seed required from the previous crop. Setting a high standard will maintain high production in the following year. If a mechanical planter is used then the size and uniformity of the seed is important.

All seed should be dusted with Thiram at 20g per 10kg seed or Germinator. In each planting furrow also spray Imidacloprid (Confidor 350SC®) at 4.5 ml /100 m row into the furrow ahead of seed placement by hand or machine.

Generally there are no problems with sprouting when temperatures are above the 18 - 21°C minimum requirement.

Planting

If a mechanical potato planter is used, plant into a small ridge having placed the granular nematicide into the ridge beforehand. Apply chemicals either just before or after seed has been placed. If planting by hand, make straight furrows of about 6cm deep in the soil and apply nematicide, insecticide and fungicide to the soil before placing the potato seed. Dust the furrow with fertilizer (basal dressing) and ridge up afterwards.



Fig 1. Potato Planting Furrow



Fig 2. Sprouted Potato Seed

Seed rate: 2 — 2.5 tons/ha or 1.0 — 1.5 tons/ha depending on variety and size of the tubers.

Seed Treatment: Before planting, the tubers should have *sprouted* or show signs of sprouting (Fig 2) otherwise a very poor and uneven crop will result.

Sprouting may be induced by either keeping the tubers in doors in bags and in a warm spot or under straw in the sun. They will usually start sprouting within 8 to 10 days provided that the weather remains fairly warm.

Plant Spacing: 45cm (interplant spacing) × 90cm (Inter-roll spacing) for **potato**
 25cm (interplant spacing) × 80cm (Inter-roll spacing) for **seed potato**



Fig 3. Sample of Potato Beds

Weed control

Before spraying any chemical make sure you have checked its harvest interval (PHI), the withholding period and the re-entry period. DO NOT spray any chemical which will leave a toxic residue in the plant after harvest. Before spraying always read the Chemical Label.

For pre-emergent weed control, apply Sencor and Dual Magnum mixed in 300 litre water per ha, followed by a light irrigation or where rain fed potatoes are being produced, apply just after a light rain shower.

Trade Names	Active Ingredient	Rate/Ha	Type of Weeds Killed
Not USAID Approved		2 L	Broadleaf
Not USAID Approved		1 L	Annual Grasses

Cultivation of the Soil

The objective of cultivating the soil is to get rid of weeds, to keep the soil loose, to break impermeable layers, to level the soil, to improve drainage (avoid water logged areas). When plants are 10 – 15cm high or when they start flowering, they may be ridged in order to protect the developing tubers from a potential infestation with potato tuber moth larvae.

Irrigation

If sufficient water is available the first irrigation should take place before the tubers are planted (unless the soil has been moistened by rain). Make sure that the soil is at field capacity at planting. Plan your irrigation schedule as such that the soil does not dry out to less than 10 – 15% below field capacity. Tuber setting starts within a month after emergence. Insufficient moisture during this period can result in fewer tubers and a low yield. The demand for water tapers off towards maturity.

Pests

Before spraying any chemical make sure you have checked on its harvest interval (PHI), the withholding period and the re-entry period. DO NOT spray any chemical which will leave a toxic residue in the plant after harvest. Before spraying always read the Chemical Label.

Aphids

Regular scouting should indicate the presence of aphids and then spraying can take place with one of the following chemicals.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Confidor	Imidacloprid	60 ml	9.0 ml	150 ml
Malathion 50EC	Malathion	250 ml	37.5 ml	625 ml
Actara WG	Thiamethoxam	80 g	12.0 g	200 g
Dimethoate, Rogor	Dimethoate	75 ml	11.2 ml	187.5 ml
Not USAID Approved		100 g	15 gm	250 g

Caterpillars

Various caterpillars attack the crop. These include looper's, army worms etc. Spray as required in 250 L/ha water with one of the following.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Fastac	Cypermethrin	7 ml	1.0 ml	17.5 ml
Malathion 50EC	Malathion	250 ml	37.5 ml	625 ml
Karate	Cyhalothrin	8 ml	1.2 ml	20 ml
Not USAID Approved		35 g	5.2 g	87.5 g
Decis	Deltamethrin	20 ml	3 ml	50 ml

False Wireworm/ White Grub

In the planting furrow apply immediately ahead of seed placement Chlorpyrifos (Dursban®) at 4 L/ha.

Potato Leaf Miner

Potato is also attacked by leaf miner (*Liriomyza trifolii*). Spray at 10 — 14 day intervals with one of the following in 250 L/ha water.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Abamectin/Agrimec	Abamectin	240 ml	36 ml	600 ml
Trigard	Cyromazine	60 g	9 g	150 g

Follow up spray program as and if required.

Potato Tuber Moth

Potato tuber moth is a serious pest and regular sprays should be undertaken every 14 – 21 days. The following can be used:

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Fastac	Cypermethrin	120 ml	18 ml	300 ml
Dursban	Chlorpyrifos	60 ml	9 ml	150 ml
Karate	Cyhalothrin	50 ml	7.5 ml	125 ml
Not USAID Approved		35 g	5.2 g	87.5 g
Decis	Deltamethrin	130 ml	19.5 ml	325 ml

Diseases

Before spraying any chemical make sure you have checked on its harvest interval (PHI), the withholding period and the re-entry period. DO NOT spray any chemical which will leave a toxic residue in the plant after harvest.

Routine spray

To prevent most diseases, spray the crop on a weekly basis with fungicides containing copper together with Mancozeb. A routine spray program is given below; one of the copper fungicides together with Mancozeb.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Dithane M45	Mancozeb	200 g	30 g	0.5 kg

Add one of the following

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Kocide	Copper hydroxide	375 g	56.2 g	937.5g
Funguran	Copper hydroxide	250 g	37.5 g	625 g
Copper Oxychloride	Copper Oxychloride	500 g	75.0 g	1.25 kg

After every third application replace the Mancozeb with Chlorothalonil (Bravo®) at 3.0 L/ha. Chlorothalonil is very good on both early and late blight and a number of other leaf spots.

Bacterial wilt

Normally the preventative program takes care of most bacterial diseases except those that attack during very high humidity conditions. For this reason potato production is discouraged during January and February. If attacks do occur then increase the rate of the copper fungicide. Always consult your chemical representative.

Black Leg



Black leg (*Erwinia carotovora*) is a weak pathogen that usually infect the plant or tuber as a secondary pathogen after insect or nematode attack. Ensure that nematodes and subsoil pests are controlled.

Black Rot

Black rot, (*Colletotrichum sp*) usually infect the plant or tuber as a secondary pathogen after insect or nematode attack. However if a fungicide is sprayed into the planting furrow at planting and the seed is dressed with Thiram normally the fungus is not seen. Crop rotation is important – **no planting of potatoes in the same field for five years** control many of these diseases.

Cercospora and other fungal leaf spots

In high humidity and warm conditions Cercospora leaf spot can be a problem. Regularly spray with a copper fungicide as outlined below every 10 – 14 days, but if the disease starts to spread then use one of the other products. Ideally one should not apply more than two sprays 14 days apart of any one of the systemic products listed below.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Kocide	Copper hydroxide	500 g	75.0 g	1.25 kg
Kocide 2000	Copper hydroxide	350 g	52.5 g	875 g
Funguran	Copper hydroxide	500 g	75.0 g	1.25 kg
Copper Oxychloride	Copper Oxychloride	650 g	97.5 g	1.625 kg
Not USAID Approved		200 ml	30 ml	500 ml
Not USAID Approved		200 ml	30 ml	500 ml

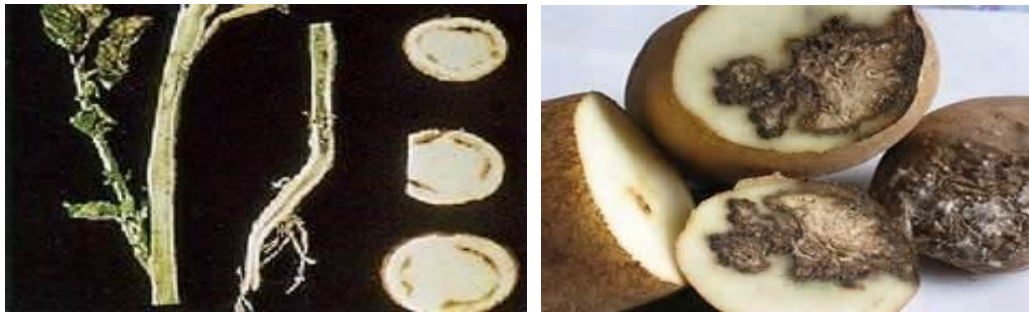
Early Blight

Normally the preventative spray program takes care of most blight diseases except those that attack during very high humidity conditions. If the disease do get out of hand, then spray one of the following diluted in 250 L/ha. Apply a follow up spray 14 days later. Do not stop the preventative spray program.



Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Dithane M45	Mancozeb	200 g	30 g	0.5 kg
Bravo	Chlorothalonil	1.2 L	200 ml	3 L
Folicur Tebuzole	Tebuconazole	200 ml	30 ml	500 ml
Not USAID Approved		44 ml	6.6 ml	110 ml
Not USAID Approved		200 ml	30 ml	500 ml
Not USAID Approved		200 ml	30 ml	500 ml

Fusarium tuber rot



Fusarium tuber rot usually infects the plant in the same way as Black Leg. However, if a fungicide is sprayed into the planting furrow at planting and the seed is dressed with Thiram, then normally the fungus is not seen. Crop rotation is important – no potato crop in five years controls a great many of these diseases.

Late Blight



Late blight is the most serious of all the potato diseases because of the rapidity of attack. Normally the preventative program takes care of late blight except an attack during very high humidity conditions. If the disease is not under control then in 250 L/ha water spray one of the following. Apply a follow up spray 14 days later. Do not stop the preventative program.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Dithane M45	Mancozeb	1200 g	179.9 g	3 kg
Kocide	Copper hydroxide	375 g	56.2 g	937.5 g
Kocide 2000	Copper hydroxide	250 g	37.5 g	625 g
Copper Oxychloride	Copper Oxychloride	500 g	75 g	1.25 kg
Tanos	Cymoxanil/famoxadone	40 g	6 g	100 g
Acrobat	Dimethamorph/Mancozeb	800 g	119.9 g	2 kg
Ridomil Gold	Metalaxyl/Mancozeb	900 g	134.9 g	2.25 kg
Not USAID Approved		450 g	67.5 g	1.125 kg

Powdery Mildew

Normally the preventative program takes care of powdery mildew except an attack during very high humidity conditions. Spray one of the following in 250 L/ha water and repeat 14 days later.

Trade Names	Active Ingredient	Rate/100L Water	Rate/15L Knapsack	Rate/Ha
Folicur Tebuzole	Tebuconazole	200 ml	30 ml	500 ml
Not USAID Approved		44 ml	6.6 ml	110 ml
Not USAID Approved		200 ml	30 ml	500 ml
Not USAID Approved		200 ml	30 ml	500 ml

Rhizoctonia solani

Rhizoctonia solani or black stem can be controlled by the use of Tebuconazole (Tebuzole®, Folicur® or Orius®) at 650 ml/ha into the planting furrow.

Scab

Scab does not like acidic soil conditions (pH > 5.2) so be careful when applying lime especially to varieties such as BP 1. This encourages the development of scab. The use of ammonium sulphate as a top dressing source of nitrogen will also help to suppress scab. High phosphate and the use of gypsum are also instrumental in controlling scab. The chemical control of scab is very expensive.



Verticillium wilt

Normally the preventative program takes care of most bacterial diseases except those that attack during very high humidity conditions. For this reason potato production is discouraged during January and February. If attacks do occur then increase the rate of copper fungicide.

Watery soft rot (Pythium)



This is a disease that comes in at planting. Fungicides applied for *Rhizoctonia* control usually help with the control of pythium.

Harvesting

At the end of the growing season when the foliage is dead, the tubers are mature and ready for harvesting. Potatoes take 3 – 4 months to reach maturity. Lifting can be done either by hand using hoes, spades, garden forks or mechanically by using lifting machines. All damaged tubers should be discarded or kept separately.

After lifting, the tubers should be placed in bags as soon as possible and taken to a cool well ventilated shed. If the tubers are left in full sunshine for long, they begin to turn green and overheating by the sun will result in a reduced keeping quality. This often leads to premature rotting.

Expected Yields

An average yield in the range of 50 - 65 tons/ha should be taken as an expected standard yield for intensive potato growers, commercial farmers.

The yield range for small scale growers is as follow:

- Summer crop 9 – 12 tons/ha
- 1st irrigated crop 12 –18 tons/ha
- 2nd irrigated crop 18–25 tons/ha

Marketing – Potatoes are often lifted before the harlems have died back and these are sold as new potatoes. The smaller tubers are often graded and sold as seed potatoes.

Conclusion – blight, leaf miners, nematodes and potato tuber moth are major pests which can completely destroy a potato crop, especially from late August to March.

A crop therefore needs much attention during this period, and the farmer should be ready to protect his/her potatoes from the first signs of damage.

References

Refer potato disease pictures and any other pictures used in this document to the following web sites:

http://vegetablemdonline.ppath.cornell.edu/factsheets/potato_detection.htm

Detection of Potato Tuber Diseases & Defects fact sheet

http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato_Detection.htm

Black Dot Disease of Potatoes fact sheet

http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato_BlDot.htm

Detection of Potato Tuber Diseases & Defects fact sheet

http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato_Detection.htm

Photo Gallery of Vegetable Diseases

<http://vegetablemdonline.ppath.cornell.edu/PhotoPages/PhotoGallery.htm>

Potato-Black Dot

<http://vegetablemdonline.ppath.cornell.edu/PhotoPages/Potatoes/BlackDot/PotBlkDtPhotoList.htm>

Vegetable Diseases Cornell Home Page

<http://vegetablemdonline.ppath.cornell.edu/index.html>

What is the CASH Project?

The Commercial Agribusiness for Sustainable Horticulture (CASH) is a project made possible through the generous support of the United States Agency for International Development (USAID) which aims to increase the technical and operational capacities of 5,000 rural smallholder horticulture producers in Lusaka's peri urban areas, Lundazi, Petauke, Katete and Chipata to efficiently respond to dynamic market requirements.

The CASH project is increasing market shares and profit margins of the farmers in the project by developing new and strengthening existing market opportunities. This project is fostering strategic alliances and partnerships and improving the in-country delivery capacity to produce and market superior quality horticultural products, thereby addressing the challenges of food insecurity and rural unemployment.

Farmers in the project are being guided and trained to become commercial horticulture producers, to ensure year round income generation, to manage their agribusinesses efficiently and as a result reduce food insecurity.

The CASH Project can be contacted at www.cashprojectzambia.org or **0211-267493/4**. Emails can be sent to natasha@asnapp.org

Enviro-Flor Ltd aims to:

- Support growing of potatoes among small scale and emerging commercial farmers in Zambia, priority given to local farmers in Lusaka and those along the line of rail; Mukushi, Kapirimposhi, Kafue, Mazabuka, Monze, Choma and Livingstone. Not excluding farmers in Eastern Province i.e. Chipata, Lundazi, Katete and Petauke.
- Provide extension services with the help of our co-operating partners, **ASNAPP (through the USAID funded CASH Project)** and **HZPC**, on basic potato production practices to improve production to sustainable levels for small scale and emerging commercial farmers in Zambia.
- Encourage and promote the growing of potatoes among small scale and emerging commercial farmers in Zambia as an alternative cash crop that can support their economies by providing significant source of income.
- Promote and change the mind-set of the general public to treat and eat potatoes like one of the staple foods in Zambia.
- Support the supply of 3rd generation potato seed to small scale and emerging commercial farmers from the locally grown potatoes produced by **Enviro-Flor Ltd** from a 2nd generation seed obtained from **HZPC-Holland**, which is tested and certified by the **Seed Control and Certification Institute (SCCI)** for commercial production.
- Provide information to our clients and other stakeholders on how to source quality potato seed from a reliable seed supplier company; **HZPC** which is based in the Netherlands through Enviro-Flor Ltd, an agent of **HZPC** varieties in Zambia.

Disclaimer

Enviro-Flor Ltd has accurately made every effort to share the agronomic practices of growing potatoes in Zambia. However, there is no guarantee that you will earn any money using the techniques and ideas provided in this pamphlet. The information provided in this pamphlet should not be interpreted as a promise or guarantee of making profit. The profit potential is dependent on the farmer using the information, ideas and techniques provided. The information provided is real, however, your level of success in attaining production results depends on the time you devote to follow the provided information, your level of skill, your finances and other factors beyond the control of Enviro-Flor Ltd. Since these factors differ according to individual farmer, Enviro-Flor Ltd cannot guarantee your production or income levels nor responsible for any of your actions or losses that you may encounter in your growing season.

Please contact your nearest chemical representative or extension agent to make sure that the correct chemicals are applied at the appropriate rate and that the chemicals used during production comply to the laws and regulations of the Government of Zambia.

Also do consult your nearest fertilizer company to ensure that professional advise is obtained in regards with the amendment of soil nutrients.

We Wish You All The Best!