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Good Agricultural Practices for Field Multiplication of Seed Potato in Cameroon

Producer Manual

Green Innovation Centres for the Agriculture and Food Sector Project (ProCISA)

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Module 1 Seed potato overview

It is widely known that one of the major constraints to potato production in Cameroon is the scarcity of quality seed and the existence of unstructured seed systems. Furthermore, seed growers do not master and apply the good agricultural practices that are conducive to the production of quality seed potato.

Seed Potato Production: a specialized activity

A seed potato grower in Cameroon is a specialized farmer who must be officially registered by the Department of Regulation and Quality Control of Agricultural Products and Inputs (DRCQ) of the Ministry of Agriculture and Rural Development (MINADER), and as such he/she must comply with a set of very strict rules.

First, seed growers must know that potato is the second top crop after cotton to be mostly affected by pests and diseases.

Moreover, the potato has the particularity to be more affected by diseases that are transmitted by contact, for instance:

- Contact between a healthy and a diseased plant in the field, when the leaves touch each other because of the wind;
- Contact between the sprouts of a healthy tuber and the sprouts of an infected tuber during storage; and
- Contact between an operator crossing a healthy potato field after having visited a diseased potato field, or a diseased plant within a plot.

Hence, seed inspectors are known to be one of the most common causes of field contamination, especially when they do not change their trousers between two inspections.

These types of field contamination must be considered by seed growers at any stage of seed potato production.

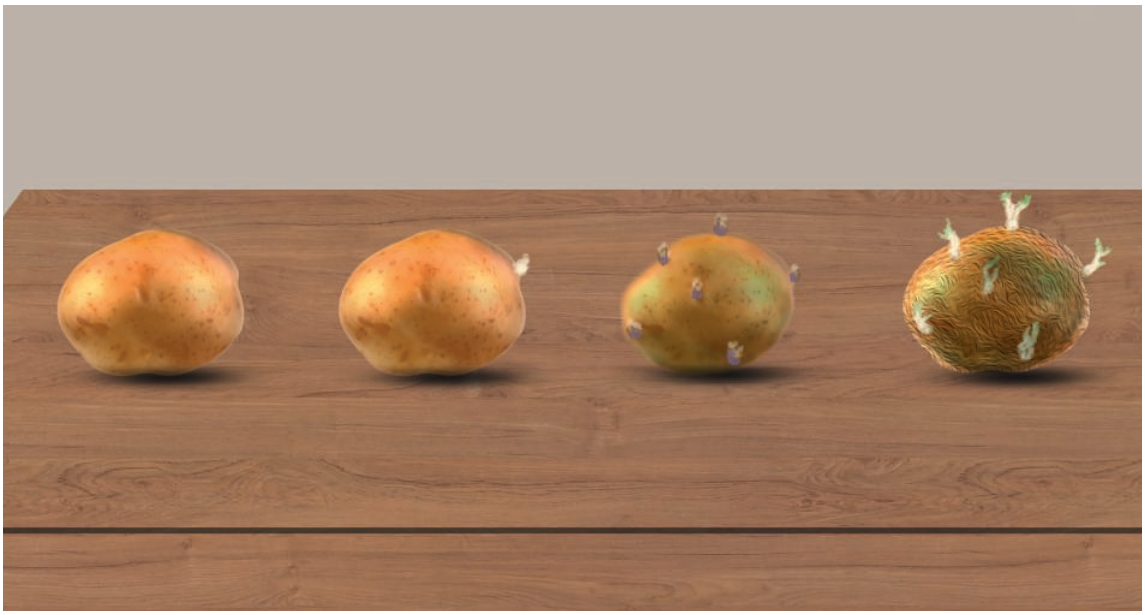
A trick before purchasing seed potatoes: take a few samples from several bags and wash them with clean water. Once washed, it is easier to observe the presence of diseases (black scurf, silver scurf, common scab, etc.) on them and, therefore, to better judge on the quality of the seed tubers that the trader wants to sell.

Important considerations in seed potato production:

- The quality is the major aspect that differentiates seed potatoes from ware potatoes, and this is the reason why seed tubers are more expensive than ware potatoes.
- Seed and ware potato production are two completely different, but interconnected activities in terms of cultivation techniques to be followed.
- The most evident objective for seed production is to produce the largest quantity of small to medium-sized tubers (25 - 55 mm) which are:

    - free from soil and seed-borne diseases, and
    - in conformity with the variety attributes.
- On average, if appropriate cultivation techniques are applied, seed yield of 20-25 t/ha may be achieved in the highlands of Cameroon.

Seed tuber characteristics



Like any living organism, seed tubers have a life cycle which can be divided into four successive phases:

i. **dormancy** (immediately after harvest): during dormancy, seed tubers breathe like a living organism, inhaling oxygen and eliminating carbon dioxide and some heat. It is important, therefore, to store seed potatoes in ventilated stores as carbon dioxide favours fast sprouting. Note this could be an advantage when the period between seasons is less than the normal dormancy period of the variety.

ii. **single sprout with apical dominance:** in certain varieties, it is necessary to take off gently with a firm twist such apical sprouts in order to favour the development of the lateral (side) sprouts.

iii. **multiple sprouts:** the right time to plant when sprouts are strong, coloured and shorts (1 - 2 cm long); and

iv. **senility** (i.e., too old seed to plant): this stage is characterized by the formation of whitish, long and tiny sprouts. If seed tubers are planted at this stage, stems will not emerge, and the tubers will produce only tiny underground tubers called “little potatoes”.

Remember: you can take off sprouts from one seed tuber only once. Producing new sprouts for the second time will consume energy and water to sprout again, thus weakening itself and becoming easy prey to pests and diseases once planted, giving a

very reduced yield.

Short (2 cm long), strong, coloured (the colour of the variety) sprouts will ensure that, once planted, the growth and development will be faster, uniform and the crop will be more vigorous.

If you have seed tubers of different sizes, plant them in separate plots or separate sections.

Potato varieties

In Cameroon, the most grown varieties are Cipira, Bambui Wonder, Dosa, Jacob 2005, Panamera, Mondial, Spunta and Désirée (Appendix 1). New varieties were introduced with the facilitation of ProCISA, a GIZ-funded project. Those varieties are now officially registered. Those varieties are currently six, namely, Bavapom, Sevim, Juwel, Krone, Marabel and Jelly. Among these, Jelly seems to be outperforming others for its tolerance to late blight, viruses and market preference.

Seed degeneration

Seed degeneration is an accumulation of pests (i.e., nematodes) and/or pathogens in the seed tubers, and physiological disorders (for instance, further to hot weather during the growing season and storage, thus influencing potato seed physiology), associated with a reduction in yield or quality of seed over successive cycles of field multiplication.

Seed degeneration is mostly caused by potato viruses that can be mainly transmitted by aphids, whiteflies or by contact with any other contaminated item. Therefore, seed growers must renew their source of starter seed regularly.

Implement a "Flush out" system.

Seed potato growers must respect a production system called "flush out". In other words, they should never grow the early field generation seed where they had grown seed of lower category previously. This means that they must always reserve the same land for super elite seed category (at a higher altitude), while another land should always be reserved for lower categories of seed (from elite to certified seed), especially when the latter is situated at lower altitudes.

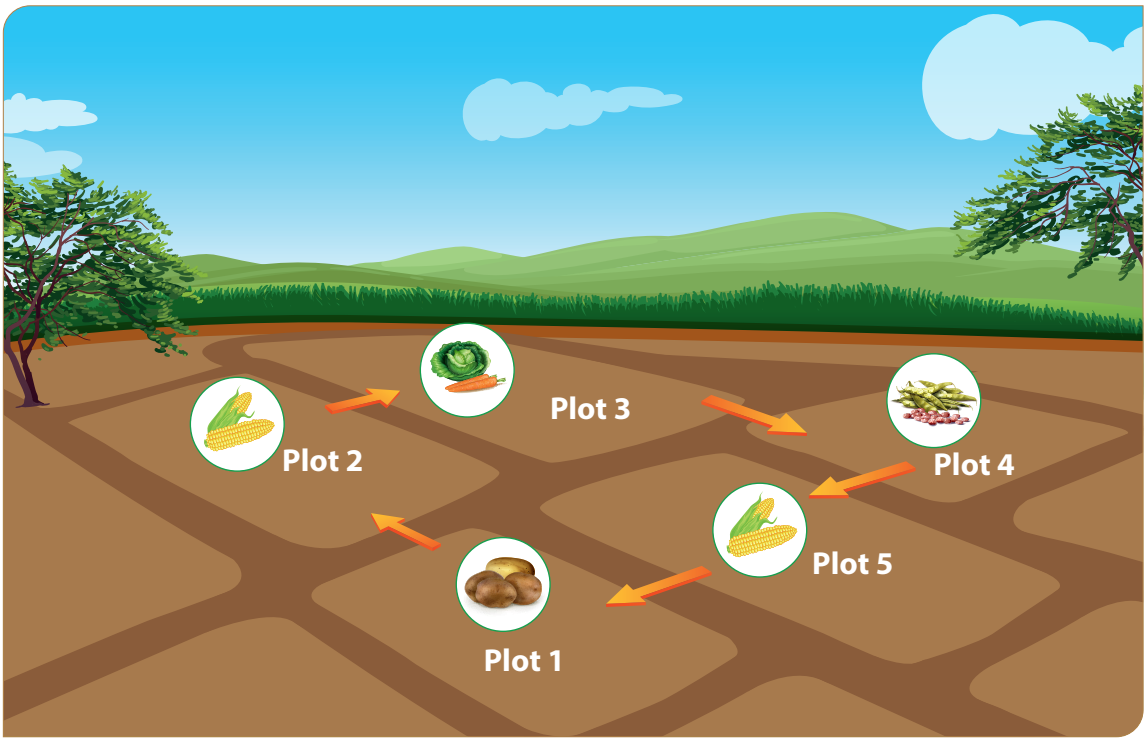
Some advice and instructions:

- Mild temperatures, highlands (above 1,800 masl) and windy areas, in general, are unfavourable to high pest and disease pressure, except for diseases like late blight.
- Before each season, selected seed growers' fields must be analysed for nutrient content and detection of nematodes and diseases.
- The soil should be deep, well-drained and loose for proper development of roots, stolons and tubers.
- The site should be free of soil-borne pests, such as nematodes, and diseases like black scurf, bacterial wilt and blackleg.
- To reduce the risk of pests and diseases, select a site where potato or other sister crops (e.g., eggplant, pepper, tomato, or tobacco) have not been grown for at least two consecutive years (four seasons). These crops should also not grow close to the potato seed field.
- After harvest, implement a rotation plan of 2-3 years (i.e., at least 5 cycles or seasons) that starves most pests and diseases, and thus sanitize the field.

- The best way to rotate crops is to divide the farm, where potato will be grown, into five plots to allow rotation of crops such as maize, beans, carrots, cabbage, and other legumes (i.e., mung bean).
- During rotation, it is important to ensure that all volunteer potato plants (i.e., potato plants from the previous season) are removed. That is why it is important to plant seasonal crops (maize, beans, etc.) before or after potato, to ensure that all volunteer plants are easily noticed and uprooted and taken out of the field.
- Never leave the harvested field under fallow because, firstly, it would be difficult to notice volunteers, and, secondly, weeds and bushes may invade the land and become difficult to remove.

Crop rotation

The following table and Appendix 2 show rotation options that can be implemented in the potato production areas of Cameroon.



Soil should always be prepared early in the season. The ground should become soft, free from clods and prepared up to a depth of 25 cm or slightly more.

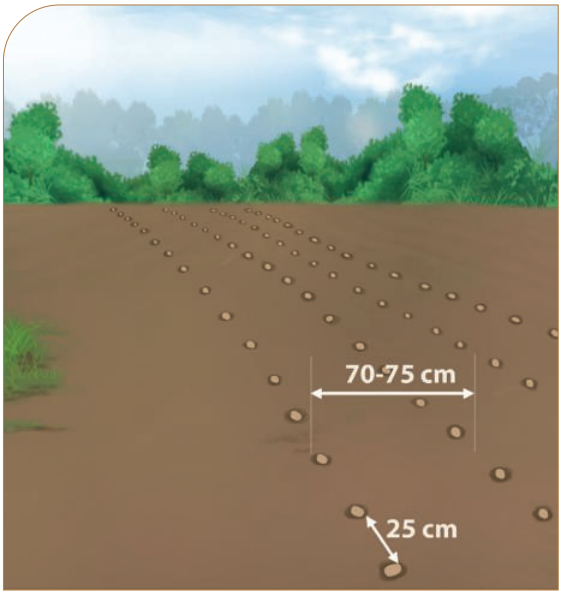
Where ploughing is done mechanically, remember to vary year after year the ploughing depth to avoid the so-called “plough-pan” that is the formation of an impermeable layer making difficult gas and water exchanges, thus increasing the incidence of diseases.

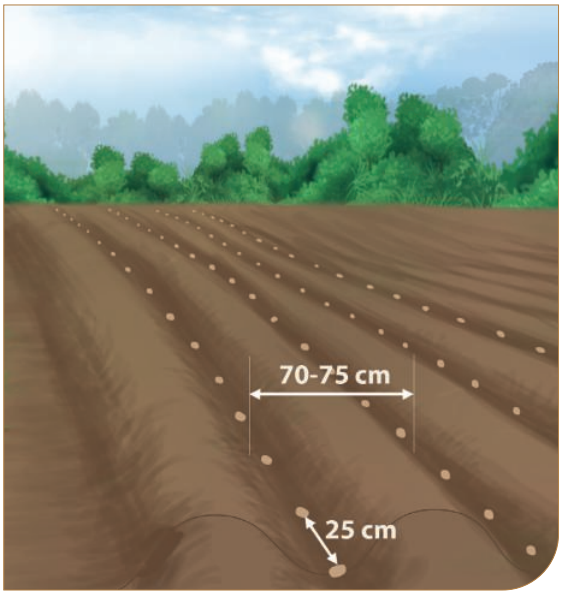
For farmers planning to plant on small plots, moto-cultivators are recommended, whereas

tractors could be used by farmers with larger fields (over 5-10 ha). Economically, an 80 Hp tractor becomes profitable over an area of at least 50 ha. Therefore, farmers are encouraged to form cooperatives or associations to acquire a tractor and share costs.

Very often tractors can become responsible for heavy soil compaction, very dangerous for potato. Therefore, it is recommended to reduce the number of tractor passages along the rows.

Tractor accessories or tools must be cleaned and if possible, sanitized (using chlorine diluted in water) after work and before moving from one field to the other to avoid pest and disease contamination between seed fields.





Spacing

Furrows or holes are prepared at a spacing of 70 - 75 cm. Within rows, use a plant spacing of 25 - 30 cm depending on seed size, 25 cm when tubers are small (around 25 mm of diameter) and 30 cm for large sized tubers (55 mm of diameter). It should be noted that seed potatoes are planted more densely than ware potatoes, and this produces a dense canopy that helps to suppress weeds.

When using potato planters, planting is done on flat land at a depth of 5 cm or less. Potato planters will prepare half-ridges that are normally completed afterwards by conventional potato ridgers equipped with discs or plough bodies.

If planting is manual, tubers should be placed at a depth of 5 to 10 cm on furrows before they are covered, waiting for ridging once plants have reached a height of around 25 cm, depending on the type of variety grown and the growth speed.

On sloping terrain, furrows should run across the slope to reduce soil erosion.

Manure and fertiliser application

Like any other crop, potato requires adequate nutrients from manure and chemical fertilizers to grow well. Cameroonian farmers prefer using poultry manure while farm-yard manure that should be always well-decomposed is rare. Seed farmers normally use 15-20 tonnes of well-decomposed manure per ha, but they use less than that for chicken dung manure (around 5 tonnes/ha).

Less nitrogen and potassium should be used than in ware potato production because

they promote tuber size, whereas smaller tubers are targeted in seed potato production. Also, when too much nitrogen is used, potato plants risk not to form tubers. Furthermore, too much nitrogen would mask mosaic symptoms on the leaves and would also promote too much aboveground growth at the expense of tuber development. Phosphorus is the most important element in seed production because it stimulates rooting, formation of stolons and increases the number of tubers.

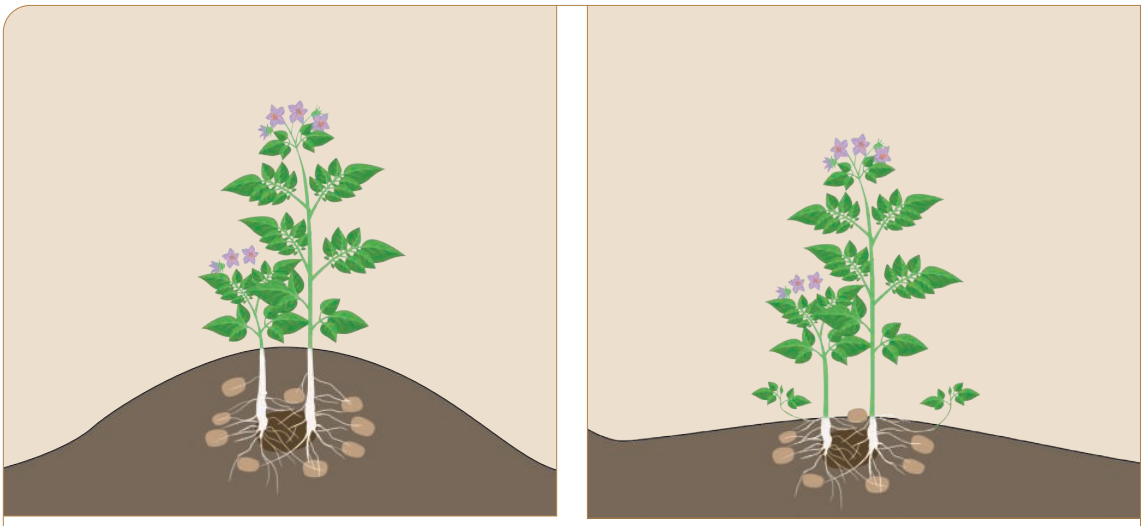
If fertilizer application and planting are done manually, chemical fertilizers should not be in direct contact with seed potatoes as sprouts may be burned. So, you must apply the fertilizers first, mix very well with the soil, and then plant the seed potato.

For fertilizers, various compound NPK fertilizer packages are available on the market in Cameroon. The most used fertilizers have a composition of NPK 12-11-18 or NPK 11-11-22 which are mixed with a second N-rich fertilizer (15-0-0) at a ratio of 4/1, respectively. Avoid any NPK fertilizers that have proportions between major nutrients (N, P and K) very different from the ones proposed here (e.g., 20-10-10).

If the plant spacing is for example 75 cm x 25 cm, 800 kg/ha of mixed fertilizers will be required, i.e., 640 kg/ha for the NPK-based fertilizer and 160 kg/ha for the N-based fertilizer. In practical terms, apply the content of two Fanta or beer bottle caps for each seed tuber or plant (around 15 g/plant). Apply one cap of mixed fertilizers at planting and reserve the second one of same fertilizers for top-dressing, 1-2 weeks after plant emergence.

But for those who may not be able to fertilize after emergence, they can apply the two caps at planting. Also, if you fail to apply fertilizers at planting, you may apply the two caps after emergence. To fertilize the crop after emergence, dig one small hole at around 10-15 cm from the plant base using a stick. Put fertilizers and fill in using hands or the stick.

Module 4 Weeding and hilling up



Good Hilling | Bad Hilling

A seed potato field must always be kept clean from weeds. In fact, weeds are potato competitors for light, nutrients and water; furthermore, they are hosts of pests and diseases affecting potato.

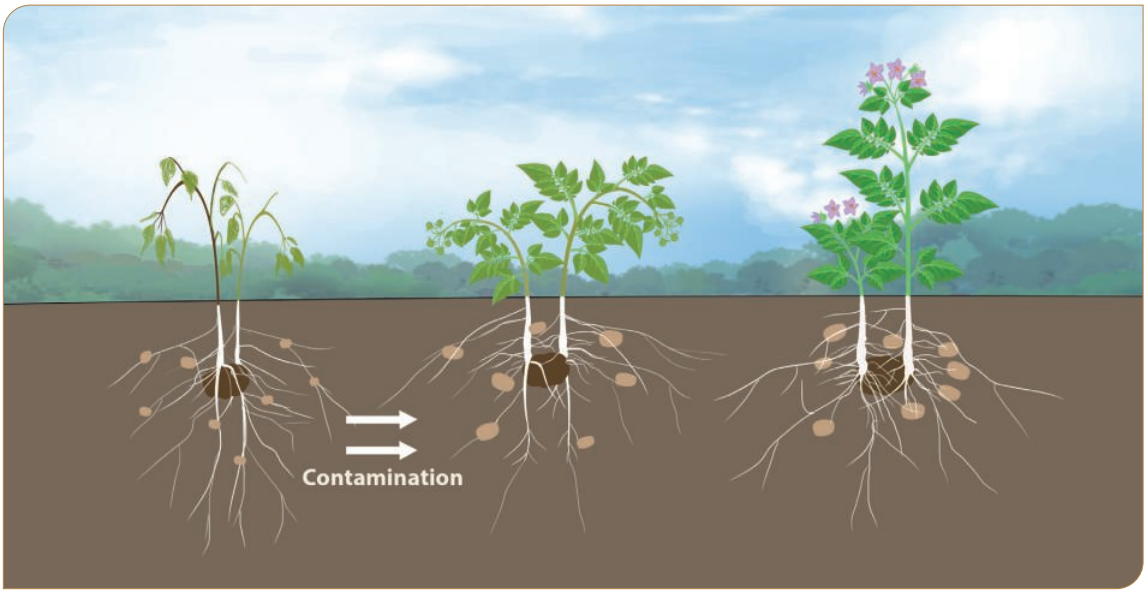
Besides weeding, hilling up potatoes is very important in seed production as uncovered stolons become aerial stems instead of producing tubers. Hilling helps increase the number of tubers, hence seed yield. The ridges should be high, at least 45 cm from the base of the ridges to the top, and must be well-formed, rounded at the top to contain as many tubers as possible and to protect them from tuber blight and other pests and diseases.

If excessive rainfall is expected, the tubers must be above the ground level when the ridges are formed. In the case of poorly made ridges, it may happen that stolons go out of the ridge and become stems.

Module 5 Disease and pest management

The potato crop is affected by many pests and diseases which cause a reduction in the yield and the rapid degeneration of the seed potato. Ultimately, these pests and diseases cause huge economic losses in ware and seed potato production. Therefore, seed growers should be very much concerned with seed tuber health. The disease-causing agents are either air-borne, soil-borne and/or seed-borne.

Bacterial wilt



Bacterial wilt (Ralstonia solanacearum) is the most important disease in seed potato systems in Cameroon and other sub-Saharan countries.

Symptoms and detection:

- Unlike other similar diseases, the plant wilts without yellowing.
- Also, it can be detected by cutting a tuber into two pieces. Black or brown ring of the vascular tissue can be seen. Sometimes, milk-like fluid may come out of tuber eyes.
- It can be detected by immersing a small piece of stem base in a glass of clean water. Bacterial wilt is shown by a white smoke dripping from the stem and moving downward in the water.

Transmission: The disease can spread from field to field or from plant to plant within a field via infected seed, water runoff, roots, contaminated soil, farm tools, livestock, and people.

Management: There is no commercial chemical to manage bacterial wilt. Therefore, the only way to manage the disease is through cultural practices:

- Planting a clean seed in fields free from bacterial wilt. Test soil for bacterial wilt if possible before planting.
- Follow the recommended crop rotation from above, rotating with other crops not belonging to the potato family, such as cereals and onions. Maize and barley are the most recommended crops before and after potato.
- Removing wilting plants (plants plus mother tubers, small tubers already formed, roots and stolons) together with soil containing roots, taking care not to splash soil on the other plants. Then, all the parts of the plant must be put in a bag that each seed grower should have. The seed grower should also dig a pit outside the field where all the infected plants should be buried and covered with lime.
- Sanitizing the tools before and after use with chlorine in water solution.
- Putting a stake on all the hills where wilted plants were eliminated. At harvest, the two neighbouring plants will be harvested separately, and tubers sold and/or consumed as ware potatoes.

Soft rot (or blackleg)

Soft rot also known as blackleg is caused by a bacterium (Erwinia carotovora).

Symptoms:

- In the field, potato plants are often attacked at the base of the stems, showing black-coloured lesions as per its name of blackleg.
- Infected tubers rot either in the field or in storage and produce a fish-like smell. In the stored tubers, the appearance of the disease is triggered by an increase of temperature.

Management:

Manage this disease by applying the same control measures as those recommended for bacterial wilt.

Late blight

Late blight (Phytophthora infestans) causes crop failure by damaging the leaves, stems and tubers.

Symptoms:
Infected leaves or stems present brown spots as if they were burned. Fortunately, it can be controlled by spraying fungicides.

The disease appears when these two conditions are present: high relative humidity (over 90%, shown by the presence of water drops on the leaves) and cool temperatures (less than 22°C). When these two conditions are present, ensure that you have fungicides with you. Otherwise, you risk losing the crop.

This disease is not a big issue during the dry season in Cameroon.

Management:
Late blight can be managed as follows:

i. Timely sprays to prevent infection when the above conditions are present.

a. The most common fungicides present on the local market are:

- Jumper D (Dimethomorphe + Chlorotalonil) sold in 60 g bags, to be directly diluted in a 15-l knapsack sprayer.
- Penncozeb 80 WP (mancozeb, 800 g/kg). The application of the two fungicides should be alternated with the advertence to increase a bit the dose at each new spray, to avoid the fungus building resistance.
- Orvego (Initium, 300 g/l and dimethomorph, 225 g/l), another recommended fungicide which is a contact fungicide with preventive and local systemic properties.

b. Three or more treatments may be done depending on the occurrence and intensity of the rains. It is important to always follow the instructions from extension services or manufacturers.

ii. Planting clean seed of less susceptible varieties.

Control of viral diseases

Symptoms:

- Viral disease symptoms are various and become easily noticeable once seed growers become well acquainted with them. They all reduce yield and can be transmitted to further seed generations if plants showing virus symptoms are not promptly eliminated.
- Any plants which do not look like most plants in the field must be eliminated. Remember, if in doubt, it is better to eliminate!
- The easiest viral diseases to recognize are potato leafroll virus (PLRV) and mosaic.

Plants infected by PLRV show leaflets curling upward, and when pressed, they feel hard and make a characteristic leathery sound.

Transmission:
Most viruses are spread mechanically through tools, rubbing by other plants, people or insects.

Sucking insects such as aphids, leafminers, and whiteflies are carriers of viruses. Therefore, choose planting sites at a higher elevation and windy for the upstream field generation categories of seed because there are fewer chances that those insects are present.

Management:

- Spraying Deltamethrin is useful when aphids have been detected under the leaves or other insects are visible on the leaves.
- The best strategy to control the virus is to plant a healthy seed, whether certified or not.
- It is also advised to use virus-resistant varieties provided there is a demand for such varieties.
- It is extremely important to keep the field and its surrounding area free of weeds because they can host viruses that infect potato.

Other diseases

Control of Black scurf (Rhizoctonia solani)

- The name of Black scurf (Rhizoctonia solani) is due to the black spots on the tuber skin, like soil that will not rub off easily.
- It is a soil and seed-borne disease, which means it is transmitted by seed tubers and the soil.
- One simple way to prevent this disease is to ensure proper crop rotation.
- The other method to get rid of the black scurf is provided in the storage section.

Control of common scab (Streptomyces scabies)

Common scab is a potato disease caused by a bacteria-like organism which makes potatoes ugly as they present scabby lesions.
This disease is already present in farmers' fields in Cameroon.

Control

- Irrigation at about 40 days after planting, a period coinciding with the stolon formation, can prevent this soil-borne disease.
- Avoid planting scabbed tubers.

Control of potato pests

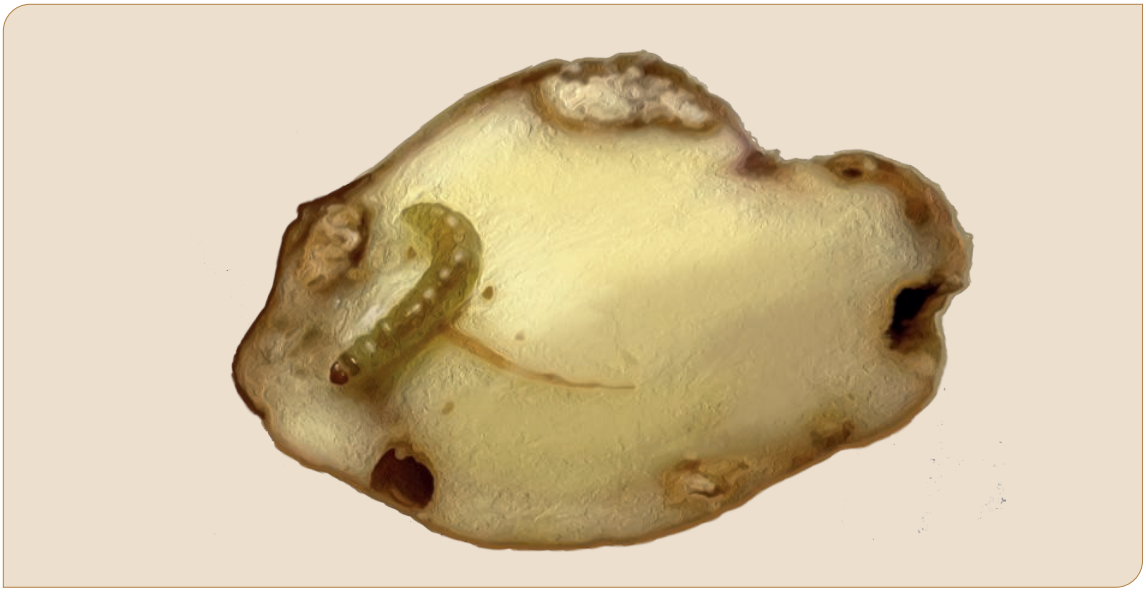
Potato cutworms

Potato cutworms, also known as nocturnal moths or grey worms, are reported to be a big problem to potato cultivation in Cameroon. As per their name, nocturnal moths in their larval stage (caterpillars) cut stems of young potato plants, especially at night when they are active.

Control:
Insecticides such as Deltamethrin used against various types of insects can be sprayed. Usually, one spray is enough once plants have emerged. Another insecticide called Bastion Super (Oxamyl 5%) can also be sprayed once instead of Deltamethrin.

Remember, before buying insecticides, ask the agro-dealer whether they would be bees-friendly or not. Agro-dealers in Cameroon are aware of this environmental concern and have received proper instructions on the use of insecticides and the insects they control.

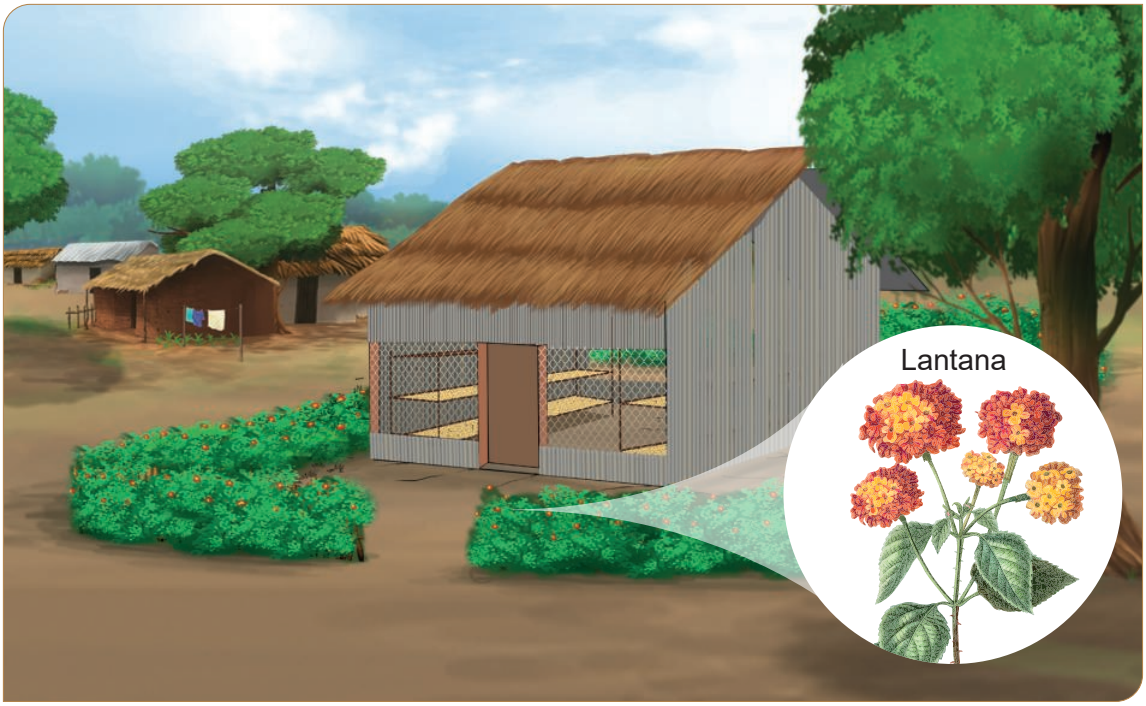
Potato tuber moth (PTM)



Symptoms:
Potato tuber moths (PTM) also called potato tuberworms infest the crop in the field and move with tubers to the store. They form mines in leaves and stems. Moth larvae penetrate tubers through the eyes and create tunnels in the tubers. In the stores, these tubers become drier than healthy ones.

Control:
Potato tuber moth can be controlled by:

i. Good hilling up to protect the tubers;
ii. Spraying the field with appropriate insecticides at 2 – 3-week intervals. The first treatment starts right after plant emergence;
iii. Inspecting the tubers carefully before and during storage, removing each tuber showing openings/galleries;
iv. Spreading leaves of natural repellent plants such as Lantana camara (widely present in Cameroon) on the seed tubers during storage. This has been successful in many countries; and
v. Alternatively, spread Actellic Super Dust (Pirimiphos-methyl 16g/kg +Permethrin 3g/kg) on the seed tubers.



Nematodes

Two types of nematodes are known in potato production: the potato cyst nematodes and the root-knot nematodes.

Symptoms:

- Infested potato plants with cyst nematodes may show varying degrees of stunting, yellowing of leaves and a tendency to wilt in dry periods.

- Root-knot nematodes attack tubers and cause blemishes making seed tubers unmarketable.

Management:
Control of nematodes is primarily preventive because they are difficult to eradicate when they are present in the field. Nematicides are dangerous for any living organisms as these chemicals can accumulate in underground water.

Control practices should include:

i. Elimination of potato volunteers;

ii. Using healthy seed potatoes;

iii. Crop rotation; and

iv. Use of marigold (Tagetes spatula) as green manure in small plots, to incorporate into the soil at flowering or plant it all around the field. In fact, marigold produces substances in their roots that are toxic to nematodes. Marigolds act as a trap crop. The nematode enters roots of the plant but is unable to develop further in its life cycle or maybe actively killed by the plant when it attempts to feed.

Tagetes spatula

Module 6 Roguing

Roguing, also known as **"Negative selection"**, is an important practice for ensuring the production of good quality seed. The practice consists of regularly inspecting the potato field, identifying and eliminating any abnormal plants, including tubers and roots.

The plants to be rogued are either diseased (e.g., bacterial wilt), or off-type varieties (variety mix-up) or any other causes of abnormal plants like volunteer plants.

For commercial seed growers, roguing is crucial as their seed lot may be rejected during the certification process if abnormal plants are not eliminated. Be careful because if the inspectors see too many missing plants in the field as the object of roguing, they can conclude that disease presence was too important and, therefore, they may downgrade the seed category at harvest.

Roguing should start when plants have reached 20-25 cm of height and should continue

until potato plants close the rows. After this moment, the crossing of the field must be restricted in order to prevent the transmission of mechanically transmitted diseases (viruses, bacterial wilt, etc.).

Do it at sunrise and walk in the field with the sun behind your back in order to better see disease symptoms, especially mosaic. If you are in doubt, take a white piece of paper and put it under the leaves; if they are affected by the mosaic virus, its symptoms are immediately visible.

The seed grower should always be equipped with a hoe, and a bag where the seed growers should put any part of the plants to be eliminated. Before plants emergence, he/she should dig a pit outside the field where the rogued plants should be buried and covered with lime.

Module 7 Dehaulming

Dehaulming is the act of removing or destroying potato shoots ahead of the complete maturity of the plant. It is another essential agricultural practice in seed production as it stops tuber growth. The objective is, in fact, to have the largest yield of small to medium-sized seed tubers even though total tuber yield (expressed in weight) becomes reduced.

Dehaulming also strengthens the skin which protects tubers during harvest, transport, and in storage from physical and pathological damages.

Towards the end of flowering, normally at around 80 days after planting, the seed grower should enter the field once a week and dig a few samples, at random. When the seed-sized tubers (25-55 mm) represent about 70% of the harvested sample, dehaulming should be carried out immediately. Check each variety if growing more than one as each variety will develop at a different pace. All varieties are not dehaulmed at the same time after planting because they do not have the same growth cycle.

It is not advised to cut the stems with a sickle or a machete as this would transmit bacterial wilt and other mechanically transmitted diseases to the seed tubers.

Large potato farms are dehaulmed using chemicals called herbicides. Do not spray herbicide like Gramoxone (paraquat) as currently done by some seed growers in the country. The efficacy of this product is only for a few days and, if it rains, other stems emerge, and tuber growth may continue.

The most effective chemical herbicide, normally used in other parts of the world, is Reglone (diquat) which should be sprayed at 3-4 litres/ha in 300-400 litres of water if spraying is done mechanically. Do not spray Reglone under dry soil conditions as this may affect tubers which show necrosis at the stolon end.

Small seed farms are dehaulmed by pulling out the potato plant while stepping around its base to prevent tubers from coming out as well. Tubers remain in the soil while the potato shoots are removed from the field and burned or dumped in a pit.

Module 8 Harvesting, sorting, and grading

Harvest is always done when tuber skin is sufficiently hardened, that is about two to three weeks after dehaulming.

To detect the right moment for harvesting, one should take a tuber in his hand and rub it between the thumb and index. If the skin does not slip, then the seed tubers can be harvested. The reason is that seed tubers must stand storage longer than ware potatoes and, especially against all the storage diseases that can affect seed tubers if they present bruises after harvest.

Harvesting should be done in dry weather and under slight moist soil conditions. If the harvest is done mechanically, the tractor driver should select a tractor speed in order to leave enough soil as a cushion between the rods of the harvester and the seed tubers, to reduce tuber bruises as much as possible.

Never allow workers to throw seed to the heap over long distances because this will bruise the tubers. Seed tubers should never drop from a height of more than 30 cm.

Let potatoes dry off on the bed top for 30 minutes or so before collecting them gently into boxes or bins. Skins may be fragile and easily damaged at this point.

Minimize the number of times you must handle them. Also, consider grading them in the field into various sizes before storing them.

Tubers from diseased plants must be collected last, for consumption and never for seed. Healthy looking tubers should then be graded by size. Standard seed tubers measure 25-55 mm in diameter. Three seed classes can be distinguished with this size range depending on the demand (i.e., 25-35, 36-45 and 46-55 mm).

Small tubers are normally not sold but kept for own utilization either in small plots or normal field. In principle, the farmer should consider the different tuber classes when establishing seed prices as larger seed tubers are expected to be cheaper than middle-sized ones.

After harvest, the seed field should be sanitized by gathering and destroying harvest remnants such as foliage residues, rotten tubers, etc.

Module 9 Seed storage

Storage is one of the major practices in seed potato management. In Cameroon, seed tubers produced by certified seed growers are kept in Diffused Light Stores (DLS) which allow half-light and half-darkness to enter (remember, you should have enough light to read a newspaper, not more, not less).

The DLS is a simple and low-cost seed storage model which was developed and promoted by the International Potato Center in many countries across the globe.

The DLS is meant to be well ventilated as tubers are like living materials that inhale oxygen and produce carbon dioxide (CO2) that must be eliminated with good ventilation. Otherwise, the temperature inside the store may increase, thus favouring early and undesired sprouting.

Inside the DLS, tubers are laid on beds in thin layers (2-3 tubers) for easy inspection of all tubers and to avoid too much darkness inside the pile.

Some seed growers may install aphid-proof nets lining the walls at each opening in order to protect sprouted seed potatoes from insects such as winged aphids (virus carriers) and PTM during the last month of storage. However, the net could produce the opposite effect if the insects managed to enter the store.

In India, atomized treatment of stored seed potatoes with 3% boric acid solution has been shown effective against soil-borne pathogens (black scurf, common scab, etc.). Boric acid is very cheap and can be found everywhere in any pharmacy. Never treat sprouted seed tubers as sprouts can be burnt by boric acid.

Most of the varieties grown in Cameroon are fully sprouted after 2-3 months in a DLS.

Potatoes require frequent inspections to identify any tubers presenting infirmity, regardless of the cause, be it pests, diseases or other physical or physiological alterations. Those tubers must be collected and taken out of the store and buried in a deep pit.

To accelerate sprouting, there are several methods to apply. One of the simplest methods is to put several bunches of sweet green bananas or a good amount of fresh coffee husks inside the store about one month before planting. The same happens with apples that can also release ethylene during maturity. They release ethylene in form of a gas, thus accelerating sprouting. It would be better to partially close the openings in order to increase the effects of the gas. It is not advised to eat those bananas as they may acquire a potato taste.

Appendices

Appendix 1

Characteristics of old varieties grown in Cameroon

Variety	Description	Maturity	Dormancy	Yield (t/ha)	Adaptability
Cipira	• Pale yellow flesh, smooth white skin, shallow eyes, and long-oval tubers • Moderately tolerant to late blight • God for processing, very high dry matter content	Medium (90 – 120 days)	2.5 - 3 months	30 – 35	• Extreme-North region (Mayo Tsanaga) • Adamawa region (above 2000 masl) • West region • North-West region • South-West region (Lebialem)
Dosa	• Brown to yellow skin, white flesh, deep eyes, oblong to round shape • Variety sensitive to tuber blight, early blight, and bacterial wilt • High dry matter content, and good cooking attributes	Early	3 months	>20	• North-West region - West region • Extreme-North region (Mayo-Tsanaga)
Panamera	• Very dense foliage with good resistance to several diseases (late blight, common and powdery scabs, early blight) • Large oval tubers with very bright and smooth yellow skin and shallow eyes	Late (>4 months)	3 months		

Variety	Description	Maturity	Dormancy	Yield (t/ha)	Adaptability
Mondial	• White skin, white flesh, oblong-shaped tubers • Sensitive to diseases, especially blackleg, late blight, and viruses • Good cooking attributes with very high dry matter content	Late	3 - 5 months	15	• Région du Nord-ouest • West region • Extreme-North (Mayo-Tsanaga)
Spunta	• White-to-yellow skin with shallow eyes, oblong shape • Sensitive to dry rot (Fusarium), bacterial wilt and viruses • Good cooking attributes, low dry matter content, good physical presentation of the tubers	Early	Medium	12	• Extreme-North region (Mayo-Tsanaga, Rhumsiki, Walaka, Kila-Walaka, Vitte-camp, Rhumzou) • West region • South-West region (Lebialem)
Désirée	• Strong stems with dark green leaves • Long oval tubers with smooth red skin, light yellow flesh, and medium eyes • Moderately tolerant to Potato Virus Y • Fairly good cooking aspect, low dry matter content	Medium	2 months	16-18	Multiplied since 2009 in the West region

Appendix 2

Crop rotation

Year	Season	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
1	1	**Potato**	Legumes/ Maize	Carrots/ Cabbage	Beans	Maize
1	2	Maize	**Potato**	Legumes/ Maize	Carrots/ Cabbage	Beans
2	3	Beans	Maize	**Potato**	Legumes/ Maize	Carrots/ Cabbage
2	4	Carrots/ Cabbage	Beans	Maize	**Potato**	Legumes/ Maize
3	5	Legumes/ Maize	Carrots/ Cabbage	Beans	Maize	**Potato**
3	6	**Potato**	Legumes/ Maize	Carrots/ Cabbage	Beans	Maize
4	7	Maize	**Potato**	Legumes/ Maize	Carrots/ Cabbage	Beans