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MINISTERE DE L'AGRICULTURE
ET DU DEVELOPPEMENT RURAL

SECRETARIAT GENERAL

DIRECTION DES ORGANISATIONS
PROFESSIONNELLES AGRICOLES ET
DE L'APPUI AUX EXPLOITATIONS AGRICOLES

SOUS-DIRECTION DE LA VULGARISATION
AGRICOLE



REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF AGRICULTURE
AND RURAL DEVELOPMENT

GENERAL SECRETARIAT

DEPARTMENT OF PROFESSIONAL
AGRICULTURAL ORGANISATIONS
AND SUPPORT TO FARM ENTERPRISES

SUB-DEPARTMENT OF AGRICULTURAL
EXTENSION

TECHNICAL AND ECONOMIC DATA SHEET FOR POTATO PRODUCTION AND POST-PRODUCTION



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OBJECTIVE

The aim of this technical data sheet is to ensure increased productivity and production in Cameroon in order to mitigate the effects of food crisis and limit the import of some essential commodities by providing producers with a compendium of good agricultural practices. It is a support and reference tool for extension workers and rural advisers in terms of producer capacity-building.

GENERAL INFORMATION

Potatoes are grown at high altitudes and low temperatures. In Cameroon, it is grown in the Western Highlands, the Adamawa area, the Mandara Mountains (Mokolo area), the Mbouroukou zone (Mélong) and the mountainous sites of Bamuck in the South-West region. The most suited areas are : Tibati, Dschang, Bangou, Bangang, Babadjou, Djuttitsa, Bamendjou, Bayangam, Balatchi, Santa, Bamenda and Mokolo.

- Altitude above 1200 metres;
- Temperatures ranging from 16°C to 28°C, with an optimum of 18-25°C.
- Abundant sunshine with little or no shade;
- Rainfall during the cycle between 300 mm and 700 mm.

I- TECHNICAL ITINERARY

II.1 Soil selection

The characteristics required for the plot selected are as follows:

- Soil rich in humus, well drained, with little or no gravel;
- - Have a gentle slope;
- - Be free of all potato diseases;
- The soil should not have been planted with potatoes or any other solanaceous plants (tomatoes, chillies, peppers, nightshades, etc.) for the previous 2 -3 years;
- A clean field, free of weeds or, at least, with easily controllable weed species. (Avoid plots with *Cyperus rotundus*, which is difficult to destroy due to the presence of propagation tubers, and *Amaranthus spinosus* with spines and massive seed production...)
- Avoid water points that are contaminated by *Ralstonia* (fungus): even slight contamination should lead to systematic abandonment of the plot. This also applies to plots containing excessive levels of salts. A history of the plot must be

established over a period of 3 years (not 3 cycles), taking into account the fertilisation received;

- A plot management plan covering the next 4 cycles must be drawn up;
In the case of seed multiplication, make sure that there is no solanaceous crop within 50 metres.

II.2 Choice of varieties

The varieties to be grown must have high yields, be short-cycle, be tasty to consumers and be adapted to the environment and preferences. The choice also depends on how the product will be used. Growers can choose from the following varieties recommended by IRAD.

Table 1: Presentation of some potato varieties

Name of variety	Origin of basic seeds	Yield (T/Ha)	Disease tolerance	Cycle length
CIPIRA	IRAD	20-35	Mildew tolerant	Average 100 days
UNICA	IRAD	45	Mildew tolerant	2.5 – 3.5 months
CHULU	IRAD	40t/ha	Mildew tolerant	2.5 – 3.5 months

II.3 Rotation plan

A plot management plan covering the next 4 cycles must be drawn up and scrupulously observed by the producer. (Example: potatoes - pulses - maize).

The propagation field must be divided into several plots where tubers of the same origin, size, variety etc. will be planted.

II.4 Soil Preparation

Soil preparation takes place between February and March in humid zones and between April and May in Sahelian zones. Soil preparation activities include:

- Manual (or mechanical) weeding to destroy all vegetation;
- Stump removal;
- Raking;
- Ploughing and ridging: use flat ploughing preferably, plant and form ridges 70 to 90 cm high during earthing-up.

II.5 Sowing method, depth, density

The quantity of seed required to plant one hectare of land varies according to the size of the tuber, as shown in the table below:

Table 2: Quantity of seed required depending on tuber size

Tuber size	Number of tubers per Kg	Number of tubers /ha	Weight of tubers per ha
28-35 mm (size of a hen's egg)	32	45,000	1,200 – 1,500 kg
36-45 mm (duck egg size)	28	40,000	1,500 – 2,000 kg

The greater the number of buds on the seed tuber, the greater the number of stems and the greater the number of tubers formed, and therefore the higher the yield.

Method:

- Create an opening along the ridge at the top, spread the organic fertiliser in the trench and cover it.
- - Place the seed in the ridge with the pre-germinated buds pointing vertically upwards. The planting depth varies between 5 and 12 cm (i.e. 5-7 cm for wet soils and 10-12 cm for dry soils). In the case of flat planting to form ridges during ridging, sow the seeds 5 cm deep.
- - The actual density of a potato crop is the density of tubers planted multiplied by the number of stems per tuber. The higher the stem density, the smaller the tubers produced.
- The spacing will be 65 to 80 cm between rows and 25 to 30 cm along the rows, i.e., a density of 40,000 to 60,000 plants per ha, corresponding to 2,000 to 2,500 kg of seeds depending on the size and spacing chosen.

II.6 Fertilisation

Fertilisation depends on a number of factors: soil analysis results, the amount of rainfall, climatic factors and even the influence of the slope.

The following fertilization applies to both seed and ware potato production.

➤ **ORGANIC MANURE**

Apply 2 to 5 tonnes/ha or 200 to 500 g/linear metre of well-decomposed organic manure (compost, droppings, etc.) when preparing the soil.

➤ **CHEMICAL FERTILISER**

N-P-K + Mgo: 134 -77 -154 + 40 for a yield target of 25-35 tonnes/ha.

1st case: N-P-K + Mgo: 11- 11- 22 + 5.5: 700 kg / ha: one sardine can for 7 plants at planting. To be supplemented with a maintenance manure of 125 kg/ha of urea, i.e, 2.5 g (one beer cap) per plant at the time of the first weeding and earthing-up 30 to 40 days after sowing.

2nd case: N- P- K + Mgo : 12- 11 - 18 - + 2.7 Mgo : 300 kg / ha of complete fertilizer, i.e. 6 g / plant, corresponding to a full sardine can for 16 plants during planting ; and as a cover, 300 kg of complete fertliser, i.e., 2 g / plant or half a beer capsule / plant + 200 kg of urea, i.e., one beer capsule.

Avoid fertilisers with high doses of nitrogen (such as 20-10-10) and chlorine-rich fertilisers. Make sure that organic matter is properly decomposed, because despite its necessity, it can be a vector for diseases and parasites. For seed production, avoid excess fertiliser, as too much nitrogen can cause tuber rot during storage.

II.7 Farm maintenance

The first ridging is done 2 to 3 weeks after emergence and the 2nd ridging 3 to 4 weeks after the first. Cover the neck of the plant well with 10 to 15 cm of soil. Weed regularly if necessary.

Potatoes need between 400 and 600 mm of water, depending on climate conditions, soil type and length of cycle. In dry conditions, a water point and an irrigation system capable of delivering 600 to 1000 m³ per ha and per cycle are required.

More generally, 1/3 of the water should be provided up to the middle of the cycle and 2/3 thereafter, avoiding surpluses. Stop water supply before the end of the cycle to allow the potato skins to form, thus ensuring better preservation of the tubers.

II.8 Disease and Pest Control

Systemic diseases:

To minimise the risk of disease outbreaks, it is advisable to use resistant varieties (Cipira, UNICA, CHULU etc.), keep the farm clean and aired, use seeds from uninfected farms and scrupulously observe the farming practices described above.

In case of high disease pressure, use systemic and contact fungicides alternately; for example: treat with metalaxyl every 2 weeks and between these 2 treatments spray with the contact fungicide or other fungicides at least once. In the rainy season, treat as soon as the plants emerge and in the dry season as soon as symptoms appear.

Bacterial diseases cause bacterial wilt and blackleg. The most dangerous is that caused by *Ralstonia solanacearum*. The plant wilts completely.

To reduce the risk of the emergence of such diseases, it is recommended to use resistant varieties, to use healthy seeds, to practise a good rotation, to avoid low altitudes and to adopt prophylactic measures (disinfection tanks, cleaning of soiled tools, etc.).

Virus diseases are characterised by leaf curling, mosaics or both. It is recommended to use healthy seeds and to control the vectors of these diseases (aphids, mealy bugs, whiteflies).

II.9 Harvesting and Transportation

Harvesting takes place 10 to 15 days after the tubers have been stripped. Test the ripeness of the tuber by pressing on it with your thumb.

Drain the tubers well after harvesting to ensure that the skin hardens properly, use a tarpaulin. Do not expose tubers to direct sunlight before bagging, and do not cover them with tops or weeds. Harvest in dry weather and avoid exposing the harvested tubers to rain. Transport bags should be clean and disinfected. Minimise injuries to tubers by lifting the soil with a pitchfork rather than a hoe and avoiding throwing them on the ground or into a bag. Carry out an initial sorting to eliminate tubers that are deformed, rotten, attacked or abnormal. 90% of successful storage is decided in the farm. A tuber thrown more than 50 cm away can no longer be stored. During transportation, limit the height of the bags in the trailer to 1 m = 600 kg / m² for the first bags.

II.10 Storage

Sort the tubers to eliminate any abnormal ones, then calibrate them and carry out phytosanitary treatments before storing (anti-moth *insecticide treatment* by powdering with products containing chlorpyrifos or malathion 5% (trade name) and broad-spectrum fungicide treatment by powdering or ULV: mancozeb 750 g/kg. Never wet the tubers.

Sweep, wash and disinfect the storeroom with bleach one week before receiving the seeds to be stored, and place a disinfection tray at the entrance to the storeroom. Ensure good air and light circulation for good pre-germination at the time of sowing or sale. Spray the shelves, partitions, ceiling and floor with an insecticide (Cypermethrin 200g/l).

Place the tubers in clean, disinfected crates (trays) and label them at a maximum of 20-25 kg per tray. Place them on the shelves where they can be sorted once a week to remove rotten plants. Only keep tubers that are healthy, clean, firm and fresh, with no traces of deep cracks, abnormalities or external defects. To control stock pests, spray once a week or use any other product indicated.

II.11 Control

The premises should be visited regularly to detect any abnormal conditions: moths, odours, insects (mealy bugs), rodents, rainwater run-off. The ideal temperature and relative humidity of the tubers should be 4-5°C and 92-95% for prolonged storage. At less than 92% humidity, tubers become soft and wrinkled. Sprouting can be prevented with growth inhibitors (e.g. chlorpropham SL) and at a temperature of 7-9°C and enable ware potatoes to be preserved very well for 7-9 months.

Storage in the dark at cool, night-time temperatures may be suitable for inhibiting sprouting for 2 to 3 months.

II.12 Packaging

Seed growers should carefully avoid breaking the sprouts when crating the product. Specific packaging should be used to pack the seedlings, providing a labelling with the following information:

- Special label “LABEL”
- Producer no., name and address
- Variety
- Size
- Quality (basic or certified)
- Name of certifier.

II.13 Processing

Products derived from potato processing include:

- Potato chips and crisps ;
- Snacks
- Potato flour for baby food and other uses;
- Mashed potatoes and other desserts ;

Constraints and Risks

- High cost of soil preparation
- Availability and accessibility of inputs
- Producer's technical skills
- Climate hazards
- Diseases
- Preservation

II- PROVISIONAL OPERATING ACCOUNT (1ha ware potato)

BUDGET

Description	Units	Qty	Unit cost	Total	Year 1
1. small equipment					
Sprayer	U	1	40,000	40,000	40,000
Machete	U	4	4,500	18,000	18,000
Hoe	U	4	3,500	14,000	14,000
Bucket	U	5	1,500	7,500	7,500
File	U	4	1,000	4,000	4,000
Twine	Roll	1	3,000	3,000	3,000
Jute bags	U	60	200	12,000	12,000
Treatment drum	U	3	20,000	60,000	60,000
Subtotal Small equipment				158,500	158,500
2. OPERATING EXPENSES					
2.1 Inputs					
Seeds	Kg	1,500	750	1,125,000	112,5000
Insecticides (decis)	Litre	5	3,200	16,000	16,000
Herbicide (Round up)	Litre	2	6,500	13,000	13,000
Pencozeb	Kg	5	2,500	12,500	12,500
Ridomil	100g sachet	10	1,000	10,000	10,000
N-P-K 12-11-18 ou 11-11-22	50 kg bag	14	26,000	364,000	364,000
15-0-0	50 kg bag	3	22,000	66,000	66,000
Organic manure	Bag	25	2,000	50,000	50,000
Sub-total inputs				1,656,500	1,656,500
2.2 Works					
Soil preparation					
Land clearing/cleaning	HJ	20	2,500	50,000	50,000
Ploughing/Tilling	HJ	28	2,500	70,000	70,000
Weeding and earthing-up	HJ	20	2,500	50,000	50,000
Spreading fertiliser	HJ	6	2,500	15,000	15,000
Sowing	HJ	10	2,500	25,000	25,000
Phytosanitary treatment	HJ	18	2,500	45,000	45,000
Herbicide spraying	HJ	2	2,500	5,000	5,000
Manual weeding	HJ	15	2,500	37,500	37,500
Sub-total Works				297,500	297,500
2.3 Harvesting and post-harvest operations					
Harvesting	HJ	10	2,500	25,000	25,000
Packaging	HJ	5	2,500	12,500	12,500
Transportation and storage	HJ	5	2,500	12,500	12,500
Subtotal harvesting and post-harvest operations				50,000	50,000
TOTAL OPERATING EXPENSES				2,004,000	2,004,000
TOTAL EXPENSES				2,162,500	2,162,500

DEPRECIATION

Designation		Qty	Unit cost	Total cost	Lifespan	Year	1 Season/An
Sprayer	U	1	40,000	40,000	3	13,333.3333	3,333.33333
Machete	U	4	4,500	18,000	1	18,000	4,500
Hoe	U	4	3,500	14,000	1	14,000	3,500
Bucket	U	5	1,500	7,500	1	7,500	1,875
File	U	4	1,000	4,000	1	4,000	1,000
Twine	Roll	1	3,000	3,000	1	3,000	750
Jute bags	U	60	200	12,000	1	12,000	3,000
Treatment drum	U	3	20,000	60,000	2	30,000	7,500
TOTAL DEPRECIATION						101,833.333	25,458.3333

FINANCIAL RESULTS

Designation	Price	Qty	Total	1 Seasons/yr	2 Seasons/yr
Operating expenses				2,162,500	4,325,000
Depreciation				25,458.3333	50,916.6667
Turnover	175	14,000	2,450,000	2,450,000	4,900,000
Gross margin				287,500	575,000
Net profit				262041,667	524083,333

APPENDIX: VARIOUS VARIETIES

Name of variety	Origin of basic seed	Yield (T/Ha)	Disease tolerance	Cycle length	Production area
CIPIRA	IRAD	20-35	Tolerant to mildew	Average 100 days	Everywhere
TUBIRA	IRAD	20-30	Moderately sensitive to mildew	Average 100 days	Everywhere
CARDINAL	EUROPE	Good	Susceptible to mildew	Average 100 days	West/ North-West
DIAMANT	EUROPE	Good	Susceptible to mildew	Long (100-130 days) after planting	West
IRAD 2005	IRAD	Nd	Nd	Nd	North-West
SPUNTA	EUROPE	Nd	Nd	Nd	West/ North-West
MONDIAL	EUROPE	Nd	Nd	Nd	West
HERTA	SOUTH AFRICA	Nd	Nd	Nd	West/ North-West
NICOLA	SOUTH AFRICA	Nd	Nd	Nd	West
DESIREE	EUROPE	15-25	Tolerant	Average 100 days	West/ North-West
PAMINA	EUROPE	25-30	Tolerant	Average 100 days	West

Source: International Potato Centre (CIP)

Seeds should be at a good pre-germination stage; they should be transported carefully in crates or baskets and never in bags, to avoid breaking the buds;

NB: Never use seeds from the previous harvest; always buy certified seeds from an approved seed grower.