Training course packages targeting food operators on the adoption and management of the technological innovations

PRECISION PROTECTION SYSTEMS

Potato production techniques and protection against late blight

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1. FoodLAND technical innovation for local food supply chains: concepts and approaches

The FoodLAND project has the ambition to impact on a large number of supply chains and communities, hence the process of food operators' capacity development has to be tailored and as much participative as possible. Accordingly, one of the assumptions of FoodLAND is that sustainable and nutrition-responsive farming systems can be achieved basically by strengthening the capacity development, and specifically by **a)** empowering farmers and processors through the implementation of capacity building processes and concrete opportunities; **b)** creating or consolidating cooperation and shared knowledge to overcome the lack of coordination among food operators; **c)** addressing the inefficient use of resources; **d)** trying to address and build resiliency to the high vulnerability of food systems to climate change; **e)** enhancing the integration of supply chains by creating commercial and stakeholders' networks; **f)** improving the responsiveness of the production sector to the market demand.

To implement these elements of capacity development, FoodLAND proposed the adoption of specific innovations, among which the organizational ones, to create strong and responsive links between producers and encompassing all the intermediate actors along the food value chain, such as researchers, SMEs, NGOs, local and national authorities. In order to ease the creation of those links and guarantee the sustainability over time of the results, 14 Food Hubs will be created in 6 countries as part of the organizational innovations. Food Hubs are conceived as multi-actors centers of innovation where to develop or enhance the organizational and operational conditions enabling local food supply chains (D3.6).

Functional to the implementation of the Food Hubs and of the innovations, the training courses were designed – in form of capacity development activities – as a two-phase process. Firstly, a training session focused on general, preparatory topics was provided to farmers as described and reported in D3.5 ("Group Introductory Training", GIT). According to the project GA, GIT broad set of goals

were: to enhance the knowledge of consumers' nutritional needs and market opportunities, and to boost the notions about climate change, sustainability, resilience, and food culture. Secondly, a specific training session were organized to provide food operators with practical information on the adoption and management of the innovations tested at lab / small scale level and to contribute to validating them at appropriate scale.

However, as the whole approach has been designed by FoodLAND to ensure the inclusion of the local actors from the first moment, both the training sessions were set up accordingly. Indeed, yet in the inception phase of the project, an assessment on participatory methods has been run and Participatory Learning and Action (PLA) approach has been eventually assessed as the best one to ensure the inclusion of multiple perspectives. The main purpose of PLA is to support people within communities to analyze their own situation, rather than have it analyzed by outsiders, and to ensure that any learning is then translated into action (Gosling and Edwards 2003). In addition, a gender-sensitive approach has been applied to the trainings that have been designed considering gender roles and power relations; they have provided equal opportunities to participate in the process by caring to times, venues and use of local languages.

The GITs have been conceived as the first step towards the innovation validation and aim at involving the producers, yet from the inception phase. They are just the first step in a sequence of 6, summed up in **Table 1**. After the GITs, where farmers and processors meet and share their vision and goals for the Food Hubs and exchange information about specific topics, the Food Hubs were created and the innovation tested (first in pre-test, then in pilot phase). The constant iteration between researchers and local actors is a key feature of the project: specifically, the practical trainings focused the single innovations (step 5) are aimed at validating the innovations at adequate scale and planned to trigger feedback loops of control and improvement involving developers and adopters.

Table 1. Activities with farmers and food processors (SMEs) and participatory approach

Step	**1**	**2**	**3**	**4**	**5**	**6**

Task	T3.3	T3.3	T3.4	T4.1¸T4.5	T5.1¸T5.5	T5.1¸T5.5
Activity	Group introductory training	Food Hubs creation	Innovation undertaking	Innovation tests	Individual and group practical training	Innovation pilot and validation

2. FoodLAND practical training: aims and scope

According to the project bottom-up and participatory approaches, following the courses on introductory topics GIT organized in the early project phase (T3.3), and as component creating / strengthening the Food Hubs as local innovation centres, FoodLAND has organized a second set of training activities with food operators based on active learning methods and gender equality principle (Task 5.1-5.9). In this regard, specific mechanisms (being aware of the gender roles and power relations; providing equal opportunities to participate in the process by putting attention to the times, venues, use of local languages, etc.) will be lifted to ensure women's participation. These training packages are aimed at providing the local farmers and food processors with operational instructions on the adoption and management of the validated innovations.

This second set of training activities has been organised – triggering PLA approach – as individual and group practical (demonstration/capacity building) activities to be conducted in parallel to the implementation of the technological research (where relevant) and of the innovation pilots and validation. These technology-centred trainings aim at strengthening the participants' understanding of novel production and post-harvest techniques, innovative tools and systems (e.g., climate smart/precision agriculture, hydroponics, and integrated aquaculture), new technologies for primary and secondary processing, and supply chain management. Thus they aim at fostering knowledge and operational capacity to deploy, manage, and maintain the validated technological innovations – documented by the released guidelines D4.1 ÷ D4.11 (e.g., training pamphlets, user manuals, flow diagrams, and operational recommendations) and practice abstracts D6.5 – validated jointly at appropriate scale.

3. Second training packages on the adoption and management of the tested innovations: an overview

The second training course aimed at consolidating the food operators' knowledge and practical skills to adopt, manage and validate the project innovations and complement the related guidelines. Specifically, the realized training materials provide local farmers and food operators with a set of notions and concrete information on a series of innovative tools and systems as per the following **Table 2**. It is clear that both the contents and formats of the learning packages widely differ across technologies as well as Food Hubs (when the same type of innovation must be validated in different contexts). The diversity that emerges from the proposed solutions reflects the different needs highlighted by farmers and stakeholders as well as the conditions and opportunities characterizing the local communities. Nevertheless, in order to take into due account the existing heterogeneity inside the local communities, the developed learning materials have been let available on the project intranet so as to be used for further training initiatives across the network of Food Hubs.

4. Second training packages on practical information on the adoption and management of the tested innovations

Precision protection systems

Potato production techniques and protection against late blight

Potato production techniques and protection against late blight

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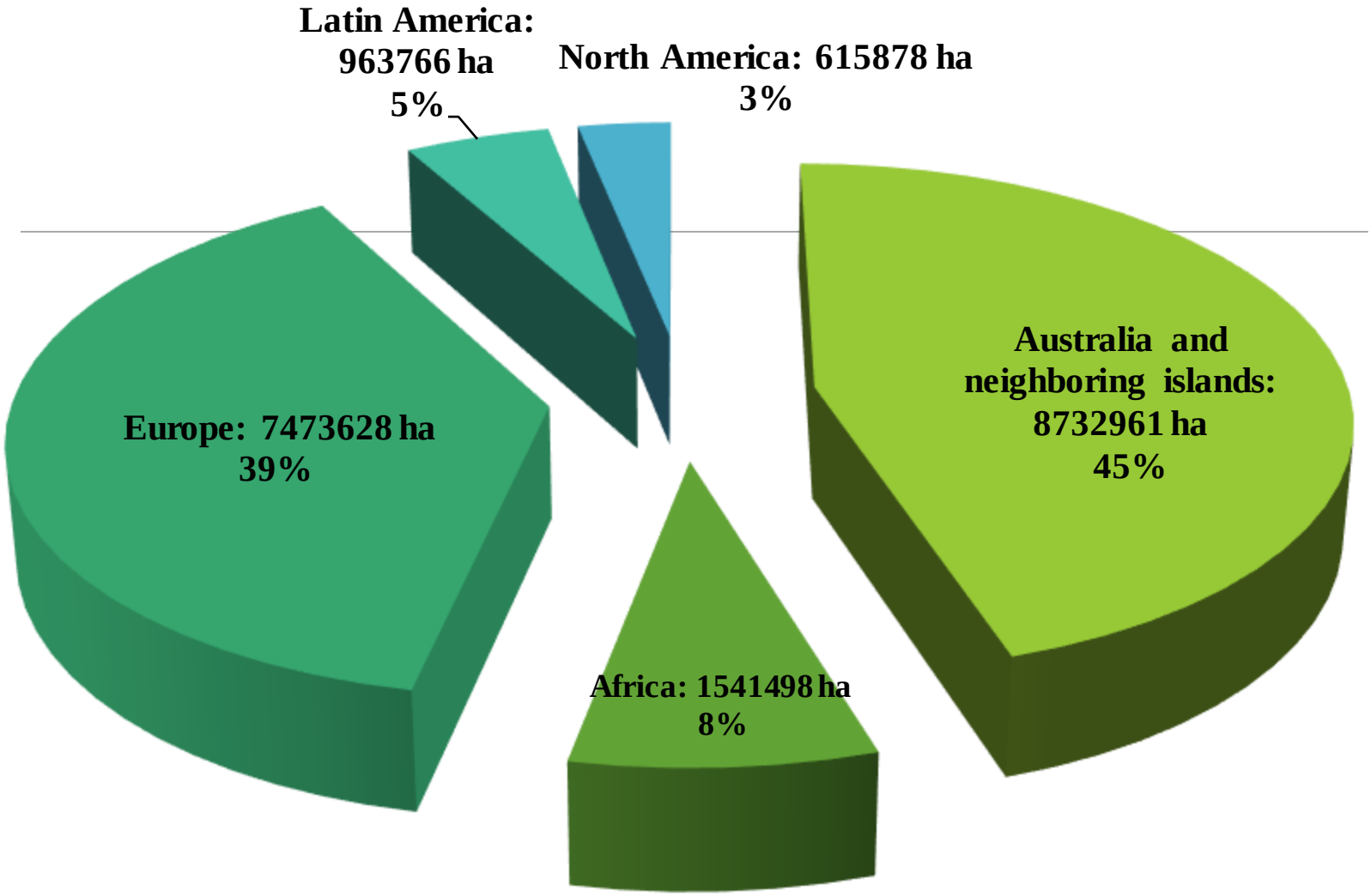
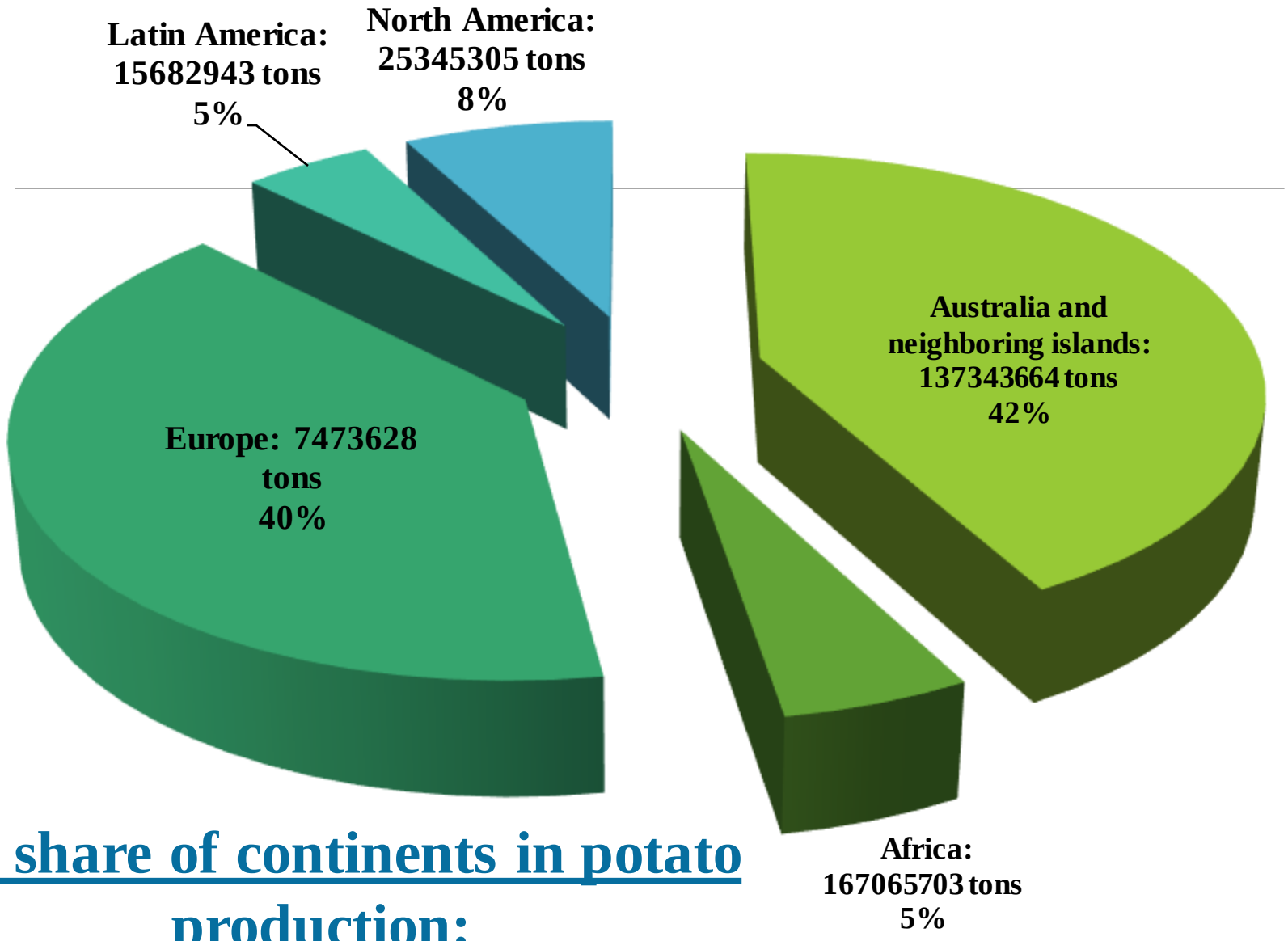
POTATO CULTIVATION IN THE WORLD AND IN MOROCCO



The share of continents in the total area planted with potatoes:



The share of continents in potato production:

Potato cultivation in the world

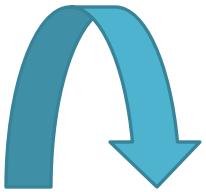
Distribution of potato production, area and yield in the world

Continents	Superficies (Hectare)	Production (Tons)	Yield (Tons /Hectare)
Australia and neighboring islands	8 732 961	137 343 664	15,7
Europe	7 473 628	130 223 960	17,4
Africa	1 541 498	16 706 573	10,8
Latin Amercia	963 766	15 682 943	16,3
North America	615 878	25 345 305	41,2
Total	19 327 731	325 302 445	16,8

Potato cultivation in the world

Asia and Europe: the most important potato-producing regions in the world

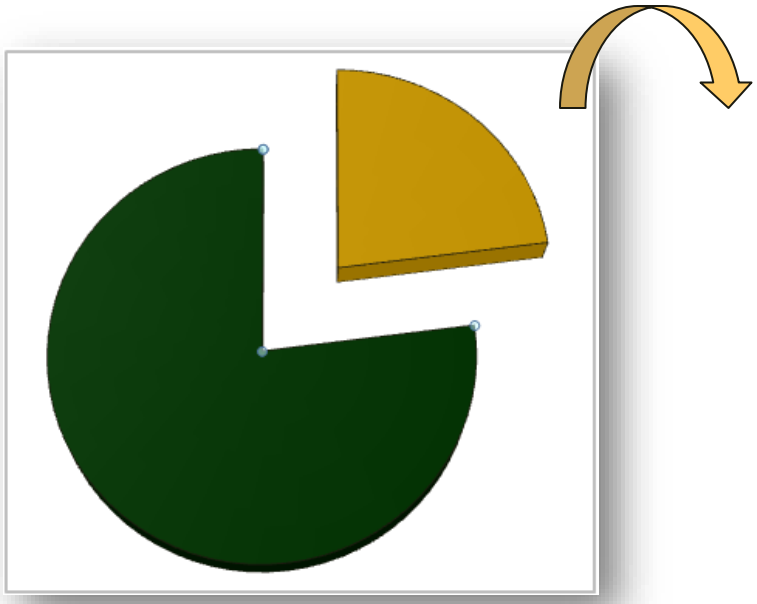
(China is the world's largest producer)



- Asia consumes half of the world's production.
- Europeans are the biggest consumers of potatoes in the world.

Potato cultivation

- The potato is the first cultivated vegetable in the world.
- The area of potato cultivated in Morocco is 60,000 hectares.



23% of green space

Potato cultivation in Morocco

- Average production: 1,393,010 tons.
- Average production yield: between 17 and 18 tons / ha.
- Export: 1.5%.

Potato Cultivation
Fes-Meknes Region

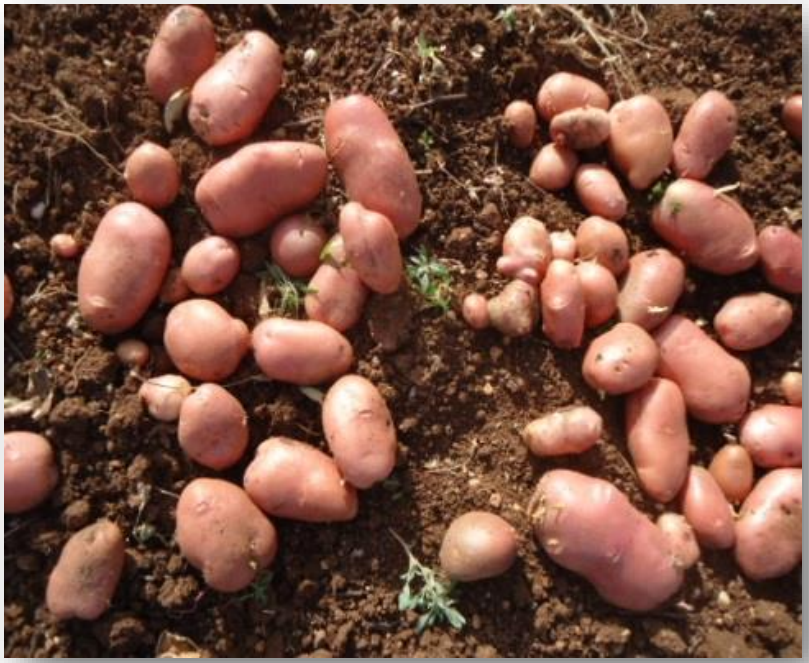
- Total potato production: 318,240 tons in 2017-2018.

- Production yield: between 23.5 and 37 tons / hectare (average yield: 28.8 tons / hectare).

Potato production areas in Morocco

- Plains.
- Mountainous areas.
- Coastal areas.

Types of Potatoes in Morocco



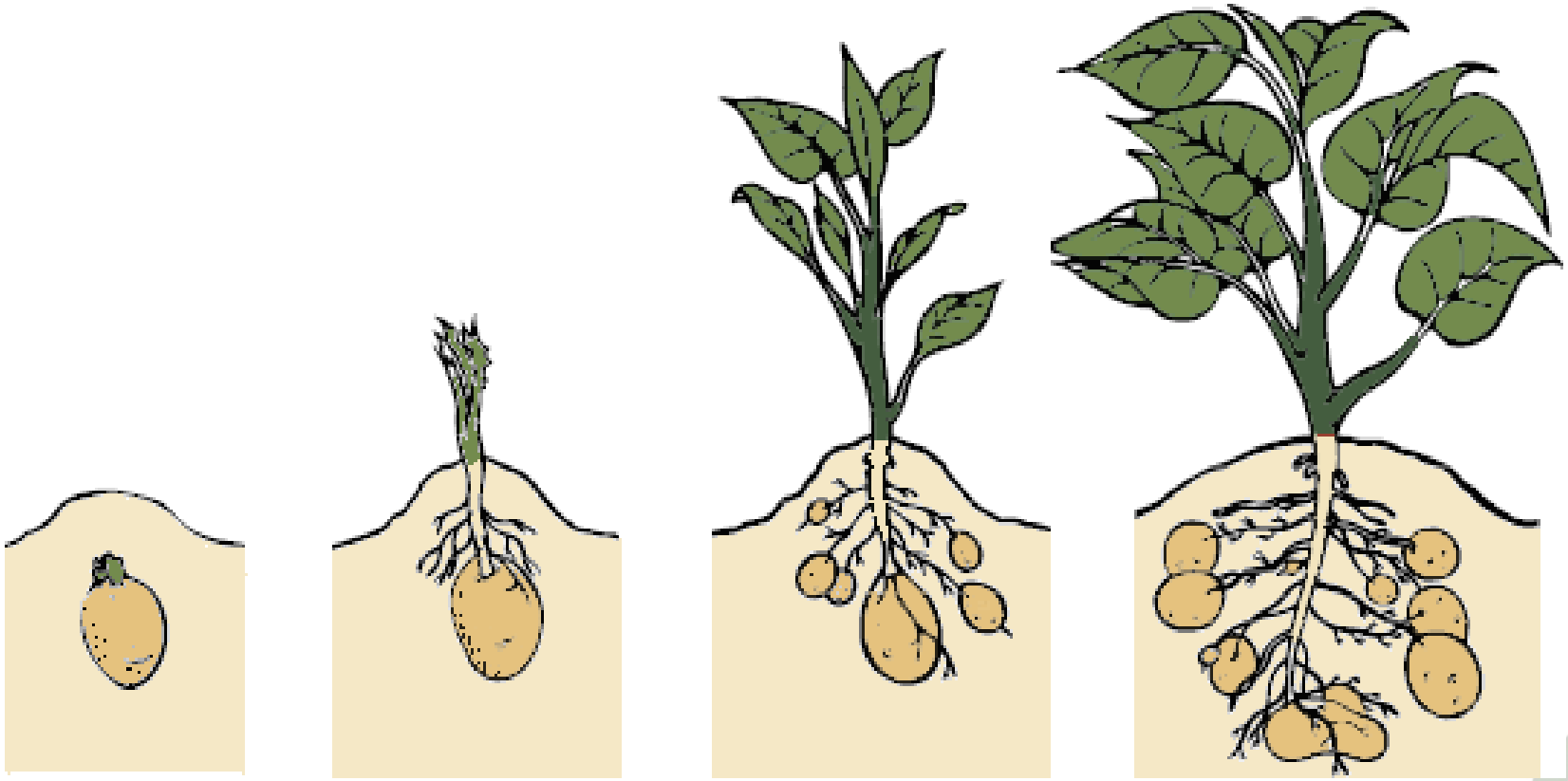
Red

White

Types of potato cultivation in Morocco

- Early (Primeur) potatoes.
- Seasonal potatoes.
- Potatoes out of season.

Potato growth stages :

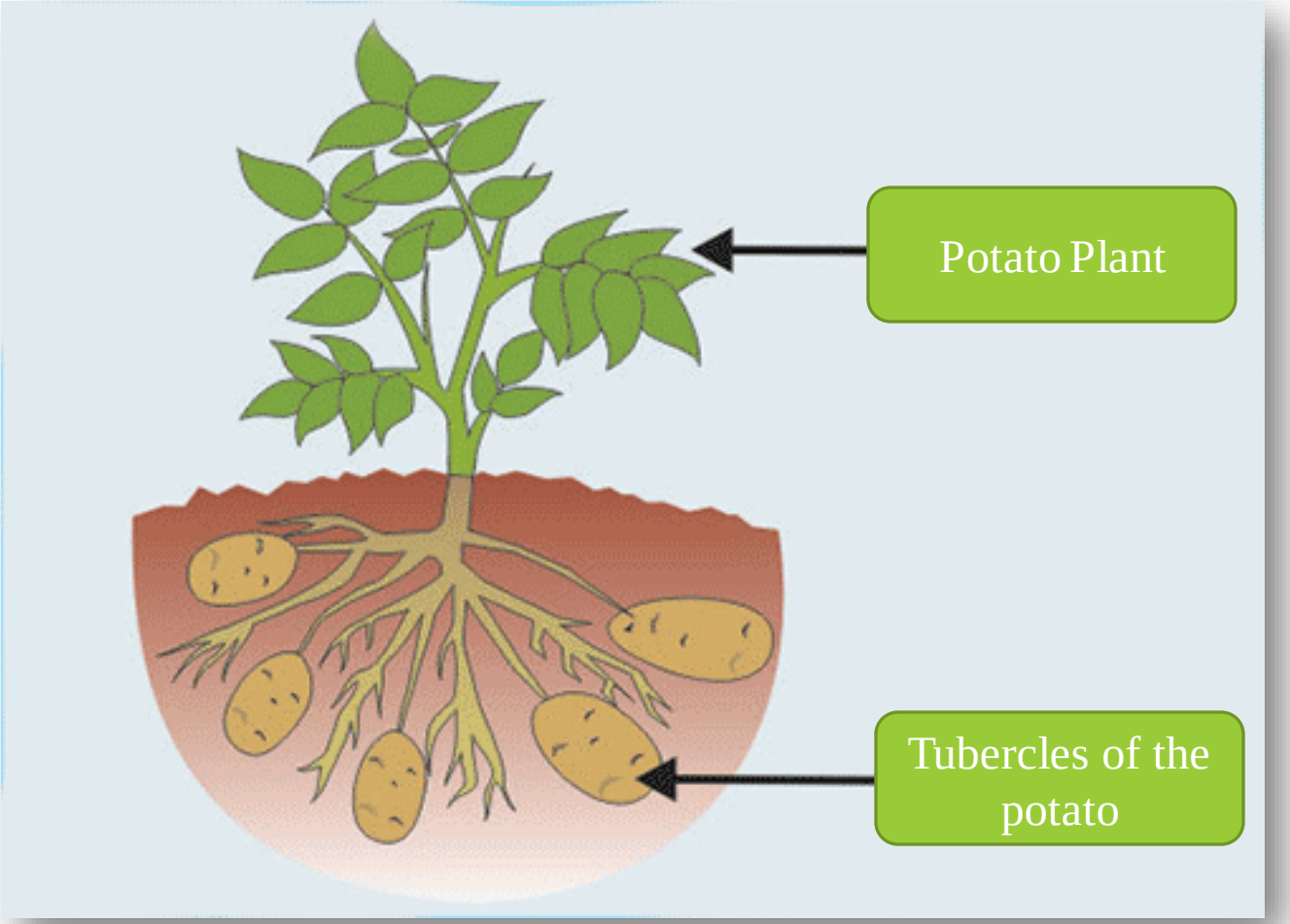


Germination Stage

Vegetative growth stage

Potato growth and maturity stage

Description of the potato plant:



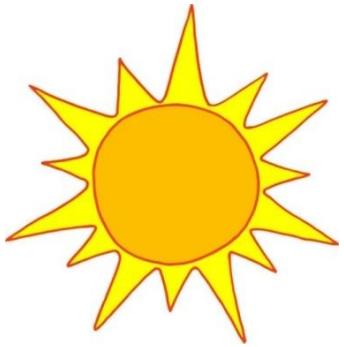
Environmental requirements:

Potato

Cannot stand an intense cold below 2 degrees

Cold and humid climate plant

Temperature



The right temperature for growing potato tubercles:

- **18 degrees during the day.**
- **12 degrees overnight.**

Water requirement

Between 400 and 600 mm depending on weather conditions

Light hours

The formation and growth of potato tubercles requires:
Less than 12 hours / day

Soil requirements for growing potatoes

- **Potatoes prefer fragile, stone-free soil.**

- **Potato is relatively salt tolerant compared to other vegetables.**

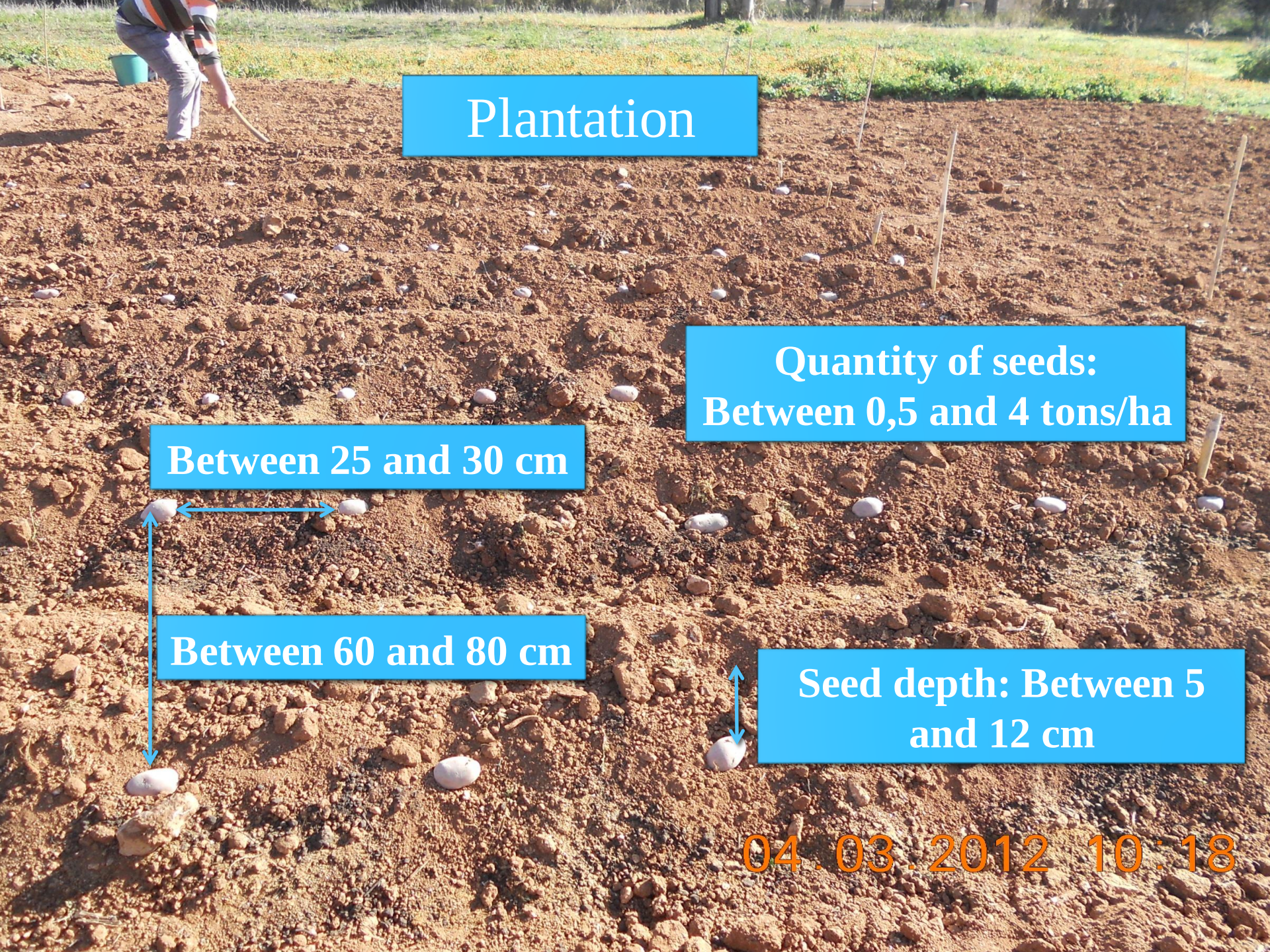
POTATO CULTIVATION TECHNIQUES

Soil preparation:

Plow the soil as deeply as possible: 30 cm

Soil preparation:

Prepare good lines for the seeds


Plantation
Quantity of seeds:
Between 0,5 and 4 tons/ha
Between 25 and 30 cm
Between 60 and 80 cm
Seed depth: Between 5 and 12 cm
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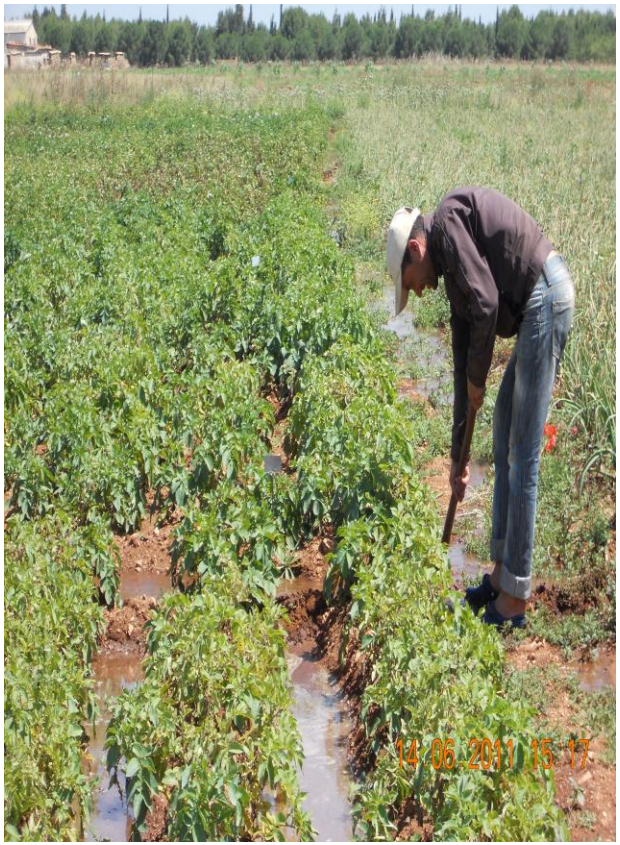
Hoeing and ridging:

After sowing: between 2 and 3 times

Weed control, prevention and treatment of diseases and insects

Prevention and treatment of mildew:

Irrigation Methods:



Surface irrigation

Drip irrigation

Sprinkler irrigation

Irrigation control:

Manual harvest:

Harvest: Between 15 and 50 tons / ha

Quantity of national harvest: Between 17 and 18 tons / ha

Mechanical Harvest:

Storage:

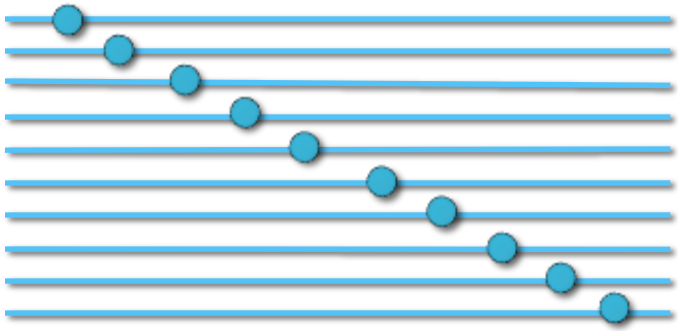
Objectives:

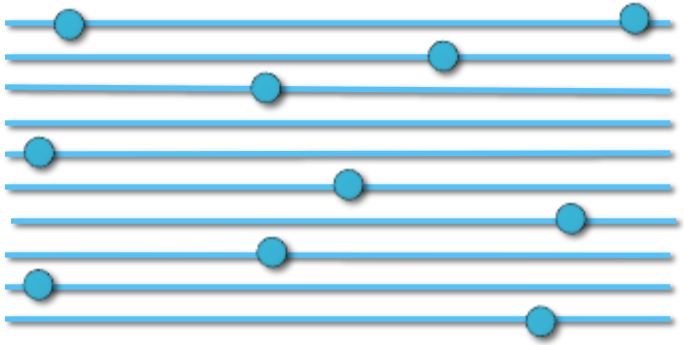
- Maintain quality.
- Prevent potato tubercles from disease.
- Lack of planting.
- Maintain the weight of the potatoes.

Storage for plantation:

Fertilization / Soil analysis:

Take soil sampling before planting





Fertilization / Soil analysis:

Send the soil to the laboratory

Result of the analysis

- **The amount of manure or compost.**
- **The amount of nitrogen, potassium, phosphoric and other fertilizers.**

Fertilization / Leaf analysis:

Take leaf samples at the start of flowering

- **Pick ten plants at random.**
- **Choose the same foliar stage.**
- **Choose healthy, well-developed leaves.**

- **Take a leaf from each plant.**

Fertilization:

- Potatoes need a lot of minerals.
- The amount varies from nutrient to nutrient.
- These elements are listed in order of importance:

Potassium> Nitrogen> Phosphorus> Calcium> Magnesium

- Effect of manganese, zinc and iron deficiency in potatoes.

Fertilization:

Elements	Needs (Kg/Tons)
Nitrogen	3 to 4,5
Phosphoric Acid	0.8 to 1,7
Potassium	4,1 to 8,5

Fertilization:

Good fertilization (Manure and fertilizer) → Good production

Storage potato requirements (50 tons / ha):

- **Potash: 250-300 kg / ha**
- **Nitrogen: Between 150 and 200 kg / ha**

(Divided between 2 and 3 times)

- **Phosphoric acid: 120-150 kg / ha**

Fertilization:

The needs of potatoes for tubercles production:

- **Potash: 200-250 kg / ha**
- **Nitrogen: Between 80-100 kg / ha**

(Divided between 2 and 3 times)

- **Phosphoric acid: 150-200 kg / ha**

Fertilization / Some fertilizers:

Fertilizers used before planting	Fertilizers used after planting	Fertilizers used during irrigation
Ammonia sulphate Potash nitrate (21%)	Ammonia sulphate (21%)	Potassium nitrate (13-0-46)
Simple Superphosphate (18%)	Ammonitrate (34%)	MAP (12-61-0)
DAP Di-ammonium phosphate(18-46)	Urea (46%)	Ammonitrate (34%)
TSP Triple superphosphate (45%)	Potash sulphate (48%)	Solupotasse (50%)
Potash sulphate (48%)		

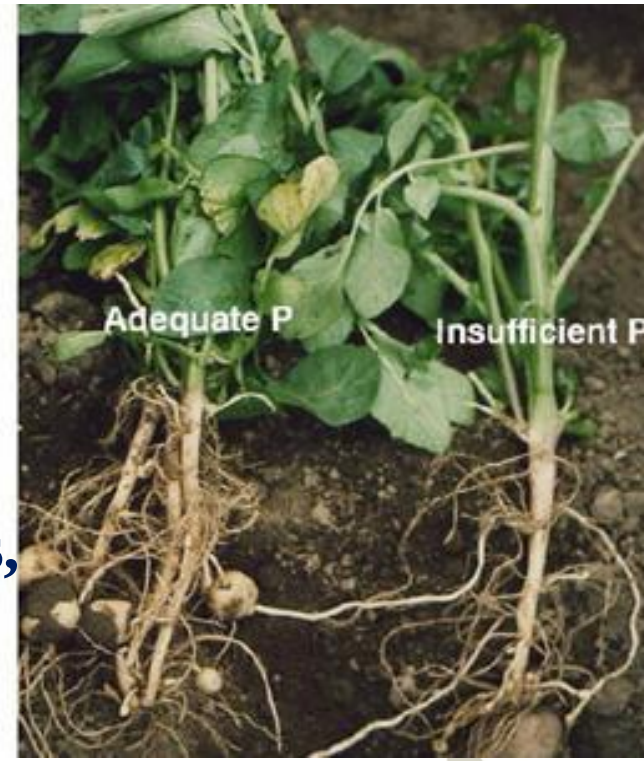
Nitrogen Fertilization:

- Nitrogen contributes to leaf development in the first two months after planting.
- Nitrogen contributes to the formation and increase in the size of tubercles.
- Excessive nitrogen fertilization causes:

- ❖ Leaf growth at the expense of tubercles.
- ❖ Disrupt tubercles maturation.
- ❖ Lack of quality.
- ❖ Physiological problems.
- ❖ Facilitates exposure to diseases and insects.

Phosphorus fertilization:

- Contributes to root development.
- Contributes to the formation of tubercles.
- Contributes to the production of tubercles, uniform size.



Phosphorus deficiency

Potassium Fertilization:

- Potassium helps plants resist frost and drought.
- Potassium helps improve the size of the tubercles.
- Potassium helps improve the quality of tubercles.

Carence en Potassium

Carence en Magnésium

Source : K+S Kali

Fertilization

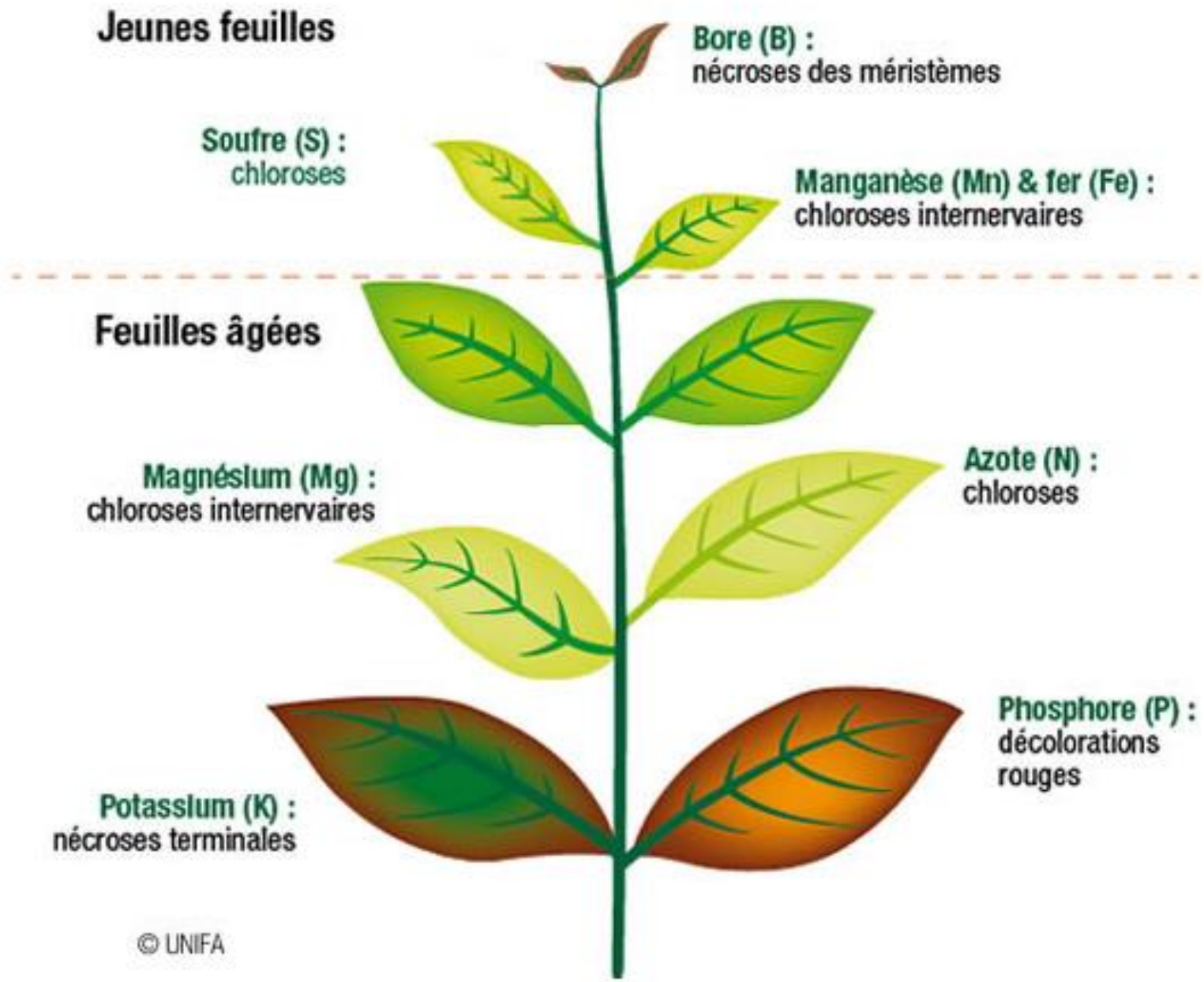
Calcium deficiency

Zinc deficiency

Fertilization:

Iron deficiency

Diagnostic des carences au champ



Organic Fertilizers:

- Contributes to the formation and development of potatoes.
- Potatoes help to gain immunity against:
  - ❖ Diseases.
  - ❖ Insects.
  - ❖ Difficult circumstances.
- Amount of sheep manure required: 30 tons / ha

FOODLAND

THANK YOU FOR YOUR ATTENTION