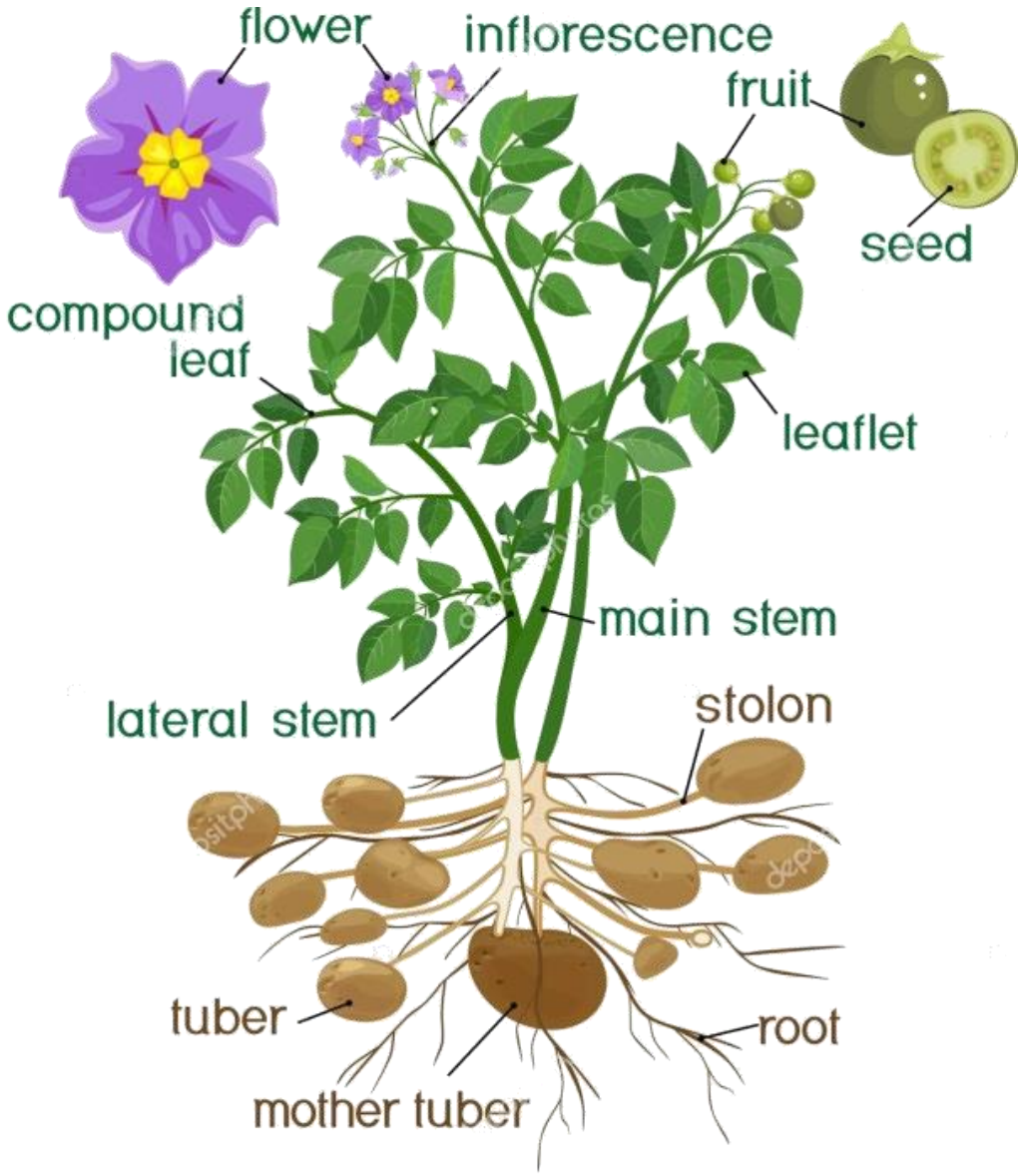
Water Ways
technologies

Potato

Agronomic Data and Irrigation

Background

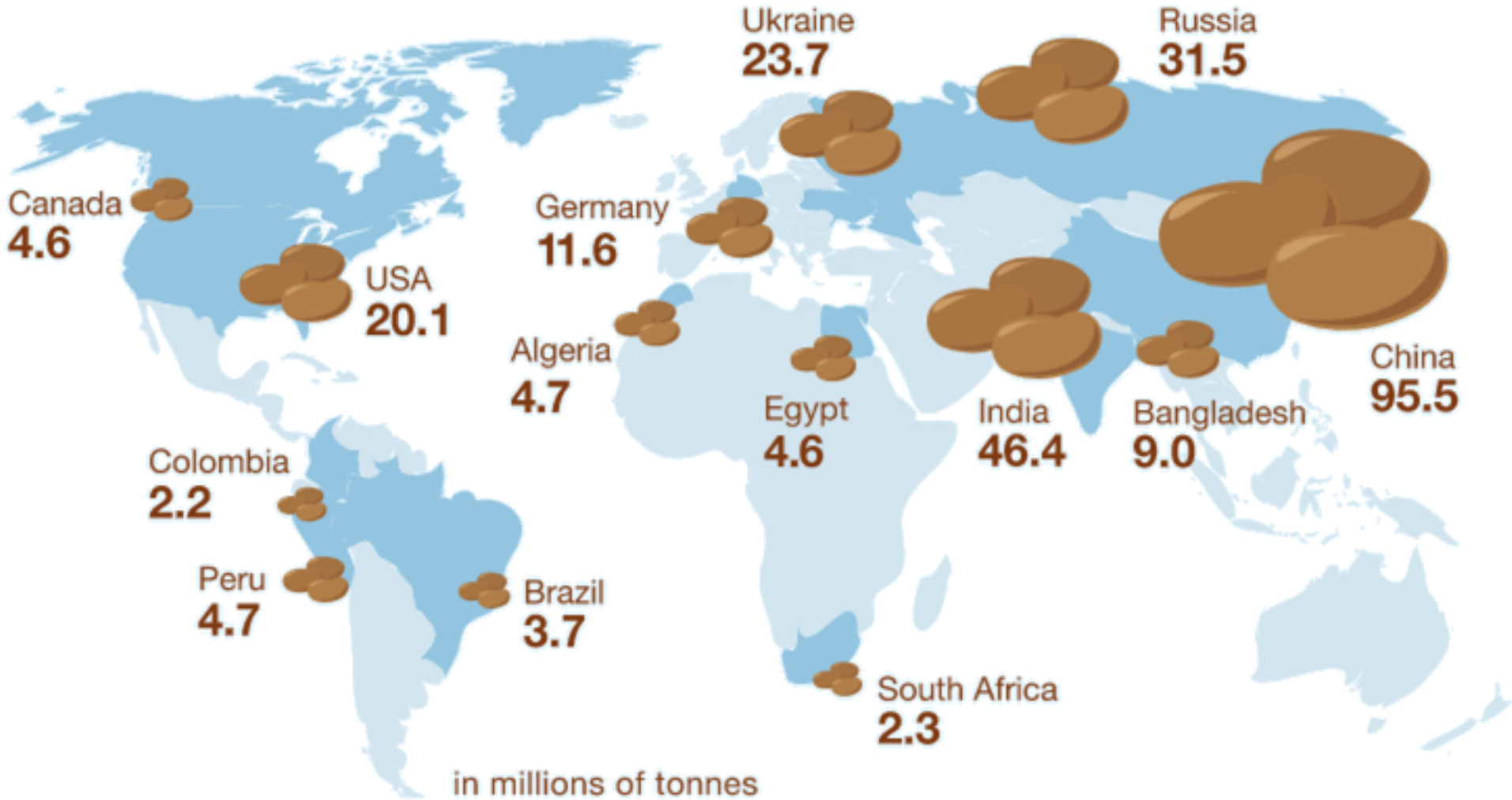


Potato

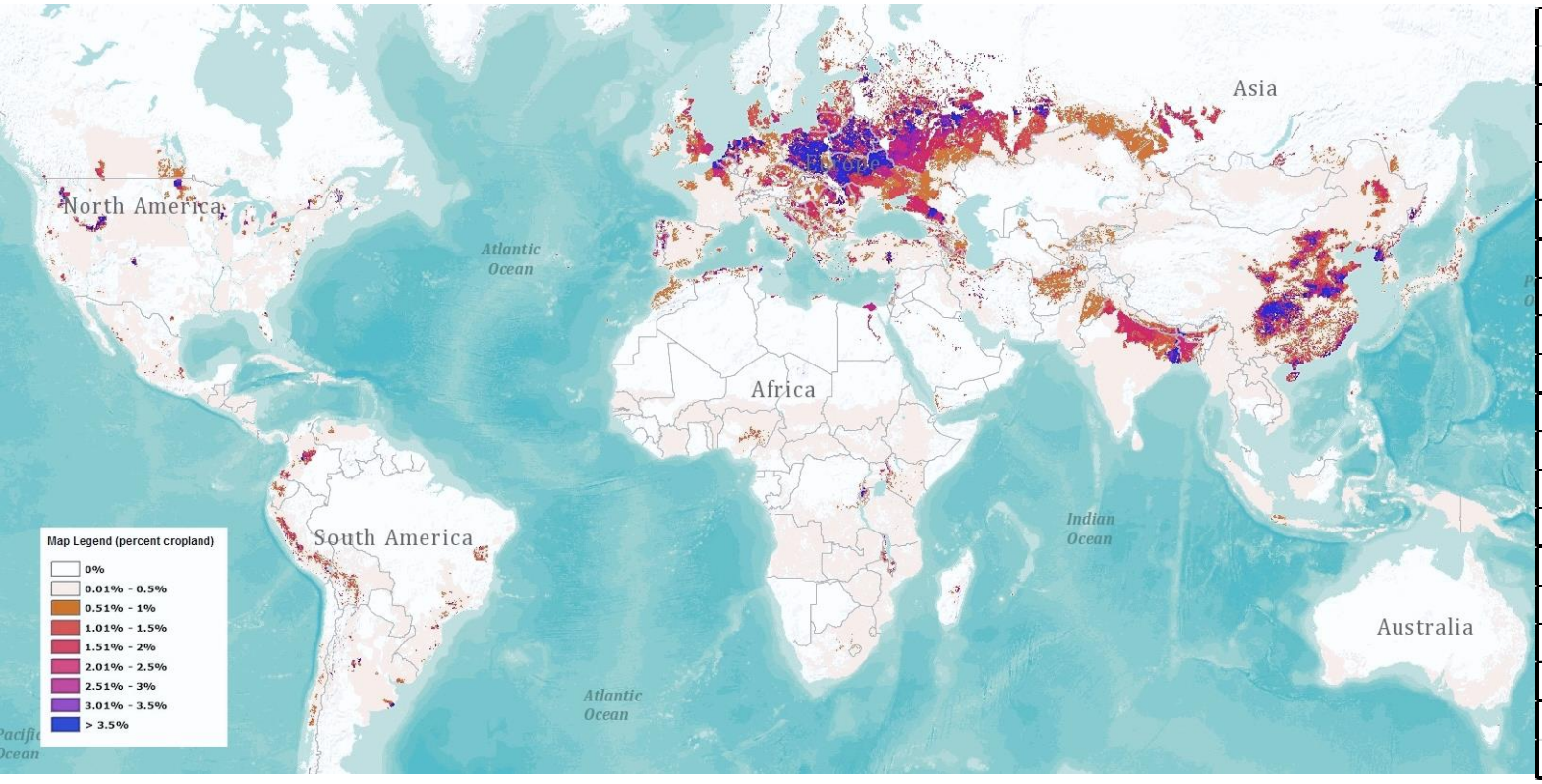
- A root vegetable, starchy tuber of the plant *Solanum Tuberosum*.
- Made up of 79% water, 15% starch, almost no fat, and is a rich source of vitamins B6 and C.
- Domesticated approximately 7,000- 10,000 years ago in the Andes region of South America (indigenous species).
- Introduced to Europe from the Americas in the second half of the 16th century and later on was spread throughout all of Europe and Asia.

Major Global Producers

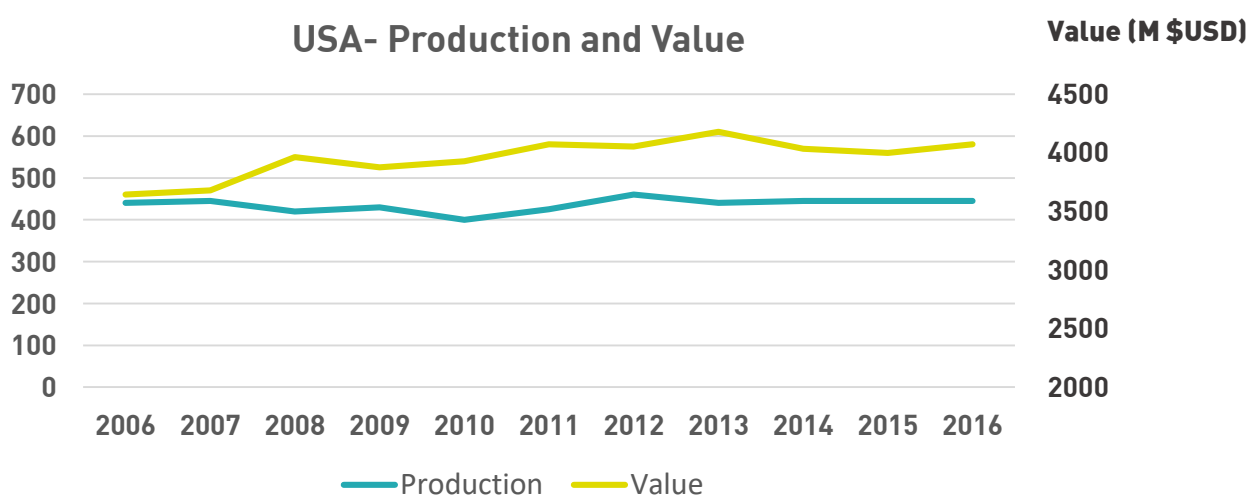
Potatoes are the world's fourth largest food crop after soy beans, maize (corn), wheat and rice.

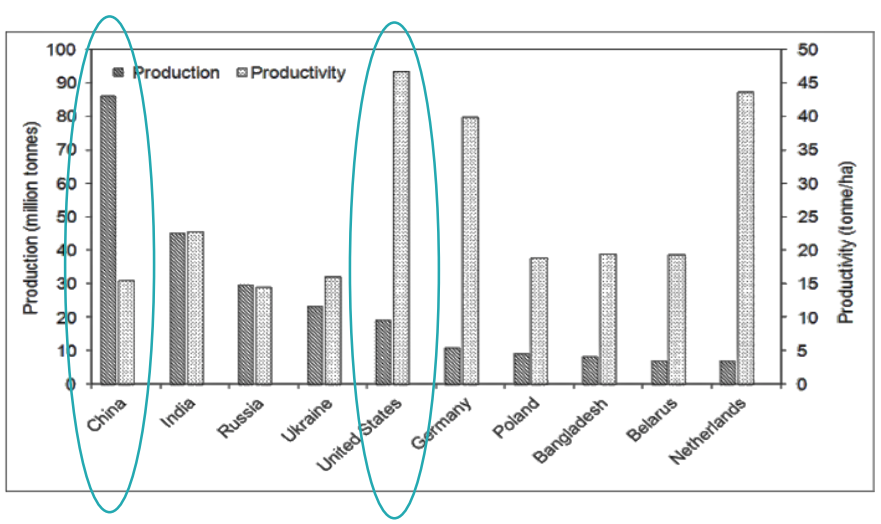


Global Yields



	production area (ha)	Yield (t)	Avarage Yield (t/ha)
Russia	1,889,208	29,589,976	15.7
Germany	250,500	11,720,000	46.8
Netherlan	160,791	7,391,881	46
Total	5,365,045	121,761,565	22.7
USA	415,010	20,017,350	48.2
Peru	310,400	4,776,294	15.4
Brazil	118,030	3,656,846	31
Total	1,797,479	44,173,458	24.6
China	5,765,144	99,147,000	17.2
India	2,179,000	48,605,000	22.3
Iran	160,092	5,102,342	31.7
Total	10,209,139	195,668,682	19.2
Algeria	148,692	4,606,403	31
South Afri	67,746	2,450,541	28.2
Tanzania	211,927	1,749,213	8.3
Total	1,892,633	25,011,823	13.2
World	19,302,642	388,190,674	20.1





Water Ways
technologies

Agro-Data

Growth Conditions

Climate requires cool climate

Soil type can grow in different types of soil from sandy to clay loams- soil must be aerated

pH in soil between 4.5- 8.5, ideal: 5.5- 7.0

EC the maximum tolerated is 107 dS/ m

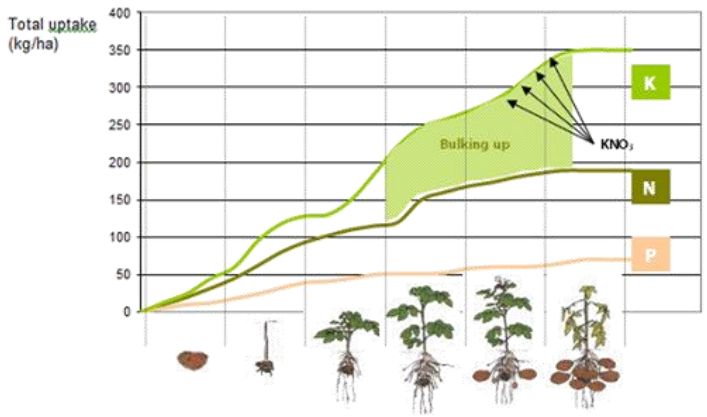
Temperature between 7- 35 C, with optimal growth at 18- 25 C

Day length long day/ short night → growth of stolon and shoots

short day/ long night→ tuber initiation

Water 500- 700 mm/ Ha/ year

Uptake of Macronutrients by a whole potato plant



Application of Macronutrients in a potato production

kg/ha	Application Rate
300	n
40	p
350	k

Growth Stages

Stage I

Sprout Development

Sprouts develop from the "eyes" until emergence from soil

Growth Stages

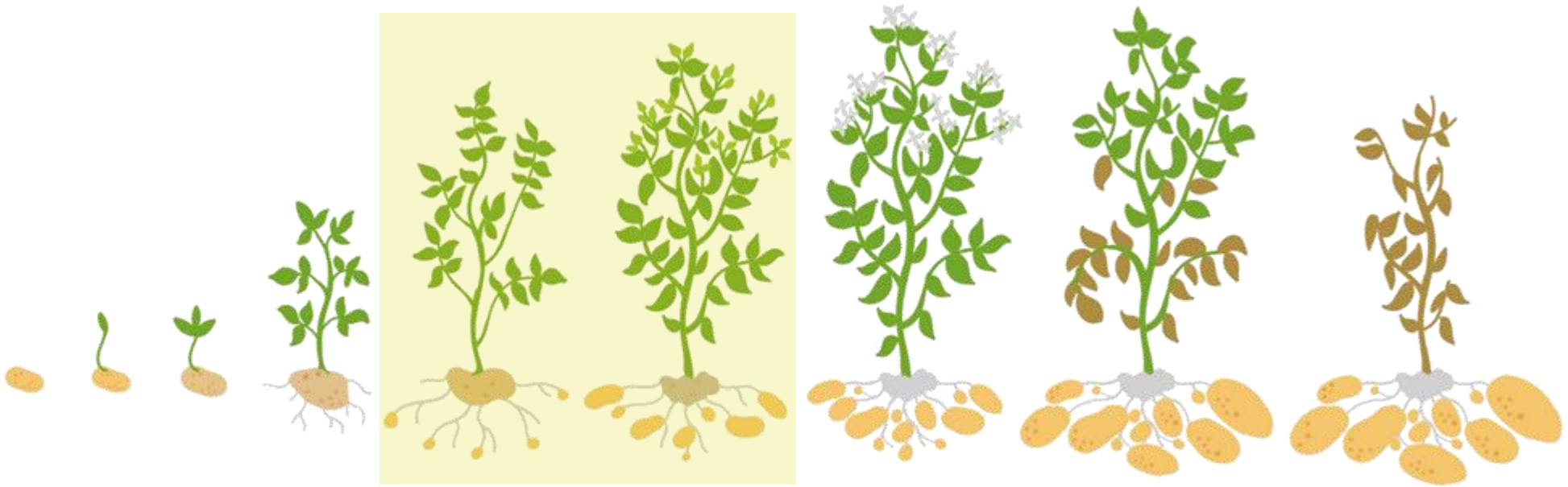
Stage II

Vegetative Growth

All the vegetative parts of the plants (leaves, branches, roots and stolons) are formed. It begins at emergence and lasts until tubers start to develop.

Stages I and II last from 30–70 days.

Growth Stages



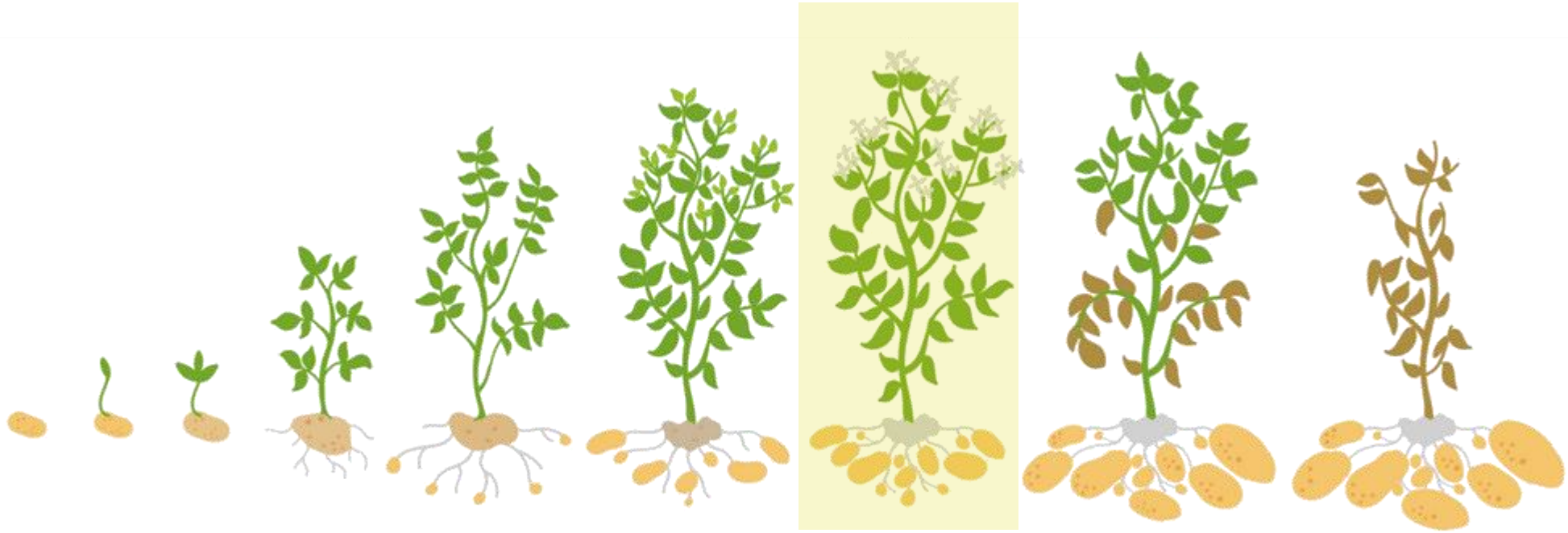
Stage III

Tuber Set/ Initiation

Tuber form at stolon tips, but are not yet enlarging. Tubers form when the plant produces more carbohydrates than is required for the vine. The number of tubers formed per plant is called the tuber set.

The number of tubers that achieve maturity is related to available moisture and nutrition. This stage lasts about 2 weeks.

Growth Stages



Stage IV
Tuber Bulking

Tuber cells expand with the accumulation of water, nutrients and carbohydrates.

This stage lasts about 45-60 days.

Growth Stages

Stage V
Maturation

Vines turn yellow and lose leaves, photosynthesis gradually decreases, tuber growth rate slows and the vines die.

(This stage may not occur when growing an early season variety).

Varieties

Potato cultivars differ in such tuber characteristics as skin color, shape, eye depth, skin texture and size.

Varietal differences affect the end use of the product and the resistance and tolerance to diseases.

Early season varieties

also called "early maturing" require 75-90 cool days to reach harvest.
Variety ex: Norland

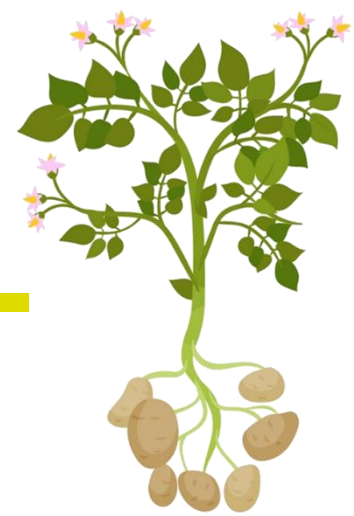
Mid-season varieties

require 90-135 cool days to reach harvest.
Variety ex: Russet Norkotah

Late season varieties

also called "long season" require 135-160 cool days to reach harvest.
Variety ex: Russet Burbank

Varieties and End Use



Food Industry

- Fresh
- Frozen / Dehydrated
- Processed food products

Starch Industry

- Starch
- Glucose

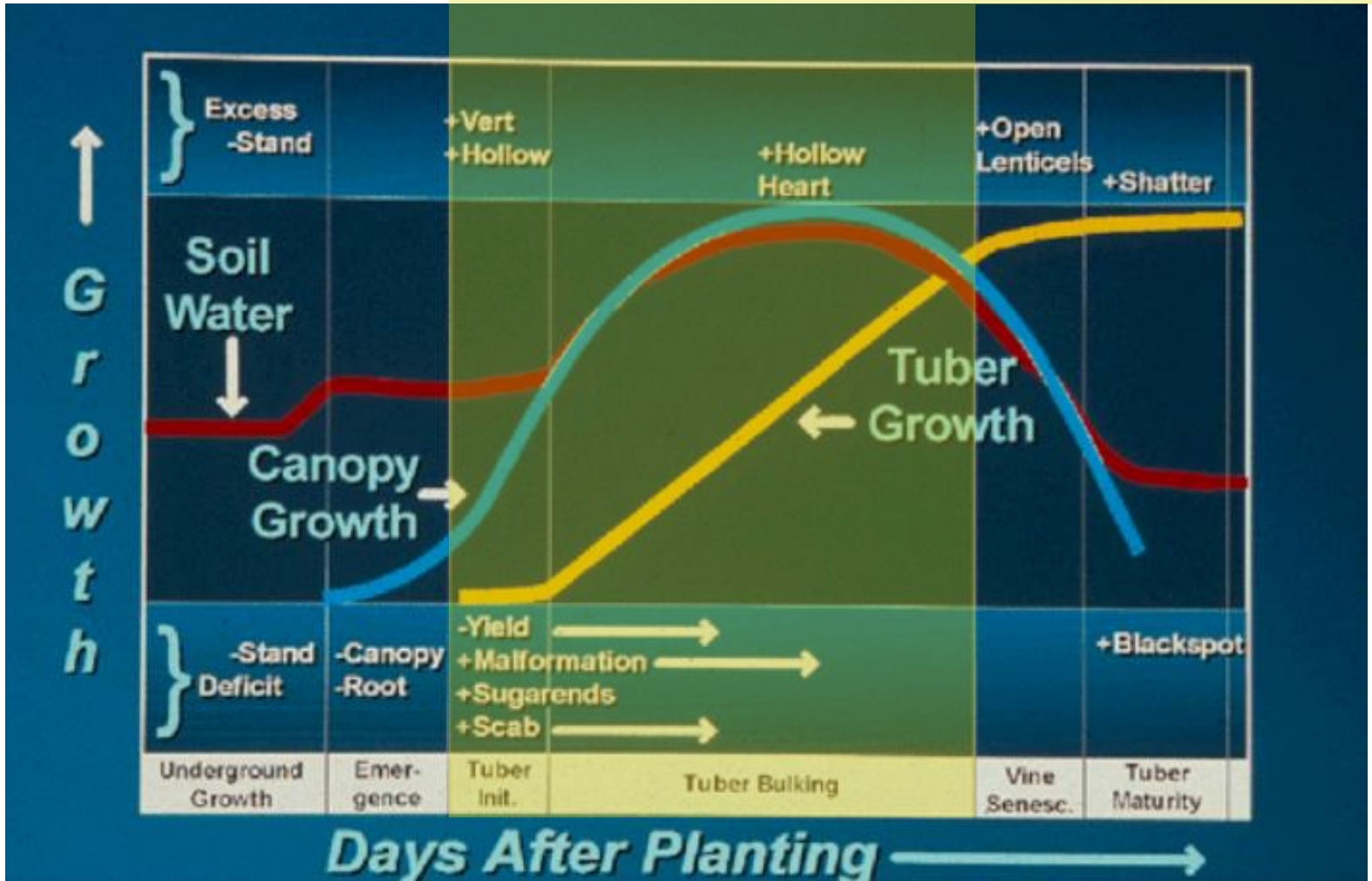
Water Ways
technologies

Irrigation

Global Irrigation Systems

Because the potato has a shallow root system, frequent and consistent irrigation have a good affect on yield

Water and nutrient deficits in the third and forth phases of the growing period (forming and enlarging the tubers) reduce yield more than those in the early part.

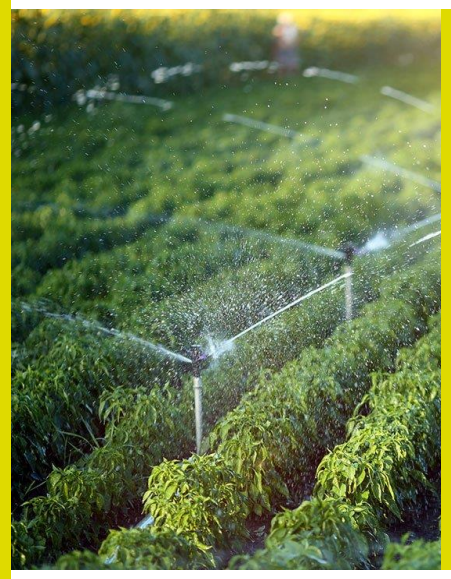


Global Irrigation Methods

Water Guns

Flood Irrigation

Water Pivot



Sprinkler Irrigation

Drip Irrigation

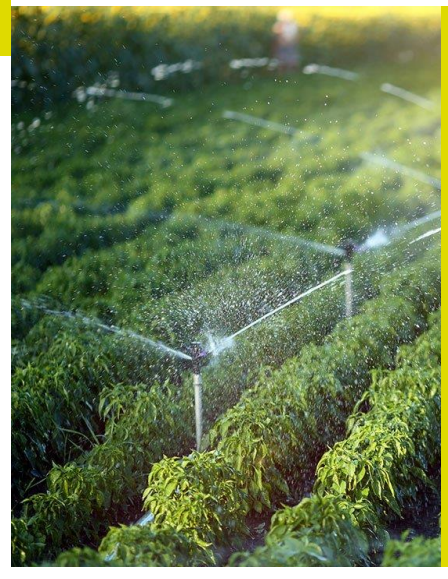
Sub-drip Irrigation

Global Irrigation Methods

Water Guns

Pros:
- One machine needed for a large area
- Can get to any point in the field
- Simple to use

Cons:
- Uneven distribution
- Can damage the plant (high pressure)
- Small area coverage
- Diseases and weeds



Sprinkler Irrigation

Pros:
- Modular
- Same equipment to large area
- Good water distribution

Cons:
- Equipment requires high maintenance
- High pressure
- Can't stay in field
- Diseases and weeds

Global Irrigation Methods

Flood Irrigation

Pros:
- Cheapest and oldest method
- No use of equipment or energy

Cons:
- Can be used only in slight slope field
- Uneven water distribution, inconsistent
- Inefficient use of water and fertilizer
- Requires labor

Pros:
- One time installation
- Accurate and frequent
- Consistent use of water and fertilizer
- Adjustable to any terrain
- Possible to apply pesticide and fertilizer,
- No leaf wetting

Cons:
- Expensive and expendable
- Requires labor for maintenance

Drip Irrigation

Global Irrigation Methods

Water Pivot

Pros:
- Efficient water use
- One time installation
- Frequent and consistent irrigation
- Cheap, adjustable irrigation rate
- Possible to apply pesticide/ fertilizer

Cons:
- No slope fields
- Diseases and weeds

Sub-drip Irrigation

Pros:
- Efficient water and nutrient absorption
- Helps prevent weeds
- Reduces humidity sourced diseases in
- the soil
- Increases yield

Cons:
- Labor (Reinstallation needed every year)

Irrigation Monitoring

Enables to give the right amount of water at the right time, as well as get to the right level of soil moisture in a specific growth phase.

I. Soil moisture level measuring equipment (tensiometer/ different moisture sensors)
II. Climate measuring equipment / web data
III. Plant growth sensors (optional)

- Integration of the real time data from the different sensors
- Characteristics and history of the specific land and growth

- Data driven decisions
- Economic use of resources
- Phase growth adjusted treatment
- Plant health
- Increasing quality and yield potential

Irrigation Monitoring

Irrigation scale when using tensiometer:

Indicates the soil water tension in Centibar.

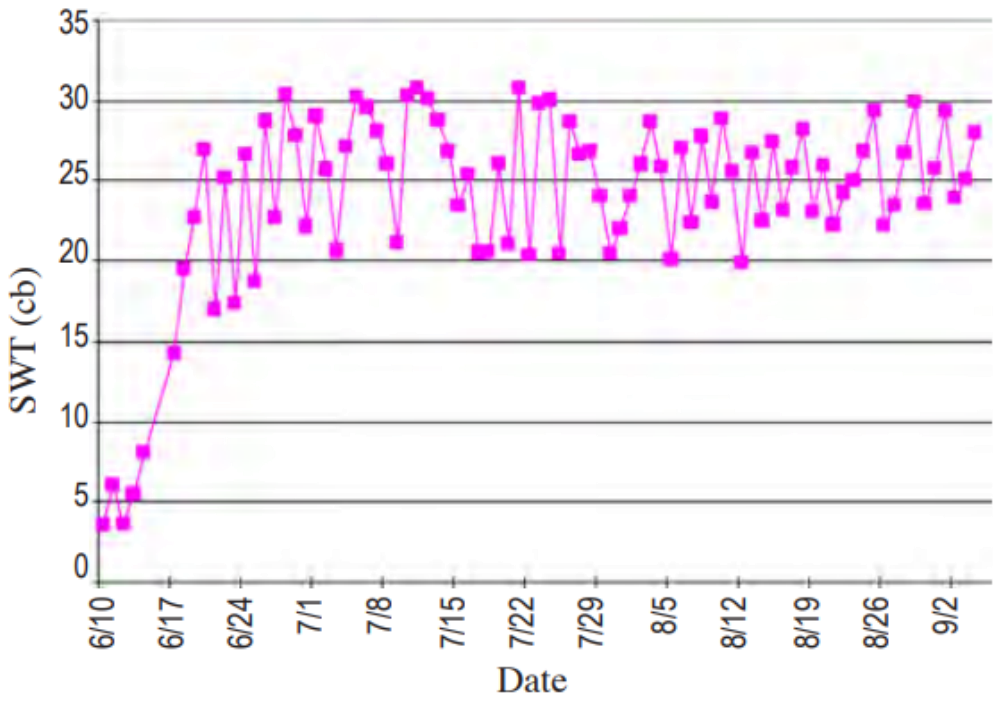
An SWT scale for potato

- > 80 cb indicates dry soil and water stress for potato plants.
- 20 to 60 cb is the range that indicates it's time to irrigate, depending on location, soil type, and irrigation system.
- 10 cb is close to field capacity.
- 0 to 10 cb indicates the soil is saturated with water.

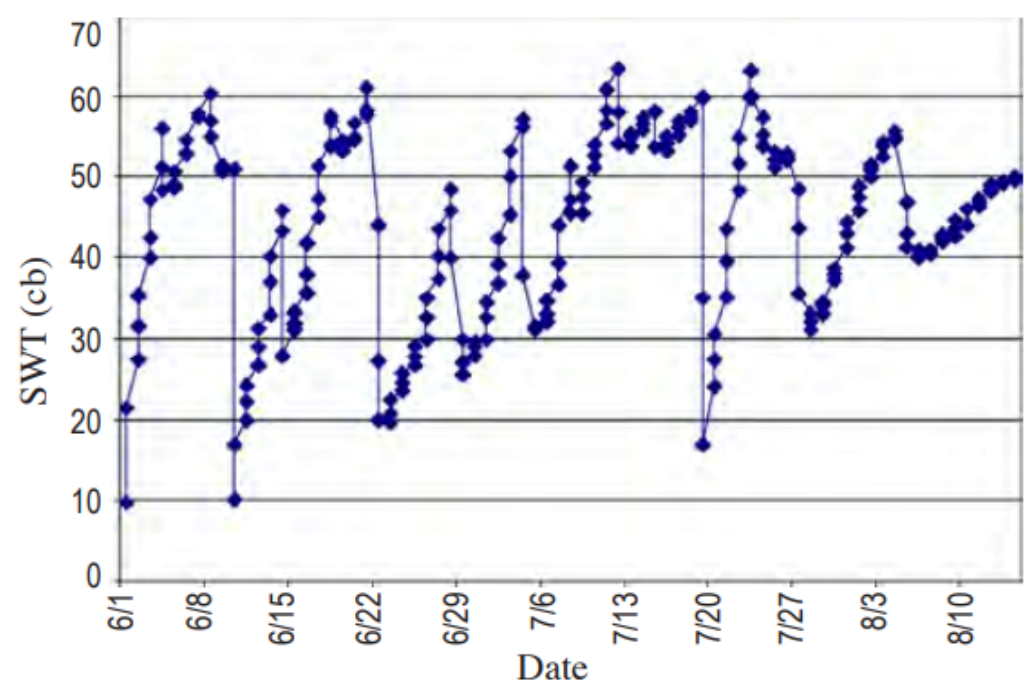
Irrigation Monitoring

Comparison of two irrigation methods in silt-loam potato fields In Ontario, CA

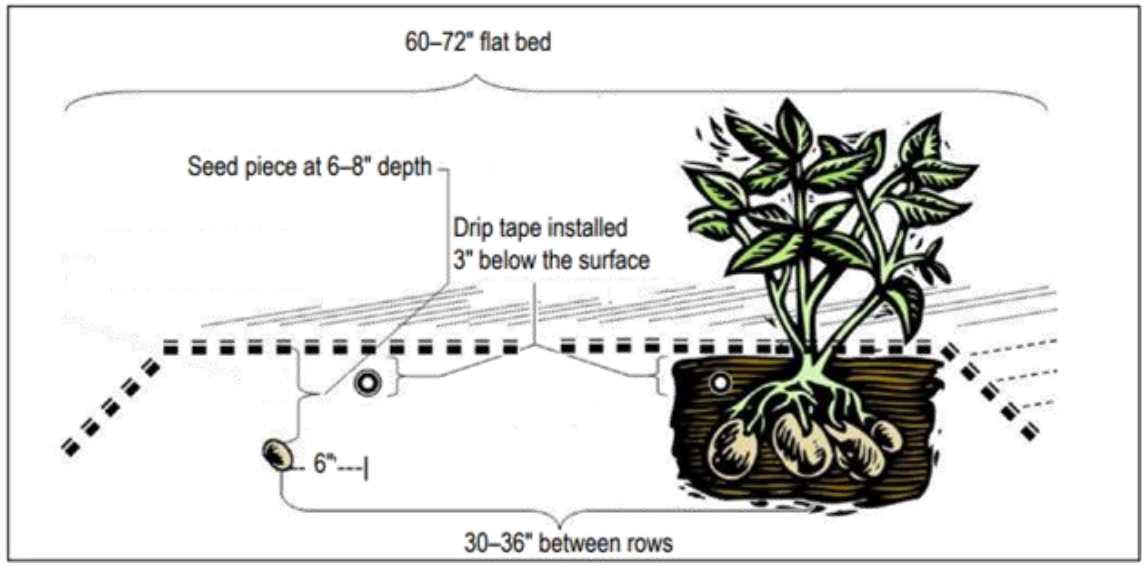
Drip Irrigation



Sprinkler Irrigation



Moisture Levels



Growth stage	Pre-planting to planting	Planting to sprouting	Emergence to tuber initiation	Tuber initiation to full bloom	Full bloom to plant senescence	Plant senescence to harvest
Soil moisture	about 70-80% of field capacity.	65-80% in the top foot of soil. No irrigation is recommended during this period (pathogen risk).	70-80% Irrigation should begin and increase gradually as canopy grows.	Optimal 80-90% FC, water stress becomes less tolerable. Transpiration reaches highest rate.	80-90% FC. Highest demand for water, most sensitive to deficit.	Irrigation should decline. Soil moisture may decline to 60-65% depending on variety and climate.

Growing Recommendations in the USA

- Select only well-adapted varieties in demand for the intended end-use and market.
- Only certified seed stock should be purchased.
- Cultivation is necessary for weed control, right moisture level and to keep soil hilled up around plants.
- Practice crop rotation and build organic matter.
- Labor recommendations: approximately 60 hours / Ha.
- Harvesting recommendations: approximately 125 hours, with an addition 60 hours for washing, grading, bagging and packing.
- Maintain the crop with an adequate water supply throughout all growth stages (particularly during tuber initiation and tuber enlargement).
- It is important to consider potato ETc in irrigation scheduling (climate, soil moisture, use of field monitoring, etc.)

Production	2625	$/Ha
Harvesting and marketing	3862	$/Ha
Gross return	8250	$/Ha
Profit	1763	$/Ha
* yield=40 t/ha. Price= 200 $/t		

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Thank you

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