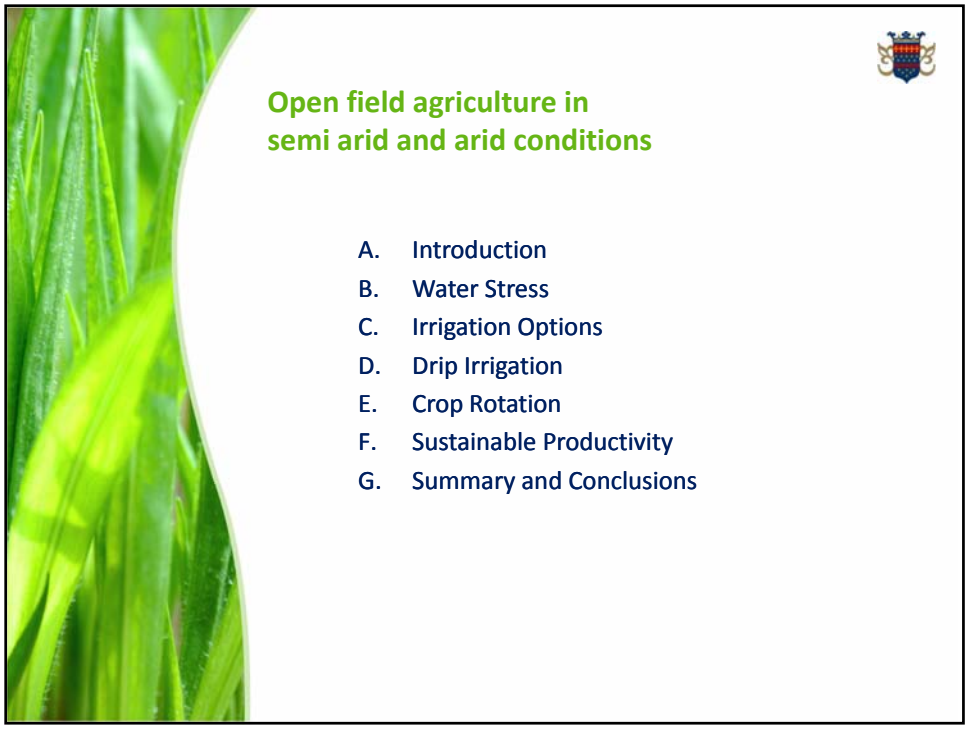

Open field agriculture in
semi arid & arid conditions
Can we overcome the Challenge?
Yaacov Cohen
Clootwijck Estate, The Netherlands
2nd Potato Show, April 2011 – Beijing, China


Open field agriculture in
semi arid and arid conditions
A. Introduction
B. Water Stress
C. Irrigation Options
D. Drip Irrigation
E. Crop Rotation
F. Sustainable Productivity
G. Summary and Conclusions

Open field agriculture in semi arid and arid conditions

A. Introduction

- Clootwijck Estate
- Yaacov Cohen

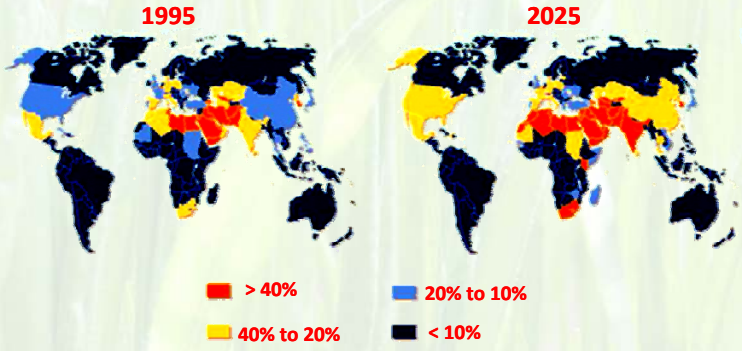
Open field agriculture in semi arid and arid conditions

B. Water Stress

- Challenge
- Fresh water stress
- Necessity
- No irrigation – no production
- No irrigation – no crop

CHALLENGE !

FRESH WATER STRESS !

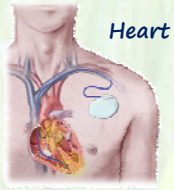


Water withdrawal as % of total available

Source: WMO, 1996; GEO, 2000; UNEP, 1999)

NECESSITY !

Mother of innovation



Heart pulsator

Disc on key

Drip Irrigation
1964

NO IRRIGATION – NO PRODUCTION !

The desert does not forgive any mistakes

Laredo Project – Peru
3.800 ha - 99 % sand - annual rain 10 mm
production 180 T / ha

NO IRRIGATION – NO CROP !

Drip Irrigation is changing the desert

Arava Valley – Israel

5.000 ha - cultivated - annual rain 30 mm/year - production 60-70 ton / ha

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C. Irrigation Options

- **Flood irrigation**
- **Pivot irrigation**
- **Sprinkler irrigation**
- **Drip irrigation**

Flood irrigation

High evaporation

Pivot irrigation

High energy consumption
Working pressure
35 - 65 meters

Sprinkler irrigation

Working pressure 2,5 - 3,5 Bar
25 - 35 meters

Drip irrigation

Working pressure 0,5 Bar
5 meter

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D. Drip irrigation

- Difference
- Water usage and pressure (energy)
- Examples
- Innovation / New:

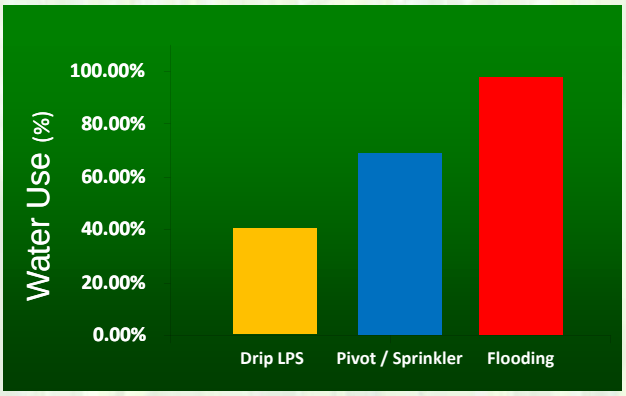
"continuous (drip) irrigation"

DIFFERENCE

Between drip irrigation and other methods?

Irrigation of the plants and not the soil

WATER USAGE and PRESSURE (ENERGY)



DRIP IRRIGATION AND POTATOES

Planting / ridging

Installation

DRIP IRRIGATION AND POTATOES

Positioning

High and uniform yield

INNOVATION / NEW

"Continuous (drip) Irrigation"

Yotvata
Arava valley
Israel

Continuous irrigation, working pressure 0.2 Bar

NEW / INNOVATION

"Continuous (drip) Irrigation"

From economical and technical solutions to agronomical advantages

Low flow dripper < 1.0 l/hr gives:

- A better water distribution
- Better fertilizer availability
- Bigger shifts
- Energy savings
- Salinity reduction
- Herbicides activation

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E. Crop rotation

- Definition
- Components
- Principles
- Benefits
- Motivation (extra)
- Systems for irrigation
- Profitability

Definition

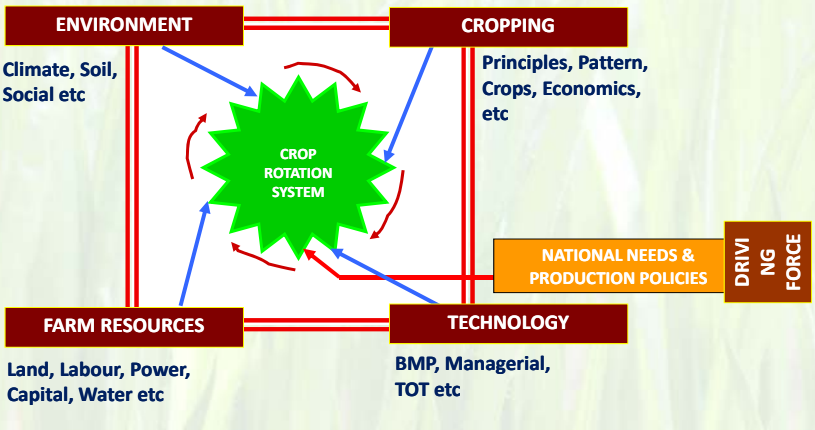
What is Crop Rotation?

The practice of alternating annual crops on a specific piece of land in a planned pattern or sequence in successive crop seasons / years so that crops of same species or family are not grown repeatedly without interruption on the same field.

Objective:

To get maximum profit from least investment without impairing the soil fertility.

Components



Principles

1. Crops with tap root system should be followed by those which have a fibrous root system.
2. Avoid growing crops belonging to same family in succession to avoid weeds, pests & disease buildup
3. Follow a legume forage crop (clover or alfalfa), with a high N-demanding crop (corn), to take advantage of the nitrogen supply
4. Use crop sequences that promote healthier crops, for example, cabbage – onions or potatoes - corn) in comparison to crop sequence (peas/oats – potato) that have adverse effects
5. Use crop sequences that aid in controlling weeds
6. On sloping & erosive lands use no till planting, extensive cover cropping, strip cropping and longer duration perennial crops

Benefits

1. Timely agricultural operations & easy supervision of work
2. Maintenance of good soil physical condition
3. Increase in organic matter and biological activity,
4. Improves distribution of plant nutrients in the soil by varying the feeding range of roots
5. Improves fertility with legume nitrogen and, when using green manure crops, makes other plant nutrients more available
6. Fosters the most effective use of manure and fertilizer
7. Reduces chemical usage by naturally breaking the cycles of pests, diseases & weeds
8. Continuous vegetative cover causes less erosion and sediment deposition

Motivation

Sustainable land treatment:

Conservation tillage improves organic matter, aggregate stability, porosity, infiltration, water movement, biological activity, reduces soil erosion and sediment deposition

No till corn in Soybean residue

Zero tillage soybeans

Motivation

- Cropping systems with a high frequency of sod reduce soil erosion
- Sod based rotations with deep root systems increase organic matter, microbial activity, aggregate stability, infiltration, water movement & aeration and reduce soil crusting and compaction
- Sod rotations with deeply rooted crops can penetrate to depths of 1.5 – 1.8 m and cycle nutrients especially the nitrates
- High residue crops in rotation with cover crops and conservation tillage increase amounts of organic matter

Systems for irrigation for different crops

- Drip irrigation is commonly used for row crops.
- Other field crops like wheat, rice, legumes that are whole area crops use movable sprinklers systems.
- In general we have this crop every 4 years- we need a sprinklers system for ¼ area and dripper systems for ¾ area.

Profitability

- The principles are clear, is it cost effective?
- We have to consider climate, labor, agro technology, inputs- fertilizers, plant protection, marketing, prices and more.
- It is rather complicated to consider all these variables .
- **Special software** using all relevant info , helps us to decide:

What crop sequence will give more money?

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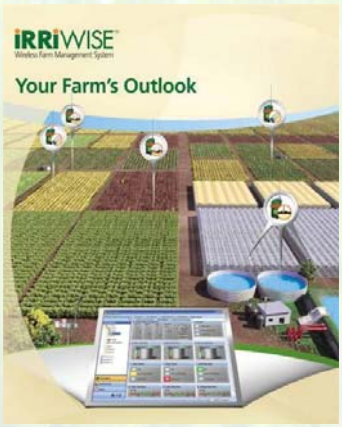
F. Sustainable productivity

- Future
- Result improving
- Monitoring and control, spraying
- Irrigation management
- Tensiometer
- Feeling, emotion

PAST **FUTURE**

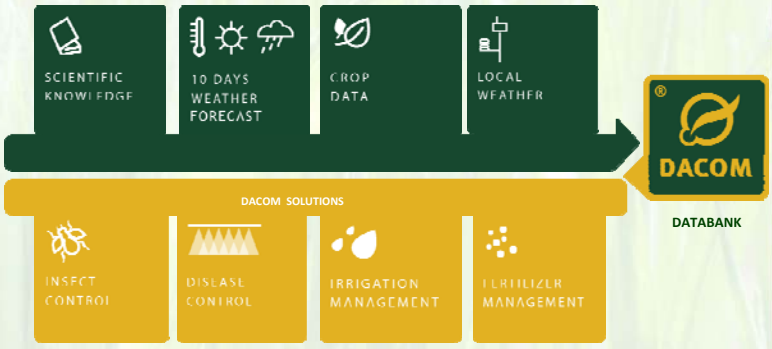


RESULT IMPROVING

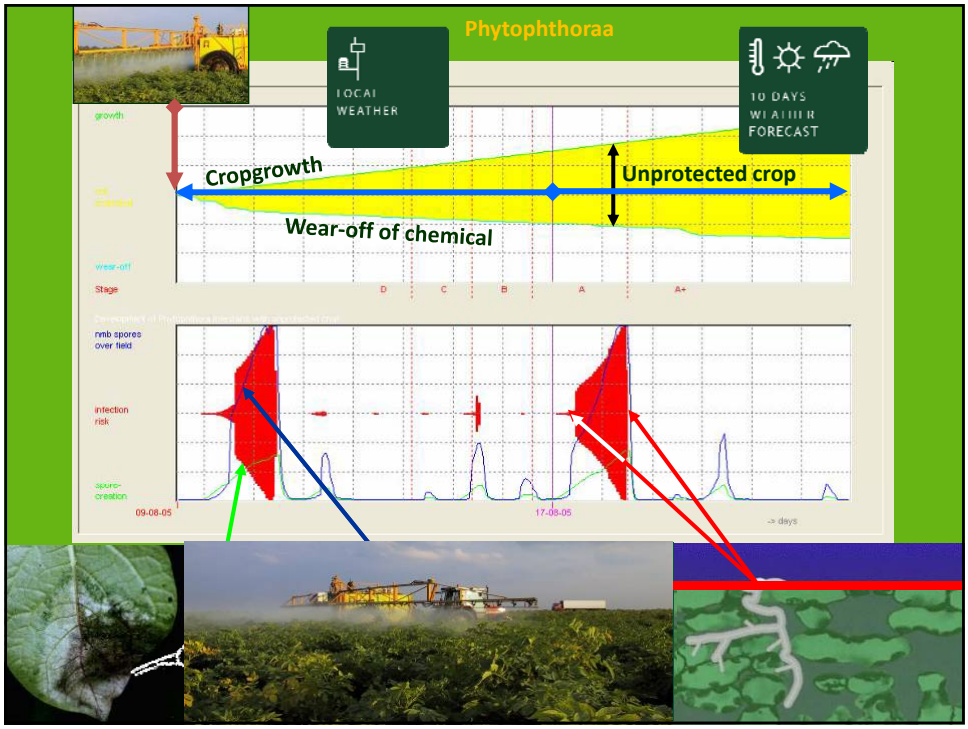
By using better management!

1. Decisions support tools
2. On Line data from field
3. Specific sensors and applicative software
4. Meteorological station
5. Evaporation Pan = How much water?
6. Soil moisture sensors = How efficient?
7. Soil solution extractors = Where is the Nitrogen?

MONITORING, SPRAYING CONTROL



DACOM DSS
Decision Support System


Phytophthoraa
LOCAL WEATHER
10 DAYS WEATHER FORECAST
Cropgrowth
Unprotected crop
Wear-off of chemical
growth
wear-off
Stage
D
C
B
A
A+
nmb spores over field
infection risk
spore-creation
09-08-05
17-08-05
-> days


IRRIGATION MANAGEMENT
How much water ?
Evaporation pan – Class A
Daily evaporation = 5.5mm
Kc = 1 / 5.5 mm x 1 = 5.5 mm

IRRIGATION MANAGEMENT

Month	1/3 month	Irrigation Coefficient
Germination		
1	1 - 10 11 - 20 21 - 31	0,4 0,5 0.7 - 0.6
2	1 - 10 11 - 20 21 - 31	0.7 - 0.8 0,9 0.9 - 1.0
3	1 - 10 11 - 20 21 - 31	0.9 - 1.0 0.9 - 1.0 0.9 - 1.0
4	1 - 10 11 - 20 21 - 31	0,9 0,75 0,6

TENSIOMETER

Tensiometers will tell us about moisture in soil

FEELING / EMOTION

Leaf sensor will tell us how does the plant feel

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G. Summary and conclusions

- Drip irrigation
- Crop rotation
- Management

DRIP IRRIGATION

- Saves : water, energy, fertilizers, plant protection agents
- Increase yields (+$)
- Eco- friendly - No nitrogen leaching, less herbicides, Insecticides, fungicides (+$)
- Less yield fluctuation; longer production and processing season (+$)
- Moveable system

CROP ROTATION

- Keeps the soil healthy and fertile
- Less tillage gives better aeration, water infiltration
- Empowers the soil for more productive years

MANAGEMENT

- Saves crop protection sprays
- Economics on water
- Optimizes yield / result

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Thank you for your attention, and remember:

every drop counts !