Workshops on Climate Smart Agriculture in Algeria

Greet Blom-Zandstra & Anne Elings

Wageningen University & Research

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Business Unit Agrosystems Research, P.O. Box 16, 6700 AA Wageningen, T +31 (0)317 48 72 31;
Business Unit Greenhouse Horticulture, P.O. Box 644, 6700 AP Wageningen; T +31 (0)317 48 56 06;

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Summary

Algeria copes with serious negative effects of Climate change, with water scarcity as the major hazard. Due to this climate change, the country copes with a very serious water scarcity problem in regions that are responsible for the highest agriculture production in the country. Therefore, it becomes crucial to implement a more adapted agriculture with regard to the climate changes, and the use of more advanced technological solutions to limit the climate effect on productivity. Herewith, Algeria might benefit from the Dutch advanced knowledge on this matter.

During a visit of two experts from WUR, workshops were held to present and demonstrate that with the adoption of Climate Smart Agriculture, farmers might be able to limit and control the effects of climate change on agriculture, so securing more productivity with less resources. The focus of the workshops was on greenhouse technology and on the production of potatoes.

For the workshops on greenhouse technology, the Dutch approach to greenhouse design was presented. This design tries to realize a greenhouse production system in which environmental and economic sustainability are optimized. Resource use efficiency in greenhouse production systems is substantially higher than in open fields.

For the workshops on sustainable potato production, the just started project on sustainable water use for potato production in El Oued, was presented. In the project, Wageningen University & Research will cooperate with the Universities of El Oued, Biskra and Ouargla. During a visit to El Oued, after the workshops, it was discussed how we can make our cooperation between the universities work.

In this report, the results of the workshops and meetings are presented.

1 Introduction

At the moment, Algeria is going through very obvious climate changes, with colder winters and hotter summers. Due to this climate change, the country copes with a very serious water scarcity problem in regions that are responsible for the highest agriculture production in the country. This will affect the future productivity of the entire agricultural sector. Therefore, it becomes crucial to implement a more adapted agriculture with regard to the climate changes, and the use of more advanced technological solutions to limit the climate effect on productivity. This new techniques may enable farmers to limit and control the effects of climate change on agriculture, so securing more productivity with less resources. Herewith, Algeria might benefit from the Dutch advanced knowledge on this matter.

From October 10th till 13th, 2017, the SIMA fair (SIMA SIPSA) took place in Algiers. Generally, a lot of farmers from the Maghreb visit the fair, presenting an excellent momentum to demonstrate and discuss Climate Smart Agriculture techniques in a Maghreb context in order to:
- Inform the Algerian and Maghreb audience on the impact of climate change on the production in the agriculture sector,
- Prove to smallholders that an adoption of a climate smart solution will mitigate the effect of Climate Change, and
- Create awareness on the need of the adoption of climate smart solutions in order to limit the climate impacts on agriculture production.

Therefore, a visit was organized for two experts from WUR in company with the Agricultural Counsellor for the Magreb (Nico Visser) and employees from the Netherlands Embassy in Algiers (Tahar Maza and Khaled Benchaalal).

1.1 Visit and workshops

In Algeria, the production of potatoes is one of the most important commodities, with a total area of 156.176 ha and a yearly production of almost 5 Mt. Currently, potato production is still unsustainable and much can be gained in terms of water use efficiency, fertilizer and pesticides applications, CO_2 footprint, field layout, the choice of appropriate varieties, the quality of the starting material and prevention of post-harvest losses. This year, a demonstration project started on Sustainable Water use in potato, which is a combined activity of Algerian and Netherlands public, private and research parties, with the aim to test and illustrate the innovative technique of underground fertigation (i.e. a combination of drip irrigation and fertilization) and how it can contribute to more sustainable water use practices. Crop production in greenhouses, having good perspectives in terms of Climate Smart Agriculture, is coming up in Algeria, but still in a preliminary phase of development.

During this visit, the focus was on potato production and greenhouses and contained two elements:
1a) Two days workshops during the SIMA-SIPSA fair:
- Presentation and demonstration of another way to irrigate potatoes in the Algerian desert in order to sustain potato production and optimize the productivity of natural resources;
- Presentation of and discuss an environmentally and economically sustainable method to realize a greenhouse project that meets the requirements of the crop, the climate, fits within an economic commercial model and gives growers the tools to cultivate desired greenhouse crops regardless under Algerian climate conditions.

1b) Two days field visits:
- A workshop with presentations on ‘Sustainable Dutch Greenhouse Design’ and on ‘Sustainable Potato Growing’ in Biskra, in cooperation with the University of Biskra and the private sector participating via the Agricultural Chamber Biskra, organized by Tahar Maza, Agricultural Assistant of the Netherlands Embassy Algiers.
- A meeting and presentation on ‘Sustainable Potato Growing’ in El Oued in cooperation with the University of El Oued and the University of Ouargla and the private sector via the potato growers cooperative, organized by Khaled Benchaalal, senior economic adviser of the Netherlands Embassy Algiers.

Concrete aims of the visit were:

- Proving to the Algerian and Maghreb audience that with the adoption of a climate smart solution, they will be able to, at least, limit and control the effects of climate change on agriculture, so secure more productivity with less resources.
- The small farmers will be informed about the climate impact on the production in the agriculture sector (potatoes and greenhouse) and start to realize the need to start taking measures towards adopting climate smart solutions in order to limit the climate impacts on agriculture production.

The programme of the visit is presented in Annex 1.

2 Presentations at the SIMA fair

2.1 The Dutch approach to greenhouses, Anne Elings

The Dutch approach to greenhouse design tries to realize a greenhouse production system in which environmental and economic sustainability are optimized. Environmental sustainability can be quantified in terms of the total use and efficiency of the use of water, energy, nutrients, crop protection agents and other inputs. Resource use efficiency in greenhouse production systems is substantially higher than in open fields. Economic sustainability can be quantified in terms of production, investment costs, running costs and pay-back period. Modules that together constitute a greenhouse construction and installation are combined to achieve this (Elings et al., 2015). Van Os et al. (2012) conducted such an analysis for Algerian conditions, in particular those around Algiers and Biskra.

Starting point of the design process is the crop that requires optimal conditions of temperature, CO_2, light quantity and quality, water and nutrients and must be well-protected against pests and diseases. Optimal conditions vary over crops and, to a lesser extent, also varieties. Management is very important and requires much knowledge on the crop and the greenhouse – this is why knowledge transfer is such an important issue in the establishment of a greenhouse sector.

Design of the greenhouse for Algerian conditions focuses on temperature control and irrigation. Temperature can be controlled through ventilation, use of covering material, shading, heating during cold nights and active cooling. For irrigation, a strategic choice has to be made between drip irrigation if the crop is grown in the soil and soilless cultivation.

First recommendations for single tunnels are:

- Enlarge the ventilation openings along the sides of the greenhouse to 30%
- Use diffuse film with high light transmission.
- Introduce pad & fan cooling in Biskra where summer temperatures are too high

First recommendations for Canarian and multispan greenhouses are:

- Realize 30% ventilation rate
- Use insect nets
- Consider heating and heat storage
- Use a fogging system in a high greenhouse

The entire presentation is given in Annex 2.

2.2 Climate Smart Agriculture, Greet Blom

Global climate change is both resulting from agricultural activities (due to its emission of greenhouse gasses) as affecting agriculture by its negative impact on crop production. For Algeria, main hazards of climate change are an increase of water scarcity, heat waves and the incidence of extremes (i.e. sand storms). Climate Smart Agriculture is an appropriate way to tackle Climate Change, aiming at securing food production, adaptation in agriculture and mitigation of greenhouse gasses. For Algeria, water conservation strategies are most needed, which may comply: smart irrigation strategies by sophisticated scheduling, introduction of innovative equipment and precision techniques and by breeding for drought tolerant and water efficient cultivars.

Recently, a new project has started on sustainable water use for potato production in El Oued, the largest potato production area of the country in which potato growing practices are rather unsustainable. In this project, a real-live situation on a 5 hectares demonstration farm will be set up, aiming at: Introduction of mechanization at planting and harvest; saving water extraction and irrigation by monitoring and control; lowering the CO_2 footprint; optimization of the supply of fertilizer and pesticides; introduction of better varieties and development of a national roll-out plan for scaling up. Farmers and other stakeholders will be involved from the beginning by regular farm visits and workshops. Results from similar projects in other countries of the arid zone give rise to expect beneficial results from this demo project as well due to substantial water savings, decreased costs and increased production levels. To convince farmers to adopt the innovative farm management strategies, data on different characteristics of the potato crop growth (water use, fertilization needs, harvest, etc.) will be collected and discussed with the participants of the visits and workshops.

In the project, Wageningen University & Research will cooperate with the Universities of El Oued, Biskra and Ouargla. Therefore, a Memorandum of Understanding between the universities has come into effect, which will enable the strengthening of the working relation within the project and the exchange of scientific knowledge between Algeria and the Netherlands.

The entire presentation is given in Annex 2.

3 Field visits

3.1 Biskra

3.1.1 Greenhouse production systems

Upon arrival to Biskra on Saturday November 15th 2017, the group was welcomed at the airport by Mr. Guemari Massoud, President of the ‘Chambre d’Agriculture Wilaya de Biskra’ and by its General Secretary Ghemri Mohomed Fonzi. The cooperation[1] is with 6200 members and an annual turnover of € 15 million the largest of Algeria and responsible for the coordination and introduction of innovative activities within the agricultural sector. Its members grow a wide variety of crops (for example, 24,000 ha cereals) and hold cattle such as sheep (wool for carpets, meat) and camels. The cooperation knows about 6000 ha of greenhouses in which mostly beef tomatoes are grown – in the soil. Cherry tomatoes are gaining attention. The beef tomatoes are traded on the domestic market. Approximately 90% of the greenhouses are of the tunnel type, but the share of Canarian greenhouses is increasing.

Figure 3.1 *Inside views of a tunnel greenhouses recently planted with tomato.*

The tunnel greenhouses are technologically very simple: soil cultivation, NPK application, drip irrigation with thin tubes and with drippers that are not pressure-regulated, only ventilation at the

[1] See http://www.vitaminedz.org/fr/Biskra/Directions-et-chambres-d-agriculture/20010/1.html

ends of the tunnel, no nets. Estimates of yield levels vary between 5-10 kg fresh m^{-2}. The greenhouses (that is, only the construction, the plastic cover is renewed) are transferred to a new location every three years to deal with soil-borne diseases. Each farmer possesses one or a few greenhouses, but assist other farmers in their activities. Although the level of technology and yields are very low, it appears that the system is economically profitable because of the low investments and operational costs.

However, water use efficiency is low, which is a major concern for the region of Biskra where annual precipitation is estimated at < 250 mm (van Os et al., 2012) and where sub-surface water is pumped for free. Also, because of the high summer temperatures and poor ventilation of the tunnel greenhouses, crop cultivation in that period is not possible. Thirdly, land use is inefficient because of the periodic transfer of the greenhouse construction to avoid problems with soil-borne diseases (it is unknown after which period land can be re-used again).

The few Canarian greenhouses were not visited.

Figure 3.2 *Outside view of a tunnel greenhouses standing empty.*

Figure 3.3 *A group of tunnel greenhouses. They are transferred every three years to a new location, in order to deal with soil-borne diseases.*

3.1.2 Université Mohamed Khider (El Biskra)

In the morning of Sunday November 16th 2017, presentations were given at the Université Mohamed Khider at El Biskra (see Annex 2). These presentations were very well attended, with ca 120 academics, students and farmers. A fair number of farmers and farm leaders participated in the discussion and gave brief overviews of their production system and problems they were dealing with.

In Biskra no arable farming is done. So potato production systems are no major issues here. Responding to the presentation on Climate Smart Agriculture following comments were made:

- The concept should have a well sound economic business model.
- Why is the project on sustainable potato farming situated in El Oued?
- What are the main problems? This comment was replied by an explanation on the current unsustainable farm management systems and the need for a development towards a more sustainable approach as water availability is expected to become limited in the near future.

With regards to greenhouse production systems the major issues were:

- How can production be increased?
- What are technological options?
- Can a demo centre be established?
- Can key data be collected (for which already farmers volunteered).

Figure 3.4 *An audience of ca 120 academics, students and farmers during the presentations at El Biskra University.*

In the afternoon, strategic collaboration between the Universities of El Biskra, El Oued and Ouargla. These three universities have a recently signed Memorandum of Understanding with the Plant Research Group of Wageningen University and Research. Within this MoU, collaboration on potatoes has been commenced, and collaboration on protected horticulture can be established.

The following was agreed upon:

- For Wageningen UR, Dr. Greet Blom will be contact person.
- For the Algerian Universities, Prof. Dr. Mahmoud Debabech will be contact person.
- The MoU is focussing on potato production, but attention to and knowledge exchange on other crops will be added in our cooperation in the long run. The attention for horticulture during this mission is already a first effort in broadening of the cooperation programme.
- Operationalisation of the MoU: A clear division of labour between universities (with concrete protocol) and communication plan will be made (coordination: Khaled Benchaalal)

- Dr. Anne Elings will write a discussion paper on greenhouses (a wide range of priorities were identified).
- Joint development of research proposals will be pursued. EU-tenders may also be interesting in this context.
- Summaries of the presentations will be send via Tahar Maza.
- A discussion on amounts of water availability in Aquifers will be setup by e-mail with Soadi Hossina.

3.2 El Oued

At Monday October 16th, Tahar, Khaled and Greet visited the university of El Oued. Approximately 90 participants (of which > 80% were female!) attended the meeting. Presentations were given by Greet (see annex 2) and Dr. Abdelmalek Zaater on the demonstration project and its objectives. It was emphasized that Algeria is the largest potato producer in the Magreb, the second in ranking in Africa and the fifteenth worldwide. The farming systems suffer from erosion, soil acidity, soil pollution and increased water scarcity. Therefore, water and energy use – currently still highly inefficient – should become more sustainable. A regulation of prices by governmental intervention is needed (and expected). The university of El Oued works on an equilibrium model for sustainable crop production and towards a 'more crop per drop' approach. During the discussion it was stated that:

- within the cooperation between WUR and the Algerian universities an integrated approach is important.
- the water which is pumped up for irrigation of the potatoes has an EC (electrical conductivity) of 3.8 mS/cm. A filter on the new equipment is needed.

Further, it was discussed how we make our cooperation between the universities work. Following appointments were made:

- Greet writes the protocols for the measurements on crop growth and crop water use in the field and send it to the contact persons (*done already*),
- Based on the protocols, the staff from the university will start with the measurements in a control field to become to build their skills,
- In the next season the scientists will train the students how to do the measurements,
- Regular communication (NL – El Oued) on the status of the art, progress, results, bottlenecks, etc. will be set up by weekly Skype meetings, starting at November 8th,
- The universities will list all participants in the project (professors, teachers, students) and the complementary specialties for each university involved in this partnership.

In the afternoon, the plot, intended to be used for the demonstration, was visited. The farmer mentioned that a drain with a depth of 35-40 m is being constructed. Next to the drip system, which will be introduce by Holland Machinery, a pivot system for the first wetting of the field is available, Electricity is available at the entrance of the field.

Figure 3.5 *plot intended to be used for the demonstration field.*

Figure 3.6 *Entrance of the plot, intended for the demonstration field.*

Figure 3.7 *Control field adjacent to plot intended as demonstration field.*

4 Results, opportunities and follow up

Results

1) Increased awareness with Algerian stakeholders with regards to climate-smart solutions to current issues in potato and greenhouse production systems.
2) New and deepened contacts between The Netherlands and Algerian stakeholders.
3) Concrete appointments for the Sustainable Water Use project in El Oued.

Opportunities

1) Joint development of a greenhouse demonstration centre to serve the needs of the Algerian growers.
2) Joint research and education, in which both the private and public sector participate.
3) Collaboration with private enterprises such as Agro Tahraoui.

Follow-up

1) Writing protocols for the following up of the Sustainable Water use project in El Oued (*Greet Blom)*
2) Further implementation of the above mentioned project activities *(Greet Blom)*
3) Development of (an outline for) a proposal for a demonstration centre and academic collaboration in the field of protected horticulture. Share outline with Mr. Nico Visser and subsequently elaborate and discuss with Algerian stakeholders. *Anne Elings.*
4) Identify needs of Agro Tahraoui and proceed accordingly. *Anne Elings*.
5) Develop discussion paper on academic collaboration in the field of protected horticulture. *Anne Elings*.

5 References

Elings, A., S. Hemming, S. Bakker, E. van Os and J. Campen, 2015. The African Greenhouse. A toolbox. Wageningen UR Greenhouse Horticulture Report GTB-1360, http://edepot.wur.nl/351439.

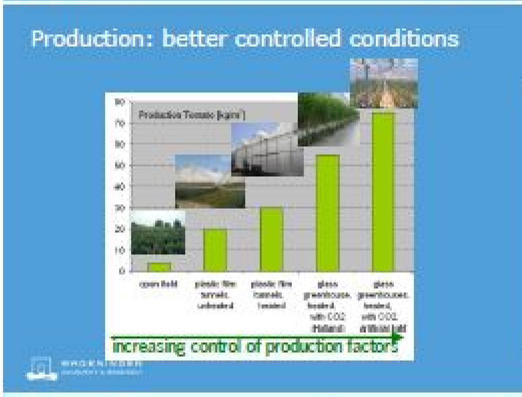
Os, E. van, B. Speetjens, M. Ruijs, M. Bruins and A. Soupanas, 2012. Modern, sustainable, protected greenhouse cultivation in Algeria. Wageningen UR Greenhouse Horticulture Report GTB-1263, http://edepot.wur.nl/280136.

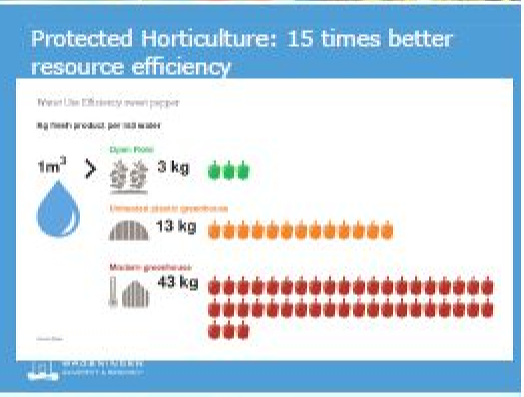
Annex 1 Programme of the visit

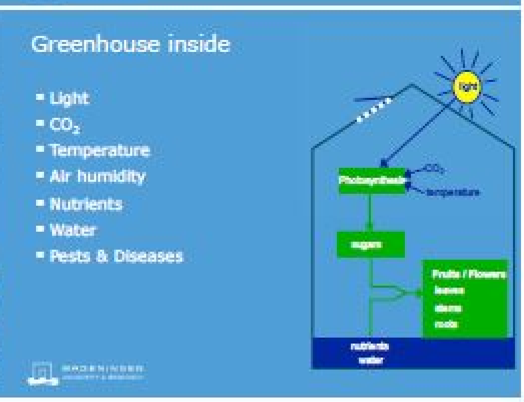
Participants	Greet, Nico, Anne, Khaled and Tahar		
Date	Hour	Activity	who
9-10-2017		Arrival from Rabat to Algiers	Nico
10-10-2017	10:00	Inauguration of Sima Sipsa	Nico And CdP
11-10-2017		Arrival from Netherlands to Algiers	Greet And Anne
12-10-2017	Sima Sipsa	Presentation (Climate smart agriculture)	Greet
12-10-2017	Sima Sipsa	Presentation (The Dutch Approach to Greenhouses)	Anne
12-10-2017	19:00	Evaluation dinner of Sima Sipsa	Dutch companies participating in Sima Sipsa
13-10-2017	All day	Attending sima sipsa	All team
13-10-2017	17:45	Departure to Biskra	All team
14-10-2017	All day	Visit of horticultural farms	All team
15-10-2017	9:00	Presentation (Climate smart agriculture)	Greet
15-10-2017	12:00	Lunch	
15-10-2017	13:00	Presentation (The Dutch Approach to Greenhouses)	Anne
15-10-2017	17:10	Departure to Algiers and Morocco and the Netherlands, respectively	Nico and Anne
15-10-2017	16:00	Departure to El Oued by rental car	Greet – Khaled - Tahar
16-10-2017	9:00	Presentation (Climate smart agriculture)	Greet
16-10-2017	12:00	Lunch	
16-10-2017	13:00	Visit Houideg Farm in El Oued	Greet – Khaled - Tahar
17-10-2017	6:30	Departure from el oued to Algiers and the Netherlands	Greet – Khaled - Tahar

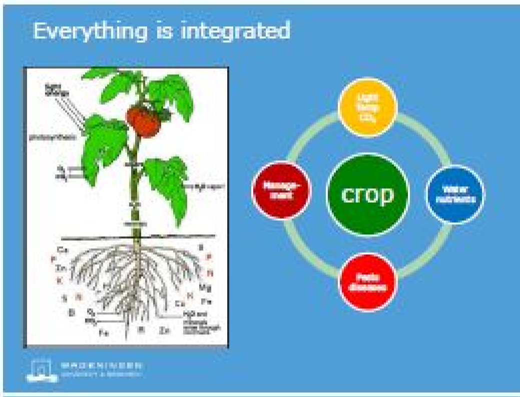
Annex 2 Presentations

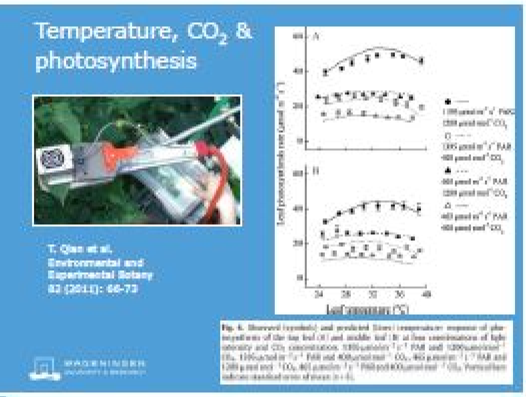
This is the presentation given by Anne Elings in Biskra on October 15, 2017. The presentation in Algiers on October 13, 2017 was a shorter version. The economic example of greenhouses for Mexico were derived from an older presentation and has been added as an illustration in the absence of detailed information for the Algerian situation.








Everything is integrated
Light
Temp
CO2
Water
nutrients
Pests
diseases
Manage-
ment
crop
WAGENINGEN


Temperature, CO2 & photosynthesis
T. Qian et al.
Environmental and
Experimental Botany
82 (2011): 66-73
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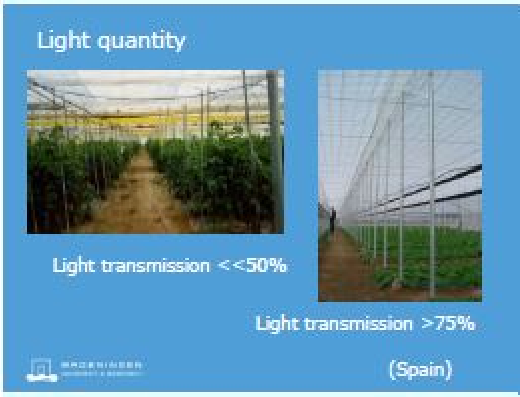
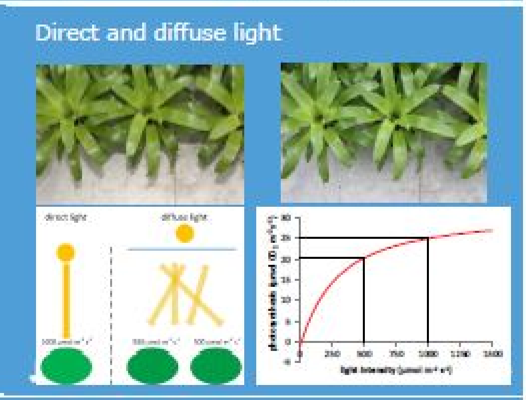

Light quantity
Light transmission <<50%
Light transmission >75%
(Spain)
WAGENINGEN


Direct and diffuse light
direct light
diffuse light


Diffuse light gives higher yield
cucumber: 4-10%
tomato:
8-10%
sweet pepper: 5%
Roses: 5%
anthurium and bromelia
25% faster & 25% more fresh weight
(values are approximate)
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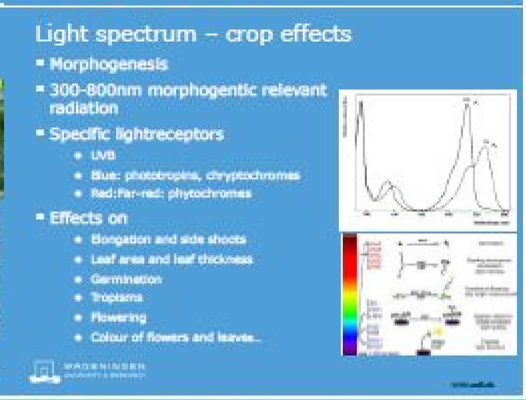
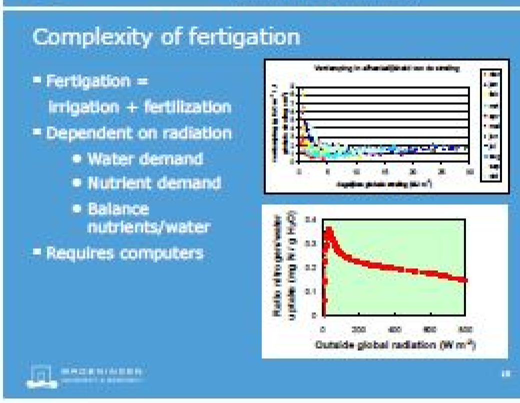
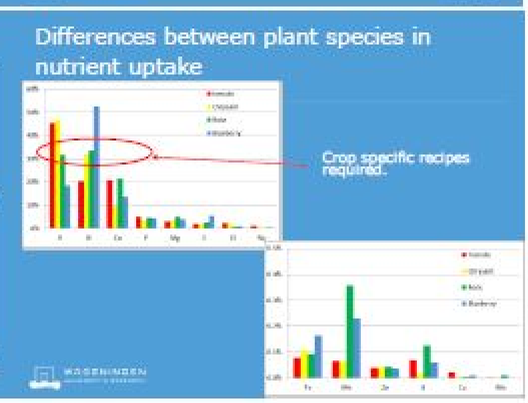

Light spectrum – crop effects
Morphogenesis
300-800nm morphogentic relevant radiation
Specific lightreceptors
UVB
Blue: phototropins, chryptochromes
Red:Far-red: phytochromes
Effects on
Elongation and side shoots
Leaf area and leaf thickness
Germination
Tropisms
Flowering
Colour of flowers and leaves…
WAGENINGEN


Complexity of fertigation
Fertigation =
irrigation + fertilization
Dependent on radiation
Water demand
Nutrient demand
Balance nutrients/water
Requires computers
Outside global radiation (W m-2)
WAGENINGEN


Differences between plant species in nutrient uptake
Crop specific recipes required.
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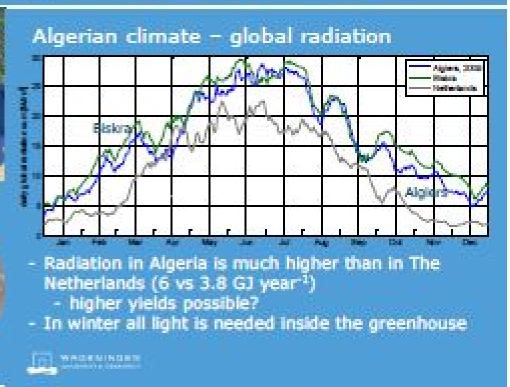
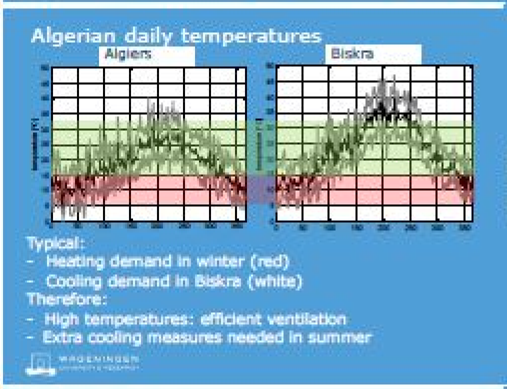
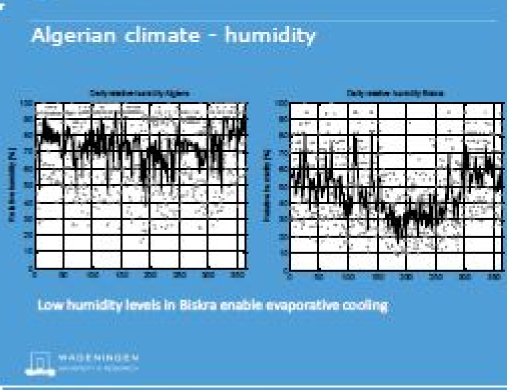
Crop and cultivar
Strategic choice
Depends on:
market demand and price
climate
skills and knowledge of staff and management
availability of resources and technology.

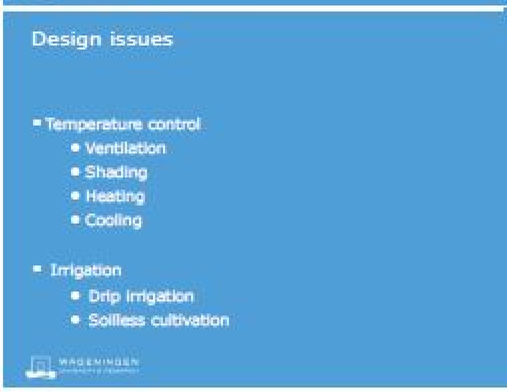

Management - Do not do this:
Free entry for pests
Insufficient water
A jungle
No sanitation

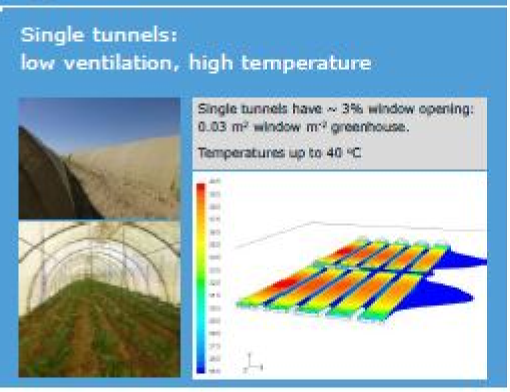

Algeria
10th country in the world
40 million inhabitants
90% along coast
different climates
8000 ha tunnels
Biskra


Algerian climate – global radiation
Biskra
Algiers
- Radiation in Algeria is much higher than in The Netherlands (6 vs 3.8 GJ year-1)
- higher yields possible?
- In winter all light is needed inside the greenhouse


Algerian daily temperatures
Algiers
Biskra
Typical:
- Heating demand in winter (red)
- Cooling demand in Biskra (white)
Therefore:
- High temperatures: efficient ventilation
- Extra cooling measures needed in summer

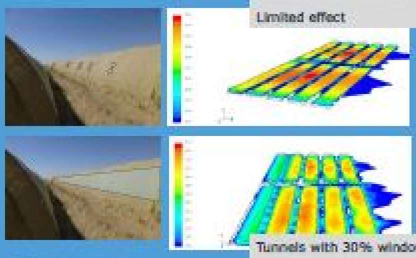

Algerian climate - humidity
Low humidity levels in Biskra enable evaporative cooling


Design issues
Temperature control
Ventilation
Shading
Heating
Cooling
Irrigation
Drip irrigation
Soilless cultivation


Single tunnels:
low ventilation, high temperature
Single tunnels have ~ 3% window opening:
0.03 m² window m⁻² greenhouse.
Temperatures up to 40 °C

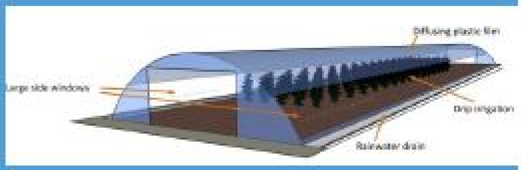
Ventilation and cooling

Tunnels with 5% window opening:
Limited effect



Tunnels with 30% window opening
$T_{outside}$=25°C; T_{inside} = 30°C

Single tunnel: future design



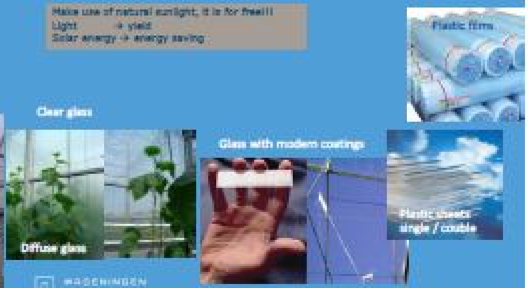
Light and shading

Rule of thumb: 1% less light = 1% less production

Highly transparent cover, clean greenhouse and use screen as little as possible.

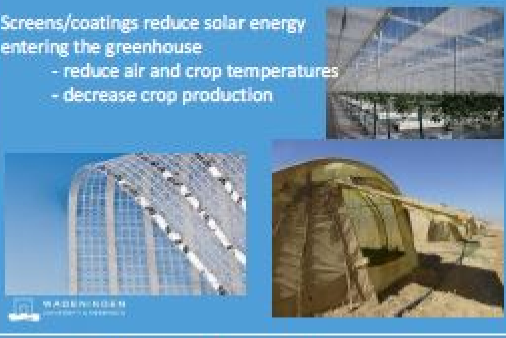
Covering material

Make use of natural sunlight, it is for free!!!
Light → yield
Solar energy → energy saving



Shading

Screens/coatings reduce solar energy entering the greenhouse
- reduce air and crop temperatures
- decrease crop production



Shading and screens

Reduces
- Radiation
- temperature
- transpiration rate
- photosynthesis, but less than transpiration

Improves light distribution and light use efficiency
Can improve quality
Preferably outside
Some crops prefer shade

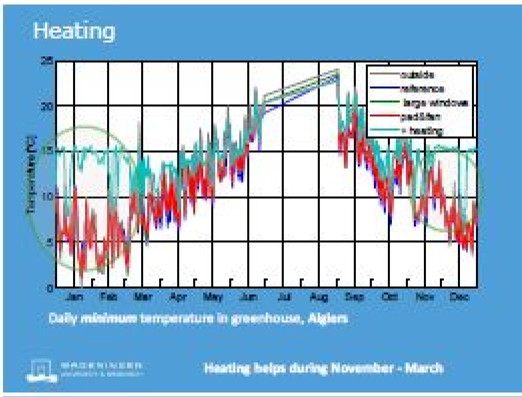
Effect of (movable) shading

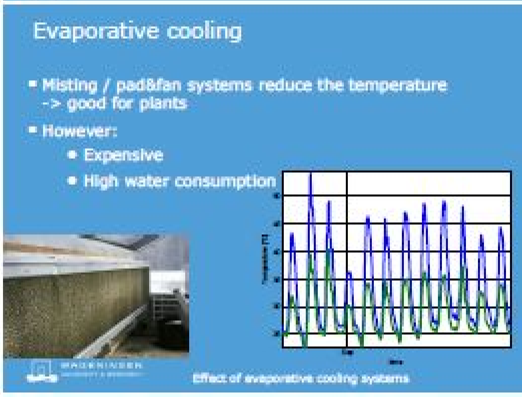
Screen type	# hours closed	Number of hours warmer than 30°C [h]		Number of hours warmer than 35°C [h]		Number of hours RH above [h]		Biomass [%]
		Tair	Tcrop	Tair	Tcrop	95%	90%	
Algiers								
reference	0	13	296	0	79	88	861	100
700W, 30% screen	771	0	253	0	15	82	833	95
600W, 30% screen	1137	0	238	0	10	88	826	93
500W, 30% screen	1539	0	211	0	11	91	828	90
permanent screen	always	0	184	0	9	117	1009	68
[illegible]								
reference	0	279	468	32	201	11	361	100
700W, 30% screen	1024	230	383	27	147	12	327	95
600W, 30% screen	1407	224	368	24	132	11	323	92
500W, 30% screen	1837	208	331	23	119	13	329	89
permanent screen	always	135	287	16	87	24	515	71

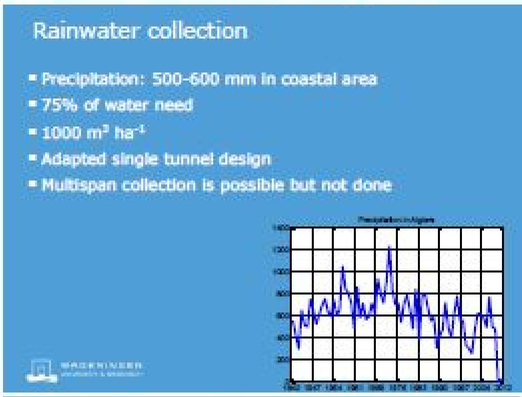
Conclusions screening

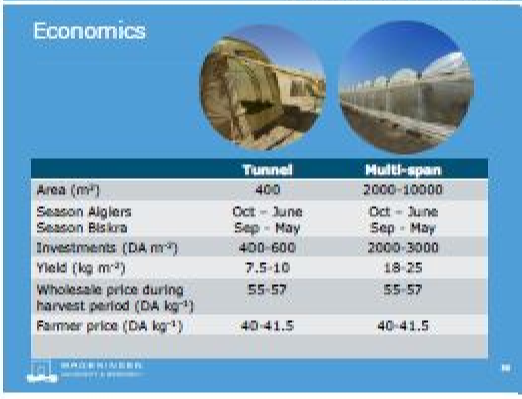
30% screening gives 30% loss in plant production

Thus: use screen as little as possible.
→ A movable screen is only used during the hottest hours of the day, when photosynthesis is high anyway.





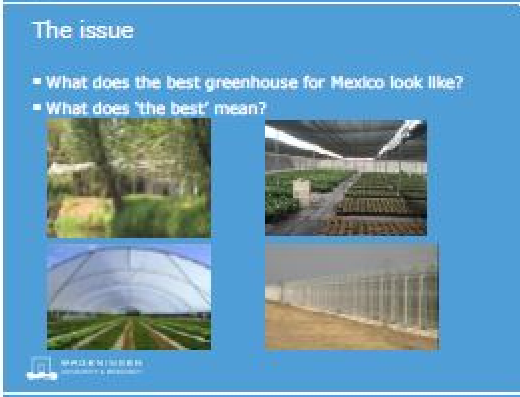


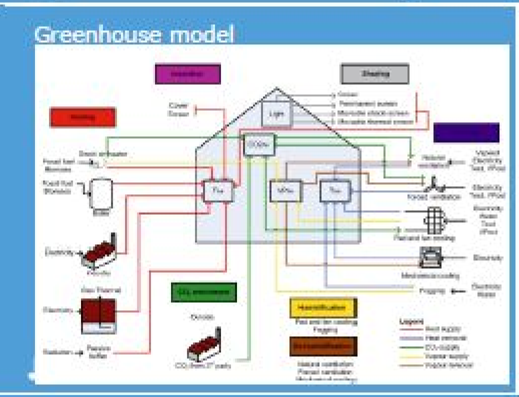


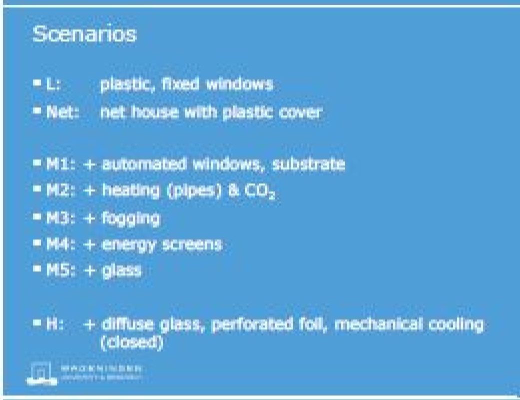
	Tunnel	Multi-span
Area (m²)	400	2000-10000
Season Algiers Season Biskra	Oct - June Sep - May	Oct - June Sep - May
Investments (DA m⁻²)	400-600	2000-3000
Yield (kg m⁻²)	7.5-10	18-25
Wholesale price during harvest period (DA kg⁻¹)	55-57	55-57
Farmer price (DA kg⁻¹)	40-41.5	40-41.5

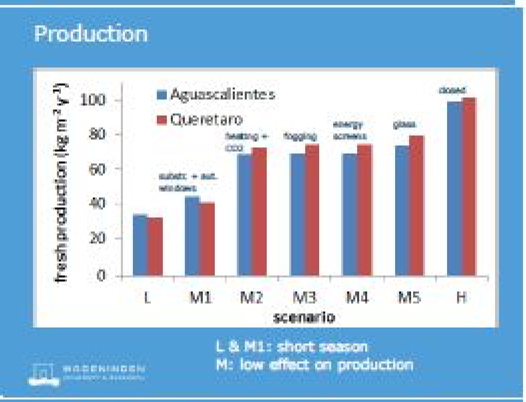
	Algiers		Biskra	
	Large windows	+ pad&fan	Large windows	+ pad&fan
Extra investment (€/m²)	0.15	1.43	0.15	1.43
Extra variable + labour + equipment (€/m²/y)	0.12	0.6	0.08	0.6
Extra yield (kg/m²)	10	15	8	17
Extra revenues (€/m2)	0.4	0.6	0.3	0.7
extra profit (€/m2/y)				
Payback period (yr)	< 1	3.9	< 1	3

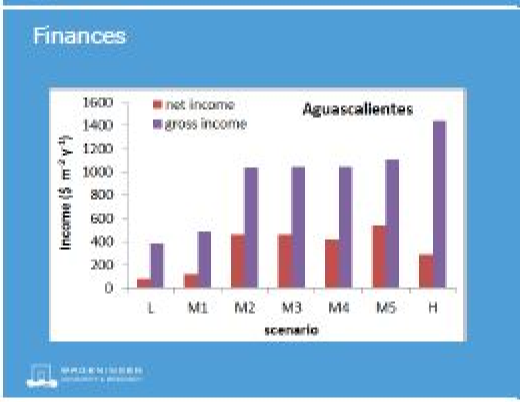
	Algiers			Biskra		
	Large windows	+ pad&fan	+ heating & CO2	Large windows	+ pad&fan	+ heating & CO2
Extra investment (€/m²)	0	1.2	2.52	0	1.2	2.52
Extra variable + labour + equipment (€/m²/y)	0.07	0.5	1.1	0.05	0.5	1.1
Extra yield (kg/m²)	9	13	32	7	16	32
Extra revenues (€/m2)	0.4	0.5	1.3	0.3	0.7	1.3
extra profit (€/m2/y)	0.3	0.02	0.2	0.2	0.1	0.3
Payback period (yr)	-	3.8	n.c.	-	2.7	n.c

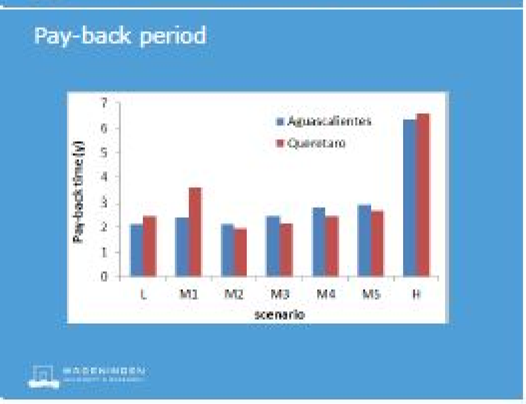


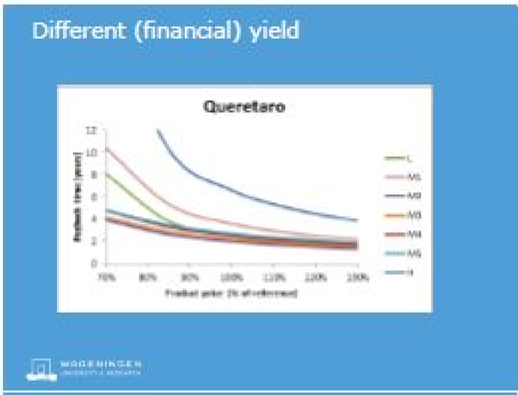











Different (financial) yield
Queretaro
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Muchas gracias
anne.elings@wur.nl
http://www.glastuinbouw.wur.nl/UK/
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Summary Economics
New designs improve economic results
Large windows show good results
Pad & fan system
no improvement of profit
High investment > high equipment costs
Large windows+pad&fan+heating+CO2 show best results in Biskra
Payback period single span:
Large windows: 1 year
Little effect of price volatility
Large windows + pad&fan 4-5 years
Sensitive to price volatility
Payback period multispan
Large window+pad&fan+heating: 4-5 years
Sensitive to price volatility
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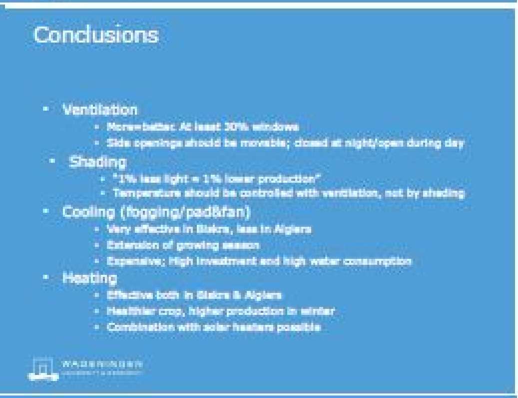
Conclusions
Ventilation
More=better. At least 30% windows
Side openings should be movable; closed at night/open during day
Shading
"1% less light = 1% lower production"
Temperature should be controlled with ventilation, not by shading
Cooling (fogging/pad&fan)
Very effective in Biskra, less in Algiers
Extension of growing season
Expensive; High investment and high water consumption
Heating
Effective both in Biskra & Algiers
Healthier crop, higher production in winter
Combination with solar heaters possible
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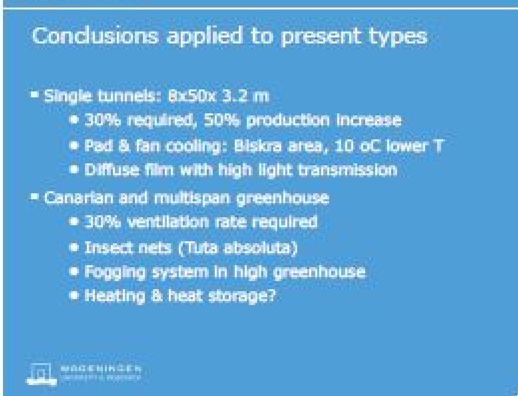
Conclusions applied to present types
Single tunnels: 8x50x 3.2 m
30% required, 50% production increase
Pad & fan cooling: Biskra area, 10 oC lower T
Diffuse film with high light transmission
Canarian and multispan greenhouse
30% ventilation rate required
Insect nets (Tuta absoluta)
Fogging system in high greenhouse
Heating & heat storage?
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Remaining issues
Training, and more training
Integrated Pest & Disease Management
Crop husbandry
Maintenance industry
IT structure; sensor technology
Market intelligence
Rules and legislation
... and many more ...
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Thank you
anne.elings@wur.nl
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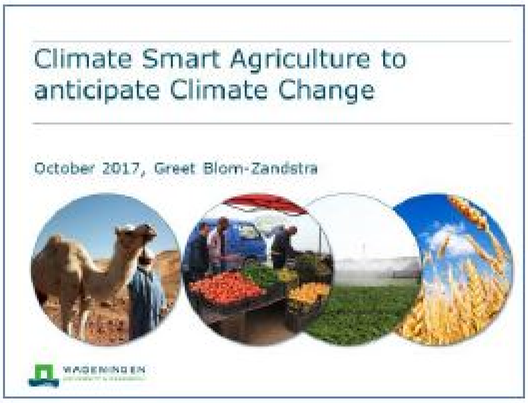
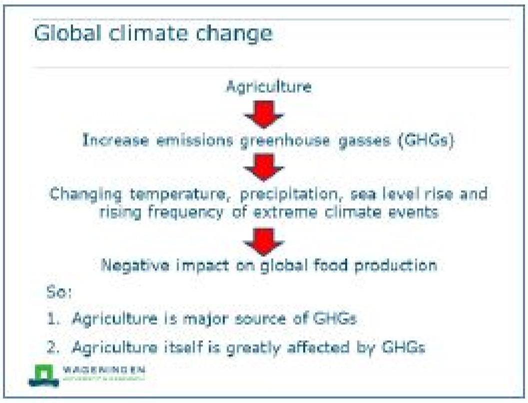
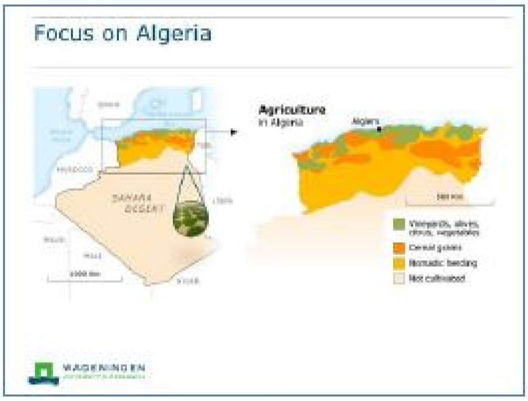
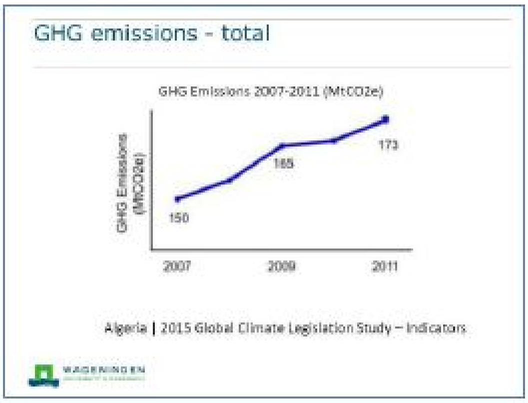
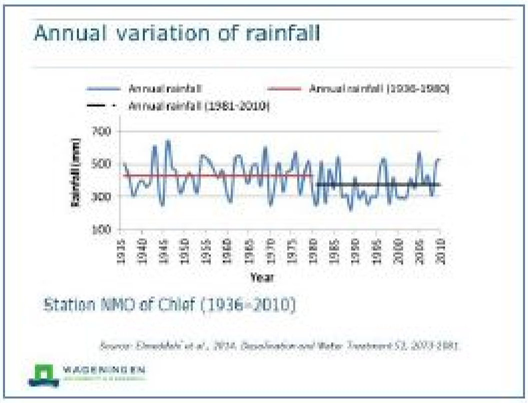
This is the presentation given by Greet Blom in El Oued. The presentations held in Algiers and Biskra contained some more general information on Climate Smart Agriculture, but less information on the running project on sustainable potato production.

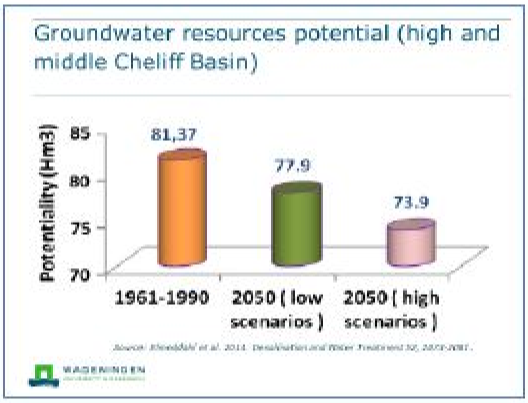


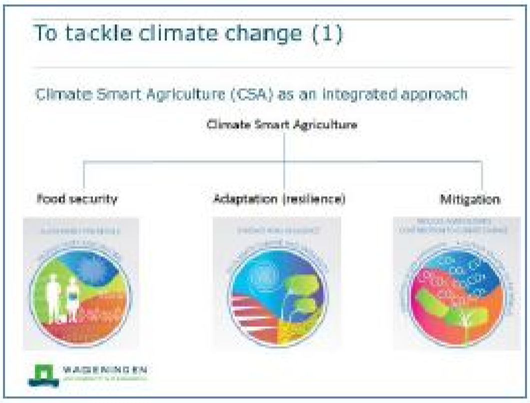











To tackle climate change (1)
Climate Smart Agriculture (CSA) as an integrated approach
Climate Smart Agriculture
Food security
Adaptation (resilience)
Mitigation
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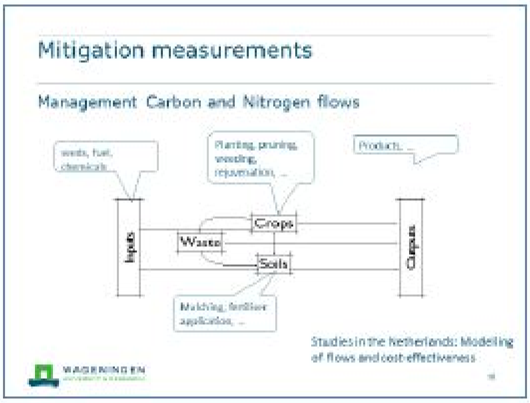
Mitigation measurements
Management Carbon and Nitrogen flows
seeds, fuel, chemicals
Planting, pruning, weeding, rejuvenation, ...
Products, ...
Inputs
Waste
Crops
Soils
Outputs
Mulching, fertilizer application, ...
Studies in the Netherlands: Modelling of flows and cost-effectiveness
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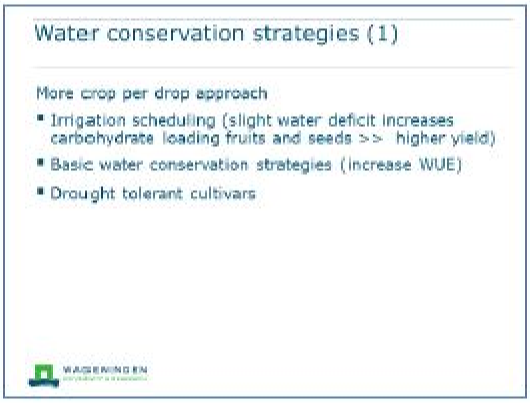
Water conservation strategies (1)
More crop per drop approach
▪ Irrigation scheduling (slight water deficit increases carbohydrate loading fruits and seeds >> higher yield)
▪ Basic water conservation strategies (increase WUE)
▪ Drought tolerant cultivars
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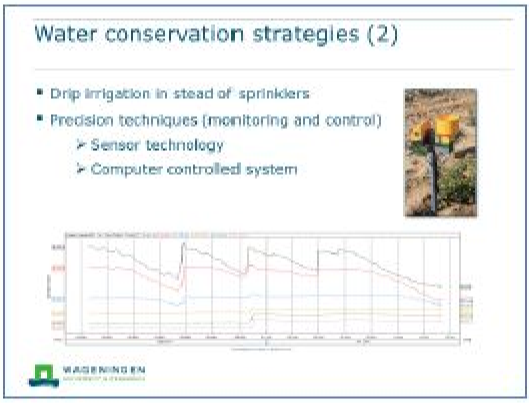
Water conservation strategies (2)
▪ Drip irrigation in stead of sprinklers
▪ Precision techniques (monitoring and control)
➢ Sensor technology
➢ Computer controlled system
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Demonstration project in El Oued region
El Oued Sustainable Water use for potato production project 2017-2019
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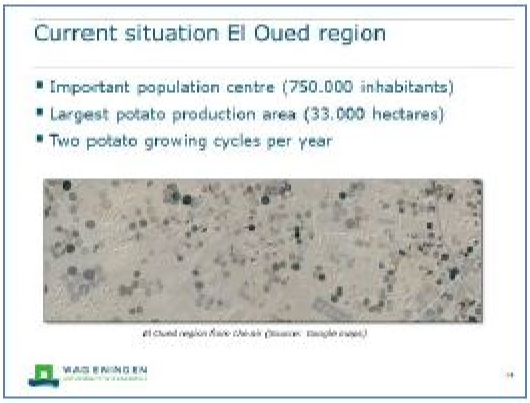
Current situation El Oued region
▪ Important population centre (750.000 inhabitants)
▪ Largest potato production area (33.000 hectares)
▪ Two potato growing cycles per year
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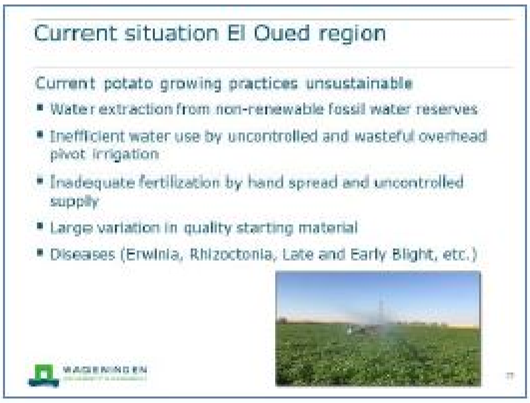
Current situation El Oued region
Current potato growing practices unsustainable
▪ Water extraction from non-renewable fossil water reserves
▪ Inefficient water use by uncontrolled and wasteful overhead pivot irrigation
▪ Inadequate fertilization by hand spread and uncontrolled supply
▪ Large variation in quality starting material
▪ Diseases (Erwinia, Rhizoctonia, Late and Early Blight, etc.)
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Waste & lower productivity
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Waste & lower productivity
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Waste & lower productivity
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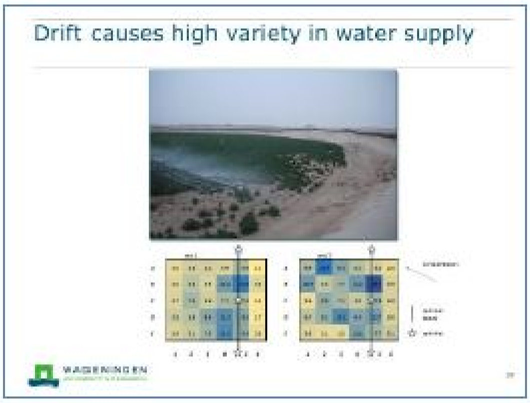
Drift causes high variety in water supply
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Potential
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Objectives new demonstration project
▪ Saving water extraction and irrigation by monitoring and control
▪ Lower the CO2 Footprint (water & energy saving)
▪ Optimization fertilizer supply
▪ Introduction better varieties
▪ Introduction mechanization at planting and harvest
▪ Development of national roll-out plan for scaling-up
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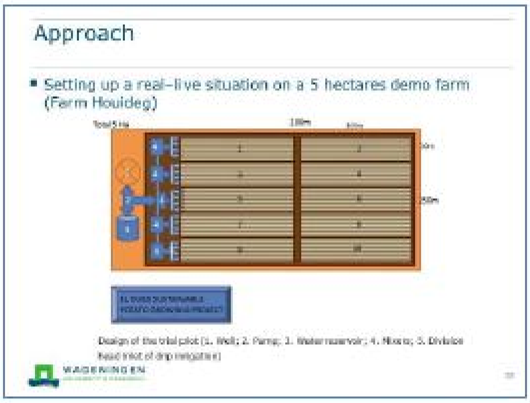
Approach
▪ Setting up a real-live situation on a 5 hectares demo farm (Farm Houideg)
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Approach
▪ Introduction of an underground fertigation system integrated drip and fertilisation)
▪ Introduction high quality varieties with low water footprint
▪ Collecting data during 4 growing seasons on:
• Total water supply
• Crop water consumption by sensors
• Actual inputs of and real demand fertilizers and pesticides
• Total yields
▪ Development of an economic water management tool to better control water use
▪ Introduction of mechanical planting and harvesting equipment
▪ Organisation of different workshops
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holland agri machinery
Soil preparation and good planting, is as important as good seeds.
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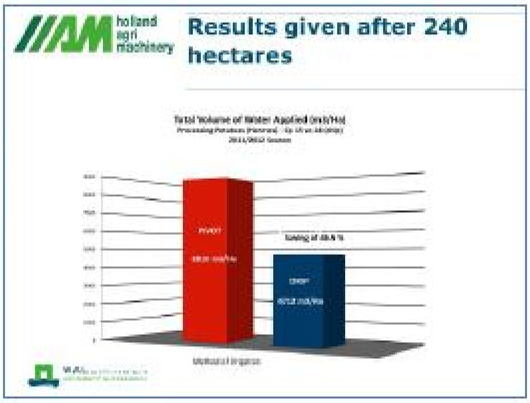
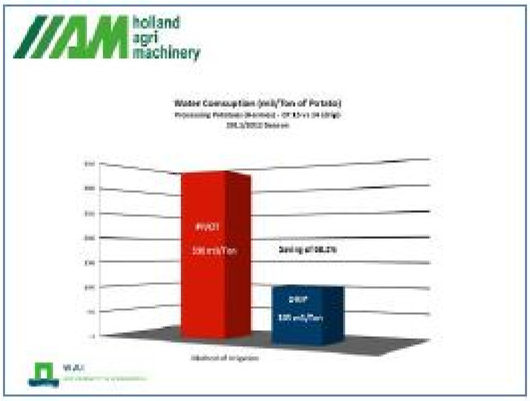
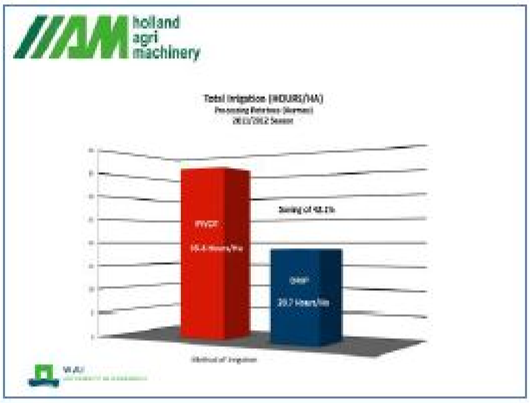
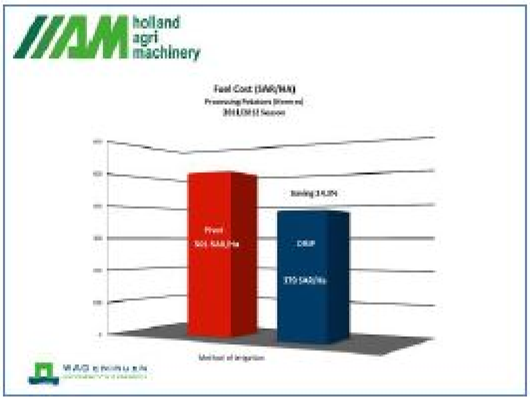
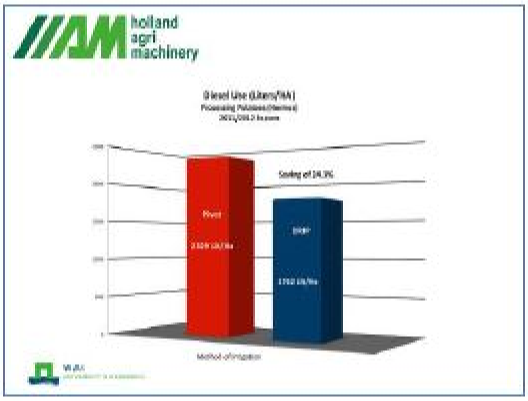
holland
agri
machinery
Difference between
Pivot and Drip irrigation

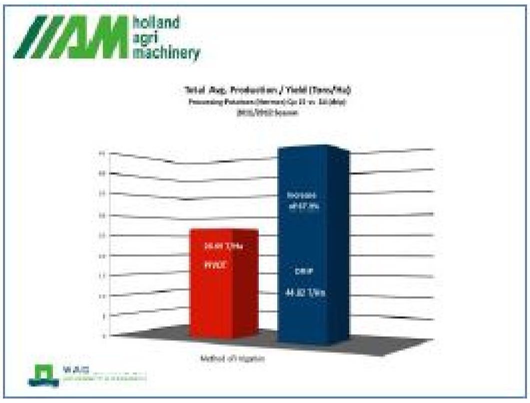

holland
agri
machinery
Results given after 240
hectares

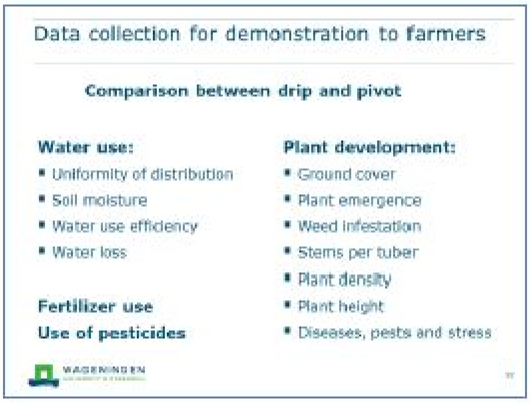

holland
agri
machinery


holland
agri
machinery


holland
agri
machinery


holland
agri
machinery


holland
agri
machinery


Data collection for demonstration to farmers
Comparison between drip and pivot
Water use:
Uniformity of distribution
Soil moisture
Water use efficiency
Water loss
Fertilizer use
Use of pesticides
Plant development:
Ground cover
Plant emergence
Weed infestation
Stems per tuber
Plant density
Plant height
Diseases, pests and stress
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Cooperation WUR < - > 3 Algerian universities?

- University of El Oued
- University of Biskra
- University of Ouargla

Memorandum of Understanding:

Strengthening of working relationship between the parties

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Cooperation

Aim:

- Facilitation of scientific knowledge exchange
- To encompass joint activities with regard to educational and scientific cooperation

Form:

- Measurements in the demonstration projects
- Training use monitoring and control approach
- Involvement in field visits farmers
- Resource sharing, student exchange, training, joint activities/projects

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Cooperation

- How do we make this cooperation operational?
- Can we make concrete plans and appointments to start the cooperation today?

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Thank you

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Corresponding address for this report:
P.O. Box 16
6700 AA Wageningen
The Netherlands
T +31 (0)317 48 07 00

Report WPR - 721

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