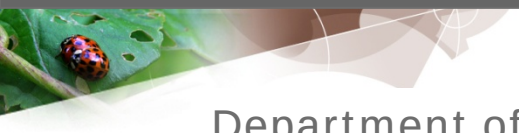

Department of Plant and Environmental Sciences

Quinoa for Future Food and Nutrition Security in Marginal Environments
6-8 December, 2016
Dubai, UAE

The worldwide potential of quinoa as a new climate-proof crop

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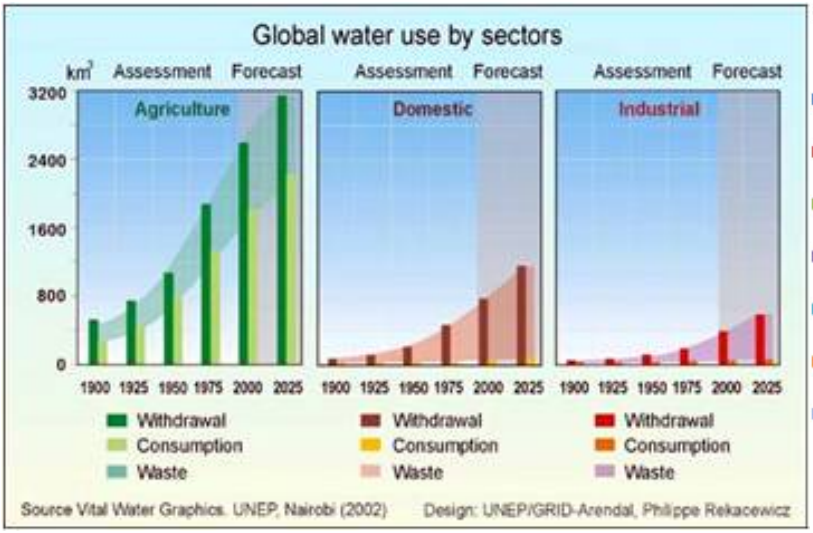
Challenges

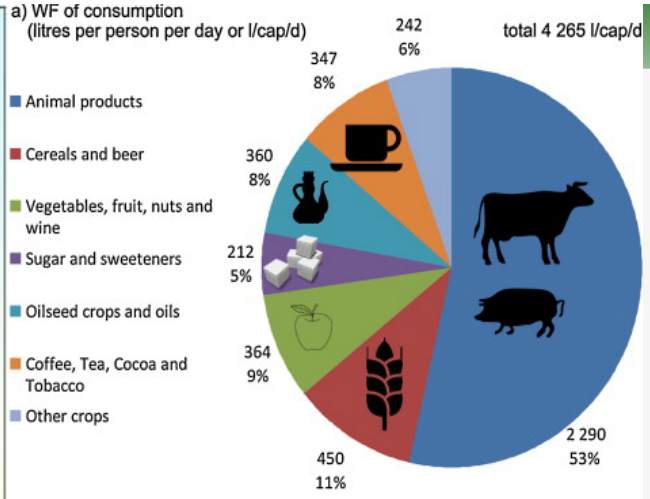
General:
Growing population
Climate changes

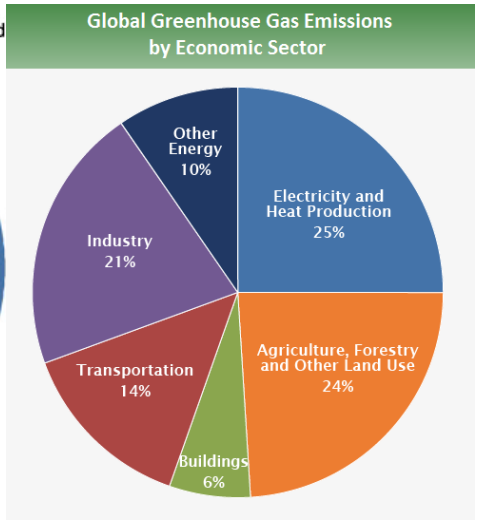
Specific:
Growing demand for meat in many parts of the world
Unsustainable protein production

Agriculture's contribution to climate changes

- Water:
  - Agriculture 70%, meat>50%
- CO2 and other GGE:
  - Agriculture 30%, meat 70%



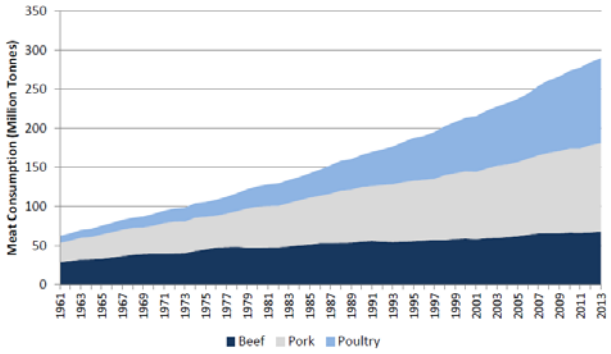




Water footprint in EU (lcd)

Solutions for agriculture

Meat consumption



Plant protein

Challenges

General:
Growing population
Climate changes

Specific:
Growing demand for meat in many parts of the world
Unsustainable protein production

PROTEIN 2 FOOD

Development of high quality food protein through sustainable production and processing

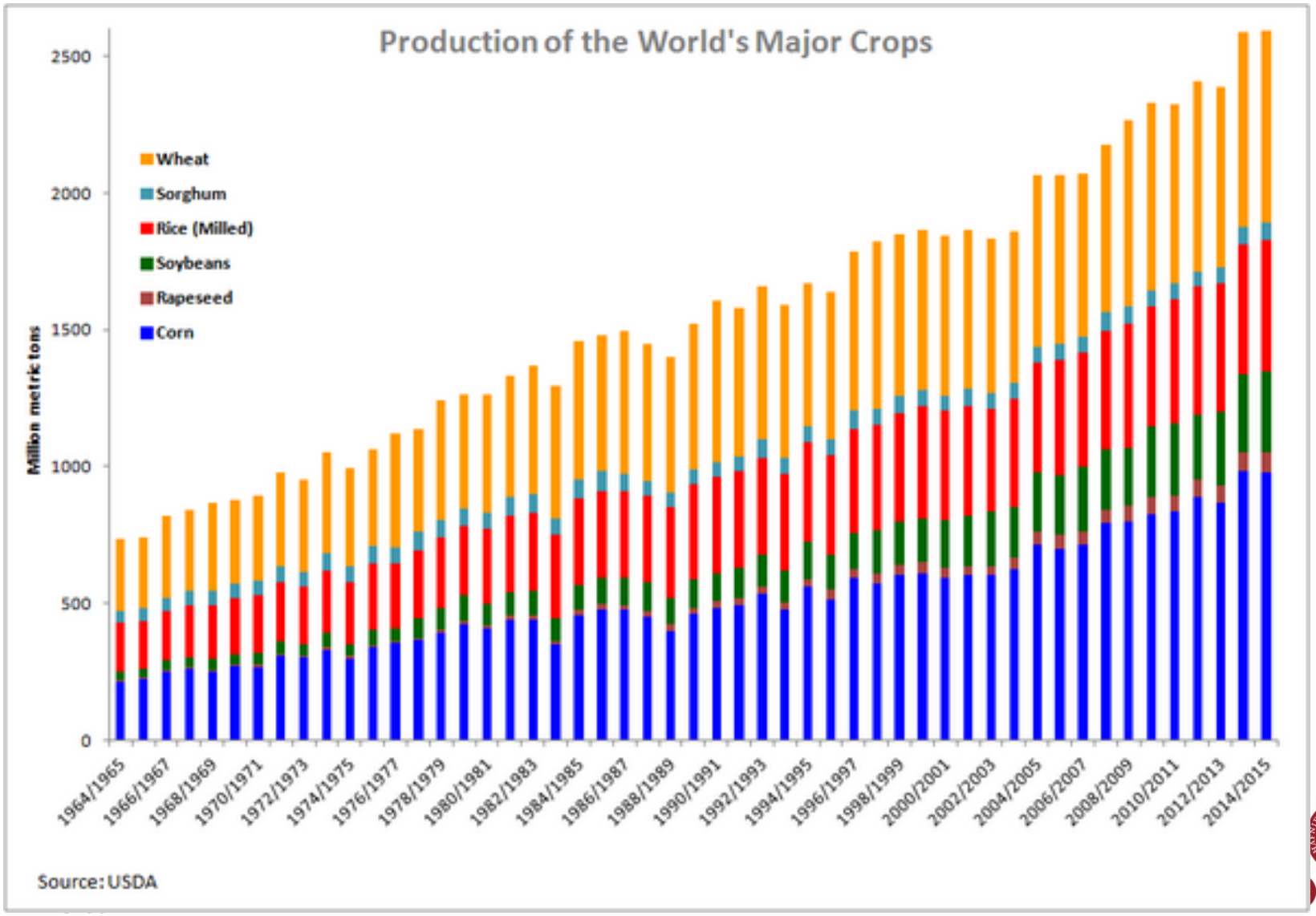
Global food security
Environmental and socio-economic sustainability

The way we work to create climate proof cropping systems

- Improved cropping systems
- New technologies
  - Ancient
  - Irrigation
  - Water harvesting
- New genetic material
  - New varieties
  - New crops

Rice, maize and wheat > 60% global food

Agro-biodiversity



BioFach Trends

KEYWORDS

- Focus on protein
- Quinoa
- Amaranth
- Petfood
- Vegan lifestyle
- Cocktails

Number of species and cvs. tested

Species	2012	2013	2014	2015	2016
Quinoa	10	2	10	7	7
Amaranth	19	12	6	6	6
Buckwheat	3	3	3	12	14
Millet	10	9	10	15	15
Tef	3	0	0	0	0
Poppy	1	1	1	0	0
Kanahua	1	9	0	0	0
Chia	1	0	0	0	0
Lentil	32	38	12	10	10
Chickpea	51	15	6	5	5
Faba bean	5	4	4	4	4
Bean	0	0	0	1	0
Pea	1	3	0	10	10
Lupin	5	5	4	4	4
Soybean	6	8	2	2	4
Oat	2	2	2	2	0
Sorghum	(200)	16	6	6	0
Camelina	0	0	22	8	8
Total	150	127	88	92	87


Quinua
2013 Año Internacional

Nutritional profile

- High protein, 15%
- Amino acids, all nine essential, close to complete
- Glutenfree
- Flavonoids (antioxidants) including quercetin
- B-vitamins such as riboflavin and folate
- Functional food, due to its high protein, fiber, antioxidant, vitamin, and mineral content, that may help reduce the risk of many diseases beyond cardiovascular disease and diabetes.
- Dietary fiber, soluble 1.5 g/100g
- Fatty acids, 83% unsaturated (omega6 50%, omega9 25%, omega3 5%)
- Minerals, high in Fe, Cu, Zn, Ca, Mg

"high nutritive value," impressive biodiversity, and an important role to play in the achievement of food security worldwide (FAO).

Crop production

Cultivar improvement	Crop management
Screening	Crop rotation and tillage strategies
Marker technology and transcriptomes	Nutrient management
Cooperation with breeders	Abiotic stress tolerance
	Biotic stress tolerance

Activities

Screening in field;

Agronomic practices (density, date and depth of sowing, fertilization) and response to abiotic stresses (drought and salinity);

Extension and training activities with farmers;

Methodology for quantification of 3D internal morphology of the seeds by X-ray micro-tomography, and 3D image analysis of the appearance, location and type of seed structure;

Protein analyses;

Protein extraction;

Product development;

Consumer studies;

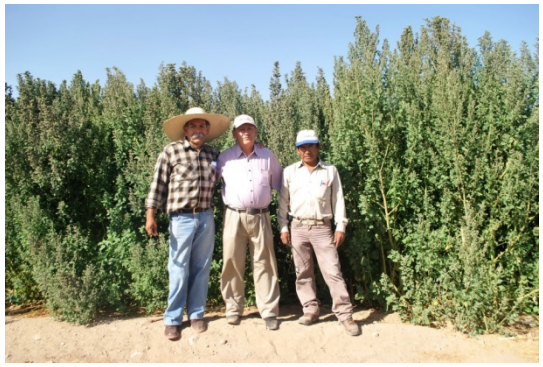
Bolivia - Altiplano S (Salinas)







Area



Area (thousand ha)
0
20
40
60
80
100
120
140
160
180
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Bolivia
Peru
Ecuador

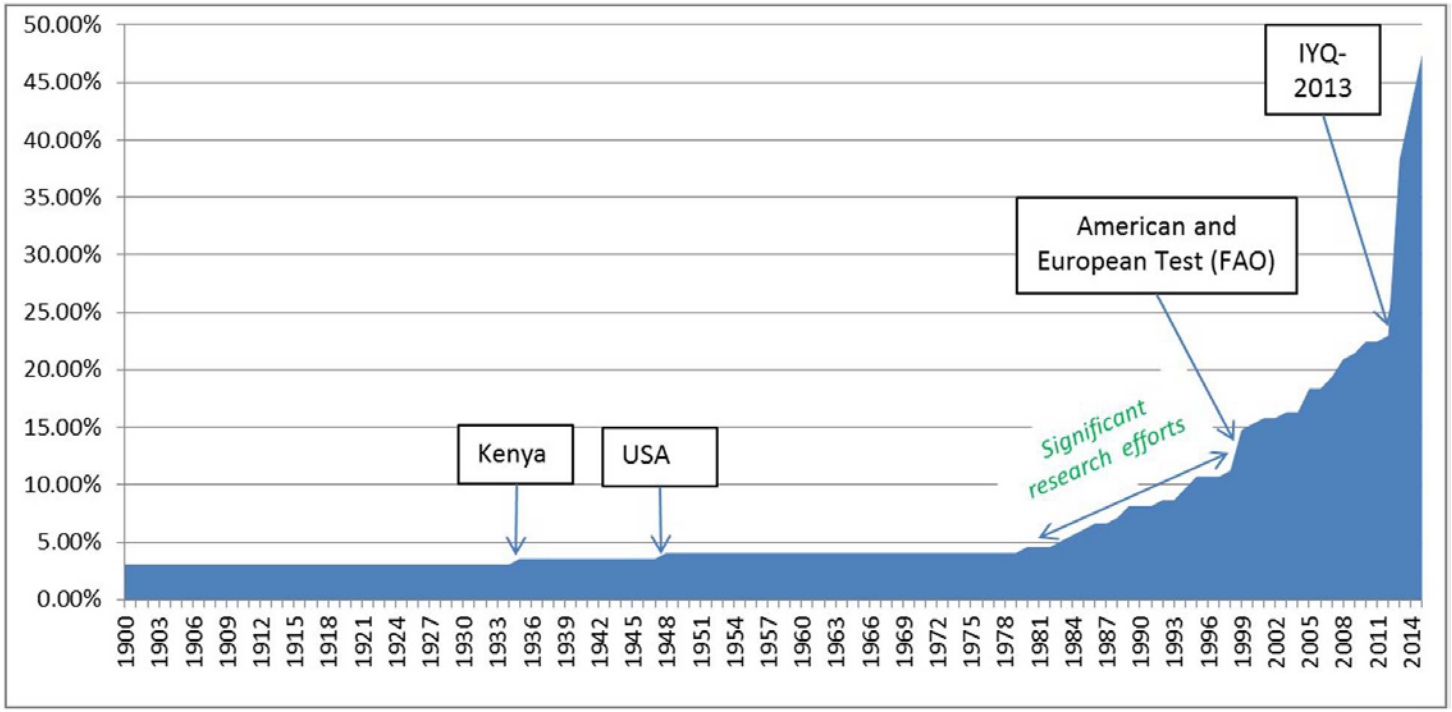
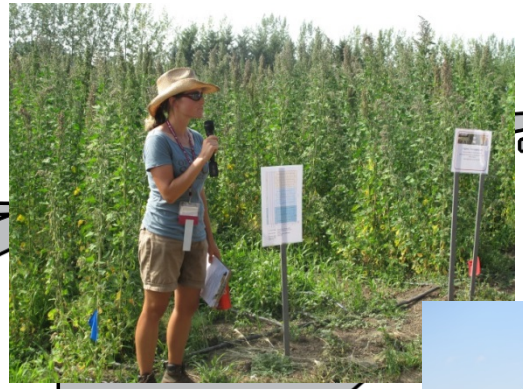


FIGURE 1 | Percentage of UN countries with quinoa experimentation or cultivation (1900–2015) (Bazile et al., 2016)







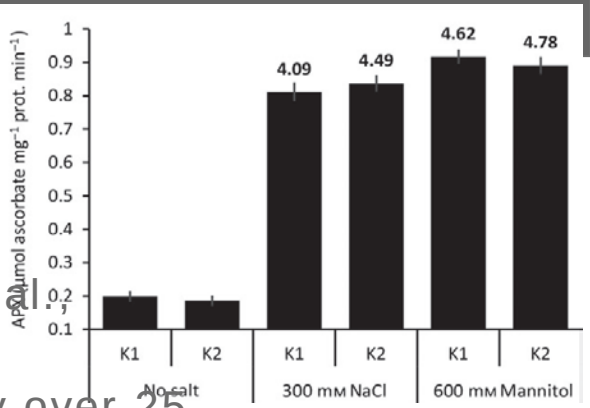


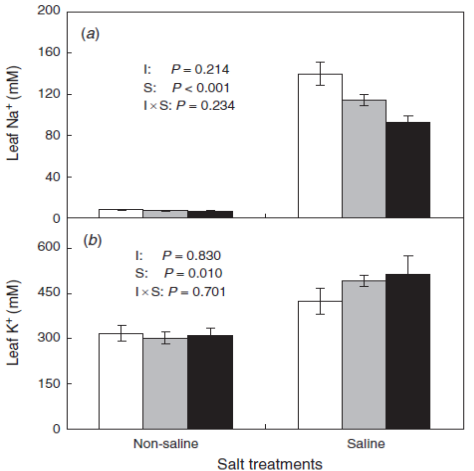


Name and occation
Slide 17

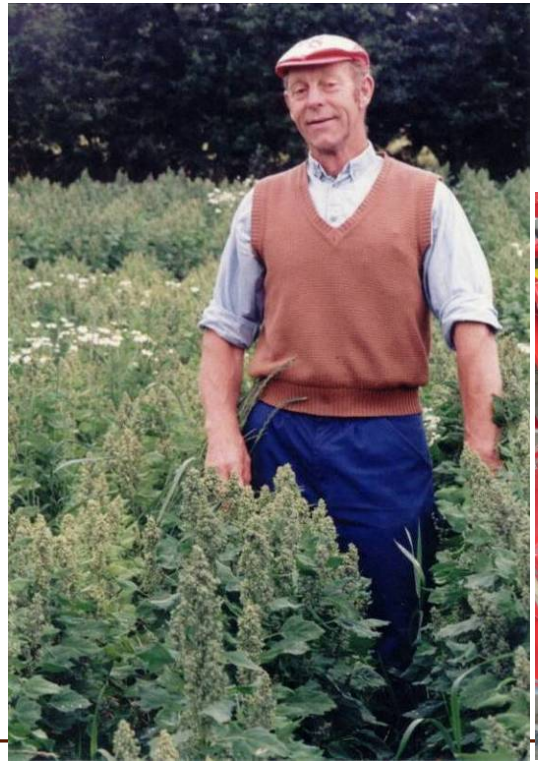
Most recent highlights

- Salt - enhances antioxidant enzymes activity (Amjad et al., 2015)
- Non-enzymatic antioxidant rutin level were increased by over 25 fold in quinoa leaves under salinity stress (Ismail et al., 2016)
- Saline irrigation significantly decreases the growth of quinoa, whereas inoculation of plants with bacterial strains mitigated the negative effects of salinity by improving plant water relations and decreasing Na+ uptake (Yang et al., 2016)
- Quinoa can be used as a model crop for understanding salt-tolerance mechanisms (Ruiz et al. 2016)
- Both yield and protein content of seed can be manipulated by N level and application strategy (Jacobsen & Christiansen, 2016)





Case - Denmark



Livø

THE QUEEN

Farmers´yield, Denmark

Host	JB	Year	Yield, tha-1	[1]Emergence	[2]Weed control	Nutrients	Comments
KK	1-2	2012	0	***	*	25tha-1	Deer
		2013	1.2	****	**	20tha-1 + 5tha-1 topdressing	Ekstremely dry summer from 5/6
		2014	0.4	***	***	Manure 28tha-1 (85N), tranversal starfish	Resowing
		2015	0	**	*		Failed weeding
TW	3	2012	0	**	**		Broad sow
		2013	0	**	**	Slurry, 20tha-1 (90 N)	Broad sow
		2014	0	**	*		Broadsow
		2015	1.2	****	****		Rows in highbeds
SB	3	2012	0	*	*	Slurry at sowing	Deep sowing, frost
		2013	0	*	**	Slurry (25tha-1, 75N)	Grassweeds
		2014	0.2	***	***	Slurry (30tha-1, 90N)	Late sowing (10/5)
		2015	0	***	*	40 kg N slurry	Failed weeding
KP	3	2012	-	-	-		
		2013	1.8	***	***	0 (after clovergrass)	Good development
		2014	1	****	**	0 (after clovergrass and oat)	Skjoldbillelarve
		2015	-				
PBH	3	2012	-	-	-		
		2013	0	*	*	80N	
		2014	0	*	*	80N	
		2015					

Quinoa in fancy kitchens

Knabstrup

Saison

Årstiderne


16/06/2015


THANKS