

PERSPECTIVE OF SALINE AGRICULTURE FOR DELTAS IN TIMES OF CHANGING CLIMATE

Adaptation to dry and saline conditions in a warming world: crop cultivation exploiting brackish water and preserving fresh water

Jelte Rozema¹, Arjen de Vos¹, Diana Katschnig¹, Sjoerd van der Zee², Fethi Bouksila³ & Akissa Bahri⁴, Marc van Rijsselberghe⁵, Jeanette Hoek⁶

¹Systemecology, Institute of Ecological Science, Vrije Universiteit, Amsterdam, Netherlands, ² Soil Physics, Ecohydrology and Groundwater Management Group, Wageningen Institute for Environment and Climate Research, Wageningen University and Research, The Netherlands, ³ National Research Institute in Rural Engineering, Water and Forestry, BP 10, 2080 Ariana, Tunisia, ⁴International Water Management Institute, PMB CT 112, Cantonments Accra, Ghana, ⁵ Texelse Milieuvriendelijke Natuurproducten, Texel, The Netherlands, ⁶ OASE foundation, Amsterdam, The Netherlands

BACKGROUND. Salinization in the Dutch delta due to global climate warming threatens conventional agriculture. Measures to combat salinization require vast amounts of fresh water at high costs. Fresh water from lake IJsselmeer and Markermeer is used to flush salinizing polders to suppress upward seepage of brackish water. National (National Waterplan 2009) and regional policy (Waterbeheersplan 2010-2015 HHNK, 2009) aims at saving fresh water during periods with increased drought and salinity.

AIM.

Preserving and adapting functions to limited fresh water supply. This project evaluates the possibilities of agricultural exploitation of brackish (and saline) water by cultivation of suitable crops. This will save vast amounts of fresh water to be used as drinking water and for industrial process water.

(A) Drip irrigation 30 % seawater salinity of potato cultivars. TEXEL



(B) *Salicornia* drip-irrigated with seawater- TEXEL



RESEARCH

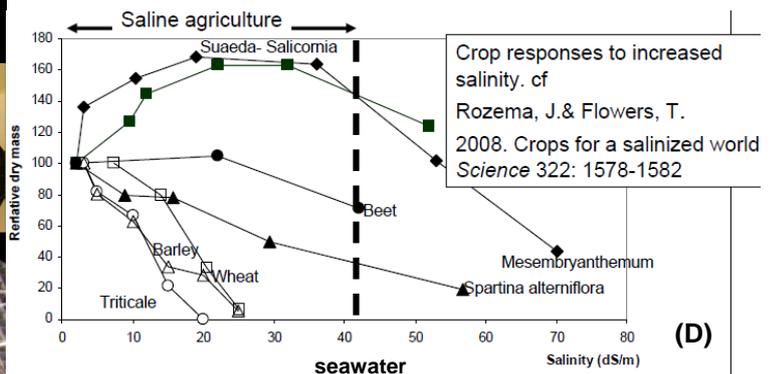
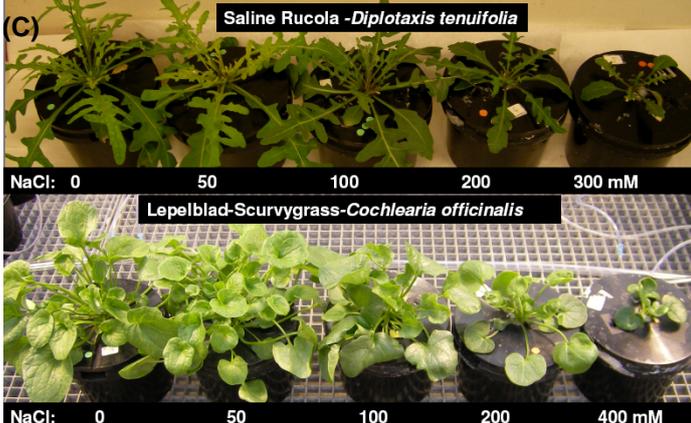
Crops with potential for saline agriculture will be studied both in hydroponic culture and field experiments. In the current project the salt tolerance of the arable crops is being compared. Drip irrigation with brackish water is being successfully practised in the cultivation of various potato cultivars (A). We developed an inland seawater drip-irrigation systems with *Salicornia europaea* to be upscaled and allowing yearround commercial cultivation of green tips of *Salicornia* (B).

Based on hydroponic (C and D) and field studies (A and B) we contributed to successful introduction of saline vegetable crops:

- Seakale (Zilte Zeekool)-*Crambe maritima*
- Saline beet (Zilte strandbiet)-*Beta maritima*
- Saline rucola- *Diplotaxis tenuifolia*

Hydroponic cultivation of saline vegetable crops

Effect of salinity on growth, mineral composition and secondary compounds



EXPECTED OUTPUT

- Salt responses of various 'saline' crops to increasing salinity under various soil and weather conditions
- Assessment of yield, quality and market value of crops cultivated under varying salinities
- Classification of the suitability of various crops for brackish and saline cultivation based on field tests and after application of Salt Response Functions.
- Manuals and protocols describing the practice of brackish and saline cultivation of crops

SALINE AGRICULTURE AND AQUACULTURE: SUSTAINABLE TERRESTRIAL & MARINE AGROSYSTEMS

Cultivation of saline crops such as *Salicornia* and Seabeet can be combined with aquaculture of algae, shellfish, seafood and shrimp. In such sustainable agrosystems, inorganic nutrients from coastal or inland fish or shrimp ponds can be used to promote the growth of halophyte crops.. Such, depletion of seafood and shellfish and deterioration of terrestrial and marine ecosystems can be avoided.

REFERENCES

- Op zoek naar de aardappel die groeit in zoute aarde-Vrije Universiteit zoekt oplossing voor verzilting van landbouwgrond. Trouw 17 juli 2010
- De zee geeft en de boer neemt. Proeven met zilte groentetelt langs de kust. De Volkskrant 24 juli 2010
- Rozema, J. and Flowers T. 2008. Crops for a salinized world. *Science* 322: 1578-1582
- Groente met een snuffje zout. De Pers 15 juni 2009. Zouttolerante gewassen oplossing voor globale verzilting.
- De Vos A.C., Broekman R., Groot M.P., Rozema J. 2010. Ecophysiological response of *Crambe maritima* to airborne and soilborne salinity. *Annals of Botany* 105: 925- 937

FUNDING: This is project WP 3.2 of KvK theme "Fresh water supply and water quality at national and regional scale". With co-financing from Provinces of Friesland & Noord-Holland-Gemengd Zilt Aqua Agrarisch Bedrijf and Ministerie LNV-Standaardisatie Zilte Teelten