



SATREPS BLUE: Climate resilient approaches for water-use efficiency and halophytic farming in the Aral Sea basin (Part II)

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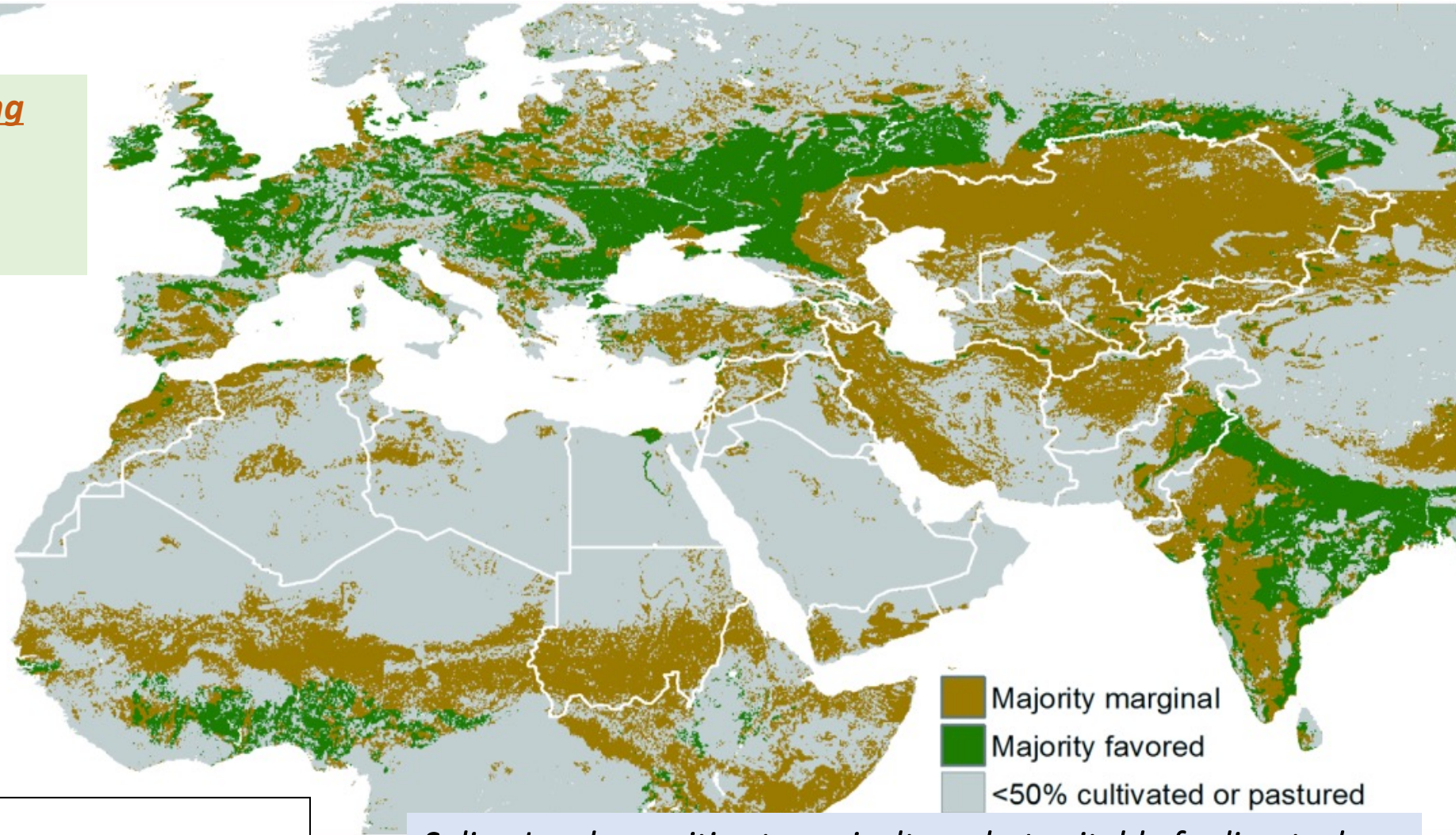
Main Working Hypothesis: Food System Must Too

Since the Climate is changing (CC) then Agriculture and

Agrobiodiversity Mainstreaming

More Food from Saline Soils

Why SALT-AFFECTED SOILS are
Important?

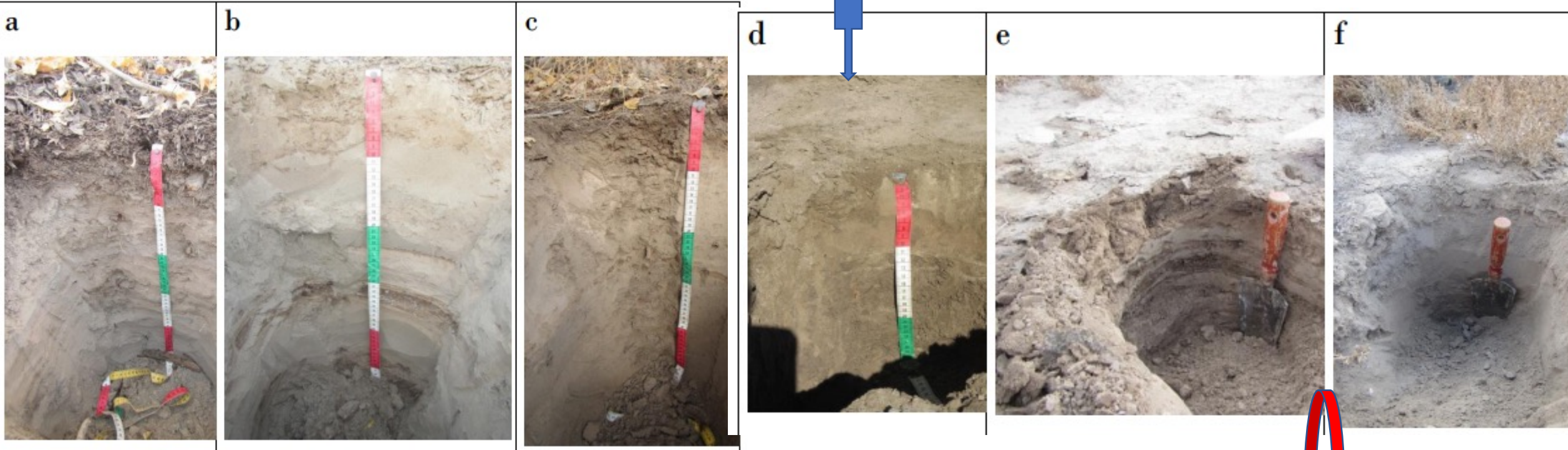


- Coastal Soil Salinization
- Dryland Salinization (Intercontinental Salinization)

Saline Lands sensitive to agriculture, but suitable for livestock grazing; landscaping, fisheries; bio-energy, technical crops & other alternative land use

Diagnostics of Salt-Affected Soils

DO WE HAVE ENOUGH SCIENCE?



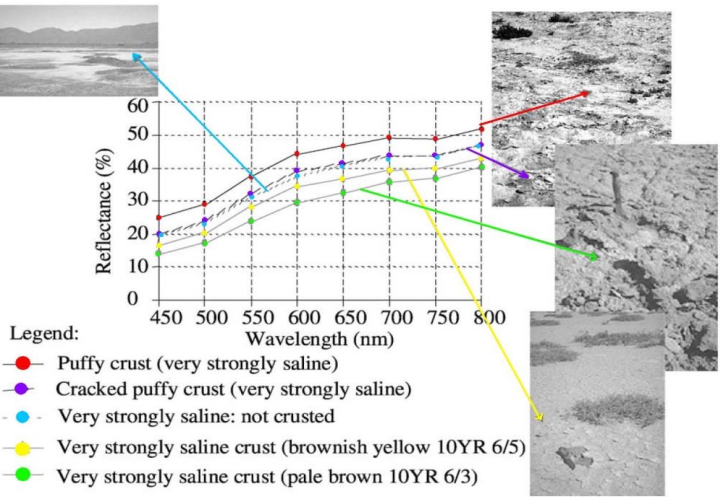
Soils in the delta of the Amu Darya (a-c) and the dry bottom of the Aral Sea (d-f)



Soils containing high concentrations of soluble salts



Potential Water/Lands for Restoration



Agriculture Irrigated Zones



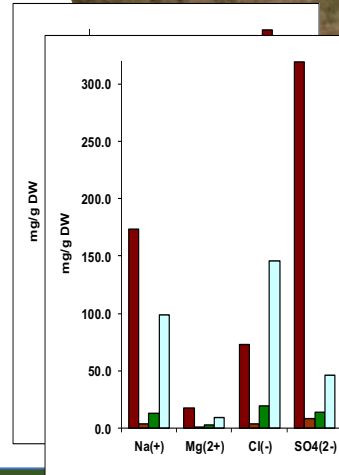
- Secondary salinization /
Human Caused

Irreversible dead lands



KEY ISSUES.....

- Water intensive pre-season leaching to ameliorate saline soils
- Non-optimized irrigation system & Alternative Use of Water Resources/Water Recycling
- Few livelihood opportunities



Priority: finding solution/options to manage root zone salt crusts (content of toxic salts - 18-



Cotton fields

Furrow irrigation with extensive water discharges



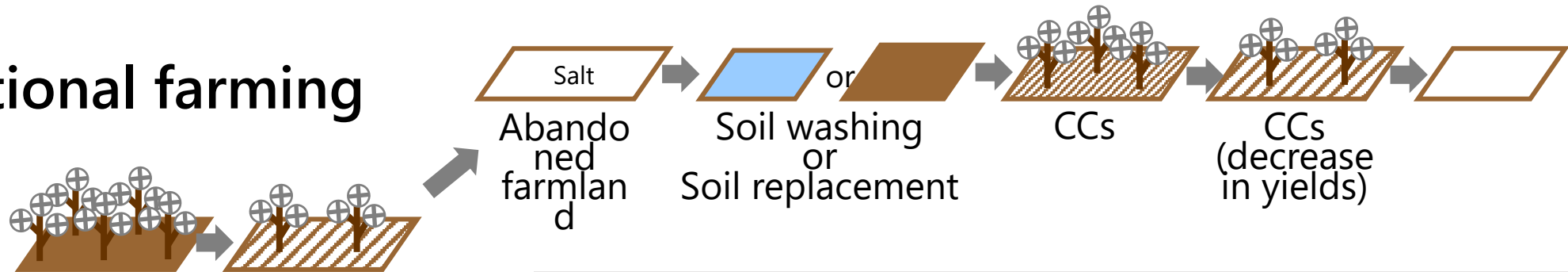
Drainage channels: source of water loss/water infiltration/salts Build Up



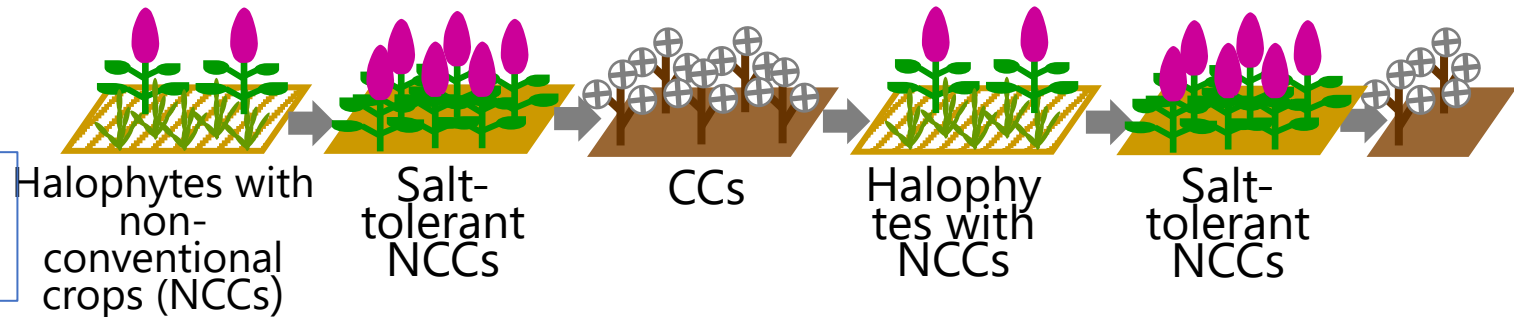
Showcase innovative solutions in Saline Agriculture, where each waste has an opportunity

USING HALOPHYTES TO GENERATE SALINE AGRICULTURAL TECHNOLOGIES

Conventional farming



Circular Halophytic Mixed Farming (CHMF)



Hal. -----Comprise 2% in Global Flora,e.g. >1600 species.

Comparison between conventional farming and the Circular Halophytes Mixed Farming (CHMF) proposed by this project. In CHMF, salt-affected farmlands can be remediated by cultivating a combination of halophytes with high salt removal capacity and non-conventional crops/Glycophytes (NCCs).

Biomelioration and reclamation of saline lands

| Types of soils damaged by salt | Recoverable? | Soil restoration method |
|--|------------------|--|
| Class I. Maximum (desertification) | impossible | Soil removal |
| Class II. High (abandoned lads) | necessary | <u>Soil restoration with halophytes</u> (Bio-restoration, SATREPS) |
| Class III. Medium reduction of crop) | possible | Growing salt-tolerant crops (legumes, amaranth, quinoa, sunflower) Bio-cleaning of soil |
| Class IV. Non-saline | - | Basic cultivation of agricultural crops |



Recovery stages



Class. II

Class. III

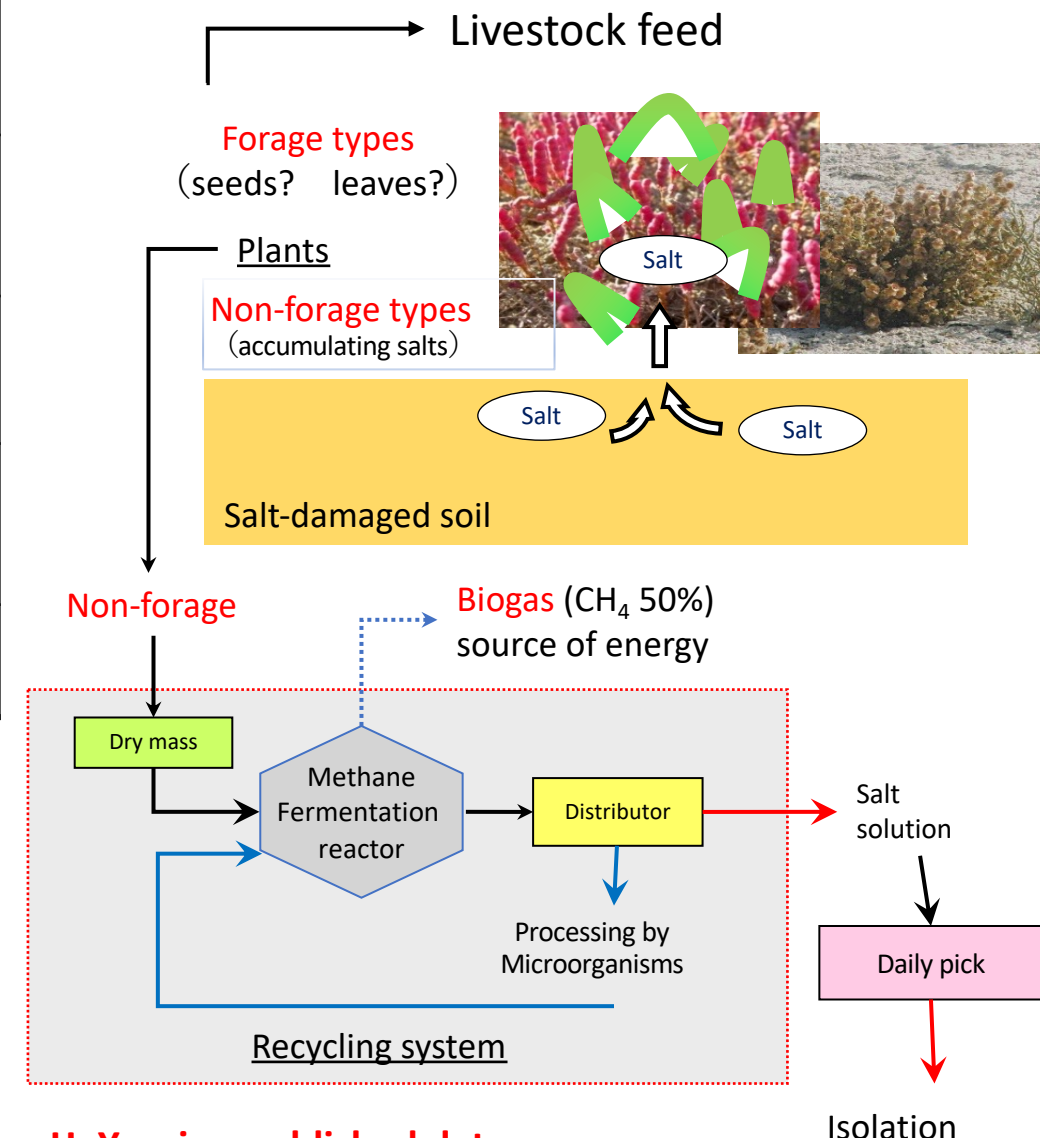
Class. IV

Class. I

(Soil cleaning/Salt Removal Capacity)

CHMF

Restoration of saline agricultural land by active cultivation of halophytes, which grow naturally in the field.



H. Yasui unpublished data



1) Sampling of halophytes in natural vegetation



Dry Solonchak in Kyzylkesek (Central Kyzylkum)



Wet Solonchak on the shores of Lyavlyakan Salt Lake
(August 2022)

- Kyzylkum Desert, Bukhara Oasis, etc. in June and September 2022
- The dry bottom of the Aral Sea in June and September 2023

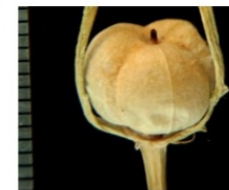
Peganum harmala L.



Plant community with dominance of *P. harmala* (during



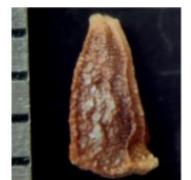
Fragment of plant in fruit maturation stage



Mature fruit morphology



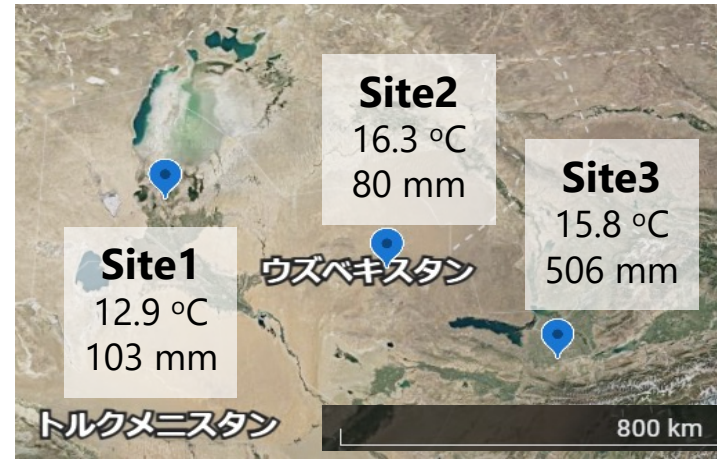
Distribution of seeds inside of fruit capsule



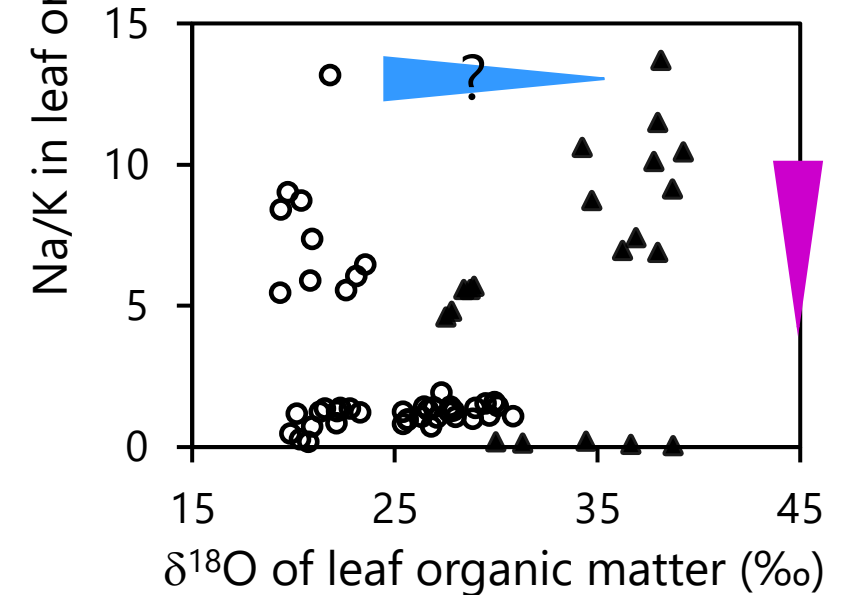
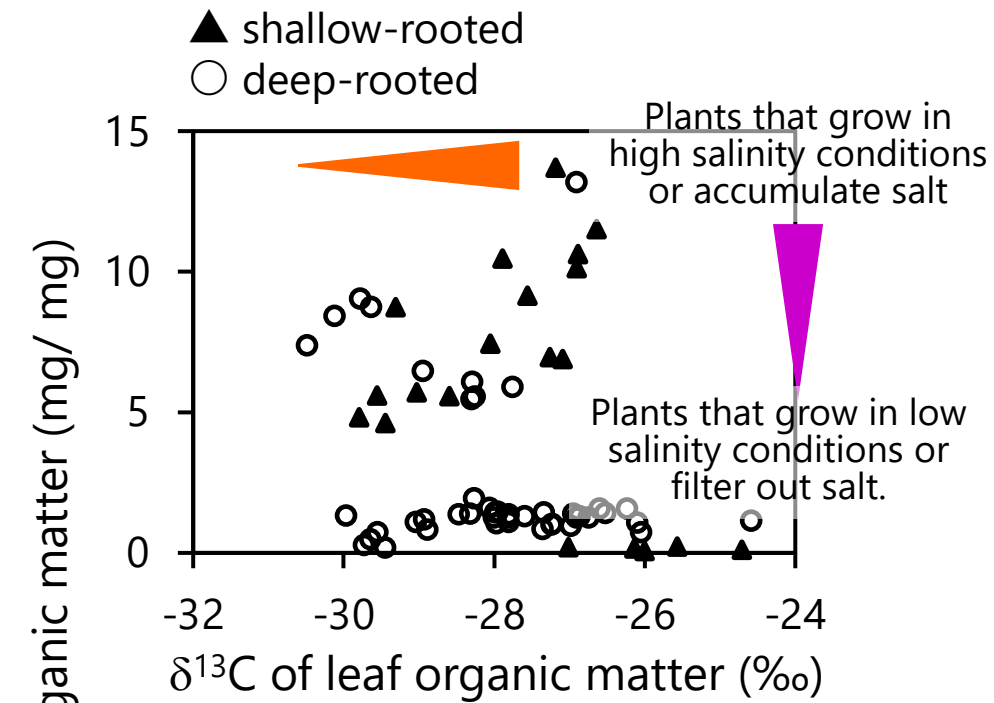
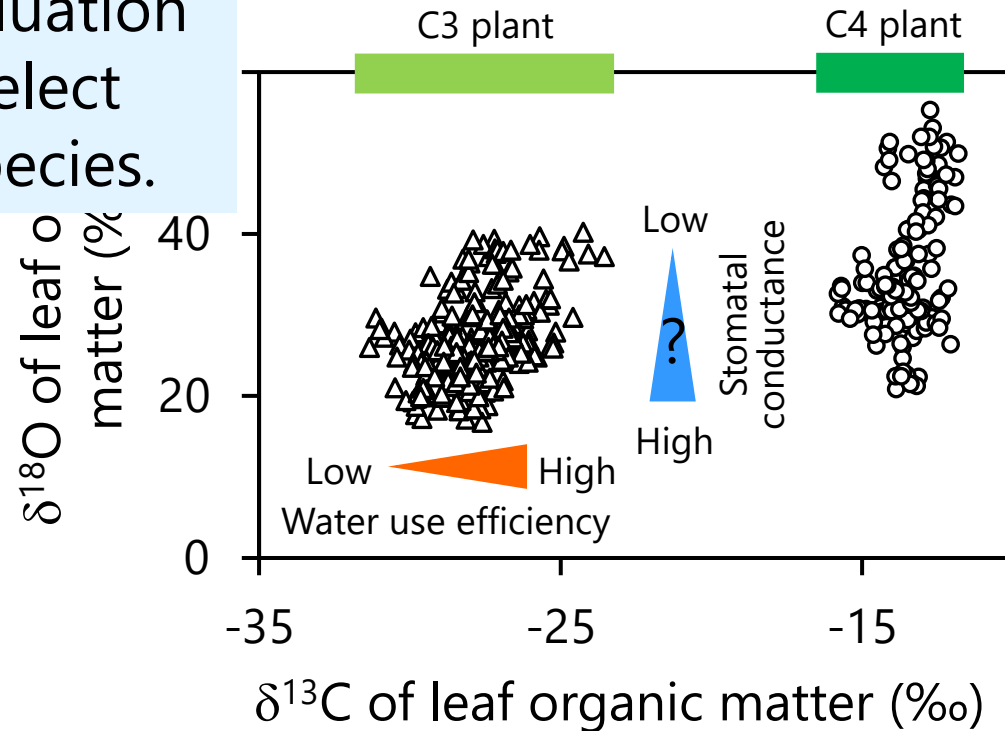
Seed morphology

Chemical and isotopic analysis on 56 species of halophytes

We are developing a simple evaluation method to select candidate species.

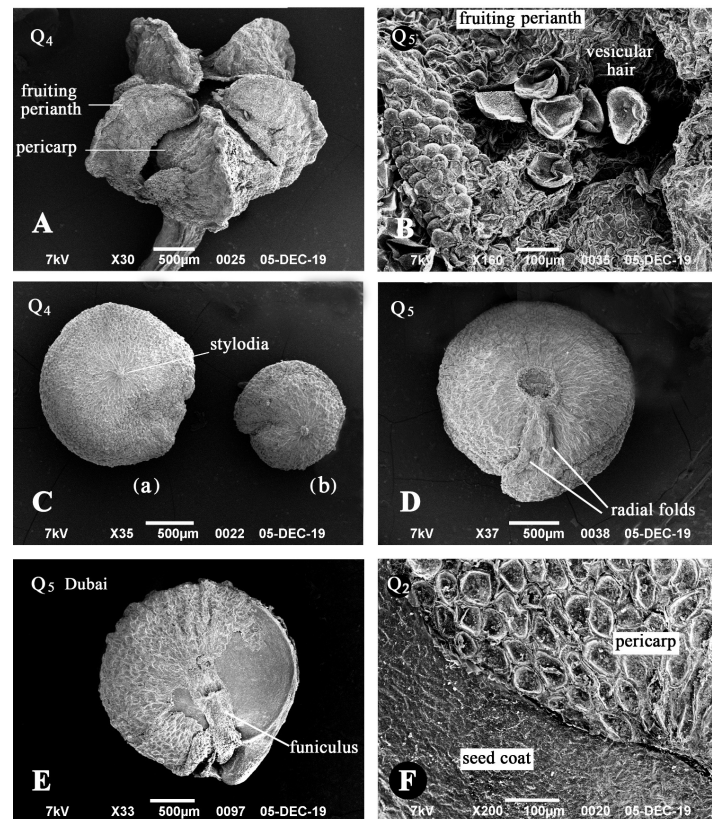
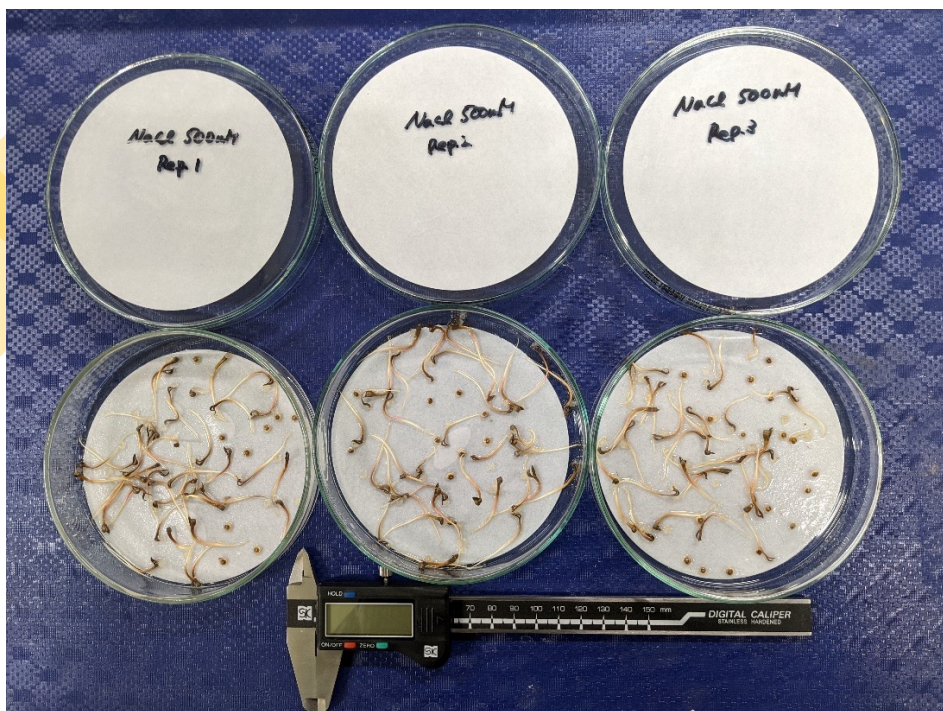


Google map



1. Structural and functional mechanisms of halophytes/NCC to drought and salinity stresses

2. Environment-induced changes and salt stress effect on seed ontogenesis and seed compound biosynthesis in halophytes and non-conventional crops



3. International Nursery/Collection on Evaluation, Breeding and Seed Multiplication

Toderich et al., 2023

October 24, 2022

eHALOPH Flora Survey and Documentation

On the top:

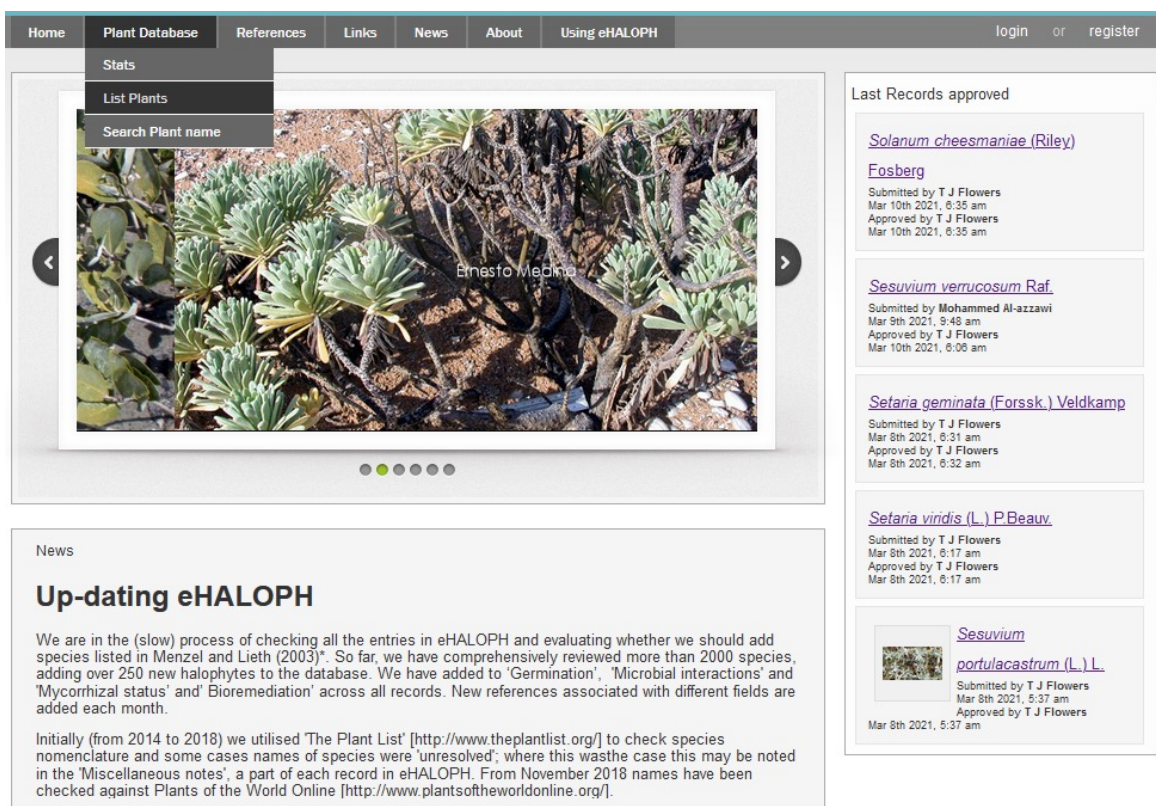
eHALOPH

Halophytes & NCC holds excellent promise for degraded/salt-affected areas –

- Comprise 2% in Global Flora ;>1600 species.

Explore New Germplasm & Exchange – International Nurseries/between TU/IICAS /XIE/ CAC /and Iran_Turanian Cold Desert Flora

- Crop Diversification, Biofortification and Biotechnology
- Evaluation and Adoption a wider range of germplasm a new sources of variability for enhanced grain quality ;
- Advanced Breeding and Genetic Engineering



Home Plant Database References Links News About Using eHALOPH login or register

Stats
List Plants
Search Plant name

Ernesto Medina

Last Records approved

[Solanum cheesmaniae \(Riley\) Fosberg](#)
Submitted by T J Flowers
Mar 10th 2021, 6:35 am
Approved by T J Flowers
Mar 10th 2021, 6:35 am

[Sesuvium verrucosum Raf.](#)
Submitted by Mohammed Al-azzawi
Mar 9th 2021, 9:46 am
Approved by T J Flowers
Mar 10th 2021, 6:06 am

[Setaria geminata \(Forssk.\) Veldkamp](#)
Submitted by T J Flowers
Mar 8th 2021, 6:31 am
Approved by T J Flowers
Mar 8th 2021, 6:32 am

[Setaria viridis \(L.\) P.Beauv.](#)
Submitted by T J Flowers
Mar 8th 2021, 6:17 am
Approved by T J Flowers
Mar 8th 2021, 6:17 am

[Sesuvium portulacastrum \(L.\) L.](#)
Submitted by T J Flowers
Mar 8th 2021, 5:37 am
Approved by T J Flowers
Mar 8th 2021, 5:37 am

News

Up-dating eHALOPH

We are in the (slow) process of checking all the entries in eHALOPH and evaluating whether we should add species listed in Menzel and Lieth (2003)*. So far, we have comprehensively reviewed more than 2000 species, adding over 250 new halophytes to the database. We have added to 'Germination', 'Microbial interactions' and 'Mycorrhizal status' and 'Bioremediation' across all records. New references associated with different fields are added each month.

Initially (from 2014 to 2018) we utilised 'The Plant List' [http://www.theplantlist.org/] to check species nomenclature and some cases names of species were 'unresolved', where this was the case this may be noted in the 'Miscellaneous notes', a part of each record in eHALOPH. From November 2018 names have been checked against Plants of the World Online [http://www.plantsoftheworldonline.org/].

In - Situ Conservation

GENE BANK

Ex - Situ Conservation

IICAS

Genepool in the field



Tissue or cell culture



Climate Chamber



**Phytotron Agro-Products ;
Agro-Biotechnology**



SEED BANKS



- at low and controlled Temperature and humidity.
- Replication and Seed Quality and Seed Viability Monitoring



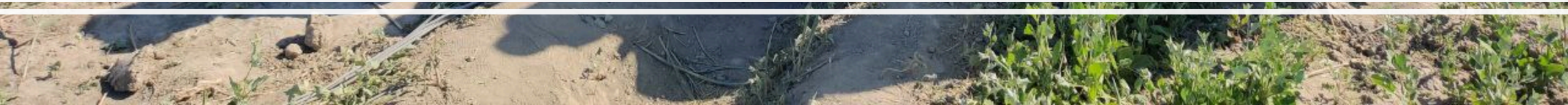
**- seeds;embryos;
pollen grains**

Outside of Plant Habitat





TRANSFER OF NOVEL CHMF APPROACHES & TECHNOLOGIES from LAB. INTO THE
FIELD

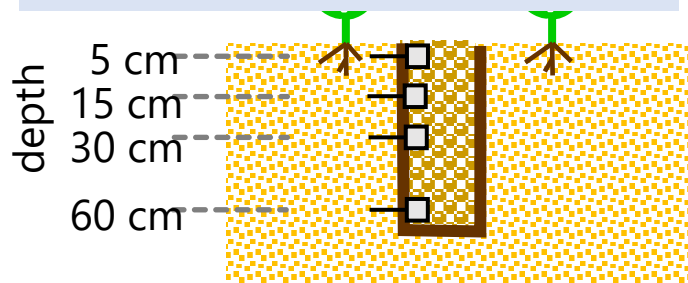


REAL-TIME SOIL DATA DOCUMENTATION AND MONITORING

10m



Digital New Generation Soil Sensors System



| | | | | |
|----------------------|----------------------|---------------------|-----------------------|--------------------|
| Artemisia halophila | Artemisia halophila | Artemisia halophila | Salsola sclerantha | Salsola sclerantha |
| Climacop-tera lanata | Climacop-tera lanata | Atriplex undulata | Medicago sativa | Medicago sativa |
| Kochia scoparia | Atriplex nitens | Amaranthus ens | Medicago sativa | Medicago sativa |
| Atriplex nitens | Amaranthus vires | Kochia scoparia | Camphorosma lessingii | Medicago sativa |
| Amaranthus virescens | Kochia scoparia | Atriplex nitens | Atriplex undulata | Atriplex canescens |
| Control | Mulch | N90P50K40 | N180P80K60 | N180P80K60 |

5m cable x4 (#1-1, 1-2, 1-3, 1-4)

Data logger 1

5m cable x4 (#2-5, 2-6, 2-7, 2-8)

5m cable x4 (#2-1, 2-2, 2-3, 2-4)

Data logger 2

5m cable x4 (#2-9, 2-10, 2-11, 2-12)

15m cable x4 (#1-5, 1-6, 1-7, 1-8)

2) Cultivation trial in Karabuga site

Control

N90P50K40

Organic mulch

Atriplex nitens

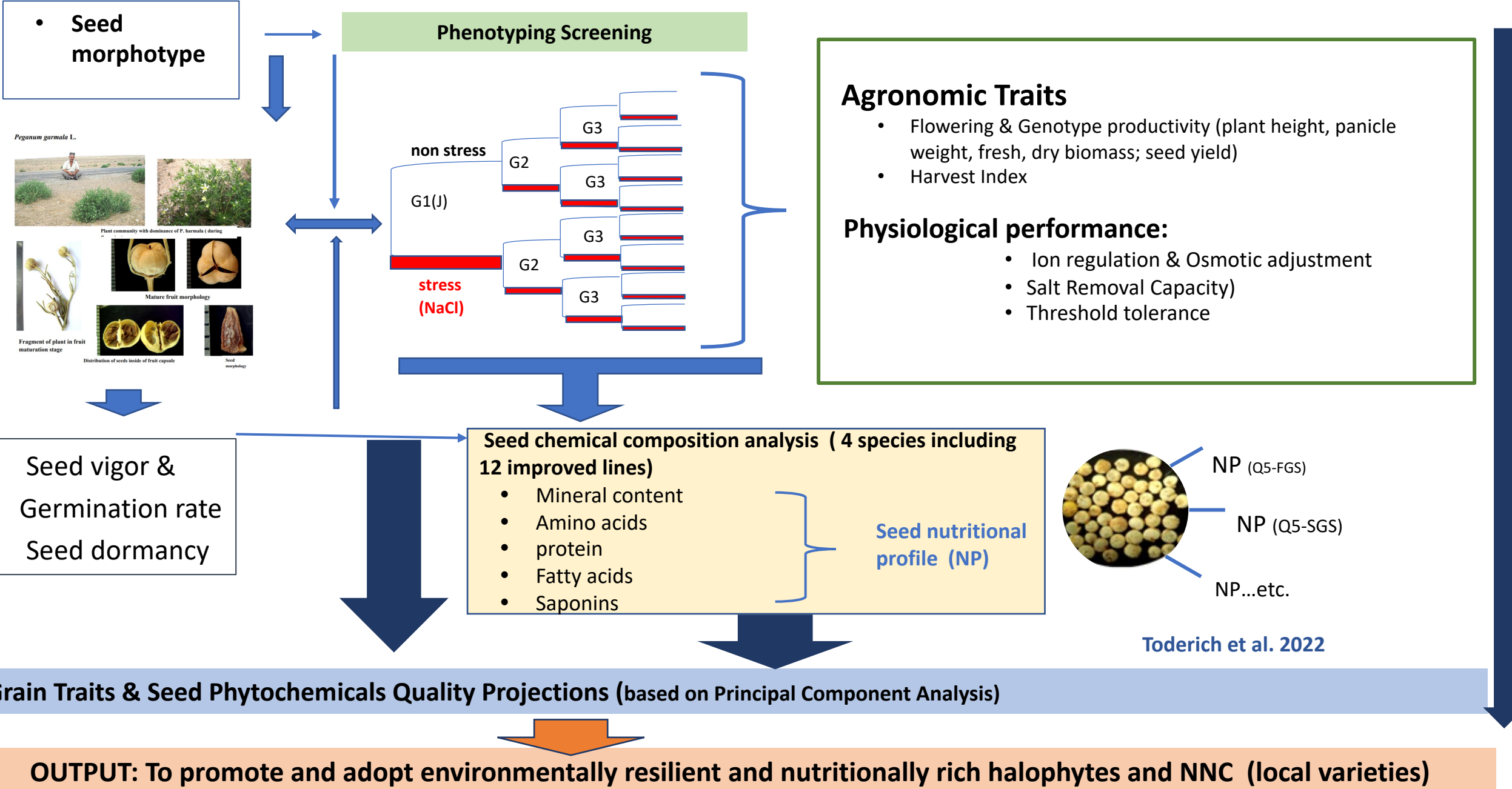


Biomass, salt removal capacities, and nutrient values will be compared among species and among treatments.

Kochia scoparia



Seed Morphology, Germination and Nutritional Value screening in AS Halophytes (78) . Tottori University



Saline Agriculture Knowledge HUB (to be establishedmonitoring and Updating with support of all teams)



<https://www.fao.org/3/cb9685ru/cb9685ru.pdf>

JOINT EVENTS



Obligatory reference:

Toderich K., Khujanazarov T., Ibraeva M., Toreshev P., Bozayeva J., Konyushkova M.V. and Krenke A.N. 2022. *Training Manual. Innovative approaches and technologies for managing salinization of marginal lands in Central Asia*. Nur-Sultan, FAO. <https://doi.org/10.4060/cb9685ru>

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Assessment methods of saline soils

Sustainable management of saline soils

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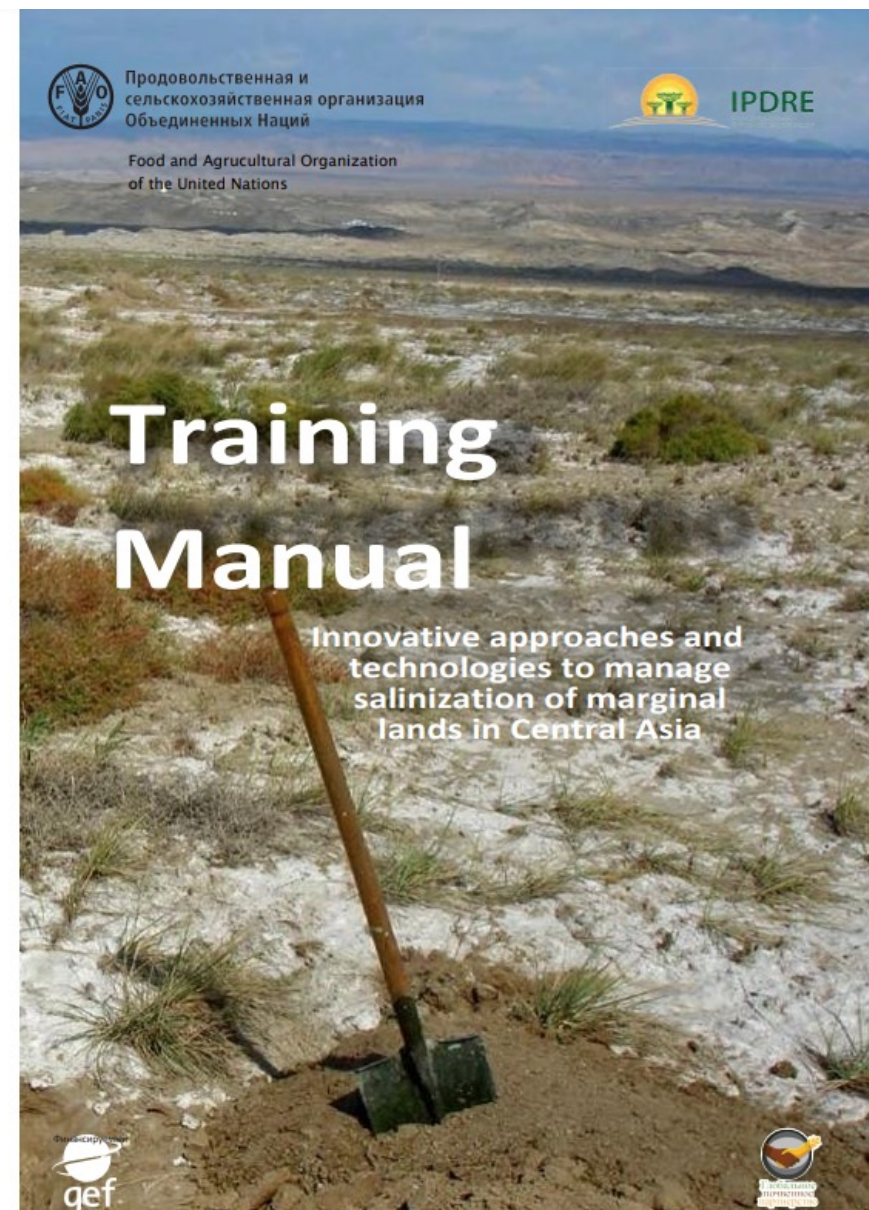
Food Programme and Nutritional Quality

Integration of Women

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BIBLIOGRAPHY



Doi: <https://doi.org/10.4060/cb9685ru>



Biosaline agriculture for Land Use Efficiency

