Growing Brassica Crops under Poor Growing Conditions for ALMANAC

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Description

1. *Description of problem*: Produce oil seed data from mustard crop grown on unproductive soil with excessive levels of salinity and boron.
2. *Technical/conceptual approach*:

Identify Saline Site →

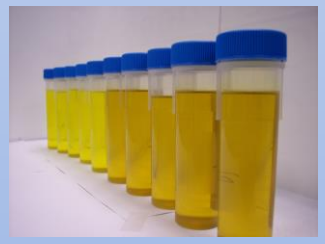
Prepare Soil →

Irrigate

Mustard in Extreme Saline Soil →

Mustard in Moderate Saline Soil →

Mustard Seed Produced



Mustard oil after two presses

Tools & Methods

1. Locate 20 acre field sites with variable levels of high salinity, boron and selenium in Central California.
2. Perform initial analyses on soil salinity, B, and Se.
3. Plant, irrigate (when available water) and harvest.
4. Collect biomass and seed yields.
5. Analyze plant material for B, Na, Se and Cl.

Key Findings

1. Produced biomass and seeds; lower yields with increased salinity (Table 1).
2. Observed toxic symptoms with excessive salt ions (Table 2).

Table 1. Mean (SD) biomass and seed yields of mustard grown under moderate and severe saline field sites in Central California.

Soil Salinity (0-30 cm)	Plants # m^2	Plants acre	Biomass ---lbs $acre^{-1}$ ---	Seeds
Moderate†	75 (8)	275,000 (4000)	7800 (820)	2200 (250)
Severe‡	60 (25)	216,000 (32000)	2010 (750)	395 (85)

†Salinity: 5-7 dS/m, 4-6 mg B/L, 0.0-0.25 mg Se/L; irrigation water salinity of 3-4 dS/m, 3-4 mg B/L.
‡Salinity: 16-34 dS/m, 15-25 mg B/L, 0.05 mg Se/L; irrigation water salinity of 0.8-1 dS/m, <1 mg B/L.

Table 2. Mean (SD) concentrations of potentially toxic ions in mustard grown under moderate and severe saline field sites in Central California.

Soil Salinity (0-30 cm)	Plant Material	B	Na	Se	Cl
		------mg kg^{-1} DM------			
Moderate†	Shoots	125 (20)	7,500 (895)	1.65 (0.10)	8,050 (980)
	Seeds	26 (10)	165 (52)	0.61 (0.08)	286 (56)
Severe‡	Shoots	465 (12)	35,200 (9000)	0.42 (0.09)	65,000 (9500)
	Seeds	34 (12)	406 (100)	0.25 (0.08)	380 (90)

†Salinity: 5-7 dS/m, 4-6 mg B/L, 0.0-0.25 mg Se/L; irrigation water salinity of 3-4 dS/m, 3-4 mg B/L.
‡Salinity: 16-34 dS/m, 15-25 mg B/L, 0.05 mg Se/L; irrigation water salinity of 0.8-1 dS/m, <1 mg B/L.

Deliverables:

1. Recorded biomass and seed yields on mustard grown under high saline, B and Se conditions.
2. Such soil and plant data will eventually be useful for the junction/model ALMANAC.

Conclusion

Mustard can be successfully grown in moderate saline conditions for biofuel production, however, there must be water of some kind of quality available for irrigation or as precipitation. Drought conditions will prevent feedstock production of any sort. Publications are in preparation.