Screening of Mulberry Genotypes for Alkali Tolerance- An Integrated Approach

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Need for the Study

- Growth in Silk production - Vertical or horizontal
- Vertical Growth – Limitation
- Horizontal Growth- constraints due to pressure on arable land and also urbanization
- Utilising lands not suited for agricultural production - salt affected soils

Soil alkalinity and mulberry cultivation

- **Soil alkalinity - osmotic stress, ion toxicity, and nutritional disturbance - reduction in growth, survival and economic yield**
- **Options to utilize alkali soils - reclamation or by growing alkali tolerant genotypes**
- **Integrated approach- adoption of reclamation at farmer's level is either slow or partial and maximum genetic potential of the genotypes can not be expressed due to the salt stress**

Materials and Methods

- **Location: CSB Farm, Kinakahalli, Karnataka (black cotton soil, pH: 9.5, Ec: 0.32 - 0.84mmhos/cm, ESP: 42 and SAR: 30)**

- **Mulberry Genotypes (8): AR-12, AR-14, AR-10, AR-08, AR-29, two improved and one ruling check**

- **Treatments (3):**

-unreclaimed alkali soil [T1],

-reclaimed with organic amendments [T2] (pressmud @ 50 MT/ha.) and

-reclaimed with inorganic amendments [T3] (gypsum @ 8MT/ha. + Sulphur @ 1MT/ha.)

Materials and Methods contd…

- **Design: RBD, 64 plants excluding border/replicn/ genotype**
- **Soil analysis: Periodically before and after reclamation**
- **Leaf yield and other data: For two years (five crops per year)**
- **Bio-assay: Five crops during second year**

Soil properties before and after treatment

Parameters	T1	T2	T3
pH	9.50	7.90	8.30
Electrical Conductivity (mmhos/cm)	0.58	0.63	0.40
Exchangeable Sodium Percentage(%)	42.00	12.00	18.60
Sodium Adsorption Ratio (%)	30.00	8.00	14.00
Organic Carbon (%)	0.33	0.54	0.76
Potassium (kg/ha.)	363.00	360.00	327.00
Phosphorous (kg/ha.)	7.00	9.00	6.70
Copper (ppm)	0.16	0.38	0.31
Zinc (ppm)	0.96	1.40	1.61
Manganese (ppm)	27.70	35.40	38.40
Iron (ppm)	0.97	6.20	4.30

Soil properties before and after treatment contd..

Gypsum - increased solubility of soil calcium carbonate which replaces sodium salts in soil - decrease in the soil pH and ESP of the soil and increase in the availability of nutrients

Improvement in macro and micronutrients status - due to synergistic effect of sulphur in the uptake of nutrients

Press mud due to relatively more soluble calcium and its organic-acidic (pH 5.62) nature - accumulation and movement of micronutrients

Leaf yield (MT/ha./yr) of mulberry genotypes

Genotype	T1	T2	T3	Average
AR-12	16.87	20.43	23.01	20.10
AR-14	14.72	17.73	20.82	17.76
AR-10	11.35	13.13	15.11	13.20
AR-08	12.65	14.74	16.34	14.58
AR-29	14.24	16.95	18.87	16.69
V1	12.09	14.73	16.86	14.56
S34	11.18	13.30	14.81	13.10
Local	9.12	10.71	11.72	10.52
Average	12.78	15.22	17.19	15.06

CD at 0.05: Treatment (Reclamation) *0.28*

Mulberry Genotype *0.45*

Reclamation x Mulberry Genotype *0.78*

Observations

- Under salt stress conditions, plants spend part of the energy for uptake and synthesis of solute resulting in growth reduction.
- Genetic potential of the genotype will be expressed because of better managerial practices due to improved soil properties in reclaimed soils.
- Expression of leaf yield of genotypes is dependent on both reclamation treatment and the mulberry genotypes with significant Treatment x Genotype interaction.
- Leaf yield varied significantly among mulberry genotypes in the same reclamation treatments, with increased gain in the reclamation treatments
- Bioassay results indicated superiority of the genotype AR-12 under reclaimed conditions over other genotypes

Integrated Package for alkali soils

Characters	T1	T3	Improvement (%)
Leaf yield (MT/ha/yr)			
First year	15.96	20.7 *	29.70
Second year	17.77	25.32 *	42.49
Average of two years	16.87	23.01 *	36.40
Weight of larvae (g)	32.509	34.652 *	6.59
ERR by number	8742.8	8961 NS	2.50
ERR by weight (kg)	15.183	16.047 *	5.69
Single cocoon weight (g)	1.822	1.881 *	3.24
Single shell weight (g)	0.326	0.349 *	7.06
Shell ratio (%)	17.88	18.59 *	3.97

Morphological Characteristics of AR-12

Type of species	***Morus indica***
Sexuality	**Predominantly male**
Plant type & Ploidy	**Erect, Triploid**
No. of shoots/plant	**8-10**
Leaf size and shape	**Large, entire, cordate**
Leaf surface	**Smooth, glossy, dark green**
Resistance to diseases	**Tolerant to leaf spot, moderately resistant to leaf rust.**
Regeneration	**13-15 days (winter) & 9-10 days after pruning during other seasons**

AR-12

Recommendations/ Way ahead

- Application of amendments particularly pressmud, makes the intercultural operations easy and economical for a marginal farmer
- AR-12 is most suitable genotype in alkali soils before and after reclamation with pressmud
- Included in Transfer of Technology of CSR & TI, Mysore for utilization of alkali waste lands.
- Can be cultivated as tree in Sodic soils of Northern India
- To identify species-specific markers for alkalinity stress condition and empirical testing of tolerant mulberry germplasm accessions in hot spots for alkali soil.


Thank You