

CHEMCO inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR

Remediation and Rehabilitation of Soil Impacted with High Soluble Salt Level Through the Use of a Novel Soil Amendment

Remtech 2013

by

**Jean Paré, P. Eng.
Chemco Inc.**



Presentation Outline

- Product Description and applicability range
- Dosage rate and cost evaluation
- Case Studies Presentation



Product Description

- Patent pending mineral based solution amendments.
- Not a fertilizer or bacterial inoculants.
- Help process takes what occurs naturally over millions of years, and orchestrates it to happen within hours.
- Duration of effect is dependent on application rate.
- Product will last for years, but chemistry changes in soil will last much longer.
- Reduces irrigation needs by up to 25%.



Technology Applicability Range

- Rehabilitation/Remediation of soil impacted with elevated heavy metals and hydrocarbons
- Rehabilitation/Remediation of soil impacted with elevated soluble salts
- Rehabilitation/Remediation of fresh or salt water contaminated by oil based matters
 - Could be use proactively to increase plant resistance to salt and or hydrocarbons as it would limit the amount of salt that would leach into the groundwater aquifer
- Erosion Control/Road Side Seeding
- Rapid turf establishment
- Enhanced moisture retention
- Increased rate of seed germination
- Increase in soil bacterial growth



Typical Dosage rate and cost

- 500 to 1000 kg per acre (4046 m²)
- Typical price range for the amendment is
- 2500 – 5000 \$ per acre depending on contaminant level and soil type
- Optimal dosage can be achieved via bench scale testing

Application Guidelines

- **Application by Drop Spreader:** may be pre-mixed with any other type of DRY product, including seed, calcium, fertilizers, etc.
- **Application by Liquid Spray:** may be mixed at 1 lb per ½ gallon WATER in a high capacity sprayer such as a hydroseeder. Mixture is a suspension, and requires mechanical agitation. Use in low volume, small nozzle chemical sprayer is NOT recommended.



Case Studies

JESCO/Army Corp. Engineers - Case Study

- **Objective:** Evaluate the soil amendment to increase common bermudagrass and seashore paspalum germination and growth in clays at various salt concentrations.
- **Protocol:** Six bulk soils samples from two USACE borrows pits in Southeast Louisiana (Fort Jackson and Westbank F sites) were collected with salinity ranges 1) 1500 to 2000 ppm 2) 2000 to 3000 ppm 3) 3000 to 3800 ppm 4) 3800 to 4500 ppm 5) 5000 to 6000 ppm and 6) >6000 ppm. The bulk samples were collected and containerized at selected site using heavy equipment.

JESCO/Army Corp. Engineers - Case Study

Soil analysis

Soil Treatment	Location	pH	Conductivity	Salts	SAR	Sodium	Sand	Silt	Clay
			-----dS/m-----	-----ppm-----		-----ppm-----	-----%-----		
1	Westbank F	5.87	2.72	1744.64	6.54	268.24	18.9	38.2	42.9
2	Westbank F	6.94	4.07	2594.99	10.43	448.14	13.1	39.1	47.8
3	Westbank F	7.00	5.20	3328.00	10.68	538.80	13.2	32.3	54.5
4	Ft. Jackson	7.51	6.50	4160.00	16.39	715.62	14.4	41.4	44.2
5	Ft. Jackson	7.30	8.76	5606.40	12.62	776.97	14.7	43.7	41.6
6	Ft. Jackson	7.52	10.43	6677.33	13.45	1039.55	14.3	33.3	52.4

JESCO/Army Corp. Engineers - Case Study

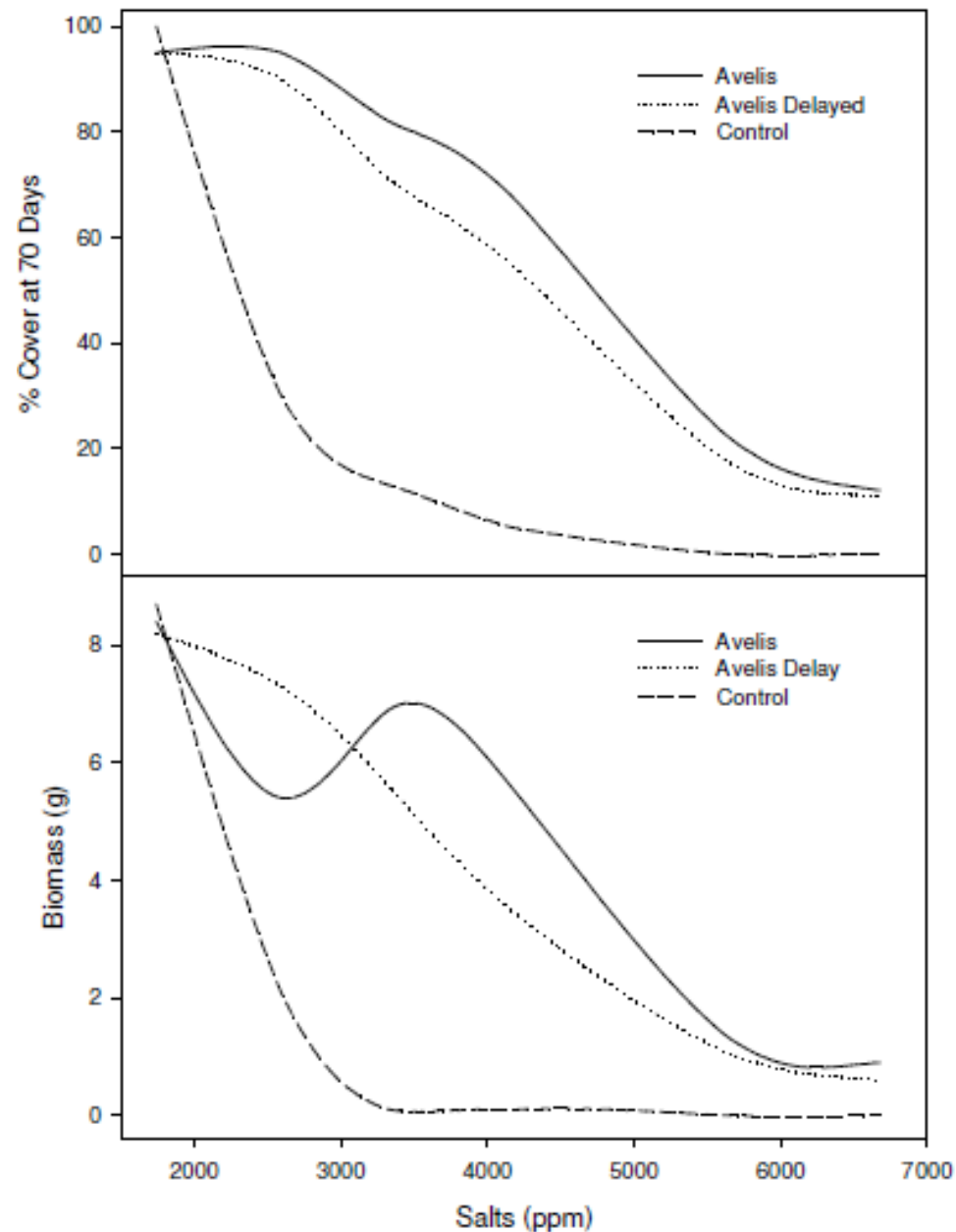
- **Soil Preparation:** PVC columns (10 inches in diameter) with a surface area of 0.55 ft² were cut to a height of 14 inches and arranged in a randomized complete block design. The columns were packed with 2 inches of pea gravel followed by 12 inches of clay. All soil was hand-packed using 2 inch diameter tamps in 3 inch lifts.



■ Test Conditions:

- After all columns were packed, the soil surface of each tube was scratched with a hand trowel. Soil treatments consisted amendment was applied at 15 g per column as a powder with untreated pots serving as controls. All pots were seeded with Arizona common bermudagrass (*Cynodon dactylon* L.) and seashore paspalum at 0.25 g pure live seed (87 lbs PLS acre⁻¹). Irrigation was applied twice daily as a mist so that the soil surface was wetted but salt leaching minimized. For one amendment treatment, irrigation was withheld 7 days before the irrigation regiment was initiated. Greenhouse conditions were 85/70 F with irradiance levels >988 $\mu\text{mol s m}^{-2} \text{ sec}^{-1}$ for a 12 hour photoperiod.
- Percent turfgrass coverage was recorded every 14 days for 70 days. At the conclusion of the study (70 days) plant material was excised and dried at 60 C for 48 hrs and dry plant biomass recorded. The upper 3 inches of soil for each treatment were analyzed for EC to determine salt concentrations. All soils used in this test had high silt and clay concentrations (>80%).

Figure –
Vegetative responses from a range of untreated and treated saline soils. Salinity effects on percent ground cover and biomass accumulation for Avelis amendment, delayed Avelis amendment and control treatments.



Photos 4-9. Avelis Test Samples at 42 days



Avelis Soil 1



Avelis Soil 2



Avelis Soil 3



Avelis Soil 4



Avelis Soil 5



Avelis Soil 6

Photos 10-15. Control Test Samples at 42 days



Control Soil 1



Control Soil 2



Control Soil 3



Control Soil 4



Control Soil 5



Control Soil 6

JESCO/Army Corp. Engineers - Case Study

- 70 days after seeding, plant biomass accumulations for untreated controls, for lowest to highest soil salinity concentrations, were: 8.7g, 2.1g, 0.1g, 0.1g, 0g, 0g.
- Comparatively, Amendment treated soils produced the following plant biomass: 8.4g, 5.4g, 6.9g, 5.6g, 1.4g, 0.9g.
- Summary: at 4200ppm NaCl the Amendment treated soil produced vegetation mass more than 5000% greater than the untreated soil.
- Bioconversion of sodium chloride in the plant will eventually reduce sodium chloride concentration
- Could be applied on % salt concentration up to 15000 mg/kg

JESCO/Army Corp. Engineers - Case Study

- Could be considered as a soil amendment during common bermudagrass establishment on heavy clay embankments.
- Delayed irrigation postponed germination but had no deleterious effect on efficacy.
- Common bermudagrass emergence and growth was established to USACE standard at NaCl level 240% higher than untreated clay with a single application
- Amendment Effects on Turf
- Establishment in Saline Clays

Marsh Grass with Heavy Oil Contamination Demonstration

- **Location:** T-Beb Nursery - Montegut, LA
May 25, 2010 to June 15, 2010
- **Description:** introduced one half quart of oil (6000 mg/kg) from the Gulf spill, each to both the control buckets where the plants were grown with synthetic fertilizer and to the Amended buckets where no synthetics fertilizer were used

Marsh Grass with Heavy Oil Contamination Demonstration



- Two weeks after the oil was introduced, the smooth cord grass in the Amended buckets, on the right, continued to thrive while the control plants deteriorated. The above photos were taken on June 7, 14 days after the oil was added.

Marsh Grass with Heavy Oil Contamination Demonstration



- Above are the treated plants that have sat in oil for eight weeks at the time of the pictures.

About our Expertise, Products and Services



CHEMCO inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR

Training and Education: technical transfer session, health and safety training;

Consulting and Technology Site Assessment: technology support and selection (chemical oxidation and reduction, co solvent-surfactant soil washing and enhanced bioremediation);

Products supply, logistic and storage: nutrients, bacterial preparations strains, oxidants, reducing agents, catalysts, oxygen and hydrogen release compounds, co solvent-surfactant blends

Laboratory Services and Analysis: Groundwater Parameter Analysis, Tracer Study, Soil and Groundwater Oxidant Demand Evaluation (SOD), Bench Scale Treatability testing in saturated and unsaturated conditions.

Acknowledgements

JESCO

US Army Corp of Engineers

T-Beb Nursery



CHEMCO inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR

Questions ?!?

Contact information:

E-mail:

jean.pare@chemco-inc.com / 418-953-3480

henry_wu@quadra.ca / 604-304-3426

www.chemco-inc.com