

Improving Agricultural Soil Properties



Innovation in practice: greenhouse trial on maize biomass production at ICBA using organic and inorganic amendments.



Visible response of maize following different amendments applied at the rate of 6% and 100% ETo. (L-R Control, AustraHort, Meliorit, Zeoplant pellet, Zeoplant and Compost).

Thematic Area: Assessment of Natural Resources in Marginal Environments

Purpose: Improve nutrient and water use efficiency of sandy soils using soil amendments for biomass production

Geographic Scope: Arabian Peninsula

Timeline: 2013 - 2014

Partners:

- Zeoplant
- AustraHort

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Innovation is key in improving agriculture and saving natural resources especially in marginal and saline environments like the Arabian Peninsula. Sandy soils found in this region are plagued with very low water and nutrient holding capacities, which results in high leaching, nutrient losses and groundwater pollution. Furthermore, the high temperatures combined with scarce rainfall calls for new ways to conserve water, improve soil properties and prevent nutrient loss. Doing so can boost crop production and ensure future generations can be sustained on a global scale.

Since, one of the best ways towards improving agricultural output is to focus on soil health. The International Center for Biosaline Agriculture (ICBA) along with its partners launched a project to test organic and inorganic amendments in green house and field trials for soil improvement and biomass production under deficit irrigation.

“ Soil amendments can prove to be a sure way to boost soil resource capacity, improving the cost-effectiveness of agricultural production. ”

Both organic and inorganic soil amendments (materials which are added to soil to enhance the soils properties) have been used in the past but not on UAE soils.

Activities and Outcomes

The study used **four inorganic amendments** (AustraHort, Zeoplant, Zeoplant pellet and Meliorit) and **one organic amendment** (compost) in varied quantities. In order to analyze the chemical composition of the amendments, X-Ray Fluorescence (XRF) was employed. The results showed that AustraHort differs from the other amendments both in chemical composition and in loss on ignition.

No major difference in composition was found when comparing the chemical makeup of soil and its mixtures with different



Growth of barley without amendment at 75% ETc shows clearly that native sandy soils require amendments to reach optimum production levels.

amendments. The XRF analysis clearly showed that the sandy soil at ICBA's testing site is made up of 70% of calcite and dolomite together and 20% of quartz. Adding amendments has helped to balance out these figures which in turn helped change pH levels of the soil and thus provided better soil conditions in terms of nutrient availability. Highest salinity levels were found in two amendments (Zeoplant and Lignin) whereas Meliorit showed the lowest EC level.

During (June-September 2013) a maize variety from Pakistan (Sahiwal) was grown in a **greenhouse** study in sandy soil. Three rates (1.5%, 3.0% and 6.0%) of all amendment types were employed including a control. Fresh water was used to offset water requirements at deficit irrigation (100% reference evapotranspiration (ET_o), 75% ET_o and 50% ET_o). The standard rates of NPK for Maize were used by using urea, triple super phosphate (TSP) and sulfate of potash (SOP) fertilizers.

Plant height, biomass (fresh and dry), root length and weight were determined. It was indicated that Zeoplant and Zeoplant pellets showed promising results in terms of plant height and biomass. At 75%

ET_o, the performance of both amendments was in fact comparable to 100% ET_o. Furthermore, the biomass was increased by more than double with Zeoplant as compared to the control treatment, which shows promise for further investigation.

In a **field trial** using barley, the results further indicated a positive effect on biomass production from adding amendments to soil. At both irrigation levels (100% crop evapotranspiration (ET_c) & 75% ET_c, the addition of amendments showed promising results in terms of biomass increase (more than double) over control treatment. At 75% ET_c and 100%ET_c (control) biomass was recorded as 6.5 & 9 tons/ha respectively, whereas with the addition of amendments variable increase of biomass recorded, maximum being 15.5 tons/ha with the application of 4.5 kg/m² Meliorit at 75% ET_c (138% increase) and 19.5 tons/ha with the application of 4.5 kg/m² Zeoplant pellet at 100%ET_c (117% increase).

The initial results of the study indicate the beneficiary impact of these amendments on UAE-type soils, throughout the green house and field trials. These results are preliminary and indicative of a potential trend. The focus was specifically on sandy soils from the UAE, which are also dominant in the Arabian Peninsula. Since these amendments may behave differently in other types of soils, more research for soil improvement and deficit irrigation is needed to evaluate impact throughout the year on crop rotation.

Future Directions

In order to disseminate the results to the farming community, partnerships have been developed with Arabian Gulf University Bahrain under the FABRI 'Further Advancing the Blue Revolution Initiative' and Young Water Scientist Partnerships (YWSP) to further test the soil amendments in green house and field trials with okra. The follow-up field trials are currently underway. Following this, guidelines will be developed to disseminate the results through flyers, presentations at international conferences, and publications in peer reviewed international journals.



Soil with 4.5 kg/m² Zeoplant pellet at 75% ETc can significantly increase the biomass production of barley as evidenced in this image.