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Synthesis and characterization of hydrophobic soil and its applications in reducing water evaporation and enhancing growth of plants, water harvesting in construction

Plants cannot live without water! and most plants require considerable quantities of water. The amounts needed vary with the types of plants, conditions, stages of growth, rapidity of growth and other factors. Because soils vary greatly in their capacities to absorb and retain moisture, and make it available to plants, it is necessary to consider the soil as well as the plants when dealing with water transport to the plant. With varying patterns of climate changes and variability, water resources for agriculture may become more unpredictable. Food security and water availability for agriculture have become important topics in the wake of global warming and climate changes. Maize ranks third after rice and wheat in terms of cereal crops with global importance. Maize production and productivity both are highly susceptible to drought stress particularly at early growth and silking stage. Increase in plant water availability through technological intervention is the need of time as the country and as the whole world is facing serious issue of decrease in ground water content. Recent development of hydrophobic soil could be one of the major breakthroughs in the area of water conservation as observed in our recent study under controlled conditions using maize as a model crop. Hydrophobic coating with organosilane can certainly reduce the evaporation rate and enhance the vegetative growth of plants. Experiments on morphological and physiological effect of hydrophobic soil on growth of maize using four hydrophobic soil layers (0.5, 1.0, 2.0 and 3.0 cm) on top of normal soil was conducted at Anand Agricultural University, Anand, Gujarat, India revealed significant increase in shoot length, number of leaves and stem diameter which clearly reflected growth promotary effects of hydrophobic layering on normal soil compared to control plants. It showed response in the scale of 1.0>0.5>2.0>3.0 cm of top soil layering. This increase may be attributed due to lesser water stress as experienced by the control plants which showed lesser growth and performance compared to all the soil layering plants. This technology for hydrophobic soil can also be used for natural water harvesting reservoir. Building foundation can be compacted with hydrophobic soil to prevent capillary rise of water into building structures.

Recent Publications

1. LW Dekker and C J Ritsema (2003) Soil Water Repellency: Occurrence, Consequences and Amelioration. Elsevier. ISBN:9780080523217. Pages:358.
2. D O Shah (1971) Significance of the 1:3 molecular ratio in mixed surfactant systems. J. Colloid Interface Sci. 37(4):744-752.
3. P D Mistry and M E Bloodworth (1963) The effect of surface-active compounds on the suppression of water evaporation from soils Int. Assoc. Sci. Hydrol. 62:59-71.
4. P Plueddemann (1970) Adhesion through silane coupling agents. J. Adhes. 2(3):184-201.
5. B Arkles (1997) Tailoring surfaces with silanes. ChemTech. 7(12):766-778.

Biography

Prakash Mehta pursued his PhD in Polymer Science from the Polytechnic University, USA (1976); MS in Polymer Engineering from Brooklyn Polytechnic, USA (1974); MS in Inorganic Chemistry at the same university (1973) and MSc in Physical Chemistry from Sardar Patel University, India (1969) respectively. He has over 35 years of experience in USA in R&D, product development and production in the field of organosilanes and silicones technology. He worked at Degussa Corporation (Evonik) for over 28 years. He has developed over 40 organosilanes/silicones commercial products. He is one of the Team Member for the waterproofing product development for the NASA space shuttle. He taught Chemistry (part time) for 25 years at the local universities (Pace University; University of South Alabama, USA respectively). He is the Research Advisor at L D Engineering College and Indian Institute of Technology Gandhinagar, Gujarat, India. He is an Inventor and Developer of Zycosoil (Soil waterproofing), Terasil, Zycotherm, AsphaSeal, AguaProof and TerrenoSeal (Soil waterproofing) commercial products. He has four US patents to his credit.

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