AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue: 01 January 2022 Article No: 19

Magnetic Water Technology - Its Role in Fruit Crops: A Review

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SUMMARY

The water scarcity and a remarkable increase of salinity in soil and water being accepted as a major limitation in farming system. While, crop production is strongly associated with fresh-water resources for irrigation purpose. Hence, enormous pressure has been put on fresh-water because of increased demand and limited availability. Accumulation of excessive salt through irrigation water and presence of salt in soil can reduce the crop yield and deteriorates the physical, chemical and biological properties of soil. Therefore exploring a new strategy to minimize the usage of water and soil salinzation without reduction in crop growth and yield is of significant importance. One of the strategy is magnetic water technology (Abobatta, 2019). It is a technology where magnetized water is obtained by passing water through a magnetic device or electro-magnetic field with specific strength and flow rate, which will enable intense and increased production both in terms of quantity and quality.

INTRODUCTION

Water crisis and soil quality degradation is a major challenge faced by farming system. While prolonged droughts periods have quickened soil degradation process, by altering physical, chemical and biological properties of soil, causing severe and enormous pressure on water resource, which is considered to be a one of the future threat in agriculture sector. The main reasons for the water scarcity and soil quality degradation are excess use of fertilizers, pesticides and insecticides, improper water and soil management, climate change, urbanization and industrialization. These all factors leads to shortage of availability of fresh water for agriculture, depletion of underground water and decreases the quality of water.

On a global scale, water is plentiful, 97 per cent is saline and 2.25 per cent is trapped in glaciers and ice, leaving only 0.75 per cent available as fresh water in aquifers, rivers and lakes. Whenever good quality water is scarce, water of marginal quality considered for use in agriculture sector. Another limitation in crop production is salinity, by continuous use of saline water for irrigation and excess use of chemicals leads to deposition of salts in soil while Accumulation of salts around the root zone of plants reduces the plant growth and yield by decreasing the nutrient and water absorption by plants. It also ruins the soil structure and other soil properties. Therefore exploring a new strategy to minimize the usage of water and soil salinzation without reduction in crop growth and yield is of significant importance. One of the strategy is magnetic water technology (Abobatta, 2019).

What is Magnetic water technology (magnetized water)?

Magnetized water is obtained by passing water through a magnetic device or electro-magnetic field with specific strength and flow rate. The positive and negative charges of water molecules are strengthened resulting in their attraction and repulsion of water molecules. During structuring crowded clumps of water molecules are broken. This tiny and uniform cluster can easily enter the passageways in plant cell membranes. When water is magnetized, some properties changed which can alter the characteristics of plant, growth and production. MWT influences physicochemical properties of water that alter the quality of water

History of Magnetic water technology

Clayton Nolte, researcher and inventor of water structuring magnetic water technology. Dr. Masaru Emote demonstrated that the magnetic water is important as its content in promoting life and plant growth. This technology was first used in Russia and used mainly in countries like China, Poland, Isarel, Australia, Bulgaria, India and Mediterrian countries.

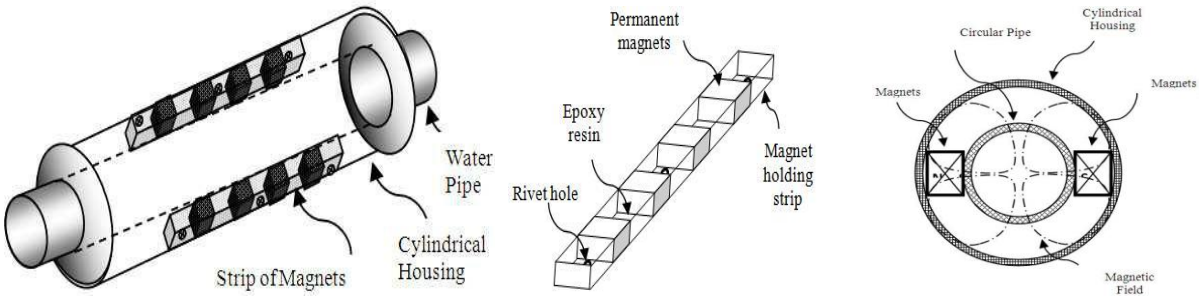

Fig.1. Construction and different parts of Magnetic Water Treatment Device

Why there is a need of magnetic water technology?

- Due to future availability of fresh water for agriculture is problematic.
- Due to increased salinity concentration of the ground irrigation water and depletion of fresh underground water.
- To make use and exploite the poor quality and saline water for irrigation purpose and to conserve the fresh water.
- To maintain and restore the fertility and physical and biological properties of soil.

Mechanism involved in the process of magnetic water treatment

Magnetic treatment device (water flows) – electrolysis takes place in which ionization of dissolved solids increases which will reverts the molecule distribution evenly. Faradays law and Lorentz force is exerted on water ions hence deactivation of anion takes place and energies and recharges the cation molecules. Thus, increases the efficiency due to more ion mobility, solubility of salts and restructured the water molecules. Hence, maximizes the absorption of nutrients by plants leading to higher yield and quality crops (Maheshwari and Grewal, 2009).

Changes in the properties of water after magnetization

Reduces the water pH, surface tension, electric conductivity, viscosity, increases the permeability of water in soil, alters the density of water, enhances the speed of infiltration rate and solubility level of ions in water increases

Benefits of Magnetic Water Technology in Fruit Crops

Magnetic water effects on soil properties

Reduces the soil pH, hence lowering soil alkalinity, dissolves slightly soluble salts, leaches the excess soluble salts away from roots zone, enhances the water holding capacity of soil, increases the nutrient mobility in soil, removes nitrate, sulphates and heavy metals from the soil and prevents formation of encrustations in the pores of soil

Magnetic water effects on crop

Helps in early germination of seeds, germination rate, proper development of root system, improves in quantity and quality of fruit, increases the nutrient content of crops and enhances the water and fertilizer use efficiency.

General benefits of magnetized water technology

Devices are eco friendly, low installation cost, no energy requirement, ability to use brackish water for irrigation, stops buildup of scale and rust, extends the life of the irrigation system and saves money, no water treatment cost, durable and long lasting and zero maintenance cost.

Role of Magnetic Water Technology in Different Fruit Crops

Grapes

In grape seedlings plants irrigated with magnetic water enhances the vegetative parameters by increasing ion mobility, number of ions and water molecules leading to increase in absorption and uptake of nutrient and water by plants, by enhancing photosynthesis and efficiency of translocation of photo assimilates leading to better vegetative growth. It also increased in root morphological characteristics by penetrating the soil faster and deeper, allowing the roots to penetrate and grow faster by enhancing faster absorption and uptake of minerals and water by roots leading to greater root growth. Magnetic treatments seem to cause conditions similar to stress for grapevine and as a result, it produces more secondary metabolites such as phenolic compounds to withstand this condition. Magnetic water and solutions in grapes by stimulating the biosynthesis of the phenolic compound can fortify the plant with these valuable metabolites

Citrus

By application of magnetized water in citrus seedlings enhances growth and photochrome element by effecting on phyto-hormone production leading to improving cell activity, increased mobile forms of fertilizers, increased water absorption, enhanced moisture content, increased photosynthetic pigments, increased endogenous IAA and increased activated the bio-enzyme systems which leads to the growth improvement. Magnetic water alleviates the damage to be caused on stomata from reducing the sodium accumulation in stomata proton pumps of seedlings and improved their stomata regulatory ability. It also enhanced the water status in plants by maintaining the stomatal conductance level. Magnetized water technique even under salinity condition (300ppm) had the highest values for growth parameters, leaf pigments content, (NPK %) and root extension in Valencia orange seedlings (Mahmoud *et al*., 2019). The nitrogen fertilization doses can be reduced by 20 per cent while maintaining the production and the possibility of increasing it by using magnetic water irrigation. The nitrogen fertilization efficiency and the nitrogen fertilization unit economic return were higher even with the reduction of nitrogen fertilization doses (Mahmoud *et al*., 2019)

Macadamia nut

Using magnetic water treatment on macadamias seedlings, led to the improvement of macadamia plants' growth rate, a faster photosynthetic activity and an overall increased plant vitality.

Fig

Application of magnetized water enhanced the plant height, chlorophyll content, plant dry weight, root weight and root numbers.

Pear

Irrigation with magnetic water increased significantly plant height, no. of leaves per plant as well as fresh and dry weight, root fresh weight as well as survival rate, N and P per cent of pear seedlings

Olive

Magnetic water enhanced the vegetative growth significantly (shoot length, leaf density and leaf surface area), number of fruits per shoot, total yield per tree and fruit physical characteristics, as well as macro and micro nutrients content in leaves, fruits and soil.

Banana

Applying magnetic water increased plant height and girth of banana and attained fewer days from planting to flowering and from flowering to harvest compared to normal water. Bunch weight and number of hands per bunch were also higher for magnetic water

Strawberry

The percentages of increase in number of flowers, number of fruits, fruit yield and quality of export production per 100 plants were recorded in magnetized water treated plants compared to normal irrigation water.

Using 75 and 50 per cent dose of NPK along with magnetized water increased the vegetative, yield, quality parameter and nutrient content of strawberry. It also enhanced the water use efficiency by maintain water status in plants and soil.

Mango

The increase of plant height, number of leaves per branch and number of fruits per plant was recorded on application of magnetized water as compared to non magnetized water.

Pomegranate

Irrigating with magnetized water along with the application of bio-fertilizers (PGPR or EM) has alleviated salinity in irrigation water and soil and increased the yield and fruit weight of Manfalouty pomegranate, also improved soil and water quality.

CONCLUSION

Magnetic water technology can be considered to be one of the most adaptive modern technology for saving irrigation water and to reduce the salt accumulation in soil and water in order to achieve maximum plant growth, nutrient content, crop yield and quality. It also enhances the efficiency of added fertilizers and promotes tolerance towards different stress conditions. Therefore, magnetic water technology could be one of encouraged way in the future to enhance crop production in an economically and environmentally friendly way. Hence, this will help the farmers to achieve more profit with minimizing the cost of production.

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