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# Structured Water: An Innovative Irrigation Option in Agriculture

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## Introduction

Today, water crisis is a major issue. It is undeniable fact that agriculture is the highest consumer of water and water has to be supplied to agriculture to realise high yield. Water is need not only for the plant but also for the soil and micro-organisms. Therefore, under the condition of water scarcity, scientific and judicious use of this precious input along with its conservation is highly needed. Besides, it is also needed to go for modern intervention so that water can be better utilized by the plants and generates benefits even with less use. Among recent interventions, one promising one is the use of structured water in agriculture.

Structured water concept is nothing new. Rainfall that we see, is the purest form of structured water as it is naturally energized in the atmosphere. It is worthy to highlight the fact that even at equal amount of availability, response of plants to irrigation and rainfall is different. Plant growth, vitality, appearance and production occur in far better way under rainfall as compared to irrigation as rain water is naturally energized. This concept of energizing water is now being utilized and successfully applied to benefit agriculture, human and livestock health as structured water.

## Structured Water

Structured water, also known as magnetized water or hexagonal water is a water where normal structure of water (tetrahedral) is modified into hexagonal shape. The chemical formula of structured water is  $H_3O_2$  instead of  $H_2O$  as common in case of normal water. Gerald Pollack of University of Washington is the pioneer of this structured water concept. According to Pollack, structured water is the 4<sup>th</sup> phase of water beyond liquid, solid and vapour (Pollack, 2013). Such kind of structured water is naturally formed and found in mountain springs, glacier melt, water fall or water from unpolluted sources. It is also found inside the cells of fruits and vegetables. Normal water contains big clusters of water molecules causing loose attraction of the water molecules and thereby, invites toxins and pollutants to enter inside the water molecule cluster. Such big cluster with presence of toxins get mostly blocked during passing through cell. But in structured water, as the hexagonal structure of molecules forms small cluster which can pass through the cell inside the plants (Ali *et al.*, 2014).

## Artificial Ways of Converting Regular Water into Structured Water

1. Magnetizing through vortex
2. Clamping magnets in pipes
3. Vigorous shaking of water
4. Running through obstructions
5. Shaking through magnetic field
6. Adding piezoelectric energy with crystals (enhydro quartz, blue topaz, laminar crystal, ANCHI crystals etc.)
7. Placing water in the vicinity of the magnet
8. Exposure to UV or infrared light
9. Exposure to natural heat or sunlight
10. Storing it in gemstone containers or egg-shaped container (and often swirling).

## Properties of Structured Water

1. Structured water exhibit antioxidant properties.
2. It has less viscosity and surface tension resulting in better penetration in cell walls and thereby, enhancement in hydration and bio-availability.

3. It shows rearrangement of water through improving H-bonding by 20-250 times more as compared to normal water.
4. It is more ionized and contains slightly more pH. (Just above 7.0), higher density (at least 10% more dense), oxygen content (by increasing air-water interface through vortexing), electrical potential (-200 mV) and less electrical conductivity and hardness than normal water.
5. It is a negatively charged water (formed through vortexing).
6. It does not contain toxins.
7. It contains hexagonal structure which can be visible through magnetic resonance spectroscopy.
8. Structured water checks the deposition or incrustation of dissolved substances in pipes/channels.
9. It possesses slightly concave meniscus.
10. It can neutralize the acidic effect of chlorine.

### Benefits of Structured Water Use in Agriculture

1. Structured water reduces salinity, sodium, TDS etc. and enables farmers to use good quality water for crop cultivation.
2. It conserves the water through reduction of water use by 20-30% and creates healthier ecosystem.
3. It makes healthy plants and improves crop growth and yield.
4. It keeps the soil minerals in balanced form.
5. It facilitates infiltration rates and thus, lowers surface evaporation water loss.
6. It reduces temperature, drought and salinity stresses.
7. Soil health improvement such as increase of water holding capacity (WHC), nutrient availability etc. is seen if structured water is applied.
8. It lowers the need of fertilizers and pesticides to an extent as nutrients and pesticides are easily solubilized in structured water.
9. Application of structured water imparts cooling effect in plants.
10. Structured water can be easily absorbed by the plant cells due to its electrical charge and plant saves energy which can be utilized in growth.
11. It ensures better taste and nutritional quality of the produce than normal water as structured water facilitates higher uptake of nutrients.
12. Cellular activity of plants is improved when the plants are irrigated with structured water.
13. It revitalizes the soil like rain water.
14. Structured water improves water use efficiency (WUE) and thereby, reduces cost of cultivation and increases profit of crop cultivation through producing higher economic product.
15. Structured water increases oxygen concentration and improves soil pH.
16. Seed germination, speed of emergence and root growth improve when structured water is applied in soil during sowing.
17. Crop watered with structured water provides produce with higher shelf life than the that from normal water.
18. Herbicide sprayed through solubilizing in structured water exhibits more effect on weeds as high absorption into the cell occurs.
19. Crop irrigated with structured water develops early canopy cover and shows competition against weeds.
20. It helps the crop through higher stomatal conductance, photosynthesis and translocation of photo-assimilates.
21. Structured water facilitates cell metabolism and mitosis.
22. Plants irrigated with structured water show vibrant colour/appearance.
23. It saves the energy.

### Technical Consideration of Structured Water Device

Energy or electro-magnetic force makes electrons around hydrogen of water to increase energy and change the way by which hydrogen molecule is connected to other molecules. In agriculture, structured water can be created by passing normal water through structured water device which is attached to the end of the pipe before use. Structured water device can be invasive or non-invasive. Invasive device needs a section of pipe to be fitted there. On the other hand, non-invasive device is wrapped around the pipe.

### Conclusion

Structured water technology has already opened the avenue in agriculture as a new innovation in the field of water management. However, it still lacks strong evidence regarding its efficacy. Therefore, various

research works on various crops in different location are needed to confirm the efficacy of this new technology in agriculture. Besides, actual functioning of structured water to improve soil, plant health and quality requires to be further elucidated. Development of cost-effective structured water device as well as transfusion of this new technology to farming community are also essential to avail the benefits of this new agricultural innovation in future.

## References

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