International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 3228-3233

Received: 05-05-2018
Accepted: 14-06-2018

Balesh Goudappanavar,
Department of Fruit Science, UHS, Bagalkot, Karnataka, India

DR Patil
Department of Agronomy, UHS, Bagalkot, Karnataka, India

Kulapati Hipparagi
Department of Fruit Science, UHS, Bagalkot, Karnataka, India

Correspondence
Balesh Goudappanavar,
Department of Fruit Science, UHS, Bagalkot, Karnataka, India

Interaction effect of structured water and fertilizer on growth and yield of grape (V*itis vinifera* L.) cv. Manjri Naveen

Balesh Goudappanavar, DR Patil and Kulapati Hipparagi

Abstract
A field experiment on 'Effect of structured water and fertilizer on growth, yield and quality of grape (*Vitis vinifera* L.) cv Manjri Naveen' was carried out during 2014-2015 at Main Horticultural Research and Extension Centre, University of Horticultural Sciences, Udyanagiri, Bagalkot. The experiment was laid out in split plot design with two types of water (structured water and bore well water) and five levels of fertilizer (100, 90, 80, 70, 60% of the RDF). Among the types of water, structured water recorded significantly the highest internodal length (4.83 cm and 5.35 cm) at 45 and 90 days respectively and girth of the fruiting shoot at 90 days (0.74 cm). The maximum berry diameter (13.42 mm), weight of 100 berries (169.98 g) and fruit yield (40.67 t/ha) were recorded. Among the levels of fertilizer, 100% RDF per vine was recorded significantly the highest internodal length (6.05 cm and 6.52 cm) at 45 and 90 days respectively and girth of the fruiting shoot at 90 days (0.85 cm). The maximum berry diameter (15.02 mm), weight of 100 berries (185.89 g) and fruit yield (44.07 t/ha). However, the interaction effect between types of water and levels of fertilizer at 90 days after for pruning in structured water recorded significantly highest the internodal length (6.70 cm) and girth (0.92 cm) of the fruiting shoot. The maximum berry diameter (15.26 mm), maximum weight of 100 berries (189.33 g) and fruit yield 45.30 t/ha.

Keywords: Berry diameter, bore well water, fertilizer, fruit yield, girth of the fruiting shoot, internodal length and structured water

Introduction
Grape *(Vitis vinifera* L.) belongs to the family Vitaceae and a commercially important sub-tropical fruit crop of peninsular India. It is the world's most important fruit in terms of total production and is considered as one of the most important fruits from the economic point of view. In India, the area under grape is estimated at 1.18 lakh ha (Anon., 2014) [3] with an annual production of 25.85 lakh tonnes and productivity of 21.8 Mt/ha. The major portion of the produce is made into wine, raisin and a small quantity is considered as dessert in many growing countries. In Karnataka, the major area in grapes is occupied by the Northern districts and the major portion of the produce is consumed as dessert and part is used as a raisin. Ripe berries contain 15-25 % of the glucose and many kinds of beneficial mineral composition and vitamins.

Structured water may be defined as layers of water slide over each other when vigorously shaken. They can be adsorbed electromagnetic force or energy. When water is turbulent, it is affected by magnetic field forces, which may be man made or natural. In nature, it occurs when water flows over magnetic rocks, obstructions, depressions and elevations resulting into "structured water". Rainmakers vortex technology revitalizes natural electromagnetic properties of water to convert water in to structured water. Bulk water is organized in to hexagonal clusters, thereby reducing surface tension of water.

In "structured water" (a) the positive and negative charges of water molecules are strengthened resulting in their attraction and repulsion, (b) water molecules make crystal chains, which helps in water absorption by the cells. During structuring crowded clumps of water molecules are broken. It is quite different from what we consider normal water. It is assimilated by the body more easily. It produces efficient cellular colloidal system. Structured water is the water that contains life giving nutrients and life force energy. These attributes lead to enhanced health and productivity for all the plants, animals, soils and people. These water activation units provide an excellent return on investment, chemical free, salt free and maintenance free.

Ordinary water can be converted into "structured water" by one of the following methods

- By clamping magnets on to the pipes conducting water
- Shaking water vigorously or string it with magnetic stirrer
- By shaking it with magnetic field.
- By running it through or over some obstructions such as smooth pebbles creating eddies/vortex.
- By swirling the water in a container.
- Drinking water proofed magnets in a container or putting water container in a proximity of magnet.

Structured water inhibits deposition or incrustation of dissolve substances. The phenomenon is not understood, yet it has useful application in saving boilers and connecting pipes from incrustation and choking. Structural water has a slightly raised less concave meniscus. It has a low surface tension and greater wetting property. Magnets are pseudo - softeners, but neither magnets nor structure water soften water chemically. Its pH is slightly above 7. This enables it to be assimilated in body fluids. The structured water neutralizes the acidic chlorine effect. The structured water breaks the clumps of water molecules and strengthens H-bond. Structured water seems to have memory (Syed and Haider., 2007) [17].

Material Methods

The field experiment was conducted during 2014-15 to study the "Effect of structured water and fertilizer on growth, yield and quality of grape (*Vitis vinifera* L.) cv. Manjri Naveen". The details of the material used and methods adopted during the course of investigation presented in this chapter. The field experiment was conducted at Main Horticultural Research and Extension Centre, University of Horticultural Sciences, Udyanagiri, Bagalkot. It is situated in the Northern Dry Zone (Zone-3) of Karnataka. The centre is located at 16º 10' North latitude, 75º 42' East longitude with an altitude of 542 m above the mean sea level.

The experiment consists of 10 treatments as detailed below.

M_1F_1	M_2F_1
M_1F_2	M_2F_2
M_1F_3	M_2F_3
M_1F_4	M_2F_4
M_1F_5	M_2F_5

A) Main plot treatments
M_1 – Structured water
M_2 – Bore well water

B) Sub plot treatments
F_1: 100 % RDF (As per package of practice and it is 300: 500: 1000 kg NPK/ ha)
F_2: 90 % of the RDF
F_3: 80 % of the RDF
F_4: 70 % of the RDF
F_5: 60 % of the RDF

Other Details

Plot size: Gross plot 3.0 m×1.5 m = 4.5 m^2
Spacing: 3.0 m ×1.5 m
Variety: Manjri Naveen
Recommended dose of fertilizer: 300:500:1000. N:P_2O_5:K_2O

Rainmaker H_2O Device

The Rain Maker H_2O device uses vortex, natural energetic technologies to replicate conditions as mountains spring water, can treat bore well water to its original nutrient dense state and generates structured water in this process. Vijay Precision Dies Pvt. Ltd. K.R.S. Road, Metagally, Mysore, 570016, Karnataka collaborated with Rain Maker H_2O, Wyoming, USA to bring Rain Maker H_2O to India (Fig 1).

Structured water contains life giving nutrients and life force energy for the plants, soil, microorganisms and animals. These attributes lead to enhanced health and productivity for all the plants, animals, soils and people. These water activation units provide an excellent return on investment, chemical free, salt free and maintenance free.

In the present investigation, water device supplied by Vijay Precision Dies Pvt. Ltd. K.R.S. Road, Metagally, Mysore, 570016, Karnataka was connected to the irrigation pipes to convert the normal water into structured water.

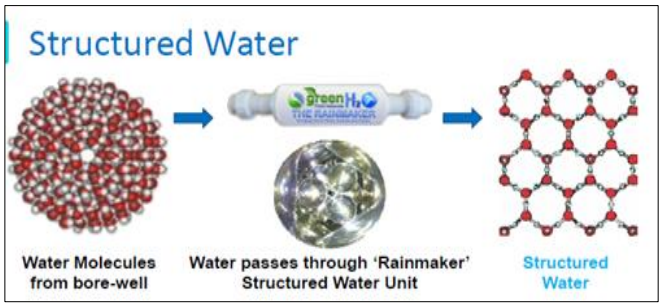

Fig 1

Water Treatments: Two types of water were used during the experiment, the first was structured water (magnetized) and the second was bore well water.

NPK Fertilization: Five levels of NPK fertilizers, namely 60, 70, 80, 90 and 100 percent sof the recommended fertilizer dose (300:500:1000 NPK kg/ha) were used as per the treatments. The design of the experiment was split plot with three replications and 10 treatments which were the combinations of two irrigation water treatments and five levels of NPK fertilizers. The main plots were devoted to the irrigation water treatments, while the NPK fertilizers were allotted in sub plots.

Internodal length of fruiting shoot (cm)

Three vines were selected per treatment and four fruiting shoots per vine were selected for measurement of internodal length of fruiting shoot between fourth and fifth node with the help of scale at two stages *viz.*, 45 and 90 days after fore pruning.

Girth of fruiting shoot (cm)

Three vines were selected per treatment and four fruiting shoots per vine were selected for measurement of girth

between fourth and fifth node with the help of vernier calipers at two stages *viz.,* 45 and 90 days after fore pruning.

Weight of 100 berries (g)
Weight of hundred berries from each treatment was recorded and expressed in milligram.

Diameter of the berry (mm)
Berry diameter of fifteen berries in each treatment was measured with the help of vernier calipers and average berry diameter was calculated and expressed in millimeter

Yield (t/ha)
The yield of vines in each treatment was recorded and average yield per hectare was calculated and expressed in tonnes per hectare.

Statistical Analysis
The design adopted was split spot. The data was subjected to statistical analysis as per the procedure out lined by Panse and Sukhatme (1985) [15].

Results and Discussion
The maximum internodal length of the fruiting shoot at 45th and 90th day after fore pruning recorded 4.83 cm and 5.35 cm in structured water as compared to bore well water 4.55 cm and 4.75 cm respectively (Table 1). The highest internodal length of the fruiting shoot in structured water may be due to magnetic force created when water was passing through the rainmaker H_2O device which converts normal water in to structured water. The similar results were observed by Pattepur. (2015) in grapevine cv. Thompson Seedless. Further, irrigation by magnetically treated water also increases shoot length and plant height in feba bean plant (Maheshwari and Grewal, 2009) [11], Fabian Lucas Ptok (2014) [7] in mung bean and alfalfa plant.

Table 1: Internodal length of fruiting shoot (cm) between 4th and 5th node after fore pruning in grape cv. Manjri Naveen as influenced by types of water and levels of fertilizer

Treatments	Inter nodal length of fruiting shoot (cm)							
Levels of Fertilizer	At 45 days after fore pruning				At 90 days after fore pruning			
	M_1	M_2	Mean		M_1	M_2	Mean	
F_1	6.20	5.90	6.05		6.70	6.35	6.52	
F_2	5.60	4.83	5.27		5.95	4.93	5.37	
F_3	4.30	4.18	4.23		4.93	4.40	4.67	
F_4	4.13	4.00	4.07		4.83	4.11	4.47	
F_5	3.90	3.73	3.82		4.40	4.03	4.20	
Mean	4.83	4.55			5.35	4.75		
	Types of water (A)	Levels of fertilizer (B)	Factor B at same level of A	Factor A at same level of B or different	Types of water (A)	Levels of fertilizer (B)	Factor B at same level of A	Factor A at same level of B or different
S.Em±	0.04	0.04	0.09	0.065	0.03	0.08	0.08	0.11
CD (0.05%)	0.25	0.12	0.24	0.27	0.22	0.25	0.40	0.37

M_1: Structured water
M_2: Bore well water
F_1:100% RDF
F_2:90% RDF
F_3:80% RDF
F_4:70% RDF
F_5:60% RDF
RDF: Recommended dose of fertilizer
NS: Non significant

The application of 100 per cent of (RDF) showed significantly highest internodal length of the fruiting shoot of 6.05 cm and 6.58 cm at 45th and 90th days after fore pruning, respectively and was superior over the other treatments (Table 1). It may be due to increase in nitrogen application increases the nitrogen content in the petiole. The similar results were found by Pattepur. (2015) in grape cv. Thompson Seedless, Martin *et al.* (2004) [14] in 'Tempranillo' grapes, Marjan *et al.* (2013) [13] in grape cv. Asgari.
The magnetic water is considered as one of the physical factors which affect the plant growth and its development. In structured water, the positive and negative charges of water molecules are strengthened resulting in their attraction and repulsion, water molecules make crystal chains, which help in water absorption by the cells. During structuring crowded clumps of water molecules are broken. It helps for obtaining the available carbohydrates, water, nutrients uptake, photosynthetic activity, plant metabolism. This may be helpful in increasing internodal length and fruiting shoot of the cane. The similar results were obtained by Atak *et al.* (2003) [4] in soyabean plant. Syed and Haider. (2007) [17], Helal *et al.* in comman bean, (2011) [9], Ahmed *et al.* in faba bean, (2013) [2] and fabian, (2014) [7] in mung bean and alfalfa. Structured water with 100 % RDF recorded highest internodal length of the fruiting shoot 6.20 cm and 6.70 cm at 45th and 90th days after fore pruning, respectively. The equivalent results were noticed by Pattepur (2015).

At 90th days after fore pruning, significantly the highest girth of the fruiting shoot 0.74 cm was recorded in structured water as compared to bore well water (Table 2). The 100 per cent of recommended dose of fertilizer (RDF) showed the significantly the highest girth of the fruiting shoot 0.85cm at 90th days after fore pruning. The interaction effect between types of water and different levels of fertilizer on girth of the fruiting shoot found to be significant at 90th days after fore pruning in structured water with 100 % RDF recorded the highest girth of the fruiting shoot (0.92 cm). Use of structured water with 100% RDF might have helped in the later stages of growth i.e. 90 days after fore pruning which resulted in significant difference with respect to girth.
The structured (magnetized) water having the positive and negative charges of water molecules are strengthened resulting in their attraction and repulsion, water molecules make crystal chains, which help in water absorption by the cells. During structuring crowded clumps of water molecules are broken and helps for obtaining the available carbohydrates, water, nutrients uptake, photosynthetic activity, plant metabolism, chloroplast development, axillary bud development and cytokine. This might have helped in increase in the girth of the cane and also increases fruiting shoot. The similar results were obtained by Atak *et al.* (2003) [4] in soyabean plant. Helal *et al.* (2011) [9] in comman bean, Ahmed *et al.* in faba bean, (2013) [2] and Fabian, Fabian Lucas Ptok (2014) [7] in mung bean and alfalfa.

The maximum weight of 100 berries (Table 3) was obtained in structured water (169.98 g) as compared to bore well water (163.30 g). This was due to more number of panicles per cane and also the maximum number of panicles per vine could be influenced by irrigating structured water. Among the different levels of fertilizer, 100 per cent recommended dose of fertilizer (RDF) per vine showed the maximum weight of 100 berries (185.89 g) and the minimum weight of 100 berries were recorded in 60 per cent RDF (147.73 g). Amira (2010) [12] was also observed increase in seed weight in flax crop with the use of magnetic water than tap water. The structured water with 100 % RDF recorded the highest berry diameter (15.26 mm) followed by 100 per cent RDF in case of bore well water (14.76 mm). The lowest berry diameter (9.70 mm). In the present investigation, structured water might have helped in more absorption of water by the cells and nutrient to the canes. This may have resulted in more berry diameter. Similar results were obtained by Ganeshmurthy *et al.* (2010) in grape.

The interaction effect between types of water and different levels of fertilizer on weight of 100 berries was significant. The structured water with 100 per cent RDF was recorded significantly highest weight of 100 berries (189.33 g) as compared to other interaction treatments followed by bore well water with 100 per cent RDF (182.45 g). Significantly lowest weight of 100 berries (145.37 g) was recorded in bore well water with 60 per cent RDF as compared to other interaction treatments. The interaction effect between types of water and different levels of fertilizer on weight of 100 berries was found to be significant. The structured water with 100 per cent RDF recorded the highest weight of 100 berries (189.33 g) followed by 100 per cent RDF in case of bore well water (182.45 g). The lowest weight of 100 berries (145.37 g).

Table 2: Girth of the fruiting shoot (cm) between 4th and 5th node after fore pruning in grape cv. Manjri Naveen as influenced by types of water and levels of fertilizer

Treatments	**Girth of the fruiting shoot (cm)**			
Levels of Fertilizer	**At 90 days after fore pruning**			
	M_1	**M_2**	**Mean**	
F_1	0.92	0.78	0.85	
F_2	0.82	0.68	0.75	
F_3	0.77	0.58	0.68	
F_4	0.65	0.50	0.58	
F_5	0.54	0.48	0.51	
Mean	0.74	0.60		
	Types of water (A)	Levels of fertilizer (B)	Factor B at same level of A	Factor A at same level of B or different
S.Em±	0.02	0.014	0.038	0.024
CD (0.05%)	0.10	0.04	0.089	0.072

The interaction effect between types of water and different levels of fertilizer on weight of 100 berries was significant. The structured water with 100 per cent RDF was recorded significantly highest weight of 100 berries (189.33 g) as compared to other interaction treatments followed by bore well water with 100 per cent RDF (182.45 g). Significantly lowest weight of 100 berries (145.37 g) was recorded in bore well water with 60 per cent RDF as compared to other interaction treatments. The interaction effect between types of water and different levels of fertilizer on weight of 100 berries was found to be significant. The structured water with 100 per cent RDF recorded the highest weight of 100 berries (189.33 g) followed by 100 per cent RDF in case of bore well water (182.45 g). The lowest weight of 100 berries (145.37 g).

The significant increase in yield parameters like number of panicle per vine, number of panicle per cane, number bunches per vine, weight of bunches, berry diameter and weight of 100 berries in structured water may be due to water molecules make crystal chains and helps in water absorption by the cells. During structure crowded clumps of water molecules are broken and absorbed by plant system more easily. Structured water produces efficient cellular colloidal system helps for activation of ions and polarization of dipoles in living cells, so that plant absorb nutrient easily, active root zone and hormonal changes (Syed and Haider, 2007) [17]. Similar results were obtained by Mahmoud and Amira (2010) [12] in flax crop and Abou *et al.* (2012) [1] in tomato crop.

The perusal of data revealed that the yield per hectare was found to be significant with types of water and levels of fertilizer (Table 4). The maximum yield per hectare was obtained in structured water (40.67 t/ha) as compared to bore well water (38.62 t/ha). This was due to more number of panicles per cane and also the maximum number of panicle per vine. Among the different levels of fertilizer, 100 per cent recommended dose of fertilizer (RDF) per vine showed maximum yield per hectare (44.07t/ha) and the minimum yield per hectare was recorded in 60 per cent RDF (34.80 t/ha).

The interaction effect between types of water and levels of fertilizer on yield per hectare was found to be significant. The structured water with 100 per cent RDF was recorded significantly the highest yield per hectare (45.30t/ha) as compared to other interaction treatments followed by bore well water with 100 per cent RDF (42.84t/ha) which was at par with structured water 90 per cent RDF. Significantly the lowest yield per hectare (34.80t/ha) was recorded in bore well water with 60 per cent RDF followed by structured water with 60 per cent RDF (36.38t/ha). The interaction effect between types of water and different levels of fertilizer on yield per hectare was found to be significant. The structured water with 100 per cent RDF recorded highest yield per hectare (45.30t/ha) followed by 100 per cent RDF in case of bore well water (42.84 t/ha). The lowest yield per hectare (34.80 t/ha) was recorded in bore well water with 60 per cent RDF.

Table 3: Berry diameters (mm) and weight of 100 berries (g) in grape cv. Manjri Naveen as influenced by types of water and levels of fertilizer.

Treatments	Berry diameters (mm)				Weight of 100 berries (g)			
Levels of Fertilizer	**M_1**	**M_2**	**Mean**		**M_1**	**M_2**	**Mean**	
F_1	15.26	14.76	15.02		189.33	182.45	185.89	
F_2	14.56	14.07	14.32		180.12	170.15	175.13	
F_3	13.77	13.13	13.45		168.02	163.25	165.63	
F_4	12.50	11.00	11.75		162.33	155.29	158.81	
F_5	11.00	9.70	10.35		150.10	145.37	147.73	
Mean	13.42	12.53			169.98	163.30		
	Types of water (A)	Levels of fertilizer (B)	Factor B at same level A	Factor A at same level B or different	Types of water (A)	Levels of fertilize (B)	Factor B at same level A	Factor A at same level B or different
S.Em±	0.02	0.04	0.04	0.05	0.05	0.07	0.11	0.10
CD (0.05%)	0.10	0.11	0.18	0.17	0.32	0.21	0.39	0.40

The interaction effect between types of water and different levels of fertilizer on yield per hectare was found to be significant. The structured water with 100 per cent RDF recorded highest yield per hectare (45.30 t/ha) followed by 100 per cent RDF in case of bore well water (42.84 t/ha). The lowest yield per hectare (34.80 t/ha) was recorded in bore well water with 60 per cent RDF (Plate 4).

The increase in girth of cane and fruiting shoot, internodal length of the cane and fruiting cane, number of panicle per vine, number of panicle per cane, number bunches per vine, weight of bunches, berry diameters and weight of 100 berries in structure water contributed to the more yield than bore well water. Because of structured water having the positive and negative charges of water molecules are strengthened resulting in their attraction and repulsion, water molecules make crystal chains, which helps in water absorption by the cells. During structuring crowded clumps of water molecules are broken. It produces efficient cellular colloidal system. The similar results were found by the magnetic treated water increased all yield characters namely plant height, technical length, based branches, fruit branches, capsules numbers weight per plant, seed number per capsules, seed number per plant and 100 seed weight over untreated by Mahamoud and Amira (2010) [12] in Flax crop. There were differential effects of magnetic treatments of different irrigation water types on yield based on fresh weight and shoot dry weight by (Maheshwari and Grewal, 2009) [11] in Celery crop. The similar results were observed by Tian *et al.* (1989) [18] in, Christopher *et al.* (2003) [5] in persimmon fruit and Danivol *et al.* (2004) [6] in tomato crop.

Table 4: Yield in grape cv. Manjri Naveen as influenced by types of water and levels of fertilizer.

Treatments	Yield t/ha			
Levels of Fertilizer	**M_1**	**M_2**	**Mean**	
F_1	45.30	42.84	44.07	
F_2	42.73	40.53	41.63	
F_3	40.56	38.33	39.45	
F_4	38.42	36.61	37.52	
F_5	36.38	34.80	35.56	
Mean	40.67	38.62		
	Types of water (A)	Fertilizer levels (B)	Factor B at same level of A	Factor A at same level of B or different
S.Em±	0.01	0.03	0.03	0.04
CD (0.05%)	0.07	0.09	0.14	0.13

References

1. Abou El-Yazied A, El-Gizawy AM, Khalf SM, El-Satar A, Shalaby OA. Effect of magnetic field treatments for seeds and irrigation water as well as N, P and K levels on productivity of Tomato plants. J Appl. Sci. Res. 2012; 8(4):2088-2099.
2. Ahmed IM, Bassem ME. Effect of irrigation with magnetically treated water on faba bean growth and composition. International. J Agri. Pol and Res. 2013; 1(2):024-040.
3. Anonymous, Indian Horticulture database, www. nhb. 2014.
4. Atak C, Emiroglu O, Aklimanoglu S, Rzakoulieva A. Stimulation of regeneration by magnetic field insoybean (*Glycine max* L. Merrill) tissue cultures. J Cell. Mol. Biol. 2003; 2:113-119.
5. Christopher J, Clark J, MacFall S. Quantitative magnetic resonance imaging of 'Fuyu' persimmon fruit during development and ripening. Magnetic Resonance Imaging. 2003; 21(6):679-685.
6. Danilov V, Bas T, Eltez RMA. Artificial magnetic field effect on yield and quality of tomatoes yield. *SHS Acta* Hort., 366: II Symposium on Protected Cultivation of Solanaceae in Mild Winter Climates, 2004, 54.
7. Fabian LP. Alternative Irrigation Methods: Structured Water in the context of a Growing Global Food Crisis due to Water Shortages. Undergraduate Honors Thesis. 2014, 182.
8. Ganeshamurthy AN, Satisha GC, Prakash P. Potassium nutrition on yield and quality of fruit crops with special emphasis on banana and grapes. Karnataka J Agri. Sci. 2011; 24(1):29-38.
9. Helal RM. The impact of magnetic water application for improving common bean (*Phaseolus vulgaris* L.) production. New York Sci. J. 2011; 4(6):15-20. ISSN: 1554-0200.
10. Hilal HM, Hilal MM. Application of magnetic technologies in desert agriculture 11- Effect of magnetic treatments of irrigation water on salt distribution in olive and citrus fields and induced changes of ionic balance in soil and plant. Egypt J Soil. Sci. 2000; 40(3):423-435.
11. Maheshwari BL, Grewal HS. Magnetic treatment of irrigation water: its effect on vegetable crop yield and water productivity. Agri. Water Mangt. 2009; 96:1229-1236.
12. Mahmoud H, Amira MSA. Irrigation with magnetized water enhances growth, chemical constituent and yield of

chickpea (*Cicer arietinum* L.). Agri. and bio. J North America. 2010, ISSN Print: 2151-7517.
13. Marjan A, Abolfazl L, Sedighe Z, Sajad M. Effects of N and Zn on quantity and quality characters of grape vine (*Vitis Viniferea* L.). International J Agri and Crop Sci. 2013. Available online at www.ijagcs.com IJACS/2013/5-3/207-211ISSN 2227- 670.
14. Martin P, Delgado R, González MR, Gallegos JI. Colour of 'Tempranillo' grapes as affected by different nitrogen and potassium fertilization rates. Acta Hort., 2004; 652:153-159.
15. Panse VG, Sukhtme PV. Statistical methods for agricultural workers. Indian Council of Agricultural Reseach., New Dehli, 1985.
16. Sateesh P. Effect of structured water on yield and quality of Grape (*Vitis vinifera* L.) variety Thompson Seedless. Report submitted to VWF Industries Pvt. Ltd, 90, KRS Road, Metagally, Mysore, 2015.
17. Syed MH, Haider A. The structured water in sprinkler and drip irrigation system. Proceedings international symposium on prospects of horticultural industry in Pakistan, 2007.
18. Tian WX, Kuang YL, Mei ZP. Effect of magnetic water on seed germination, seedling growth and grain yield of rice. J Jilin Agri. Univ. 1989; 11(4):107-108.