Research Paper

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Effect Of Structured Water And Fertilizer On Petiole Content (N, P And K) Of Grape (*Vitis Vinifera* L.) Cv. Manjri Naveen

Fruit Science

KEYWORDS : Bore well water, Fertilizer, Interaction, Nitrogen, Petiole, Phosphorus, Potassium and Structured water

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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 consisted of types of water (Structured water and Bore well water) and five levels of fertilizer (100, 90, 80, 70, 60 % of the RDF) and was laid out in split plot design.

Among the types of water, structured water recorded significantly the highest percentage of N (1.38 and 1.42%), P (0.47 and 0.57%) and K (2.31 and 2.64%) content in petiole at 45 and 90 days respectively. Among the levels of fertilizer, 100% RDF per vine was recorded significantly the highest percentage of N (1.45 and 1.50%), P (0.55 and 0.64%) and K (2.61 and 2.90%) content in petiole at 45 and 90 days respectively recorded in 100% RDF.

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) 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).

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 16° 10' North latitude, 75° 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

Main plot treatments

M_1 – Structured water
M_2 – Bore well water
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 kg / ha

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 (control) of 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.

Petiole analysis

At the present investigation, leaf petiole opposite to inflorescence were collected at bloom stage, as suggested by Cook and Wheeler (1978) for nutrient analysis. The petiole samples were dried and powered in laboratory for analysis.

Leaf petiole samples were washed sequentially in 0.2 per cent detergent solution or twice in distilled water. After surface drying with blotting paper, the samples were dried in a forced draft air oven at 70°C until a constant weight was recorded. The dried samples were ground in a Willey mill and stored in airtight container. Estimation of total nitrogen was done by following method

Nitrogen (%)
Nitrogen content in leaf was determined by Kjeldhal distillation method. A known weight of sample was digested with conc. H_2SO_4 and digestion mixture. The digested samples were distilled for estimating N-content as outlined by Piper (1966).

Phosphorus (%)
Intensity of phosphorus in di-acid digested sample was estimated by phospho-vanado-molybdate complex method. Yellow colour was read using spectrophotometer at 430 nm and was estimated by referring to standard curve (Piper, 1966).

Potash (%)
The di-acid digest sample was fed to a calibrated flame photometer and per cent potassium was calculated by following Piper (1966) method.

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).

Results and Discussion
The data showed that the nitrogen was found to be significant with types of water (Table 1). Significantly the maximum nitrogen was recorded in structured water (1.38%) as compared to bore well water (1.35%). The nitrogen was found to be significant with levels of fertilizer. Among the different levels of fertilizer, 100 per cent RDF recorded significantly maximum nitrogen (1.45%) as compared to other levels of treatments followed by 90 per cent RDF (1.40%). Significantly the minimum nitrogen was recorded in 60 per cent RDF (1.30%)

The maximum nitrogen content in petiole was found in application of structured water with 100% RDF may be due to increase in N supply enhanced N-concentrations in the petioles. Similar results were observed by Marjan *et al.* (2013), Aurelie Metay *et al.* (2014) and Wolf *et al.* (1983) in grape. Abd El-Razek *et al.* (2011) reported that higher N-fertilization improved vegetative growth (leaf area, cane diameter) and reduced bud burst, bud fertility and fruitfulness.

The data indicated that the phosphorus was found to be significant with types of water (Table 1). Significantly the maximum phosphorus was noticed in structured water (0.47%) as compared to bore well water (0.43%). The phosphorus was found to be significant with levels of fertilizer. Among the different levels of fertilizer, 100 per cent RDF recorded significantly maximum phosphorus (0.55%) and was superior over other treatments followed by 90 per cent RDF (0.50%). Significantly the minimum phosphorus was recorded in 60 per cent RDF (0.36%) followed by with 70 per cent RDF (0.39%).

The maximum phosphorus content in petiole was recorded with the application of structured water with 100% RDF is due to higher P_2O_5 content in RDF. The similar results were observed by Grant and Mathews (1996), Smolarz and Marcik (1997) in grape, Abou *et al.* (2012) in tomato and Dimitrios *et al.* (2013) in cotton.

The results revealed that the potassium was found to be significant with types of water (Table 1). Significantly the maximum potassium was found in structured water (2.31 per cent) as compared to bore well water (2.18%). The potassium was found to be significant with levels of fertilizer. Among the different levels of fertilizer, 100 per cent RDF noticed significantly maximum potassium (2.61%) as compared to other levels of treatments followed by 90 per cent RDF (2.41%). Significantly the minimum potassium was recorded in 60 per cent RDF (1.80%).

The maximum potassium content in petiole was found with the application of structured water with 100% RDF is due to application of higher K through RDF. Morris and Cawthon (1982) also reported application of K increased the K concentration in the petiole analysis in Concord grape. The similar results were observed by Poni *et al.* (2003) in grape cv. Caber-

net Sauvignon and Al-Moshileh and Al-Rayes (2004) in table grape.

Table 1. Percentage of N, P and K content in petiole at 45 days after back pruning (April) as influenced by types of water and levels of fertilizer

	Nitrogen (%)				Phosphorus (%)				Potassium (%)			
Levels of Fertilizer	M_1	M_2	Mean		M_1	M_2	Mean		M_1	M_2	Mean	
F_1	1.47	1.43	1.45		0.57	0.53	0.55		2.72	2.50	2.61	
F_2	1.42	1.38	1.40		0.53	0.48	0.50		2.48	2.33	2.41	
F_3	1.37	1.33	1.35		0.48	0.44	0.45		2.33	2.20	2.27	
F_4	1.33	1.31	1.32		0.40	0.38	0.39		2.17	2.10	2.13	
F_5	1.30	1.30	1.30		0.37	0.35	0.36		1.87	1.73	1.80	
Mean	1.38	1.35			0.47	0.43			2.31	2.18		
	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	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±	0.001	0.048	0.002	0.006	0.002	0.005	0.015	0.007	0.007	0.028	0.017	0.037
CD (0.05%)	0.005	0.008	NS	NS	0.013	0.016	NS	NS	0.046	0.085	NS	NS

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

The data revealed that the nitrogen was found to be significant with types of water (Table 2). Significantly the maximum nitrogen was recorded in structured water (1.42%) as compared to bore well water (1.38%). The nitrogen was found to be significant with levels of fertilizer. Among the different levels of fertilizer, 100 per cent RDF noticed significantly maximum nitrogen (1.50%) followed by 90 per cent RDF (1.44%). Significantly the minimum nitrogen was recorded in 60 per cent RDF (1.31%) followed by 70 per cent RDF (1.35%). The interaction effect between types of water and different levels of fertilizer on nitrogen was found to be non-significant.

The maximum nitrogen content in petiole was found with the application of structured water with 100% RDF is due to increasing N supply through RDF. Similar results were observed by Marjan *et al.* (2013) grapevine, Aurelie Metay *et al.* (2014) in grape and Wolf *et al.* (1983) where in enhanced N-concentrations in the petioles may be due to increase in N supply.

The results revealed that the phosphorus was found to be significant with types of water (Table 2). Significantly the maximum phosphorus was noticed in structured water (0.57%) as compared to bore well water (0.51%). The phosphorus was found to be significant with levels of fertilizer. Among the different levels of fertilizer, 100 per cent RDF recorded significantly the maximum phosphorus (0.64%) as compared to other levels of treatments followed by 90 per cent RDF (0.60%). Significantly the minimum phosphorus was recorded in 60 per cent RDF (0.44%) followed by 70 per cent RDF (0.48%).

The maximum phosphorus content in petiole was recorded with the application of structured water with 100% RDF because of excessive P content in RDF. Similar results were observed by Grant and Matthews (1996) in grapevine and Smolarz and Marcik (1997) in grape.

Table 2. Percentage of N, P and K content in petiole at 90 days after fore pruning (October) as influenced by types of water and levels of fertilizer

	Nitrogen (%)				Phosphorus (%)				Potassium (%)			
Levels of Fertilizer	M_1	M_2	Mean		M_1	M_2	Mean		M_1	M_2	Mean	
F_1	1.52	1.48	1.50		0.68	0.61	0.64		3.07	2.73	2.90	
F_2	1.47	1.42	1.44		0.62	0.57	0.59		2.87	2.48	2.67	
F_3	1.42	1.38	1.40		0.57	0.52	0.54		2.60	2.30	2.45	
F_4	1.36	1.33	1.35		0.53	0.44	0.48		2.40	2.17	2.28	
F_5	1.33	1.30	1.31		0.48	0.40	0.44		2.67	1.90	2.10	
Mean	1.42	1.38			0.57	0.51			2.64	2.31		
	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	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±	0.003	0.008	0.006	0.010	0.006	0.0041	0.004	0.008	0.046	0.025	0.104	0.057
CD (0.05%)	0.015	0.025	NS	NS	0.036	0.012	NS	NS	0.286	0.077	NS	NS

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

F_5 : 60% RDF

The perusal of data revealed that the potassium was found to be significant with types of water (Table 2). Significantly the maximum potassium was noticed in structured water (2.64%) as compared to bore well water (2.31%). The potassium was found to be significant with level of fertilizer. Among the different levels of fertilizer, 100 per cent RDF recorded significantly maximum potassium (2.90%) as compared to other levels of fertilizer treatments followed by 90 per cent RDF (2.67%). Significantly the minimum potassium was recorded in 60 per cent RDF (2.10%) followed by 70 per cent RDF (2.28%).

The soils receiving structured water with 100% RDF noticed maximum K content in petiole may be due to application of K through RDF. Similar results were obtained by Poni *et al.* (2003) in grape cv. Cabernet Sauvignon, Al-Moshileh and Al-Rayes (2004) in grape and Morris and Cawthon (1982) recorded that the application of K increased the K concentration in the petiole analysis in Concord grape.

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