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Efficacy of Structured Water Vortex Generators and Scalar Frequency Enhancement on Yield, Fruit Quality, and Water Use Efficiency in Organic Tomato Production

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Abstract

A 15-week grow trial conducted from 31 October 2025 to 13 February 2026 at South Regional TAFE, Bunbury Campus, Western Australia, evaluated the effectiveness of Structured Water Vortex Generators (SWVG) Model PW75 and SWVG combined with a scalar generator, compared with a control treatment. Equipment was supplied by President Water. All water used in the trial was pre-filtered through 20” x 4.5” housings fitted with GE DGD 50-5 sediment filters and Pentair CRFC radial flow cartridges to reduce the potential detrimental effects of chloramines in municipal water on soil biology.

Three garden beds were assessed: Bed 1 Control, Bed 2 with the SWVG PW75, and Bed 3 with the SWVG PW75 combined with scalar frequency enhancement at 432 Hz, in the production of organic Solanum lycopersicum (Ox Heart and Juane Flamme) tomatoes. The alternative hypothesis (H_1) proposed that SWVG and SWVG + Scalar treatments would increase yield and fruit quality compared with the control. Results supported this hypothesis, with Bed 2 yielding 23.25% more than the control and Bed 3 achieving a 141.14% increase over the control.

Across the treated beds (Beds 2 and 3), **water use was reduced by 18.2%**. Microbial biomass testing at trial completion showed total biomass of 1367 µg/g in Bed 1 (Control), 2599 µg/g in Bed 2 (SWVG), and 3540 µg/g in Bed 3 (SWVG + Scalar), representing increases of 90.1% and 159.0% respectively over the control. Bed 3 produced the strongest performance in both yield and fruit quality. Bed 2 yield/results were affected by irrigation issues during the campus Christmas shutdown period, when one of the three emitters became completely blocked, as confirmed by soil moisture data and video observations. Overall, these findings suggest that SWVG and SWVG + Scalar may enhance yield, quality, and water-use efficiency, with promising implications for sustainable horticulture.

Introduction

Water structuring through vortex spin motion is a natural process that can enhance the physical, chemical, and biological properties and behaviour of water. Structured Water Vortex Generators are designed to mimic this natural process by increasing coherence, dissolved oxygen, nutrient bioavailability, and microbial activity, which may contribute to stronger plant growth, improved fruit quality, and reduced water, energy, and fertiliser requirements.

Scalar frequency enhancement is used as a complementary process alongside vortex-based water structuring to further improve the performance and vitality of water in biological growing systems. By applying specific frequencies to vortexed water, this technology is believed to support greater water coherence, improve nutrient uptake, stimulate beneficial microbial activity, and enhance the plant's ability to absorb and utilise water more efficiently. In horticultural production, these combined effects may contribute to higher yields, improved crop quality, and better water-use efficiency.

In regions such as Western Australia, where water quality can present challenges for horticultural production, these technologies may offer a practical and regenerative approach to improving productivity, resilience, and sustainability.

Experimental Design

The trial was conducted from 31 October 2025 to 13 February 2026 at SR TAFE, Bunbury Campus (33.35°S, 115.64°E). Three identical raised steel garden beds (2750 mm × 750 mm) were prepared using soil from previous mustard cover crops, topped with 20 mm of organic compost and 75 mm of straw to assist with moisture retention. Each bed was planted with two Ox Heart and two Juane Flamme tomato plants. Beds were trellised using reo concrete mesh and irrigated via 19 mm poly pipe fitted with three emitters connected to mains water.

Water delivery was controlled using a Rain Smart Irrigation System, set to run Bed 1 for 11 minutes daily and Beds 2 and 3 for 9 minutes daily.

- Bed 1 (Control): Filtered water only
- Bed 2 (Vortex Generator): Filtered water + PW75 Vortex Generator
- Bed 3 (Vortex + Scalar): Filtered water + PW75 Vortex Generator + Scalar Frequency Generator at 432 Hz

At planting, and on two additional occasions during the trial, all seedlings were treated with Neutrog GoGo Juice at a rate of 40 mL per 10 L of water. No synthetic soil amendments were used. On one occasion, Coles brand milk powder (1 kg in 10 L of water) was applied as a foliar treatment to address blossom end rot.

Data Collection

Tomatoes were harvested periodically and weighed using digital scales. Soil was monitored most weeks using an electronic soil meter, with measurements including nitrogen, phosphorus, potassium, electrical conductivity, temperature, and moisture. Visual observations of plant health and fruit quality were recorded regularly through photographs and video documentation.

Data, Images and video can be found here: https://drive.google.com/drive/folders/1shgoPCm4Bl_LWOZl9T4FJtlXvWS4Mi1M?usp=sharing

Results

Total yields showed clear differences across the three water treatments. Bed 2 yielded 23.25% more than Bed 1 (Control), while Bed 3 produced 141.14% more than the control. Water use in Beds 2 and 3 was reduced by 18.2% through the Rain Smart Irrigation System settings.

Tomato size and colour also varied across treatments, with fruit from Bed 3 appearing larger and darker red. Plants in Beds 2 and 3 showed darker green foliage and greater turgidity than those in the control bed.

Only a small amount of blossom end rot was observed in Beds 1 and 2 compared with the previous year. Overall, both yield and quality trends supported the view that SWVG and SWVG + Scalar treatments contributed positively to crop performance, with the strongest response recorded in the combined treatment.

Table 1. Yield data for 2 × Ox Heart and 2 × Juane Flamme plants per bed.

Date	Bed 1 (Town Supply) Control Weight (kg)	Bed 2 (Vortex Generator) Weight (kg)	Bed 3 (Combined) Carbon Filter + Vortex Generator Weight (kg)
13/01/2026	0.59	0.16	0.75
14/01/2026	-	0.29	-
16/01/2026	0.50	0.03	0.72
19/01/2026	1.30	1.83	1.67
21/01/2026	0.38	1.70	2.70
23/01/2026	4.35	5.42	12.92
30/01/2026	1.87	3.50	8.90
05/02/2026	5.57	5.32	7.24
09/02/2026	0.40	0.90	2.10
13/02/2026	2.20	2.00	4.38
Total Yield (kg)	**17.16**	**21.15**	**41.38**

Water Use Efficiency and Production per Unit of Water

Water productivity — defined here as the ratio of marketable fruit yield to total irrigation input — is a key metric for evaluating the practical benefit of any water treatment technology in horticultural production. In this trial, irrigation was delivered via timed emitters controlled by the Rain Smart Irrigation System. Bed 1 (Control) received 11 minutes of irrigation per day, while Beds 2 and 3 (SWVG and SWVG + Scalar, respectively) each received 9 minutes per day, representing an 18.2% reduction in daily irrigation time. Over the 106-day trial period (31 October 2025 to 13 February 2026), cumulative irrigation delivery totaled 1,166 minutes for Bed 1 and 954 minutes for each of Beds 2 and 3.

To quantify irrigation water use efficiency (IWUE), production per unit of irrigation time was calculated for each bed. Because all beds used identical delivery infrastructure (19 mm poly pipe with three emitters per bed), irrigation duration serves as a directly proportional proxy for volumetric water delivery, allowing meaningful comparison across treatments.

Table 2. Water Productivity and Irrigation Water Use Efficiency (IWUE) by Treatment

Metric	Bed 1 (Control)	Bed 2 (SWVG)	Bed 3 (SWVG + Scalar)
Daily irrigation time (min)	11	9	9
Total irrigation time (min)	1,166	954	954
Total yield (kg)	17.16	21.15	41.38
Water productivity (kg min^{-1})	0.0147	0.0222	0.0434
Water productivity (kg hr^{-1})	0.88	1.33	2.60
IWUE gain over control (%)	—	+50.6	+194.7
Crop-per-drop ratio (relative to control)	1.00	1.51	2.95

Interpretation

The data reveal substantial improvements in water productivity across both treatment beds. Bed 2 (SWVG) produced 1.51 times more fruit per unit of irrigation than the control, while Bed 3 (SWVG + Scalar) achieved a 2.95-fold increase in crop per drop — producing nearly three times the yield for each minute of water delivered.

These gains arise from two compounding factors: (1) the 18.2% reduction in irrigation duration applied to the treated beds, and (2) the concurrent yield increases of 23.25% (Bed 2) and 141.14% (Bed 3) relative to the control. The combination of reduced water input with increased crop output results in IWUE improvements that exceed the yield gains alone. This multiplicative effect is particularly notable in Bed 3, where a 141.14% yield increase paired with an 18.2% water reduction translates to a 194.7% improvement in water productivity.

It should be noted that the IWUE figures for Bed 2 may underrepresent the true potential of the SWVG treatment, given the documented emitter blockage during the Christmas shutdown period that reduced effective water delivery to part of the bed. Had all three emitters remained functional, both yield and water productivity for Bed 2 may have been higher.

Implications for Sustainable Agriculture

Water-use efficiency is increasingly recognised as a critical determinant of agricultural sustainability, particularly in water-limited environments such as Western Australia. The observed improvements in crop per drop suggest that SWVG and SWVG + Scalar technologies may offer a practical pathway to producing more food with less water — a priority identified by the Food and Agriculture Organization (FAO) and central to the concept of sustainable intensification.

From a production perspective, the capacity to reduce irrigation inputs by 18.2% while simultaneously increasing yields has direct implications for grower profitability, water resource management, and system resilience during periods of water restriction or drought. If these efficiency gains are replicable across broader-scale trials and diverse crop types, they may represent a meaningful contribution to the “more crop per drop” objective that underpins modern water-smart agriculture.

Further research quantifying volumetric water delivery (litres per bed per cycle) would strengthen these findings by enabling expression of water productivity in standard units (kg m^{-3} or kg L^{-1}), facilitating direct comparison with published benchmarks for tomato production water-use efficiency.

Discussion

The PW75 Vortex Generator appeared to enhance tomato yield and quality, consistent with previous observations regarding the benefits of structured water. The 141.14% yield increase observed in Bed 3 suggests a possible synergistic effect between vortexing and scalar frequency enhancement, warranting further investigation. The 18.2% reduction in water use across the treated beds also highlights the potential for improved water-use efficiency, a key consideration in sustainable horticulture.

The larger, darker red tomatoes produced in Beds 2 and 3 may indicate improved nutrient uptake and overall plant performance. Likewise, the darker foliage and stronger turgidity observed in the treated beds suggest greater plant vigour, which is consistent with claims relating to enhanced microbial activity and dissolved oxygen availability.

Stem tissue Brix values were analysed on 10 December 2025 and recorded as follows:

- Bed 1: 0.5
- Bed 2: 3.0
- Bed 3: 3.25

The lower Brix reading in Bed 1 coincided with the onset of leaf-borne disease. A more regimented approach to Brix monitoring, with stronger correlation to plant health and yield outcomes, is recommended for future trials.

At the completion of the trial a test of microbial biomass and fungal to bacteria ratios testing was conducted using a Microbiometer Starter Kit PRO.

Table 3. Microbial Biomass and Fungal to Bacteria Ratios

Metric	Bed 1 (Control)	Bed 2 (SWVG)	Bed 3 (SWVG + Scalar)
Total Biomass (µg/g)	1367	2599	3540
Fungal/Bacteria Ratio	0.3:1	1.3:1	16.7:1
Fungal (%)	78	57	94
Bacteria (%)	22	43	6

The results showed vast improvement in fungal to bacteria ratios. Both in total biomass and fungal to bacteria ratios in the two beds with vortex water. Bed 2 total biomass was 90.1% higher than the control (Bed 1), while Bed 3 total biomass was 159.0% higher than the control. Bed 3 demonstrated the highest fungal dominance with 94% fungal composition and a fungal to bacteria ratio of 16.7:1, indicating a highly fungal-dominant soil ecosystem. We believe this has huge beneficial ramifications for the horticulture industry.

Limitations

Irrigation emitter issues in Bed 2 had a substantial effect on the results. During the trial, one of the three emitters became completely blocked, reducing the reliability of direct comparison for that treatment. For future trials, drip irrigation may offer a more consistent and reliable watering method. The drop in moisture levels of Bed 2 are evident via soil probe testing.

The four-week delay in planting compared with the previous year should also be noted as a factor that may have influenced crop performance and seasonal comparability.

Table 4. Rainfall During Trial Period

Month	**Date**	**Rainfall (mm)**	**Monthly Total**
October 2025	31st	1.2	1.2 mm
November 2025	1st; 5th; 6th; 22nd; 23rd; 24th; 26th	8.4; 0.4; 5.6; 5.6; 3.8; 0.4; 2.2	26.4 mm
December 2025	No rain recorded	0.0	0.0 mm
January 2026	26th	3.2	3.2 mm
February 2026	No rain recorded (1st–13th)	0.0	0.0 mm
Total Period			**30.8 mm**

Conclusion

Although some trial parameters differed from those used in the previous year, the results indicate that water treatment using vortex generators may substantially enhance organic tomato yields when compared with the control treatment.

The 18.2% reduction in water use across the SWVG-treated beds highlights a practical opportunity for the broader horticultural industry to improve both sustainability and profitability.

To further validate and expand these findings, additional research is recommended in the following areas:

- Quantification of nutritional improvements, including Brix values
- Optimisation of soil conditions, with particular attention to calcium management
- Evaluation of scalability across a wider range of crops and soil types

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