# Efficacy and Effectiveness of Structured Water Vortex Generators on Yield, Quality, and Water Use Efficiency in Organic Tomato Production

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## Abstract

A 19-week grow trial (30 September 2024 to 10 February 2025) at South Regional TAFE, Bunbury Campus, Western Australia, evaluated the efficacy of the Structured Water Vortex Generator (PW50, President Water) on organic *Solanum lycopersicum* (San Marzano) tomato production. Three garden beds were compared: Bed 1 (control, municipal water), Bed 2 (PW50 Vortex Generator), and Bed 3 (PW50 Vortex Generator + GARD/RV carbon/KDF filter).

The alternative hypothesis ($H_1$) posited that the Vortex Generator would significantly increase yield and quality. Results confirmed $H_1$, with Bed 2 yielding 30.91% more than the control and Bed 3 achieving a 225.76% increase over the control, with a 25% reduction in water use across treated beds (Bed 2+3). Bed 3 produced larger, darker red tomatoes, although a small amount of Blossom End Rot (BER) occurred, likely due to a calcium deficiency resulting from rapid growth. These findings suggest that Vortex Generators enhance yield, quality, and water usage efficiency (WUE), with implications for sustainable horticulture.

## Introduction

Water structuring through vortex motion, a natural process, enhances the physical, chemical, and biological properties of water, potentially benefiting plant growth. Structured Water Vortex Generators mimic this process, reportedly increasing oxygen levels, nutrient bioavailability, and microbial activity, leading to higher yields, improved Brix values, and reduced water and fertiliser needs. In regions like Western Australia, where water quality can challenge horticulture, such technologies offer a sustainable solution.

This study tested the PW50 Vortex Generator (President Water, Western Australia) on organic San Marzano tomato production, hypothesising that it would improve total yield, fruit quality, and WUE compared to a control. A secondary treatment combined the PW50 with a carbon/KDF filter to assess synergistic effects and total elimination of chlorine.

## Experimental design

The trial was conducted from 30 September 2024 to 10 February 2025 at SR TAFE, Bunbury Campus (33.35°S, 115.64°E). Three identical raised garden beds (2750 mm × 750 mm, steel) were prepared with soil from prior mustard cover crops, topped with 20 mm organic compost and 75 mm hardwood mulch. Each bed was planted with four San Marzano tomato seedlings, six marigolds, six cosmos, and two cornflowers (companion plants selected for pest management and beneficial insect attraction). Beds were trellised with reo-concrete mesh and irrigated via 19 mm poly-pipe with three emitters connected to mains water. Irrigation was set at 20 minutes daily, with watering volumes confirmed by bucket test.

*Image Bed 1 Right, Bed 2 Middle, Bed 3 Left*

- **Bed 1 (Control)**: Mains water, unrestricted flow.
- **Bed 2 (Vortex Generator)**: Mains water + PW50 Vortex Generator, flow restricted to 75% capacity via 19 mm ball valve.
- **Bed 3 (Combined)**: Mains water + PW50 Vortex Generator + GARD/RV carbon/KDF filter, flow restricted to 75% via 19mm ball valve.

Seedlings in each bed were treated with Neutrog GoGo Juice (40ml in 10litres of water) at planting and twice during the trial. No synthetic soil amendments were used. On one occasion, Coles Brand Milk Powder (1kg in 10 litres of water) was foliar applied in an endeavour to address Blossom End Rot to Bed 3 only.

## Data Collection

Tomatoes were harvested periodically, weighed using kitchen scales, and measured with a tape measure. Visual observations of plant health and fruit quality were recorded weekly and photographed. Data were analysed descriptively, with percentage changes calculated relative to the control.

## Results

Total yields (Table 1) showed significant differences across treatments. Bed 2 yielded 30.91% more than Bed 1 (control), while Bed 3 produced a 225.76% increase over the control. Water use was reduced by 25% in Beds 2 and 3 via flow restriction. Tomato size and colour varied, with Bed 3 fruits being larger and darker red (Table 2, Fig. 1). Plants in Beds 2 and 3 exhibited darker green foliage and greater turgidity than the control.

BER occurred in Bed 3, presenting as brown spots on fruit bases (Fig. 2), likely due to calcium depletion from rapid growth. The application of powdered milk mitigated this issue. Yield and quality data strongly supported $H_1$, with the combined treatment (Bed 3) outperforming others.

**Fig.1 and 2 : Tomato growth comparison**

**Figure.3 Production from Bed 3.**

**Figure 4. Comparison Bed 1 vs Bed 3**

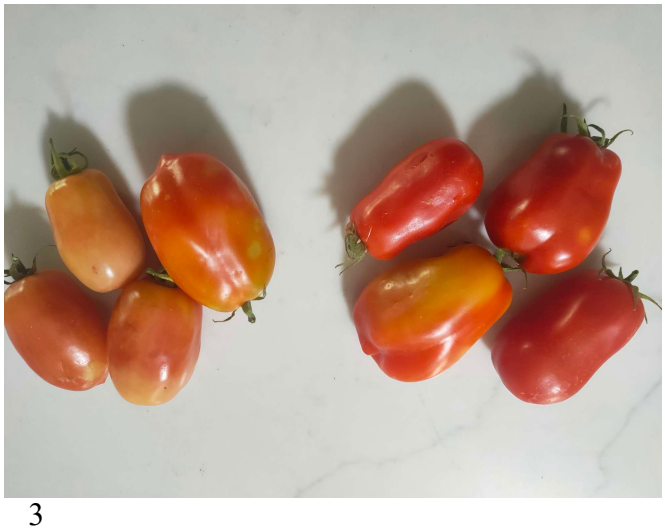

**Figure.5 Sample of Blossom End Rot from Bed 3**

## Discussion

The PW50 Vortex Generator significantly enhanced tomato yield and quality, aligning with prior research on structured water's benefits. The 225.76% yield increase in Bed 3 suggests a synergistic effect of vortexing and carbon filtration, likely improving water quality and nutrient delivery. The 25% water reduction in treated beds highlights improved WUE , a critical factor in sustainable horticulture.

Larger, darker red tomatoes in Bed 3 indicate enhanced nutrient uptake, though BER's occurrence suggests rapid growth outpaced calcium availability. This was managed effectively, but future trials should include soil nutrient testing to optimise conditions. The darker foliage and turgidity in treated beds further indicate improved plant vigour, consistent with claims of increased microbial activity and oxygen levels.

Limitations include the lack of pre-trial soil analysis and holiday observation gaps (December 2024–January 2025). Future studies should quantify brix values, soil moisture, and nutrient uptake rates to elucidate mechanisms behind these outcomes.

**Table: 1 San Marzano tomato yields per bed**

| Date | Bed 1 (Town Supply) Control Weight (kg) | Bed 2 (Vortex Generator) Vortex Generator Weight (kg) | Bed 3 (Combined) Carbon filter + Vortex Generator Weight (kg) |
|---|---|---|---|
| 31/12/2024 | 1.55 | 1.25 | 1.42 |
| 08/01/2025 | 1.8 | 2.3 | 14.5 |
| 16/01/2025 | 4.78 | 6.45 | 12.9 |
| 24/01/2025 | 2.59 | 4.15 | 6.0 |
| 27/1/2025 | N/A | N/A | 2.5 |
| 30/01/2025 | 1.28 | 1.53 | 3.28 |
| 10/02/2025 | 1.2 | 1.6 | 2.5 |
| **Total Yield (Kg)** | **13.2** | **17.28** | **43.0** |

*Source: Grow trial observations and data collection, 2025, SRTAFE, Bunbury.*

## Conclusion

The PW50 Vortex Generator, particularly when paired with a carbon/KDF filter to neutralise, markedly improved organic tomato yield (up to 225.76%), quality, and WUE (25% reduction) in this trial. These findings support its potential to transform horticulture by reducing resource inputs while boosting productivity. In further research/trials are recommended to validate nutritional benefits (e.g., brix values), optimise and test soil focusing on calcium management, and assess scalability across diverse crops and soils.

View on YouTube:

Tomato Grow Trial: Boosting Yields, Water Use Efficiency with PW50 Structured Water Vortex Generator (video 15:06)

## Acknowledgments

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