

## Effects of Irrigation Applications during Post-Anthesis Period on Flower Development and Pyrethrin Accumulation in Pyrethrum

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**Abstract :** Pyrethrum (*Tanacetum cinerariifolium*) is a perennial plant belongs to family Asteraceae. This is cultivated commercially for extraction of natural insecticide pyrethrins, which accumulates in their flower head achenes. Approximately 94% of the pyrethrins are produced within secretory ducts and trichomes of achenes of the mature pyrethrum flower. This is the most widely used botanical insecticide in the world and Australia is the current largest pyrethrum producer in the world. Rainfall in pyrethrum growing regions in Australia during pyrethrum flowering period, in late spring and early summer is significantly less. Due to lack of adequate soil moisture and under elevated temperature conditions during post-anthesis period, resulting in yield reductions. Therefore, understanding of yield responses of pyrethrum to irrigation is important for Pyrethrum as a commercial crop. Irrigation management has been identified as a key area of pyrethrum crop management strategies that could be manipulated to increase yield. Pyrethrum is a comparatively drought tolerant plant and it has some ability to survive in dry conditions due to deep rooting. But in dry areas and in dry seasons, the crop cannot reach to its full yield potential without adequate soil moisture. Therefore, irrigation is essential during the flowering period prevent crop water stress and maximise yield. Irrigation during the water deficit period results in an overall increased rate of water uptake and growth by the plant which is essential to achieve the maximum yield benefits from commercial crops. The effects of irrigation treatments applied at post-anthesis period on pyrethrum yield responses were studied in two irrigation methods. This was conducted in a first harvest commercial pyrethrum field in Waubra, Victoria, during 2012/2013 season. Drip irrigation and overhead sprinkler irrigation treatments applied during whole flowering period were compared with 'rainfed' treatment in relation to flower yield and pyrethrin yield responses. The results of this experiment showed that the application of 180mm of irrigation throughout the post-anthesis period, from early flowering stages to physiological maturity under drip irrigation treatment increased pyrethrin concentration by 32%, which combined with the 95 % increase in the flower yield to give a total pyrethrin yield increase of 157%, compared to the 'rainfed' treatment. In contrast to that overhead sprinkler irrigation treatment increased pyrethrin concentration by 19%, which combined with the 60 % increase in the flower yield to give a total pyrethrin yield increase of 91%, compared to the 'rainfed' treatment. Irrigation treatments applied throughout the post-anthesis period significantly increased flower yield as a result of enhancement of number of flowers and flower size. Irrigation provides adequate soil moisture for flower development in pyrethrum which slows the rate of flower development and increases the length of the flowering period, resulting in a delayed crop harvest (11 days) compared to the 'rainfed' treatment. Overall, irrigation has a major impact on pyrethrin accumulation which increases the rate and duration of pyrethrin accumulation resulting in higher pyrethrin yield per flower at physiological maturity. The findings of this study will be important for future yield predictions and to develop advanced agronomic strategies to maximise pyrethrin yield in pyrethrum.

**Keywords :** achene, drip irrigation, overhead irrigation, pyrethrin

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