



Assessing Water Stress Impact on Greenhouse Cucumber Growth and Yield

Imran Arshad¹, Irfan Ahmed Shaikh¹, Zaheer Ahmed Khan²

¹Department of Irrigation and Drainage, FAE, Sindh Agriculture University Tandojam, Sindh, Pakistan

²Department of Farm Structures, FAE, Sindh Agriculture University Tandojam, Sindh, Pakistan

*Corresponding author: engr_imran1985@yahoo.com



Abstract

Efficient irrigation is crucial for vegetable production, impacting growth and yield. In this study, conducted under greenhouse conditions on sandy soil, we examined the effects of different irrigation frequencies on cucumber growth and yield. Results revealed that the five-times-a-day irrigation treatment (T5) exhibited superior outcomes across various parameters, including days to flower development (30.385), fruit setting (9.055), and maturity (6.178), as well as producing the highest number of fruits per plant (33.746), longest fruit (17.812 cm), heaviest fruit (131.977 g), longest vine (2.73 m), and highest fruit yield (57.644 tons ha⁻¹). Conversely, the once-a-day irrigation treatment (T1) yielded inadequate results. Our findings underscore the efficacy of a five-times-a-day irrigation schedule, with five-minute intervals, for optimal cucumber growth and yield using drip irrigation in greenhouse settings.

Keywords: Cucumber, Water Stress, Drip Irrigation, Greenhouse, Agriculture.

Introduction

The demand for vegetables in the UAE's domestic and local markets is rapidly increasing, prompting a focus on vegetable production. Traditionally, farmers have primarily grown vegetables during the winter season due to its short duration and unfavorable conditions for open-field production during the rest of the year. However, the introduction of greenhouse technology has allowed for year-round production, particularly during the summer season (El-Mogy *et al.*, 2012). Cucumber cultivation has gained significant interest among UAE farmers due to its adaptability to various soils and moderate tolerance to salinity. To optimize cucumber yield, maintaining optimal soil water supply is crucial, especially during flowering and fruiting stages. Drip irrigation, a widely adopted method in greenhouse farming, offers precise water and nutrient delivery directly to plant roots, thereby reducing water stress and enhancing yield (Arshad *et al.*, 2014). This research aims to evaluate the impact of different irrigation treatments combined with constant fertilizer doses on cucumber growth and production parameters under greenhouse conditions in the UAE.

Conclusions

Cucumber yield and growth can be improved by using the appropriate level of irrigation. Too little or too much water can limit cucumber growth. Five daily applications of water for five minutes each, with 45 minutes in between, were found to be the best irrigation schedule for cucumber plants. This schedule produced the highest fruit yield, number of fruits per plant, fruit length, and fruit weight. These findings are only applicable to sandy soils, as the results may differ for other soil types.

Table 1. Effect of different rates of irrigation treatment on agronomic parameters of cucumber.

Treatment	Days taken to flowering	Days taken to Fruit setting	Days taken to fruit maturity	No of Fruits per Plant	Fruit length (cm)	Fruit Weight (gm)	Vine Length (m)	Fruit Yield (ton/ha)
T ₁	37.624d	14.637cd	10.576d	23.290d	12.923d	106.334d	1.892cd	43.910d
T ₂	35.100c	13.320c	9.510c	25.807cd	13.971c	116.647c	1.921c	45.743c
T ₃	33.445b	11.666b	8.436bc	26.001b	14.456bc	123.370b	2.067b	50.431bc
T ₄	31.489ab	10.623ab	7.424b	30.138ab	15.872b	129.199ab	2.455ab	54.887b
T ₅	30.835a	9.055a	6.178a	33.746a	17.812a	131.977a	2.736a	57.644a
LSD (P< 0.05)	0.627	0.361	0.933	2.006	0.96	15.077	0.117	0.826

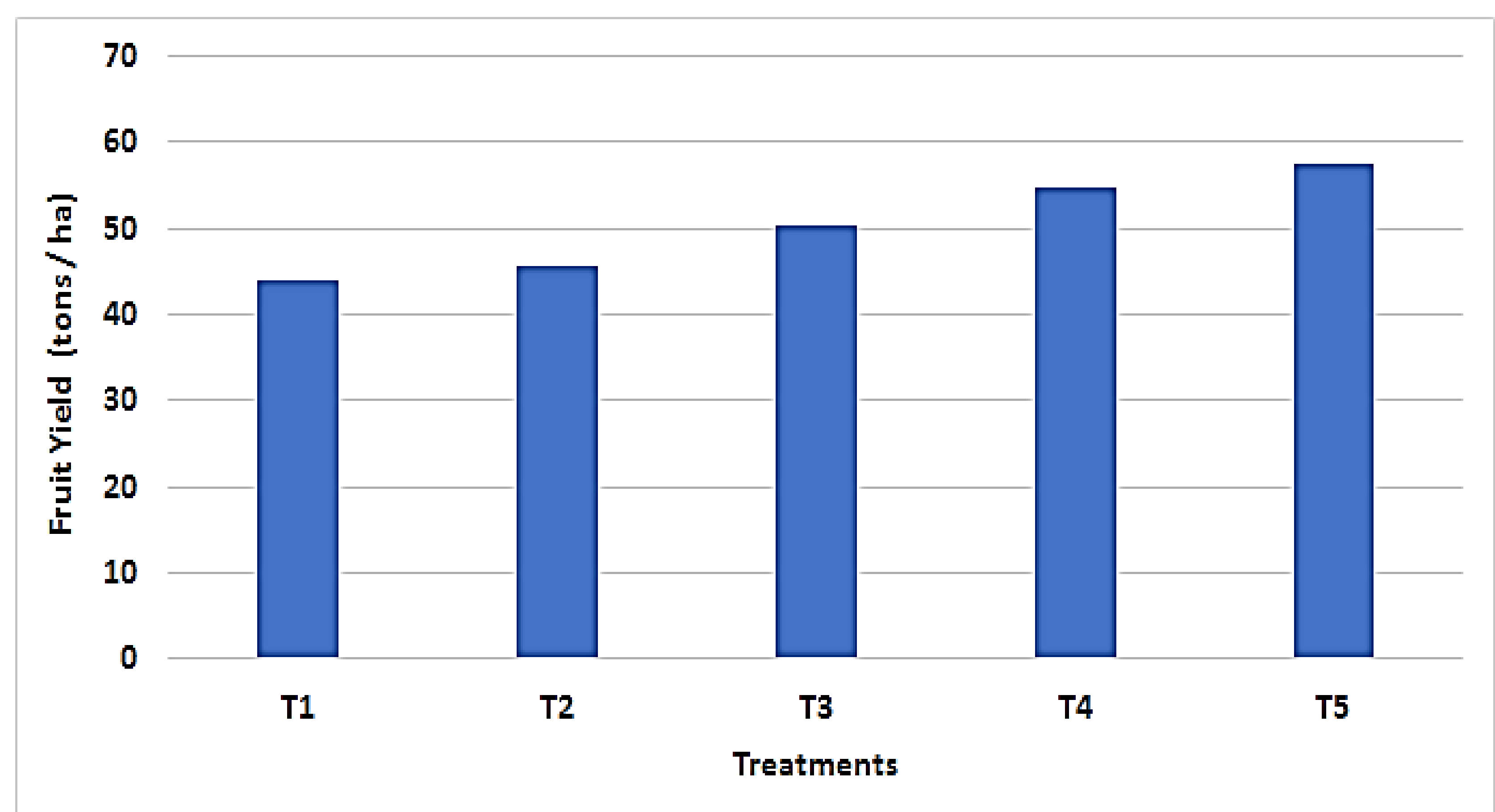


Fig. 01. Comparison of various treatments for cucumber fruit yield (tons/ ha).

Materials and Methods

The study utilized a randomized complete block design with five irrigation treatments, varying in frequency from one to five times daily, across three replications. The irrigation water applied in such a way that (T1 = one time, T2 = two times, T3 = three times, T4 = four times, and T5 = five times) application per day respectively. The field, spanning 148.5 m², featured 15 laterals with pressure-compensating emitters. Water, sourced from 10 m away, was supplied via a drip unit at a constant 20 psi pressure using a 2-inch water pump. Each irrigation lasted 5 minutes with a 45-minute gap between applications. Cucumbers were cultivated in a nursery with coco peat-filled plastic trays, followed by transplanting and cultural practices. Fertilizers were applied uniformly through the drip system, and agronomic parameters were assessed from ten randomly selected plants per treatment, including flowering, fruiting stages, fruit characteristics, vine length, and yield. Data were analyzed using ANOVA for statistical significance.

Results

The study investigated the impact of different irrigation treatments on various agronomic parameters of cucumber plants. Significant differences were observed in parameters such as days to flowering, fruit setting, fruit maturity, number of fruits, fruit length, fruit weight, vine length, and fruit yield across different irrigation rates. Generally, treatments with higher irrigation levels exhibited shorter durations to flowering, fruit setting, and fruit maturity, resulting in increased fruit yield. Specifically, Treatment T5 consistently showed favorable outcomes, with the shortest durations to flowering and fruit setting, highest number of fruits per plant, longest fruit length, heaviest fruit weight, longest vine length, and highest fruit yield. These results suggest that optimizing irrigation levels, particularly with high pulse irrigation, can significantly enhance the growth, development, and yield of cucumber plants. This underscores the importance of water management strategies in maximizing agricultural productivity.

References

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