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Enhancing water productivity and yield of drip irrigated onion using deficit irrigation, mulching and fertigation

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Abstract
The main factor that affects the process of photosynthesis in plants is water availability. Insufficient water can directly impact agriculture by leading to reduced food production. When dealing with limited water, it becomes crucial to maximize how efficiently water is used to optimize profits. To achieve this goal, it's important to assess the relationship between the sizes of the plant bulbs. The aim is to improve plant growth and increase onion yields using a comprehensive approach that combines controlled watering, fertilization, and protective coverings. This research seeks to determine the point at which the highest income is achieved in the production process. Deficit irrigation (DI) is a strategy that involves providing limited water during sensitive growth stages or throughout the growth period of crops. This approach aims to make the most of water resources by subjecting plants to specific levels of water stress. The impact of DI, mulching, and fertigation on onion yields and other growth factors was found to vary based on the intensity of water stress, the type of mulch used, and the application of fertilizers. Among all the treatments, it was observed that the combination of 100% DI with straw mulch and 100% fertigation resulted in the highest level of production. However, there was no significant difference in production between treatments involving 80% DI and 75% fertigation.

Keywords: Deficit irrigation, paddy straw mulching, Fertigation, Drip irrigation, bulb diameter, water productivity

Introduction
Water holds immense significance in our existence. It serves essential roles in irrigation and diverse household applications. Additionally, the vitality of water extends to supporting the viability of all Earth's ecosystems. Presently, around 70% of global freshwater withdrawals are channelled into agricultural activities, as highlighted in the FAO Water Report of 2011. This proportion is projected to rise significantly, potentially reaching up to 95% in developing nations, as indicated in the FAO Water Report of 2012. All methods of water application on surfaces result in very low efficiency in water usage, whereas pressurized irrigation methods such as trickle irrigation are highly suitable for horticultural and vegetable crops. These methods exhibit remarkably high water use efficiency, ranging between 80% and 95%, as indicated by Howell TA in 2003. Trickle irrigation also holds the potential to optimize and decrease water consumption within irrigation systems, as highlighted by FAO in 1985. With the increasing demand for water, there is a need to reform irrigation management and scheduling to enhance crop water use efficiency. This would help conserve the limited water resources available for agricultural use. Enhancing water use efficiency can be accomplished through three key approaches: reducing the water needed for each unit of production at the user level, effectively allocating water at the catchment level, and implementing intelligent virtual water trade on the international stage. (Hoekstra *et al*., 2005) [4].

The combination of population growth and climate change necessitates a rise in food production while concurrently decreasing water usage in agriculture. One proposed approach to achieve this is deficit irrigation, which aims to maintain and enhance crop yield while minimizing water consumption in farming. However, despite its potential, deficit irrigation has not been widely embraced (Liuyang *et al*., 2020) [5]. This method involves deliberately subjecting crops to a certain level of water stress during specific growth stages or throughout the entire growing season. Nonetheless, this practice does not substantially diminish yields, and the benefits of conserving water can be directed towards irrigating other crops. Given its efficient utilization of water resources, deficit irrigation is a suitable water-saving technique that warrants investigation in this study.

Methodology

Location of study area

The trial was carried out at the JNKVV farm located in Jabalpur. The coordinates of the site are approximately 23.21 degrees North latitude and 79.96 degrees East longitude. The elevation of this location is roughly 411.8 meters above the average sea level. The climate of the region falls under the category of hot sub-humid and it is positioned within the agro-climatic zone of Kymore and Saptura hills. The area typically experiences an average annual precipitation ranging from 1000 to 1500 mm, coupled with an average minimum temperature of 17 degrees Celsius and an average maximum temperature of 32 degrees Celsius. The soil composition in this vicinity is described as medium to deep clayey, black loam soils with moderate to low levels of available water content.

Soil Analysis: Before planting, samples were collected from the experimental area and analyzed for different soil characteristics. The analysis revealed that the soil had a clay loam texture, moderate bulk density, and sufficient field capacity.

Plant height

The measurement of the plant's height is taken in centimeters from the base to the highest leaf tip above the ground at thirty-day intervals from planting until the plant reaches maturity.

Fig 1: Measurement of plant height

Bulb diameter

The equatorial and polar diameter of bulb Onions were measured from all replications in cm. The observation was made after maturity and harvesting of the crop.

Results and discussions

Plant height

The table provided depicts the growth of plants in terms of height, measured in centimeters, over thirty-day intervals from transplanting until they reached maturity. The results of the experiment are shown in Table 4.2. Among the treatments, the most significant plant heights were observed in T_4 and T_5, while the least average heights were found in T_3 and T_6. In the absence of mulch but with irrigation alone, plant heights ranged from 59.3 to 65.0 cm in the first year. On the other hand, plants mulched with straw and treated with 100% fertigation had heights ranging from 63.0 to 68.0 cm. During the initial year, the tallest and shortest heights recorded were 68.0 cm and 63.0 cm for straw-mulched plants with 100% fertigation, and 67.0 cm and 62.0 cm for straw-mulched plants with 75% fertigation, respectively.

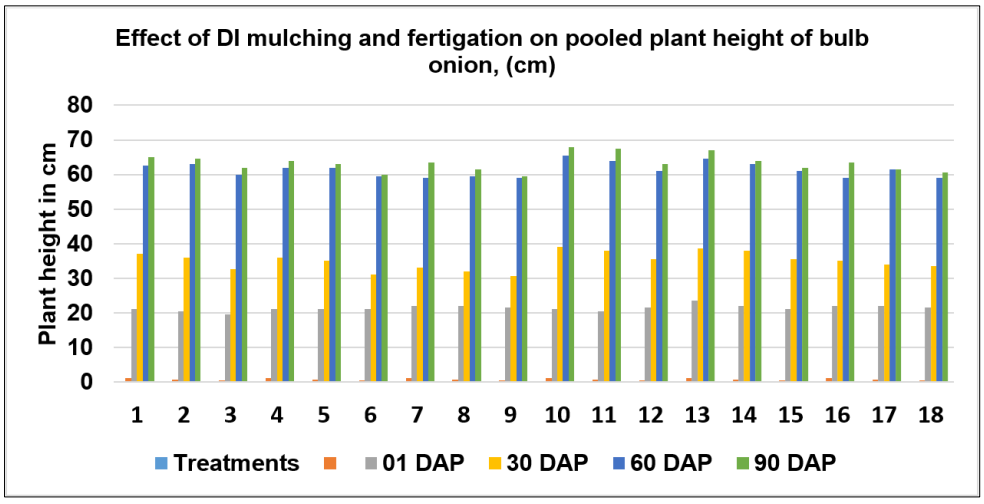

Fig 2: Graph of plant height

Bulb diameter

The largest bulb diameters were achieved from treatments T_4 and T_5, with T_1, T_2, and T_3 following in descending order. The smallest equatorial mean diameter was observed in the control group (T_3), which measured below the average value of 5.5 cm.

Table 1: Bulb diameter of onion 2022

Year	Treatment	T_1	T_2	T_3	T_4	T_5	T_6
Y1	100%	6.7	6.4	4.7	8.1	8.0	6.0
	75%	6.2	6.1	4.6	8.0	7.9	6.2
	50%	4.7	4.1	3.1	6.5	6.4	6.0

Onion yield

The summary of onion yield results, considering both combined and individual years of the study, shows that the T_4 treatment (with zero water stress, mulch, and 100% deficit irrigation) exhibited the highest onion production. This can be attributed to the increased availability of nutrients and moisture content, leading to larger bulb diameters and heavier onions. Among the sub-treatments, all except the 100% fertigation level had lower yields. The lowest yield was observed in the 60% water stress and 50% fertigation combination, where onion bulb growth was stunted and mass was reduced.

In the first year, the T_4P sub-treatment yielded the highest at 18.7 tons/ha, while the lowest yield of 14.0 tons/ha came from T_3C. Similarly, in the second year, the T_6P sub-treatment achieved the highest yield at 18.7 tons/ha, while T_3C again had the lowest yield at 14.3 tons/ha.

Table 2: Onion yield in tons/ha of year 2022

Year	Treatments	T_1	T_2	T_3	T_4	T_5	T_6
Y1	100%	17.8	17.6	14.9	18.7	18.1	16.8
	75%	17.4	17.1	14.0	18.3	18.0	16.2
	50%	15.0	16.2	15.7	17.7	17	15.9

Conclusion

Onion yield, bulb diameter, and plant height were notably influenced by deficit irrigation and fertigation. There was no significant disparity observed between treatments receiving 100% and 80% fertigation, as well as those receiving 100% and 75% fertigation. However, a noteworthy discrepancy was evident in treatments employing 60% deficit irrigation and 50% fertigation.

References

1. FAO. Water Development and Management Unit - Information Resource; c1985.
2. FAO. Water Report. The state of the world's land and water resources for food and agriculture (SOLAW): managing systems at risk, 2011. Food and Agriculture Organization of the United Nations, 2011. Rome and Earthscan, London; c2011. (Available at: http://www.fao.org/docrep/017/i1688e/i1688e.pdf, Accessed on 13/01/2020).
3. FAO. Water Report. Water at a Glance: the relationship between water, agriculture, food security and poverty 2012. FAO and Earthscan, Rome; c2012. (Available at: http://www.fao.org/nr/water/docs/waterataglance.pdf, Accessed on 12/01/2020).
4. Hoekstra AY, Hung PQ. Globalisation of water resources: international virtual water flows in relation to crop trade. Journal of Global Environmental Change. 2005;(15):45-56.
5. Liuyang, Zhao, Yu, Xiaodong, Siddique, Kadambot HM. Improvement/maintaining water use efficiency and yield of wheat by deficit irrigation: A global meta-analysis, Agriculture Water Management, Elsevier; c2020. p. 228.