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# Drip Irrigation with Saline Water for Oleic Sunflower

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## Abstract

The field experiments were carried out in 2007 and 2008 to study the effects and strategies of drip irrigation with saline water for oleic sunflower. Five treatments of irrigation water with average salinity levels of 1.6, 3.9, 6.3, 8.6, and 10.9 dS/m were designed. For each treatment, 7 mm water was applied when the soil matric potential (SMP) 0.2 m directly underneath the drip emitters was below 20 kPa, except during the seedling stage. To ensure the seedling survival, 28 mm water was applied after sowing during the seedling stage. Results indicate that amount of applied water decreases as salinity level of irrigation water increases. The emergence will be delayed when the salinity level of irrigation water is higher than 6.3 dS/m, but these differences will be alleviated if there is rainfall during emergence period. The final emergence percentage is not changed when salinity level of irrigation is less than 6.3 dS/m, and the percentage decreases by 2.0% for every 1 dS/m increase when the salinity level of irrigation water is above 6.3 dS/m, but the decreasing rate will be reduced if there is rainfall. The plant height and yield decrease with the increase of salinity of irrigation water. The height of plants decreases by 0.6–1.0% for every 1 dS/m increase in salinity level of irrigation water.

**Keywords:** Salinity levels • Oleic sunflower • Irrigation water

## Introduction

The yield decreases by 1.8% for every 1 dS/m increase in salinity level of irrigation water, and irrigation water use efficiency (IWUE) increases with increase in salinity of irrigation water. The soil salinity increases as the salinity of irrigation water increasing after drip irrigation with saline water in the beginning, but the soil salinity in soil profile from 0 to 120 cm depths can be maintained in a stable level in subsequent year irrigation with saline water. From the viewpoints of yield and soil salt balance, it can be recognized even as salinity level of irrigation water is as high as 10.9 dS/m, saline water can be applied to irrigate oleic sunflower using drip irrigation when the soil matric potential 0.2 m directly under drip emitter is kept above 20 kPa and the beds are mulched in semi-humid area. Sunflower, as a major oil seed, is widely cultivated in the world. Oleic sunflower is rich in monounsaturated fats, and therefore considered as a useful source of dietary fat in preventing heart disease, which makes oleic sunflower an important breeding objective for sunflower. Irrigation is known to boost both growth and yield of sunflower, and many aspects of the increase in yield following irrigation have been studied, such as full irrigation, irrigation only at certain growth stages or deficit irrigation. However, scarcity of fresh water is becoming a constraint to irrigation throughout the world. Meanwhile, saline water is in plentiful supply in the world such as in the semi-humid area. It would be a feasible way to use saline water as an important substitutable resource for fresh water in irrigating the plants such as oleic sunflower which is moderately tolerant of salinity if appropriate practices were applied [1-3].

Drip irrigation is able to apply water at low discharge rate and high frequency over a long period of time, resulting in a condition to maintain high soil water content in root zone all the time, and minimize salinity levels in the soil water due to leaching. Meanwhile, because of the point-source characteristic of drip irrigation, the salts along with water can be pushed toward the fringes of wetting area, and forming a desalinization zone in the centre of wetting area, in close proximity to the dripper. Thus, drip irrigation is widely regarded as a suitable system for applying saline water to crops studied the effects of soil matric potential (SMP) on field crops with drip irrigation, and reported that the matric potential of soil 0.2-m directly underneath the drip emitter can be used to judge whether it is time to irrigate the crop. Based on this finding, experiments were carried out to investigate the effects of saline water, applied with drip irrigation, and soil matric potential on tomato which is classified as a tolerant to salinity (Francois, 1984). In the experiments, the electrical conductivity of saline water (ECiw) was from 1.1 to 4.9 dS/m when the SMP at 0.2 m depth immediately under drip emitters was controlled from 10 to 50 kPa. Results showed that saline water can be used to irrigate tomato after seedlings survival stage by drip irrigation when ECiw value was less than 5 dS/m, which is consistent with the salt tolerance of the crop that has been reported to have a threshold salinity of 5.7 dS/m and a percent yield reduction per unit increase in salinity above the threshold of 3.4 %. Meanwhile, the soil salinity in the layer of 0–90 cm did not increase obviously after 3-year saline water irrigation [4,5].

## Conclusion

However, the studies did not cover the effect of saline water on seedling emergence or the effect of higher salinity levels of irrigation water on plant growth and yield. On the other hand, in the semi-humid area in china, mean annual precipitation was more than 500 mm, and the precipitation was mainly concentrated from August to August which was the growing season for crop. The rain occurs during the crop season may mitigate the impact of salinity in the root zone in this area. The objectives of this study were: to investigate the effect of drip irrigation with saline water on emergence, vegetative growth, yield, and IWUE of oleic sunflower when salinity level was up to 10.9 dS/m; to assess the impact on soil salinity by drip irrigation with saline water of different salinity levels; and to approach a management strategy for oleic sunflower when saline water is applied through drip irrigation in the semi-humid area with plentiful saline water.

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