Investigating the effect of different planting patterns on potato growth indices under different levels of irrigation and potassium sulfate fertilizer

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Extended Abstract

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Introduction

Potato is amongst the most important crops in the world. It is the third most consumed crop worldwide after rice and wheat and is followed by corn in this regard (Kazemi *et al.,* 2016). Abiotic stresses like drought may cause adverse effects on growth and tuber yield of potato plants as they are very sensitive to soil moisture reduction (Deblond *et al.,* 1999). Potassium is used as a cofactor of enzymes, osmotic activities and plant electrolyte regulation, and is an essential element for osmotic control, which can reduce osmotic potential and improve plant acclimatization under drought conditions (Taiz & Zeiger, 1991). Given the importance of potato production and its high demand for water and because of scant research being conducted on the planting patterns of this crop, the present study aimed to investigate the effects of various planting patterns and different potassium fertilizer levels on potato growth indices under water-limited conditions in Khorasan Razavi province.

Materials and Methods

This experiment was conducted at Jolge Rokh- agricultural research station over spring and summer of 2016 and 2017 cropping seasons. The experiment was laid out as a split split plot arrangement based on a randomized complete block design with three replications. The trial factors consisted of three planting

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patterns including common planting, common dense planting and zigzag planting designated as the main plots, and irrigation with three levels [control (without stress), irrigation based on 80% of the crop water requirement (as deficit irrigation treatment), and irrigation based on 60% of the crop water requirement (as stress treatment)] designated as the sub -plots, and three levels of potassium fertilizer (0 (control), 75 and 150 kg potassium sulfate per hectare) designated as sub-subplots The water needed for the plant was determined based on water requirement of the potato, which was determined using the software (OPTIWAT) and FAO Penman-Monteith method. The leaf area and leaf dry weight were measured during the growing period at two-week intervals.

Results and Discussion

The results showed that the greatest leaf area index (LAI), crop growth rate (CGR) and total dry matter (TDM) were observed with zigzag planting pattern at either year of the study. The maximum TDM under common, common dense and zigzag planting in the first year were 634.3, 671.9 and 870 $g.m^{-2}$, respectively, while the corresponding values for the second year were 808.5, 919.2 and 1065 $g.m^{-2}$, respectively. Irrigation treatments based on 80 % and 60% of the crop water requirement reduced the growth indices and yield of the tubers. The greatest tuber yield was observed with full irrigation treatment (100% of the crop water requirement (32 and 35.2 ton. ha^{-1} in the first and second year, respectively), while the lowest tuber yield was obtained with 60% of the crop water requirement (20.2 and 20.4 ton. ha^{-1} in the first and second year, respectively). The results showed that potassium sulfate increased TDM, LAI, CGR, NAR and tuber yield. The application of 150 kg of potassium sulfate produced the greatest TDM (850.2 and 1118.9 $g.m^{-2}$ in the first and second year, respectively), whereas no fertilizer usage gave the lowest TDM (584.2 and 743 $g.m^{-2}$ in the first and second year, respectively). In potato plants, sufficient quantities of potassium increase the number of tubers and dry matter production through strengthening potato stems, and at the same time, the plant can acclimatize to environmental stresses.

Conclusion

The results showed that the greatest LAI, TDM, CGR, NAR and tuber yield were observed with the zigzag planting. On the other hand, irrigation based on 60% the crop water requirement reduced the growth indices and tuber yield. It is worth noting that applying 80% of the crop water requirement also decreased the investigated growth traits of the potato plants. Therefore, it is recommended that the exposure of potato plants to deficit irrigation conditions be avoided and the efforts should be made to provide them with adequate water. But the remarkable point was that the usage of potassium sulfate fertilizer could enhance and improve

growth rates under low irrigation and water stress conditions.

Keywords: Crop growth rate, leaf area index, water requirement, tuber yield

References

Deblonde, P.M.K., Haverkort, A.J., and Ledent, L.F. 1999. Responses of early and late potato cultivars to moderate drought conditions: Agronomic parameters and carbon isotope discrimination. *European Journal of Agronomy*, 11: 91-105.

Kazemi, M., Banayan Aval, M., and Ghorbani, R. 2016. Quantitative analysis of food security in Khorasan Razavi province based on potato production. *Agronomy Journal (Pajouhesh & Sazandegi)*, 112: 63-75 (In Persian with English Summary).

Taiz, L., and E. Zeiger. 1991. *Plant physiology*. Benjamin/Cummings Publishing Company. Inc. Red wood City.CA. pp 68–70. 88–89.114. 353.