VARIATIONS IN RESPONSES OF POTATO GERMPLASM TO DEFICIT IRRIGATION AS AFFECTED BY SOIL TEXTURE

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Abstract

The response to irrigation of three parental potato cultivars was studied on loam and sandy soils by use of the line source sprinkler technique, which provided a continuous irrigation variable from 0 to 100% or more replacement of estimated evapotranspiration (Et). Solid-set sprinkler irrigation from planting until near full ground cover provided optimal early plant growth and a soil profile filled with water when the irrigation variable was started in July. On the loam soil this residual soil water provided most of the water needs of the three cultivars over a 10-12 week period until harvest. On this soil, irrigation levels providing replacement above 20 to 40% Et had little beneficial effect. In fact, higher irrigation levels had serious deleterious effects, especially on grade and solids of Nooksack. On the loam soil, Nooksack performed best in every regard at deficit irrigation levels below 50% Et. In contrast, on this loam soil, differing irrigation levels had very little effect on the productivity of Lemhi. The response of all cultivars on sandy soil was much different than on loam soil. On sand, total and U.S. No. 1 yield of all cultivars increased greatly as irrigation levels increased, up to 70 to 80% Et. Levels above this had minimal effect. Nooksack again performed better than the other two cultivars under deficit irrigation. The results of these and other studies show there is potential for identifying or developing potato cultivars which are more efficient users of irrigation water.

Resumen

En suelos francos y arenosos se estudió la respuesta de tres cultivares progenitores de papa a la irrigación, utilizando la técnica de aspersores conectados a una línea fuente que proveyeron de 0% a 100% o más de agua, en reemplazo de la evapotranspiración estimada (Et). La irrigación por aspersión, con un sistema instalado permanentemente, desde el momento de la siembra hasta la casi total cobertura foliar del suelo, propició un crecimiento óptimo y temprano de las plantas y dejó un perfil del suelo saturado con agua. 

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de agua para el inicio de la medida de la variable “irrigación” en julio. En el suelo franco, el agua residual proveyó la mayor parte de las necesidades de agua de los tres cultivares, en el lapso de 10-12 semanas hasta la cosecha. En este suelo, los niveles de irrigación que proveyeron agua de reemplazo por encima de valores de 20 a 40% de la Et, tuvieron poco efecto benéfico. De hecho, los niveles de irrigación más altos produjeron efectos seriamente perjudiciales, especialmente en relación con la calidad y el contenido de sólidos de Nooksack. En el suelo franco, Nooksack se comportó mejor, en todo aspecto, a niveles deficitarios de irrigación por debajo de 50% de la Et. En este suelo franco, los diferentes niveles de irrigación tuvieron muy poco efecto sobre la productividad de Lemhi. La respuesta de todos los cultivares en suelo arenoso fue muy diferente de aquélla en suelo franco. En arena, el rendimiento total y el rendimiento de tubérculo de grado No. 1 de EE.UU. de todos los cultivares aumentó notablemente con el incremento de los niveles de irrigación hasta 70% a 80% de la Et. Los niveles superiores a los mencionados tuvieron un efecto mínimo.

La papa Nooksack se comportó mejor que los otros dos cultivares bajo irrigación deficitaria. Los resultados de estos y otros estudios demuestran que existe un potencial para la identificación o el desarrollo de cultivares de papa que sean más eficientes en la utilización del agua de regadío.

Introduction

As the cost of irrigation continues to increase and water availability decreases, it becomes increasingly important to identify or produce new potato germplasm that needs less water. The purpose of this investigation was to study in detail the irrigation needs of three cultivars that are currently being used as parents and which, in preliminary trials and observations, had demonstrated different reactions to irrigation. Results of this study are intended to act as a beginning for efforts to produce water stress resistance potato germplasm.

Irrigation studies of potatoes and the sensitivity of potatoes to water stress are well documented (1, 2, 5, 7, 10, 11, 12). It is generally concluded that a continuous and adequate water supply is required from tuber initiation until near maturity for high yields and good grade and quality. Because of the damaging effects on tuber grade that can result from periodic water stress, excessive irrigation is common with potatoes. This is especially so with the Russet Burbank cultivar under center pivot irrigation on sandy soils. Such high irrigation rates may not be needed or desirable for most or even all cultivars. It has been reported that response to irrigation is influenced by cultivar (2, 5, 7, 9, 11), but little is known about the potential for reducing water use in potato production by developing or selecting cultivars that require little irrigation. This study was conducted to define cultivar differences in water requirements.