

Irrigation and Fertilizer Management for Potato in a Subtropical Region

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ABSTRACT

Sustainability of irrigated agriculture mainly depends upon efficient management of water and fertilizer in order to enhance crop productivity, minimize leaching and ground water pollution related problems. Potato is one of the most popular tuber crops throughout the world. Judicious management of irrigation water and chemical fertilizers are therefore vital for potato crop production as well as soil and groundwater contamination. The reported study was undertaken for potato crop to examine the interactive effect of irrigation water and fertilization on crop yield, Water Use Efficiency (WUE), Nitrogen Use Efficiency (NUE) and nitrogen leaching. Controlled field and lysimetric study were conducted on potato crop in a coarse textured lateritic soil during the year 2002-03, 2003-04 and 2004-05. For controlled field experiment, three irrigation treatments such as: 10% Maximum Allowable Depletion (MAD) of Available Soil Water (ASW) (I_1), 40% MAD of ASW (I_2) and 60% MAD of ASW (I_3) and four fertilizer treatments of N:P:K as 0:0:0 kg ha⁻¹ (F_1), 120:100:80 kg ha⁻¹ (F_2), 180:150:120 kg ha⁻¹ (F_3) and 240:200:160 kg ha⁻¹ (F_4) were used. Each water and fertilizer treatment was replicated three times. For lysimetric experiment, three lysimeters were used for three fertilizer treatments of N:P:K as 120:100:80 kg ha⁻¹ (F_2), 180:150:120 kg ha⁻¹ (F_3) and 240:200:160 kg ha⁻¹ (F_4) with irrigation treatments of 10% Maximum Allowable Depletion (MAD) of Available Soil Water (ASW). Experimental results revealed that greater Water Use Efficiency (WUE) in terms of yield is obtained in case of I_2 treatment than I_1 and I_3 treatments indicating that 40% depletion (I_2) is the threshold MAD for the potato crop. Water use efficiency increased with increase in the application of fertilizer. Nitrogen Use Efficiency (NUE) decreased with increase in nitrogen application whereas NUE increased with increase in water application. Greater nitrogen use efficiency was found in case of nitrogen application of 120 kg ha⁻¹ followed by 180 kg ha⁻¹ and 240 kg ha⁻¹ treatments showing that threshold value for N application is 120 kg ha⁻¹ (F_2) for the potato crop in sandy loam soil. The leaching loss and nitrogen uptake by the plant is more for high fertilizer rate and frequent irrigations. Therefore, 40% maximum allowable depletion of available soil water with nitrogen application rate of 120 kg ha⁻¹ is recommended as the best combination for effective management of irrigation water and chemical fertilizer to prevent ground water pollution without sacrificing crop yield.