



Increased yield and quality of potato tubers by application of potassium nitrate

Field experiments on potato supplied with nutrients through drip irrigation, were conducted at the DeirAlla agricultural research station located at Jordan valley. Land is limited in Jordan and most of the production area for potatoes is under semi-arid conditions. Nutrient practice can be improved to improve sustained productivity, besides other measures such as the development of locally adapted high yielding varieties. Understanding plant growth and nutrient uptake in response to different fertiliser strategies is important to maximise growth and nutrient uptake efficiencies.

In relative amounts, potassium is the second mineral element after nitrogen of importance for optimal growth and development of the potato crop. Therefore, the effect of four potassium nitrate fertiliser doses was assessed in potato cultivar Spunta planted under drip irrigation in a clay loam soil at a plant density of 25.000 tubers/ha.

T1: 0 kg/ha KNO_3

T2: 130 kg/ha KNO_3 (57 kg/ha K_2O)

T3: 260 kg/ha KNO_3 (114 kg/ha K_2O)

T4: 380 kg/ha KNO_3 (172 kg/ha K_2O)

Water supply was dosed according to crop need, based on the evapotranspiration. Evapotranspiration was estimated from the measured soil water content. Water use efficiency (WUE) was calculated for each treatment as tuber yield divided by seasonal evapotranspiration.

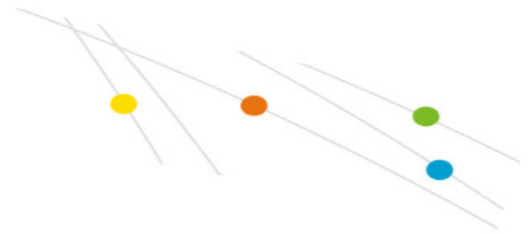


Potassium nitrate was applied by direct injection in the main line of the drip irrigation system, starting from plant emergence, in 10 applications during the crop season. All treatments received a total of 180 kg N/ha and 420 kg P/ha, injected weekly in the drip irrigation system. Potatoes were harvested 110 days after planting.

The total fresh tuber yield per plant increased linearly with increasing potassium nitrate rate (Figure 1). This was mainly due to the increase in average tuber weight. Tuber weight increased with 11,2% (T1), 16,6% (T2) and +32,5% (T3) relative to the average tuber weight of the control treatment.

Quality aspects of the tubers also increased with increasing potassium nitrate rates. Ascorbic acid content in tubers at the highest rate of potassium nitrate was 38% higher compared to the control (Figure 1). Specific gravity (a measure of processing quality) increased up to 1,92% (T4), and ash content increased progressively with increasing levels of potassium nitrate. Protein of the potatoes also increased significantly with increasing potassium nitrate rates (Figure 2). Additionally the content of carbohydrates and fat was higher in tubers of plants receiving more potassium nitrate.

Evaluation of the loss of tuber yield with drying (15 h at 105°C) indicated that plots receiving potassium nitrate had the lowest reduction of weight compared to the control (Figure 2). This was attributed partly to the increase in potato dry matter. Authors discussed that this may also be a beneficial effect of increased potassium content. The maintenance of tuber moisture content during storage by K-application in the field has been previously reported.



Fertigation with potassium nitrate was proposed as improvement of sustainable water management. Crop water use efficiency values showed a pronounced increase with increasing potassium nitrate rate. More than 25% higher WUE in kg of tuber per m³ of water was observed at the two highest rates of potassium nitrate. This was due to the increase of fresh tuber yield per plant at the same amount of water provided with the drip irrigation.

It is evident from this trial that increasing the use of potassium nitrate in of potato grown under fertigation in Jordan, will benefit farmers by increasing yield without increasing the use of water. As an extra benefit, it will additionally increase quality parameters of the tubers.

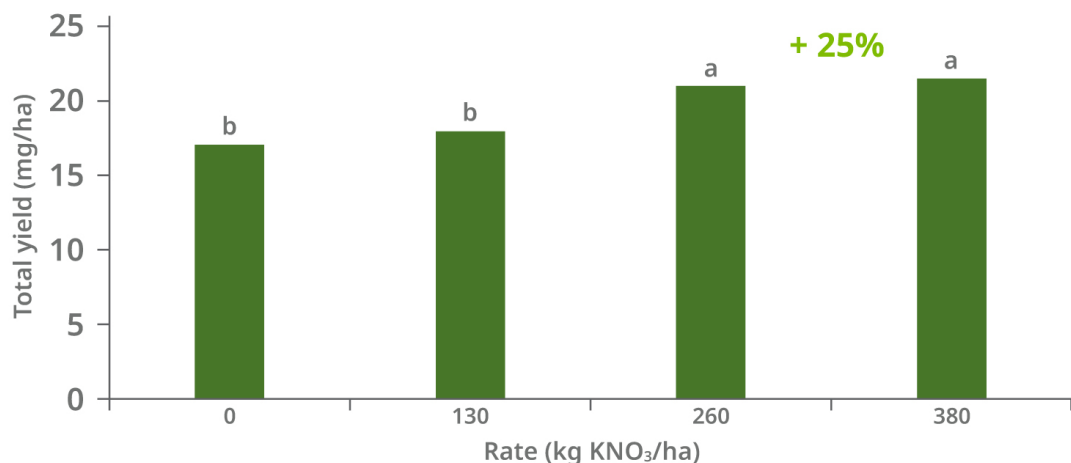


Figure 1. Average tuber yield in potato fertigated by drip irrigation with increasing rates of potassium nitrate added to the nutrient solution. Means labelled with the same letter are not significantly different (LSD, 5%).

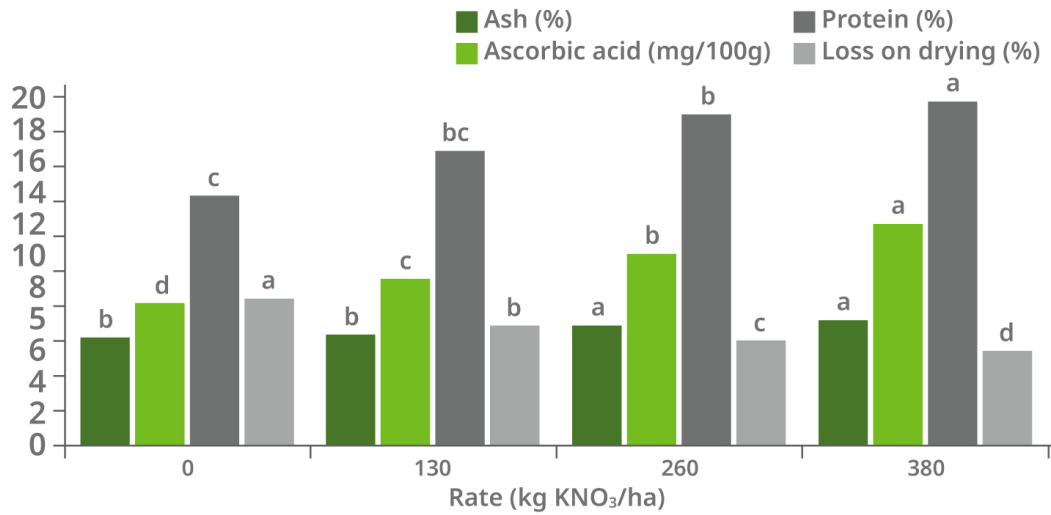


Figure 2. Average tuber quality parameters response to increasing rates of potassium nitrate added to the nutrient solution.
Means labelled with the same letter are not significantly different (LSD, 5%).