Evaluation of Drought Tolerance of Potato Cultivars under Greenhouse Conditions

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Abstract

Seed potatoes of seven cultivars grown in the Kingdom have been used in the study: 'Mondial', 'Sandy', 'Hermes', 'Rosetta', 'Victoria', 'Asterix' and 'Safrane'). Plantlets of 6–8 cm long and 4–6 leaflets were transferred to the greenhouse where each one was planted in a pot containing peat moss: sand (2:1) growing media. Acclimatization was carried out for two weeks and water stress treatments were started as irrigation of 20, 40, 60, 80 and 100% of water depletion by evaporation (WDE). Potato drought tolerance was evaluated by taking growth measurements (plant height, number of branches, leaf area, proline content, tuber number and weight) at 0, 30, 60 and 90 days after treatment (DAT). Significant differences have been reported among cultivars and between irrigation treatments in most traits. In general, as water stress increased, vegetative growth and tuber yield decreased. Proline content increased as water stress increased. Significantly higher tuber weight was measured in Rosetta plants at 60 DAT. Whereas at 90 DAT, both Rosetta and Sandy plants had higher tuber weight followed by Hermes, Safrane, Asterix and Mondial plants, respectively. Accordingly, three cultivars have been selected based on their tuber weight response at the 20% WDE. These cultivars were 'Rosetta' (drought tolerant), 'Sandy' (moderately drought tolerance) and 'Asterix' (drought sensitive).

INTRODUCTION

Potato is grown in many arid regions that are characterised by water shortage and low quality water, which affect plant growth and yield. Potato is characterised as drought sensitive (van Loon, 1981). Drought conditions result in reduced vegetative growth, leaf area index (Jefferies and Mackerron, 1993), and plant height (Zrust, 1995b). Heuer and Nadler (1998) and Ojala et al. (1990) reported that drought reduce leaf area and vegetative growth.

Many studies have illustrated the effect of drought treatments on low tuber number in potatoes (Levy, 1992; Haverkort et al., 1990; Mackerron and Jefferies, 1986). It is reported that even short periods of water stress can cause significant reduction in tuber yield (Jefferies, 1994). Tuber quality can also be affected (Mackerron and Jefferies, 1986; Shock et al., 1993; Nadler and Heuer, 1995). Lahlou and Ledent (2005) evaluated potato cultivars for their drought tolerance under field and greenhouse conditions. They reported that stolon number was enhanced and total stolon length was reduced by drought and that fresh tuber yield was significantly correlated to root dry mass which was reduced by drought.

Van der Meschet and Rossouw (1997) studied various traits related to drought tolerance in potato. They found that proline content in the leaves is a key factor in determining drought tolerant of sensitive cultivars. Martinez et al. (1995) indicated that proline accumulation in potato leaves can be used as a chemabio indicator of cultivar efficiency for salt tolerance. Zrust (1995a) noticed that water-stressed potato plants grown in the field or greenhouse has resulted in an increase in proline content in tubers. He found that potato cultivars with highest drought tolerance (i.e. 'Desiree' and 'Apes') had

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