Russet Burbank Potatoes at Ballarat

Introduction

Irrigation scheduling with the neutron probe in the Ballarat area has resulted in significant improvements in irrigation management in recent years. Improved grower awareness of the importance of irrigation for yield and quality has resulted in less excess water use in potato crops, as demonstrated by Marshall and Gowers (1987).

During the 1990/91 season, Russet Burbank potatoes growing on red krasnozem soils were monitored as part of a commercial service offered to all growers. In previous years the service concentrated on when to irrigate and how much water to apply. There was very little interpretation of the neutron probe data to understand how much water was moving through the soil profile and when plant stress may have occurred.

Crops monitored this year were scheduled very well with the irrigation systems available (travelling gun types). There were few occasions when irrigation was considered untimely and there was no evidence of stress due to lack of water.

The season was relatively dry during November and December. The Christmas to New Year period was hot with temperatures above 35^{o}C, followed by 70mm rainfall on the 5th January. The remainder of the season was mild to hot without extremes of temperature except for a hot spell on the 6th and 7th March. There were about 3 weeks of windy conditions in February.

Three aluminium access tubes were placed in the plant row in representative areas of potato fields. Twice weekly neutron probe readings were taken at 20, 30, 40, 50, 60 and 80cm and averaged for the three aluminium tubes.

Results

Significant differences were identified between the amount of water applied to the crop and that measured as crop water use. This may be due to:

1. Run-off from the "hilled" soil in the plant row away from the area of measurement. This may occur, but only partly explains the difference.

2. Through drainage.

The seasonal trend in soil water content for a potato crop at Ballarat is shown in Figure 1. At first glance there appears to be only 2 occasions when excess water was applied causing the line to go above the Full Point.

However, careful analysis of the daily water use (DWU) figures and the soil profile graphs indicate that at 12 of the 20 recorded irrigation and rainfall events, more water was applied than could be used by the crop (Figure 2). In general, this occurred if more than 20mm of irrigation water was applied, resulting in loss of 10-15mm of irrigation water for a typical 30-35 mm irrigation.

A high level of interpretive skill is required to detect through drainage events from soil profile graphs. Small changes (1-2%) in volumetric soil water content may account for large differences between recorded irrigation or rainfall data and crop water use.

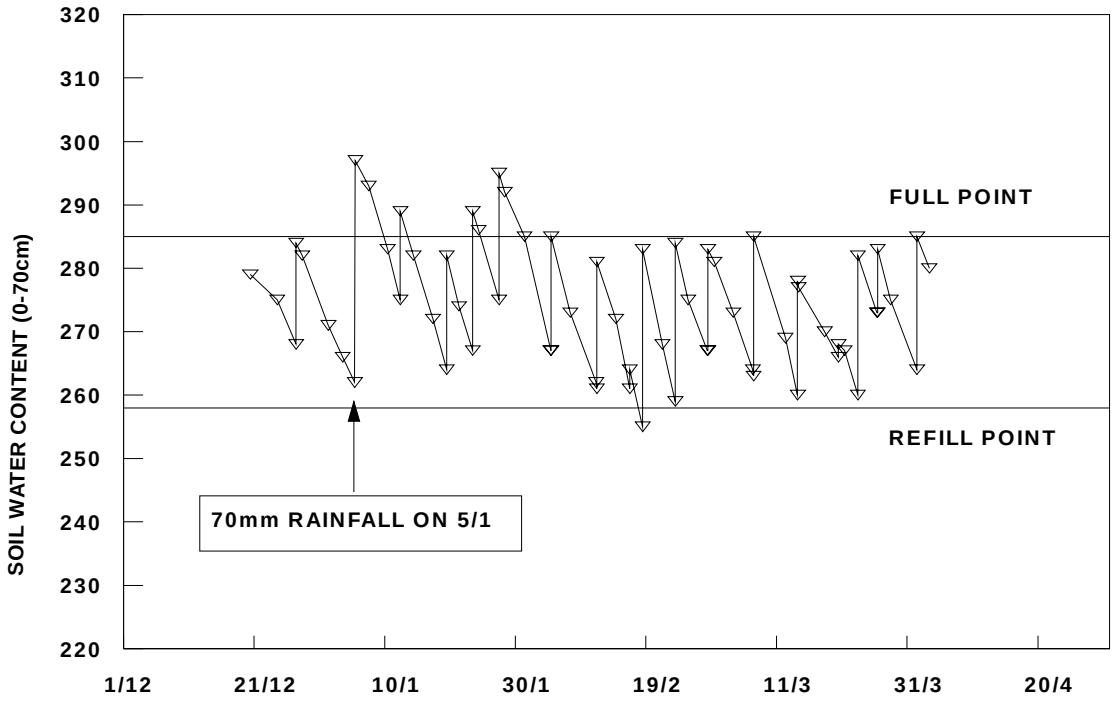

Figure 1. Soil water content in the surface 0-70cm for Russet Burbank potatoes during the 1990/91 season at Ballarat

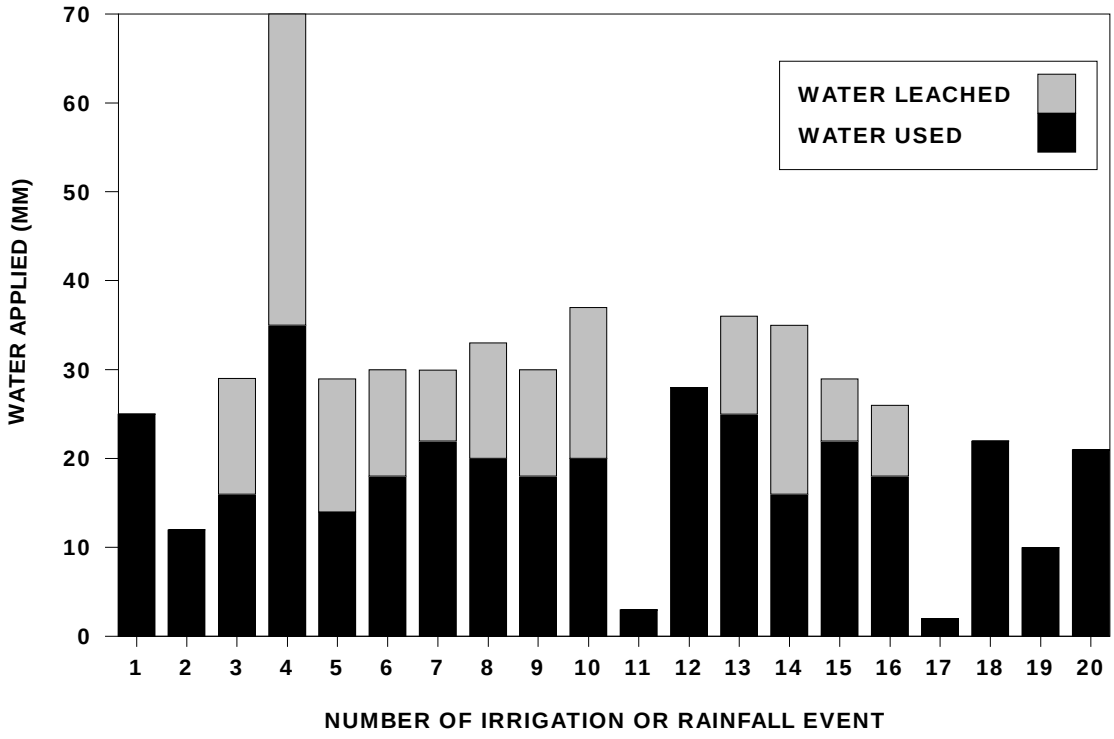

Figure 2. Water used by the crop and water leached from the soil profile following rainfall and irrigation.

Figure 3 shows changes in soil water content (VSW) at each depth in the profile. Following 70mm rainfall on the 5/1, the soil water content was still high (above the Full Point) at 293mm on the 7/1. Between the 7/1 and the 10/1 there was a significant decrease in soil water content at all depths. Measurements of root length in this crop show little root growth below 30cm.

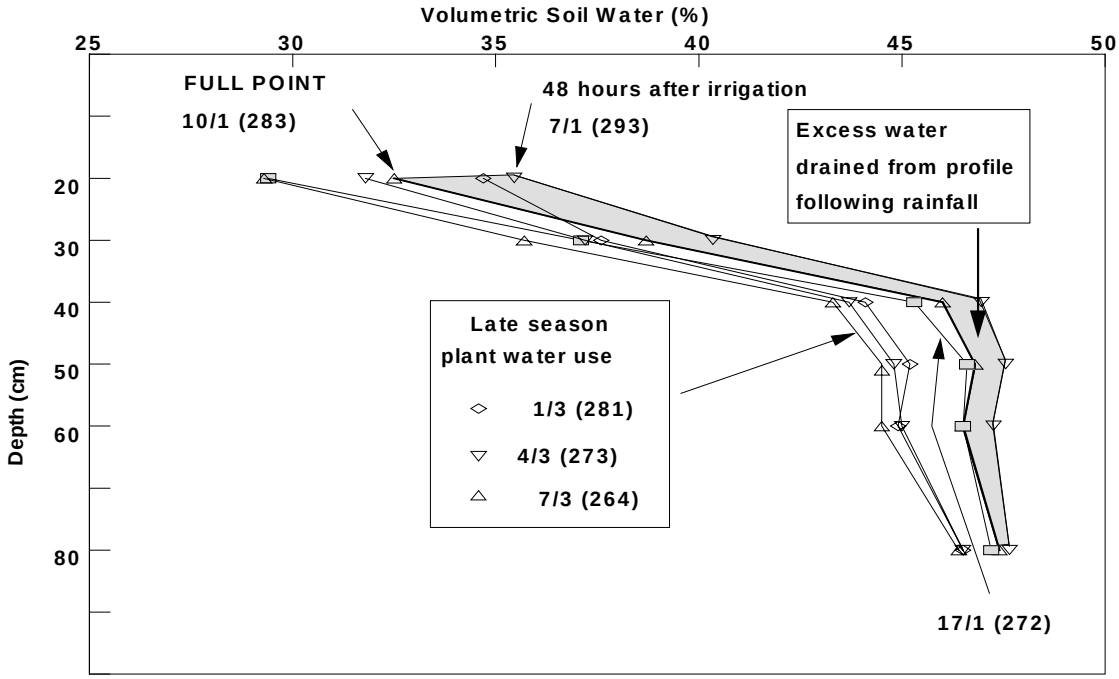

Figure 3. Soil water infiltration showing through drainage following 70mm rainfall on 5/1, and late season plant water use.

It appears that the large change in soil water content at 40-80cm is due to through drainage and not plant root extraction. Between the 10/1 (283mm) and the 17/1 (272mm) there was no change in soil water content at 60cm and only a very small decrease at 50cm. This is consistent with the pattern of plant water use in March which shows no change in soil water content at 60cm from 1/3 (281mm) to 4/3 (273mm). On 7/3 (264mm), there was plant water use at 60cm as the more developed root system late in March dried the soil deeper than earlier in the season.

Conclusion

Through drainage may occur for up to 5 days following heavy application of water. The water drains from the soil regardless of the soil water content at the time of watering. However when less than 20mm of irrigation water is applied, there is usually no loss of water by through drainage. This suggests that no more than 20mm water should be applied per irrigation, regardless of how dry the soil profile is at the time of irrigation, to avoid leaching of excess water.

These findings have important implications for crop nutrition as applied fertiliser is likely to be leached from the soil profile. This is particularly important for early crop growth, and a strategy of

reducing fertiliser application at planting and topping up nutrition as the crop grows may well improve fertiliser use and crop nutrition.

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