Management techniques and turnip variety effects on turnip yield in western Victoria

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ABSTRACT

Factors associated with turnip dry matter (DM) yield were surveyed for 266 turnip crops on 142 dairy farms in south western Victoria. The average date for the commencement of seedbed preparation was early October, although the range was from mid-August until mid-December. Sowing dates ranged from mid-September until mid-December, with the average sowing date being mid-October. The average DM yield was 5t DM/ha, although they ranged from 0.4–19.2t DM/ha. Factors that had the greatest effect on total DM yield were secondary cultivation practices, total water received by the crop, gravimetric soil moisture and temperature at sowing, seedling density and insect damage. In conclusion, conservation of moisture, particularly during the final stages of seedbed preparation and sowing into fine warm moist seedbeds is likely to improve DM yields.

KEY WORDS

Turnips, cultivation, soil moisture, soil temperature, rainfall, DM yield.

INTRODUCTION

It is estimated that brassica crops are grown on approximately 70% of dryland dairy farms in southern Victoria and Tasmania to provide additional summer feed, with turnips being the most popular crop (2). The nutritive characteristics of turnips are somewhat similar to cereal grains with a high DM digestibility and low protein and fibre (3). Growing turnip crops through the summer period provides a break crop as part of a pasture renovation program. Low producing pastures can be cultivated and sown down to a crop during spring. After the crop has been grazed off, further cultivations can be undertaken in late summer or early autumn and the paddock sown back to either an annual or perennial pasture. In Gippsland, Moate et al (1) estimated average turnip DM yields to be 9.8 t DM/ha, whilst it is estimated that in south western Victoria this figure is closer to 5t DM/ha. Methodology for the general establishment and growing of turnip crops is well known. However much of this information is very generic and the effect that particular practices have on DM yield of turnips is not well known. The aim of this study was to determine the key factors associated with growing turnip crops that most influenced final DM yield.

MATERIALS AND METHODS

In spring 1999, dairy farmers across south western Victoria were invited to have their turnip crops surveyed. In total, 266 crops on 142 farms were assessed. On the day prior to turnips crops being sown each paddock was visited and soil temperature at 5 cm recorded. A bulk soil sample was also collected and used to determine gravimetric soil moisture content. Details of how the seedbed had been prepared and the planned crop sowing details were also recorded. A record sheet was left with the farmer to record weekly rainfall and/or irrigation water applied, use of fertilisers, herbicides or insecticides. Approximately 4-6 weeks after crops were sown seedling density (plants/m^2) was measured. Prior to the crops being grazed, 10 random 1 x 1 m quadrats were harvested and material from each quadrat separated into leaves and bulbs, weighed and sub samples taken to determine DM content. All factors, variates or categories, were analysed by a mixed effects model (with factors fixed and farms/paddocks random) against total, leaf and bulb dry matter yield using residual maximum likelihood analysis (4).

RESULTS

On average, cultivation commenced during the first week of October with sowing commencing two weeks later. There was a wide range in both gravimetric soil moisture (7.9 – 59.4%) and temperature (11.8 –

30.5^{o}C) at sowing. The main implements used for primary cultivation were mouldboard plough (34%), chisel plough (31%), discs (27%). The majority (87%) of secondary cultivations was undertaken using a power implement such as a power harrow. The most common variety of turnip sown was Barkant, which accounted for 27% of all crops sown. Mammoth purple top (16%), Vollenda (10%), Rondo (9%) were the next most common. Observed insect damage for all crops was similar ranging from 2 to 3.5 on the scale of 1 – 10 used in this study. The average DM yield across all turnip varieties was 5t DM/ha, however the range indicated wide variations in DM yield (0.4–19.2t DM/ha). The lowest yielding variety was Rondo (4.1t DM/ha) and the highest being Barkant, Polybra and Vollenda with 5.3t DM/ha. Apart from Appin and Mammoth purple top the leaf:bulb ratios were similar for all varieties at about 1. For Mammoth purple top and Appin this value was 1.7 and 2.9 respectively. The average rainfall received for the turnip crops surveyed from sowing to grazing was 158.3mm with a range from 48–271mm. Twenty seven of the surveyed crops received additional water by irrigation, with the average water received being 100.1mm, although this ranged from 12.7-220mm.

Increases in either total water received, gravimetric soil moisture or soil temperature at sowing or seedling density led to a significant ($P<0.05$) increase in DM yield. The effect of insect damage on DM yield, indicated that an increase in insect damage led to a significant ($P<0.05$) decrease in DM yield. Where secondary cultivation was undertaken using a power implement, DM yield was significantly ($P<0.05$) increased.

DISCUSSION AND CONCLUSION

Where a power implement such as a power harrow or rotary hoe were used for the secondary cultivation, crops produced a higher DM yield than when either non power implements were used or no secondary cultivation took place. It is thought that this is likely to be due to reduced losses of conserved soil moisture during the final seedbed preparation when using such a power implement, and to the production of a better quality, finer seedbed. A finer seedbed will also improve the seed to soil contact that in turn will aid germination. Increasing both soil moisture and temperature of the seedbed had a positive effect on DM yield. The warmer and wetter the soil at sowing the greater the final DM yields. It is important to note that the information presented here is only valid within these ranges. An increase in seedling establishment of 50 plants/m^2 will lead to an additional 170kg DM/ha indicating the importance of ensuring a good seedling density.

Results indicate that a rise of 10?C in soil temperature at sowing can improve DM yield by 450kg DM/ha, whilst a 10% rise in gravimetric soil moisture can increase DM yield by 280kg DM/ha. The degree of insect damage had a major effect on final crop DM yield. The highest recorded score (ie. the most severe damage) in the survey was an 8. Analysis of the data indicates that the difference in DM yield between an 8 and a 0 was nearly 700kg DM/ha. The quantity of water, either as rainfall or irrigation, received by the crop during the growing period had the greatest effect on crop dry matter yield. If a crop received an additional 100mm of water the DM yield increased by almost 900 kg DM/ha, whilst 200mm would elevate this figure to 2300kg DM/ha.

In conclusion the effect of water received by turnip crops on DM yield would account for much of the reason that higher DM yields are achieved in other dairying regions (Gippsland, Tasmania) with higher and more reliable summer rainfall. Furthermore there are a number of other factors can impinge on final DM yield that are within the control of the farmer. These include conserving soil moisture during seedbed preparation, using power implements for final seedbed cultivation and minimising insect damage to the growing crop.

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