MONITORING RATES OF DRY MATTER ACCUMLATION

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ABSTRACT

Dry matter content is the measure of fruit maturity utilized by the New Zealand Avocado industry. The pattern of development of fruit dry matter content in 'Hass' avocados has been monitored on a regional basis for the past two seasons. Rates of dry matter accumulation tend to be relatively constant within a season for a given region. However, there can be pronounced regional and seasonal differences, both in terms of initial dry matter contents and subsequent rates of accumulation. Regional differences are not consistent on a seasonal basis.
Keywords: maturity, regional differences

INTRODUCTION

Commercial fruit maturity standards for avocados in New Zealand are based on dry matter contents. This research is aimed at developing a monitoring programme for the purpose of early season prediction of when maturity clearance requirements are likely to be met within 3 of the major growing districts in New Zealand (Far North, Whangarei and Western Bay of Plenty). For a reliable early season prediction as to when maturity requirements are likely to be met, the pattern of dry matter accumulation must follow a consistent, identifiable pattern. The pattern of dry matter accumulation was monitored over two seasons and several regions to determine whether it was sufficiently consistent to allow a system to be developed to predict early season maturity.

METHODS

Sampling dates 2000 season

Fruit dry matter content was monitored in the Far North and the Bay of Plenty. Samples consisting of 20 fruit were drawn from five orchards in each region. Fruit were sampled in the Far North in the weeks commencing 9th July, 30th July, 6th August and 13th August. Fruit were sampled from the Bay of Plenty in the weeks commencing 30th July, 13th August and 27th August.

Sampling dates 2001 season

Fruit dry matter content was monitored in the Far North, Whangarei and Bay of Plenty. Samples consisting of 20 fruit were drawn from five orchards in each region. Fruit were sampled from all regions in the weeks commencing 2nd July, 16th July, 30th July, 13th August, 27th August and 10th September.

Dry matter determination

Average fruit dry matter content was determined based on a 20-fruit sample using the testing procedure outlined in the industry Quality Manual (AIC, 2001). This procedure is based on a 20 g sample from each fruit, which is reweighed after 24 hours drying at 60 ºC.

RESULTS & DISCUSSION

Dry matter tends to accumulate at a relatively constant rate within each season, as evidenced by the significant fits obtained using linear regressions (Table 1, Figure 1). From Figure 1 it can be seen that two factors determine the time at which commercial maturity (24% dry matter content) will be reached. These are the actual dry matter contents at the start of the monitoring period, and the subsequent rates of accumulation. In the 2000 season, although the Far North region started at a higher dry matter content, the rate of increase was lower than for the Bay of Plenty. However, the Far North orchards on average reached commercial maturity 25 days early than the Bay of Plenty orchards.

Table 1. Results of regression analysis including goodness of fit (R^2 and probability values).

Season	Region	Equation	R^2	P value
2000	Far North	Y = 22.21 + 0.080X	0.98	< 0.01
	Bay of Plenty	Y = 19.08 + 0.105X	0.99	0.07
2001	Far North	Y = 20.87 + 0.063X	0.97	<0.001
	Whangarei	Y = 21.94 + 0.061X	0.95	<0.001
	Bay of Plenty	Y = 21.05 + 0.070X	0.96	<0.001

In the 2001 season, dry matter levels in the Bay of Plenty were initially higher than in the 2000 season (2% greater at the end of July). However, the rate of dry matter accumulation in the 2001 season was lower than in the 2000 season. Commercial maturity on average was therefore reached 11 days early in the 2001 season than in the 2000 season. By contrast, in the Far North dry matter contents at the start of monitoring in the 2001 season were not only less than at the equivalent time in the 2000 season, but the rate of subsequent dry matter accumulation was also less. As a result attainment of commercial maturity in the Far North was delayed by 27 days on average compared with the 2000 season.

The extent to which seasonal variability impacts on regional maturities is illustrated by the dates at which the average of the monitor orchards exceeded the commercial maturity requirement for dry matter content. In the 2000 season, the Far North orchards were on average about 25 days earlier

than the Bay of Plenty orchards. However, in the 2000 season the Bay of Plenty orchards on average were 13 days earlier than the Far North.

White et al (2000) showed that in the 1999 season, dry matter tended to increase at a faster rate for single orchards in KatiKati and Te Puke, compared with an orchard in the Far North. For the Bay of Plenty orchards fruit dry matter content increased in a linear fashion from August through to February. In the 1998 season a linear increase in dry matter accumulation was observed for a single orchard in Te Puke and the Far North from September to January (Requejo-Tapia, 1999)

The time taken for dry matter to increase by one percentage point as calculated from the regression equations is shown in Table 2. Again it is evident that dry matter accumulated faster in the 2000 season compared with the 2001 season and that the regional differences were more pronounced in the 2000 season.

Table 2. Number of days taken to increase dry matter by one percentage point for each of three regions, based on the rate parameter from the respective regression equations

Region	2000	2001
Far North	12.5	15.9
Whangarei	-	16.4
Bay Of Plenty	9.5	14.3

In New Zealand, the increase in dry matter over the period July to September has been demonstrated to be mainly due to the deposition of lipids in the oil cells (White el al., 2000; Requejo-Tapia, 1999), reflecting results obtained in both California (Ranney, 1991) and South Africa (Kruger, 1995). Each of these studies has shown that the sum of the dry matter and oil contents is essentially constant, indicating that the dry matter increase is due to accumulation of oil.

There were differences between individual orchards in the pattern of dry matter accumulation. Many orchards showed a plateau in dry matter contents lasting 2-4 weeks, which coincided with the peak of flowering. This plateau is most likely a reflection of the competitive sink strength for carbohydrate accumulation of flowers and developing fruitlets compared with fruit approaching maturity. However, when sufficient orchards are sampled a consistent linear pattern was observed.

CONCLUSION

Dry matter accumulation in fruit over the period from July to September has been demonstrated to increase in a linear pattern over several seasons. However, there are considerable season differences in initial levels and subsequent rates of dry matter accumulation. The linear pattern of dry matter accumulation can be used to advantage by monitoring early season dry matter and predicting the times at which commercial maturity is likely to be reached in the different regions.

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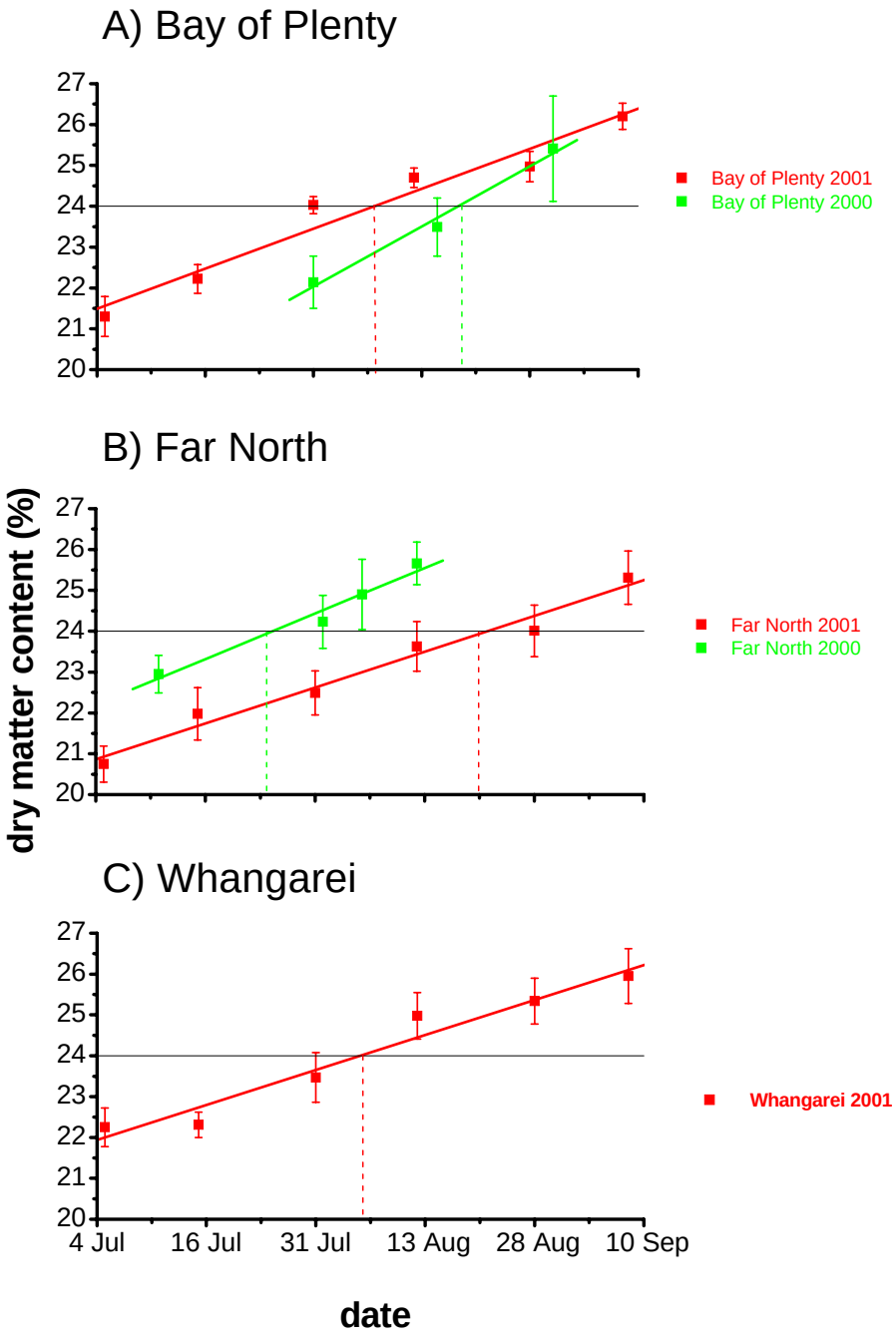

Figure 1. Patterns of dry matter accumulation in each of three regions. Each point represents the mean of 5 20-fruit samples ± standard error. Coloured solid lines are fitted lines from the linear regressions. Dashed lines indicate the time that average dry matters reached 24 %.