

MONITORING RATES OF DRY MATTER ACCUMULATION

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ABSTRACT

Regional monitoring of the pattern of development of fruit dry matter content in 'Hass' avocados has continued for a third season. Dry matter samples were collected from several orchards each in the Far North, Whangarei and the Bay of Plenty at fortnightly intervals. As with previous seasons rates of dry matter accumulation tended to be relatively constant within a season for a given region. However, in some seasons rates of dry matter accumulation may decline for a period of 4-6 weeks. This appears to coincide with the onset of flowering. In contrast to past seasons, weak correlations were observed between fruit size and dry matter content.

Keywords: maturity, regional differences, fruit size

INTRODUCTION

A maturity monitoring programme has been established within three of the major growing districts in New Zealand (Far North, Whangarei and Western Bay of Plenty). The programme is now in its third season. Results are posted to the industry website (www.nzavocado.co.nz) on a regular basis providing the industry with a real time tool to monitor regional dry matter development.

The ability to predict when early maturity clearance requirements are likely to be met would be of major value to the industry. This requires information on the pattern of dry matter accumulation over the season. Determining the feasibility of early season forecasts remains a key objective of this study.

MATERIAL AND METHODS

Samples consisting of 20 fruit were drawn from five orchards in Whangarei and four orchards each in the Far North and the Bay of Plenty. Samples were collected and processed by AgFirst New Zealand Ltd. Fruit were sampled in each region on 3rd May, 15th May, 4th June, 17th June, 1st July, 15th July, 6th August and 2nd September 2002.

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° C.

Results were analysed using weighted regression analysis and analysis of variance in Minitab release 13.31.

RESULTS & DISCUSSION

Maturity levels at the start of the 2002 season were high relative to past seasons based on the date at which the average for the monitor orchards reached 24 % dry matter content. Fruit maturity in the 2002 season for the Bay of Plenty region was about 2 weeks earlier than in 2001 and 4 weeks earlier than in 2000 (Figure 1). In the Far North maturity levels were more than 4 weeks earlier than in the 2001 season and about 1 week earlier than in the 2000 season. In Whangarei, fruit dry matters were running 1 week earlier compared with the 2001 season.

As with past seasons, dry matter tended to accumulate at a relatively constant rate over most of the season, as evidenced by the significant fits obtained using linear regressions (Table 1, Figure 1). Although rates of dry matter accumulation tended to be constant within a season, there are periods in some regions and in some seasons where a deviation from this pattern occurs. This appears to be related to the onset of flowering and may be the result of developing flowering buds out competing fruit for carbohydrate resources. This flattening out of dry matter occurred in the Far North this season during mid July (Figure 1), and in the 2001 season it occurred mid-July in Whangarei and Late August in the Bay of Plenty.

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
2002	Far North	$Y = 19.13 + 0.061X$	0.97	<0.001
	Whangarei	$Y = 16.95 + 0.078X$	0.99	<0.001
	Bay of Plenty	$Y = 17.91 + 0.073X$	0.99	<0.001

There were significant differences ($p < 0.001$) in dry matter content between regions (Table 2), but these were not consistent over time as indicated by the significant ($p < 0.001$) interaction between region and sampling date.

Table 2. Summary of treatment effects from ANOVA

Source	Significance
region	<0.001
date	<0.001
region*date	<0.001

Dry matter content increased by approximately one percentage point every two weeks over the monitoring period from May to September (Table 3).

Table 3. 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	2002
Far North	12.5	15.9	16.4
Whangarei	-	16.4	12.8
Bay Of Plenty	9.5	14.3	13.7

A major objective of the maturity monitoring programme is to provide advance warning of the date at which a region will pass the maturity standard and potentially commence harvesting. Based on last season's data this date could have been forecast 5 weeks ahead for the Bay of Plenty (Table 4). However, any deviation from a linear pattern decreases the ability to forecast ahead, and this is evidenced by the results from the Far North and Whangarei.

Table 4. Number of days in advance with which the date that an average of 24% dry matter would be reached for each region could be predicted within +/- 3 days accuracy.

Region	days
Far North	5
Whangarei	15
Bay of Plenty	38

A weak correlation was observed between fruit size and dry matter content (Figure 2). This was most pronounced in the Far North and weakest in the Bay of Plenty. This contrasts with the previous season where no relationship between fruit size and dry matter content was observed in any of the regions (Pak and Dawes, 2001).

The correlation between fruit size and dry matter would have contributed to the apparent decline in the rate of dry matter accumulation in the Far north this season. Commercial harvesting had commenced on at least one of the monitor blocks in the Far North over this period. Selective picking for larger count sizes would have tended to remove fruit with higher dry matter, thereby lowering the average dry matter content in subsequent samples.

CONCLUSION

Dry matter accumulation in fruit over the period from July to September has been demonstrated to increase in a relatively linear pattern over several seasons. However, there are considerable season differences in initial levels and subsequent rates of dry matter accumulation. Deviations from the linear pattern occur in some regions in some seasons. These deviations are the major limiting factor in predicting the times at which commercial maturity is likely to be reached in the different regions. A weak correlation was observed between fruit size and dry matter content.

ACKNOWLEDGEMENTS

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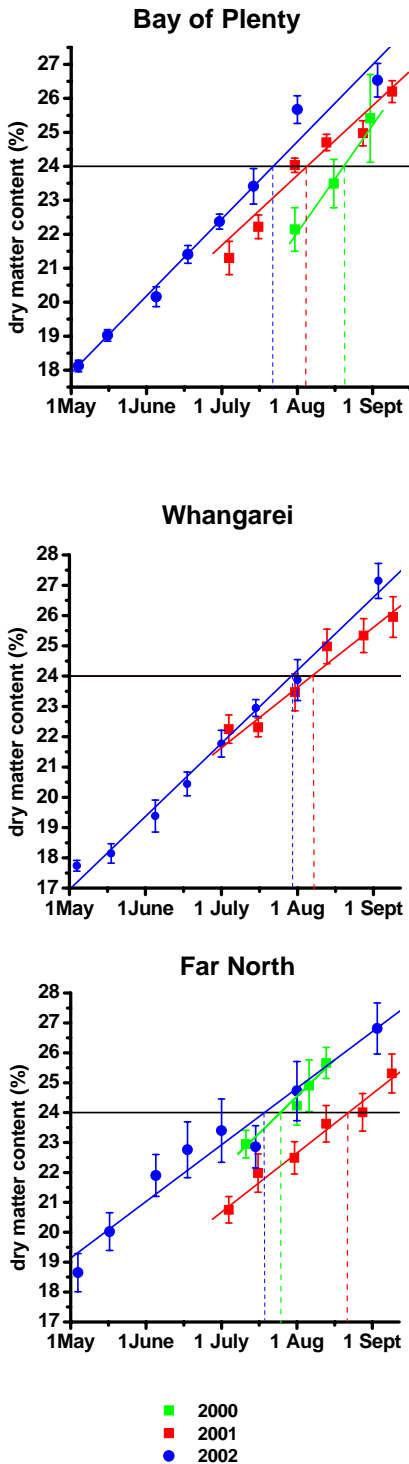


Figure 1. Patterns of dry matter accumulation in each of three regions. Each point represents the mean of 5 20-fruit samples \pm standard error. Coloured solid lines are fitted lines from the linear regressions. Dashed lines indicate the time that average dry matters reached 24 %.

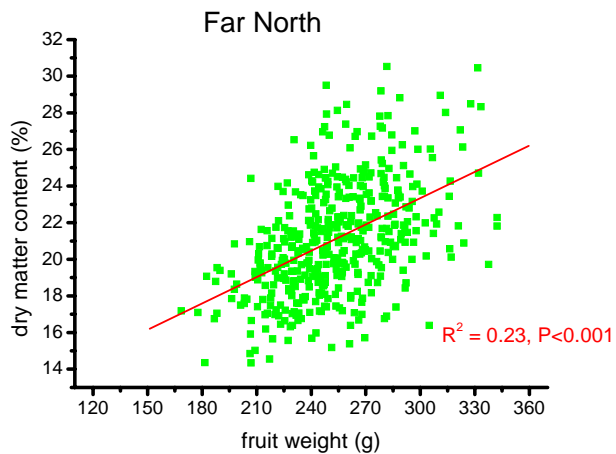
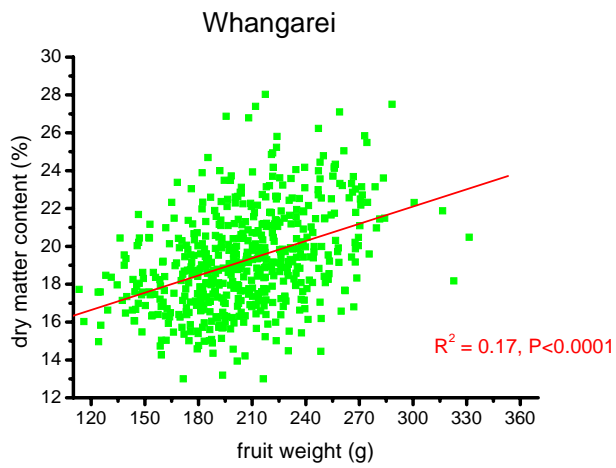
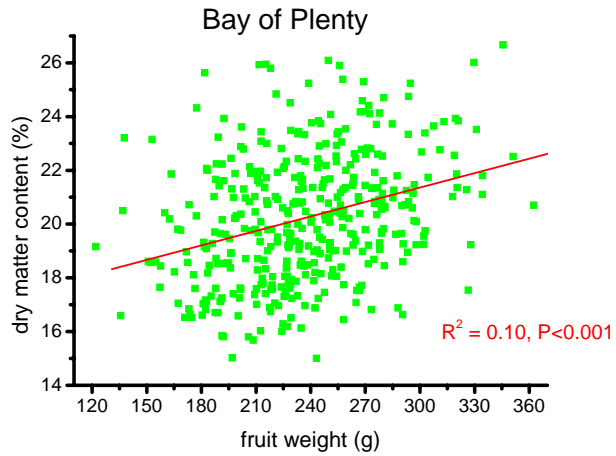


Figure 2. Relationship between fruit size and dry matter content in each of 3 growing regions (N=440). Fitted regression line, goodness of fit and probability value shown for each region.