

# The Northland Dairy Development Trust & The Northland Agricultural Research Farm

## Reducing Reliance on Imported Feed Trial

Update 1 December 2016

### Project funders

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# Reducing Reliance on Imported Feed Trial Update

*Chris Boom (AgFirst Northland) & Kate Reed (NARF Farm Manager) – November 2016*

This trial is being conducted by the Northland Dairy Development Trust in conjunction with the Northland Agricultural Research Farm. The project is funded by DairyNZ, Ministry of Primary Industries (Sustainable Farming Fund) and Hine Rangi Trust.

## Summary

This project is testing and demonstrating how two dairy production systems using all 'home grown' feed (Grass Only farm and Cropping farm) compare to a system using Palm Kernel Expeller (PKE farm). Stocking rate is 7% lower on the Grass Only farm compared to the other two farms.

This farm systems trial has now been running for 18 months. Weather conditions have been relatively kind throughout this time resulting in good pasture growth and covers on all farmlets through most of the study. In response to these conditions, supplement use has been significantly lower than expected on the PKE farm. During 2015/16, crops were established on the Cropping farmlet with a total of 23% of the farm area in turnips, fodder beet and maize (silage). Turnip yield was estimated at 9.0 t DM/ha, fodder beet 15.5 t/ha and maize silage 22.0 t/ha.

For the 2015/16 season, milk production was highest on the Cropping farm at 1,049 kg MS/ha compared with 870 kg MS/ha on the Grass only and 1,028 kg MS/ha on the PKE farm.

Costs were calculated for each of the farms, including differential labour requirements. Farm working expenses/kg MS were \$3.59, \$4.20 and \$4.01 for the Grass Only, Cropping and PKE farms respectively. At a \$3.90/kg MS pay-out, the Grass only farm had the highest operating profit at \$975/ha followed by the PKE farm at \$480/ha and the Cropping farm at \$298/ha. A milk payout would have needed to be \$6.00/kg MS before the PKE farm was the most profitable and \$18.00 before the Cropping farm was the most profitable.

Wet conditions during spring 2016 has shown high levels of pugging damage on ex-crop paddocks due to poorer soil structure. This has had a significant impact on the productivity of the Cropping farm. To date (21<sup>st</sup> November 2016), production is 488, 495 and 523 kg MS/ha for the Grass Only, Cropping and PKE farms respectively.

This study has shown how a Grass Only farm system can be more profitable than other systems. However, this study has had relatively good pasture growing conditions. Results are likely to vary in a more challenging season.

## Background

New Zealand dairy farms have come to rely heavily on importing feed onto the farm. There is widespread concern in the farming community as to the impact if this feed was not available due to lack of supply, market pressures, milk composition requirements or food safety concerns. Increased levels of imported feed have also driven up farm working expenses, making farm systems vulnerable during seasons with lower pay-out.

Removal of imported feed would have significant impacts on the productivity of New Zealand dairy farms in the short to medium term. A farm systems trial was established at the Northland Agricultural Research Farm (NARF), located at Dargaville, to test and demonstrate how dairy systems might maintain production and/or profit without imported feed. The trial is expected to run for at least three years to ensure a range of climatic challenges.

## Trial Structure

This trial commenced on 2<sup>nd</sup> June 2015 and it is now half way through the second year. The trial compares three farmlets:

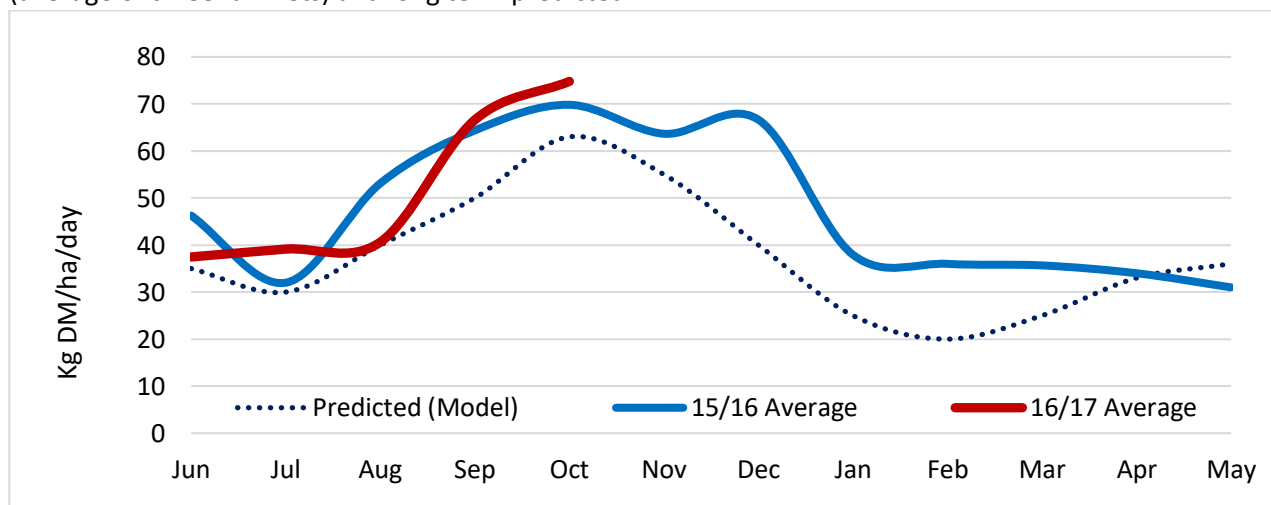
1. **Grass Only Farm** - No imported supplement, home grown grass silage may be used. Stocking rate of 2.6 cows/ha (73 cows calving on 28 ha)
2. **Cropping Farm** - No imported supplement, crops grown on farm (turnips, fodder beet and maize silage). Stocking rate of 2.8 cows/ha (80 cows calving on 28 ha)
3. **PKE Farm** - Importing of PKE as required to optimise profit from pasture. Stocking rate of 2.8 cows/ha (80 cows calving on 28 ha)

## Pasture Growth

Good pasture growing conditions prevailed through the 2015/16 season, with a mild and relatively dry winter/early spring followed by regular rainfall through summer and early autumn. This resulted in calculated pasture growth of 17.4 t DM/ha for the season (based on post and pre-grazing rising plate assessments). This compares with a historical annual production of 13.7 t DM/ha.

Good pasture growing conditions have continued into the 2016/17 season with a relatively dry winter and regular rainfall during spring. Ground conditions finally got wet during spring 2016 but soil and pasture damage was less than normally experienced.

**Figure 1.** Calculated pasture growth rates (average/month) for 2015/16 and 2016/17 seasons to date (average of three farmlets) and long term predicted.



## Pasture Covers

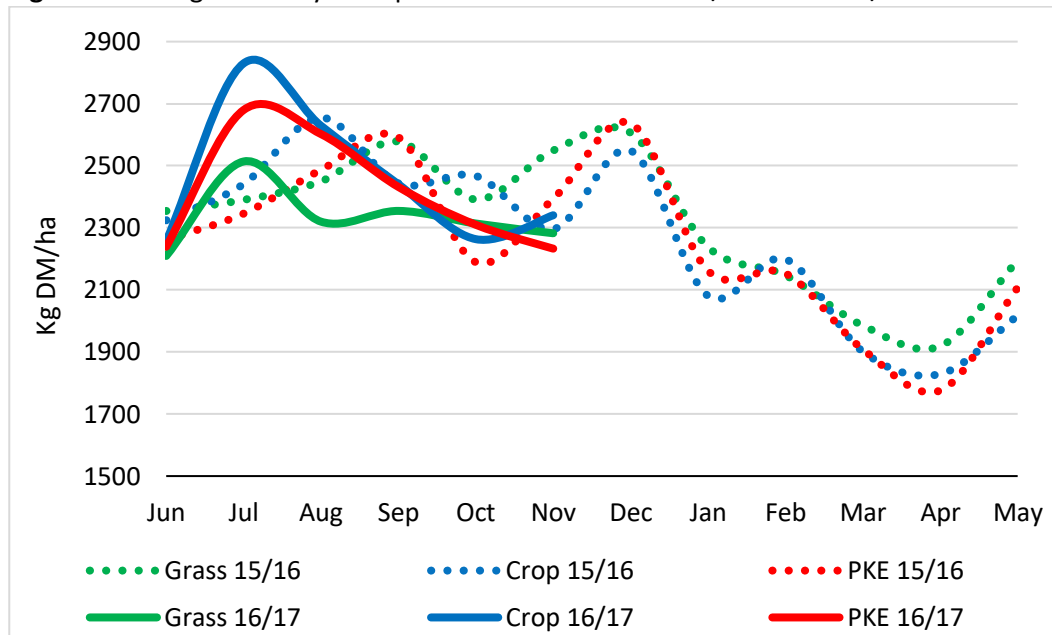
Pasture covers are shown in Figure 2. In response to good pasture growth, pasture covers have generally been significantly higher on all farms than was expected through farm system modelling. The drop in pasture cover during March/April 2016 was largely bought on by all kikuyu based pastures being mulched (with Italian ryegrass being introduced) on each of the farms.

The Grass Only farm has not yet been under pressure with good covers throughout. High covers during spring allowed 20% of the farm to be cut for silage in October & December 2015. Most of the 2015 grass silage was fed back to the cows during autumn and winter 2016, though some remains. To date, 33% of the farm has been cut for silage during spring 2016.

The Cropping farm has held higher covers than the other farms through the June to August period. This farm has less kikuyu and more perennial ryegrass than the other farms, due to the cropping regime, which may have resulted in better pasture growth during early winter, prior to the Italian ryegrass on the kikuyu areas fully contributing on the other farms. Areas have been taken out of grazing for cropping from September/October in each year which effectively increases stocking rate to 3.5 cows/ha, thus allowing for no pasture silage conservation.

The PKE farm has also maintained good pasture covers which resulted in less supplement (PKE) being fed during 2015/16 season than was expected. Grass silage was harvested on 21% of the farm during October and December 2015, with approximately half of this fed back during autumn/winter 2016. To date 30% of the farm has been cut for silage during spring 2016.

**Figure 2.** Average monthly farm pasture cover for the 2015/16 and 2016/17 season to date.



### Supplement and crop use

The use of PKE on the PKE farm was well below expected levels during the 2015/16 season, with 469 kg/cow being fed, compared to an expected requirement of 1,047 kg/cow in an average season. To date, 226 kg/cow has been fed during winter 2016, and none during spring.

During spring 2015, crops were established on 23% of the land area on the Cropping farm, being 9% of the farm in maize silage, 7% turnips and 7% fodder beet. Crops established well, however the turnip and fodder beet yields were disappointing averaging 9 t DM/ha and 15.5 t DM/ha respectively. Turnips were fed to the Cropping cows during January and February 2016, while fodder beet was fed February – early May. Maize yield was estimated at 22 t DM/ha. Cropped paddocks were sown into either perennial or annual ryegrass.

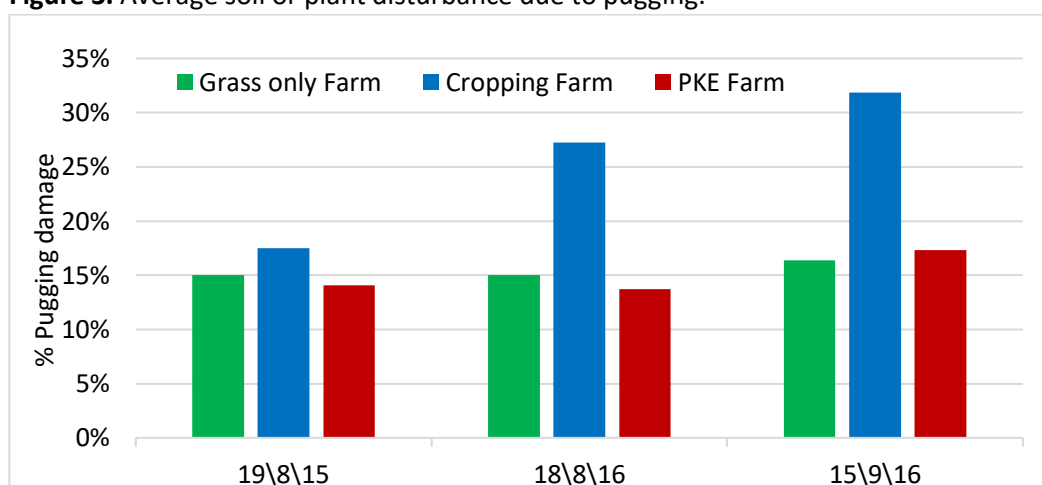
Cropping for 2016/17 season will occur on 21% of the Cropping farm, being 7% in maize silage, 9% in turnips and 6% in fodder beet. A wet mid spring delayed crop establishment with Turnips being sown 28<sup>th</sup> October and 4<sup>th</sup> November, while fodder beet was sown 1<sup>st</sup> November. These crops are showing good plant numbers to date. Maize is yet to be sown (as at 24<sup>th</sup> November), due to paddocks being very wet (ex-turnips). The negative effect of cropping on soil structure appears to be a significant issue for the Cropping farm.

## Pugging Damage

Soils at NARF are predominantly marine clay which is subject to waterlogging and treading damage (pugging) when conditions are wet. To understand the effect of the different farm systems on soil and plant damage, all paddocks were surveyed for pugging damage, once during 2015 and twice during 2016. Damage was assessed by placing a pointer down 100 times/paddock and assessing whether there was significant soil or plant disturbance at each point.

Figure 3 shows how the cropping farm has higher had levels of pugging damage than the other farms during winter 2016. This was clearly due to the ex-crop paddocks having very high levels of pugging. The cultivation process has a negative effect on soil structure and provides a challenge for the Cropping farm.

**Figure 3.** Average soil or plant disturbance due to pugging.



## Feed Eaten

Calculated feed eaten during the 2015/16 season was similar between the Cropping and PKE farms. The home grown feed was highest on the Cropping farm due to crop production.

**Table 2.** Calculated feed eaten (t DM/ha).

	Total feed eaten	Home grown pasture & crop	Imported supplement
Grass only Farm	11.7	11.7	0
Cropping Farm	13.3	13.3	0
PKE Farm	13.3	12.0	1.3

## Milk Production

The Cropping farm had the highest milk production and Grass Only the lowest during 2015/16 season, as shown in Table 3. Light conditioned cows were dried off on all farmlets from early April. Remaining cows were dried off on the Grass Only farm on the 3<sup>rd</sup> May and on the other two farms on the 13<sup>th</sup> May.

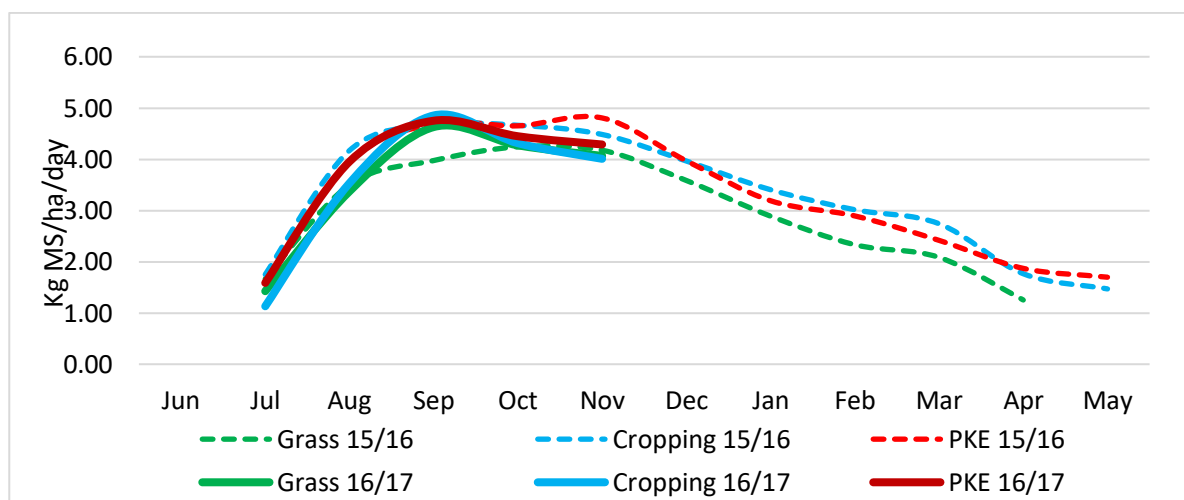
The Grass Only farm has had a good start to the 2016/17 season, being 6% ahead of the previous year while the Cropping and PKE farms are 6% and 2% behind last season respectively. On a per cow basis, the Grass Only farm has the highest production.

**Table 3.** Milk solids production per ha and per cow.

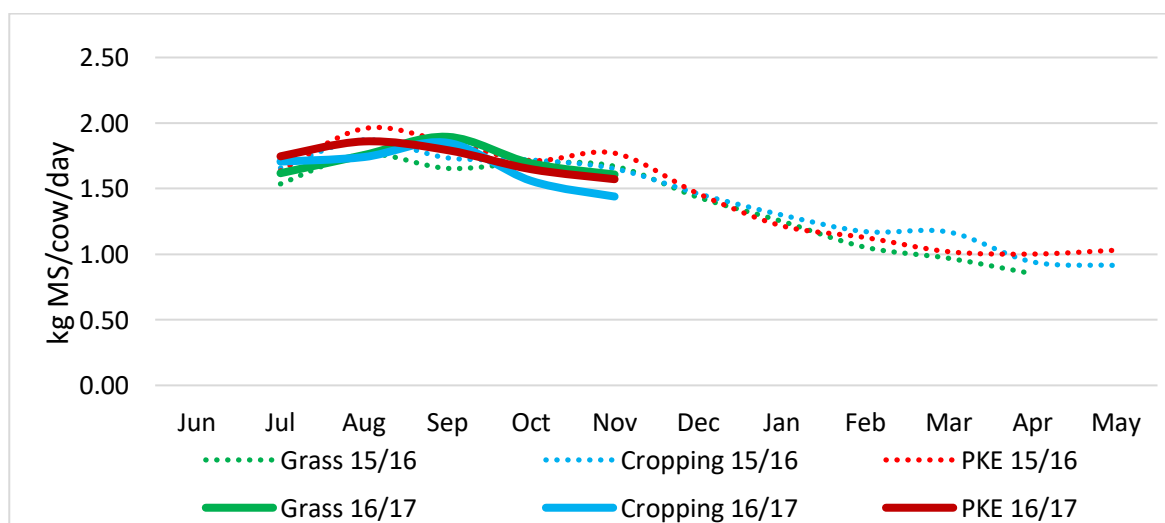
	2015/16 kg MS/ha	2016/17 to 22 <sup>nd</sup> Nov kg MS/ha	2015/16 kg MS/cow	2016/17 to 22 <sup>nd</sup> Nov kg MS/cow
<b>Grass Only Farm</b>	870	488	347	193
<b>Cropping Farm</b>	1,049	495	384	178
<b>PKE Farm</b>	1,028	523	379	188

Figures 4 & 5 show the average daily milk production for the three farms. Milk production per cow was higher on the Cropping farm due to turnips going into the system in early January and some maize feeding to fill gaps. The lower production on the Grass only farmlet on a per ha basis can be largely explained by the lower stocking rate compared to the other farmlets and the lack of supplementation or crops.

**Figure 4.** Milk solids production for the 2015/16 and 2016/17 seasons (kg MS/ha/day).



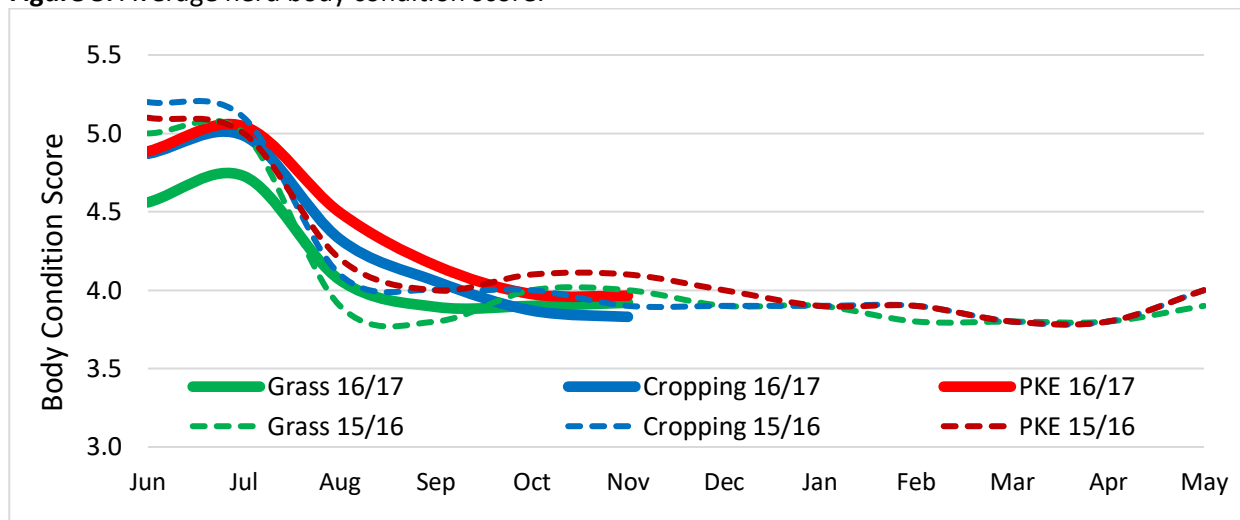
**Figure 5.** Milk solids production for the 2015/16 and 2016/17 seasons (kg MS/cow/day).



## Body Condition Score

Body condition score has been assessed every two weeks. The Grass only farm started the 2016/17 season (1<sup>st</sup> June 2016) below target and failed to achieve the target of 5.0 prior to calving. Body condition was better on the Cropping and PKE farms.

**Figure 5.** Average herd body condition score.



## Other results

The table below provides a summary of the three farms. Nitrogen has strategically been used over all three farms, however difficulty in getting onto ex-cropping paddocks during wet periods resulted in slightly lower N use on the Cropping farm.

Mating results have varied between all three herds, however these differences are not considered as a consequence of the farm treatment. Once-a-day milking was utilised for cows with BCS of 3.5 and under from 2 weeks prior to mating.

**Table 4.** Various data for the three farms.

2016/17 June - November	Grass Farmlet	Cropping Farmlet	PKE Farmlet
Area (ha)	28	28	28
Peak number of Cows	72	78	78
Stocking Rate	2.6	2.8	2.8
Nitrogen (Units N/ha)	124	110	124
3 Week submission Rate	85%	85%	79%
Non-return rate	82%	82%	79%

## Differences in farm labour required

Time spent doing tasks on each individual farm, over and above farm operations that are common to all farms, has been recorded. The table below shows this additional cost in time required by NARF staff for feeding out, moving cows to and from pads or crops, and crop establishment. It should be recognized that additional time spent shifting cows was based on mobs of 70 – 80 cows, this would be more efficient per cow with larger mobs.

**Table 5.** Additional labour and tractor time for Cropping and PKE farmlets compared to Grass only

	Task:	2015/16 Hours	2016/17 Hours
Grass Only Farm	Tractor Time	0	30
	Moving cows/Fences	0	0
Cropping Farm	Tractor Time	114	63
	Moving cows/Fences	313	59
PKE Farm	Tractor Time	100	47
	Moving cows/Fences	193	23

## 2015/16 Financial results

The financial results for the three farms have been calculated for the 2015/16 season and are shown in the table below. The income is based \$3.90/kg MS plus other income from livestock sales. The expenses are based on actual expenses with some adjustments for labour and administration to compensate for extraordinary expenses of the research farm.

Farm working expenses/kg MS were \$3.59, \$4.20 and \$4.01 for the Grass Only, Cropping and PKE farms respectively. At a \$3.90/kg MS pay-out, the Grass only farm had the highest operating profit at \$975/ha followed by the PKE farm at \$642/ha and the Cropping farm at \$444/ha. A milk payout would have needed to be \$6.00/kg MS before the PKE farm was the most profitable and \$18.00 before the Cropping farm was the most profitable.

Additional capital is required to run develop infrastructure, machinery and additional cows for the more intensive systems. Assumptions were made and adjusted operating profit is shown in the tale below based on servicing the additional capital. Taking the additional capital requirement into account further favours the Grass Only farm.

**Table 6.** Calculated income, expenses and operating profit for the three farms along with scenarios based on alternative pay-out and adjustment for additional capital required for the alternative farm systems.

2015/16 Financials	Grass Only Farm		Cropping Farm		PKE Farm	
Income	\$/ha	\$/kg MS	\$/ha	\$/kg MS	\$/ha	\$/kg MS
Income from milk	\$3,391	\$3.90	\$4,071	\$3.90	\$4,013	\$3.90
Other Income	\$707	\$0.81	\$754	\$0.72	\$754	\$0.73
<b>Total Income</b>	<b>\$4,098</b>	<b>\$4.71</b>	<b>\$4,825</b>	<b>\$4.62</b>	<b>\$4,766</b>	<b>\$4.63</b>
Total Working Expenses	\$3,123	\$3.59	\$4,381	\$4.20	\$4,125	\$4.01
<b>Operating Profit at \$3.90</b>	<b>\$975</b>	<b>\$1.12</b>	<b>\$444</b>	<b>\$0.43</b>	<b>\$642</b>	<b>\$0.62</b>
<b>Alternative pay-out</b>						
<b>Operating Profit at \$5.50</b>	<b>\$2,334</b>	<b>\$2.68</b>	<b>\$1,968</b>	<b>\$1.89</b>	<b>\$2,127</b>	<b>\$2.07</b>
<b>Operating Profit at \$7.00</b>	<b>\$3,638</b>	<b>\$4.18</b>	<b>\$3,534</b>	<b>\$3.39</b>	<b>\$3,670</b>	<b>\$3.57</b>
<b>Additional Cost of Capital</b>						
Additional Capital Required	\$500	\$0.57	\$2,242	\$2.14	\$2,483	\$2.42
Cost of Capital at 6.5%	\$33	\$0.04	\$146	\$0.14	\$161	\$0.16
<b>Adjusted Operating Profit at \$3.90</b>	<b>\$942</b>	<b>\$1.08</b>	<b>\$298</b>	<b>\$0.29</b>	<b>\$480</b>	<b>\$0.47</b>