# COMPUTER CROP MODELS AS A MANAGEMENT TOOL

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# Scope

- Crop modelling History
- CANEGRO sugarcane model
- Evolution of a benchmarking tool
- Models as a management tool
  - Harvest Planning
  - Performance monitoring
  - Replant Planning
  - Irrigation scheduling

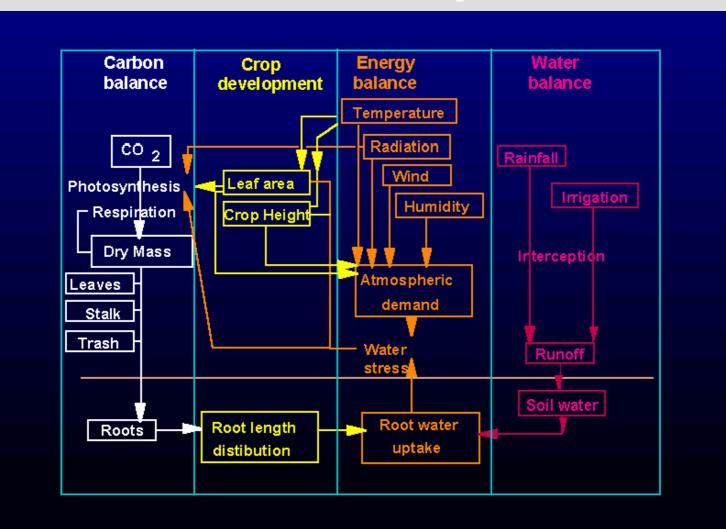
# History

- Development started during the 70's
- Initially of Maize, Wheat, Sorghum
- Development on Sugarcane models began during early 80's
  - South Africa CANEGRO
  - Australia AusCane, Qcane, APSIM
  - •Many others throughout the world
- Initially a research tool to compliment conventional experimentation
- Pressure to use models to assist agri-business
- Development continues today

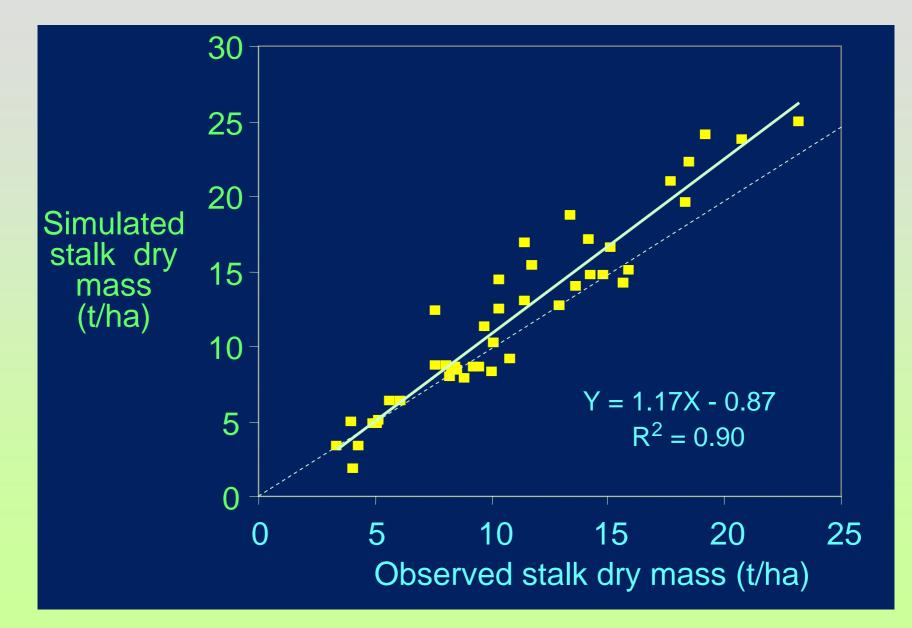
# The CANEGRO crop model

- Developed primarily in South Africa
- International consortium DSSAT
- Primarily climate-driven
- Features
  - Hesketh-McCree RUE-based Carbon Balance
  - •Water balance multi-layer single dimension model
  - •Energy Balance Sugarcane-specific Penman-Monteith
  - Mechanistic canopy development routine

# **CANEGRO - Conceptual Basis**



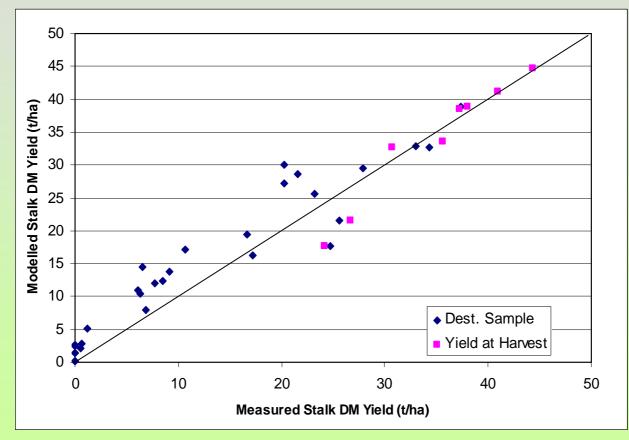
## **Model Validation – South Africa**



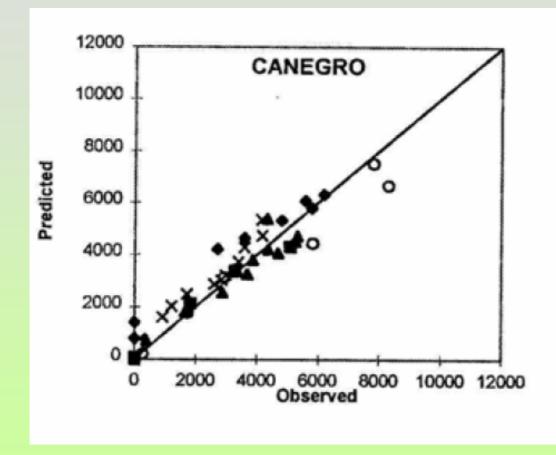
#### **Model Validation - Swaziland**

•Stress Trial – 4 levels of stress, 4 seasons

Destructive sampling – 2 monthly intervals and
Yield at Harvest



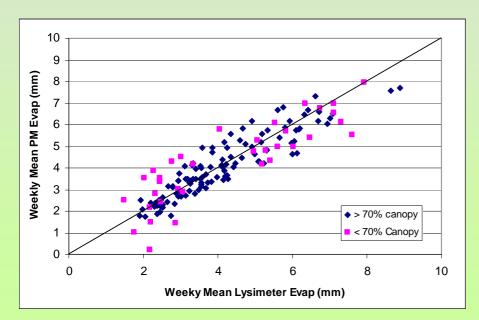
#### **CANEGRO Validation - International**

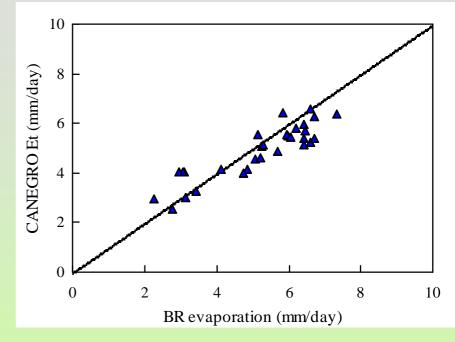


- 4 sites in Australia
- 1 site in Hawaii

#### CANEGRO Validation – Evapotranspiration Estimate

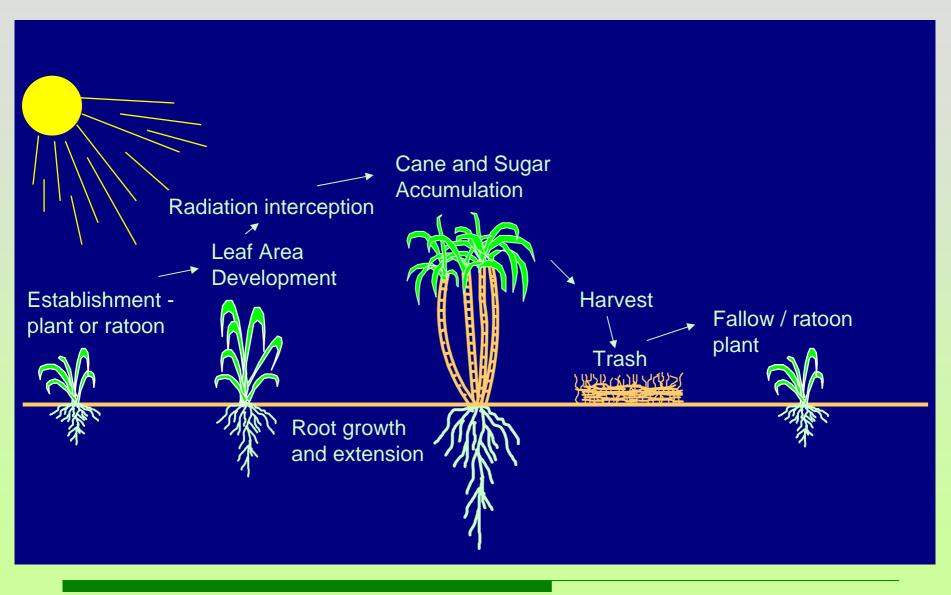
- Penman-Monteith sugarcane reference Et approach
- Original Validation Three years Lysimeter data – Pongola, South Africa



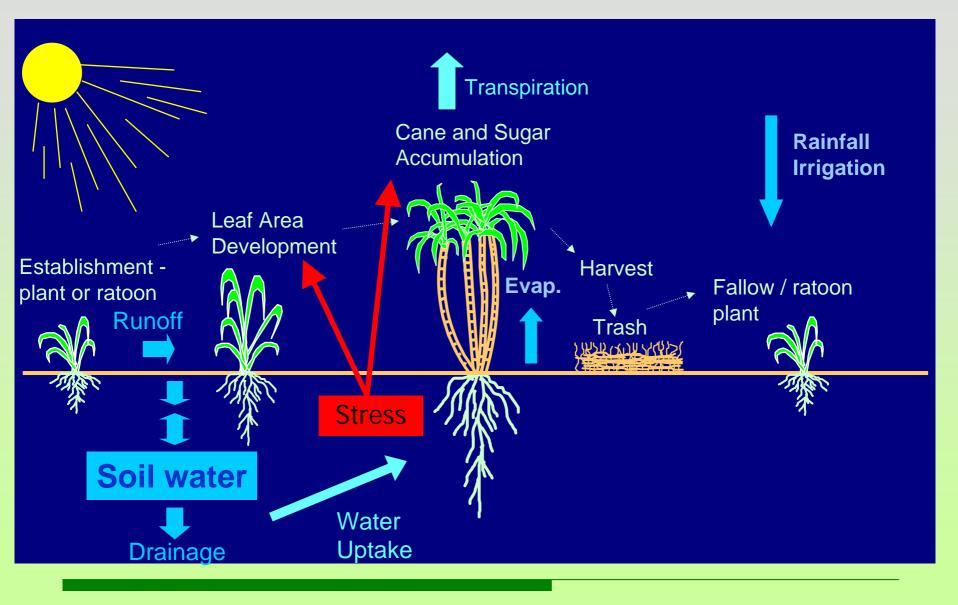


Et Validation
Bowen ratio Measurements, Swaziland

## **Potential Yield Calculation**



## Water Limited Yield Calculation

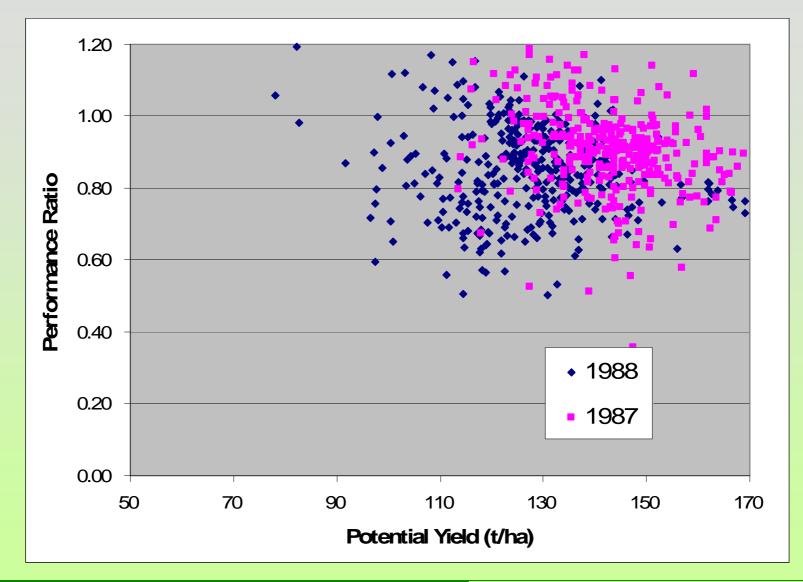


## Evolution of a Benchmarking Tool Step 1 – Potential Yield

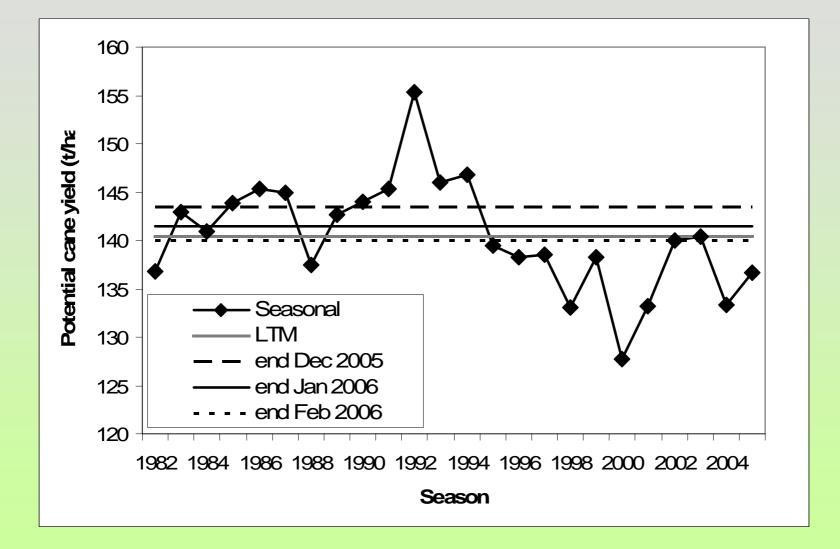
- Questions raised regarding performance at RSSC, Swaziland during the late 80's
- 1987/88 season avg yield = 130 t/ha
- 1988/89 season avg yield = 107 t/ha

• Why the big drop?

#### **Season Potential and Performance**



## **Potential Yield - Season Benchmarking**

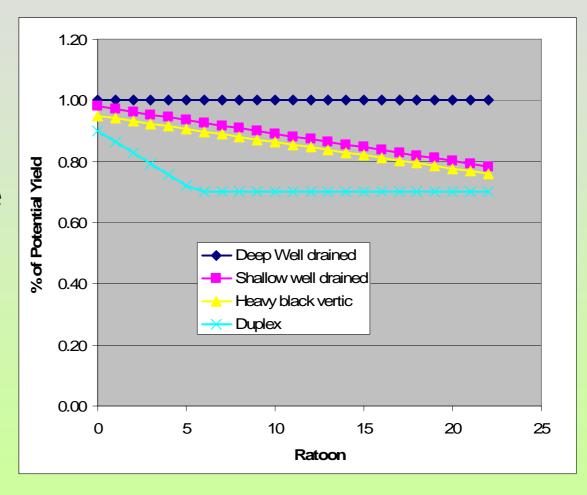


## Evolution of a Benchmarking Tool Step 2 – Attainable Yield

- Questions regarding field performance comparisons raised
- Potential yield concept able to cope with seasonal variability
- Need to consider other agronomic constraints
- Led to development of Attainable Yield concept

## **Attainable Yield Concept**

Identified the soil/ratoon interaction as the most important agronomic consideration



## **Attainable Yield Concept**

- Soil/Ratoon matrix combined with other agronomic factors in a simple multiplicative model of the form:
- AttYId = PotYId \* Soil/Rat fac \* Variety fac \* Irrig fac
- Eg. Shallow well drained soil, 6<sup>th</sup> ratoon, NCo376, Dragline irrigation system
- AttYld = 140 t/ha/an \* 0.94 \* 1.00 \* 1.00 = 132 t/ha/an

Examples of model use in commercial operations – CanePro Cane Management Software

1. Harvest Planning and Yield Estimates

## The Problem

- Large Estates
  - 3500 ha 21000 ha
  - 100 1000 fields
  - Supplying 1 2 mills
- Complex harvest planning decisions
- Need for accurate estimates
  - Usually majority or only mill supply
  - Implications for season start and duration
- Need for in-season revision of estimate

## Estate Practice – Prior to CanePro

- Estimate largely based on 5-year mean productivity
- Realise the effect of age and climate on yield but unsure how to incorporate into early estimates
- Rely on Section Managers subjective yield assessment
- Yield revisions 2 4 times per season

## The Need

- Easy-to-use harvest planning tool which:
  - Is flexible
  - Integrates the effect of climate and age on yield
  - Provides real-time in-season revisions
  - Model inputs simple and easy to obtain

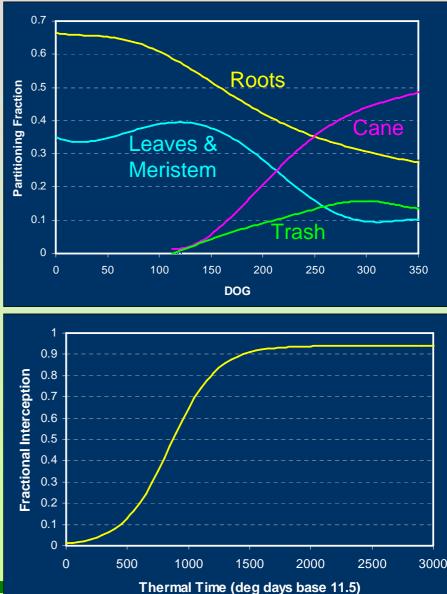
# How?

 Combine commercially available harvest planning engine with a simplified yield simulation model and performance ratio concept

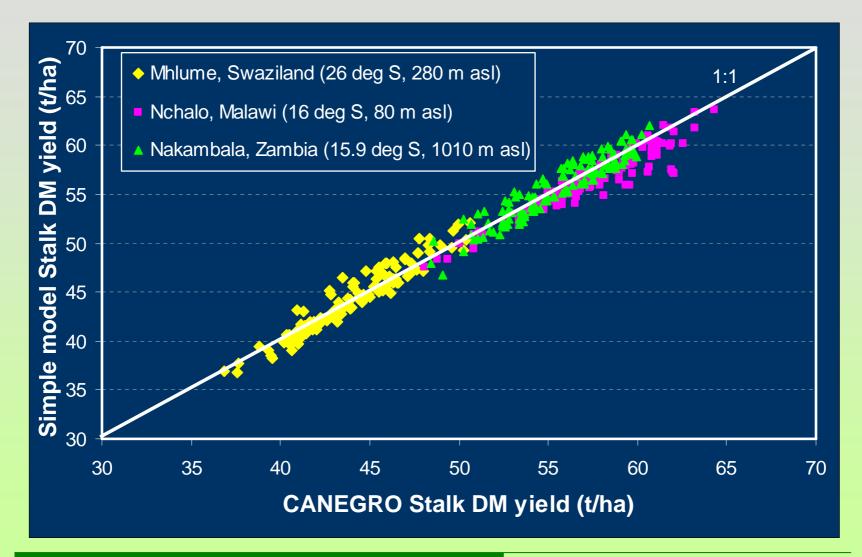
# Simplified Yield model

 Potential yield model developed using CANEGRO RUE model (McCree & Hesketh) and DM partitioning algorithms

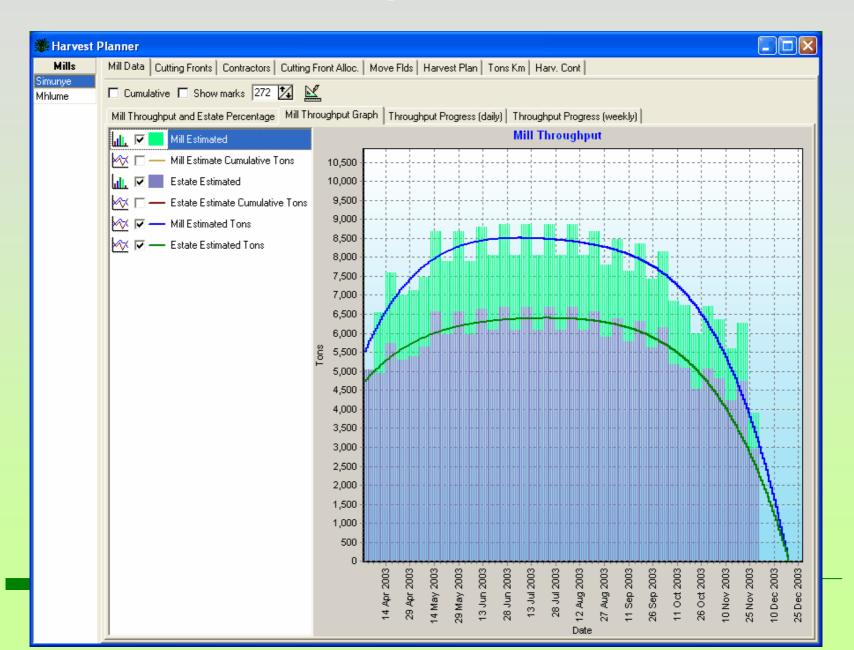
 Empirical temperature based radiation interception curve (base 11.5)



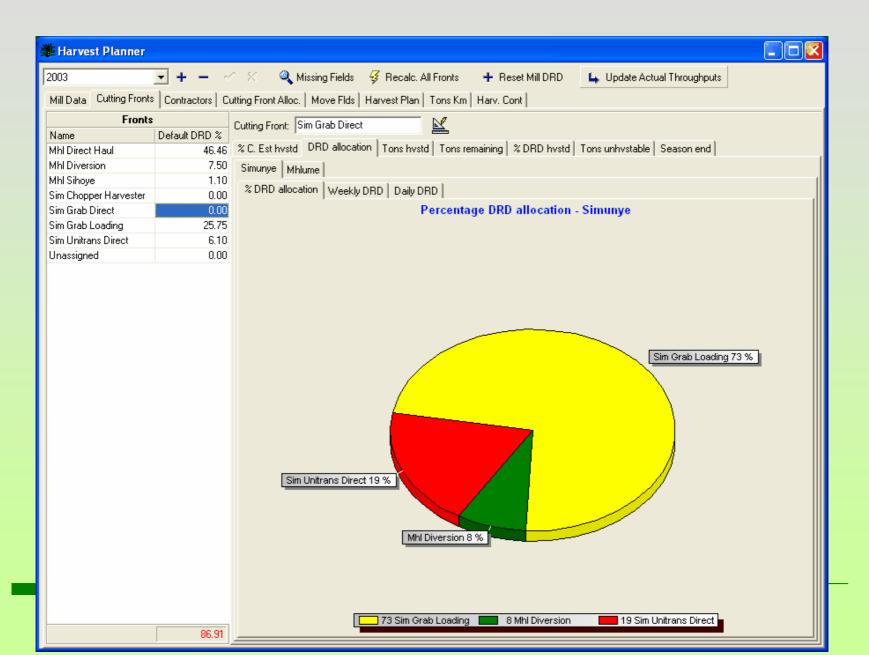
## **Model Validation**



#### Step 1- Crush Programme



#### **Step 2 – Cutting Fronts**



#### Step 3 – Field Harvest Order

🗱 Harvest I	Planner											
2003	- 🕄 🕄	📓 😭 🛛 🔍 Missing Fields 😽	Recalc. All Fronts	🚺 View E	ditor 🕂	Reset Mill DRD	4	Update Actual Throughputs				
Mill Data Cutting Fronts Contractors Cutting Front Alloc. Move Flds Harvest Plan Tons Km Harv. Cont												
From cutting front: Mhl Direct Haul 🗸 Set seq to grid sort order												
		Cutting Sequence Data	a	Area	(ha)	Estim 🔺		•				
Name	Seq △ Grow st		Carried over		To Harvest	Current T						
215010	1 28/02/2	2002 10/04/2003	0.00	13.50	13.50	121.9						
215020	2 01/03/2	2002 10/04/2003	0.00	10.80	10.80	121.6		General Details				
215030	3 27/02/2	2002 10/04/2003	0.00	8.10	8.10	116.8		Name   Cut date   Carried over   S				
402011	4 12/05/2	2002 10/04/2003	0.00	2.00	2.00	123.3						
402012	5 12/05/2	2002 11/04/2003	0.00	1.80	1.80	141.5						
403010	6 08/03/2	2002 11/04/2003	0.00	15.20	15.20	122.4						
403020	7 09/03/2	2002 11/04/2003	0.00	13.10	13.10	122.1	•					
403030	8 27/02/2	2002 11/04/2003	0.00	10.60	10.60	122.5						
416010	9 02/03/2	2002 12/04/2003	0.00	10.80	10.80	121.9						
416020	10 05/03/2	2002 12/04/2003	0.00	6.20	6.20	122.3						
416030	11 28/02/2	2002 12/04/2003	0.00	7.00	7.00	122.5						
416040	12 04/03/2	2002 13/04/2003	0.00	10.90	10.90	122.6						
520010	13 28/04/2	2002 13/04/2003	0.00	18.60	18.60	155.4						
520020	14 25/04/2	2002 14/04/2003	0.00	19.00	19.00	157.2	>					
521010	15 01/05/2	2002 14/04/2003	0.00	19.40	19.40	154.7						
521020	16 01/05/2	2002 15/04/2003	0.00	19.70	19.70	154.9						
222010	17 04/03/2	2002 16/04/2003	0.00	4.60	4.60	120.3						
222020	18 06/03/2	2002 16/04/2003	0.00	6.80	6.80	120.9						
222030	19 05/03/2	2002 16/04/2003	0.00	10.50	10.50	120.0						
222040	20 07/03/2	2002 17/04/2003	0.00	11.30	11.30	120.6	•					
222050	21 09/03/2	2002 17/04/2003	0.00	10.90	10.90	120.4						
223010	22 20/03/2	2002 17/04/2003	0.00	10.60	10.60	119.7						
223020	23 15/03/2	2002 18/04/2003	0.00	13.20	13.20	119.9						
223030	24 18/03/2	2002 18/04/2003	0.00	10.00	10.00	120.6						
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Field status co	olours:		Tin	ne frame: [				·				

#### Step 4 – Harvest Plan



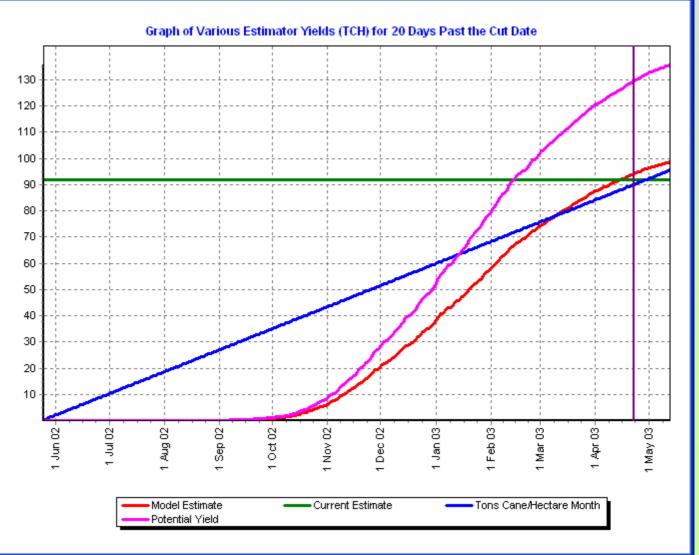
## Step 4 (contd...) – Harvest Plan

Harvest Planner									
2003	- 🗞 🛛 🛛	😭 🛛 🍳 Missing Fields	😼 Recalc. Front	😼 Recalc. All	Fronts 🗕 S	how Selected Fr	ont 🕂 Res	et Mill DRD	
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Mhl Direct Haul	Drag a colur	mn header here to group by	that column						
Mhl Diversion						Estimate	d Cane Yield		
Mhl Sihoye	Field	Cut date 🛛 🛆	End cut date	Tons cane/ha	Total Tons	Tons hystd		Tons unharvestable	Fette
Sim Chopper Harveste	906020	26/07/2003	30/07/2003	107.8	2059.43	Tons nosta	2059.43	0.00	LSU
Sim Grab Direct	125010	26/07/2003	26/07/2003	97.1	1787.41		1787.41	0.00	
Sim Grab Loading	125020	26/07/2003	27/07/2003	83.5	1879.78		1879.78	0.00	
Sim Unitrans Direct	1404	27/07/2003	27/07/2003	142.1	3893.54		3893.54	0.00	
Unassigned	1404	27/07/2003	28/07/2003	142.1	2511.11		2511.11	0.00	
	204	27/07/2003	30/07/2003	96.0	3176.95		3176.95	0.00	
	131010	27/07/2003	27/07/2003	70.0	553.17		553.17	0.00	
	131030	27/07/2003	27/07/2003	82.7	678.02		678.02	0.00	
	131040	27/07/2003	28/07/2003	54.3	548.10		548.10	0.00	
	131020	27/07/2003	27/07/2003	67.9	800.83		800.83	0.00	
	1412	28/07/2003	29/07/2003	134.3	3343.41		3343.41	0.00	
	5033	28/07/2003	29/07/2003	136.3	4389.88		4389.88	0.00	
	1413	29/07/2003	30/07/2003	140.3	3324.12		3324.12	0.00	
	1418	29/07/2003	29/07/2003	139.3	1630.09		1630.09	0.00	
	1419	29/07/2003	29/07/2003	142.4	840.42		840.42	0.00	
	5032	29/07/2003	30/07/2003	136.6	2746.59		2746.59	0.00	
	1414	30/07/2003	31/07/2003	140.4	2106.13		2106.13	0.00	
	5012	30/07/2003	31/07/2003	113.1	2623.77		2623.77	0.00	
	5031	30/07/2003	30/07/2003	136.9	1341.83		1341.83	0.00	
	4012	30/07/2003	02/08/2003	178.0	2865.34		2865.34	0.00	
	847010	30/07/2003	04/08/2003	103.0	2440.06		2440.06	0.00	
	1415	31/07/2003	31/07/2003	139.8	2824.74		2824.74	0.00	
	1416	31/07/2003	01/08/2003	139.2	1531.63		1531.63	0.00	
	143010	31/07/2003	31/07/2003	89.2	544.04		544.04	0.00	
	143020	31/07/2003	31/07/2003	89.1	882.03		882.03	0.00	
	143030	31/07/2003	01/08/2003	86.9	860.72		860.72	0.00	
	1,304				2,104,203.4	0.00	2,104,203.45	0.00	
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#### **Estimate Detail**

#### 🇱 Yield Data for Field: 315

- Current season Details										
Grow Start Date	25/05/2002									
Cut Date	23/04/2003									
Estimator Method	Current Estim									
Area to Harvest	19.50									
Orig. Area to Harvest	19.50									
Tons/ha/mnth Est.	8.20									
Current Estimate	91.87									
Original Estimate	90.53									
Official Estimate	0.00									
Current Tons	1,791.47									
Original Tons	1,765.43									
TCHA	100.75									
Ratoon	12									
Cut Age	10.9									
Perf. Ratio										
- Previous Seasons Yields (TCHA)										
2002	93.08									
2001	93.62									
2000	103.55									
- Previous Seasons Ratoo	ns									
2002	11									
2001	10									
2000	9									
- Previous Seasons Cut Da	ates									
2002	24/05/2002									
2001	30/05/2001									
2000	10/06/2000									
- Previous 3 Seasons Perf. Ratios										
2002	.68									
2001	.69									
2000	.81									



## Advantages

- Flexibility
  - Harvest date and estimate re-calculated if field harvest sequence changed
- Captures climate and age effects
- Live in-season
  - Harvest plan continually updated and estimate refreshed
- Better control of other operations linked to harvest date e.g. ripening
- What-if analysis w.r.t. season start and duration

Examples of model use in commercial operations – CanePro Cane Management Software

2. Performance Monitoring

### **Performance Monitoring**

Excl       Price       Std Stab         Excl       Price       Std Stab         Excl       Department       Endersite       Endersite       Endersite       Endersite         1333       1333       1333       1333       1333       1333       1333       1333       1333       1233       1	. 🗆 🔀																ns (All)	() and Locatio	s for Seasor	rvested Fields	🀲 H
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1986       904       R2       1248       930       545       59302.3       125       1240       107.7       104.1       74.6       894       93.7       58.703       4.00       0.07         1987       1988       1986       96.4       60.4       51.847.6       12.6       118.6       98.5       98.5       98.7       80.6       93.7       67.0       44.441       52.18       100.6         2004       R4       121.4       33.6       55.1       45.895.9       12.2       118.2       12.8       118.8       76.1       78.3       106.8       63.272       42.83       13.0         2004       V2       12.1       31.6       67.2       48.767.0       12.0       116.1       175.5       78.9       104.5       55.36       57.9       77.1       100.4       43.551       65.954       42.28       12.6       103.5       106.0       104.3       75.0       68.7       73.0       112.2       21.373       4.028       -18.8       72.0       50.57       102.5       102.5       102.5       98.7       73.1       97.1       69.05       4.24       12.8       12.4       12.4       12.6       12.1.3       102.5       102.5	/	-4.6	-2,665	58,366	99.6	85.9	77.9	110.7	112.3	112.3	121.4	12.2	55,701.1	51.2	95.1	122.0		2004			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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All Section       2004       V3       109.7       86.6       53.4       42.928.4       10.5       109.0       103.5       106.0       104.3       73.0       83.1       93.8       46.518       -3.590       -7.7         02       2004       V4       136.6       91.0       64.9       17.344.6       133.1       136.0       129.4       129.4       124.7       66.7       73.0       112.2       21.373       4.028       18.8         03       04       A       122.5       97.0       56.9       57.228.4       12.6       121.3       102.5       99.8       73.1       97.1       89.9       53.025       4.204       78         04       0       04       8       129.0       101.1       57.6       43.255       12.8       111.5       111.5       101.8       80.3       89.5       43.917       4.745       -10.8         065       065       07       02.0       129.2       102.3       63.1       55.894.4       130.1       127.9       109.4       109.6       106.6       79.2       96.0       95.0       52.423       3.471       66.6         065       004       F       19.9       81.3       55.2<	/		2.4																•	10	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
01       01       03       103       103       103       103       103       103       104       730       831       338       45,518       -3,390       -7.7         02       04       V4       1366       910       649       17,344       133       1360       1284       1284       124       1284       124       1284       124       1284       1284       124       1284 <td< td=""><td>/</td><td></td><td></td><td>100000000000000000000000000000000000000</td><td></td><td>1.1.1.1.1</td><td></td><td>1000</td><td></td><td>10000</td><td></td><td>1.000</td><td></td><td></td><td></td><td>1071021</td><td>a second s</td><td>177.7.7.2</td><td></td><td>CALCULATION OF THE OWNER OWNER</td><td>All Se</td></td<>	/			100000000000000000000000000000000000000		1.1.1.1.1		1000		10000		1.000				1071021	a second s	177.7.7.2		CALCULATION OF THE OWNER	All Se
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03 04 05 06 06 07 08 09 09 09 10       2004       8       1230       101.1       57.6       43,265.5       12.8       128.3       111.5       111.5       108.1       78.4       93.6       97.3       41,616       1.649       4.0         06 07       06       07       08       09.4       0.0       192.2       102.3       63.1       55.894.4       13.0       127.9       109.4       109.6       106.6       79.2       96.0       96.0       52.423       3.471       8.6         004       E       127.1       93.3       56.3       54.242.8       12.8       126.1       105.8       102.9       73.4       90.6       92.7       53.868       374       0.0         09       09       04       G       112.8       95.6       58.4       51.01.6       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         11       11       11       11       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         12       13       -4.404       104       -4.404 <td>/</td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td>101/01</td> <td></td> <td></td> <td>11 C C C C C C C C C C C C C C C C C C</td> <td>225123135</td> <td>1.000</td> <td></td> <td>100000</td> <td>10 million 10 million 1</td> <td></td> <td></td> <td>1 March 10 Mar</td> <td></td> <td></td> <td></td>	/					1	101/01			11 C C C C C C C C C C C C C C C C C C	225123135	1.000		100000	10 million 1			1 March 10 Mar			
06       06       00       115.4       73.8       53.6       33.172.3       12.3       114.6       100.9       99.4       63.1       80.3       83.5       43.917       4.745       -10.8         06       07       08       2004       C       129.2       102.3       63.1       55.894.4       13.0       127.9       109.4       109.6       106.6       79.2       96.0       96.0       52.423       3.471       6.6         07       08       2004       E       127.1       93.3       56.3       54.242.8       12.8       126.1       105.8       102.9       73.4       90.6       92.7       53.868       37.4       0.7         09       10	/		2															2			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
06       07       08       129.2       102.3       63.1       55.894.4       13.0       127.9       109.4       109.6       106.6       79.2       96.0       96.0       52.423       3.471       6.6         07       08       127.1       93.3       56.3       54.242.8       12.8       126.1       105.8       102.9       73.4       90.6       92.7       53.868       374       0.7         09       10       11.9       81.3       55.2       56.755.6       12.2       119.5       103.8       100.8       67.8       80.7       90.7       63.334       -65.79       -10.4         11       12       95.6       58.4       53.401.6       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         12       13       -	/					10000	100000		10000		in the second						1.8.6	1000000			• • • • • • • • • • • • • • • • • • •
07       08       127.1       93.3       56.3       54,242.8       12.8       105.8       102.9       73.4       90.6       92.7       53,868       374       0.7         08       09       10       119.9       81.3       55.2       56,755.6       12.2       119.5       103.8       100.8       67.8       80.7       90.7       63,334       -6.579       -10.4         10       11       12.8       95.6       58.4       53,401.6       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62,174       -8,772       -14.1         11       12       14       15       100.4       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62,174       -8,772       -14.1         12       13       -<			100000	1			20.00			10.000	14.554.554	10.000		-	A	10.000		1 200.000			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
08       09       12.1       00.5       00.5       00.4       12.2       110.5       100.5       100.5       100.5       00.5       00.7       63.334       -6.579       -10.4         09       10       10       122.8       95.6       58.4       53.401.6       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         11       12       13       14       15       10       10       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         12       13       14       15       10						5 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	10000	2023.033.0	10000		1000		10-2 · 10-0 ·					1	_		
09       10       122.8       95.6       58.4       53.401.6       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         11       12       14       15       10       10       10       10       11.6       122.5       120.4       127.9       123.7       77.9       77.3       111.3       62.174       -8.772       -14.1         12       13       14       15       10	/																	\$			- 08
10 11 12 13 14 15 Variable (All) Organisation Potential Yield (TCH) Potential Yield (TCH) Potential Yield (TCH) Criganisation Potential Yield (TCH) Criganisation Potential Yield (TCH) Criganisation Actual Yield (TCH) Criganisation Criganis Criganisation Criganisation Cr	-	2012/01/20												1	1000						E 100000
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14       Image: Constraint of the second seco																					- 12
Total Yield (TCH)     Total Yield (T	-						•									111					E 200
Variable (All) Urganisation S Potential Yield (TCH) 139.7 Actual Yield (TCH) 98.1			1		_											100 -	al Yield (TCH)	Potentia	-1		
	-				<b>h</b>											90 -	'ield (TCH)	Actual 🗌			
		n ( )				- 00	i 🤖 j	1 1			1		1			20	h Limited Yield (TCF	🛛 🗖 Irrigation		N. A. CARL	Contraction (Sector)
																° <sup>u</sup> T					
									-			··· <b>[]</b> · <b>]</b> ]·			-	70 -					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
				-0												60	nth)	Age (mr			E 110,000
Age (mnth) 12.2																	riety Rule (TCH)	After Va			1 1 N
After Variety Rule (TC 140.3																50 -	il/Ratoon Rules (T	After So			1 1 1 2 2 3 3
After Soll/Ration Ru 136.0																40					1 1 2 2 3
																					1 1 AAAA
Arter Season Fule (1 20.1 After Season Rule (TCH) 30																<b>3</b> 0 -	ason Rule (TCH)	After Se			1 200
- Actual as % of Attain: 76.6 🔽 🗖 Actual as % of Potential 20 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 +	-							5							-	20 -	as % of Potential	🔽 🚺 Actual a	i 76.6		1 1 2200
																	∞ % of Attainable	Actual a		- 19 19 19 19 19 19 19 19 19 19 19 19 19	1 1 1 2 2 2
																10				전해 관계 이상에 대한 경험을 얻는 것 같아요.	1 1 A A A A
Target Diff (Tons) -10,749 Target Yield																0		=		국업 및 방송의 위험을 얻으며 여기가 많다.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Valiance (x)     Target Tons     R1     R2     R3     R4     V1     V2     V3     V4     A     B     C     D     E     F     G     H     01     10     11     12     13     14     15     16     17     02     03     04     05     06     07     08	09	07 08	04 05 06	02 03 0	16 17	3 14 15	11 12 1	01 10	G H	E F	ВСД	V4 A	V2 V3	R3 R4 V1	R1 R2		l'ons	Target	-17.9	Idrice (%)	Yu

## **Advantages**

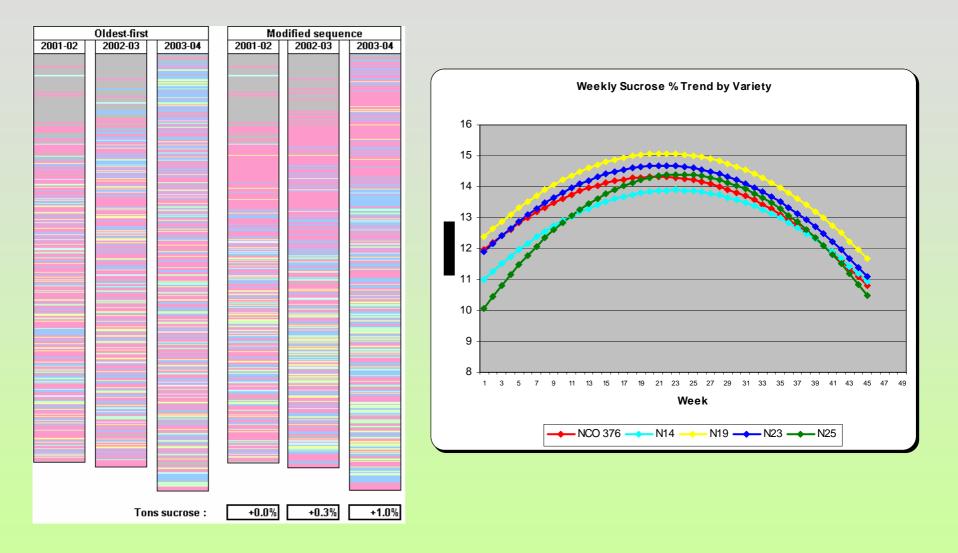
- Allows for comparisons between/within season
- Allows benchmarking between estates
- Allows benchmarking between different environments/countries
- Used to assess manager performance
- Crucial part of replant planning decisions

Examples of model use in commercial operations – CanePro Cane Management Software

3. Harvest Sequencing

## **Harvest Planner Developments**

- Optimise harvest sequence using knowledge of sugarcane physiology
  - Seasonal growth characteristics
  - Seasonal cane moisture profile
  - Seasonal cane sucrose curve



Quickly realised that to optimise harvest sequence one cannot ignore replanting and the need to accommodate the movement of fields to be replanted Examples of model use in commercial operations – CanePro Cane Management Software

4. Replant Planning

# **Replant Planning Concepts**

- Identify fields to be replanted and when over a selected number of cutting seasons.
- Identify which varieties should be used to replant each field to obtain an ideal variety mix.
- Integrate a knowledge of replant dates into the harvest plan to optimise field sequencing over the chosen cutting seasons.

### **Replant Planner Algorithm**

#### Setup

#### Mill Specific Planting Seasons

- Duration
- Mill Crush Rate

#### **Planting Periods**

- Duration
- Planting Capacity

#### **Yield Adjustment Factors**

- Soil/Ratoon Matrix
- Irrigation Factors
- Variety Factors

#### Sucrose Curves

 Variety, soil and mill specific

#### Select Fields to Replant

- 1. Establish Field performance ranking using attainable yield concept over last 5 ratoons
- 2. Allow User to Modify Ranking
- 3. Estimate ideal replant ratoon for each field using:
  - 5 year mean field performance ratio
- Subsequent soil/ratoon matrix
- Planting capacity
- Assign planting season based on ratio of current to ideal replant ration
- Assign planting period based on relative advantage of moving forward or back in the replant period

#### **Ideal Variety Mix**

- 1. Identify highest yielding variety for each day of season (tons sucrose)
- 2. Establish ideal estate variety composition
- Establish adjusted ideal estate variety composition of each replant period based on:
- Current variety composition
- Variety exception constraints
- Variety area constraints

#### **Final Output**

- 1. Replant Plan
- Plant Date
- Variety
- 1. Adjusted Harvest Plan

### Step 1- Setup - Seasons

	asons Potential Yiel	de l'Europe Comm						
	Potential Yiel	Cutting Season		DRD So			DRD % Increase	
		1						UBOMBO CANE
	Name	Start date	End date	Use season		CARGO CHOPPER	CARGO WHOLESTICK	TRANSPORT
6	2008-09	1/04/2008	31/12/2008	2007-08	0	-15.0	5.0	10.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2007-08	1/02/2008	25/03/2008	31.0	239.	· · · · · · · · · · · · · · · · · · ·		
	Spring 2008-09	1/07/2008	15/09/2008	80.0	880.	0 6		
6	2009-10	1/04/2009	31/12/2009	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2008-09	1/02/2009	25/03/2009	31.0	234.	N		
	Spring 2009-10	1/07/2009	15/09/2009	80.0	880.	0 6	41	411
6	⊒ 2010-11	1/04/2010	31/12/2010	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2009-10	1/02/2010	25/03/2010	31.0	234.	7 9		
	Spring 2010-11	1/07/2010	15/09/2010	80.0	880.	0 6		
6	2011-12	1/04/2011	31/12/2011	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2010-11	1/02/2011	25/03/2011	31.0	234.	7 9		
	Spring 2011-12	1/07/2011	15/09/2011	80.0	880.	0 6		
6	2012-13	1/04/2012	31/12/2012	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2011-12	1/02/2012	24/03/2012	31.0	234.	7 9		
	Spring 2012-13	1/07/2012	15/09/2012	80.0	880.	0 6		
6	2013-14	1/04/2013	31/12/2013	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow	a	
	Autumn 2012-13	1/02/2013	25/03/2013	31.0	234.	7 9		
	Spring 2013-14	1/07/2013	15/09/2013	80.0	880.	0 6		
6	2014-15	1/04/2014	31/12/2014	2007-08	0	-15.0	5.0	20.0
1	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2013-14	1/02/2014	25/03/2014	31.0	234.	7 9		
	Spring 2014-15	1/07/2014	15/09/2014	80.0	880.	0 6		
6	2015-16	1/04/2015	31/12/2015	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autumn 2014-15	1/02/2015	25/03/2015	31.0	234.	7 9		
	Spring 2015-16	1/07/2015	15/09/2015	80.0	880.	0 6		
6	2016-17	1/04/2016	31/12/2016	2007-08	0	-15.0	5.0	20.0
	Planting period	Start date	End date	Max ha/week	Total area (ha)	Min weeks fallow		
	Autum 2015-16	1/02/2016	24/03/2016	31.0	234.	7 9		

### Step 1- Setup – Soil/Ratoon matrix

#### 🌋 Replant Setup

Preview

Excel

Seasons Potential Yields Sucrose Curves

						1	Soil Ra	toon M	atrix									Additional Facto	rs
Soil Category	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Irrigation System	
B Set	0.921	0.901	0.882	0.862	0.842	0.822	0.802	0.783	0.763	0.743	0.723	0.703	0.684	0.664	0.644	0.624	0.604	Center Pivot	1.000
CSet	0.982	0.975	0.969	0.962	0.955	0.949	0.942	0.935	0.928	0.922	0.915	0.908	0.902	0.895	0.888	0.882	0.875	Flood	1.000
D Set	0.938	0.927	0.916	0.905	0.894	0.883	0.872	0.861	0.851	0.840	0.829	0.818	0.807	0.796	0.785	0.774	0.763	Floppy	0.890
FSet	0.938	0.927	0.916	0.905	0.894	0.883	0.872	0.861	0.851	0.840	0.829	0.818	0.807	0.796	0.785	0.774	0.763	Furrow 1-5	0.920
l Set	0.792	0.777	0.762	0.747	0.732	0.717	0.702	0.687	0.672	0.657	0.642	0.627	0.612	0.597	0.582	0.567	0.552	Furrow 11-15	0.840
K Set	0.983	0.968	0.952	0.937	0.922	0.907	0.892	0.877	0.862	0.842	0.832	0.817	0.801	0.786	0.771	0.756	0.741	Furrow 6-10	0.860
L Set	0.947	0.938	0.929	0.920	0.911	0.902	0.893	0.884	0.875	0.866	0.857	0.848	0.839	0.830	0.821	0.812	0.803	Overhead	1.000
N Set	0.947	0.938	0.929	0.920	0.911	0.902	0.893	0.884	0.875	0.866	0.857	0.848	0.839	0.830	0.821	0.812	0.803	Portable Pipe Spl	1.000
R Set	1.000	0.992	0.985	0.977	0.970	0.962	0.954	0.947	0.939	0.932	0.924	0.917	0.909	0.901	0.894	0.886	0.879	Semi Solid-Set Spl	1.000
S Set	0.948	0.943	0.938	0.933	0.928	0.923	0.918	0.913	0.908	0.903	0.898	0.893	0.888	0.883	0.878	0.873	0.868	Sprinkler 1-5	0.890
T Set	0.972	0.963	0.955	0.946	0.938	0.929	0.921	0.912	0.904	0.895	0.887	0.878	0.870	0.861	0.853	0.844	0.836	Sprinkler 11-15	0.840
U Set	0.792	0.777	0.762	0.747	0.732	0.717	0.702	0.687	0.672	0.657	0.642	0.627	0.612	0.597	0.582	0.567	0.552	Sprinkler 6-10	0.870
V Set	0.907	0.882	0.857	0.832	0.807	0.782	0.757	0.732	0.706	0.681	0.656	0.631	0.606	0.581	0.556	0.531	0.506	Step-Down furrows	1.000
W Set	0.921	0.901	0.882	0.862	0.842	0.822	0.802	0.783	0.763	0.743	0.723	0.703	0.684	0.664	0.644	0.624	0.604	other furrows	0.000
YSet	0.792	0.777	0.762	0.747	0.732	0.717	0.702	0.687	0.672	0.657	0.642	0.627	0.612	0.597	0.582	0.567	0.552	Variety	
																		CP66	1.000
																		MIX	1.000
																		N14	0.960
																		N15	1.000
																		N17	1.000
																		N19	0.950
																		N22	0.830
																		N23	1.050
																		N24	0.850
																		Factors In Use	
																		Factor	Active
																		Irrigation System	
																		Variety	
																		i anoy	
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### Step 1- Setup – Variety Quality Curves

#### 🏶 Replant Setup

Excel Preview

Preview XX

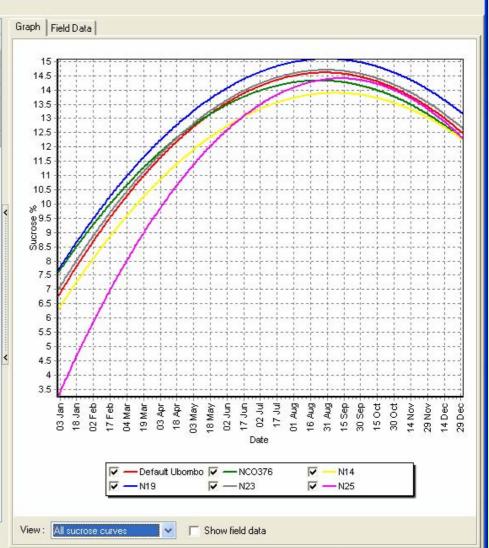
#### Seasons Potential Yields Sucrose Curves

Name	Polynoi	mial Coef	ficients	Applies To						
Name	Constant	Linear	<b>Juadratic</b>	Mill	Variety	Soils				
Default Ubombo	6.672	6.597E-2	-1.372E-4	Ubombo	All varietie:	All soils				
NC0376	7.511	5.784E-2	-1.228E-4	Ubombo	NC0376	All soils				
N14	6.198	6.156E-2	-1.232E-4	Ubombo	N14	All soils				
N19	7.586	6.193E-2	-1.279E-4	Ubombo	N19	All soils				
N23	6.907	6.455E-2	-1.338E-4	Ubombo	N23	All soils				
N25	3.140	8.831E-2	-1.732E-4	Ubombo	N25	All soils				

Use Fitted Curve

X Delete

🔶 Add



### **Step 2- Field Performance**

Excel F	Preview	🌱 🤴	Field selec	tion strategy :	Declining yield	ds 🔹	بر Recalculate	View Events	Optin	nise plant sequ		)ptimise harve	est seque	ence	
ield Perfor	ormance V	ariety Exclusions   .	Area Constraints	Replant Plan	n Long-Term H	Harvest	Plan Scena	rios   Seed Require	ments						
👍 Add	Selected Fi	eld(s) to Replant Pl	an												
•				F" 1	15.11				<b>F</b>						
Field	∆ Area I	ha) Curr Variety	Curr Ratoon		d Details Ratoon Ratio	Per		Grow Star		eld History t Date	Dataan	Variety	Fit	Actual	ane Yie Potenti
PPA03	Alea	12.5 N19		Max haloon 8.57	0.117	rei	Season 2007-08	18/10/200		/10/2007		1 N23		123.45	Fotenti 118
PA04	-	20.0 NC0376	6	0 3332.03	0.689		2007-00	15/08/200	100	/10/2006	2.3	0 N23		125.45	136
PPA05		17.0 N23	2				2005-06	15/06/200		/05/2005	11 19.1	5 NC0376		77.56	137
PPA06	10	15.3 N23	3				2003-00	13/06/200		/06/2004		4 NC0376		90.51	150
PPA07	-	14.1 N23	4	8.21	0.233		2004-03	29/06/200	14 <u>6 - 1715</u>	/06/2003	133	3 NC0376		107.13	145
PPA08		4.9 N23	7				2002-04	22/06/200		/06/2002		2 NC0376		113.45	141
PPA09		13.5 N23	12	<u> </u>	1.394	-	0001.00	E IOE 1200	250 503	100/2002	-0	1 100070		05.04	4
PPA10		18.7 N23	2			-	<			A					>
PPA11		5.6 N19	2	0	0.210					()					
				0 2000	0.000					QBLF					
PSPA1		24.0 N23	1	8.68	0.115		<								
		24.0 N23 27.0 N23	1	8.68 8.92			<		1					Current c	vcle I
PSPA2		27.0 N23	. ·	8.92	0.000		1.10							🗖 Previous	cycles
PSPA2 PSPB			0	8.92	0.000		1.10							<ul> <li>Previous</li> <li>Excluded</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1		27.0 N23 42.4 N23	0	8.92 8.35	0.000 0.958		1.00							🗖 Previous	cycles from fit
PSPA2 PSPB PSPC1 PSPC2		27.0 N23 42.4 N23 17.5 N23	0 8 11	8.92 8.35 8.34	0.000 0.958 1.319 0.117									<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3		27.0 N23 42.4 N23 17.5 N23 19.0 N19	0 8 11	8.92 8.35 8.34 8.51	0.000 0.958 1.319 0.117 0.108		1.00 0.90	) <b>P</b>			<u> </u>			<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX	0 8 11 1 1	8.92 8.35 8.34 8.51 9.26 7.98	0.000 0.958 1.319 0.117 0.108 0.125		1.00 0.90	) <b>P</b>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23	0 8 11 1 1 1	8.92 8.35 8.34 8.51 9.26 7.98 5.95	0.000 0.958 1.319 0.117 0.108 0.125 1.681		1.00 0.90 <b>.50 .5</b> 0.70 <b>.5</b>	) <b>P</b>						<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA QBLB		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23	0 8 11 1 1 1 1 10	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307		1.00 0.90 <b>.50 .5</b> 0.70 <b>.5</b>	] <b>A</b>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA QBLB QBLC		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376	0 8 11 1 1 1 1 10 9	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482		1.00 0.90 <b>.50 .5</b> 0.70 <b>.5</b>	) <b>R</b>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPC3 PSPD QBLA QBLB QBLC QBLD1		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25	0 8 11 1 1 1 10 9 3	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482		1.00 0.90 <b>.50 .5</b> 0.70 <b>.5</b>	) <b>R</b>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPA2 PSPC1 PSPC2 PSPC3		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25 26.4 N25	0 8 11 1 1 1 10 9 3 3 1	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169		1.00 0.90 0.80 0.80 0.80 0.80 0.80 0.60	)		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPA2 PSPC1 PSPC2 PSPC3 PSPC3 PSPD QBLA QBLA QBLC QBLD1 QBLD2 QBLD1 QBLD2		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25 26.4 N25 15.7 N23	0 8 11 1 1 1 10 9 3 3 1 1 0	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.54	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000		1.00 0.90 0.80 0.80 0.80 0.80 0.80 0.90 0.9	.     . <td></td> <td><b>•</b></td> <td></td> <td></td> <td></td> <td><ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul></td> <td>cycles from fit</td>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA QBLA QBLD QBLD1 QBLD2 QBLE1 QBLE2		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NCO376 32.6 N25 26.4 N25 15.7 N23 19.5 N25	0 8 11 1 1 1 10 9 3 3 1 0 5	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.54	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354		1.00 0.90 <b>.50 .5</b> 0.70 <b>.5</b>	.     . <td></td> <td><b>•</b></td> <td></td> <td></td> <td></td> <td><ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul></td> <td>cycles from fit</td>		<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPC3 PSPA2 PSPA2 PSPA2 PSPA2 PSPA2 PSPA2 PSPA2 PSPA2 PSPA2 PSPA3 PSPA3 PSPC4 PSPC4 PSPC3 P		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NCO376 32.6 N25 26.4 N25 15.7 N23 19.5 N25 16.0 N23	0 8 11 1 1 1 10 9 3 3 1 0 5	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.64 5.64 5.64	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354 0.189		1.00 0.90 0.80 0.80 0.80 0.80 0.80 0.90 0.9			<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA1 PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA QBLB QBLC QBLD1 QBLD2 QBLE1 QBLE2 QBLE2 QBLF QBLG QBLH		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25 26.4 N25 15.7 N23 19.5 N25 16.0 N23 14.2 N23	0 8 11 1 1 1 1 1 1 1 1 9 3 3 1 1 0 5 2 2 1	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.64 5.64 5.64 5.29 4.76	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354 0.354 0.189 0.210		1.00 0.90 1.00 0.00 0.00 0.00 0.00 0.00			<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPA2 PSPC1 PSPC2 PSPC3		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25 26.4 N25 15.7 N23 19.5 N25 16.0 N23 14.2 N23 9.8 N23	0 8 11 1 1 1 10 9 3 3 1 1 0 5 2 2 1 1	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.64 5.64 5.64 5.29 4.76 6.03	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354 0.354 0.210 0.210 0.000		1.00 0.90 0.90 0.90 0.90 0.90 0.90 0.90			<b>•</b>				<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPA2 PSPC1 PSPC2 PSPC3 PSPC3 PSPD QBLA QBLB QBLC QBLD1 QBLD2 QBLE1 QBLE2 QBLE2 QBLE4 QBLE4 QBLF QBLG QBLH QBLI		27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NC0376 32.6 N25 26.4 N25 26.4 N25 15.7 N23 19.5 N25 16.0 N23 14.2 N23 9.8 N23 26.5 N23	0 8 11 1 1 1 10 9 3 3 1 1 0 5 2 2 1 1 0 0 5 2 2 1 0 0 5 2 2 1 0 0 5 0 2 1 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.64 5.64 5.64 5.29 4.76 6.03 6.53	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354 0.210 0.210 0.000 0.306		1.00 0.90 1.00 0.00 0.00 0.00 0.00 0.00							<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratod</li> </ul>	cycles from fit
PSPA2 PSPB PSPC1 PSPC2 PSPC3 PSPD QBLA QBLB QBLC QBLC QBLD1 QBLD2 QBLE1 QBLE2 QBLE2 QBLF QBLG	-	27.0 N23 42.4 N23 17.5 N23 19.0 N19 8.8 MIX 47.0 N23 17.7 N23 18.8 NCO376 32.6 N25 26.4 N25 26.4 N25 15.7 N23 19.5 N25 16.0 N23 14.2 N23 9.8 N23 26.5 N23 15.5 N25	0 8 11 1 1 1 10 9 3 1 1 0 5 2 2 1 1 1 0 2 2	8.92 8.35 8.34 8.51 9.26 7.98 5.95 6.88 6.23 5.90 5.24 5.64 5.64 5.64 5.29 4.76 6.03 6.53	0.000 0.958 1.319 0.117 0.108 0.125 1.681 1.307 0.482 0.169 0.000 0.886 0.354 0.210 0.210 0.000 0.306		1.00 0.90 0.80 0.80 0.70 0.50 0.50 0.50 0.50 0.30 0.30 0.30 0.3					16 18		<ul> <li>Previous</li> <li>Excluded</li> <li>Soil/Ratoo</li> <li>Fitted</li> </ul>	cycles from fit

### **Step 2- Variety Constraints**

Excel Preview	Filtering Group		lection strateg	y : Declinin	g yields 🔻	چر Recalculate	• View Ev	vents	otimise plant s	equence	Optimise ha	arvest sequen	ce	
ield Performance	Variety Exclusions	Area Constrai	nts Replant F	Plan   Long-	Ferm Harvest F	Plan   Scenario	os Seed R	equirements						
By Plant Variety	By Location													
	Variety		Autum	n 2007-08	(ha)	Spring	2008-09	(ha)	Autum	n 2008-09	(ha)	Spring	2009-10	(ha)
Name	Current Area (%)	Planned (%)	Min	Max	Planned	Min	Max	Planned	Min	Max	Planned	Min	Max	Plan
CP66														
MIX	3.1													
N14	0.4													
N15														
N17														
V19	8.3	6.7	30.0	120.0		250.0	1200.0	89.9	250.0	1200.0	40.1	250.0	1200.0	
N22														
N23	36.1	24.7	60.0	260.0		250.0	1200.0	116.4	250.0	1200.0	59.9	250.0	1200.0	1
N24														
N25	22.4	38.7		0.0		250.0	1200.0	386.5		0.0		250.0	1200.0	-
N26														
N28	j.													
N30														
N32														
N36	2	11.6				50.0	100.0	54.1				50.0	150.0	
N52/219														
N52\219														
NC0376	29.7	18.4	40.0	120.0		250.0	1200.0	236.4	250.0	1200.0	147.3	250.0	1200.0	
TOTAL	100.0	100.0	130.0		0.0	1050.0		883.3	750.0		247.3	1050.0		
CAPACITY					239.1			880.0			234.7			1
/ ×	<													1

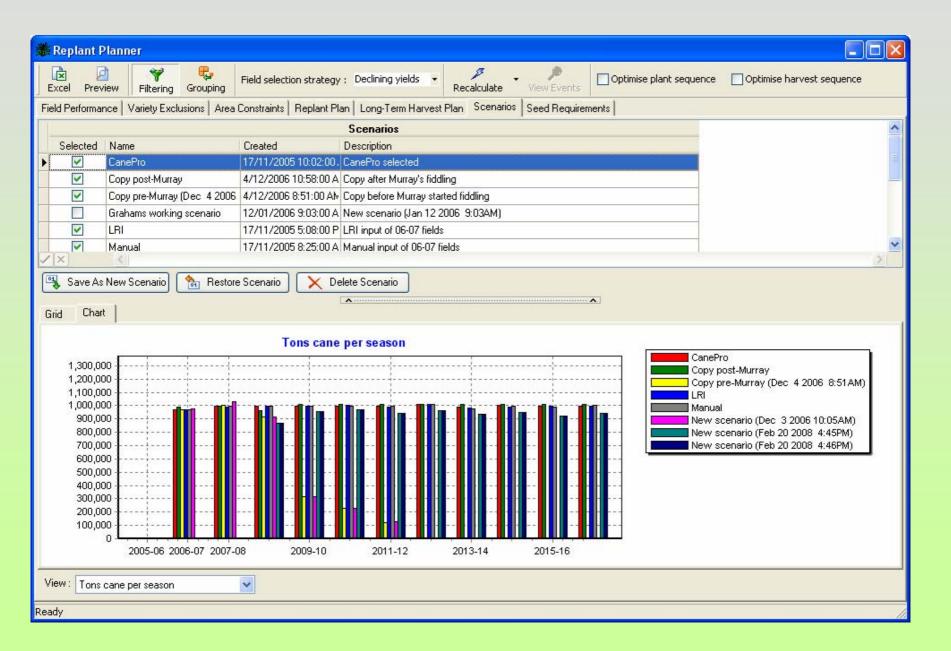
### **Step 3- Replant Plan**

Excel Prev	view Filtering	Grouping	eld selection stra		Recald	ulate View Eve	ents	mise plant sequend	e Optimi	ise harvest sequence
Field Performa			nstraints Replar	ht Plan   Long-	Term Harvest Plan S	cenarios   Seed Re				
	Field D							Replant Details		🐴 📉 🗙 Remove from Plan
Field	Area (Ha)		Current Variety		Plant Period	Period Locked		Variety Locked		Select All
LMH03	9.2	100	NC0376	2008-09	Spring 2008-09	Z	NC0376	Image: A state of the state	1/07/2008	Select All
LMH04	5.5		N23	2008-09	Spring 2008-09		N25		1/07/2008	Set Selected
LMH07	7.2	2	N23	2008-09	Spring 2008-09		NC0376		2/07/2008	👔 Update Plant Sequend
LMU09	6.7		NC0376	2008-09	Spring 2008-09		N25		2/07/2008	www.update Flant Sequent
LMU10	6.8		N25	2008-09	Spring 2008-09	<ul> <li>Image: A start of the start of</li></ul>	N25		25/07/2008	🛛 🚺 👔 Update Field History.
LTA02	31.0		NC0376	2008-09	Spring 2008-09	~	N25	~	3/07/2008	
LTA03	21.0	11	NC0376	2008-09	Spring 2008-09		N25		6/07/2008	
LTA10	12.4	6	N25	2008-09	Spring 2008-09	<b>V</b>	N25	<b>~</b>	28/07/2008	
LVV04	16.7	8	N23	2008-09	Spring 2008-09	<b>v</b>	NC0376	<b>V</b>	8/07/2008	
QCO02	23.5	7	MIX	2008-09	Spring 2008-09	<b>~</b>	NC0376	<b>~</b>	9/07/2008	
TTJ02D	16.2	1	N25	2009-10	Autumn 2008-09		N19		1/02/2009	
TTJ12	8.4	13	NC0376	2008-09	Spring 2008-09		NC0376		11/07/2008	
TTJ22A	12.5	9	NC0376	2009-10	Autumn 2008-09	<ul> <li>Image: A start of the start of</li></ul>	NC0376	<ul> <li>Image: A set of the set of the</li></ul>	4/02/2009	
TTJ22B	12.5	9	NC0376	2009-10	Autumn 2008-09	<ul> <li>Image: A start of the start of</li></ul>	NC0376	~	7/02/2009	
TTJ22D	12.5	9	NC0376	2009-10	Autumn 2008-09		NC0376	~	10/02/2009	
VML01	10.7	7	NC0376	2009-10	Autumn 2008-09	<b>V</b>	N19	<b>V</b>	13/02/2009	
VNZ02	11.2	10	N25	2008-09	Spring 2008-09		N19		12/07/2008	
VSH02	34.0	4	N25	2008-09	Spring 2008-09	~	N25	~	13/07/2008	
LMH06	8.0	10	N19	2008-09	Spring 2008-09		N25		16/07/2008	
LMU03	10.2	11	NC0376	2008-09	Spring 2008-09		N25		23/07/2008	
568	8258.2									~
✓ ×	<								>	

### Step 3- Long Term Harvest Plan

Excel Preview	w Filtering (	Field	d selection strat	egy : Declining yields	Reca	/ Iculate View	🖻 Events 🗖	Optim	nise plant sequence	Optimise ha	arvest sequen	ce
Field Performance	e Variety Exclusi	ons Area Cons	traints Replar	t Plan Long-Term Harv	vest Plan	Scenarios   Seed	Requirements	:				
Harvestings   Fi	ields Carried Over	Cut Front Utilis	ation 8 of Are	a Harvested By Variety	% of Area	Harvested By Rat	oon Age Dis	tributio	on Monthly Area H	larvested By Varie	ty	
			Fiel	d Details							11.541	Harvest Del
Field Name	Area (Ha)	Ratoon	Variety	Grow Start	Mill	Cuttir	ng Front		Cut Date	Cut Age	Season	Tons Ca
VG102	15.5	6	N23	18/05/2007	Ubombo	CAR	GO WHOLEST	TICK	29/07/2008	14.39	2008-09	
SFIW	33.0	6	N23	10/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	29/07/2008	10.61	2008-09	
PMR14	3.3	3	NC0376	12/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	31/07/2008	10.61	2008-09	
HS005	17.3	0	N25	12/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	31/07/2008	10.61	2008-09	
VGI03	14.1	9	NCO376	16/05/2007	Ubombo	CAR	GO WHOLEST	TICK	31/07/2008	14.52	2008-09	Î
PMR15	4.7	3	NCO376	12/09/2007	Ubombo	UBO	MBO CANE TI	RAN:	31/07/2008	10.61	2008-09	
VG107	10.0	5	NCO376	27/08/2007	Ubombo	CAR	GO WHOLEST	TICK	1/08/2008	11.17	2008-09	
PMR16	1.0	4	NCO376	12/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	1/08/2008	10.65	2008-09	
TTJ01D	13.2	13	NCO376	14/09/2007	Ubombo	CAR	GO CHOPPER	}	1/08/2008	10.58	2008-09	
PMR23C	18.0	3	NCO376	12/09/2007	Ubombo	UBO	MBO CANE TI	RAN!	1/08/2008	10.65	2008-09	
PMR23A	12.5	4	N23	12/09/2007	Ubombo	UBO	MBO CANE TI	RAN!	1/08/2008	10.65	2008-09	
SFLE	29.0	2	NCO376	13/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	2/08/2008	10.65	2008-09	
MSL04	44.8	4	N23	2/07/2007	Ubombo	CAR	GO CHOPPER	}	2/08/2008	13.05	2008-09	
VML04	11.6	2	NC0376	15/05/2007	Ubombo	CAR	GO WHOLEST	TICK	2/08/2008	14.62	2008-09	
HPA21	11.6	3	NCO376	15/09/2007	Ubombo	UBO	MBO CANE TI	RAN!	3/08/2008	10.61	2008-09	
VOR01	36.5	18	NCO376	4/07/2007	Ubombo	CAR	GO WHOLEST	TICK	3/08/2008	13.01	2008-09	
SFU	29.7	5	N25	14/09/2007	Ubombo	UBOI	MBO CANE TI	RAN:	3/08/2008	10.65	2008-09	
HPA12	8.8	1	N23	15/09/2007	Ubombo	UBOI	MBO CANE TI	RAN!	4/08/2008	10.65	2008-09	
SHS02	23.0	2	N23	17/09/2007	Ubombo	UBO	MBO CANE TI	BAN!	4/08/2008	10.58	2008-09	
4327	80437.3									12.10		
<				-111						1		>

### **Step 4- Scenarios**



# **Advantages**

- Improves replant field selection decisions
- Place varieties in the right time of the season to optimise overall season yield
- Optimise long-term harvest plan to minimize age effects
- Scenarios allow evaluation of decisions on overall sucrose yield

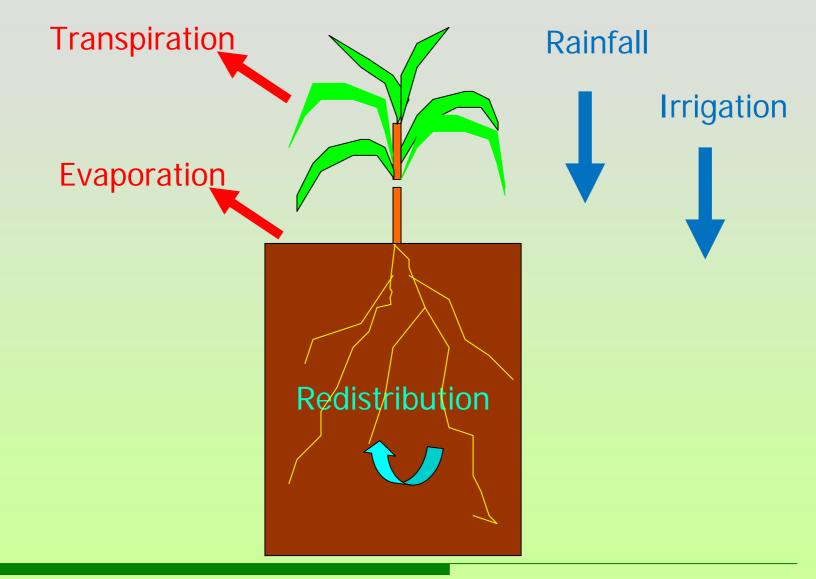
Examples of model use in commercial operations – CanePro Cane Management Software

5. Irrigation Scheduling

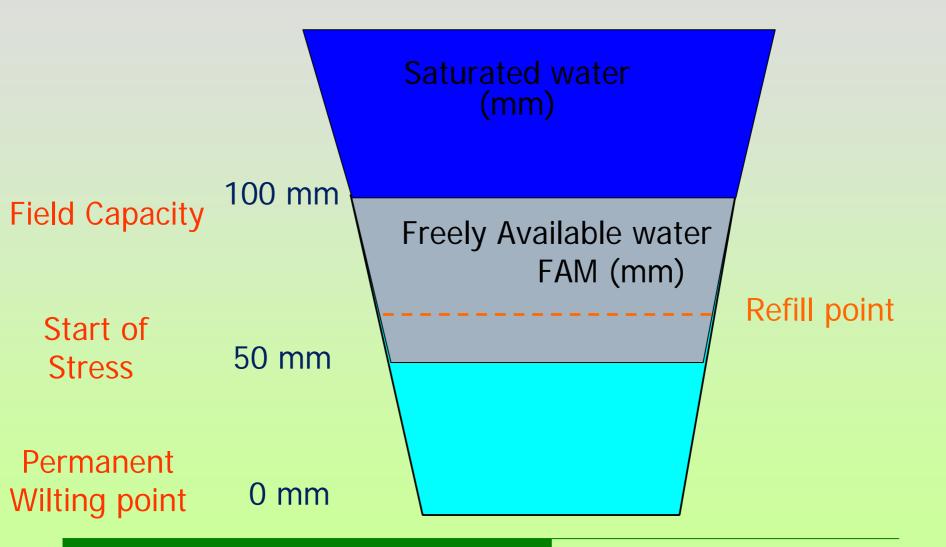
# Irrigation Scheduling Concept

- Water balance
- Soil water concepts
- Estimating components of the water balance

# Water Balance



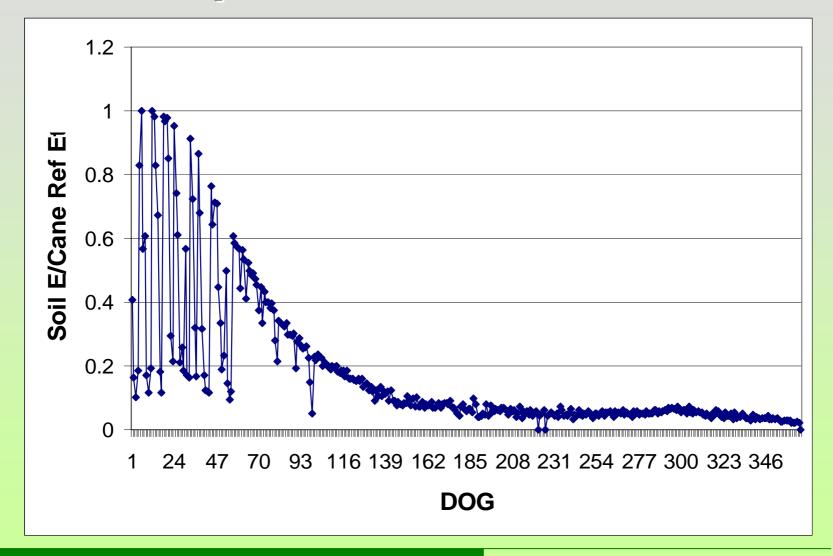
# Soil Water Concepts



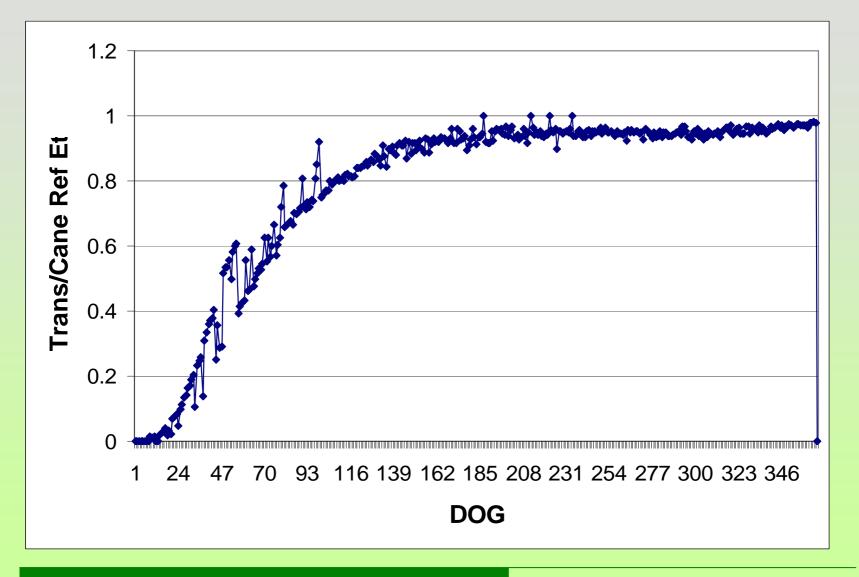
# Estimating components of the water balance

- Evaporation + transpiration Potential Et calculated using Penman-Monteith
- Soil evaporation calculated separately from transpiration
- Rainfall and estimate of net irrigation as direct inputs

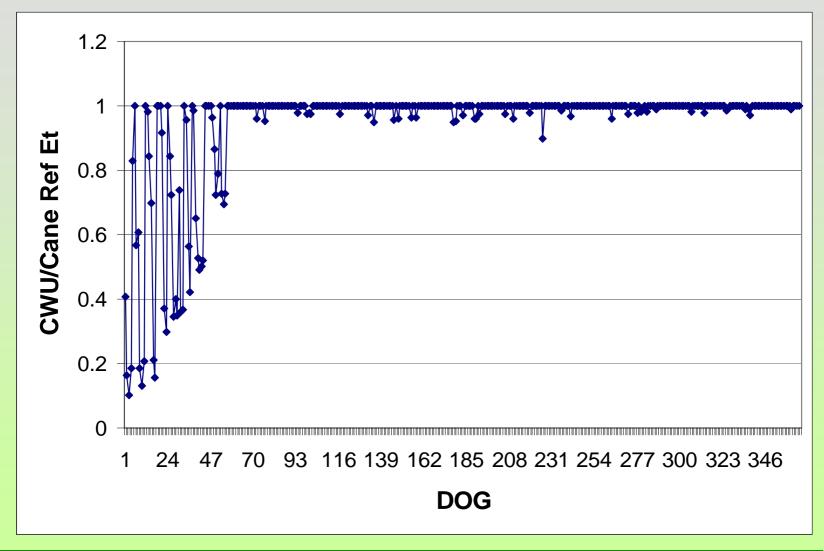
# Soil Evap. as a % of Pot Et



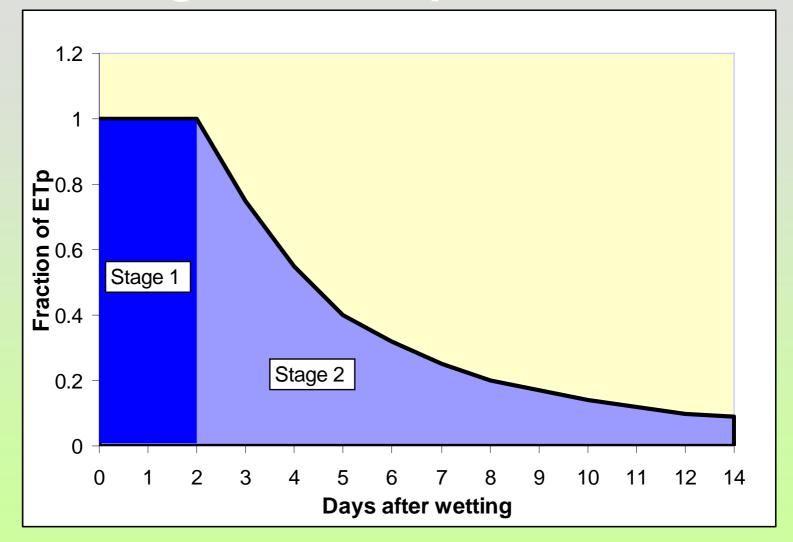
# Transpiration as a % of Pot Et



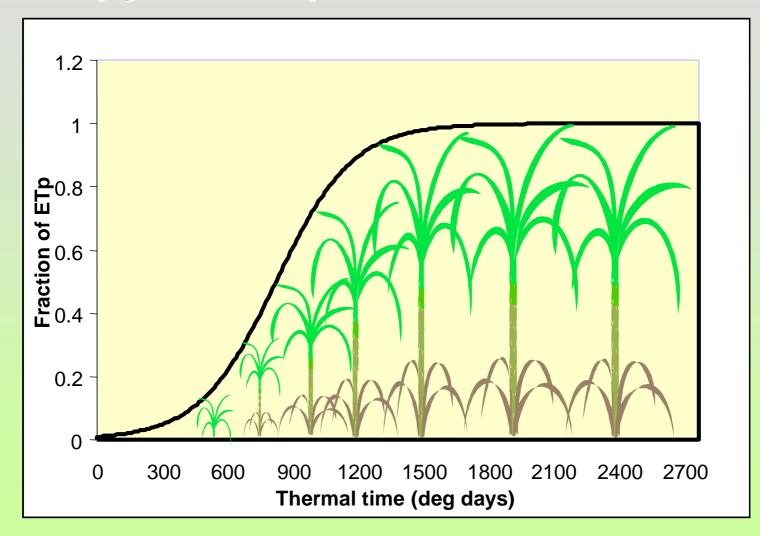
# CWU as a % of Pot Et



### **Two-Stage Soil Evaporation Model**



### Transpiration – Thermal Time-based Canopy Development Model



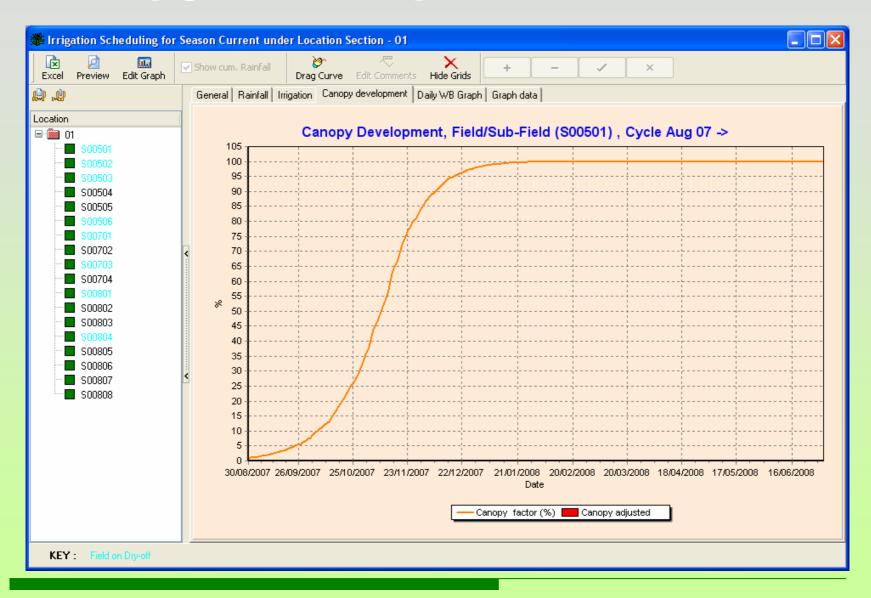
# Field soil details

🏶 Irrigation Scheduling for S	eason Current under Location Se	ction - 01			
Excel Preview Edit Graph	Show cum. Rainfall Drag Curve		+ - / ×		
<b>A</b>	General Rainfall Irrigation Canopy of	development Daily WB Graph	Graph data		_
Location	🗖 Field Details - General		Irrigation System Details		
⊡ <b>∭</b> 01	Field Name	S00501	Irrigation System	Sprinkler (24 mm)	
S00501	Ratoon	1	Wetted Area(%)	100	
S00502	Grow Start Date	30/08/2007	Typical Net App. (mm)	24	
🖬 \$00503	Harvest Date	6/08/2008	Minimum Cycle Time (days)	3	
S00504	Met. Site	Mlaula AWS	Typical App. Efficiency (%)	75	
- <b>S</b> 00505	Rain Gauge	ML01-Gauge 1			
<b>S00506</b>	Irrigation System	Sprinkler (24 mm)			
S00701	🗖 Soil Details				
	TAM (mm)	70			
S00703 S00704	FAM(mm)	35			
S00704	Refill Point (mm)	35			
S00802	Starting SWB (mm)	0			
S00803	Drain Days	2			
	Dry-Off Details				
<b>S</b> 500805	Dry-off Date	20/06/2008			
S00806	Multiple of TAM	2.5			
S00807	Dry-off TAM (mm)	70			
500808 📃 🛄	Link Dry-off to Last Spray Date?				
KEY : Field on Dry-off					

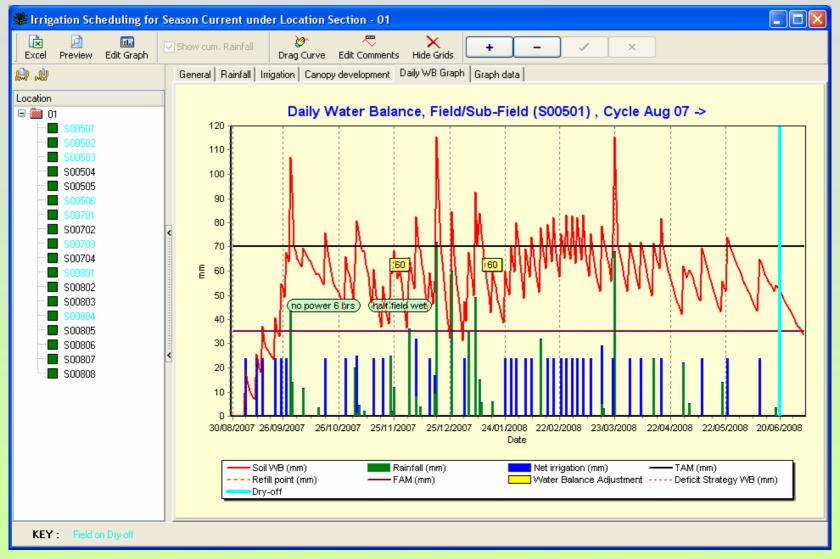
# **Irrigation & Rainfall**

Excel Preview Edit Graph		Show cum. Rainfa	) Drag C		Edit Comments	K lide Grids	+	-	× 🛛 ×		
<b>.</b>		General Rainfall	Irrigation	Cano	py development   Daily	WB Graph	Graph data				
.ocation		Date	Net Irrigation (mm)			Cumu	lative Irrigation,	, Field/Sub-F	ield (S00501) , (	Cycle Aug 07 ->	
S00501		2/01/2008	24.0								
<b>-</b> \$00502		24/01/2008	24.0		800 🕂				· · · · · · · · · · · · · · · · · · ·		
🖬 \$00503		27/01/2008	24.0		750						
S00504		30/01/2008	24.0		700				1		
S00505		4/02/2008 7/02/2008	24.0 24.0							/	
S00506		16/02/2008	24.0		650 +					1	
S00702		19/02/2008	24.0		600 +		· · · · · · · · · · · · · · · · · · ·			/	
🔳 S00703		23/02/2008	24.0		550				/		
S00704		26/02/2008	24.0		500						
S00801		29/02/2008	24.0				· · · · · · · · · · · · · · · · · · ·				1
S00802 S00803		3/03/2008	24.0		E 450			~~~~~	1		
S00804		6/03/2008	24.0		400 +		· · · · · · · · · · · · · · · · · · ·				
S00805		10/03/2008	24.0		350				<u></u>		
S00806		16/03/2008	24.0		300			$\mathcal{A}$	1		
S00807	<	22/03/2008	24.0		< 1			7	1		1
S00808		31/03/2008	24.0	=	250 +			-			·
		6/04/2008	24.0		200 +	·····/		J	· · · · · · · · · · · · · · · · · · ·		
		17/04/2008	24.0		150						
		9/05/2008	24.0		100						
		23/05/2008	24.0						·		
		9/06/2008	24.0		50						
					5/1	0/2007	4/12/200	)7	2/02/2008	2/04/2008	1/06/2008
		TOTAL	848.0	~					Date		

# **Canopy Development**



# Water balance



# Weekly Schedule

Hierachy	0	Current soil water o	details (2/07/20	08)	Irrig. between	0		Net Irrigal	ion Applica	ation (mm)			-		Gr	oss Volume	ne (ML)			
ame	Current WB (m	TAM (mm)	FAM (mm)	Refill Point (mm)	2/07/2008 & 3/07/2008 (mm)	Thursday	Friday	Saturda.	Sunday.	. Monda	Tuesda	Wedne	Thursda	Friday 4	Saturda	Sunday.	. Monday	Tuesda	Wednes	
01													10.08	10.08	10.08	1	2.40	8.84	8.8	
- S00501		70	) 3	5 35	0.0															
- S00502		70	3	5 35	0.0															
- S00503		65	5 3	3 33	0.0															
- S00504	29.8	8 75	5 3	3 33	0.0	24.0	()						2.78	2.78	2.78	3				
- S00505	33.7	7 85	5 4	3 43	0.0	24.0	1						3.02	3.02	3.02	2				
- S00506		85	5 4	3 43	0.0															
- S00701		75	5 3	8 38	0.0															
- S00702	65.6	5 75	5 3	8 38	0.0															
- <b>S00703</b>		75	5 3	8 38	0.0															
- S00704	57.7	7 75	5 3	8 38	0.0															
- S00801		75	5 3	8 38	0.0															
- <b>E</b> \$00802	38.6	5 65			0.0					24.0	)						2.40	2.40	2	
— 📕 S00803	39.8	3 60	) 3	0 30	0.0															
- S00804		85	5 4	3 43	0.0															
- <b>E</b> \$00805	64.8	3 85	5 4	3 43	0.0	0														
- <b>E</b> \$00806	40.3			3 33	0.0						24.0	)						6.44	6	
- <b>S</b> 00807	39.8	3 60	) 3		0.0															
- S00808	26.9	9 60	) 3	0 30	0.0	24.0	1						4.28	4.28	4.28	3				

# **Advantages**

- Improve water use efficiency
- Raise awareness of irrigation on the estate
- Improve logistics of water-ordering

# Conclusions

- Models have the ability to provide physiologically based decision-support tools to commercial operations
- Allows for wide adoption of new technology through client base
- Improve yields through better decisions
- Save costs through better monitoring and control