Australian Government
Cotton Research and Development Corporation

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Energy Use @ Keytah

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Background

- Changes to farming system @ Keytah
  - reduced tillage
  - row spacing (40" – 30 & 60")
- Cotton in rotation with Wheat
  - Cotton / Wheat / Fallow / Cotton
- Reduction in tractors (& staff)
  - 26 tractors reduced to 11 tractors (and further)
  - reduced tillage 10:1
  - increased spraying 5:8
- Zero Till - soil moisture > 40%
  - 2007 limited water (< 1 ML / Ha)

Methodology - What we did

- Developed case studies on actual crop history data
  - 2000 Benchmark (K8)
  - Reduced Till (K8 & C16)
  - Towards Zero Till (K13 & C17)
- Linked machinery / tractors with practices
- Determined fuel (energy) use
  - based on machinery specs, observation and collated data (previous work) - desktop

Direct Energy Use and GHGs

- Cotton Industry highly mechanised
- GHGs from fossil fuels on farm ~ 20%
- Estimated that 40 – 50% of farm input costs relate to machinery
- Past work
  - Energy: 3.7 – 15.2 GJ / Ha; ($80 - $310 / Ha)
  - GHGs: 275 – 1404 kg CO_2

	Total Energy (GJ/Ha)	# Energy Costs ($ / Ha)	GHG Emissions (kg of CO_2)	Since 2000
2000 Benchmark	16.32	402	6377634 (1226 kg/Ha)	
Reduced Till	14.33	353	5599958 (1076 kg/Ha)	-12%
Towards Zero Till	12.44	306	4861566 (935 kg/Ha)	-24% *(-13%)

Fuel price: $0.95/L

	Preparation	Planting	In Season	Irrigation	Harvest	Post Harvest
2000 Benchmark	34%	2%	5%	45%	12%	2%
Reduced Till	19%	2%	6%	52%	13%	8%
Towards Zero Till	7%	2%	6%	60%	16%	9%

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2000 Benchmark

Process	Practice	No. Passes	Operation	Fuel Use per pass (L/Ha)	% Energy
Preparation	Discing	3	Tillage	12	9%
	Regrade (annual cost; every 5 yrs)	1	Tillage	30	7%
	Deep Ripping	1	Tillage	18	4%
	Lister – Bed Forming (apply N)	1	Fert	20	5%
	Ripper (apply MAP)	2	Fert	7	3%
	Cultipacker	1	Tillage	4	1%
	Spraying (Herbicide) - Raptor	7	Spraying	3	5%
Planting	Plant Cotton (MaxEmerge)	1	Planter	5	1%
	Aerial Spray (Herbicide)	1	Spraying	0.035	0%
	Chains	1	Tillage	4	1%
In Season	Inter-row Cultivation (clean furrows)	2	Tillage	6	3%
	Shielded Spray (Herbicide)	1	Spraying	3	1%
	Boom Spray (Insecticide)	2	Spraying	3	1%
	Aerial Spray (Insecticide)	9	Spraying	0.035	0%
	Aerial Spray (Defoliation)	2	Spraying	0.035	0%
Irrigation	Irrigation (7 ML / Ha)	2.5	Irrigation	77	43%
Harvest	Cotton Picker	1	Harvesting	45	10%
	Module Builder	1	Harvesting	5	1%
Post Harvest	Mulcher	1	Crop Dest	7	2%

Reduced Tillage

Process	Practice	No. Passes	Operation	Fuel Use per pass (L/Ha)	% Energy
Preparation	Deep Ripping	1	Tillage	18	5%
	Lister – Bed Forming (apply N)	1	Fert	20	5%
	Ripper (apply MAP)	1	Fert	7	2%
	Spraying (Herbicide) - Raptor	7	Spraying	3	6%
	Cultipacker	1	Tillage	4	1%
Planting	Plant Cotton (MaxEmerge)	1	Planter	5	1%
	Boom Spray (Herbicide – Roundup)	1	Spraying	3	1%
In Season	Inter-row Cultivation (clean furrows)	1	Tillage	5	1%
	Boom Spray (Herbicide – Roundup)	2	Spraying	3	2%
	Boom Spray (Insecticide)	3	Spraying	3	2%
	Aerial Spray (Insecticide)	8	Spraying	0.035	0%
	Aerial Spray (Defoliation)	2	Spraying	0.035	0%
Irrigation	Irrigation (7 ML / Ha)	2.5	Irrigation	77	52%
Harvest	Cotton Picker	1	Harvesting	45	12%
	Module Builder	1		5	1%
Post Harvest	Root Cut	1	Crop Dest.	7	2%
	Mulcher	1	Crop Dest	7	2%
	Ripper (Pupae Bust)	1	Tillage	16.5	4%

Towards Zero Tillage

Process	Practice	No. Passes	Operation	Fuel Use per pass (L/Ha)	% Energy
Preparation	Spraying (Herbicide) - Raptor	6	Spraying	3	6%
	Spread Fertiliser	1	Fertiliser	3	1%
Planting	Plant Cotton (MaxEmerge)	1	Planter	5	2%
	Boom Spray (Herbicide – Roundup)	1	Spraying	3	1%
In Season	Inter-row Cultivation (clean furrows)	1	Tillage	5	2%
	Boom Spray (Herbicide – Roundup)	2	Spraying	3	2%
	Boom Spray (Insecticide)	3	Spraying	3	3%
	Aerial Spray (Insecticide)	9	Spraying	0.035	0%
	Aerial Spray (Defoliation)	2	Spraying	0.035	0%
Irrigation	Irrigation (7 ML / Ha)	2.5	Irrigation	77	60%
Harvest	Cotton Picker	1	Harvesting	45	14%
	Module Builder	1	Harvesting	5	2%
Post Harvest	Root Cut	1	Crop Dest.	7	2%
	Mulcher	1	Crop Dest	7	2%
	Ripper (Pupae Bust)	1	Tillage	16.5	5%

Concluding Remarks

- **Significant Improvement in Energy**
  - 12% further 13%
  - **energy use comparative to other enterprises**
    - **energy: 12.4 – 14.3 GJ / Ha (15.2 GJ)**
    - **cost: $306 - $353 / Ha ($310)**
    - **GHGs: 935 – 1076 kg CO2 / Ha (1404 kg CO2)**
- **Irrigation the next step ?**
  - **conversion of diesel to LPG (30% saving ?)**
  - **26 pumps; 26000 hrs**
- **Reducing Energy Use**
  - **practice change (min till)**
  - **refinement of current system (pump and tractor)**

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