On-board Module Builder Cotton Pickers: Preliminary Economic Analysis

Terry Griffin, Ph.D.
Assistant Professor
Department of Agricultural Economics and Agribusiness

- "**Preliminary Economic Analysis**" because evaluation is based on assumptions rather than actual field data collected from farming operations and university research, i.e. limited hard data
- Evaluate benefits of harvest timeliness
  - Not a comparison of manufacturers
- Classic harvest timeliness model
  - In context of on-board module builder picker

Claims of Potential Benefits

- Faster in-field speeds
  - 4.2 mph rather than 3.6-4.0 mph
- Greater field efficiency (FE)
  - 90% field efficiency rather than 70% FE
- Less waste at bottom of conventional module
  - Bottom 6 inches or 450 pounds
- Less equipment and labor needed
  - No boll buggy or module builder
  - Fewer tractors and laborers

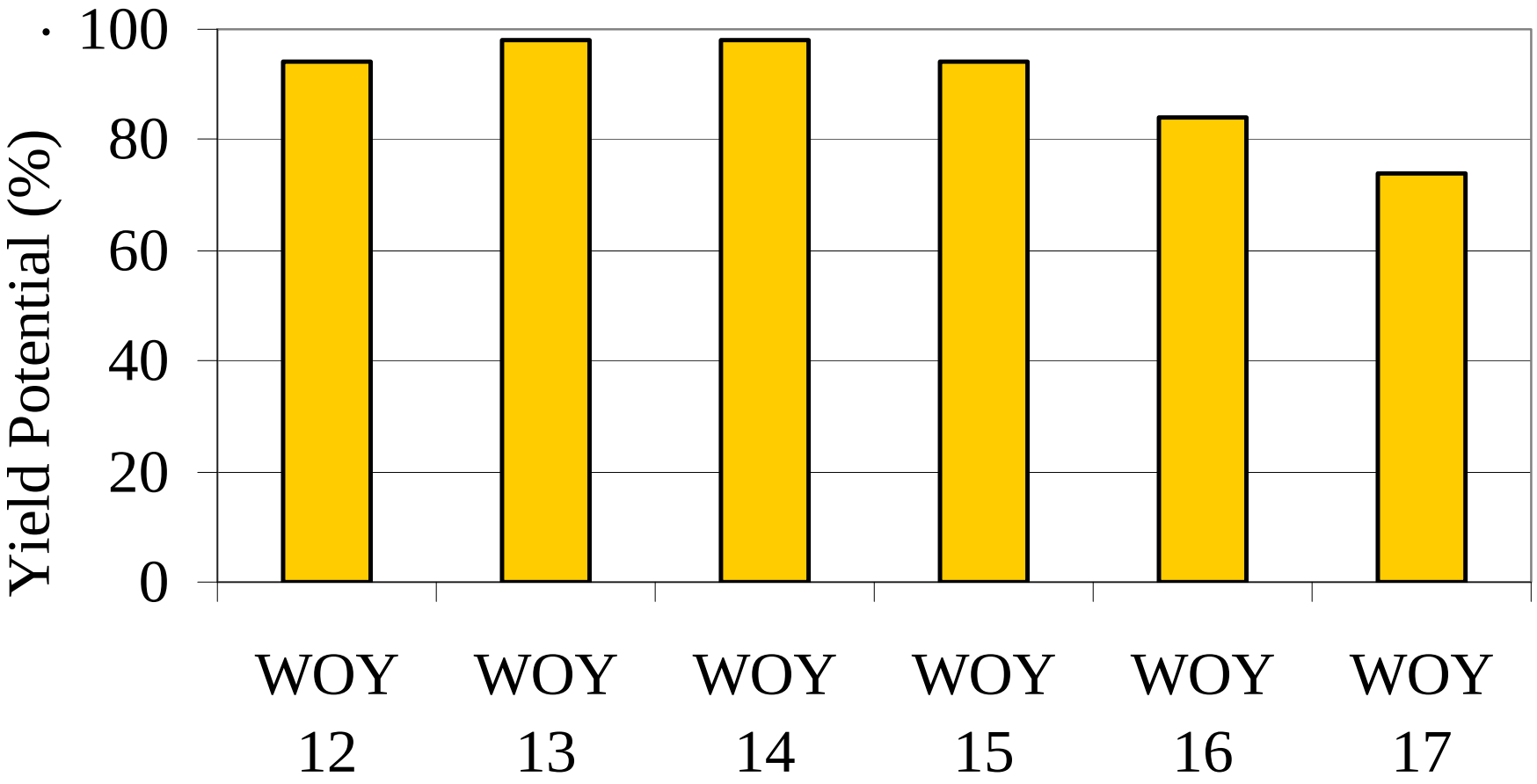
Research questions

- What is the value of increased field efficiency?
- What is my new “appropriate” farm size?
- How much can I afford to pay?
- OBMB vs Conventional (aka Base)
  - Value of eliminating boll buggy and module builder

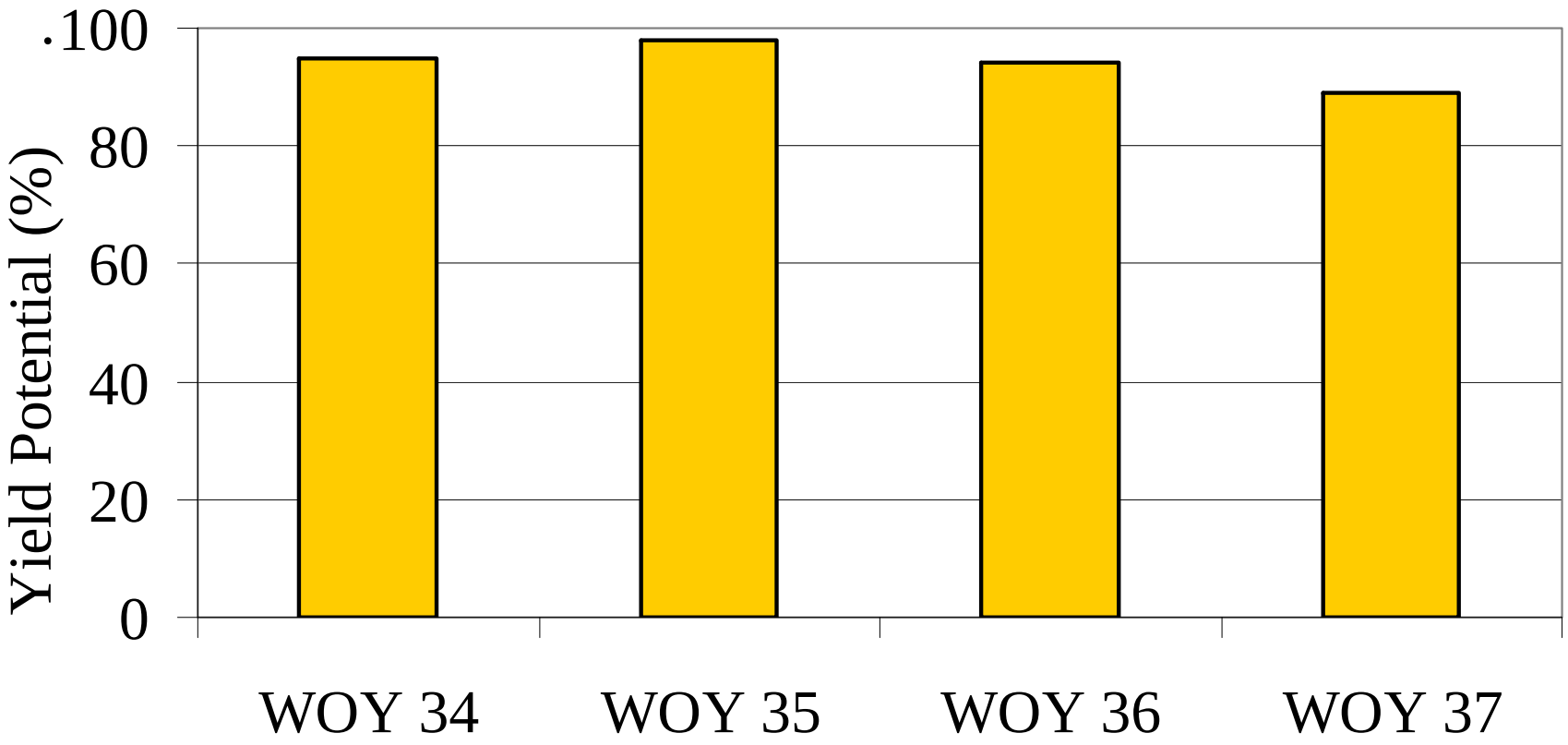
“The Model”

- Whole-farm linear programming (LP) model
- Developed at Purdue University
  - Used since 1968 at Top Farmer Crop Workshop
  - Over 25,000 times by more than 5,000 farmers
- Optimizes whole-farm returns to fixed costs
- Single equipment set farms
- Yield penalty based on plant:harvest period

Example Planting-time Yield Penalties



Example Harvest-time Yield Penalties



Working Rate

$$\text{Working rate} = \frac{\text{speed (mph)} \times \text{width (ft)} \times \text{field efficiency (\%)}}{8.25}$$

aka: working rate, field capacity, performance rate

Field Efficiency

- Machine prep time, maintenance, repair
- Travel time to, from, and between fields
- Turning time
- Loading and/or unloading
- Operator’s personal time

$$FE\% = \frac{\text{time machine is operating}}{\text{total time committed to operation}}$$

Base farm assumptions

	Number machines	Hours per day	Size	
Tractors	5	12		
Paratill	1	12		
Harvester	1	8	6 row	
Disk	1	12		
Hipper	1	12	12 row	
Sprayer	1	8	90 ft	

Base farm assumptions

- 3 full time laborers and 8 part time
- Days suitable for fieldwork (weather) set to “bad” year

	Potential yield per acre	Price per unit	Direct costs per acre
Cotton	960 lb	$0.72 per lb	$456.19

Price, yield, and cost ratios more important than the value
Values set to 5 year planning process levels

Field Efficiency (FE) Assumptions

- Traditional harvest FE assumed to be 70%
- Boll buggy utilization increases FE
  - Similar to grain carts with combines
- When harvester does not stop to unload
  - FE approaches 90%
- Whole-farm economic impacts of FE
  - 70, 75, 80, 85, and 90%

Base data

Annual acreage, costs, and assumptions

	Field efficiency (%)	Speed (mph)	Working rate (ac per hour)	Annual Acres *	Cost ** per acre
Base	70	3.6	5.8	1161	$66.39
OBMB	70	4.2	6.8	1354	$75.33
OBMB	75	4.2	7.3	1451	$70.31
OBMB	80	4.2	7.7	1548	$65.91
OBMB	85	4.2	8.2	1644	$62.04
OBMB	**90**	**4.2**	**8.7**	**1741**	**$58.59**

* Assumes 200 hours of annual use

** Does not include boll buggy or module builder

Willingness-to-pay for increased working rates with constant farm size

System (FE%)	Working rate (ac/hr)	Annual acres	Annual use (hours)	Returns to fixed costs	Change from base
Base (70%)	5.8	1161	200	$471,936	$0
OBMB (90%)	8.7	1161	133	$473,467	**$1,531**

When farm size is constant, only $1,531 difference based on decreased yield penalties

Willingness-to-pay for increased working rates when farm size can expand

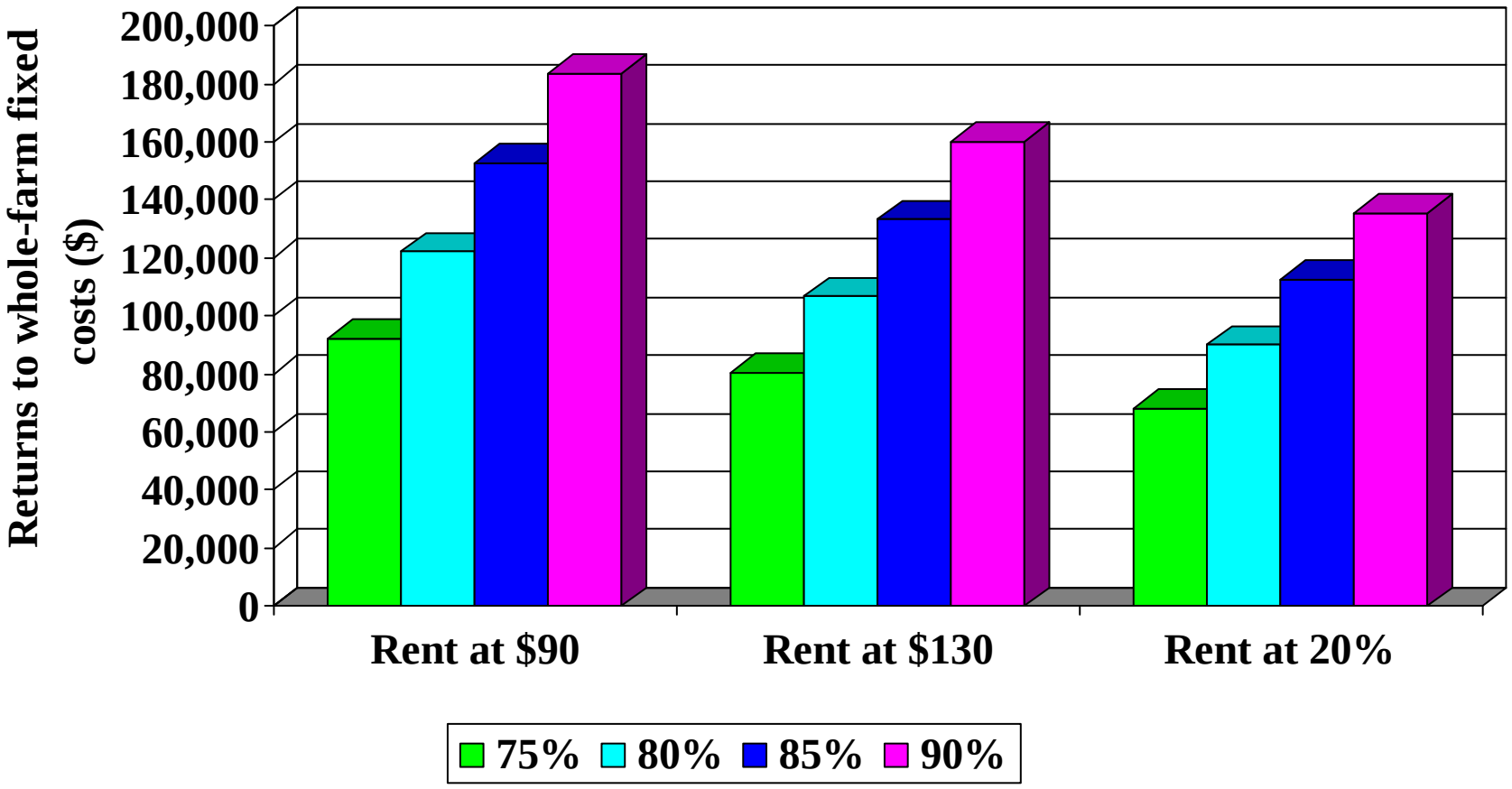
System (FE%)	Working Rate (ac/hr)	Annual acres* (200 hrs)	Acreage change	Additional land rented at:		
				$90 (USDA)	$130	$173 (20% share)
Base (70%)	5.8	1161	0	0	0	0
OBMB (75%)	7.3	1451	290	$92,193	$80,586	$68,166
OBMB (80%)	7.7	1548	387	$122,210	$106,734	$90,175
OBMB (85%)	8.2	1644	484	$152,698	$133,353	$112,653
OBMB (90%)	**8.7**	**1741**	**580**	**$183,554**	**$160,339**	**$135,500**

Only $1,531 difference if farm size constant

*based upon fully utilized at 200 hours annual use

Rents stated as “equivalent cash rent value”

Value of increasing field efficiency from 70%



By expanding acreage to fully utilize picker at 200 hours

Farm Acreage Expansion

System (FE%)	Working rate (ac / hr)	Acreage at hours annual use			Picker hrs* Nov 1 to 15 (300 hrs use)
		200	250	300	
Base (70%)	5.80	1,161	1,451	1,741	35.2
OBMB (75%)	7.25	1,451	1,814	2,176	37.2
OBMB (80%)	7.74	1,548	1,935	2,321	33.9
OBMB (85%)	8.22	1,644	2,055	2,467	34.5
OBMB (90%)	8.71	1,741**	2,176	2,612	35.1

* 60.3 hours available November 1 to 15

**Used no November 1 to 15 harvest time and only used
6.1 hours of 80.9 hours from September 16 to 30 period

Financing assumptions: Cotton Pickers

- $503,666 OBMB picker (85% of list price)
- $365,763 conventional six row
- 8 years useful life
- 30% salvage value
- 8.5% interest rate
- Measured with capital recovery
  - "cost of owning capital equipment"

Budgeting Comparison

Operating expenses*	Base	OBMB	Difference
Picker	$54,730	$75,364	$20,634
Boll buggy	$17,308	$0	($17,308)
Module builder	$20,312	$0	($20,312)
Total	$92,350	$75,364	($16,986)

*Capital recovery for pickers
8 year useful life on pickers
Does not include efficiency improvements
Using data in MSBG

Other considerations

- Cost of plastic wrapping
- Module handling equipment
  - $18,000 machinery cost plus 220 hp tractor

Cost of plastic wrapping

Acreage	Yield						
	1	1.5	2	2.5	3	3.5	4
1	**$6**	**$9**	**$13**	**$16**	**$19**	**$22**	**$25**
500	$3,158	$4,737	$6,316	$7,895	$9,474	$11,053	$12,632
1000	$6,316	$9,474	$12,632	$15,790	$18,947	$22,105	$25,263
1500	$9,474	$14,211	$18,947	$23,684	$28,421	$33,158	$37,895
2000	$12,632	$18,947	$25,263	$31,579	$37,895	$44,211	$50,526

Assumes $25 per 5000 lb module
Assumes 38% of seed cotton is lint

Conclusions based on “The Model”

- OBMB may be profitable for single equipment set farms when boll buggy and module builder are removed from the operation
- When acreage can expand to fully utilize higher field efficiency and working rates, OBMB begins to become profitable

Bottom-line Considerations

- Farmers considering OBMB should evaluate
  - Acreage expansion options in the local land market
  - Their existing equipment set
  - Impact of increased timeliness
- Opportunity especially for farms desiring to increase harvest efficiency
- "Model" results only as good as data entered
  - Based on representative farm assumptions
  - Individual farms may differ

Thanks: Assistance with Model

Dr. Craig Dobbins	Farm Management	Ag Economics	Purdue
Dr. Jeremy Ross	Soybean agronomist	Agronomy	UA
Trey Reaper	Soybean verification	Agronomy	UA
Dr. Jason Kelley	Corn agronomist	Agronomy	UA
Dr. Tom Barber	Cotton agronomist	Agronomy	UA
Dr. Bobby Coates	Rice policy	Ag Economics	UA
Stewart Runsick	Rice verification	Agronomy	UA
Dr. Brad Watkins	Rice economics	Ag Economics	UA
Dr. John Anderson	Crops economist	Ag Economics	MSU
Dr. Gregg Ibendahl	Crops economist	Ag Economics	MSU
Herb Willcutt	Mechanization	Ag Engineering	MSU

Terry Griffin

tgriffin@uaex.edu

501.671.2182 (O)

501.249.6360 (C)