Mechanized Burley Grading: A Partial Budgeting Analysis

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Mechanical Grader

- Mechanized burley tobacco grading machine based on flue-cured harvester technology, manufactured by Carolina Tobacco Services, Inc.


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Objective

- Evaluate overall performance of mechanical burley grader
- Evaluation

1) Evaluate grader for effectiveness of leaf removal
2) Evaluate accuracy of grade separation
3) Collect initial labor data

Systems evaluated

	Hand Graded	Stalk - Inverted	Tips Hand Pulled 7 - 8	Tips Left Intact
High-Case				
Low-Case				

Systems Evaluated

Leaf Loss

Lb/Acre	HC	LC	ΔLL HC	ΔLL LC
Hand Graded	45.60	50.40		
Stalk - Inverted	1169.42 a	459.10 b	1123.82	408.70
Tips Hand Pulled	130.30 c	100.18 c	84.70	49.78
Tips Left Intact	305.07 b, c	262.89 b, c	259.47	212.49

Labor Systems Evaluated

Labor Study

		Hours/Acre	Stick/Hour	ΔHour
5 Man	Hand Graded	60	100	
8 Man	Pulling Tips	40	240	-20
7 Man		35	240	-25
4 Man		26	180	-34

Crop Throw – Grading Performance

Crop Throw – Grading Performance

	Contract Altria C.S.	Hand Graded	Stalk Inverted		Tips Hand Pulled		Tips Left Intact	
Stalk position	Range %		HC	LC	HC	LC	HC	LC
Flyings	4 -12	7.75	0.00 a	0.00 a	0.00 a	0.10 a	0.00 a	0.00 a
Cutters	17 – 25	28.62	56.51 a	44.47 b	40.28 b	37.55 b	24.55 c	33.97 b, c
Leaf	43 - 52	45.78	31.91 c	49.25 b, c	38.30 c	45.87 c	75.45 a	66.03 a, b
Tips	15 - 24	17.85	11.57 a, b, c	6.28 b, c	21.42 a	16.47 a, b	0.00 c	0.00 c

Partial Budgeting

Partial Budget	
Problem: Mechanization (Grading)	
Additional Cost	Additional Revenue
Reduce Revenue	Reduce Costs
A. Total Additional Cost and Reduced Revenue	B. Total Additional Revenue and Reduced Costs
Net Change in Profit (B-A)	

Economic Net Profit Changes

Hand Graded vs. Mechanical Grader		Decreased Cost ($/ac)	Reduced Revenue($/ac)	ΔΠ ($/ac)
Lcase	8 man	182.43	86.12	96.31
	7 man	227.43	86.12	141.31
	4 man	304.83	367.61	-62.78
HCase	8 man	182.43	146.53	35.90
	7 man	227.43	146.53	80.90
	4 man	304.83	448.88	-144.05

- $9/men hour (UT 2009 budgets)
- $1.73/lb (UT 2009 budgets)

Investment Analysis

- Profitability of a mechanical grader investment can be made using the Net Present Value (NPV) method under the following assumptions:
- 8% Discount Rate
- $30,000 Initial Mechanical Grader Cost
- $30,000 loan at 10% interest with equal principal payments over 3, and 5 years scenarios.
- Net Cash Revenue per acre for each year constant ($141.31 under Low Case scenario)
- Depreciation cost and maintenance not consider

The 50 and 100 acres scenario (5 years Payback period)

	50 ACRES		100 ACRES	
Year	Net Cash Flow	NPV	Net Cash Flow	NPV
1	-1934.50	-1791.20	5131.00	4750.93
2	-1334.50	-1144.12	5731.00	4913.41
3	-734.50	-583.07	6331.00	5025.75
4	-134.50	-98.86	6931.00	5094.49
5	465.50	316.81	7531.00	5125.47
NPV		-3300.44		24910.05

The 50 and 100 acres scenario (3 years Payback period)

	50 ACRES		100 ACRES	
Year	Net Cash Flow	NPV	Net Cash Flow	NPV
1	-5934.50	-5494.91	1131.00	1047.22
2	-4934.50	-4230.54	2131.00	1826.99
3	-3934.50	-9725.45	3131.00	2874.21
NPV		-19450.89		5748.42

Preliminary Results

- According to the investment analysis, under particular assumptions a 100 acre operation investment in a mechanical grader is profitable given that it has a positive NPV (under both the 3 and 5 year scenarios).
- For a 100 acre operation this investment can be paid in either 3 or 5 years guaranteeing a yearly positive Net Cash Flow [(Net Cash Revenue from Investment - Debt payment)]
- If willing to pay the investment in 2 years, the minimum operation size to have a positive NPV and a yearly positive Net Cash Flow is 128 acres.
- A 50 acre operation will be able to invest in a mechanical grader obtaining a positive NPV and positive yearly Net Cash Flow if the investment is paid over a 7 year period.
- This results might be different under different assumptions.

Preliminary Results

- Labor savings in all the systems
- Leaf loss increase using mechanical grader
- Positive changes in net profit using mechanical grader vs traditional hand grading method
- Accuracy of grading diminishes with mechanical grader (Discount?)

Future Research

- NTRM analysis
- Economic impacts of leaf quality changes
- Economic impact of grade distribution changes

QUESTIONS?

Leaf Loss Calculations

- Pull 5 sticks and set aside for traditional hand stripping (Total of 27 sticks graded)
- Weight of leaf and stem left on stalk =0.19
- Total Possible Weight per 5 Sticks = 11.41
- Leaf Loss = 0.19/11.41=1.67%

Leaf Loss Calculations

- 15 Sticks /Rep (3 reps per system)
- Gather leaves, pieces of leaves, and stem from floor around end of grader + Randomly pick 10 stalks from bunch on floor and pull all leaf and stem left on stalk
- Weight loss/ total weight (boxes + leaf loss) = % leaf loss

Crop Throw – Grading Performance Calculations

- Pull a sample from each HALF BOX (at least 20 leaves), evaluate for accuracy of mechanical grade separation, and individually weigh each grade found in each HALF BOX.

Crop Throw – Grading Performance Calculations

- Upper stalk positions are very beat-up - many stems were left on stalks but lamina beat off which made it more difficult to grade b/c of a lot of leaf fragments and very few whole leaves in boxes