Life Cycle Analysis on Cotton and Cow-Calf Production in the Texas High Plains and Rolling Plains

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Objectives

To estimate greenhouse gas (GHG) emissions from cow-calf and cotton production in Texas high and rolling plains

Introduction

- The U.S. Environmental Protection Agency (EPA) has continued its effort in regulating GHG emission since 2011.
- According to 2010 EPA statistics, GHG emission from agriculture accounted for 7% of the total GHG emissions.
- GHG emission depends on the climate, soil type, rainfall, methods of fertilization, tillage and irrigation.
- To better inform the policy makers, an initial yet important step would be to gather economic and emissions data on a regional basis.
- The target area of our study is the Texas High Plains and Rolling Plains.

Materials & Methods

- The life cycle analysis (LCA) method employed to quantify the environmental impact of cow-calf and cotton production systems.
- A representative cow-calf farm with 400 cows, 60 heifers, 325 calves and 15 bulls. Breeding season from April to August. All of the calves except 60 heifers sold after weaning at 6 to 8 months.
- The cow-calf farm on a native pasture where supplemental protein is used in winter when the grass protein is low.
- The cotton production data taken from the project "An integrated approach to water conservation for agriculture in the Texas southern high plains".
- 3 systems out of 33 systems chosen in this project. 3 irrigation types: sub-surface drip, center pivot and furrow respectively.

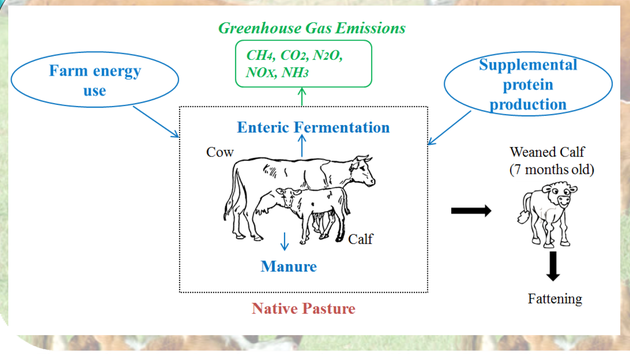

Figure 1: System boundary of representative cow-calf farm on Texas rolling plain

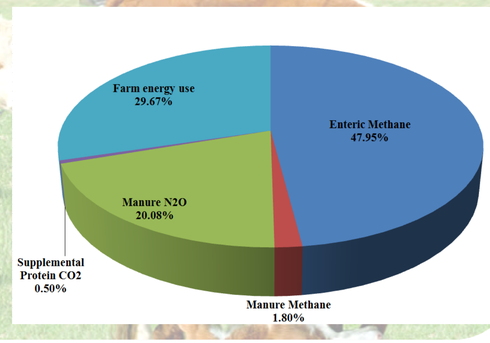

Figure 2: Total GHG emission breakdown for the cow-calf production

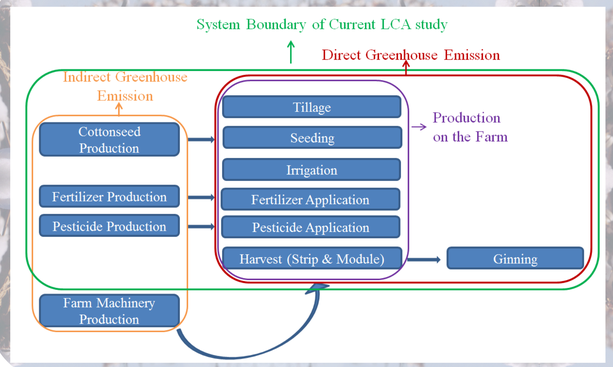

Figure 3: Flowchart of major greenhouse gas sources of the cotton production system

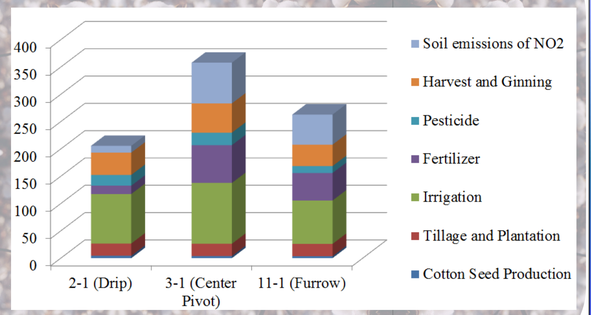

Figure 4: GHG emission breakdown for the 3 cotton production systems (Unit: kg of Carbon Equivalent per acre)

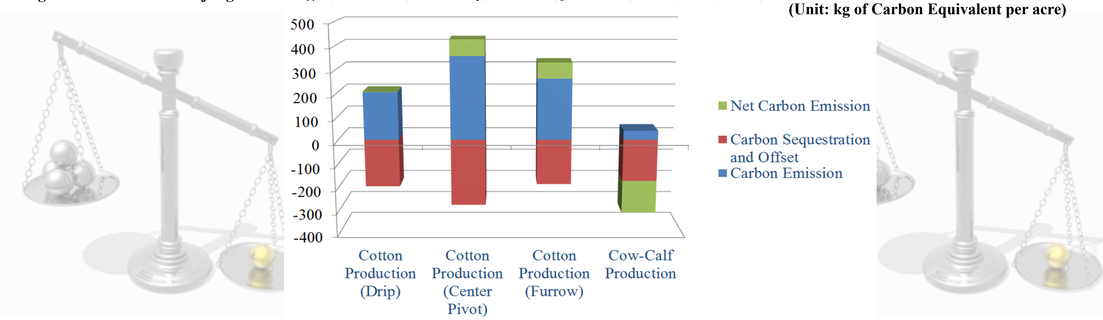

Figure 5: A comparison of carbon emission and sequestration between cotton and cow-calf production systems (Unit: kg of Carbon Equivalent per acre)

Results

Table 1: Summary results of carbon emission and sequestration from 3 systems of cotton production and cow-calf production

Production System	Cotton (Drip)	Cotton (Center Pivot)	Cotton (Furrow)	Cow-Calf
Total Carbon Emission (kg/acre)	205.65	357.89	262.85	39
Total Carbon Sequestration and Offset (kg/acre)	204.53	287.78	195.02	180.90
Net Carbon Emission (kg/acre)	1.12	70.11	67.83	-141.90
Yield (lb/acre)	1280	1801	1209	-
Profit ($/acre)	206.95	429.88	283.5	0.612
Net Carbon emission (kg CE/lb)	0.0009	0.0389	0.0561	-
Net Carbon emission (kg CE/$)	0.0054	0.1631	0.2393	-231.9

Conclusions

- Compared to cotton production systems, cow-calf production has much lower carbon emission while similar carbon sequestration level.
- On both per yield and per profit basis, system 2-1 (drip irrigation) generates the lowest carbon emission while system 11-1 (furrow irrigation) generates the highest carbon emission.
- Potential carbon policy may give producers incentives to choose certain production practices.

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