**OVERVIEW**

Carbon Markets and Offsets
Carbon offsets are credits traded on carbon markets that represent GHG emissions reductions generated from a change in management practice (Figure 1).
Compliance and Voluntary carbon markets are active in the US and globally, and can be an on-farm income source (Figure 2).
Offsets may be in short supply and agriculture can be an important source.
Nitrous oxide (N$_2$O) with its high global warming potential (GWP) or CO$_2$e of ~300 provides a high payback for its emission prevention.

**METHODOLOGIES**

**METHODOLOGIES**

Protocol Flexibility and Impact

N$_2$O response affects: Inventory estimates; Incentive to change management, and; Emission reduction credits

**FINDINGS**

**Protocol Accounting and Benefits**

Greater N$_2$O emissions reductions from reduction in N rate (A) with non-linear (C) compared to linear (B) relationship (Figure 5).
N$_2$O rate vs. N$_2$O emissions

**CHALLENGES**

**Protocol Validation Issues**

Baseline Establishment
- Base Years
- Proof of Practice
- Proof of ownership

Proving Additionality
- Regulatory Surplus
- Performance Standard
- Social Barriers

Permanence and Reversal
- N$_2$O emissions avoided are: Immediate; Irreversible; Permanent
- Producer aggregation

Conclusions
- Carbon credits needed and agriculture can provide them
- N$_2$O reduction is promising source
- Protocols need to be robust and transparent
- Projects need to be low cost and low complexity

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