The Farmer Is In: Diagnosing and Solving Problems on Your Farm

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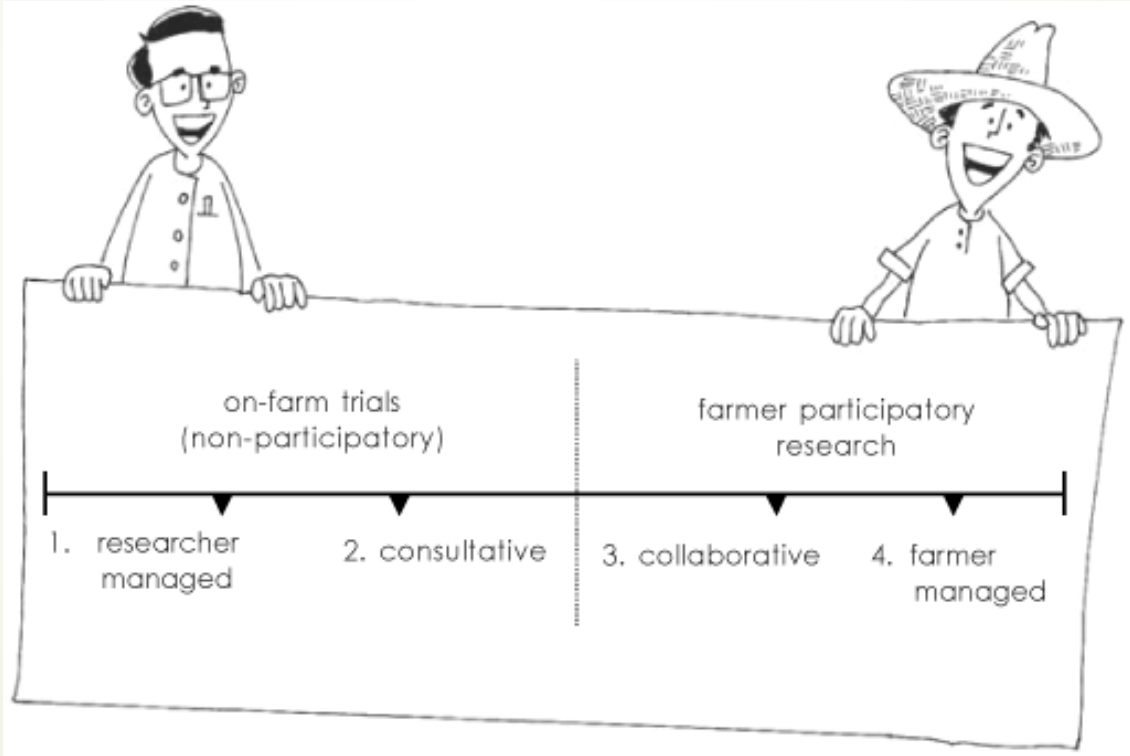
On-farm research

- Observation
- Experience
- Experimentation
- Systematic
- Scientific method
- Statistical analysis



- Observation
- Experience
- Experimentation
- Systematic?

Introduction and inspiration

- How many are actively engaged in farmer managed experimentation/on-farm research?
- What are some pros and cons of solving problems for yourself as opposed to relying on extension?

Strengths	Shortcomings
• Consider only relevant issues • Detailed knowledge of local conditions • Relatively quick and adaptive • Context-specific • Holistic • Empowering and exciting • Strengthens relationships	• Limited knowledge of current cutting-edge science • Issues with precision, robust experimental designs, control, replicability, etc. • Limited communication

Introduction and inspiration

- Why is on-farm problem-solving and innovation important to you?
  - Changing weather patterns
  - Trialing new crops
  - Finding new markets
  - Fixing broken equipment
  - Managing pests and weeds
  - Enhancing soil health
  - Meeting customer demands
  - Coping with price volatility
  - Minimizing waste and environmental impacts
  - Reducing inputs while increasing yields

Introduction and inspiration

- History of farmer-driven research
  - Pre-1950s: Small, independent farmers
  - 1950-1980s: Land grant universities, agricultural extension, "Get big or get out"
  - 1980s-present: Organic and local food movements

On-farm Problem Solving Process

- Identify farm vision
- Define farm system
- **Observe and evaluate the farm system**
- **Identify problems and opportunities**
- **Design actions**
- **Implement actions**
- **Evaluate actions**

Observing the farm

- Walk the farm
- Record observations
- Routine testing
- Collect outside observations
- Taste your own food
- Invite feedback from labor, customers
- Assess equipment

Identify Problems and Opportunities

- Review farm calendar
- Analyze financials
- Analyze records
- Establish benchmarks
- Review past successes and failures
- Review means of production
- Consult experts
- Prioritize problems/opportunities

	Urgent	Unurgent
Important	Do	Plan
Unimportant	Delegate	Ignore

Waste	Explanation
Overproduction	Producing more than your customers want
Waiting	While sometimes unavoidable, but can be due to poor timing
Transportation	Requires time and resources that do not contribute to creating value
Overprocessing	Processing products (e.g., washing, packaging, etc.) more than customers want or need
Inventory	Keeping more resources than necessary (storage and upkeep costs)
Motion	Similar to transportation, requires time and energy during production that does not contribute to value
Defects	Quality is more important than quantity in small operations
Overburdening	Insufficient resources to support labor leading to burnout
Uneven production/sales	While seasonality makes some unevenness unavoidable, try to maintain a steady supply chain
Unused talent	Capacity for innovation and adaptation not encouraged or actively discouraged

Design

- Investigate subject
- Research solutions/options
- Assess risk/rewards
- Choose course of action
- Design trial
- Identify success criteria

- Resources
  - Primary
  - Secondary
    - Books
    - Websites
  - Networks
    - Extension
    - Farmer-to-farmer

Design

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Methodical tinkering/ tweaking

- No imminent problem, just improving production
- Easily reversible, small change
- E.g., variety trial, changing timing of planting, increase fertilizer application

Problem-solving

- Known problem, unknown solution
- Short-term, small-scale experimentation
- E.g., new cover crop

Whole farm change

- Unknown problem, unknown solution
- Involves diagnosing cause of problem
- E.g., declining soil health, introdced pest, conventional to organic transition

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Control	Treatment 1	Treatment 2

- *Characteristics of effective on-farm trials/experiments*
  - *Appropriate*
  - *Simple*
  - *Accessible*
  - *Flexible*
  - *Realistic*
  - *Organized and systematic*
  - *Collaborative*
  - *Holistic*
  - *Controlled*
  - *Replication?*

Replication 1	Replication 2	Replication 3
Treatment 1	Control	Treatment 2
Control	Treatment 2	Treatment 1
Treatment 2	Treatment 1	Control

Design

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- *Guidelines for SMART indicator selection*
  - **S**pecific
  - **M**easureable
  - **A**chievable
  - **R**elevant
  - **T**ime-bound

Implementation

- Collect resources
- Allocate time
- Assign duties
- Execute plan
- Collect data
- Monitor results
- Fine-tune actions
- Review success criteria

- Assuming you did all the previous steps, this one is easy:
  - **Just do it**

Implementation

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Field	Date	Height (cm)	Observations

Implementation

- Collect resources
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- Assign duties
- Execute plan
- Collect data
- Monitor results
- Fine-tune actions
- Review success criteria

Evaluation

- Observe end result
- Analyze data
- Reassess risks and rewards
- Invite feedback
- Determine next steps
- Share results

- Options
  - Find a viable solution
    - Implement/scale up
  - Tested solutions do not meet criteria of success
    - Alter approach/try alternative solutions
    - Abandon efforts to solve the problem

ON FARM RESEARCH AT ELDERBERRY POND FARM

SPORE EXCLUSION TUNNEL

WICKING HILLS

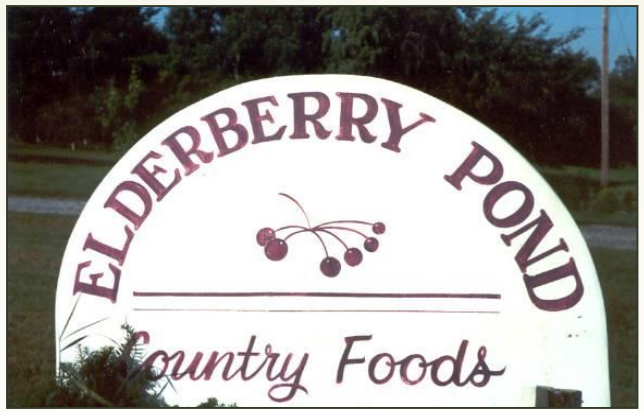
NATURAL IRRIGATION SYSTEM

LOU LEGO

Elderberry Pond Country Foods

Our Farm

Ashmead's Kernel



100 Acres, 30 in fruits & Vegetables

Very Diversified Plantings

NOFA Certified Organic

Our Markets

On-Farm Retail Store

Fine Dining Restaurant

Farmer's Markets

FARM DIVERSITY INCREASED OVER TIME IN RESPONSE TO MARKET DEMAND

SPORE EXCLUSION HIGH TUNNEL

IN 2008 ALL OF OUR CUCUMBER AND MELON PLANTS DIED IN 1 WEEK FROM A DISEASE WE HAD NEVER SEEN BEFORE

RESEARCHED ON LINE , IN OUR PLANT DISEASE BOOKS, AND WITH SEVERAL UNIVERSITY EXTENSIONS AND THE PROBLEM APPEARED TO BE DOWNY MILDEW

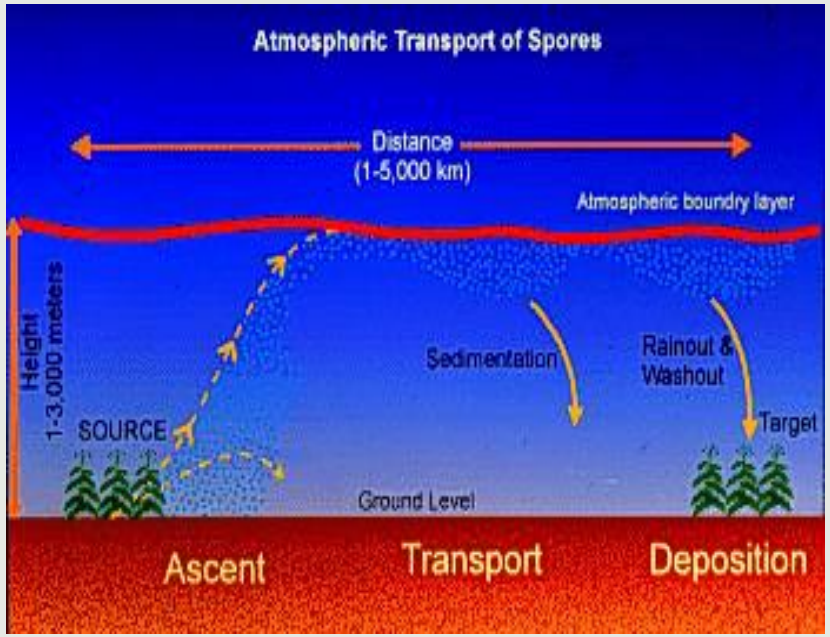
LEAF SAMPLES TO NC STATE....CONFIRMED

NOW WHAT!!

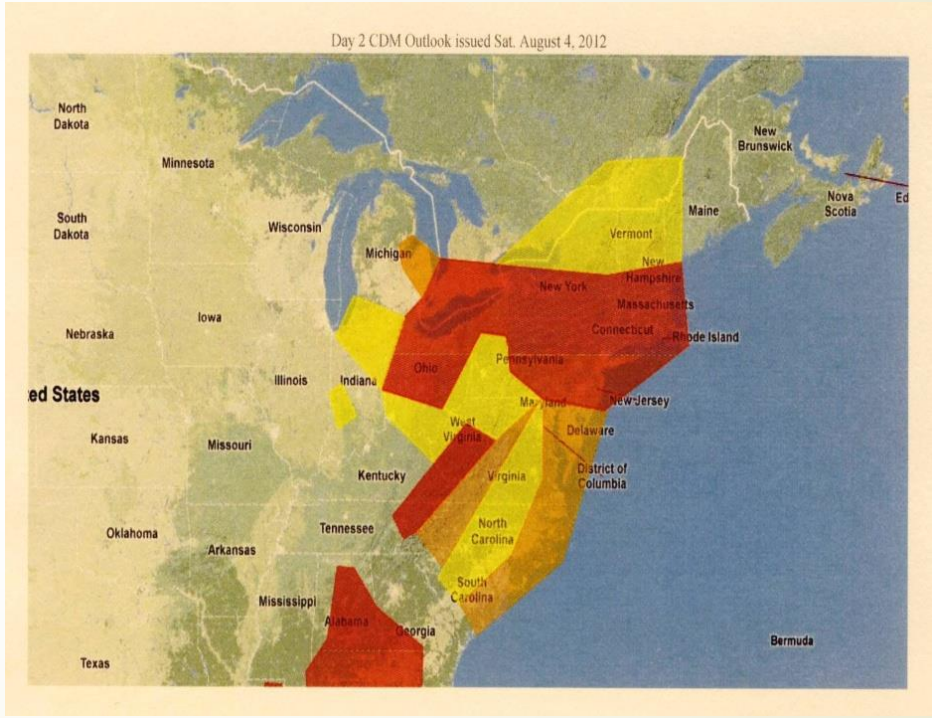
No Approved Sprays

DOWNEY MILDEW INFECTIONS ???

FROM WHERE? HOW ? AND WHEN?



TRANSPORT MODEL



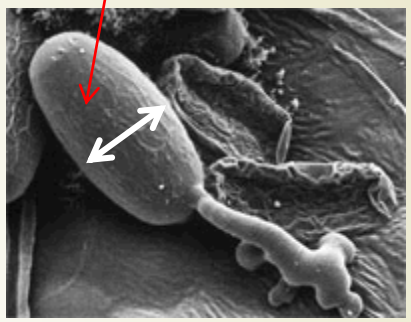
IPM PIPE- CDM ALERT SYSTEM

THE PREDICTIONS ARE REALLY GOOD, BUT WHAT DO YOU DO?

PARTICULARLY, IN A HIGH TUNNEL

QUESTION I HAD…

Could the spores that cause downy mildew and tomato late blight be excluded from a plastic tunnel during an infection period using inexpensive anti-allergen furnace filters?



NO ONE KNEW …MOST DOUBTED

TWO NE SARE FARMER GRANTS

2009 – Low Tunnel Experiment

30 ft. tunnel two filters

2012 – High Tunnel Experiment

96 ft. tunnel 15 filters

METHODS FOR BOTH EXPERIMENTS:

PLANT CUCUMBERS IN LATE SPRING IN OUTSIDE CONTROL PLANTINGS, IN A CONVENTIONAL TUNNEL WITH ROLL UP SIDES, AND IN A SPORE EXCLUSION ENCLOSURE

USE VARIETIES NOT REQUIRING POLLINATION, HAVING SOME CLAIMS FOR DM RESISTANCE AND HAVING GOOD TO EXCELLENT EATING QUALITIES.

USE NC STATE DM WEBSITE FOR DISEASE MAPPING AND INFECTION PREDICTIONS

SOIL TESTS IN ALL SITES

ABBY SEAMAN TECHNICAL ADVISOR FOR BOTH TESTS

Note: Floating Row Covers were also evaluated for spore exclusion possibilities during the 2009 Experiment

RESULTS OF THE 2009 TESTS

One of the worst CDM seasons- First Infection in early August

Treated Row Covers delayed Infections by about a week

Spore Exclusion Tunnel had no infections –
surrounded by infected plants

Microscope photos showed filters loaded with spores

Control Bed

Spore Exclusion Tunnel

ISSUES TO BE ADDRESSED IN THE 2012 HIGH TUNNEL TESTS

Could a Large Tunnel be closed tightly enough?

Temperature /Humidity Control- Would Plants cook during Infection Periods with Sides rolled down?

How to enter and exit Spore Exclusion Tunnel- During Infection Period

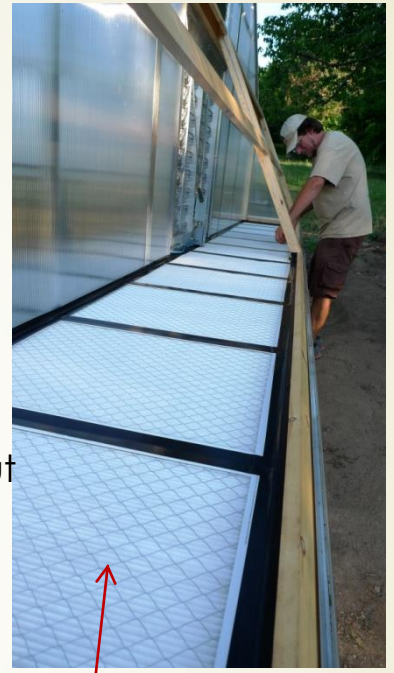
How much Air Flow was needed ? How many Filters ?

Could Tunnel be re-opened following an infection period?

AGAIN…THERE WERE LOTS OF DOUBTERS

DESIGN OF THE SPORE EXCLUSION HIGH TUNNEL

All air blown into tunnel goes through filters



15 - 3M Lowe's
Filtrite Furnace Filters

"Aluminet" Cloth to separate hot air at top to be vented out

Lots of water for irrigation to feed the evaporation

Plants trellised high for trans-evaporation

RESULTS IN HIGH TUNNEL TESTS WERE THE SAME AS IN LOW TUNNEL TESTS
NO DM OR LATE BLIGHT IN EXCLUSION TUNNEL AND SEVERS DM IN CONVENTIONAL HIGH TUNNEL AND IN OUTSIDE BEDS.

Note: Final Report is available by searching National SARE Farmer Grant Database under NE SARE- New York "Spore Exclusion Tunnel" Our thanks to NE SARE!

SO, ONE CRISIS AVERTED AND NOW A NEW REALITY… CLIMATE CHANGE!

WHAT WE HAVE DONE IN THE PAST AND UPGRADES WE'VE MADE

2005 DRAIN TILES CLEANED AND EXTENDED- CREEKS CLEANED OUT, POND REBUILT



2012 HYBRID MULCHING PROJECT



2015 HILLING MORE THAN JUST POTATOES...GARLIC, ONIONS, LEEKS, SWEET CORN,



HILLING MORE CROPS WORKS WELL DURING FLOODING RAINS

Water drains off hills into subsoil...

Hilling reduces in-row weeds

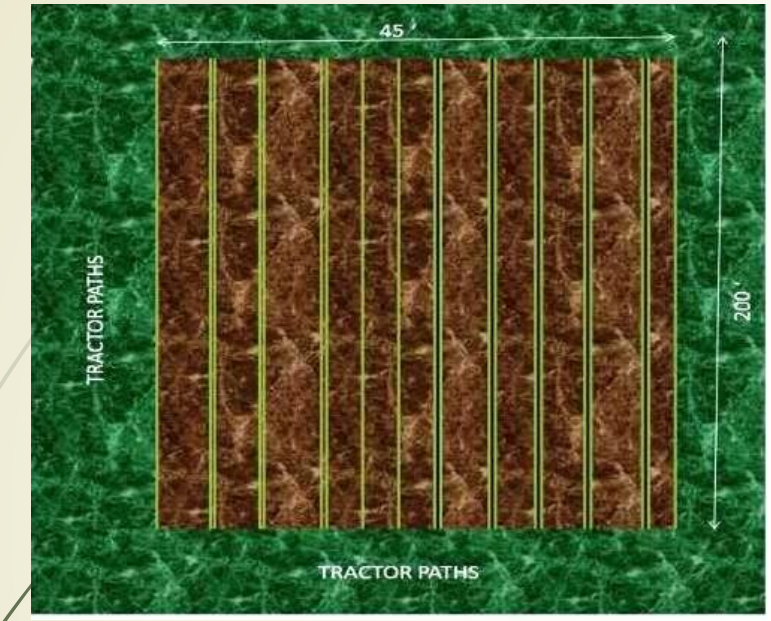
Less soil compaction from standing water

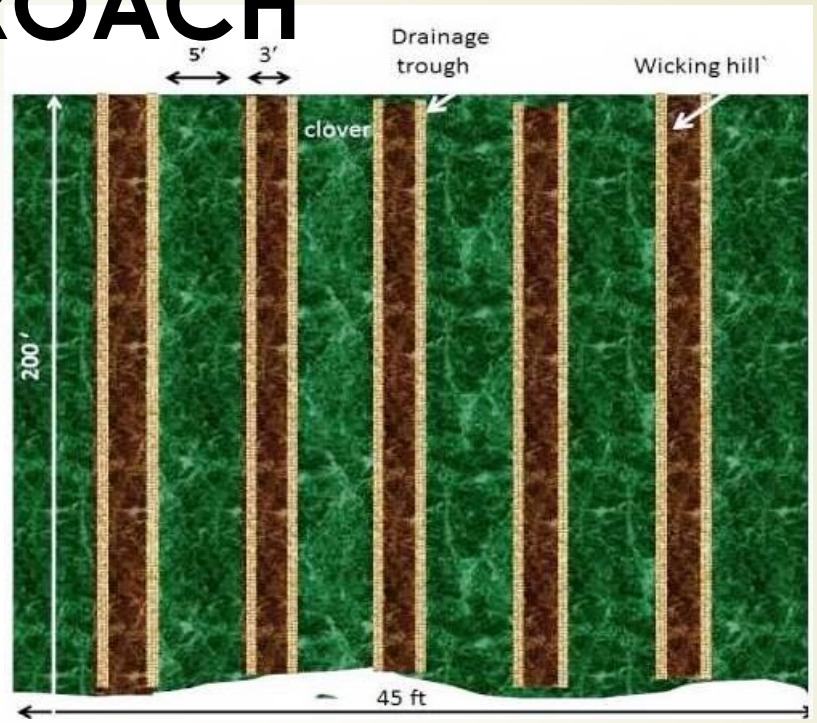
BUT...

Long dry spells can cause plant dehydration or loss and soil life depletion

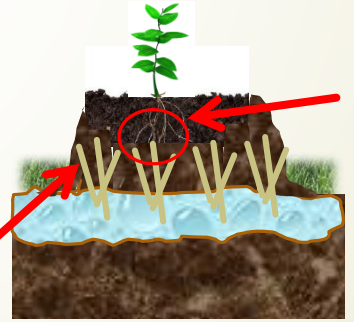
WICKING HILLS CAN BE A SOLUTION TO BOTH FLOODING AND DRAUGHT CONDITIONS

WICKING HILLS APPROACH





FLAT FIELD



Stalk/Root Coupling Zone

WICKING HILLS

WICKING MATERIALS

WICKING HILLS AND STALKS

ORIGIN OF THE STALKS? SUNFLOWERS !

SHADE FOR CLOVER, SOIL CARBON & FIBER

CUT FLOWERS

CHICKEN AND WILD BIRD FEED

TRAP CROP FOR STRIPPED CUCUMBER BEETLES

AND THE RESULTS... CARROTS

IN VERY DRY JUNE

FLAT FIELD

WICKING HILL

AND

IN VERY WET NOVEMBER

FLAT FIELD

WICKING HILL

WE WILL BE CONVERTING MOST OF OUR FIELDS TO WICKING HILLS

SUMMARY

TWO EXAMPLES OF SERIOUS PROBLEMS ON OUR FARM WHERE :

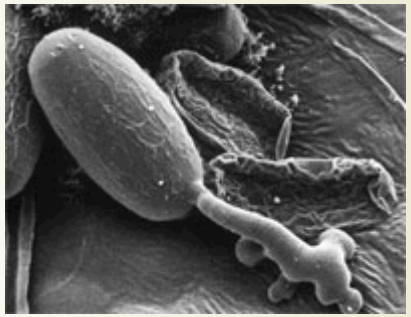
OBSERVATION "WALKING THE FARM"

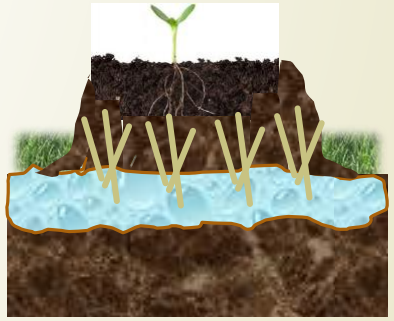
INVESTIGATION- RESEARCHING, COLLABORATING,

FORMULATING TEST TRIALS

SEEKING FINANCIAL SUPPORT

OUTREACH- REPORTING TO OTHER FARMERS





HAS HELPED SUSTAIN OUR FARM AND HOPEFULLY OTHER FARMS

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Thank you for your consideration

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