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- Find a handout of the slides and a fact sheet at <http://www.extension.org/pages/71272>
- To type in a question, use the question box on your control panel. We will read the questions aloud after the c. 45 minute presentation.
- The webinar is being recorded and you can find it in our archive in the coming week at <http://www.extension.org/pages/25242>



## Dehulling Ancient Grains

Brian Baker; Frank Kutka, NPSAS; Nigel Tudor,  
Weatherbury Farm, Elizabeth Dyck, OGRIN

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Nigel Tudor



Brian Baker



Frank Kutka



Elizabeth Dyck



## DEHULLING ANCIENT GRAINS

Brian Baker, Frank Kutka, Nigel Tudor, Elizabeth Dyck  
Value-Added Grains for  
Local and Regional Food Systems Project



## Outline

- Overview of the Value-Added Grains Project
- Einkorn, emmer, and spelt as potentially high-value crops
- Dehulling methods
- Economic considerations: comparison of three, larger-scale manufactured dehullers
- Two farmers' approaches to dehulling
  - Nigel Tudor, Pennsylvania
  - Blaine Schmaltz, North Dakota
- Smaller-scale dehulling options

## Value-added grains for local and regional food systems project

- Funded by USDA Organic Research and Education Initiative (OREI)
- Goal: To increase organic, food-grade, small grain production through
  - a focus on potentially high-value crops
  - adding value through local, organic production
  - adding value through processing, on or off the farm
    - **A major project objective: Document and evaluate a variety of approaches to grain dehulling**

## Value-added grains for local and regional food systems project team

### Universities

Cornell  
North Dakota State  
Penn State  
Oregon State  
Greenmarket/GrowNYC



### Farmer organizations

Northeast Organic Farming  
Association of NY (NOFA-  
NY)  
Pennsylvania Association for  
Sustainable Agriculture  
(PASA)  
Northern Plains Sustainable  
Agriculture Society  
(NPSAS)  
Organic Growers' Research and  
Information-Sharing Network  
(OGRIN)

## Advisory committee: Farmers, processors, bakers, chefs

Michael Anthony, Gramercy Tavern,  
New York, NY

Troy DeSmet, Nature's Organic Grist, St. Croix  
Falls, WI

Matt Funicello, Rockhill Bakehouse, Glens  
Falls, NY

Patricia Jackson, chef, New York, NY

Kit and Cathy Kelley, White Frost Farm,  
Washingtonville, PA

Klaas Martens, Lakeview Organic Grain, Penn  
Yan, NY

Thor Oechsner, Oechsner Farms, Newfield, NY

Blaine Schmaltz, Blaine's Best Seeds, Rugby,  
ND

Sam Sherman, Champlain Valley Milling,  
Westport, NY

Luke Stodola, Small World Bakery, Rochester, NY

Gil Stallknecht, Montana State

University (emeritus), Lewistown, MT

Joel, Elaine & Eric Steigman, Small Valley  
Milling, Halifax, PA

Roberta Strickler, grains marketing, Lancaster,  
PA

Nigel Tudor, Weatherbury Farm, Avella, PA







**Why the renewed interest in the ancient grains einkorn, emmer and spelt?**



**Stress tolerance in the field**





## Flavor



## Nutritional quality and price

Some organic retail prices, November 2014:

Whole einkorn: \$4-\$7/lb

Whole emmer: \$3-\$6/lb

Whole spelt: \$1.30-\$4/lb

### Ancient grains: challenges

- Yields tend to be lower than modern wheat
  - Spring emmer: about 20% less
  - Spring einkorn: about half
  - Winter varieties of emmer and einkorn may have higher yield potential (as does modern winter wheat)—need more testing

### Ancient grains: challenges

- Do not thresh free of their hulls
  - Additional step needed for human consumption
  - Added handling costs
  - Higher transportation costs
  - Other crops that can require dehulling
    - Rice, barley & oats
    - Sunflower
    - Buckwheat



### Advantages of having a dehuller

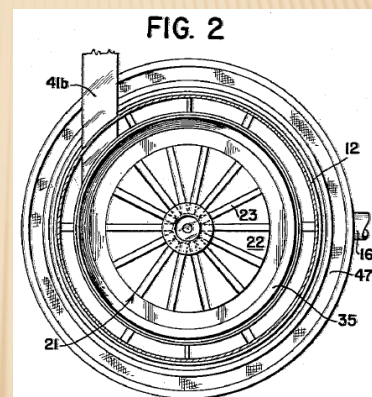
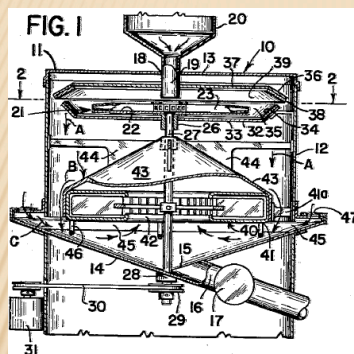
- The value-added step is captured on the farm, because the dehulled grain commands a higher price.
- If the final buyer requires dehulling before delivery, an on-farm dehuller saves the added cost of having the hulls removed by a mill or another farm.
- Dehulling capacity provides more options for markets.
- The cost of transportation is reduced by selling a less bulky product.
- Dehulled grains require less storage volume.
- Farmers have more options of crops that they can grow and sell.
- Hulls are a marketable co-product for feed, animal bedding and other uses.

### Disadvantages of having a dehuller

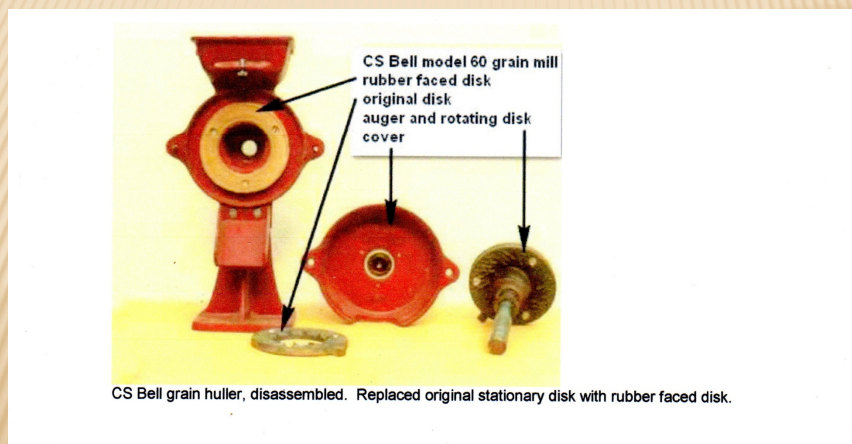
- The volume of grains that are dehulled and marketed as added value needs to be sufficient to recover the cost of the investment.
- Dehulling requires labor for setup and operation.
- Dehulled grains are generally more prone to losses from rancidity, decay and post-harvest diseases than grains in the hull.
- Quality control requires attention to detail, and the risks of loss through machinery malfunction are increased.

## Dehuller Considerations

- Dehuller designs
  - Impact, friction or abrasion
  - Throughput
  - Manufactured vs. modified vs. custom built
- Operating conditions
  - Cleaner
  - Dryer
- Maintenance & repair



Forsberg impact dehuller  
 (<http://www.google.com/patents/US3098515>)



From Dong and Edberg, Grain huller for rice, spelt wheat, quinoa and millet,  
<http://members.efn.org/~itech/pdf%20files/Grain%20huller.pdf>

## Models compared



Codema VSH2096



Heger DS II 800



Horn DVC-2



## Assumptions

Parameter	Value
Spelt Price (in hull)	30¢/lb
Spelt Price (dehulled)	68¢/lb
Extraction	60%
Labor	\$12.79/hr
Electricity	0.232¢/kWh
Depreciation	5 yr straight line
Conversion € to \$	1.37
Interest Rate	2.125%

## Model comparison

Value	Codema VSH 2096	Heger DS II 800	Horn DVC 2
Type	Impact	Friction	Friction
Hourly Capacity	3,000 lb	2,200 lb	3,000 lb
MSRP	\$16,000	\$20,000	\$35,000
Ann. M&R	\$2,970	\$1,800	\$3,150
Variable Cost	2.41¢/lb	2.24¢/lb	2.04¢/lb
Breakeven	470 hrs	321 hrs	407 hrs
EBIDTA*	\$46,762	\$45,383	\$57,381

\*Earnings Before Interest, Depreciation, Taxes and Amortization



Weatherbury Farm

## Crops grown on Weatherbury Farm

### Fall Planted Crops:

Soft White Winter  
Wheat

Hard Red Winter  
Wheat

Spelt

Rye

### Spring Planted Crops:

Hull-less Oats

Emmer

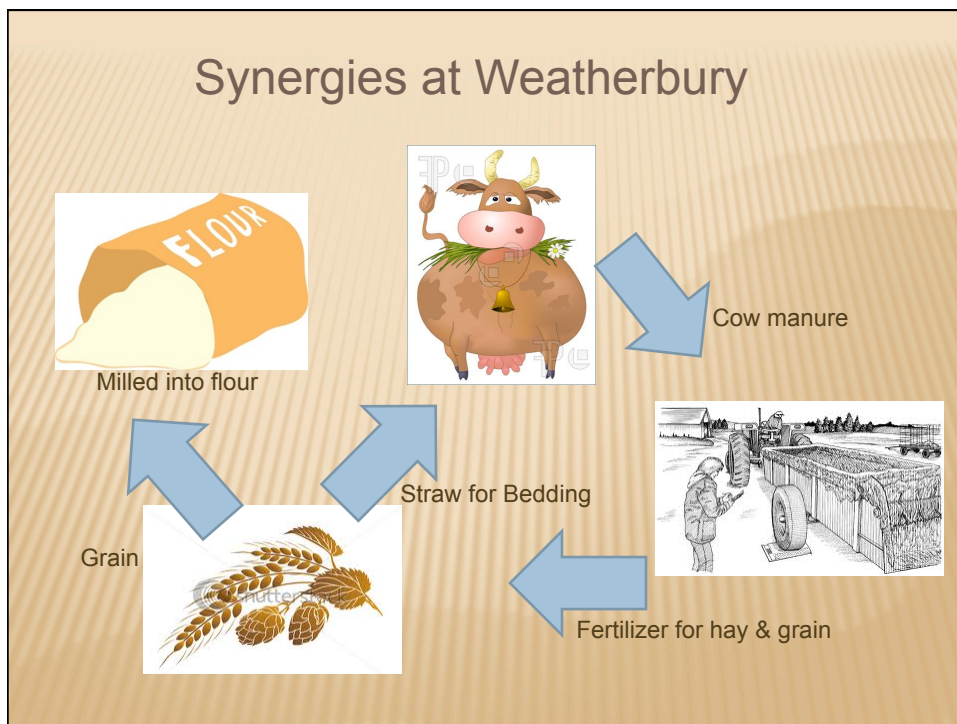
Open Pollinated Corn

### Mid-Summer Planted:

Buckwheat



## Synergies at Weatherbury



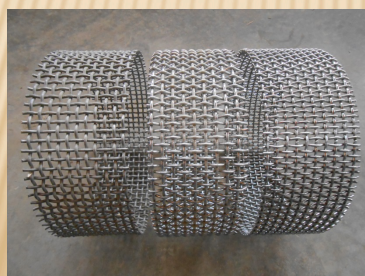
## Why did I start growing spelt?



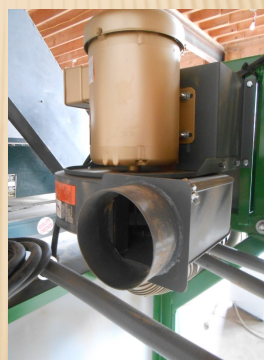
## Why did I build a dehuller?



## How my dehuller works

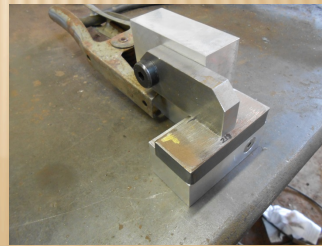


## Aspirator





## Building the dehuller



## The electronics



Control Panel



Main Panel



Dynamic Brake  
Panel

## Dehulling spelt



## Dehulled grain



Raw Spelt



Once through  
dehuller:  
88.5% dehulled



Twice through  
dehuller:  
98% dehulled



## Dehulled grain



Spelt Berries  
off of gravity  
separator



Dehulled Black Winter  
Emmer

## A farmer's view of dehulling economics

My Local dehulling mill (100+ miles away) is paying \$0.30/lb for spelt in the hull.

- At a 63% extraction rate, this is \$0.47/lb for the grain.

-The mill is selling dehulled spelt for \$0.90/lb.

-\$0.43/lb is the price difference between hulled and dehulled.

-At a 300lb/hr dehulling rate I am capturing \$128/hr of value (\$129/hr - \$1/hr for electric and wearing parts). As my current setup requires two people, we are making \$64/hr per person.

-The payback on my \$12,546 investment at current prices would be 98hrs of operation; 29,400lbs of dehulled spelt or approximately 16.15 acres of ~100bu spelt.



## Adding value

For 1 acre of spelt at approximately 100 bu / 2,800lbs I would get:

\$840 selling it as raw spelt in the hull (2,800lbs x \$0.30/lb)

\$1,456 selling it wholesale as dehulled spelt  
(65% extraction= 1,820lbs x \$0.80/lb)

\$2,366 selling it as whole grain spelt flour (\$1.30/lb)

## Other hulled grains



Black Winter  
Emmer



Einkorn



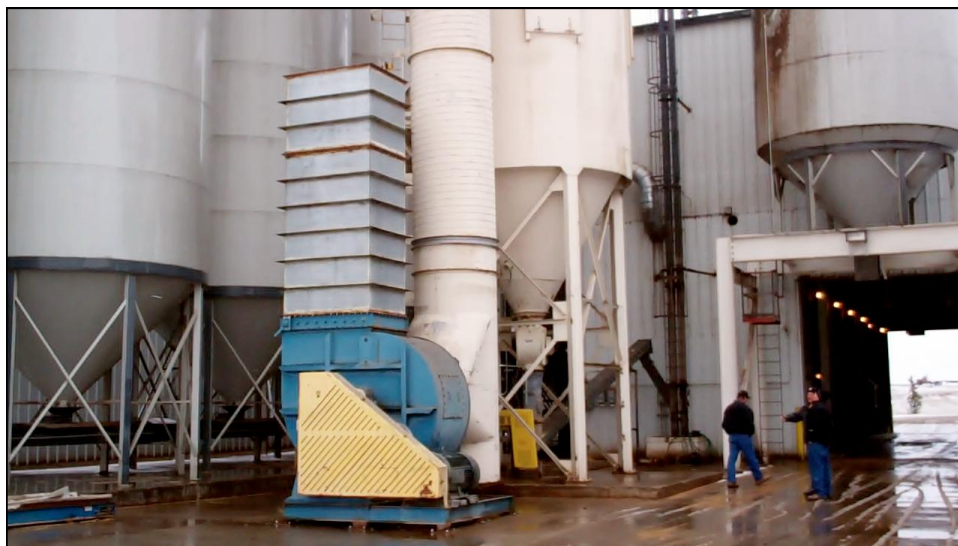
**Blaine Schmaltz, 2006**



**Cleaned and dehulled Lucille emmer**







**Aspiration is important at any scale**



**Pearled barley**





**Aspirated fines from barley mills**

**So far it has been hard to dehull emmer  
in a feasible manner**

- 7-10% loss from cleaning on farm
- Pearling and impact machines damage too much product; up to 40% loss in the mill
- Price to farmers not high enough to cover these losses
- Impractical for processors to do all of the cleaning and recleaning with these losses









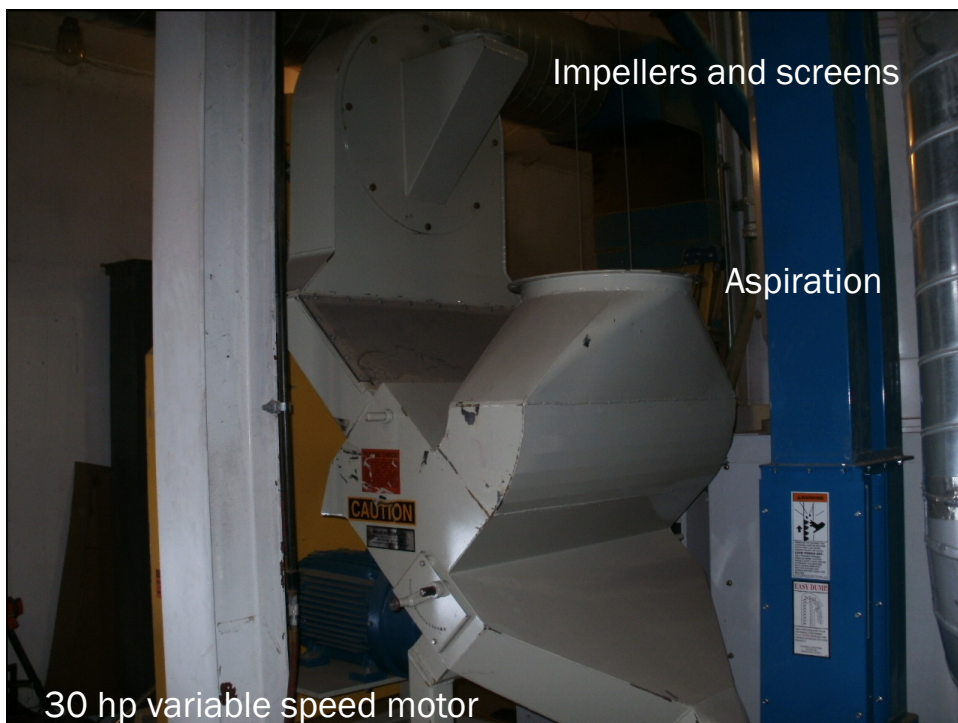


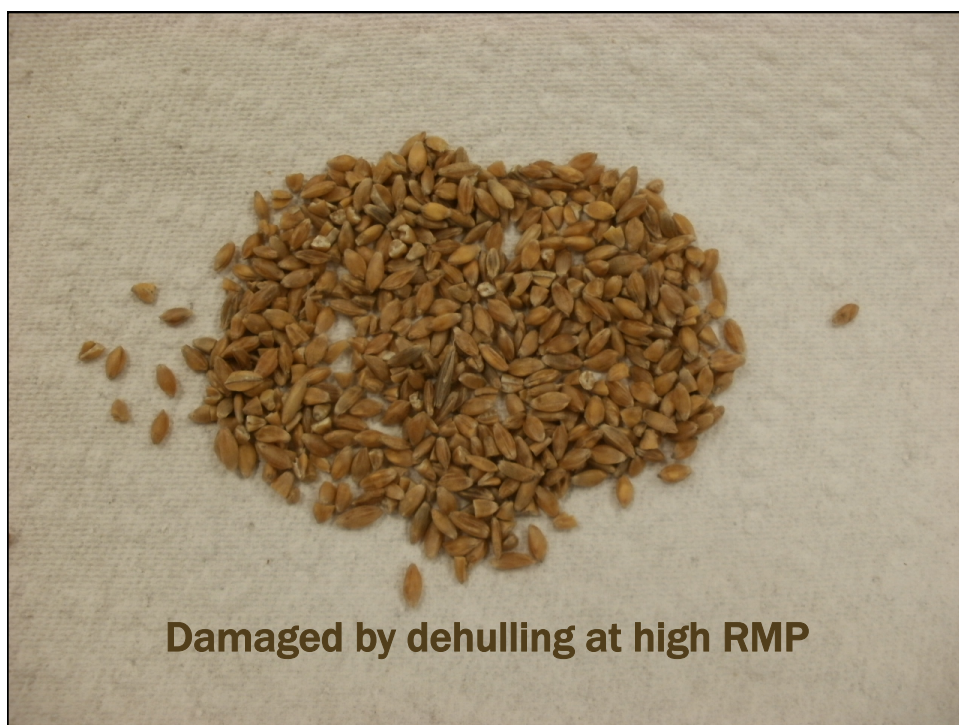
**From the sift deck – Needs more!**



**Clean enough for seed or dehulling**











**Clean the grain again!**



**Final Product**





**Emmer hulls – A valuable byproduct?**

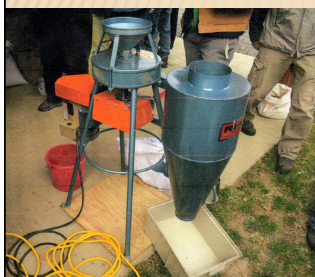
### What has Blaine learned?

- Emmer is a great crop for organic management, especially when rain <20"
- Prone to lodging, bulky, limited large-scale processing capacity
- Need to clean to seed quality for effective dehulling – scalpels, gravity, air, screens
- Dehulling needs good equipment with plenty of aspiration as well as recleaning steps
- Price needs to be high enough to cover production and cleaning expenses
- Look for ways to value byproducts

## Small-scale dehulling options: The French example



## Small-scale dehulling options: Sharing equipment



Forsberg 7-D impact dehuller

Sharing equipment with a mobile dehulling unit:  
small dehuller (new) + lab gravity table (used)  
Total cost: ~\$11,000



Oliver 30 gravity table



Close-up of deck





Robert Perry, NOFA-NY, with dehulling equipment  
“mobilized”

### Small-scale dehulling options: Can you dehull with a combine?



Farmers report that this depends on the crop—even the variety. Two farmers with AC all crop combines have had up to 50% dehulled kernels of Maverick spelt.



### Small-scale dehulling options: Modifying equipment



Henry Beiler, Watsontown, PA  
modified a used IH burr mill with  
rubber disks made from horse  
mat: Cost ~\$350

### Small-scale dehulling options: Abrasion dehuller



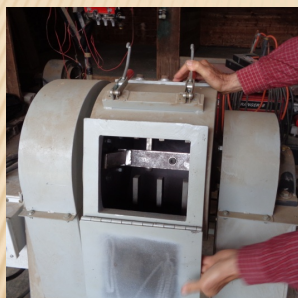
Farm-built abrasion dehuller  
Cost \$400 without motor

### Small-scale dehulling options: Experimental prototype

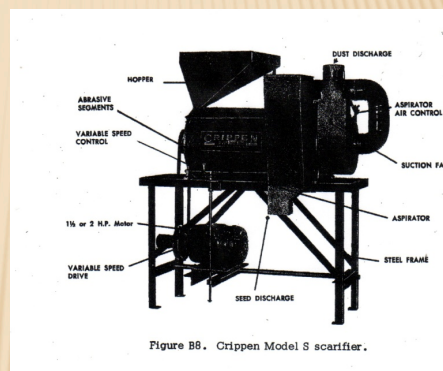


Cornell experimental dehuller designed and built by grad students in the School of Mechanical and Aerospace Engineering to be a low-cost method of dehulling emmer

### Small-scale dehulling options: Existing equipment



Debearder



Seed Processing and Handling Handbook, 1968, Seed Technology Laboratory, Mississippi State University State College, MI

Seed Scarifier



### Small-scale dehulling options: Existing equipment



Stone mill



Blender

Important: Machines not designed to dehull will vary in efficiency—and need to be combined with a separation method.

### Summary

- Ancient grains are potentially very high-value crops.
- The dehulling factor, and its associated costs, should be considered as you decide whether to grow these grains.
- Dehulling is a process: seed-cleaning and separation equipment are needed in addition to a dehuller, whatever the scale.
- Dehullers vary in method, throughput, efficiency, power requirements, and cost.
- Dehullers may also vary in effectiveness by crop, i.e., do not assume that a model is a “universal” dehuller.
- For smaller-scale operations, modifying existing seed-cleaning or milling equipment—or building your own—may be good options.
- Markets for dehulling by-products and for harvests that do not meet human consumption standards should be identified.



## Value-added grains for local and regional food systems project

Special thanks for help with this presentation to:

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Elam Stoltzfus  
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Blaine Schmaltz  
Steve Zwinger  
**June Russell**  
USDA NPGS GRIN

More information on ancient grains:



[www.extension.org/pages/66321/the-ancient-grains-einkorn-emmer-and-spelt-what-we-know-and-what-we-need-to-find-out-webinar#.VG0wRofxIAQ](http://www.extension.org/pages/66321/the-ancient-grains-einkorn-emmer-and-spelt-what-we-know-and-what-we-need-to-find-out-webinar#.VG0wRofxIAQ)

[www.extension.org/pages/66869/management-for-high-quality-organic-wheat-and-ancient-grain-production-in-the-northeast#.VGoKzvnF-So](http://www.extension.org/pages/66869/management-for-high-quality-organic-wheat-and-ancient-grain-production-in-the-northeast#.VGoKzvnF-So)

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