CONSIDERATIONS FOR GETTING INTO VALUE-ADDED SMALL GRAINS PRODUCTION FOR LOCAL MARKETS

Justin O’Dea, Vegetable & Field Crop Educator
Artisanal Wheat On the Rise

Giving factory flour the heave-ho, small farmers from New England to the Northwest are growing long-forgotten varieties of wheat.

Small-scale grains: Another piece of the locavore puzzle

By Rhea Kennedy

Bring Back Local Grains! One Man’s Quest in Upstate NY

By Amy Halloran on September 27, 2012

Brooklyn Brewery gives local beer new meaning

The brewer’s latest draft, Greenmarket Wheat, is a partnership with GrowNYC, and uses grains exclusively grown by farmers within 200 miles of the city.

Adding Value to Grain Proves a Successful Move for NY Operation

Still Life

New York’s distillery boom revives a spirited tradition.
It’s easy, right?
“(A) very beautiful and fertile wheatland which here grows so abundantly that this Esopus is the granary of the whole New Netherlands...”

- Visitor to the Esopus Flats, Kingston NY, 1679

“This is the granary of North America... From the state of New York, many parts of the continent are supplied with grain; and from the city of New York, and the ports on the river Hudson, more grain and flour are exported, than from any other port in the Union...”

- Sir William Strickland, on Wheat Production in New York’s Hudson Valley, 1795
The breadbasket revival?

- Hessian Fly invades... --> Yield Declines!
- Soil fertility declines... --> Resources depleted!
- Settling of Western NY, Erie Canal opens... --> Economically inefficient!

Contemporary Hudson Valley:
Fresh-market fruit & veg., dairy

Greenmarkets NYC, artisan bakers, NYS Farm brewery, distillery license demanding HV grown wheat!? barley!? rye!?

- 2012 Small grain variety trials begin!
Why the west dominates

- Environment
  - Semi-arid origins, evolution
  - Dry summers, Mediterranean
  - Low disease pressure
  - Unhindered grain maturity
    - Consistent high quality grains
Why the west dominates
Why the west dominates
Why the west dominates
Why the west dominates

- Environment
  - Semi-arid origins, evolution
  - Dry summers, Mediterranean
  - Low disease pressure
  - Unhindered grain maturity
    - Consistent high quality grains

- Land base scale
- Low population & associated pressures
- Knowledge
- Equipment
- Infrastructure
Reinventing the NE breadbasket

Challenges:

- Meeting modern human consumption and/or quality market standards.
  - Fusarium mycotoxins (Deoxynivolenol “DON”, aka “vomitoxin”)
  - Pre-harvest sprouting (bread, malting quality weak)
  - Low crude protein levels % breads (low gluten strength)
Reinventing the NE breadbasket

Challenges:

- Meeting modern human consumption and/or quality market standards.
  - Fusarium mycotoxins (Deoxynivolenol “DON”, aka “vomitoxin”)
  - Pre-harvest sprouting (bread, malting quality weak)
  - Low crude protein levels % breads (low gluten strength)
- Capital for equipment
Reinventing the NE breadbasket

Challenges:

- Meeting modern human consumption and/or quality market standards.
  - Fusarium mycotoxins (Deoxynivolenol “DON”, aka “vomitoxin”)
  - Pre-harvest sprouting (bread, malting quality weak)
  - Low crude protein levels % breads (low gluten strength)
- Capital for equipment
- Land base
Reinventing the NE breadbasket

Challenges:

- Meeting modern human consumption and/or quality market standards.
- Fusarium mycotoxins (Deoxynivalenol “DON”, aka “vomitoxin”)
- Pre-harvest sprouting (bread, malting quality weak)
- Low crude protein levels % breads (low gluten strength)
- Capital for equipment
- Land base
- Knowledge, genetics
Reinventing the NE breadbasket

Challenges:

- Meeting modern human consumption and/or quality market standards.
  - Fusarium mycotoxins (Deoxynivolenol “DON”, aka “vomitoxin”)
  - Pre-harvest sprouting (bread, malting quality weak)
  - Low crude protein levels % breads (low gluten strength)
- Capital for equipment
- Land base
- Knowledge
- Economic immaturity
  - Price??
  - Fledgling markets, evolution of economic infrastructure
Opportunities

- Reliable rainfall!

“Dryland agroecosystem yields in the northern Great Plains (NGP) of North America are primarily limited by low and erratic water availability.”

- Diverse options for rotations!

[Graphs showing precipitation trends for Hurley, NY and Havre, MT]
Opportunities

- Reliable rainfall!
  “Dryland agroecosystem yields in the northern Great Plains (NGP) of North America are primarily limited by low and erratic water availability.”
  - Diverse options for rotations!

- Production Economy
  - Economy of scale
  - Relatively low-input
  - Rotational benefit
    - Weed control
    - Disease control

- Proximity to premium, direct markets

- Expanded market opportunity
  - Product diversity = stability, resilience
  - Non-perishable, dry commodity
    - Expanded window to move product
Assessing your assets

Start small & manageable, work up as you learn.

- Appropriate acreage, economy of scale
- Appropriate soils, site (loams, good drainage, 3’+ depth, flat to gentle slopes)
- Access to capital or equipment (reliable?)
- Learn your market, choose wisely.
  - Establish secondary livestock feed market, even if using grain on site for value-added product/s
Assembling your toolbox

- Reliable access to equipment for:
  - Primary & secondary tillage (plow, disk, harrow etc.)
  - Seeding (grain drill)
  - Weed, disease, pest management (tine weeder, boom sprayer)
  - Harvesting (combine)
Assembling your toolbox

- Reliable access to equipment for:
  - Primary & secondary tillage (plow, disk, harrow etc.)
  - Seeding (grain drill)
  - Disease & weed management (tine weeder, boom sprayer)
  - Harvesting (combine)
  - Cleaning (barrel, screen cleaners), moving (augers, gravity wagon, truck)
Assembling your toolbox

- Reliable access to equipment for:
  - Primary & secondary tillage (plow, disk, harrow etc.)
  - Seeding (grain drill)
  - Management (tine weeder, boom sprayer)
  - Harvesting (combine)
  - Cleaning (barrel, screen cleaners)
  - Drying and storing (aerator/drier, covered space & bags, or bins; rodent proofing measures, insect control*)
Getting started

- Set yourself up for success.
  - Sod ground needs time and work to bring into production.
  - Follow a broadleaf crop, but avoid vetch. Grassy crops host small grain diseases; Long, “stacked” rotations may be an exception.
  - Choose a species and variety that is suits your needs. This is foundational.
    - Winter, spring; red, white; hard, soft; feed, malting, 2 vs. 6 row....
    - Disease, sprouting resistance (soft white wheat, malting barley= higher sprouting susceptibility)
  - Weed control is especially important for spring grains.
  - Seed timely, at appropriate rates. Use a grain drill. Observe hessian fly free dates.
  - Don’t neglect fertility. Legumes are a great rotational crop, but avoid over-fertilizing.
Avoid a colossal fail.
- Tine weed 2-3x for spring grains, herbicide, undersow with red clover
- Fungicide for fusarium head blight, aggressive foliar diseases
  - Resistant varieties, fertility helps
  - Fusarium head blight risk assessment tool (PSU)
Avoid a colossal fail.

- Tine weed 2-3x for spring grains, herbicide, undersow with red clover
- Fungicide for fusarium head blight, aggressive foliar diseases
  - Resistant varieties, fertility helps
  - Fusarium head blight risk assessment tool (PSU)
- Scout field for evidence of scab (Fusarium).
- Have your harvest, drying, cleaning, and storage equipment & plan in order
- Monitor grain moisture as harvest approaches.
  - Harvesting before 12-13% and drying down mitigates risk of pre-harvest sprouting.
Finishing up

- Keep your powder and your pants dry.
  - Harvest dry, turn up the air on the combine if fusarium infection is prevalent.
  - Clean immediately, ASAP
    - Chaff, weed seeds, fusarium shrunken kernels
    - Green matter can ruin grain (esp. ragweed)
  - Measure harvest grain moisture, dry as needed, low heat drying if needed (\(<110\,^{\circ}\F\) to keep germination viable)
    - 16-18\% Moisture- consider heated aeration
    - 14-15\% Moisture- needs aeration
    - 12-13\% Moisture- is stable
  - Moisture can vary with humidity & temperature, monitor throughout storage.
You passed the course, now for the final exam.
You passed the course, now for the final exam.

- **Grain moisture**
  - <13%

- **Test weight (density)**
  - Varies by grain

- **Grain Protein**
  - >12% for bread wheat
  - <12% for malting

- **Falling number**
  - >200 seconds (low sprouting)

- **DON (mycotoxin)**
  - <1 ppm

### Test Results

<table>
<thead>
<tr>
<th>Lab ID</th>
<th>Sample Description</th>
<th>Grain Moisture</th>
<th>Test Weight</th>
<th>Flour Moisture</th>
<th>As-Is Protein</th>
<th>DM Protein</th>
<th>Falling Number</th>
<th>DON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>lbs/bu</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>seconds</td>
<td>ppm</td>
</tr>
<tr>
<td>C577</td>
<td>Harvard HRWW</td>
<td>14.0</td>
<td>54.7</td>
<td>10.2</td>
<td>10.8</td>
<td>11.6</td>
<td>281</td>
<td>&gt;5.0</td>
</tr>
<tr>
<td>C578</td>
<td>Conlon 2-row</td>
<td>10.9</td>
<td>46.3</td>
<td>8.6</td>
<td>13.9</td>
<td>14.7</td>
<td>132</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>C579</td>
<td>Wintmalt 2-row</td>
<td>10.7</td>
<td>45.2</td>
<td>9.4</td>
<td>10.4</td>
<td>11.5</td>
<td>144</td>
<td>0.7</td>
</tr>
<tr>
<td>C580</td>
<td>CDC Meredith 2-row</td>
<td>16.4</td>
<td>48.3</td>
<td>9.8</td>
<td>10.7</td>
<td>11.9</td>
<td>366</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Vomitoxin/DON (ppm)</td>
<td>Grain protein (%)</td>
<td>Pre-harvest sprouting (seconds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------</td>
<td>-------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1 ppm</td>
<td>≥12%</td>
<td>&gt;350 sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 ppm</td>
<td>10-12%</td>
<td>200-350 sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2-10 ppm</td>
<td>&lt;10%</td>
<td>&lt;200 sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Your malting barley

**Vomitoxin/DON (ppm)**
- ≤1 ppm
- 1-2 ppm
- >2-10 ppm

**Grain protein (%)**
- <12%
- >12%

**Pre-harvest sprouting (seconds)**
- >350 sec
- 200-350 sec
- <200 sec
High DON levels: Prevent fusarium infection.
- Use moderately resistant varieties
- Rotate with non-hosts of *Fusarium graminearum*
  - Minimize corn, wheat, rye, barley, oats, forage grasses residue contact, grassy weeds
  - Follow broadleaf crops
- Have adequate fertility & correct pH = heightened potential to resist disease
- Apply triazole (Caramba, Prosaro) fungicide within 3-5 days of flowering (anthesis)
- Rigorous cleaning to remove infected, shrunken kernels
Manage Protein Levels

- Protein is dependent on available N (assuming other nutrients are adequate), diluted by available water
- Adequate N fertility for desired quality
  - Bread wheats need N for glutens
  - Malting barleys need N to support yields, but not for protein boost
- Variety plays a role
- Legumes can help—biologically mediated N release, but need to be given credit in fertility strategy.
- Over fertilizing with N = lodging
  - Lodging resistant varieties help
Troubleshooting 3

- Low falling number, high grain moisture
  - Pre-harvest sprouting resistant varieties
  - Highly targeted harvest timing for each variety’s need
  - Ability to dry (and even better, to be able to add low heat)
Other considerations

- Weed tainted grain (imparts off flavors, moisture, contaminates)
  - Good cleaning practices
- Foliar disease
  - Follow good rotation practices
  - Scout for vigorous diseases
  - Adequate fertility for plant health
- Ergot (especially in Rye)
  - Follow good rotational practices
In the pipeline... stay tuned

- Statewide variety trials, Ulster County, 2014-2018
  - Wheats for artisan baking markets
  - Malting barleys
  - Hybrid ryes (stellar yields, from Germany)
  - Some wheats for malting (‘Medina’)
  - Applied trials with area bakers, malters, brewers, distillers

- Ongoing fusarium management research

- Annual field days, winter workshops

- Production guides (paper and video)
### Preliminary Results

#### 2014 Hudson Valley Spring Malting Barley and Spring Wheat Summary - Cornell

**Spring Malting Barley**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Grain Yield (kg/h)</th>
<th>Test Wt (kg/ha)</th>
<th>Lodging</th>
<th>Heading Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conv Rank</td>
<td>Org Rank</td>
<td>Mean Rank</td>
<td>Conv</td>
</tr>
<tr>
<td>1 Herta</td>
<td>1712</td>
<td>5</td>
<td>2161</td>
<td>5</td>
</tr>
<tr>
<td>2 Conlon</td>
<td>1501</td>
<td>8</td>
<td>2030</td>
<td>7</td>
</tr>
<tr>
<td>3 Genie</td>
<td>243</td>
<td>10</td>
<td>589</td>
<td>9</td>
</tr>
<tr>
<td>4 M152</td>
<td>2959</td>
<td>1</td>
<td>2886</td>
<td>2</td>
</tr>
<tr>
<td>5 Lacey</td>
<td>2871</td>
<td>2</td>
<td>3128</td>
<td>1</td>
</tr>
<tr>
<td>6 Quest</td>
<td>2518</td>
<td>3</td>
<td>2771</td>
<td>3</td>
</tr>
<tr>
<td>7 KWS Thessa</td>
<td>383</td>
<td>9</td>
<td>504</td>
<td>10</td>
</tr>
<tr>
<td>8 Cerveza</td>
<td>1642</td>
<td>6</td>
<td>2048</td>
<td>6</td>
</tr>
<tr>
<td>9 Newdale</td>
<td>1502</td>
<td>7</td>
<td>1639</td>
<td>8</td>
</tr>
<tr>
<td>10 AAC Synergy</td>
<td>1898</td>
<td>4</td>
<td>2245</td>
<td>4</td>
</tr>
<tr>
<td>Mean</td>
<td>1723</td>
<td>2000</td>
<td>1861</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td>11.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Spring Wheat**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Grain Yield (kg/h)</th>
<th>Test Wt (kg/ha)</th>
<th>Lodging</th>
<th>Heading Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conv Rank</td>
<td>Org Rank</td>
<td>Mean Rank</td>
<td>Conv</td>
</tr>
<tr>
<td>1 Stoa</td>
<td>1908</td>
<td>5</td>
<td>2019</td>
<td>8</td>
</tr>
<tr>
<td>2 Red Fife</td>
<td>1905</td>
<td>6</td>
<td>2054</td>
<td>6</td>
</tr>
<tr>
<td>3 RB07</td>
<td>2101</td>
<td>2</td>
<td>2218</td>
<td>3</td>
</tr>
<tr>
<td>4 Tom</td>
<td>1962</td>
<td>3</td>
<td>2040</td>
<td>7</td>
</tr>
<tr>
<td>5 MN08078W</td>
<td>1747</td>
<td>8</td>
<td>2182</td>
<td>4</td>
</tr>
<tr>
<td>6 Rollag</td>
<td>1741</td>
<td>9</td>
<td>1860</td>
<td>9</td>
</tr>
<tr>
<td>7 Sabin</td>
<td>1874</td>
<td>7</td>
<td>2532</td>
<td>2</td>
</tr>
<tr>
<td>8 Glenn</td>
<td>1941</td>
<td>4</td>
<td>2073</td>
<td>5</td>
</tr>
<tr>
<td>9 Lucille (Emmer)</td>
<td>1267</td>
<td>10</td>
<td>1723</td>
<td>10</td>
</tr>
<tr>
<td>10 CDC Zorba (Speit)</td>
<td>3035</td>
<td>1</td>
<td>2789</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>1948</td>
<td>2149</td>
<td>2049</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td>8.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2014 Hybrid Winter Rye Regional Trial – Cornell University**

### Cumulative Summary

<table>
<thead>
<tr>
<th>Entry</th>
<th>Grain Yield</th>
<th>2 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Palazzo</td>
<td>6600</td>
<td>105</td>
</tr>
<tr>
<td>2 KWS Magnifico</td>
<td>6613</td>
<td>105</td>
</tr>
<tr>
<td>3 Brasetto (180 km2)</td>
<td>6556</td>
<td>104</td>
</tr>
<tr>
<td>4 Brasetto (200 km2)</td>
<td>6639</td>
<td>106</td>
</tr>
<tr>
<td>5 Brasetto (250 km2)</td>
<td>6903</td>
<td>110</td>
</tr>
<tr>
<td>6 KWS Bono (H 119)</td>
<td>6508</td>
<td>104</td>
</tr>
<tr>
<td>7 KWS Rhavo (H 120)</td>
<td>6539</td>
<td>104</td>
</tr>
<tr>
<td>8 Medina (wheat ck)</td>
<td>3857</td>
<td>61</td>
</tr>
</tbody>
</table>

M. E. Sorrells, D. Benschere, and J. Shiffer - Department of Plant Breeding & Genetics - Cornell University