



# Welcome to a Tour of Ardent Mill, Port of Albany

- Welcome
- Video Tour of Ardent Mill – Sean Gager, Plant Manager (15 minutes)
- Wheat, Wheat Grading, Wheat Varieties for NYS – Aaron Gabriel, CCE (15 minutes)
- Participants to Answer Questions Using Zoom Polling feature (2 minutes)
- Questions & Discussion – no time limit

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under sub-award number SARE LNE20-396.



# Wheat, Wheat Grading, Wheat Varieties for NYS

Aaron Gabriel

518-380-1496, [adg12@cornell.edu](mailto:adg12@cornell.edu)

Capital Area Agriculture and Horticulture Program

<http://blogs.cornell.edu/capitalareaagandhortprogram/category/field-crops/>

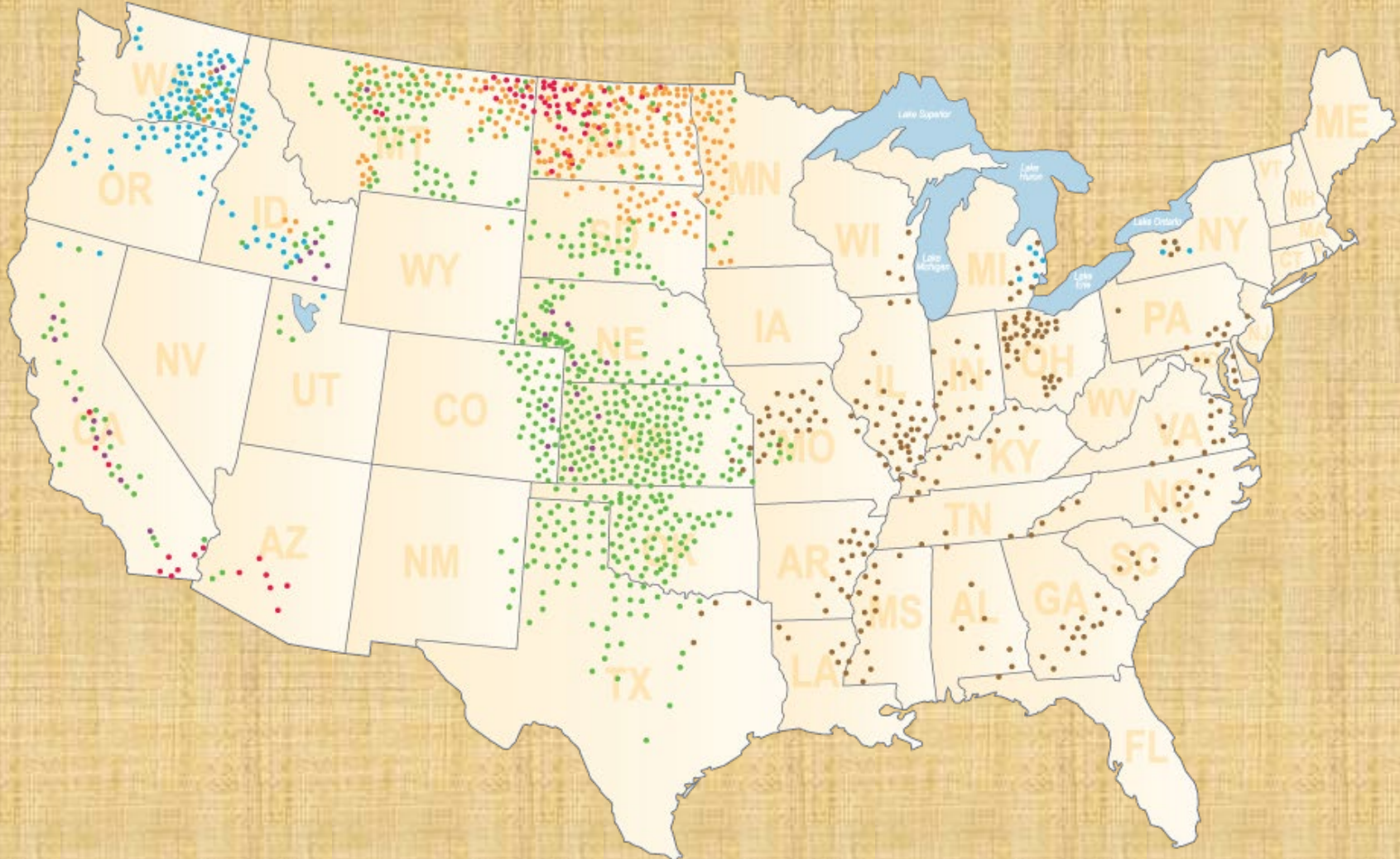
Cornell Cooperative Extension

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under sub-award number SARE LNE20-396.



# Six Classes of Wheat

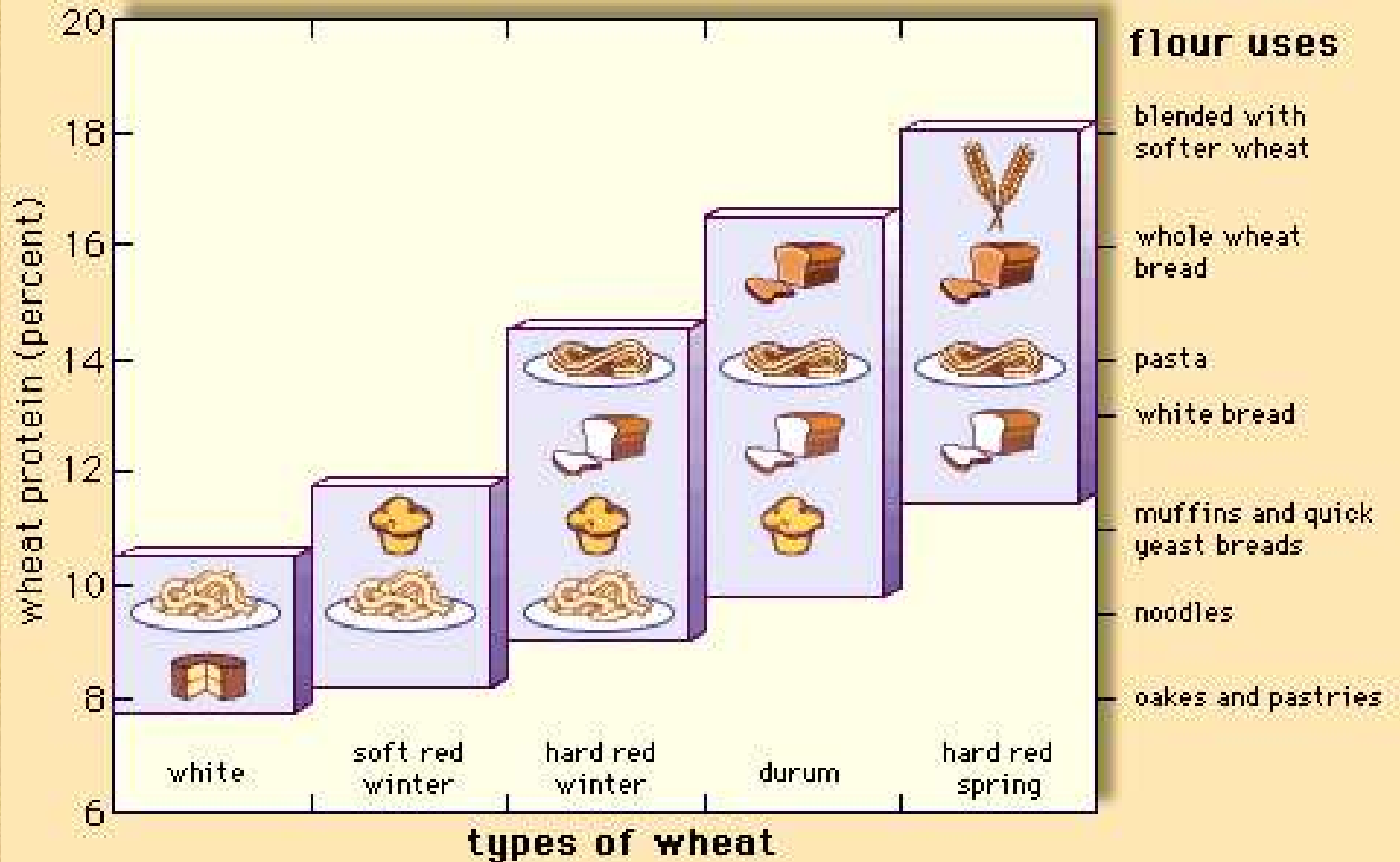
- ❖ Hard / Soft
- ❖ Red / White
- ❖ Winter / Spring



● HARD RED WINTER    ● HARD RED SPRING    ● SOFT RED WINTER    ● SOFT WHITE    ● HARD WHITE    ● DURUM

- Six class of wheat based on hardness, color, and time of planting
- There are several subclasses as well
- In New York, soft white winter wheat has been grown, but markets have diminished. Soft red winter wheats also grow well here and are used for blending with hard wheat to make flour for breads.
- Varieties are adapted to certain climates and regions of the US. SWWW and SRWW varieties have been tested in NY, but not many other classes of wheat. Some hard wheat varieties were trialed at Cornell and other northeast university from 2012-2015 as part of an organic grain project. So if you grow a non-traditional class of wheat for New York (ie, hard red or hard white) you may not know if it is adapted until you try it out.

# How wheat is used based on protein





- Protein content is the main factor that determines which use is best for a particular wheat.
- Gluten is a storage protein found in the endosperm of the seed along with all the starch.
- The rheology testing we saw in the video helps measure the strength and elasticity of the gluten.
- Low protein wheats are for cakes, pastries. Breads require more gluten, with pizza dough requiring the most. Types of noodles vary as does the amount of protein needed for each type

# U.S. Wheat Grades – Federal Grain Inspection Service (FGIS) (established for exports)

Grading factors	Grades U.S. Nos.					
	1	2	3	4	5	
<b>Minimum pound limits of:</b>						
<b>Test weight per bushel</b>						
Hard Red Spring wheat or White Club wheat	58.0	57.0	55.0	53.0	50.0	
All other classes and subclasses	60.0	58.0	56.0	54.0	51.0	
<b>Maximum percent limits of:</b>						
<b>Defects:</b>						
<b>Damaged kernels</b>	<i>ounces</i>					
Heat (part of total)	1.9	0.2	0.2	0.5	1.0	3.0
Total <i>Heat &amp; damaged, diseased</i>	19.2	2.0	4.0	7.0	10.0	15.0
Foreign material	<i>3.8</i>	0.4	0.7	1.3	3.0	5.0
Shrunken and broken kernels	<i>29</i>	3.0	5.0	8.0	12.0	20.0
Total <sup>1</sup> <i>damaged, shrunken, foreign, broken</i>	29	3.0	5.0	8.0	12.0	20.0
Wheat of other classes: <sup>2</sup>						
Contrasting classes	<i>9.6</i>	1.0	2.0	3.0	10.0	10.0
Total <sup>3</sup>	29	3.0	5.0	10.0	10.0	10.0
Stones	<i>1.0</i>	0.1	0.1	0.1	0.1	0.1

- Test weight is a rough indication of wheat quality and health
- Almost 2 lbs of unwanted materials are allowed in Grade 1 wheat – that seems to be a lot. Mills will have their own standards.
- These US standards are for wheat going into a cargo ship. At a mill, that 29 ounces or less of un-wanted material will be cleaned out.
- “Contrasting classes” would be an “opposite” class, red wheat mixed into white wheat, or hard wheat mixed into soft wheat. There is more tolerance for club wheat being mixed into soft white wheat, because it is a similar class (actually a subclass of soft white). Contrasting class specifics are stated in detail in the US Wheat Standards document.



## U.S. Wheat Grades

Wheat Grades  
1                      2                      3                      4                      5

### Maximum count limits of:

	1	2	3	4	5
<b>Other material in one kilogram:</b>					
<b>Animal filth</b>	1	1	1	1	1
<b>Castor beans</b>	1	1	1	1	1
<b>Crotalaria seeds</b>	2	2	2	2	2
<b>Glass</b>	0	0	0	0	0
<b>Stones</b>	3	3	3	3	3
<b>Unknown foreign substances</b>	3	3	3	3	3
<b>Total <sup>4</sup></b>	4	4	4	4	4
<b>Insect-damaged kernels in 100 grams</b>	31	31	31	31	31

U.S. Sample grade is Wheat that:

- (a) Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, or 5; or
- (b) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor) or
- (c) Is heating or of distinctly low quality.

- Adding one load of un-healthy or dangerous grain would be a big problem for a mill and also violate the Food Safety Modernization Act.



## Moisture

- **13% moisture is the target**
- **Farm moisture meters are not always correct and need to be calibrated.**
- **For farmers in my six county area, I can help you calibrate your moisture meter**



# Wheat Grading Process

**Sample Taken**



**Evaluate for Sample Grade**  
least tolerance for dangerous  
materials – manure, glass



**Evaluate for Special Grade**  
little tolerance for stuff that  
hurts quality – garlic bulbs,  
live insects, smut, smell



**Remove Dockage**  
Easily removed materials  
large than, smaller than, and  
lighter than the grain



**Test Weight measured**  
lbs/bushel (37.2 quarts)  
*>1 1/8<sup>th</sup> qt test sample  
removed*



**Shrunken & Broken Kernels**  
sieved out and measured



**Foreign Material**  
manually removed & weighed



**Total Defects Combined**  
sum of broken/shrunken &  
foreign material



**Grade assigned**

- Grading procedures set by the USDA Federal Grain Inspection Service (FGIS). They must be used for international trade and are generally accepted for all grain commerce.

## Sample Grades – materials that are toxic and dangerous



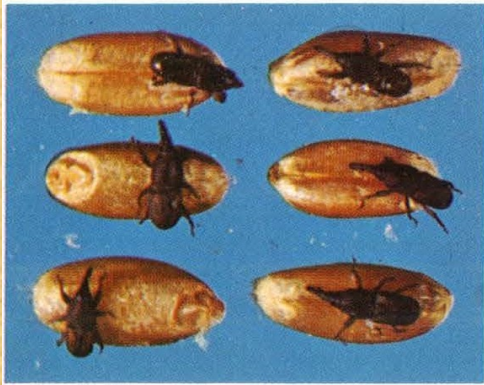
***Farmers are the first line of defense to keep food safe & healthy***



Grain is first evaluated for things that would make it unfit for consumption.

**Farmers are the first line of defense to keep food healthy and safe.**

**Special Grades – materials that affect quality**  
(1000 grams = 2.2 lbs)



**WEEVILY (Infested)**  
1 in 1000 g sample



**SMUTTY**  
“light” has smell and  
14-30 smut balls (kernels)  
“smutty” is >30 smut balls  
In 250 g sample



**ERGOTY** - more  
than 0.05% ergot.  
(0.48 oz/60 lbs)



**GARLICKY**  
2 – 6 dry bulbs is “light”  
>6 is “garlicky”  
in 1000 g

Special Grades focus on materials that affect the quality of the grain. Mills may have their own standards, especially when it comes to live insects. If you have a sample of grain in a Ziploc bag, you can kill any weevils in it by placing it in a freezer for 24 hours. It will probably kill other insects as well – the sample that I tried it with just had adult weevils. Freezing the sample did not affect the moisture reading of the grain. Keep it in the closed bag until it goes back to room temperature to avoid condensation on the grain.





## Broken & Shrunken Kernels

Sieved out with a 0.064" X 3/8" oblong sieve



Broken and Shrunken kernels reduce flour quality; will absorb water at different rate than whole kernels during tempering. Before milling grain is tempered before milling, brought up to 16% moisture by adding water to it. Broken kernels are also food for insects and mold in storage.

Millers try to extract as much flour from each seed as possible. Broken and shriveled seeds are bad for efficiency.



## Foreign Material

Materials other than wheat: other grain & weed seeds, chaff, dead insects, Un-threshed kernels, etc.





Not very appetizing. It is more work for the miller to clean the grain. Foreign material will reduce flour quality. Proper combine settings is important to reduce foreign material.

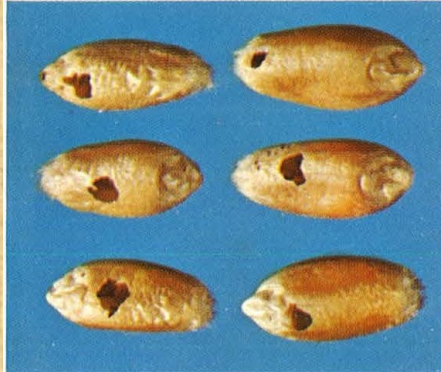
# Damaged kernels – partially manageable by the farmer



**SICK WHEAT**  
(germ is dead, brown, black, missing)



**HEAT DAMAGED**



**WEEVIL OR INSECT BORED**



**BLACK-TIP FUNGUS**



**BLIGHT AND SCAB**



**GREEN (Immature)**



**FROSTED**



Flavor, smell, and dough properties are affected by damaged grains, as well as flour yield.

An excellent article that explains how damaged kernels affect milling and baking qualities, “The Implications of Frequently Encountered Grading Factors on the Processing Quality of Common Wheat” -

<https://pdfs.semanticscholar.org/001f/662e1b2099733dc54ef438b77697e17d7e42.pdf>

- Sick Wheat – dead/damaged germ, fat has high acidity
- Heat Damaged – Gluten properties are damaged
- Insect Damage – loss of endosperm, environment created for molds, off flavors
- Black-tip Fungus – germ discoloration, mostly cosmetic, insignificant affect on quality
- Blight & Scab – mycotoxin levels, destroys starch & protein structure & baking quality, dull color in flour, low flour yield
- Green Kernels – low yield/poor milling, high ash, poor color
- Frosted Kernels – low flour yield, high ash, dark color, hard kernels decrease milling quality, poor gluten quality.





## Sprout Damaged Wheat

Mature seeds sprout on the plant before harvest during periods of damp weather. This hurts the falling number score of the flour and greatly reduces quality.



- Mature grain can sprout while on the plant when there is rain or morning dews to induce sprouting.
- Sometimes there are no visible signs of pre-harvest sprouting by looking at the kernel.
- Pre-harvest sprouting seriously reduces flour quality.
- Sprouting increases the amount and activity enzymes in the seed. Enzymes catalyze chemical reactions and it only takes a tiny amount to change the quality of flour.
- Unlike wheat of different protein content, which you can blend by volume to get what you want. It is not practical to dilute or blend out pre-sprouted grain. It takes just a tiny amount of active enzyme to ruin flour qualities.

## Wheat Varieties for NYS

### *2019 Red Winter Wheat Summaries - Cornell University*

Entry	Grain Yield (kg/h)						Test		Lodg. 0-9	Head Date	Preharvest		Winter		FHB				
	Regional Locations					Mean	Rank	Weight kg/hl			Rank	Sprouting 0-9	Rank	Surv. %	Height cm	Incid. %	Sev. %	Index	Rank
	Ith-Sny	Ith-Ket	SenCo	Ith-McG	Mean														
1 Otsego	4602	4539	5321	4062	4631	25	70.2	18	N	6/7	1.0	7	78	99	NA	NA	NA	NA	
2 Erie (OH02-12686)	6077	5194	5151	3067	4872	15	69.9	21	O	6/9	3.6	34	77	86	45	16	7.1	25	
3 Pioneer 25R40	6353	5469	5712	5106	5660	1	71.9	2	N	6/5	1.6	16	80	69	43	12	5.2	15	
4 IL04-8445-440	5754	4163	5110	2602	4407	30	70.3	17	E	6/5	0.5	2	66	76	26	20	5.2	16	
5 Pioneer 25R25	5388	4534	5361	3452	4684	20	69.3	27		6/7	1.7	19	64	74	39	14	5.4	18	
6 NY11013-10-72-1314	6075	4606	5452	3498	4908	14	70.5	14		6/9	1.0	9	71	94	39	26	9.9	32	
7 NY11013-10-15-1318	5998	5198	5388	3381	5317	5	70.8	9		6/7	1.5	15	78	81	31	15	1.8	12	

- <https://blogs.cornell.edu/varietytrials/small-grains-wheat-oats-barley-triticale/small-grains-cultivar-trial-results/>
  - Soft Red Winter Wheat are typically grown in NY
  - 2012 – 2015 Organic Wheat trials (includes hard winter wheats)
- To find seed companies (I am hesitant to make a list for NY)
  - Go to university variety trials and look for the list of companies participating
  - Do an internet search
- Cannot find a directory of US wheat varieties. Canada has a list of varieties by class, , <https://www.grainscanada.gc.ca/en/grain-quality/variety-lists/>
- For varieties not trialed by Cornell, the best bet is to do an internet search by wheat variety name to find information. Start small scale with any un-proven variety (an acre or less).



- There are many varieties of wheat which have been tested for our NY environment – soft white winter (lowest protein) and soft red winter wheat (medium protein used for blending with other high protein wheat for different types of bread flours).
- The best approach is to use varieties tested in and adapted to New York.
- Not every single wheat variety suitable for NY is in the Cornell trials – just not possible.
- Try new varieties on a small scale. Some niche markets may want different classes of wheat. One local pasta company, as I am told, gets durum wheat from Maine, the least likely place to grow durum wheat. It is possible, but you have to be careful.



## ***Questions about grain grading & varieties?***

**NEXT – six questions to answer using the “polling” feature of Zoom**

**THEN – Questions and Answers for Sean and general discussion**

**(no time limit)**

Aaron Gabriel

518-380-1496, [adg12@cornell.edu](mailto:adg12@cornell.edu)

Capital Area Agriculture and Horticulture Program

<http://blogs.cornell.edu/capitalareaagandhortprogram/category/field-crops/>

Cornell Cooperative Extension