NEW YORK STATE

BREWERY

SUPPLY CHAIN ANALYSIS

v2: December 2017

Cornell Cooperative Extension
Harvest New York

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BACKGROUND

The New York State (NYS) craft beer industry has experienced significant growth in the past few years due, in part, to the passage of the Farm Brewery Law, which grants breweries that choose to operate under this license certain benefits but also requires the purchase of an increasing percentage of NYS grown ingredients between 2013 and 2024. In response to this emerging market opportunity, New York State Empire State Development, New York State Department of Agriculture and Markets, Cornell College of Agriculture and Life Sciences (Cornell CALS), Cornell Cooperative Extension (CCE), Hartwick Center for Craft Food and Beverage, and the NYS Brewers Association have been busy working with growers, malt house operators and breweries on a number of different research, technical assistance and programmatic efforts to ensure the continued growth and viability of this nascent, yet potentially significant economic driver for NYS.

To support this industry, Cornell Cooperative Extension Harvest NY administrated round one of market surveys in 2015 (referred to in this report as V1). Understanding the importance of tracking progress, Harvest NY administered a second round of surveys in 2017 (referred to as V2 in this report). The information contained in this report is largely with regard to the V2 survey, but when applicable and relevant, comparisons are made between V2 and V1 responses.

EXECUTIVE SUMMARY

To serve as an update to the 2016 Brewery Supply Chain Analysis, Cornell Cooperative Extension Harvest NY administered a second round of surveys to growers, malt house operators and breweries in the spring of 2017. The effort admittedly realized a lower response rate from growers, malt house operators, and brewers, when compared to the V1 analysis, yet still presents important information.

In 2016, based on the estimated gallons produced by farm breweries and the estimated acres of malting barley that met grade, there was enough malt in the state to meet the 20% purchase requirement of farm breweries in 2016, and arguably close to, if not enough, to meet the 60% purchase requirement. However, price still remains a challenge for brewers. Given two years of survey data, brewers are, on average, paying $0.40 per lb more for NYS malt. Second to quality concerns with NYS malt, price ranks the second biggest concern they have with regard to using NYS malt; a concern that could likely become more pressing as the required use of NYS malt increases to 60% and 90%.

Malting barley production and malting barley that met grade has increased year after year, from 2013-2016; however, there is still a considerable amount of malting barley that is reported to have met grade, but is still going unsold. This likely contributes to the number one concern echoed by malting barley growers of *uncertainly about market demand*, followed closely by their top two concern of their *uncertainly to grow a crop that meets quality standards of malsters and brewers*. Closely related is their top storage challenge, which is the *need to hold malting barley for longer periods due to lack of demand*.

Five new malt houses have opened their doors since the first round of surveys were administered in the winter of 2015, bringing the total number of NYS malt houses to 13. Not only has the capacity to malt barley significantly increased in NYS, but malsters have reported an increase in the malting of other grains, such as wheat and rye, and also noted an increase in the production of specialty malts, such as high-kilned, caramel/crystal and roasted malts.

Brewers are projecting a sizable increase in their barrel production moving forward. Namely, a 52% increase in barrels produced between 2018 to 2024, with the greatest increase being reported by farm breweries. Despite brewers concerns with sourcing and using NYS malt, all license types are projecting an increase in demand for NYS malt. Specifically, micro-brewers, farm-brewers and brew pubs are reporting an increase in NYS malt demand between 2018 to 2020 of 96%, 34% and 32%, respectively, with even greater demand being projected between 2020 and 2024, as nascent operators scale up and the purchase requirement for farm brewers increases.

Despite the challenges experienced by members of the NYS craft beer supply chain, there has been a significant amount of progress since 2013, when the farm brewery license was passed. Malting barley production continues to increase and quality is improving; malting volume and variation have increased significantly, and brewers are still

EXECUTIVE SUMMARY continued

dedicated to supporting NYS growers and malt house operators. The continued research and applied programming being conducted by Cornell CALS, Cooperative Extension, and Hartwick College will only increase the likelihood of success for the three key stakeholder groups in this emerging industry.

METHODOLOGY

In the spring of 2017, Harvest NY surveyed malting barley growers, malt houses and breweries. In addition, to obtain more responses regarding the number of acres of malting barley grown in 2016 and the number of those acres that met grade, project collaborators made direct calls to known malting barley growers, which was 52 at the time. The information contained within this report was analyzed using the 2016 survey responses, and the information obtained from the direct calls. Where relevant, data from the V1 analysis is also presented.

Of the known 52 malting barley farmers, 28 responded to the survey, which is a **54%** response rate. The information depicted in Table 2 was developed through direct calls to farmers, which yielded an 83% response rate. There are currently 13 malt houses in the state, 5 of which responded, resulting in a **38%** response rate. The survey was sent to 288 breweries, 83 of which responded, yielding a **29%** response rate.

LIMITATIONS

The survey suffered a fairly low response rate from all three supply chain stakeholder groups. Growers and malt house responses were considerably lower in this round of surveys, as opposed to round one. However, less survey fatigue was realized by brewers in round two, as more brewers answered the majority of the questions in this round, as opposed to round one of surveys.

Because of the varying size of operators in the supply chain, and the considerable growth rate this industry has experienced over the last several years, it's difficult to make any assumptions regarding growth patterns about the industry, based solely on those that responded to the survey.

Also serving as a limitation is the assumption that survey respondents did not always answer certain questions in the right unit of measurement, resulting in a potentially inaccurate representation of data for some questions, namely in the brewers' section.

If round three of surveys is to be administered, it would be prudent to re-think the dissemination and execution to supply chain stakeholders. Because growers were more responsive when directly called, that may be one possible solution to obtain a higher response rate from this group. With only 13 malt houses, direct outreach also may yield a higher response rate. With regard to brewers, some other type of survey dissemination, aside from email outreach, needs to be considered, as indicated by two rounds of surveys yielding a low response rate. One suggestion moving forward with all three surveys is to scale them down to a few critically important questions, as opposed to lengthy, detail-oriented surveys.

GENERAL ANALYSIS ASSUMPTIONS

- All data is self-reported, either via the paper survey, or from direct outreach [to growers] by project collaborators.
- 48lbs/bushel was used when respondents reported in the wrong unit and answers needed to be converted from bu to lbs or vice versa.
- The survey was administered in the Spring of 2017.
- Total breweries by license type is reported as was in November 2017. However, all other data is based on the number of breweries as of May 2016.
- V1 refers to the 2016 Harvest NY Brewery Supply Chain Analysis, whereas V2 refers to the current round of survey analysis, administered in the Spring of 2017. Unless otherwise noted, all data, charts and text refers to V2 survey data and subsequent analysis.

SUMMARY OF FINDINGS

The following findings and recommendations are based on the survey responses received, and potentially do not translate to findings representative of the entire industry, as the data in this analysis is not based on all growers, malt houses and breweries in NYS.

- Additional malting barley that meets grade will be needed to support the growing demand of NYS breweries, both farm brewers that are required to use NYS grown ingredients, and those other license holders that also want NYS grown.
- Continued development of profitable secondary and tertiary markets for malting barley are needed to minimize the impact on growers if their crop does not meet grade or if it meets grade but is not sold to malt houses and/or brewers.
- Malting barley that meets grade has increased year over year, from 2013-2016. This, coupled with survey respondents' qualitative responses, indicates that farmers and maltsters are getting better at growing and malting this relatively new crop. Continued support from Cornell CALS, Cornell Cooperative Extension, Hartwick College Center for Craft Food and Beverage, and other support agencies is critical to continue this trend and ensure an adequate supply of high quality malting barley and malt for breweries.
- NYS malt continues to cost about $0.40 per lb more than non-NYS malt and price is the number two concern brewers have with sourcing NYS malt. When the required use of NYS ingredients increases to 60%, this cost discrepancy may be amplified.
- There is an unmet demand amongst brewers for specialty malts, such as high-kilned malts, caramel/crystal malts, and roasted malt than that which is currently being produced by NYS malt houses.[1] Based on unmet demand, and qualitative responses from brewers, this could serve as a challenge if not addressed when the requirement for NYS grown increases to 60%, as brewers may not be able to source the malt in the quantity needed to brew the beer type they desire.
- Fifteen farmers reported not growing malting barley in 2016. This could be for a number of reasons; however, outreach should be conducted to determine if this trend is reflective of farmers' inability to grow the crop profitably, as data supports the need for increased production of malting barley in NYS to meet brewers' demand.
- An online exchange was offered as a possible solution to help facilitate the identification and purchase of NYS malting barley and malt amongst supply chain stakeholders. 84% of growers, 100% of malt houses and 87% of brewers felt this would be one solution to support the success of this industry.
    - NOTE: Cornell Cooperative Extension Harvest NY received a USDA Local Food Promotion Program planning grant to explore the idea of developing an online classifieds system that supports the entire craft beverage industry (beer, wine, cider, spirits). Results and next steps derived from that grant will be offered in late spring 2018.

[1] Specifically, unmet demand for high-kilned (Vienna, Munich), caramel/crystal, roasted malts are, respectively: 20,730lbs, 55,305lbs, 21,905lbs

SUPPLY CHAIN SNAPSHOT

This section presents data pertinent to the entire supply chain and summarizes information relative to:

- Prices received and paid by supply chain stakeholders
- Malting barley acreage needed to meet Farm Brewery License requirements

PRICES OF MALTING BARLEY & MALT THROUGHOUT THE SUPPLY CHAIN

Growers, malt house operators and brewers were asked the prices they receive and pay to and from various market channels for malting barley and malt. Where N/A is listed in the standard deviation column, that indicates only one response was received, resulting in an inability to calculate the standard deviation. Important to note are the low standard deviations across all market channels, which indicates minimal variation in the prices paid and received.

Table 1. Prices of Malting Barley and Malt by Supply Chain Stakeholder

	Mean	Standard Deviation	Minimum	Maximum
Farmer: price per lb received through each market channel*				
NYS Malt House	$ 0.22	0.04	$ 0.18	$ 0.29
Out of State Malt House	$ 0.19	N/A	$ 0.19	$ 0.19
Animal Feed: Conventional	$ 0.07	0.00	$ 0.07	$ 0.07
Animal Feed-Organic	$ 0.22	0.04	$ 0.19	$ 0.25
Malt-House: price per lb received by each market channel				
NYS Brewery	$ 0.93	0.06	$ 0.85	$ 1.00
Out-of-State Brewery	$ 0.90	0.07	$ 0.85	$ 0.95
Home Brewers	$ 1.10	0.21	$ 0.95	$ 1.25
Distillers	$ 0.93	0.08	$ 0.85	$ 1.00
Animal Feed	$ 0.10	N/A	$ 0.10	$ 0.10
Brewer: price per lb paid to malt house				
NYS Grown (base malt)	$ 0.96	0.16	$ 0.50	$ 1.50
Out-of-State (base malt)	$ 0.58	0.17	$ 0.30	$ 1.25

*NOTE: Growers were asked price per bushel, which was then converted to lbs using 48 lbs/bu.

POINTS OF DISCUSSION

→ Noted that when compared to price per lb received by growers as reported in the V1 analysis, all market channel prices have decreased in the V2 analysis, with the exception of the price received for animal feed. However, in the V2 analysis, organic and conventional were parsed out separately, where they were combined in the V1 analysis. Noted in the V1 analysis is that organic feed contributed to the higher price received by growers from the animal feed market.

→ When looking at the price received by malt houses, all prices per lb also decrease, with the exception of distillery, which remains the same at $0.93/lb. The home-brew market still remains the highest price per lb market channel for malt house operators.

→ In terms of brewers, the price of NYS malt is still considerably higher than that of non-NYS malt. The average price paid for NYS malt also decreased from $1.11 to $0.96 per lb between the V1 and V2 surveys; however the price of non-NYS malt also decreased by a similar amount. At both the time of the V1 and V2 surveys, brewers were paying on average, $0.40/lb more for NYS malt.

SUPPLY CHAIN SNAPSHOT

MALTING BARLEY ACREAGE NEEDED TO MEET FARM BREWERY LICENSE REQUIREMENTS

Table 2 estimates the number of malting barley acres needed to satisfy the needs of farm brewers at various purchase requirements for years 2015 and 2016. Production gallons for all farm breweries were provided by the NYS Department of Taxation and Finance, and were estimated given a certain set of assumptions.[1] Based on these assumptions, in order to meet the current purchase threshold of 20%, as mandated by the Farm Brewery Law, 492 acres of malting barley were required in 2016. Based on the 28 growers that reported total acreage of malting barley that met grade in 2016 of 1,019 acres, there was enough malting barley, in theory, to meet the 20% requirement.

Table 2. Malting Barley Acreage Needed to Satisfy Farm Brewery License Requirements

Year: percent malt needed	Production Gallons	In Barrels	Lbs in Malt	Malt lbs at % NYS Grown Required	In Grain	Grain (bu)	Acres Needed
2015: 20%	1,148,239	37,040	2,518,718	503,744	629,679	13,118	**262**
2016: 20%	2,151,784	69,412	4,720,042	944,008	1,180,011	24,584	**492**
2016: 60%	2,151,784	69,412	4,720,042	2,832,025	3,540,032	73,751	**1,475**
2016: 90%	2,151,784	69,412	4,720,042	4,248,038	5,310,048	110,626	**2,213**

Assumptions: 1 bbl = 31 gal // 68 lbs malt/bbl beer // 0.8 lb malt = 1 lb barley // 48 lbs/bu // 50 bu/acre

[1] Note: The following is only one of several assumptions made to generate the estimated production gallons. Statistics only include taxpayer matching with State Liquor Authority (SLA) license information. A 'tax year' refers to returns filed for the January-December liability period.

POINTS OF DISCUSSION

→ In addition to having enough malting barley to meet the 20% purchase requirement for farm breweries, total additional acres needed to meet the 60% purchase requirement in 2016 were 456. Recognizing that not all malting barley growers are represented in this estimate of 1,019 acres that met grade in 2016, it would stand to reason there was almost enough, if not more than enough, to meet the 60% threshold in 2016. Given the growth of the industry, and the impending increase from 20% to 60% to 90% hops and other ingredients, it would be prudent to continue to track malting barley acreage that met grade and compare it against the acreage required to meet farm breweries needs.

→ Where there appears to be enough malting barley to meet the 20% mark for farm breweries in 2016, the entire farm brewery industry is very nascent. According to self-reported growth estimates, 40 farm brewers projected an average increase in barrel production between 2018 to 2024 of 104%. As these farm breweries increase their barrel production, in conjunction with the increases associated with the Farm Brewery Law, malting barley production is going to have to increase at a similar rate to meet the growing demand.

It is important to continue to track malting barley production that meets grade to determine if available acreage can meet the increasing farm brewery's needs.

MALTING BARLEY PRODUCTION

This section highlights the following aspects of malting barley production:

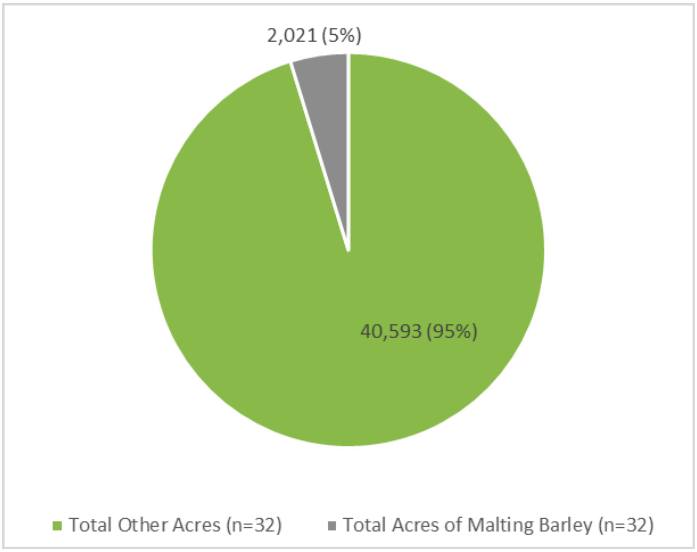
- Total acres of malting barley, actual and potential
- Percentage of malting barley that met grade for years 2013-2016
- Malting barley acreage by variety
- Distribution of malting barley across market channels
- Barriers to market growth
- Grain quality challenges
- Storage capacity and challenges

TOTAL ACREAGE OF MALTING BARLEY

Thirty-two farmers responded to this question, with a combined acreage of 42,614, 5% (2,021 acres), of which was dedicated to malting barley at the time of survey administration. As indicated by the percentage, collectively malting barley accounts for a very small fraction of their total crop portfolio. Growers were asked to report total potential acres of malting barley, given a favorable market. Twenty-seven growers responded with total potential acreage of 2,645.

It is important to note that the total potential acreage of malting barley includes fewer growers (27 vs 32) than those growers that reported total acres farmed and total acres of malting barley. Also, potential acreage of malting barley represents the maximum amount growers indicated they could grow, as some provided a range, so the estimate errs on the liberal end of the spectrum.

Figure 1. Total Acres



MALTING BARLEY

• production **increased 131%**

• potential acres **increased 39%**

POINTS OF DISCUSSION

→ There is a relatively small difference in total acres of current malting barley vs potential acres of malting barley, namely 624 acres. Assuming this estimate of potential acreage is an accurate depiction of current malting barley growers' capacity to increase acreage, one could argue that efforts should be made to encourage new growers to plant malting barley to meet the increasing demand from NYS breweries, 188 of which have a legal mandate to purchase NYS ingredients at an increasing rate between now and 2024.

→ In the V1 analysis, 28 farmers reported total malting barley acres of 874.5, with a potential to increase to 1,905 given favorable market opportunities. Based on the data from both V1 and V2 surveys, neither of which accounts for the malting barley grown by non-survey respondents, reported malting barley production increased by 131% and potential acres of malting barley increased by 39%.

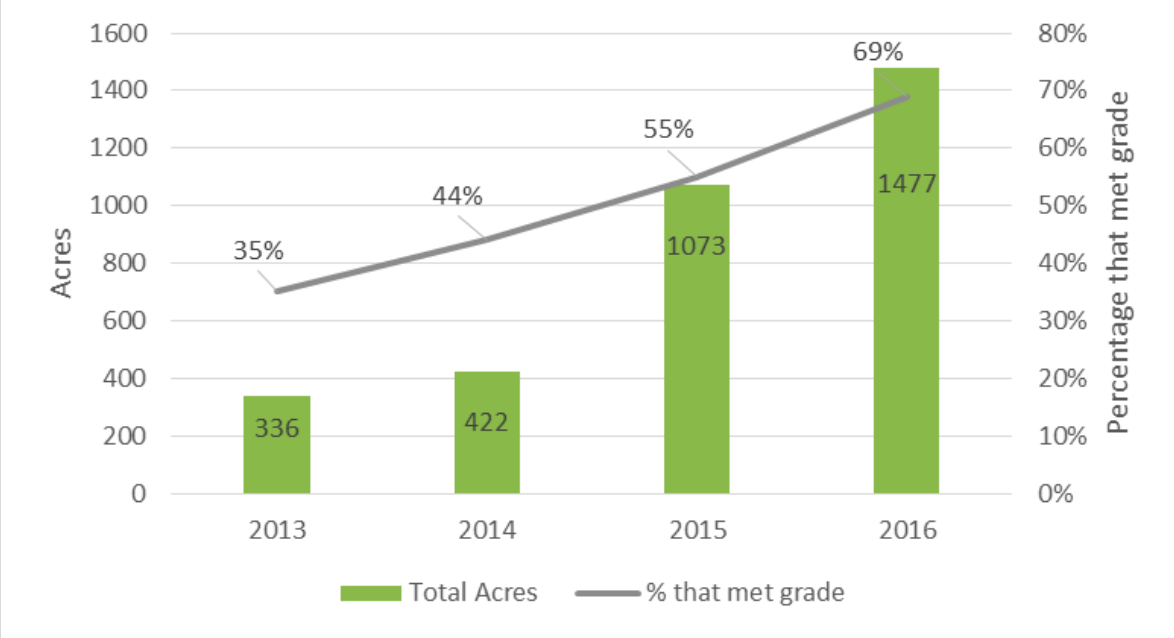
MALTING BARLEY PRODUCTION

MALTING BARLEY ACREAGE AND PERCENT THAT MET GRADE

Figure 2 depicts malting barley acreage from 2013-2016. The 2013 and 2014 figures were extracted from the V1 analysis. 2015 data is reported as was on the V2 survey and includes results from 22 growers. 2016 V2 survey data suffered a low response rate from growers, so project contributors called known malting barley farmers and asked them for total acreage in 2016 and the percent that met grade. Project contributors connected with 43 malting barley growers; 15 reported not growing in 2016 and 28 reported the total acreage of 1,477, as depicted in the chart below.

Based on available data, both total acres of malting barley and total malting barley that met grade has steadily increased year over year, with the most significant increase realized in total acres from 2014-2015.

Figure 2. Malting Barley Acreage



POINT OF DISCUSSION

→ Of the 69% of malting barley in 2016 that met grade, farmers reported that 23% (or 233 acres) of it went unsold, which suggests the need for continued alternative market development, a finding also recommended in the V1 analysis, and/or better communication throughout the supply chain to mitigate potential malting barley that meets grade not making it to market. Also important to note is that malting barley that met grade, but still was unsold at the time of grower outreach could have been sold at a later date, as growers are storing barley onsite. With that point in mind, both qualitative and anecdotal data suggests that growers are storing malting barley for longer periods than they would like, reaffirming the need for improved secondary market development and communication throughout the supply chain.

MALTING BARLEY PRODUCTION

MALTING BARLEY ACREAGE BY VARIETY

Table 3 breaks down malting barley by variety, percent that met grade and acres that met grade. Where N/A is listed under the range, it indicates there was only one response for that variety, making it impossible to include a range. Also important to note is the difference in 2016 acreage reported in **Figure 2** and Table 3, in the amount of 631 acres. As previously mentioned, due to a low survey response rate from growers regarding 2016 acreage, direct calls were made, which resulted in the higher acreage reported in Figure 2. Table 3 depicts the 2016 acreage as reported through the survey instrument.

Important to note is the variety "tinical", which was written in by one grower. The variety is not recognized by any Cornell/CCE Production Specialists, so it's assumed the variety was written in incorrectly. However, it is reported in Table 3 as it was on the survey.

Survey results indicate an increase in the percentage of malting barley that made grade from 2015 to 2016 for the following varieties: Endeavor, SY Teepee, AAC Synergy, Quest, Conlon, Newdale, and Genie. Conversely, the percentage of malting barley that met grade from 2015 to 2016 decreased for Wintmalt.

Table 3. Malting Barley Acreage by Variety

VARIETIES THAT INCREASED % MAKING GRADE, 2015-2016

ENDEAVOR
SY TEEPEE
AAC SYNERGY
QUEST
CONLON
NEWDALE
GENIE

VARIETIES THAT DECREASED % MAKING GRADE, 2015-2016

WINTMALT

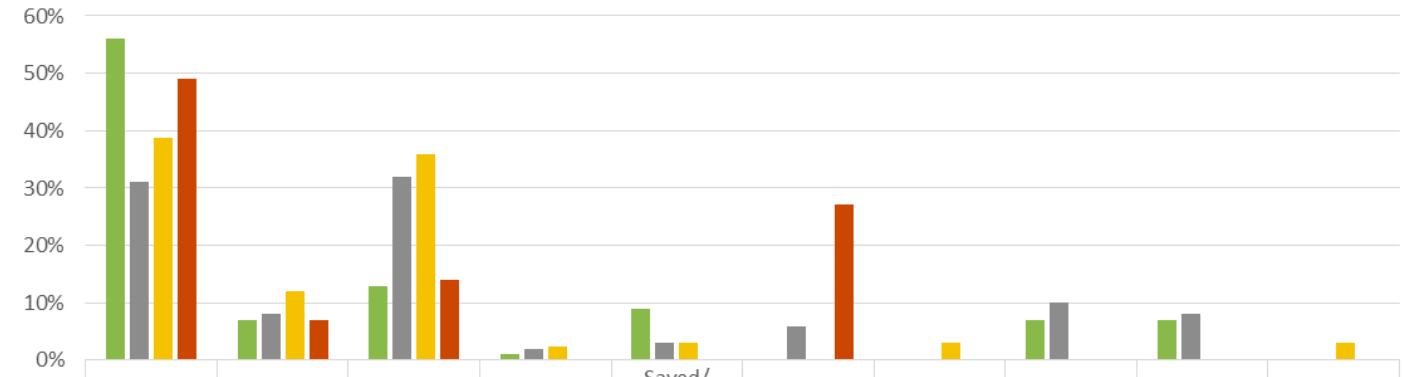
Variety	2015: total acres	2015: weighted % that met grade	2015: acres that met grade	2015: avg bu/ac & range	2016: total acres	2016: weighted % that met grade	2016: avg bu/ac & range
Endeavor (winter, 2-row)	90	90%	81	100 N/A	90	100%	90 N/A
Wintmalt (winter, 2-row)	351	88%	309	60 40-90	333	47%*	87 70-102
Alba (winter, 6-row)	15	10%	2	30 N/A	----	----	----
SY Tepee (winter, 2-row)	30	0%	0	80 N/A	45	100%	80 N/A
AAC Synergy (spring, 2-row)	140	15%	21	56 52-60	190	88%	54 40-70
Quest (spring, 6-row)	105	68%	71	61 48-70	20	100%	66 N/A
Conlon (spring, 2-row)	193	55%	106	40 35-66	119	84%	38 0-72
Newdale (spring, 2-row)	86	0%	0	19 0-50	34	26%	30 0-60
AC Metcalfe (spring, 2-row)	4	0%	0	0 N/A	----	----	----
CDC Copeland (spring, 2-row)	4	0%	0	0 N/A	----	----	----
Genie (spring, 2-row)	5	50%	3	40 N/A	15	83%	40 35-45
Tinical	50	0%	0	25 N/A	----	----	----
TOTAL ACRES	**1073**		**592**		**846**		

*One grower, who reported 150 acres did not indicate how many acres met grade, so that lowered the weighted average sum of total acres that met grade. When removing that outlier, the percent that met grade for Wintmalt increased from 47% to 86%, indicating only a minimal decrease in the percent that met grade between years 2015 to 2016 of 2%.

MALTING BARLEY PRODUCTION

MALTING BARLEY DISTRIBUTION BY MARKET CHANNEL

Figure 3. Distribution of Malting Barley Across Markets



	NYS Malt House	Out-of-State Malt House	Animal Feed*	Distillery	Saved/ Replanted Seed	Met Grade, but Unsold	Never Grew	Had No Market	Not Harvested	Intermediary Grain Buyer
2013	56%	7%	13%	1%	9%	0%		7%	7%	
2014	31%	8%	32%	2%	3%	6%		10%	8%	
2015	39%	12%	36%	2%	3%	0.16%	3%			3%
2016	49%	7%	14%	0%	0%	27%	0%			0%

* For 2015 and 2016 data, so as to match up with 2013 and 2014 data, both organic and non-organic animal feed was combined and reported in the aggregate. However, they were 28%:6% non-organic, and 8%:8% organic, for years 2015 and 2016 respectively.

NOTE: Empty cells indicate the response was not offered as a market channel choice on a particular survey.

POINT OF DISCUSSION

→ Of importance is the high percentage of malting barley (27%) in 2016 that was reported to meet grade, but went unsold. Recognizing that the barley may have been sold at a future date, this general trend has been highlighted elsewhere in this report and further suggests the need to find strong alternative markets for malting barley and/or facilitate better communication within the supply chain.

The College of Agriculture and Life Sciences at Cornell University is leading a multi-year Malting Barley Research and Extension Initiative, through the support of the New York State Department of Agriculture and Markets and the Genesee Valley Regional Market Authority. Gary Bergstrom, Professor and Chair of the Plant Pathology and Plant-Microbe Biology Section, is co-leading the initiative, alongside Mark Sorrells, Professor of Plant Breeding and Genetics. Bergstrom's work is centered on disease and toxin management, while Sorrells has been focusing on the performance of current malting barley varieties, with the next step being breeding of future varieties suitable to NYS.

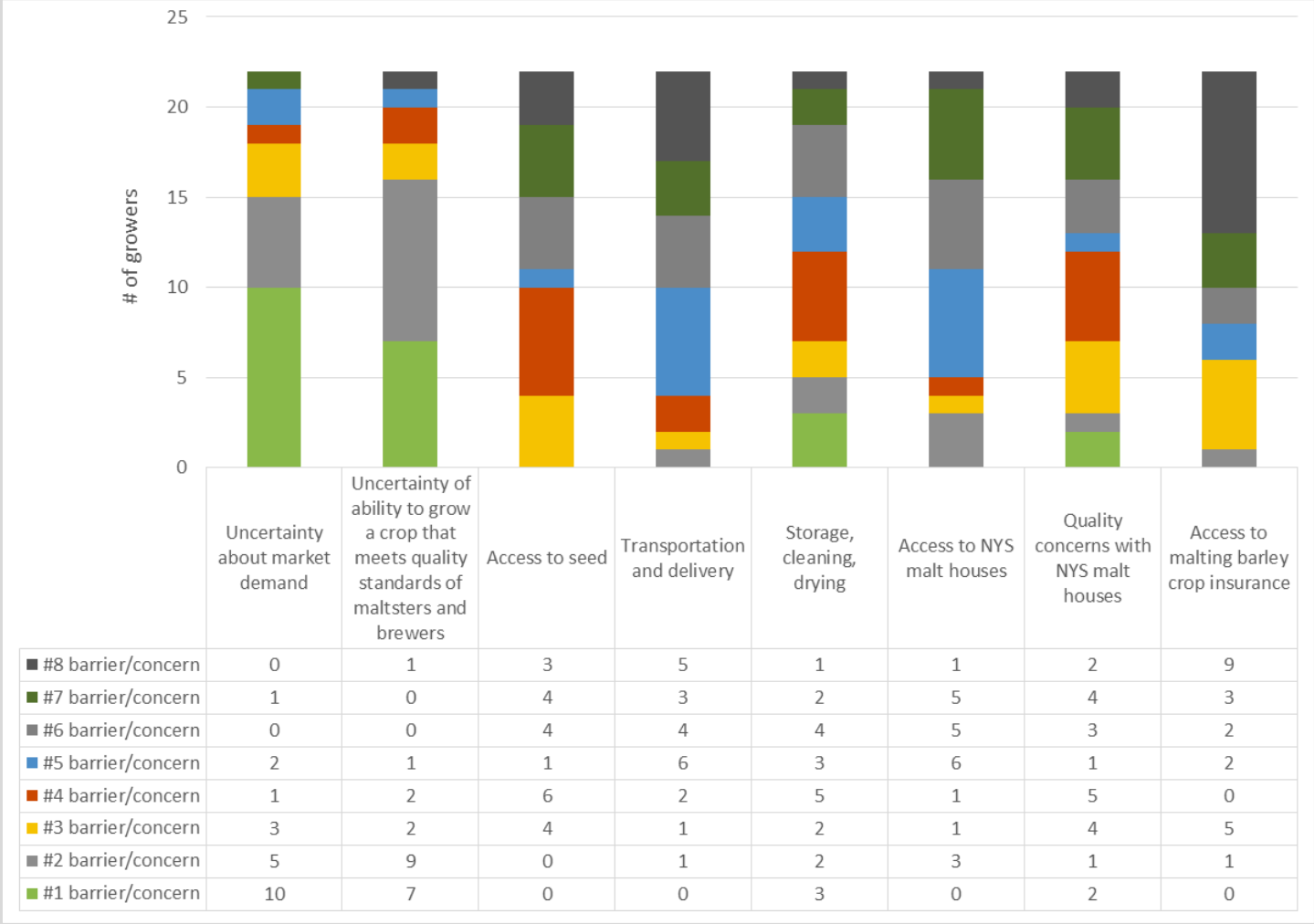
In addition, Cornell Cooperative Extension has five Specialists supporting malting barley growers: Mike Stanyard, Kevin Ganoe, John Hanchar, Aaron Gabriel, and Christian Malsatzki.

MALTING BARLEY PRODUCTION

MARKET GROWTH BARRIERS & CONCERNS

Survey respondents were asked to rank their biggest concerns/barriers to market growth. Twenty-two growers responded in total. 45% of respondents indicated that *uncertainty about market demand* is their top barrier at this time and 23% indicated it as their second biggest barrier. Thirty-two percent of respondents stated that *uncertainty of your ability to grow a crop that meets quality standards of maltsters and brewers* as their number one barrier and 41% stated it as their number two barrier. Important to note is that both these barriers were the top two indicated in the V1 analysis.

Figure 3. Distribution of Malting Barley Across Markets



	Uncertainty about market demand	Uncertainty of ability to grow a crop that meets quality standards of maltsters and brewers	Access to seed	Transportation and delivery	Storage, cleaning, drying	Access to NYS malt houses	Quality concerns with NYS malt houses	Access to malting barley crop insurance
#8 barrier/concern	0	1	3	5	1	1	2	9
#7 barrier/concern	1	0	4	3	2	5	4	3
#6 barrier/concern	0	0	4	4	4	5	3	2
#5 barrier/concern	2	1	1	6	3	6	1	2
#4 barrier/concern	1	2	6	2	5	1	5	0
#3 barrier/concern	3	2	4	1	2	1	4	5
#2 barrier/concern	5	9	0	1	2	3	1	1
#1 barrier/concern	10	7	0	0	3	0	2	0

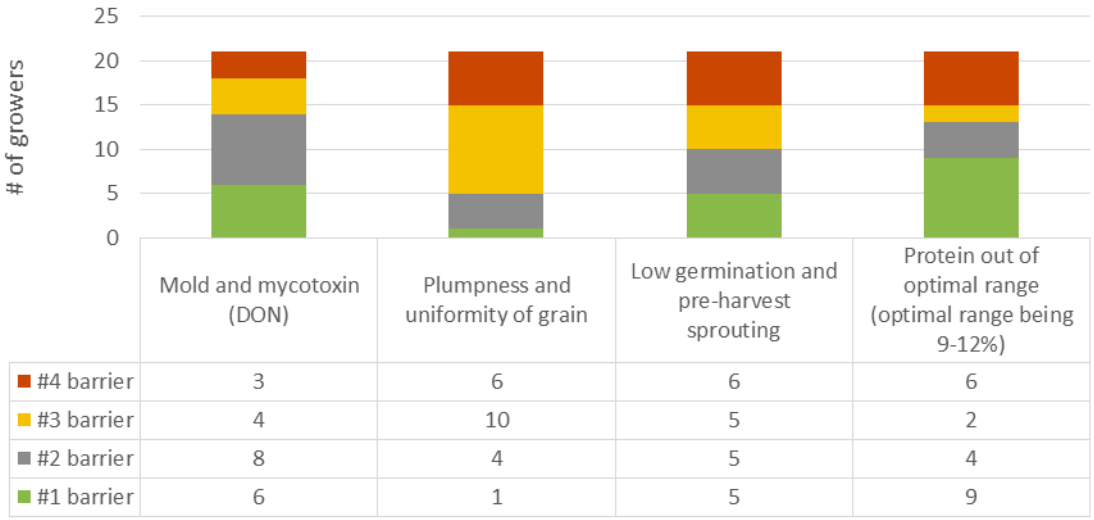
GRAIN QUALITY CHALLENGES

Survey respondents were asked to rank their biggest grain quality challenges. Twenty-one growers responded in total, with 43% of them citing *protein out of optimal range* as being their top challenge, and 19% cited it as their second biggest challenge. 29% of respondents cited *mold and mycotoxins* as their number one challenge and 38% cited it as their second biggest challenge. As outlined in the V1 analysis, mold and mycotoxins was ranked as the number one challenge at that time, with protein being out of optimal range ranking the lowest of the four challenges offered.

MALTING BARLEY PRODUCTION

GRAIN QUALITY CHALLENGES continued

Figure 4. Grain Quality Challenges



	Mold and mycotoxin (DON)	Plumpness and uniformity of grain	Low germination and pre-harvest sprouting	Protein out of optimal range (optimal range being 9-12%)
#4 barrier	3	6	6	6
#3 barrier	4	10	5	2
#2 barrier	8	4	5	4
#1 barrier	6	1	5	9

STORAGE

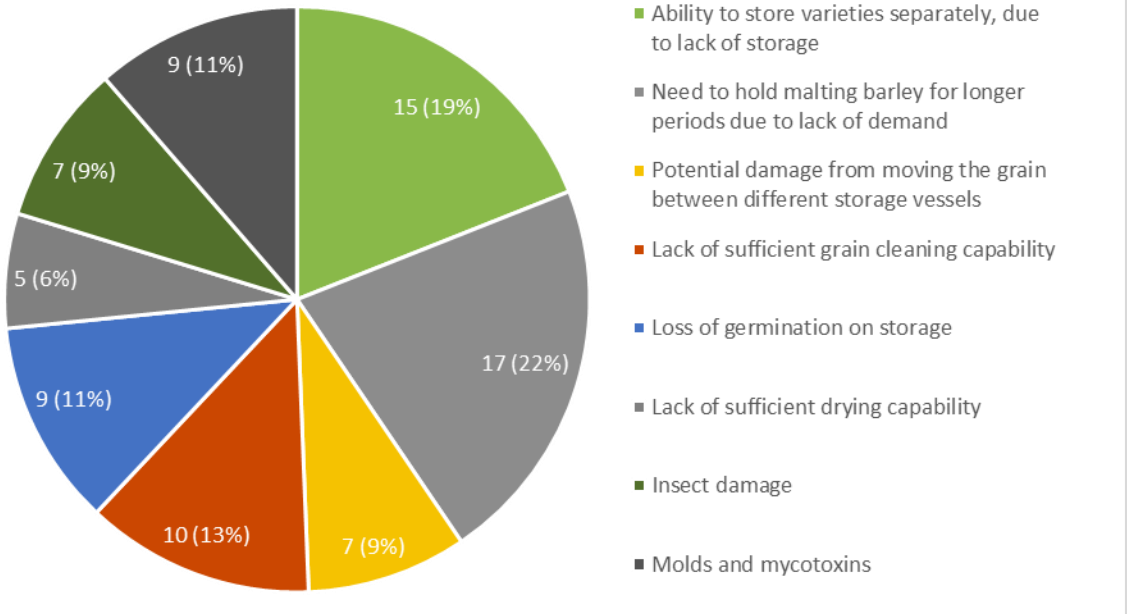
Of the 25 growers that responded, 24 of them are storing malting barley onsite, with only one using a 3rd party storage provider. On average, 21% of growers' total grain storage is being dedicated to malting barley, with the range being 3%-100%.

ONSITE STORAGE 96%

TOTAL GRAIN STORAGE DEDICATED TO MALTING BARLEY 21%

Survey respondents were asked to list all the storage challenges they face. The two challenges that had the highest number of growers citing it as a challenge are the *need to hold malting barley for longer periods of time due to lack of demand* with 17 growers and the *ability to store varieties separately due to a lack of storage* with 15 growers. In the V1 analysis, the top ranked storage challenges were the same two.

Figure 5. Storage Challenges



MALT PRODUCTION

TOTAL MALT PRODUCTION

Malt-house operators were asked to report the type and volume of grains malted in 2015 and 2016, respectively. **Figures 6 and 7** display the results of four NYS malt houses. As noted, the pounds of barley, wheat and rye malted increased between years 2015 and 2016.

Important to note that this question was asked in the V1 survey; however, that survey received a 100% response rate from malt-houses, where this round only received a 38% response rate, so it's challenging to compare and accurately contrast potential production volume increases by grain type.

Figure 6. Pounds of Barley Malted, 2015-2016

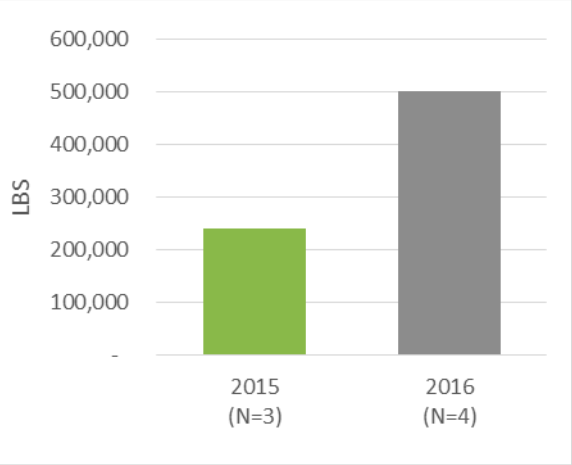
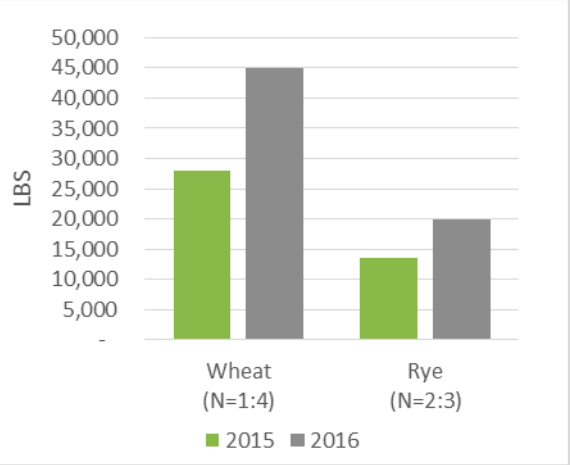


Figure 7. Pounds of Other Grains Malted, 2015-2016



POINT OF DISCUSSION

→ Brewers reported an interest in sourcing 136,340 lbs of wheat malt and 76,050 lbs of rye malt. With malt-houses reporting 45,000 lbs of wheat being malted and 20,000 of rye being malted at the time of survey administration, it appears that brewers demand for specialty malts far outweighs that which malt houses are currently malting.

Photos: Dennis Nesel, Hudson Valley Malt

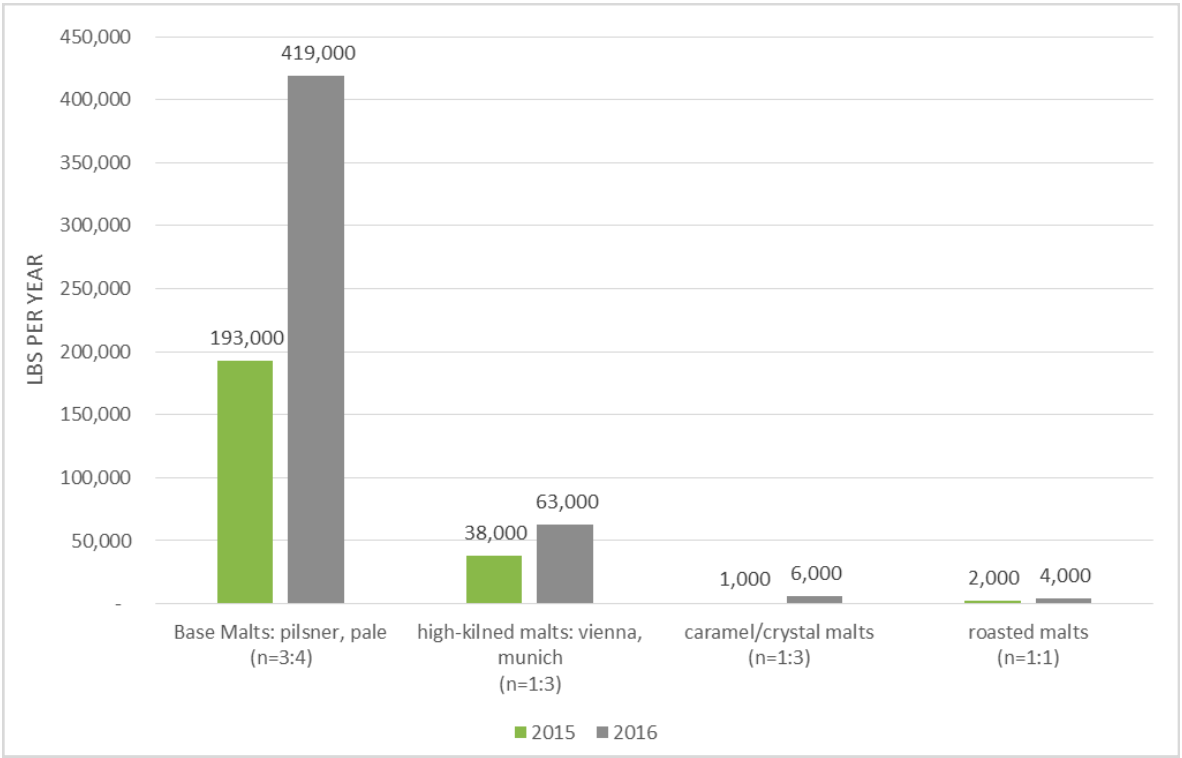
MALT PRODUCTION

TOTAL MALT PRODUCTION continued

Figure 8 represents total malt production by type for years 2015 and 2016 respectively for four NYS malt-houses. Base malt production occupies the greatest percentage of malt-house output, a fact also true in the V1 analysis, where as other types of malt are only being produced by select malt-houses.

Current and potential production capacity, in lbs per month, was also surveyed. Four malt-houses operators reported a total current monthly malt production volume of 79,300 lbs, and five malt-houses reported a total potential monthly malt production volume of 439,333 lbs, which equates to a potential annual malt production volume of 2,636 tons.

Figure 8. Total Malt Production, 2015-2016



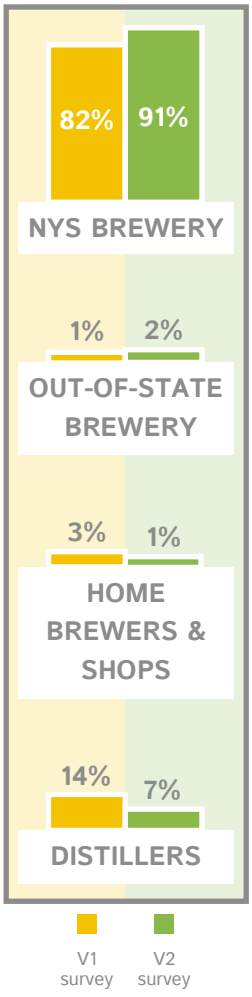
POINT OF DISCUSSION

→ Important to note is the scale differential amongst NYS malt houses. Of the five malt-houses that responded to the survey, the potential malt production per month ranged from 6,000 to 333,333 lbs per month, with a standard deviation of 138,665, indicating significant variation from the mean.

MALT SOLD BY MARKET CHANNEL

Figure 9 displays the average percentage of malt being sold through each market channel. 8:4 malt-houses contributed to the V1 & V2 survey, respectively. As indicated in both rounds of surveys, the majority of NYS malt is going to NYS malt houses. However, there is an increase of 9% in the amount of NYS malt going to NYS breweries between the V1 and V2 surveys. Similarly, there is a slight increase (1%) going to out-of-state breweries, and a decrease of 2% and 7 % going to home brewers/shops and distillers, respectively.

Figure 9.
PERCENT MALT SOLD THROUGH EACH MARKET CHANNEL



NEW YORK STATE CRAFT BEER PRODUCTION

This section presents the following information, specific to the brewery end of the supply chain:

- Types of NYS brewery licenses
- Detailed requirements and benefits of the Farm Brewery Law
- Current and potential production volume by license type
- Total production by license type
- The percentage of NYS and non-NYS malt and hops purchased by license type
- Brewers demand for specialty malts
- The intent to purchase NYS and non-NYS malt and hops in the future
- Concerns with sourcing NYS malt and hops

TYPES OF NEW YORK STATE BREWERY LICENSES

There are four licenses in NYS that grant operators the right to brew beer. **Table 4** breaks each type down by name and production volume thresholds.[1]

Table 4. NYS Brewery Licenses and Thresholds

Brewery License Type	Production Thresholds
Brewer (D101)	Authorizes licensee to brew more than 75,000 barrels per year, with no cap on the amount that can be manufactured in a year.
Micro-Brewer (MI 101)	Authorizes licensee to manufacture and wholesale up to 75,000 barrels of beer annually.
Farm-Brewer (FD 106)	Authorizes licensee to operate a brewery for the manufacture of up to 75,000 barrels of NYS labeled beer and/or cider annually, with conditions on the sources of ingredients.
Brew Pub	Authorizes licensee to manufacture 5,000 barrels of beer per location per year (can have up to 5 separate locations), not to exceed 20,000 barrels per year.

NOTE: A barrel of beer is equivalent to 31 gallons.

Farm-brewers, unlike any of the other licensees, have been afforded certain advantages under the license, but as a result, are required to purchase increasing percentages of NYS ingredients for use in each brew. The legislation, which went into effect on January 1, 2013, has the following conditions:

- Through 2018, at least 20% hops and 20% of all other ingredients must be grown in NYS.
- Between January 1, 2018 and December 31, 2023, at least 60% of hops and 60% of all other of ingredients must be grown in NYS.
- After January 1, 2024, 90% of hops and 90% of all other of ingredients must be grown in NYS.

Specific advantages/conditions of the Farm Brewery Legislation include:[2]

- Farm brewers can make NYS labeled hard cider and sell it on the premises by the glass.

[1] https://www.sla.ny.gov/system/files/ManufacturerFee-Chart-05122017.pdf
[2] http://newyorkcraftbeer.com/2015/11/legal-to-do-list-for-starting-a-brewery-in-new-york/

NEW YORK STATE CRAFT BEER PRODUCTION

TYPES OF NYS BREWERY LICENSES continued

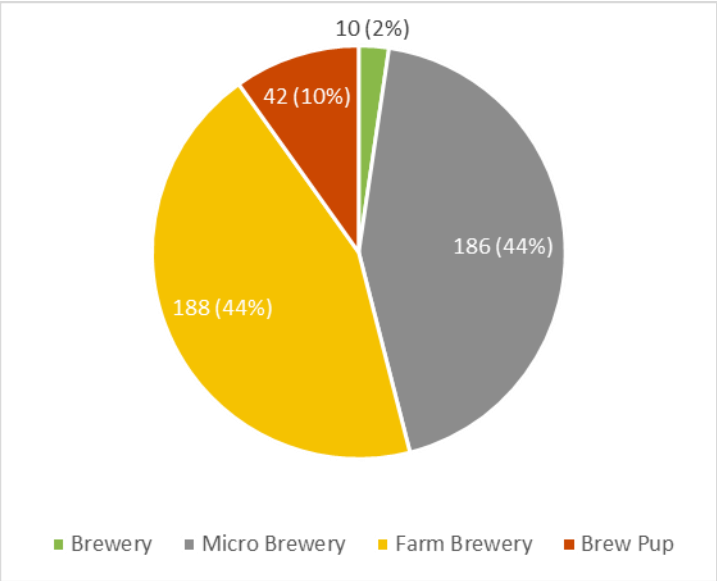
- Farm brewers can sell beer and cider from other farm breweries, and can sell beer and cider to other farm breweries, farm cideries, farm wineries, and farm distilleries.
- Farm breweries are allowed to have five branch offices located away from the brewery premises that will be considered part of the brewery, and all activities that could take place at the brewery can be conducted at the branch offices.
- Farm breweries can operate a restaurant or other food or drinking establishment and sell there the beer made at the brewery.
- Farm breweries can sell by the bottle or glass and conduct tastings of all New York State labeled beer, wine, cider, and liquor.
- Farm breweries can sell related products at their brewery, such as beer making equipment and souvenir items.

BREWERIES IN NEW YORK STATE

As of November 2017, there were 384 brewery establishments operating in NYS, understanding that some of these establishments hold multiple licenses, as indicated in Figure 9. Since 2012, the number of NYS craft breweries, which includes farm-breweries, micro-breweries and restaurant pubs, has increased by 286%, a considerable growth pattern in a short timeframe.

A total of 426 licenses were granted as of November 2017. **Figure 9** breaks them down by license. Micro-breweries and farm breweries account for an equal share and collectively account for 88% of total licenses granted at this time.

Figure 9. Breweries by License Type in New York



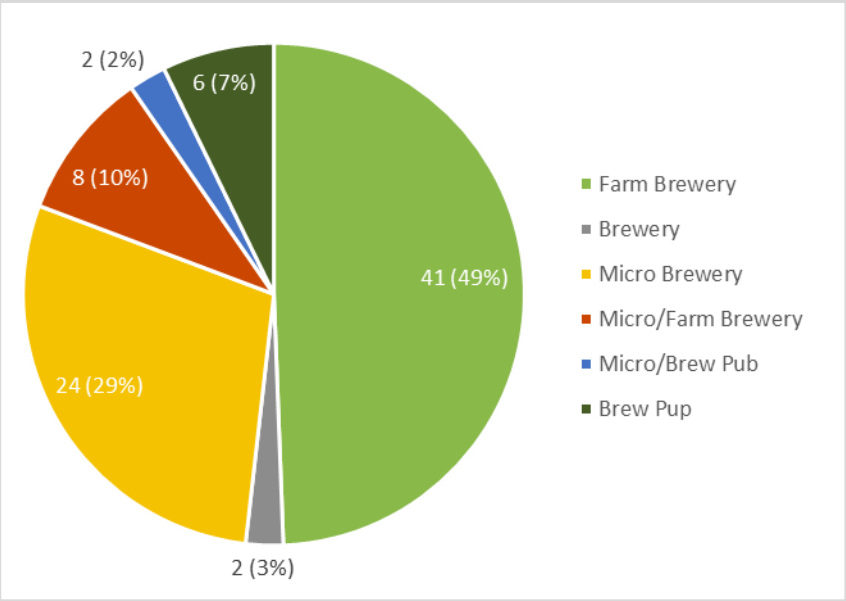
The number of New York craft breweries has **increased 286%** since 2012.

NEW YORK STATE CRAFT BEER *on the rise*

SURVEY RESPONDENTS BY LICENSE TYPE

Figure 10 breaks down survey respondents by license type. Eighty-five NYS brewers responded to the survey, 10 of which hold dual licenses and almost half of which hold a farm brewery licenses only.

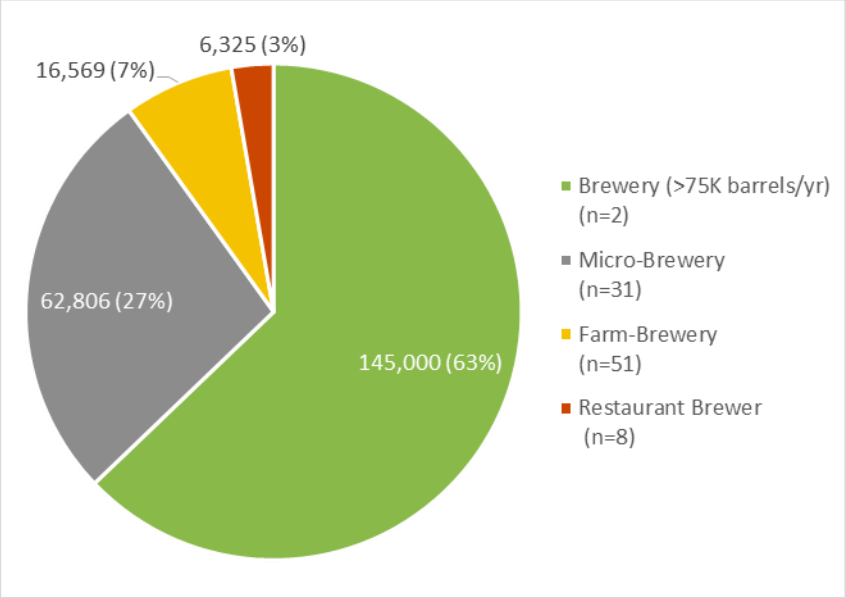
Figure 10. Survey Respondents by License Type



PRODUCTION BY LICENSE TYPE

Survey respondents were asked what their production volume was under each license at the time of survey administration. Total production for all respondents was 230,700 barrels annually, with 63% of that total accounted for by two breweries. Micro-breweries accounted for the second highest proportion, with 62,806 barrels per year.

Figure 11. Production in Barrels by License Type



BREWERY RESPONSES

ANNUAL PRODUCTION BY LICENSE TYPE

Table 5 demonstrates the varying levels of barrel production, annually, by license type.

Table 5. Barrel Production by License Type

License Type	Brewery	Micro-Brewery	Farm-Brewery	Brew Pub
Mean	72,500	2,094	325	791
Standard Deviation	38,891	2,090	350	788
Minimum	45,000	50	24	175
Maximum	100,000	8,000	2,100	2,500
Count	2	30	51	8

POINT OF DISCUSSION

→ The large standard deviations and difference in minimums and maximums across each license type demonstrates just how much diversity exists in the size of brewery operations in NYS. This fact makes it challenging to anticipate future growth patterns of breweries and the subsequent increasing demand for NYS malt and hops, when solely based on incomplete data resulting from low survey response rates; making it ever more important to encourage higher response rates on future surveys of this kind.

PROJECTED PRODUCTION BY LICENSE TYPE

Brewers were asked to estimate their production of barrels/yr, under each license type, through 2024. As noted in **Table 6**, the greatest percent increase in production from 2018 to 2024 is projected by farm breweries, with an average of 40 farm breweries projecting an increase in barrel production of 104%, or 31,253 barrels. Percent growth for all license types is 52%, or 148,618 barrels. By the end of 2024, the farm brewery legislation requires that 90% of hops and 90% of all other ingredients must be grown in NYS. To satisfy 90% of the projected barrel production in 2024, equivalent to 61,200 barrels (based on the 35 farm breweries that responded to this question), 1,951 acres of NYS grown malting barley will be required in 2024. It is important to note that these 35 farm breweries only represent 19% of total farm breweries as of November 2017.

Table 6. Estimated Production in Barrels and Percent Growth, by License Type

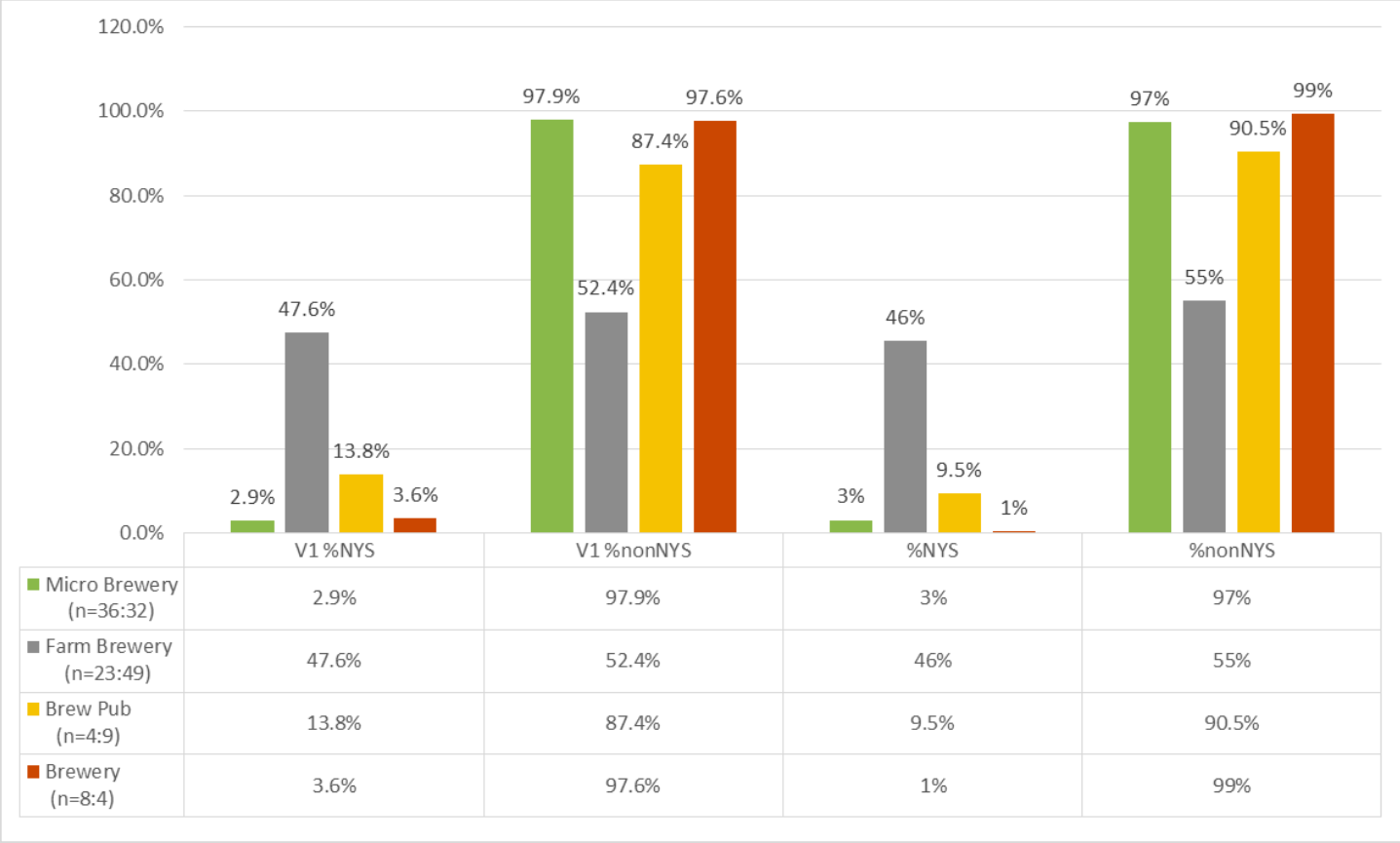
License Type N=2018:2020:2024, respectively	2018	2020	2024	% Growth from 2018 to 2024
Brewery (N= 3:3:4)	155,800	173,000	198,000	27%
Micro Brewery (N=34:32:26)	92,985	129,150	163,900	76%
Farm Brewery (N=45:41:35)	29,947	43,230	61,200	104%
Brew Pub (N=6:4:5)	6,625	6,875	10,875	64%
Total	**285,357**	**352,255**	**433,975**	**52%**

NYS AND NON-NYS MALT PURCHASED BY BREWERS

In both Figure 12 and Figure 13, the columns marked V1 were extracted from the 2016 Harvest NY Supply Chain Analysis, and have been presented alongside current estimates for comparison purposes. Important to note are the number of respondents per survey, which are listed in the left-most column, respectively for the V1 and V2 surveys. Depending on the license type, the number of respondents either increased or decreased between survey years.

Figure 12 depicts the current percent of purchases for NYS malt and non-NYS malt by brewers at the time of survey administration.

Figure 12. Percent NYS Malt and Non-NYS Malt Purchased by License Type



	V1 %NYS	V1 %nonNYS	%NYS	%nonNYS
Micro Brewery (n=36:32)	2.9%	97.9%	3%	97%
Farm Brewery (n=23:49)	47.6%	52.4%	46%	55%
Brew Pub (n=4:9)	13.8%	87.4%	9.5%	90.5%
Brewery (n=8:4)	3.6%	97.6%	1%	99%

POINTS OF DISCUSSION

→ With the exception of a slight increase in the percentage of NYS malt purchased by micro-breweries between the V1 survey and the V2 survey, the percent of NYS malt purchased decreased for the remaining three license types, with the most notable decreases being attributed to the brew pub license and brewery license

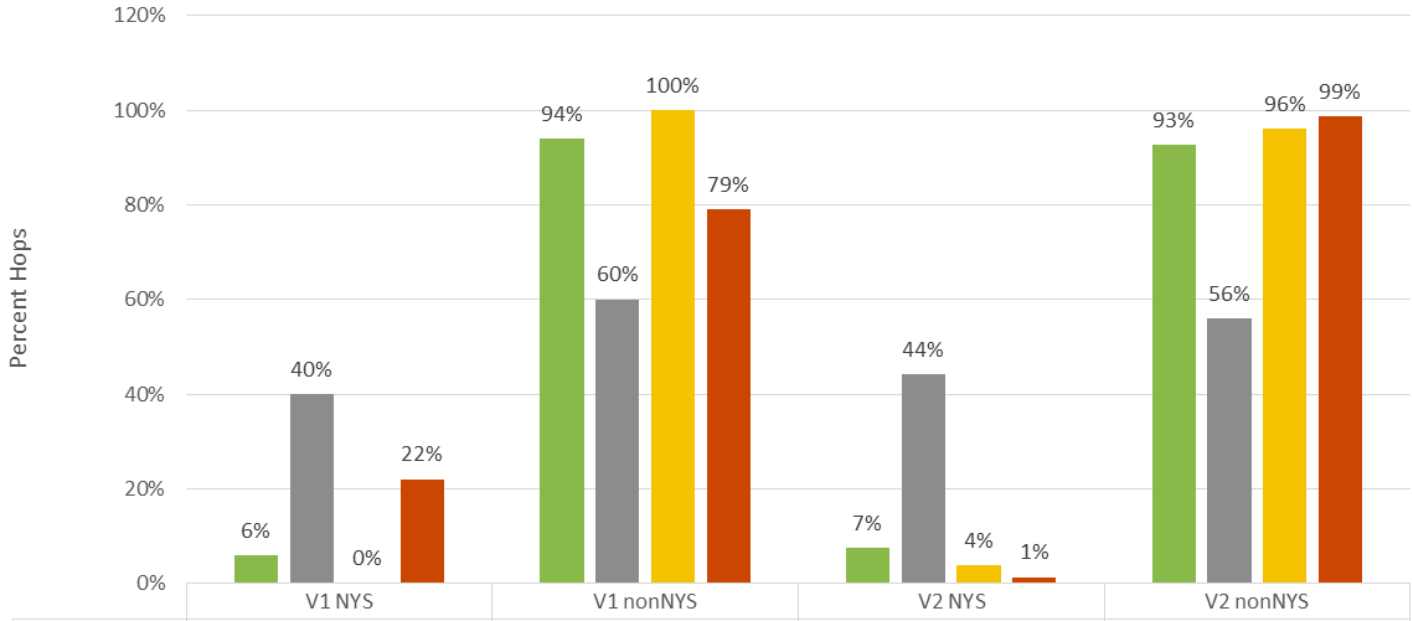
→ The percent point decrease of NYS malt purchased among breweries is notable, as to be licensed as a brewery, production volume has to be in excess of 75,000 barrels per year. If the percent decrease is a trend reflective of all breweries, and not just the four that responded to the survey, it could signal a sizable decrease in the demand for NYS malt, as a 2.6% percentage point decrease in the quantity demanded for NYS malt from breweries that operate at this scale is fairly significant.

NEW YORK STATE CRAFT BEER PRODUCTION

NYS AND NON-NYS HOPS PURCHASED BY BREWERS

Figure 13 depicts the current percent of purchases for NYS and non-NYS hops by brewers at the time of survey administration.

Figure 13. Percent NYS Hops and Non-NYS Hops Purchased by License Type



	V1 NYS	V1 nonNYS	V2 NYS	V2 nonNYS
Micro Brewery (n=18:29)	6%	94%	7%	93%
Farm Brewery (n=13:50)	40%	60%	44%	56%
Brew Pub (n=1:9)	0%	100%	4%	96%
Brewery (n=4:3)	22%	79%	1%	99%

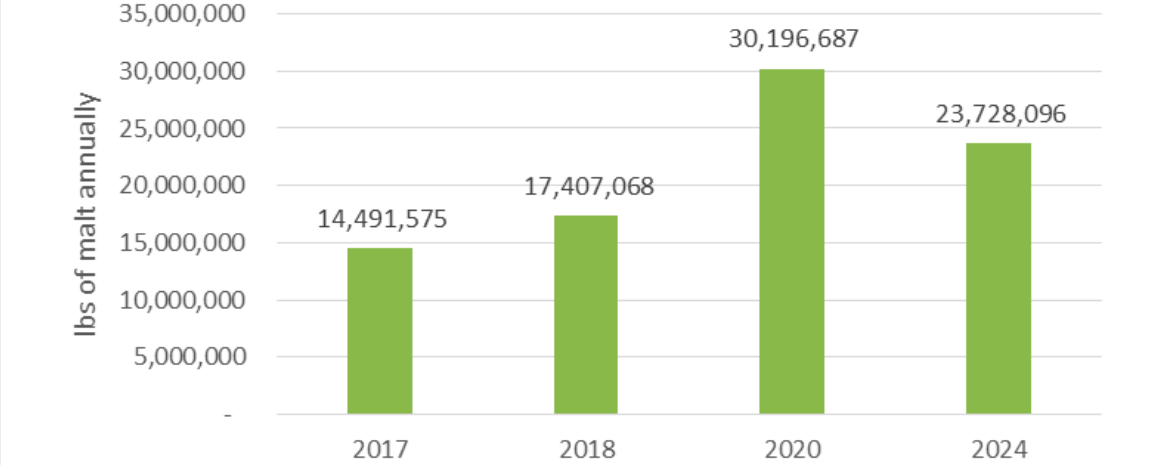
POINT OF DISCUSSION

→ Brewers reported an increase in NYS hops purchases for all license types, except the brewery license, which decreased dramatically from 22% to 1%. If this is a trend truly reflective of the brewery license type, it would be a cause for concern as that level of reduction given the production volume breweries are operating within is quite substantial. Polling larger breweries about why the potential decrease in demand for NYS hops may be prudent.

INTENT TO PURCHASE NEW YORK STATE GROWN MALT

Figure 14 demonstrates the projected increase in the quantity demanded for non-NYS malt for years 2017 through 2024. Depicted in this figure is projected demand by all types of brewery licensees.

Figure 14. Projected Quantity Demanded of non-NYS Malt by All Breweries



POINT OF DISCUSSION

→ The demand for non-NYS malt increases through 2020, and then declines in 2024. This is not terribly surprising given the increasing threshold for NYS ingredients under the Farm Brewery License. By 2024, based on current legislation, the required use of NYS ingredients will be at 90%.

Table 7 and **Figure 15** break-out NYS malt demand between 2017 to 2024 by license type. Important to note is that one brewer reported increases as percentages, and thus was removed from the dataset. The brewery that reported in percentages estimated purchasing NYS malt at an increasing rate over the time period provided, beginning at 0% in 2017 and increasing to 4% by 2024. It is assumed that based on the raw data that other respondents confused the unit of measurement and reported in percentages, rather than lbs, but as they did not specifically state "percent" or "%", the project team analyzed the data as reported from the respondents. Given that assumption, the demand for malt is likely underestimated.

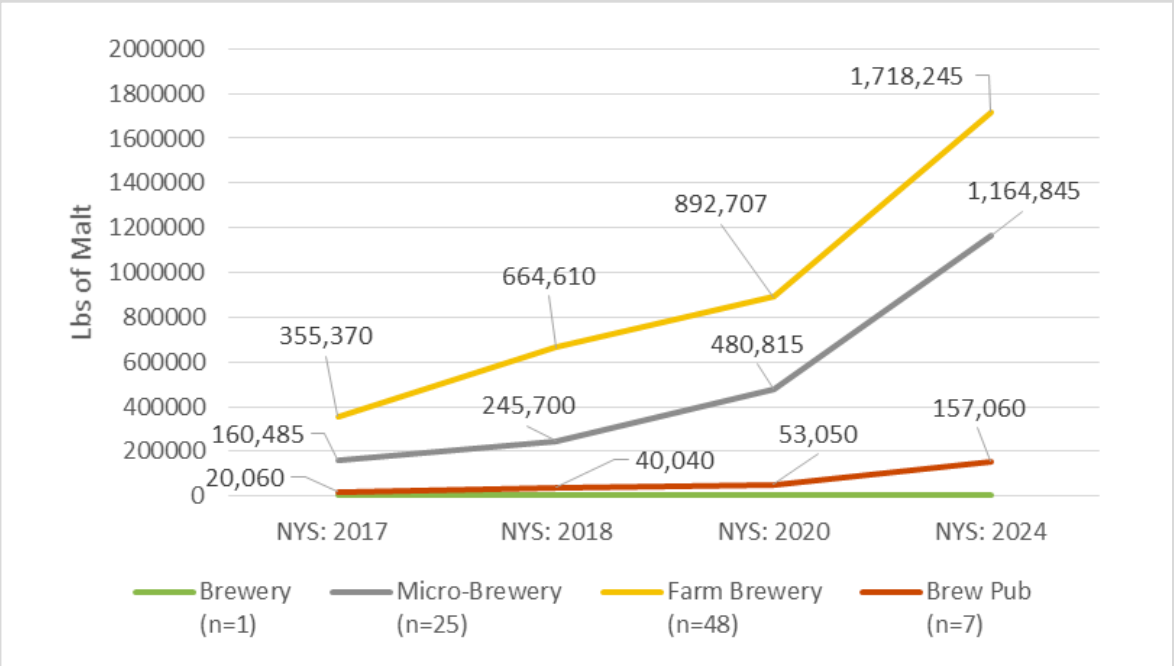
Table 7. Malt Demand by License Type, 2017-2024

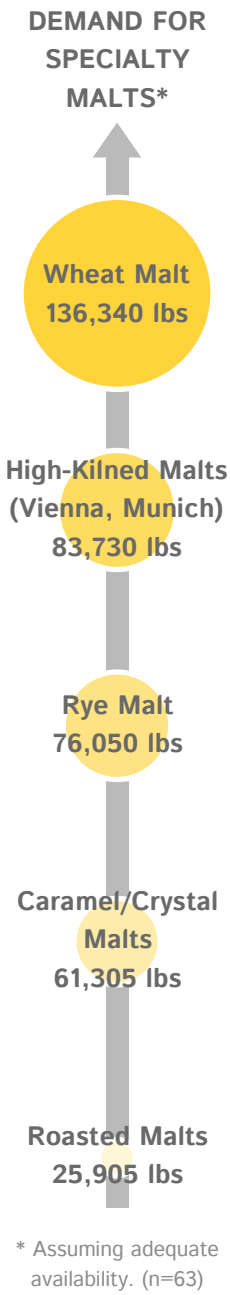
License Type	% increase from 2017 to 2018	% increase from 2018 to 2020	% increase from 2020 to 2024
Micro-Brewery (n=25)	53%	96%	142%
Farm Brewery (n=48)	87%	34%	92%
Brew Pub (n=7)	100%	32%	196%

NEW YORK STATE CRAFT BEER PRODUCTION

INTENT TO PURCHASE NEW YORK STATE GROWN MALT continued

Figure 15. Projected Quantity Demanded of NYS Malt by All Breweries





POINTS OF DISCUSSION

→ As indicated by the data, with the exception of the single brewer, all license types have projected an increase in the demand for NYS malt over time, with considerable increases being projected by brew pubs and micro-breweries, neither of which have a legal mandate to use NYS grown ingredients. Between 2020 to 2024, micro-breweries have projected a 142% increase in their malt demand, and brew pubs have projected a 196% increase.

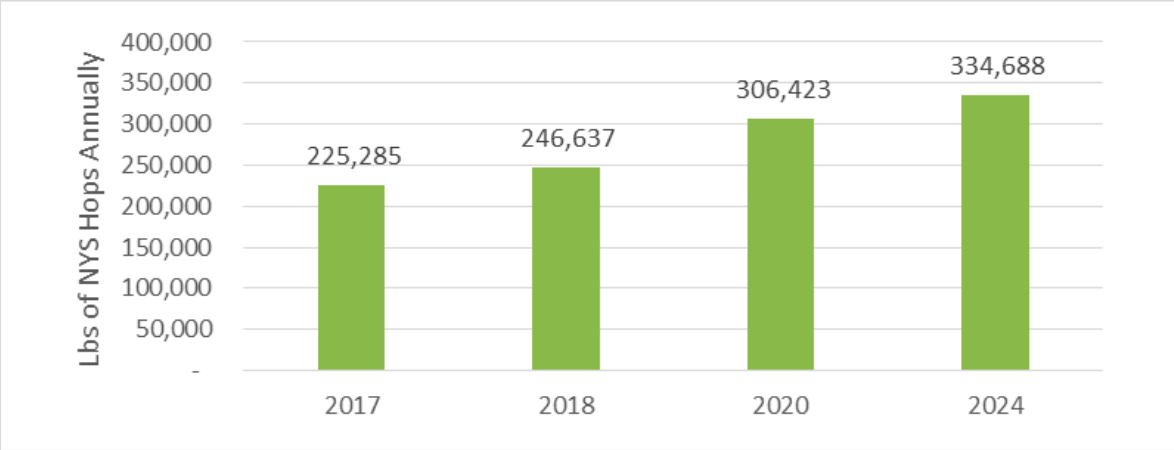
→ Total demand for NYS malt across all license types in 2024 is 3,042,150 lbs. In order to meet this demand, 1,584 acres of malting barley that meets grade will be required. Where this doesn't seem like an unachievable number of acres given the current production of malting barley, it's important to note that only 48 of the 188 farm breweries are represented in this analysis. Quantifying the projected demand of the remaining 140 farm breweries that are currently in operation will provide a much more accurate representation of the true acres needed to meet the demand of the farm breweries in 2024.

→ Also of interest in the discrepancy in the projected acres of malting barley required as outlined in Table 6, which reports 1,951 acres of malting barley needed to satisfy the 90% threshold of 61,200 barrels of projected beer being produced by farm breweries in 2024. When asked a similar question, yet worded differently, as depicted in Figure 15, farm brewers estimated a projected quantity of NYS malt demanded by 2024 of 1,718,245 lbs, which equates to 895 acres of malting barley. Interestingly, a higher number of farm breweries responded to the question answered in Figure 15 (48 vs 35) than in Table 6, yet the projected acres needed of malting barley is considerably lower. This could be accounted for by the project collaborators' assumption that brewers responded in the wrong unit for the question represented in Figure 15, it could be inconsistent projections, or a combination of both.

INTENT TO PURCHASE NEW YORK STATE GROWN HOPS

Brewers were asked to project their quantity demanded for both NYS and non-NYS hops between now and 2024. **Figure 16** portrays the projected quantity demanded for non-NYS hops, while **Figure 17** demonstrates the projected quantity demanded of NYS hops by license type. Similar to the errors noted in the malt data, one brewer reported projected quantities in percentages, and thus that data was removed and it's assumed based on the raw data that others made that same mistake, but that data is included in these estimates. Given this information, the demand for both NYS and non-NYS hops is likely underestimated.

Figure 16. Projected Quantity Demanded of non-NYS Hops by All Breweries



Unlike the trend that is noted with non-NYS malt, the projected quantity demanded for non-NYS hops doesn't taper off by 2024, but rather continues to increase. With the exception of a slight decrease of 1lb by breweries between 2020 and 2024, the projected quantity demanded of NYS hops steadily increases for each license type between 2017 to 2024, as noted in **Figure 17**; with the most significant percent increase being reported by brew pubs, as indicated in **Table 7**.

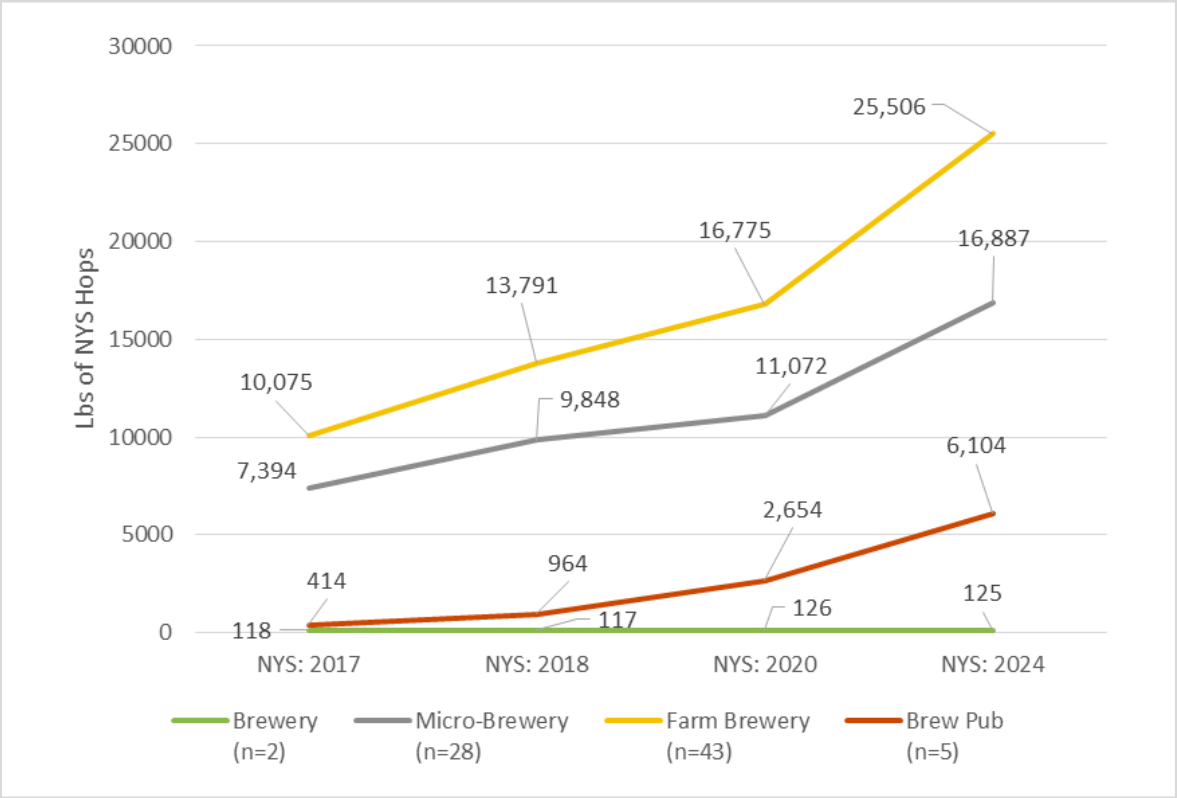
Table 7. Malt Demand by License Type, 2017-2024

License Type	% increase from 2017 to 2018	% increase from 2018 to 2020	% increase from 2020 to 2024
Micro-Brewery (n=28)	33%	12%	53%
Farm Brewery (n=43)	37%	22%	52%
Brew Pub (n=5)	133%	175%	130%

NEW YORK STATE CRAFT BEER PRODUCTION

INTENT TO PURCHASE NEW YORK STATE GROWN HOPS continued

Figure 17. Projected Quantity Demanded of NYS Hops by All Breweries



A resource for brewers to use to identify hop growers is the Northeast Hop Alliance's new search-able database, which allows hop growers to post both the quantity, variety and location of hops they are looking to sell.

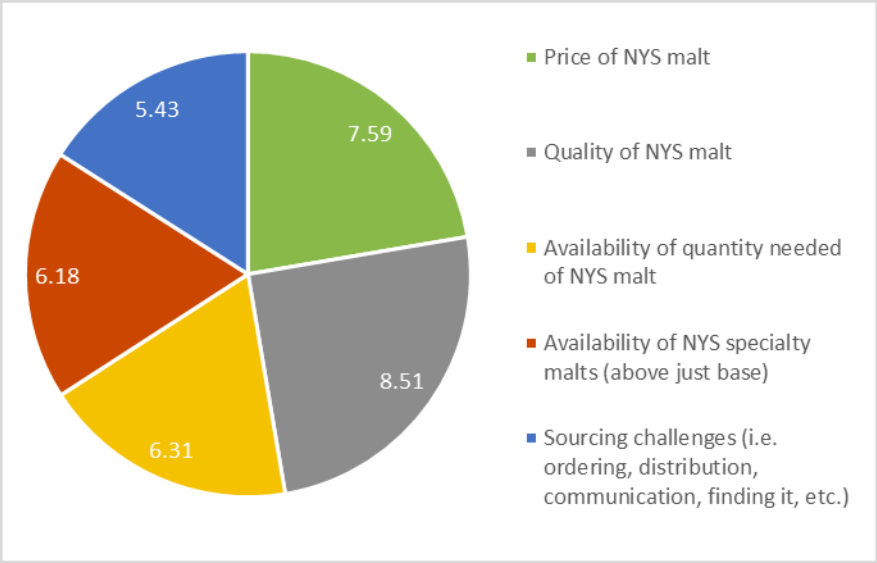
www.northeasthopalliance.org

SOURCING NEW YORK STATE MALT AND HOPS

Brewers were asked to rank their challenges/concerns with sourcing NYS malt and hops, on a scale of 1-10, with one being the least important.

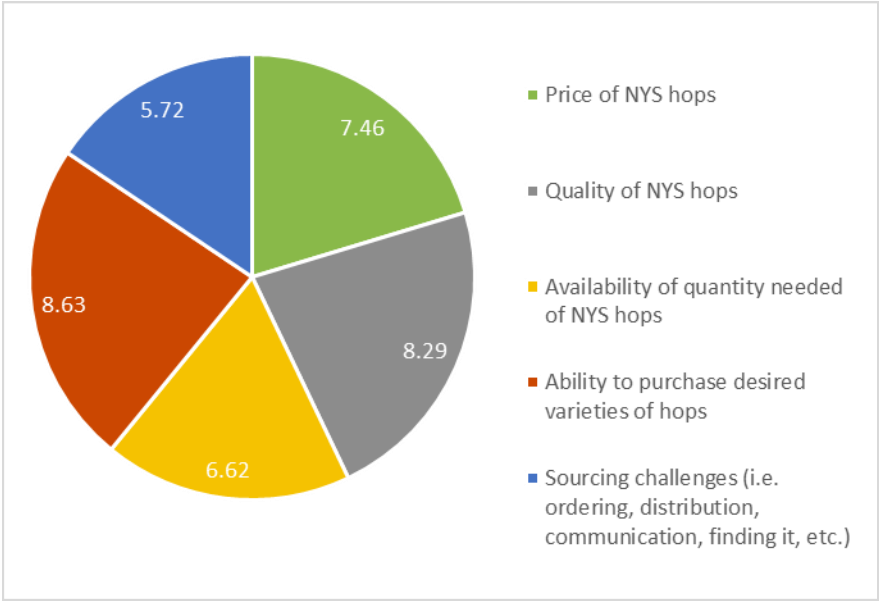
Figure 18 illustrates that brewers top two concerns with sourcing NYS malt are quality and price, the same two top concerns in the V1 analysis.

Figure 18. Brewers Concerns with Using NYS Malt



With regard to hops, as represented in **Figure 19**, brewers ranked their *ability to purchase desired varieties of hops* at their top challenge and *quality of NYS hops* being a close second. This changed slighted since the V1 survey, as price was the top challenge, and quality was the second highest ranked challenge in that round.

Figure 19. Brewers Concerns with Using NYS Hops



NOTES

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Educational purposes only
The information contained in this publication is intended solely for the education of those interested in the brewery supply chain in New York and is not intended to provide legal, accounting, or other professional advice.

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