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Eastern NY Commercial Horticulture Program

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Tree Fruit News

Storage Workshop 2017 Review for Eastern New York

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Now that apple harvest is well under way across eastern New York, it is a good time to revisit the key takeaway points from our storage meetings held in August. The following are some of Dr. Chris Watkins' suggestions for dynamic controlled atmosphere (DAC) of McIntosh and Cortland, preventing superficial scald, bitter pit, and CO2 injury in Honeycrisp, proper storage temperatures to prevent disorders in NY-1 and NY-2. Dr. Watkins also reviewed the progress to data on understanding the causation and control of Gala stem-end browning.

Honeycrisp Storage

At the workshops, Dr. Watkins observed that Honeycrisp has many storage issues, so it is good to have a plan for the fruit when you are getting ready to store them.

Soft scald and bitter pit

Bitter pit has not historically been as big of an issue in the Champlain Valley compared to soft scald and soggy breakdown. The reverse is true in the Hudson Valley, where bitter pit is a major concern, with soft scald and soggy breakdown less common. Conditioning fruit for a week at 50F will give excellent control of soft scald and soggy breakdown, but is more likely to lead to bitter pit worsening during the storage period. ENYCHP extension specialists have observed fruit with bitter pit lesions across all of eastern New York. The incidence of bitter pit in the Hudson Valley appears to be approximately half of last season's levels.

- In the Champlain Valley, preconditioning for seven days at 50F, then storage at 38F is recommended to control soft scald and soggy breakdown.
- In the Hudson Valley, unless a block has a strong history of soft scald/soggy breakdown, pre-conditioning is generally not recommended. Take into consideration the balance between bitter pit and scald risk before deciding on a storage regime.
- Research is currently being conducted to predict soft scald and bitter pit risk in Honeycrisp. Ethanol has not proven to be a reliable predictor of soft scald. Studies are currently underway evaluating several potential methods of bitter pit prediction.

Controlled Atmosphere Storage and CO2 injury

- Honeycrisp have a high risk of CO2 injury if stored in CA storage. Conditioning will reduce this risk, and diphenylamine (DPA) also controls CO2 injury as well. Delaying CA storage

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In this issue of Tree Fruit News:

Temperature and Rain 8/22/17 - 9/18/17

Locations	Avg Temp (F)	Max Temp (F)	Min Temp (F)	Total Rain (in)
Chazy	61.6	82.2	43.5	2.5
Peru	61.8	84.6	42.3	2.1
Crown Point	61.4	84.9	41.0	0.0
Clifton Park	63.6	88.6	40.1	1.7
Hudson	63.9	90.9	41.1	3.4
Highland HVRL	64.6	88.7	45.4	3.3
Marlboro	N/A	N/A	N/A	2.3
River-head	69.9	85.8	54.0	3.3

for one month in air reduces CO2 injury, but this practices can lead to increased bitter pit incidence and fruit greasiness.

- For the Hudson Valley, if being stored in CA, a month in air at 38F after conditioning will reduce CO2 injury, unless the fruit are treated with DPA.

Gala Stem End Flesh Browning

Gala stem end flesh browning (SEFB) appears to be an increasing problem in Gala. In addition to New York State, the disorder has been observed in Ontario Province, Washington State, and Brazil. Factors associated with individual orchard blocks are suspected contributors, but have not been specifically identified to date. SEFB appears to be analogous to Empire flesh browning.

As of two years ago, our understanding of the SEFB problem included:

- SEFB delayed, but not controlled by:
    1. Conditioning (7 days at 50F)
    2. Harvista but not ReTain
    3. A single trial indicated that DCA markedly reduced disorder incidence.
- Harvest effect not well investigated (small but relatively minor effect)
- No consistent effect of postharvest 1-MCP (SmartFresh)

Two experiments were conducted in WNY in 2015 to determine if the effect of DCA on reducing stem end browning and core browning reproducible.

2015 Experiment 1: Gala, *Fulford* strain, four field reps of 20 trees either untreated and Harvista treated (8/31/15), Harvest dates were 9/6/15 and 9/13/15, harvested fruit were cooled to 33F overnight and treated with 1-MCP for 24 h and then allowed to vent for an additional 24 h, fruit were stored in air, CA (2%O2/ 2% CO2) and DCA-CF (0.5% O2/1.0% CO2), quality assessments after 3 and 6 months plus 1 and 7 days at 68F, disorder assessments after 7 days at 68F.

2015 Experiment 2: Fruit from 4 orchard blocks (Brookfield strain) were collected from an apple storage facility in WNY on 9/15/15, cooled to 33F overnight, half the fruit untreated or treated with 1-MCP for 24 h., stored in CA (2% O2/ 2% CO2) or DCA-CF (0.5% O2/ 1.0% CO2), Quality assessments after 5 and 8 months in storage plus 1 and 7 days at 68F, Disorders assessed after 7 days at 68F.

For 2016, an experiment was conducted to determine if the effect of DCA was due to low oxygen or low carbon dioxide, and are there any effects of oxygen and carbon dioxide levels on fruit quality. Atmosphere and temperature variables assessed in the experiment included 0.5% and 2% oxygen, 1% and 2% carbon dioxide, 33F and 38F storage.

Overall conclusions from the 2015 and 2016 experiments

- SEFB is delayed but not controlled by Harvista and DCA.
- No consistent effects of 1-MCP on storage disorders but usually helps maintain firmness.
- Standard CA (2% oxygen/2% carbon dioxide) at 33F for up to short term storage remains recommendation.

Orchard block factors which contribute to SEFB remain elusive.

NY-1 and NY-2 Storage: What we know so far.

NY-1 should be stored at 38F, like Honeycrisp, to avoid low temperature disorders. NY-1 is also susceptible to a number of disorders when put into CA storage, including CO2 injury, greasiness, and stem end flesh browning. The risk of greasiness increases dramatically at 38F, this is the trade-off to avoid significant flesh browning at 33F. 1-MCP and DPA may have only limited effects on storage disorders if fruit were promptly picked and placed into storage. If CA and cooling are delayed after picking (10 days in a recent trial), 1-MCP can be used to better preserve fruit quality while in storage.

Conventional water core, "stress" water core, and core browning was found to be an issue for NY-2 in 2015, but not in 2016. The difference between seasons was remarkable, but we don't know the reason why. Was the effect environmental, or just random chance? Here is a summary of Dr. Watkin's research results from 2015 and 2016:

- Storage quality of NY-2 has been highly variable to date:

⇒ Same trees in 2016 as in 2015, but different results.

Gala Stem End Flesh Browning

HarvestWatch containers in storage bins

⇒ Almost disorder-free in 2016 harvest, while 2015 serious losses.

⇒ 2016 appears to have less stress on fruit.

⇒ Started harvest one week earlier in 2016, but does not account for absence of disorders as two harvests overlap between years.

⇒ Factors not well understood, but **water core in fruit at harvest may result in poor storage quality.**

- Maturity indices for NY-2 have been difficult to determine.
- Not even sure about storage temperatures!

CA vs. DCA Storage for McIntosh, Cortland, and Red Delicious

In dynamic controlled atmosphere storage, the oxygen is brought to very low levels (often below 1kPa), close to the anaerobic compensation point (ACP). The ACP is the oxygen concentration where total respiration by the fruit is at its lowest point. This point is very close to the lowest oxygen level (LOL) that is tolerated by fruits, and therefore this system requires constant monitoring to ensure the level of oxygen in the storage never falls below the LOL. There are different methods used to monitor the LOL of the fruit in storage, including stress markers from chlorophyll fluorescence, the respiratory quotient (the ratio of CO_2 to O_2), and ethanol concentrations within the fruit. There are sensors to monitor all of these indicators, and these are connected via computer to allow the system to adjust the O_2 and CO_2 concentrations with a range that is safe while maximizing fruit condition. To utilize DCA storage, the storage room must be very well sealed, to maintain these extremely low, precise levels of O_2 and CO_2.

Dr. Watkins performed trials to compare CA and DCA storage in the Hudson and Champlain Valley's during 2016. Apples were kept at room temperature for 3 or 10 days in order to contrast a "lab scenario" (3 days) with a more practical "field" scenario (10 days), before being stored for eight months in CA or DCA. Half of the apples were treated with 1-MCP prior to storage. After storage, fruit were assessed after one and seven days at 68F for the incidence of superficial scald and CO2 injury.

Champlain Valley Results:

- When fruit did not receive 1-MCP treatment, fruit stored in DCA storage had less incidence of superficial scald than those stored in CA storage. When storage was delayed for three days, apples had 30% more superficial scald when stored in CA storage than fruit kept in DCA. When storage was delayed an additional week, fruit in CA storage had 50% more superficial scald compared to those stored in DCA.
- When 1-MCP is used on fruit, scald incidence is greatly reduced, and there is little difference between CA and DCA stored fruit.
- For McIntosh, fruit stored in DCA had 16% less CO2 injury compared to CA stored fruit. Flesh firmness in McIntosh was slightly greater for fruit kept in DCA storage, though 1-MCP preserved flesh firmness best. DCA improved Cortland flesh firmness similar to 1-MCP treatments.

Overall, for McIntosh and Cortland, CA plus 1-MCP can delay scald development, but DCA with or without MCP may be more effective in delaying scald. DCA may not preserve firmness on the shelf after storage though, so 1-MCP should be used to preserve firmness.

Hudson Valley Results:

- The potential for superficial scald in air-stored McIntosh (27%), and Red Delicious (51) was high in 2016, all treatments and conditions (CA, DCA, MCP, no-MCP, 3 day, 10 day) showed complete control of superficial scald.
- Cortland is very susceptible to superficial scald (81% in 2016 air storage). All treatments and pre-storage conditions reduced scald to a significant degree (9 - 13% incidence), there were no significant differences between conventional CA, DCA, with or without MCP, 3 or 10 days pre-storage at room temperature regimes.
- CO2 injury of McIntosh was significantly reduced when stored under DCA without MCP treatment.
- The application of DCA significantly improved the retention of flesh firmness in McIntosh, even more so when combined with MCP treatment.

Dynamic Controlled Atmosphere Storage Summary

- CA plus 1-MCP can delay scald development, but generally DCA with or without 1-MCP is more effective, depending on variety. (Cortland is the least consistent).
- Overall, DCA is effective as a non-chemical control of scald, but lacks benefit during shelf life period (except Delicious).
- 2016 harvest experiments – difficult to interpret, except that Cortland is clearly the most scald susceptible variety and the hardest to control.
- Little effect of slower CA/DCA application on scald, but some loss of quality on McIntosh and Cortland (not Delicious).

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BMSB and Woolly Apple Aphid Management Considerations at Harvest in the Mid-Hudson Valley

Peter Jentsch– Cornell HV Lab

BMSB:

Summary and recommendations: Drying seed pods of deciduous trees and broad leaf weed species combined with reduced day length are prompting both native and invasive stink bug begin intensive feeding on tree fruit as they begin moving toward overwintering sites.

We are finding very high numbers of brown marmorated stink bug (BMSB) in pheromone traps the last two weeks, with over 100 observed over 7-days at the HVRL in Highland on Tedder traps.

Stink Bug on Mutsu at Harvest, September 12, 2017

Secondly, we have been finding green stink bug (GSB), Chinavia halaris (Say) on fruit along orchards bordered by woodlands and irrigation ponds, with feeding injury exceeding 1%. We have also seen the first movement to buildings by adult BMSB.

The importance of scouting and considerations for stink bug management occurring this week cannot be overstated in Mid-Hudson Valley orchards.

• Management Thresholds: In orchard blocks where native green stink bug and brown marnorated stink bug have exceeded trap threshold, or where 1 SB is observed on border trees along 100′ of row, or darkened depressions with feeding punctures in the center of the feeding site is observed, management should begin. Apply efficacious insecticide (Chart Below) against green and brown marmorated stink bug to reduce the risk of stink bug injury. As nymphs mature to adults, populations increase by the day.

Management Decision Making: Base selection of insecticides on PHI and efficacy, not price. Reduced rates, even of the best materials, will allow for more injury. The best materials in the pyrethroid class (Danitol for GSB and Bifentrin for BMSB) have 14d PHI's. Planning and preparation is critical during development of varieties and harvest intervals. Closer SC, although it has no efficacy against the adult SB, will buy you at least 3 days of feeding inhibition.

• Stink Bug Migration: As these insects are very mobile, moving in and out of the orchard during the pre-overwintering phase, considerations for alternate row middle on tight schedules and perimeter applications to reduce migration should be made.

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Product	Active ingredient	Rate / A	REI Hrs.	PHI Days	Efficacy (USDA)	Max. per crop / season	App. Interval
Actara 25WDG	Thiamethoxam	2.0-5.5 oz/A	12	35	+++	16.5 oz./A (0.258 lb. a.i./A)	10d
Asana XL 0.66EC	Esfenvalerate	4.8-14.5 fl oz/A	12	21	++	101 fl oz/A (0.525 lb AI/A).	NA
Baythroid XL 1EC	Beta-Cyfluthrin	1.4-2.8 fl oz/A	12	7	++	2.8 fl oz/A (0.022 lb AI/A).	14d
Bifenture EC	Bifenthrin	5.2-12.8 fl oz/A	12	14	++++	32 fl ozs (0.50 lbs ai)	30d
Bifenture 10DF	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Brigade WSB	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Closer SC***	Sulfoxaflor	2.75 – 5.75 fl oz/A	12	7	+	17.0 fl ozs (0.266 lbs ai)	7d
Danitol 2.4EC	Fenpropathrin	10.66-21.33 fl oz/A	24	14	+++	42.56 fl ozs (0.80 lbs ai)	10d
Endigo ZC	Thiamethoxam / Lambda-cyhalothrin	5-6 fl oz/A	24	35	++++	19 fl oz./A (0.172 lb ai) NY	10d
Gladiator	Zeta-Cypermethrin / Avermectrin B1	19.0 fl oz/A	24	28	++++	19 fl oz./A (0.172 lb ai) NY	21d
Lannate 2.4LV*	Methomyl	2.25 pt/A	72	14	++++	240 ozs (0.50 lbs ai)	7d
Lannate 90SP*	Methomyl	8-16 oz/A	72	14	++++	5.0 lbs	7d
Leverage 360	Beta-Cyfluthrin / Imidacloprid	2.4-2.8 fl oz/A	12	7	+++	2.8 fl oz/A	14d
Surround 95WP	Kaolin	25-50 lb/A	4	0	+	NA	0d
Voliam Xpress EC	Chlorantraniliprole / Lambda-cyhalothrin	6-12 fl oz/A	24	21	+++	31.0 fl oz/A	10d
Vydate 2L*	Oxamyl	4-8 pt/A	48	14	++	281 fl oz/A (128 oz AI/A).	7d
Warrior 1CS	Lambda-cyhalothrin	2.56-5.12 fl oz/A	24	21	++	20.48 fl. oz. (0.28 lb. a.i.)**	5d
Warrior II 2.08CS	Lambda-cyhalothrin	1.28-2.56 fl oz/A	24	21	++	10.24 fl. oz. (0.28 lb. a.i.)**	5d

* Although these materials have excellent topical ratings in lab bioassay studies, field efficacy studies have shown economic fruit injury from BMSB feeding, suggesting low residual levels.

** Post bloom applications

*** Feeding inhibition up to 72hr. post application

(+) low to (++++) high efficacy

• Maintain coverage Fuji, Ruby Frost, Mutsu (Crispin), Red & Golden Delicious, Pink Lady are preferred varieties by SB species and should be protected throughout harvest.

Variety Funnel: Fewer fruit are available for stink bug to move to during the harvest window into October. The last fruit in the orchard during years of high BMSB populations often are affected the most. In 2012, Pink Lady suffered over 20% injury as they were about to be harvested. Rome are not noticeably affected.

The Brown marmorated stink bug has been observed throughout the central and southern counties of NYS with very few found north of the Albany area (NYS BMSB Populations). Over the past three weeks, both adult and young nymph BMSB have been found in pheromone baited traps. We are also seeing newly emerging nymphs hatching from eggs in native grape found in Ulster County as of Friday, September 9th, indicating a 2nd generation and increasing BMSB populations as we move through harvest.

Woolly Apple Aphid:

Synopsis: Woolly Apple Aphid (WAA): Increasing populations of Woolly Apple Aphid have been reported this season, most problematic in mid-late season varieties of apple. The use of the pyrethroid class for BMSB management in August-September is likely reducing biological control that plays an important role in maintaining low levels of this insect pest.

If this insect appears during harvest, management may require the use of short PHI materials (7 day or lower), effective at eliminating the insect colony, reducing honeydew created by the pest along with the white cottony fibers to assure the fruit is commercially acceptable.

Management: of the WAA should include higher volume applications (>100 GPA) then what would be used for apple maggot and codling moth. The waxy covering protecting the insect from desiccation necessitates the use of a penetrant, providing more effective access to directed contact of the active ingredient to the developing WAA colony. Few insecticides are labeled and effective for use in NYS.

PHI will dictate the use of material choice nearing harvest. Diazinon (High degree of control) and Beleaf 50SG (Moderate Control) having a 21 day PHI. Movento 240 SC, also very effective earlier in the season, takes time for systemic activity to occur with late season applications in September. This insecticide may have greater challenges for uptake and distribution later in the season as sunlight and temperature decrease. Admire Pro 4.6SC and Assail 30SG are two options that should also be considered based on the 7 day PHI. Other products such as horticultural oils (Pure Spray, Bio-Cover) and soap (M-Pede; Gowan) may be options for conventional and organic growers requiring zero days to harvest (0 PHI), yet may prove challenging if high temperature or slow drying conditions prevail so as to cause fruit russet or phytotoxicity on susceptible varieties.

Note: Mixing formulations of diazinon or Danitol with Captan or Captec have caused crop injury in the past. Therefore, diazinon and Captan formulations should not be tank-mixed. This type of phytotoxicity results from either a direct interaction of the active ingredients or an interaction of the "inert" ingredients in one formulation that enhances the toxicity of the other one. (reference from Russ Holze and Dave Rosenberger)

Overview: The WAA tends to be a sporadic pest in orchards in the northeastern United States, occurring in high numbers only every few years. However, through the use of pyrethroids for the control of the brown marmorated stink bug we are seeing frequent and high infestations of this

Aerial Colony of WAA.

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Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Woolly apple aphid	1B	*Diazinon 50WP	1 lb/100 gal water	21/PF(A)	96	High	[36.1,36.1b]
	4A	*Admire Pro 4.6SC	7-10.5 fl.oz./acre	7	12	Moderate	[36.2]
	4A	Assail 30SG	2.5-4 oz/acre	7	12	Moderate	[36.1,36.1a]
	9C	Beleaf 50SG	2.0-2.8 oz/acre	21	12	Moderate	[36.1]
	23	Movento 240SC	6-9 fl.oz./acre	7	24	High	[29.4b,36.1]

insect pest on apple over the past few years. Since the

WAA is frequently parasitized by Aphelinus mali, a tiny wasp that is also native to North America, the use of pyrethroids late in the season have likely reduced the biological control provided by this important parasitoid.

Biology: The woolly apple aphid is considered to be native to North America, and can be found in most apple-growing areas of the world. The WAA feeds mainly on apple, but can also be found on pear, quince, mountain ash, hawthorn, and cotoneaster.

Life Cycle: The majority of nymphs are borne alive on apple trees by the un-mated female. The WAA nymph passes through four instars, changing in size from 0.6 mm (.02 in.) long in the first to 1.3 mm (.05 in.) long in the fourth instar. The nymphs are dark reddish-brown with a bluish-white waxy covering that becomes more extensive in the later instars. The first instar nymphs (crawlers), which are considerably more active than later instars, are a dispersal stage. They initiate aerial colonies in the spring from overwintering root infestations. The crawlers are carried by wind from tree to tree within an orchard or nursery, or move downward from the branches to initiate colonies on roots.

Damage: Cottony-white aerial colonies are found most frequently on succulent tissue, such as current season's growth, water sprouts, unhealed pruning wounds, or cankers. Heavy infestations can cause honey dew and sooty mold on the fruit, and galls on the plant parts. Underground colonies may be found throughout the year on the root systems of orchard trees or nursery stock. Severe root infestations can stunt or kill young trees, but usually cause little damage to mature trees. WAA can also transmit perennial apple canker, Pezicula malicorticis Jacks.

Biological Control: The WAA is frequently parasitized by Aphelinus mali, a tiny wasp that is also native to North America. Parasitized aphids appear as black mummies in the colony. A. mali has been successfully introduced to many apple-growing areas of the world, and is providing adequate control of the WAA in several areas. It does not provide sufficient control in commercial orchards in the northeastern United States because of its sensitivity to many commonly used insecticides; however, the wasp is thought to reduce WAA populations in abandoned orchards. Because the woolly apple aphids are somewhat protected by their waxy covering, regular spray programs may not provide adequate control. High volume applications of recommended insecticides may be necessary to penetrate the wax. Failure to control aerial infestations can result in underground infestations on susceptible rootstocks. Chemical control of root infestations is not possible; resistant rootstocks provide the only defense against underground infestations.

Rootstock Susceptability: Failure to control aerial infestations can result in underground infestations on susceptible rootstocks. Chemical control of root infestations is not possible; resistant rootstocks provide the only defense against underground infestations. The Mailing-Merton (MM) rootstock series was developed to provide resistance to WAA infestation. The M-9 series, M-26, M-27 are all susceptible to WAA. Its reproduction on these hosts is primarily parthenogenetic, that is reproduction without mating.

Management:

Diazinon is an excellent material against the WAA. . It is principally used prebloom for control of San Jose scale or postbloom for broad-spectrum control of major pests. It is generally less persistent than other standard phosphates. This insecticides has caused russeting or related finish problems on Golden Delicious, R.I. Greening, and Baldwin. No injury has been reported on McIntosh or closely related varieties yet only limited observations have been made on other varieties. Note that the material should not be used in tank mix with Captan under slow drying conditions, strong acids & alkalis and copper-containing compounds.

Spirotetramat (Movento) is a tetramic acid registered for the control of a number of indirect pests in pome fruits and stone fruits, primarily aphids (including woolly apple aphid), mealybugs, pear psylla, and San Jose scale. It has systemic activity, exhibiting 2-way movement in the plant, both upwards in the xylem to new shoots and leaves, and downwards in the pholem to the root tissues. Its mode of action is as a Lipid Biosynthesis Inhibitor (LBI), and it is active by ingestion against immature insects feeding on treated plants. Additionally, adult females have exhibited reduced fecundity and offspring survival.

Acetamiprid (Assail) belongs to the neonicotinoid group of insecticides (along with *AdmirePro and *†Actara). It was registered by the US EPA under the reduced risk pesticide policy and is considered a replacement for older OP insecticides. Assail has a spectrum of effectiveness across several insect groups, and is active against pests such as plum curculio, apple maggot, internal leps, aphids, leafhoppers, leafminers, San Jose scale, European apple sawfly and mullein plant bug, plus pear pests such as pear psylla and Comstock mealybug.

Imidacloprid (*Admire Pro, *Leverage) is a broad spectrum contact and locally systemic chloronicotinyl insecticide with low mammalian toxicity. It is primarily effective against aphids, whiteflies, thrips, scales (crawlers), pyslla, leafhoppers, mealybugs, some beetle and weevil species, and leafminers. The original *Provado formulation has been replaced by *AdmirePro, which is labeled on pome and stone fruits for aphids (except woolly apple aphid), leafminers, leafhoppers, San Jose scale, pear psylla, mealybug, Japanese beetle, cherry fruit flies and San Jose scale. It has also shown activity against pear midge when applied at petal fall. It is additionally labeled for use as a soil-applied product against woolly apple aphid. This material has no effect on any mites, beneficial or phytophagous, but is hard on Stethorus. Mite flare-up is often associated with use of Imidacloprid during the season.

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USDA

2017 Value Added Producer Grants – Deadline January 31, 2018 (or January 24th on-line)

Liz Higgins- ENYCHP

The USDA Value Added Producer Grant provides 1:1 matching grants to help agricultural producers and groups of agricultural producers add value to their commodities. Value is added by processing, marketing or market differentiation/labeling. To help you see if the VAPG might be a good fit for a project that you have in mind I have provided a list of some of the value-added projects that were funded last year specifically in tree fruit. Lots of hard cider. However in prior years marketing new varieties, reaching new markets and developing additional products were all funded. This year there is only $18 million available so it will likely be a more competitive round than prior years. I have put a link to the webinar that I offered on the program on the Eastern NY team Facebook Site. https://www.facebook.com/CCEENYCHP/

2016 tree fruit projects ($45 million available)

Delaware FIFER ORCHARDS, INC. $250,000 To expand marketing efforts for a family-owned apple orchard. The orchard sells its produce directly through its Farm and Country

Maine RICKER HILL ORCHARDS $250,000 To unify the brand, expand product reach nationally, and to increase production of raw apple cider vinegar, hard cider, fruit wines, and carbonated sweet ciders.

Michigan MACKINAW TRAIL WINERY, INC. $193,500 To support market expansion of hard apple cider.

Montana BIG MOUNTAIN CIDERWORKS $235,689 To process pears and apples into hard cider and distribute them locally

New York FISHKILL FARMS, LLC $53,625 To explore

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the feasibility of creating a cidery and producing hard cider from apples grown in the farm's organic and ecologically grown apple trees.

New York VIZCARRA FAMILY VINEYARDS LLC $250,000 To expand sales and promotion of hard cider products.

New York DONOVAN ORCHARDS LLC $185,000 To expand sales and promotion of hard cider products

Oregon THOMPSON CREEK ORGANICS $100,000 To process and market apple wine and Pommeaus. Marketing costs will consist of website development, new materials to advertise cider club, and additional staff to conduct demo tastings to collect consumer input.

Pennsylvania OYLERS ORGANIC FARMS $24,530 To expand the production of certified organic applesauce and increase retail and wholesale sales through a marketing campaign

South Carolina LAND, EDWARD $36,505 To produce brandy from apples grown on applicant's farm

Tennessee GOUGE, ETHAN $10,000 To develop a feasibility study in conjunction with University of Tennessee to determine the feasibility of a farm-based cider production that would add value to the farm's certified Organic orchard while tapping into growing markets for local farm products.

Utah STRAY ARROW RANCH LLC $12,500 To produce a market feasibility study for the Stray Arrow Cidery in Torrey Utah.

Virginia SEAMANS' ORCHARD, L.C. $250,000 To increase the marketing and sales of locally produced apples

Virginia VINTAGE VIRGINIA APPLES, LLC $250,000 To provide working capital to hire more staff, purchase packaging, and hire a marketing firm to expand cider business

Washington CENTER VALLEY ORCHARD, LLC $250,000 To implement the business and marketing plan for a community supported cider program at Finnriver Farm & Cidery

Wisconsin LEFFEL ROOTS, LLC $22,530 To fund the processing and distribution costs associated with adding three value-added product lines: bakery items, cider and hard cider

Wisconsin ONEIDA NATION $37,500 To conduct a feasibility study, and create a business plan and market study for processing apple chips.

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