

Research of Nursery Greenhouse Policy

Deliverable 2.4.3. Final Research Report

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EXECUTIVE SUMMARY

The Statement of Work (SOW) for Order No: 140D0420F0036 P00003 Task Order #3 - Research of Nursery Greenhouse Policy requested research into the greenhouse industry to determine the feasibility of adding provisions to the current nursery crop insurance program or developing a program separate from the existing program. In addition to these efforts, stakeholders requested research into alternative approaches to compensate plant producers for their losses to specific destruction orders carried out to limit the spread of potentially catastrophic plant diseases.

The first practical challenge to assessing the feasibility of offering a crop insurance product for Greenhouse/Controlled Environment Agriculture (CEA) is defining what it is (and what it is not) and measuring its scope when there is relatively little consensus of what to measure and how to measure it. Greenhouse and CEA encompass a variety of production and marketing activities. The National Agricultural Statistics Services (NASS) publishes two censuses beneficial for this project: Census of Agriculture and Census of Horticultural Specialties. Both report data for production “under protection.” Slightly different definitions of “under protection” are stated in these censuses. These definitions do not impose any conditions other than physical properties. Heating and cooling may be passive. A CEA structure, on the other hand, is one in which some or all the variables affecting plant development are controlled. It can be any type of structure, including ocean shipping containers or a brick and mortar building with no windows. Defining the type of structure required to qualify for crop insurance under a CEA policy is needed.

Collection of large volumes of independently verifiable quantitative data to evaluate risk is critical for conventional crop insurance development feasibility. Both NASS censuses provide data concerning production, sales, and other attributes of the business activity. However, the proportion of the data that relate to specifically delineated CEA activities is not known. The amount of production in enclosed brick and mortar buildings or in ocean shipping containers is not known. The definitions of “under cover” do not appear to include an environment in which all factors affecting productivity (hours of daylight/artificial light, amount of water, temperature, nutrients, etc.) are controlled.

As with any feasibility assessment, stakeholder input and feedback are critical components. The limitations on gatherings and other restrictions imposed by the COVID-19 pandemic precluded the listening sessions that normally would have been undertaken. Interviews with industry leaders and virtual sessions were used to obtain the greatest possible amount of stakeholder feedback. Stakeholders were very generous with their time and accommodating to the technology. While no on-site sessions were held, extensive and very high quality comments and input were collected.

The Contractor evaluated existing programs and potential models for development of a program for CEA, with particular interest in the Whole Farm Revenue Protection, Nursery, Nursery Value Select (NVS), and Quarantine Pilot Programs. Information concerning insurance risks for greenhouse production is limited for any of these programs, with experience under the current Nursery crop insurance policy being the most robust. Information concerning risks in CEA production is even more limited. The available evidence shows a meaningful share of CEA production differs from production covered by the existing Nursery and NVS policies. A portion

of CEA production is covered by Nursery and NVS policies for specific types/categories. For CEA the most important factors affecting production are controlled. The proper amount of water and nutrients are supplied in a CEA environment. Temperature is controlled. Lighting is controlled. These methods include aeroponics, a practice in which a nutrient-laden solution is sprayed on the roots of the plant or hydroponics, wherein plants are grown in nutrient-laden solution with or without a medium. The difference is the roots are in the solution or are sprayed with the solution. In neither case is a plant grown in a standard nursery pot or in the field. The plant may not be sold with roots attached. These are conditions of insurance under the Nursery and NVS policies. The existing Nursery and NVS crop insurance policies do not meet all the needs of CEA growers. For many, this is because those existing policies insure the plant, not the products of a plant. These policies also cover risks that are mitigated in CEA production. For example, hail or fire risk may be effectively non-existent for CEA. A premium rate might reduce the risk charge for those risks that are reduced in CEA. Many CEA operations are oriented to selling cuttings from or the fruits of a plant (tomatoes, cucumbers, peppers, etc.) and discarding the plant when its productivity declines. In many respects, much CEA production is similar to the production of field crops with multiple plantings/multiple harvests (sweet corn, peppers) or single planting/multiple harvest (strawberries). These crops are insured when produced in a field, but coverage is not offered for CEA production. Many of the stakeholders interviewed in the development of this report represent ‘young plant’ operations dedicated to rearing clones, cuttings, and seedlings as the first phase of a multi-segment plant development process and these operations are ineligible for coverage under the existing program, but expresses strong interest in the principles of the NVS design. Based on consideration of each existing program, the Contractor believes NVS provides the most appropriate model for consideration of development of a new program for CEA.

The Agricultural Improvement Act of 2018 (2018 Farm Bill) specifically requested information concerning a disease named *Ralstonia* (*solanacearum* race 3 biovar 2 (RSr3b2)). This disease affects the roots of certain plants, notably potatoes, tomatoes, peppers, tobacco, and eggplant (closely related plants in the *solanaceae* group). The 2018 Farm Bill specifically referenced an outbreak in 2004 in the state of Michigan. That outbreak affected growers in 27 states. Another outbreak occurred in 2020, affecting 288 growers in 39 states. In both cases, the pathogen was introduced via imports of geranium clippings. There is no approved treatment for this disease. Infected or potentially affected plants must be destroyed. The Contractor could not find any evidence of a compensation program similar to those available for livestock that must be destroyed to prevent the spread of disease. It can be questioned whether this peril constitutes a “natural disaster” as defined in the Act (7 U.S.C. 1508(a)(1)). It is a disease that can occur naturally and there are no specific actions or labeled products that prevent or treat the disease. The clippings were allowed to enter the United States at the port of entry. The Contractor carefully reviewed the legal authority under which Animal and Plant Health Inspection Service (APHIS) has compensated livestock producers following depopulation orders and the limitations currently imposed on the authority to compensate for plant producers. In addition to pursuing insurance development, the Contractor believes stakeholders may choose to address their concerns, in part, through requesting modifications to the APHIS authorities.

I. INTRODUCTION

The SOW for Order No: 140D0420F0036 P00003 Task Order #3 - Research of Nursery Greenhouse Policy requested research into the greenhouse industry to determine the feasibility of adding provisions to the current nursery crop insurance program or developing a program separate from the existing program. As with any feasibility assessment, stakeholder input and feedback are critical components. The limitations on gatherings and other restrictions imposed by the COVID-19 pandemic precluded the listening sessions that normally would have been undertaken. Interviews with industry leaders and virtual sessions were used to obtain the greatest possible amount of stakeholder feedback.

The 2018 Farm Bill provides the underlying basis for this Order, as follows:

“The Agricultural Improvement Act of 2018 (2018 Farm Bill) directed RMA to: “offer to enter into 1 or more contracts with 1 or more qualified persons to carry out research and development, regarding a policy to insure in a controlled environment such as a greenhouse—(I) the production of floriculture, nursery, and bedding plants; (II) the establishment of cuttings or tissue culture in a growing medium; or (III) other similar production, as determined by the Secretary.” The 2018 Farm Bill requires “research and development described [above] shall evaluate the effectiveness of policies for the production of plants in a controlled environment, including policies that—

- (i) are based on the risk of—
 - (I) plant diseases introduced from the environment;*
 - (II) contaminated cuttings, seedlings, or tissue culture; or*
 - (III) Federal or State quarantine or destruction orders associated with the contaminated items described in subclause (II);**
- (ii) consider other causes of loss applicable to a controlled environment, such as a loss of electricity due to weather;*
- (iii) consider appropriate best practices to minimize the risk of loss;*
- (iv) consider whether to provide coverage for various types of plants under 1 policy or to provide coverage for 1 species or type of plant per policy;*
- (v) have streamlined reporting and paperwork requirements that take into account short propagation schedules, variable crop years, and the variety of plants that may be produced in a single facility; and*
- (vi) provide protection for revenue losses.”*

The SOW states the objectives are the following:

- 1) To obtain analysis, determine the viability and determine issues related to insuring nursery crops grown in controlled environments, as outlined by the 2018 Farm Bill. The Contractor shall produce a research report that determines the viability of adding provisions to the nursery crop insurance program offered by RMA or developing an insurance program(s) separate from the RMA-offered nursery crop insurance program. If the latter, the Contractor will recommend the most viable type of insurance program.*
- 2) At RMA’s option, to develop a policy for nursery crops in a controlled environment that conform to the requirements in the 2018 Farm Bill.*

If the Risk Management Agency (RMA) decides the evidence supports development of a pilot crop insurance product, the Contractor is required to draft an insurance program (in a later phase of development) that meets the following criteria:

- 1) *Provides meaningful and timely risk management benefits to nursery greenhouse producers at a national level, without distorting markets;*
- 2) *Is cost effective from the perspective of nursery greenhouse producers;*
- 3) *Is actuarially sound so that premium rates will cover expected losses plus a reasonable reserve;*
- 4) *Is able to be consistently administered given the structure and resources of RMA and approved insurance providers; and*
- 5) *Is marketable based on industry input and feedback.*

The Contractor is directed to research the potential to offer a policy for crop insurance to greenhouses and/or their production and determine if a program is viable. The research must address the following risks and issues, among other risks and issues determined in the Draft Report. The SOW states the risks that must be addressed:

- 1) *The risk of—*
 - (I) *plant diseases introduced from the environment;*
 - (II) *contaminated cuttings, seedlings, or tissue culture; or*
 - (III) *Federal or State quarantine or destruction orders associated with the contaminated items described in subclause (II);*
- 2) *Causes of loss applicable to a controlled environment, such as a loss of electricity due to weather;*
- 3) *Appropriate best practices to minimize the risk of loss;*
- 4) *Various types of plants under one policy or for one species or type of plant per policy;*
- 5) *Streamlined reporting and paperwork requirements that take into account short propagation schedules, variable crop years, and the variety of plants that may be produced in a single facility; and*
- 6) *Revenue losses.*

As stated previously, listening sessions are necessary to develop fully the insurable risks and gaps in available insurance coverage for greenhouse growers. Available literature does not fully document the nature of these risks, particularly in the context of crop insurance. Direct contact with greenhouse operators will provide complete information. The Contractor was able to have three virtual listening sessions and five follow up interviews with the industry in January 2021. These were beneficial to determine the risks and concerns of the greenhouse industry. This Research Report includes analysis and results, for each section based on research conducted and input from crop experts, industry stakeholders, and extension specialists from land grant universities.

The review found published data regarding plants produced ‘under protection’ in the Census of Agriculture and in the Census of Horticultural Specialties. ‘Under protection’ is subdivided into greenhouse and shade. The Census of Agriculture defines production ‘under protection’ as “...plants grown under a structure (such as glass, fiberglass, plastic, or saran) for the entire

growing season.”¹ The Census of Horticultural Specialties defines a greenhouse as an area “... covered by glass, rigid plastic and plastic film.”² This census further defines a greenhouse as a structure with a transparent roof regardless of the material used for its sides. These definitions focus on the structure in which the plants are grown, not the practices used for production.

The term CEA refers to plants grown with control over one or more factors affecting growth. The plants might be afforded minimal protection from the elements at one end of a continuum to complete control of all factors affecting the physical development of the plant: the intensity and amount of light, temperature, relative humidity, irrigation, fertilization, etc. The structure may be fabricated of plastic film over wood or metal framing, a glass greenhouse, a brick and mortar building with no windows, a converted shipping container, a pole barn, or any structure that does not have a transparent roof. Plants in this environment may be produced in soil without standard nursery pots, in standard nursery pots, in nutrient-rich water continuously, or in spray placed on bare roots. There is no way to discriminate the Census data by degree of control over the environment in which the plants were grown.

The existing Nursery crop insurance policy³ does not define the type of structure used for the container grown practice. The Nursery Crop Provisions require the plants to be in standard nursery containers; the NVS Crop Provisions require standard nursery containers or a growing medium suitable for the plant (including a hydroponic tank). The plants must be intended for sale as plants with the roots attached. Incidental production of fruits and nuts is allowed but that production is not insured. CEA production encompasses vegetables (tomatoes, peppers, cucumbers, lettuces, and others) and other edible products that are severed from the plants and sold. The plants are discarded. Plants may be severed from the roots for sale as floral or other decorative arrangements. These differences in production methods and manner of sale render the existing Nursery crop insurance policies unusable for certain elements of the CEA industry.

An emerging phenomenon is denoted as “urban agriculture.” This term refers to CEA production within urban areas, generally within highly controlled environments. These operations focus on providing fresh produce to restaurants and grocers. The Contractor found no data specific to these operations. These operations reportedly often are highly automated with significant automation and control over growing conditions. The need for a traditional Federal crop insurance, particularly traditional weather-peril based coverage, is deemed to be very low if it does not also include coverage for disease and other CEA-relevant perils.

¹ 2017 Census of Agriculture Report Form Guide, page 29.

(https://www.nass.usda.gov/AgCensus/Report_Form_and_Instructions/2017_Report_Form/2017_Census_of_Agriculture_Report_Form_Guide.pdf)

² 2019 Census of Horticultural Specialties Instruction Sheet, page 4.

(https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Census_of_Horticultural_Specialties/2019-census-of-hort-instruction-sheet.pdf)

³ The Nursery Value Select (NVS) crop insurance policy is substantially the same as the Nursery policy in this regard.

II. RISK ANALYSIS

This section addresses the requirements in the SOW that the Contractor provide:

Risk Analyses – The Contractor shall define the economic perils; collect data to identify and quantify these perils; identify data that are unavailable, but necessary to quantify these risks; estimate the frequency and severity of the most important perils that currently are uninsured, classify each of the perils as insurable or uninsurable and justify the classification of the risk. The Contractor shall also identify man-made or created perils that can affect the crop and describe when and how these perils can occur. The Contractor shall also identify state, county and regional grading standards and USDA grading standards; determine the identity and independence of the grading agency and entity that performs the grading evaluation; provide a copy of the most recent grading standards; determine alternative uses for the reduced quality crop. The Contractor shall also report any history of disaster program payments, including NAP, as a result of any action for the past ten years of available data. The data shall be from acceptable and appropriately-cited sources.

II.A. CEA Production Data

The 2017 Census of Agriculture (2017 Census) provides a detailed compilation of data concerning crop production “under cover.” The term does not specifically identify the production area and value of crops grown with CEA practices. It simply reports production under cover. The 2017 Census form asks respondents to identify crops grown “under glass or other protection.”⁴ The Report Form Guide for the 2017 Census provides this information: “Area under protection refers to plants grown under a structure (such as glass, fiberglass, plastic, or saran) for the entire growing season.”⁵ Crops covered only temporarily to be further grown in the open should not be included for area under protection.” Thus, crop production occurring in any permanent or temporary structure qualifies as grown under glass or other protection if it is used for an entire growing season. In addition, under the 2017 Census, any tract, whether urban or rural, qualifies for reporting if at least \$1,000 in gross sales were realized or would have been realized.

The Census of Horticultural Specialties (Horticultural Census), conducted every five years ending two years after the Census of Agriculture, specifically defines structures that qualify as greenhouses in its instructions. Instructions for Section 23 Item 1 state: “Report the area (square feet) covered by glass, rigid plastic and plastic film greenhouses. The roof covering (glazing) determines the greenhouse classification. For example, a structure with a glass roof, but insulated fiberglass sides is considered a glass greenhouse. Or, a structure that has an acrylic plastic roof with film plastic sides that can be rolled up in warmer weather should be considered a rigid plastic greenhouse.”

⁴ https://www.nass.usda.gov/AgCensus/Report_Form_and_Instructions/2017_Report_Form/17a100_121316_general_final.pdf, page 10, Accessed June 2020.

⁵ 2017 Census of Agriculture Report Form Guide, page 29.

https://www.nass.usda.gov/AgCensus/Report_Form_and_Instructions/2017_Report_Form/2017_Census_of_Agriculture_Report_Form_Guide.pdf. Accessed June 2020.

As will be discussed later in this document, CEA activities also occur in brick and mortar buildings such as old factories or warehouses or in shipping containers. All elements, such as light, water, fertilizer, etc., needed to support plant growth are provided artificially in these applications. Neither census appears to provide for reporting such production, also known as “urban agriculture.”

Table 1 summarizes the data from the 2017 Census of Agriculture regarding horticultural production. These data are at the national level; state-and county-level data also are reported by the 2017 Census. Acres in production, as reported in Table 1, are derived from square feet in production (43,560 sq. ft. = 1 acre) as reported in the 2017 Census. The purpose of this calculation is to provide perspective of the size of this industry and of individual commodities or commodity groups relative to currently insurable crops. The column “crop insurance available” represents a best assessment by the Contractor regarding whether the plant classification could be included under the current nursery program (Nursery) or the NVS program. According to the Contractor’s assessment, a substantial number of commodities grown under cover (crop insurance flag = N) may not be insurable under the existing crop insurance policies. A question mark indicates that certain plants within the category may be insurable under these policies, but others may not.

Table 1. Data Regarding Horticultural Production Under Cover, 2017 Census of Agriculture, by Commodity Group

Plant Category	Operations with Area in Production (no.)	Square feet in production (1,000)	Acres in Production	Crop Insurance Available
Aquatic plants	331	1,308	30	N
All bedding plants	12,919	383,835	8,812	Y
Dry bulbs & corms & rhizomes & tubers	347	1,683	39	N
Cut flowers and cut cultivated greens	2,078	228,441	5,244	N
Floriculture, total	17,051	869,497	19,961	N/A
Floriculture, other	636	13,132	301	N/A
Flower Seeds	294	495	11	N
Flowering Plants, Potted	4,206	145,629	3,343	Y
Foliage plants	2,670	98,459	2,260	Y
Fruit, totals	838	11,708	269	N
Mushrooms	1,261	36,283	833	N
Mushroom spawn	46	36,281	833	N
Nursery totals	4,302	308,880	7,091	Y
Propagative material	1,356	37,174	853	N
Tomatoes	7,974	63,930	1,468	N
Transplants, tobacco	267	3,260	75	Y
Transplants, vegetable and strawberry	2,058	29,860	685	Y
Vegetable seeds	599	8,973	206	N
Vegetable, totals	10,849	112,564	2,584	N
Totals	70,082	2,391,391	54,899	

Source: Contractor’s Underwriting Department, after 2017 Census of Agriculture, NASS, USDA.

Table 2 displays operations reporting crops grown in greenhouses or under protection in the NASS Census of Agriculture by year for the last four censuses. Most of these crops fall under the Horticulture and Floriculture categories. While this data provides a snapshot into the total

number of operations in the growing crops under protection, it is not nearly specific nor consistent enough to allow for the statistical analysis required for insurance policy development.

Table 2. NASS Census of Agriculture - Crops Grown in Greenhouses/Under Protection (Total Operations)

	2002	2007	2012	2017
Aquatic Plants, Under Protection	621	364	277	331
Bedding Plant Totals, Under Protection	16,849	14,747	14,216	12,919
Bulbs & Corms & Rhizomes & Tubers, Dry, Under Protection	576	247	193	347
Cut Flowers & Cut Cultivated Greens, Under Protection	1,754	1,316	1,706	2,078
Floriculture Totals, Under Protection	21,728	18,670	18,724	17,051
Floriculture, Other, Under Protection		172	880	636
Flower Seeds, Under Protection	340	191	212	294
Flowering Plants, Potted, Indoor Use, Under Protection	6,806	5,006	4,051	4,206
Foliage Plants, Indoor Use, Under Protection	3,237	2,099	2,300	2,670
Fruit Totals, Under Protection		249	673	846
Horticulture Totals, (Excl Cut Trees), Under Protection	29,104			
Nursery Totals, Under Protection	4,956	4,590	4,883	4,302
Nursery, Other, Incl Greenhouse, Under Protection	1,341			
Nursery, Other, Under Protection		228		
Propagative Material, Under Protection		1,066	1,114	1,356
Tomatoes, Under Protection		2,926	6,323	7,974
Transplants, Commercial, Tobacco, Under Protection		438	447	267
Transplants, Commercial, Vegetable & Strawberry, Under Protection		1,135	1,942	2,058
Vegetable Seeds, Under Protection	542	361	555	599
Vegetable Totals, Incl Fresh Cut Herbs, Under Protection	3,416	4,075	8,750	10,849
Total	91,270	57,880	67,246	68,783

Source: Contractor's Underwriting Department, from NASS, USDA QuickStats.

Table 3 displays the number of square feet (in thousands) of crops reported to be grown in greenhouses or under protection in the NASS Census of Agriculture by year in the last four censuses. This provides a snapshot into the size of the greenhouse industry, though the actual production represented is difficult to gauge. The square foot measurement does not provide insight into the productivity of a crop, i.e. the height of the shelves, the additional management in greenhouse growing conditions likely leading to greater productivity, or the longer production season/potential for year round harvests. It does provide a relative indication of the size of the crop categories relative to one another for cases where significant differences can be noted.

Table 3. NASS Census of Agriculture - Crops Grown in Greenhouses/Under Protection (Sq. Ft.) (Thousands)

	2002	2007	2012	2017
Aquatic Plants, Under Protection	3,546	1,712	1,642	1,308
Bedding Plant Totals, Under Protection	386,963	361,051	363,168	383,835
Bulbs & Corms & Rhizomes & Tubers, Dry, Under Protection	4,044	2,112	1,306	1,683
Cut Flowers & Cut Cultivated Greens, Under Protection	230,314	174,340	235,151	228,441
Floriculture Totals, Under Protection	973,658	819,941	873,291	869,497
Floriculture, Other, Under Protection	0	2,049	13,974	13,132
Flower Seeds, Under Protection	1,188	320	369	495
Flowering Plants, Potted, Indoor Use, Under Protection	173,130	142,638	137,145	145,629
Foliage Plants, Indoor Use, Under Protection	183,251	139,863	123,852	98,459
Fruit Totals, Under Protection	0	0	7,951	11,708
Nursery Totals, Under Protection	187,766	221,814	258,499	308,880
Nursery, Other, Incl Greenhouse, Under Protection	16,117	0	0	0
Nursery, Other, Under Protection	0	1,431	0	0
Propagative Material, Under Protection	0	29,976	35,628	37,174
Tomatoes, Under Protection	0	43,950	55,181	63,930
Transplants, Commercial, Tobacco, Under Protection	0	3,965	4,487	3,260
Transplants, Commercial, Vegetable & Strawberry, Under Protection	0	20,248	21,527	29,860
Vegetable Seeds, Under Protection	1,865	838	4,801	8,973
Vegetable Totals, Incl Fresh Cut Herbs, Under Protection	64,364	61,766	98,000	112,564
Total	2,226,206	2,028,011	2,235,972	2,318,827

Source: Contractor's Underwriting Department, from NASS, USDA QuickStats.

The total number of operations indicated in Table 1 is the sum of the number of operations reported for each plant classification. Hence, a producer of two or more plant classifications is included multiple times. For perspective, 23,221 operations reported production under cover for the 2014 Census of Horticulture. These data indicate the number of growers and the total area involved in production may exceed that of some currently insurable commodities.

Some commodities, such as tomatoes, do have crop insurance policies in existence. However, those Crop Provisions clearly are oriented toward field planting in soil, not grown under CEA conditions. For example, the Fresh Market Tomato (Dollar Plan) crop insurance policy defines the insured crop as "... all the field grown mature green or ripe fresh market tomato types in the county..." Field grown is not a defined term. It is possible that all or a portion of a tomato crop planted in a field may be grown "under cover" (such as shade cloth) and be insurable as a fresh tomato crop and be included in Census reports as being grown "under protection." A similar consideration applies to other commodities identified in Tables 1, 2, and 3.

The most recent Census of Horticultural Specialties was conducted for calendar year 2014. Questionnaires have been mailed for calendar year 2019; data were reported in December 2020.

The 2014 Horticultural Census included operations reporting \$10,000 or more of horticultural sales during that calendar year. These data are summarized by "Kind of Business," whereas the data in Tables 1, 2, and 3 are summarized by commodity types. The number of operations shown in Table 4 may be a better reflection of the businesses actually operating in this production space. Slightly more than half of the horticultural specialty operations are family or

individually owned. About one-third are corporately owned, while the remainder are partnerships or other forms of ownership.

Table 4. Number of Horticultural Specialty Operations in 2014 and Legal Status for Tax Purposes, by Kind of Business, 2014

Kind of Business	Family or Individual	Partnership	Corporation	Other*	Total
Annual bedding/garden plants	3,157	420	1,900	66	5,543
Aquatic plants	36	8	39	1	84
Cut Christmas trees	2,083	297	465	48	2,893
Cut cultivated greens	225	15	81	1	322
Cut flowers and cut lei flowers	640	89	266	16	1,011
Dried bulbs, corms, rhizomes, and tubers	55	10	30	-	95
Flower seeds	27	3	22	4	56
Foliage plants for indoor or patio use	254	18	314	7	593
Food crops grown under protection	934	117	459	93	1,603
Nursery stock	2,437	471	3,004	51	5,963
Other *(see text)	662	80	421	26	1,189
Potted flowering plants for indoor or patio use	354	50	404	23	831
Potted herbaceous perennial plants	498	76	317	22	913
Propagative horticultural materials, bareroot, and unfinished plants	164	33	215	33	445
Sod, sprigs, or plugs	438	117	628	17	1,200
Transplants for commercial vegetable and strawberry production	112	29	80	5	226
Vegetable seeds	117	40	91	6	254
All horticultural specialty operations	12,193	1,873	8,736	419	23,221

* Cooperative, estate or trust, institutional, etc.

Source: Contractor's Underwriting Department after 2014 Census of Horticultural Specialties, NASS, USDA.

Table 5 displays the number of operations from both the 2009 and 2014 Censuses of Horticulture listed as growing plants specifically categorized as grown in a greenhouse or under protection. Some of these totals correlate with those reported in the Census of Agriculture, while others, notably the vegetables, are reported by type rather than commodity totals.

Table 5. NASS Census of Horticulture - Crops Grown in Greenhouses/Under Protection (Total Operations)

	2009	2014
Aquatic Plants, Under Protection	284	265
Bedding Plants, Annual, Under Protection, Greenhouse	7,751	7,665
Bedding Plants, Herbaceous Perennial, Under Protection, Greenhouse, Pots	4,882	4,745
Bulbs & Corms & Rhizomes & Tubers, Dry, Under Protection	64	63
Cut Cultivated Greens, Under Protection, Greenhouse	152	197
Cut Flowers, Under Protection, Greenhouse	820	969
Flower Seeds, Under Protection	29	62
Flowering Plants, Potted, Indoor Use, Under Protection, Greenhouse	3,644	3,632
Foliage Plants, Indoor Use, Under Protection, Greenhouse, Hanging Baskets	1,085	940
Foliage Plants, Indoor Use, Under Protection, Greenhouse, Pots	1,956	1,906
Herbs, Fresh Cut, Under Protection	323	524
Horticulture Totals, Under Protection, Greenhouse	13,546	14,593
Horticulture, Other, Under Protection, Greenhouse	2,809	3,731
Lettuce, Under Protection	338	763
Nursery Totals, Under Protection, Greenhouse	3,642	3,815
Peppers, Under Protection	265	534
Strawberries, Under Protection	76	130
Tomatoes, Under Protection	1,148	1,889
Transplants, Commercial, Tobacco, Under Protection	189	183
Transplants, Commercial, Vegetable & Strawberry, Under Protection	403	543
Vegetable Seeds, Under Protection	61	80
Total	43,467	47,229

Source: Contractor’s Underwriting Department, from NASS, USDA QuickStats.

Table 6 displays the number of square feet (in thousands) of crops reported grown in greenhouses or under protection in the NASS Census of Agriculture by year in the last two Censuses of Horticulture. Crop production for several categories is significant. In addition to traditional nursery crop production, a significant amount of food crop production is grown under protection. Of these, the most notable is tomatoes and transplant stage crops (see Table 7).

Table 6. NASS 2014 Census of Horticulture - Crops Grown in Greenhouses/Under Protection (Sq. Ft.) (Thousands)

	2009	2014
Aquatic Plants, Under Protection	1,534	1,160
Bedding Plants, Annual, Under Protection, Greenhouse	260,797	268,430
Bedding Plants, Herbaceous Perennial, Under Protection, Greenhouse, Pots	94,206	97,763
Bulbs & Corms & Rhizomes & Tubers, Dry, Under Protection	350	332
Cut Cultivated Greens, Under Protection, Greenhouse	4,244	4,570
Cut Cultivated Greens, Under Protection, Shade Structures	152,820	167,687
Cut Flowers, Under Protection, Greenhouse	53,610	54,851
Flower Seeds, Under Protection	103	185
Flowering Plants, Potted, Indoor Use, Under Protection, Greenhouse	123,127	127,512
Foliage Plants, Indoor Use, Under Protection, Greenhouse, Hanging Baskets	17,371	18,293
Foliage Plants, Indoor Use, Under Protection, Greenhouse, Pots	41,725	48,662
Herbs, Fresh Cut, Under Protection	5,929	13,854
Horticulture Totals, Under Protection, Greenhouse	859,063	894,907
Horticulture, Other, Under Protection, Greenhouse	128,915	140,584
Lettuce, Under Protection	2,753	4,330
Nursery Totals, Under Protection, Greenhouse	178,847	174,232
Peppers, Under Protection	1,230	3,522
Strawberries, Under Protection	939	623
Tomatoes, Under Protection	39,962	42,597
Transplants, Commercial, Tobacco, Under Protection	3,760	3,775
Transplants, Commercial, Vegetable & Strawberry, Under Protection	32,286	31,582
Vegetable Seeds, Under Protection	238	135
Total	2,003,809	2,099,588

Source: Contractor's Underwriting Department, from NASS, USDA QuickStats.

Table 7. 2014 NASS Horticultural Census Food Crop Production Under Protection Distribution of Square Feet in Production

Crop	Distribution (Percent)
Herbs, Fresh Cut, Under Protection	14
Lettuce, Under Protection	4
Peppers, Under Protection	4
Strawberries, Under Protection	1
Tomatoes, Under Protection	42
Transplants, Commercial, Tobacco, Under Protection	4
Transplants, Commercial, Vegetable & Strawberry, Under Protection	31

Source: Contractor's Underwriting Department, from NASS.

Like the Census of Agriculture, the Horticultural Census also includes data about greenhouses and shade structures: number of operations with area in production and square feet in production with separate tabulations for greenhouses built in the census year; and for greenhouses only, the type of construction (film plastic, glass, or rigid plastic). Tables 8 and 9 report the data concerning greenhouses and greenhouse construction by type. Table 8 reports number of operations; Table 9 reports area in square feet. Nearly 15,000 operations (about 65 percent of all operations with production under cover) reported greenhouses. Total area under protection with structures that NASS classifies as greenhouses was more than 20,000 acres (note: the data are reported in square feet; the Contractor converted those data to acres (1 acre = 43,560 sq. ft.) to provide a perspective of the extent of this industry relative to smaller acreage crops that presently are insurable. The sum of the number of greenhouses by type exceeds the number of operations since an operation might have multiple types of greenhouses.

Table 8. NASS Horticulture Operations by Type of Greenhouse

	2009	2014
Horticulture Totals, Under Protection, Greenhouse - Operations With Area In Production	13,546	14,593
Horticulture Totals, Under Protection, Greenhouse, Built Within Current Year	868	1,002
Horticulture Totals, Under Protection, Greenhouse, Film Plastic	11,930	12,757
Horticulture Totals, Under Protection, Greenhouse, Glass	1,703	1,485
Horticulture Totals, Under Protection, Greenhouse, Rigid Plastic	2,898	3,178

Source: Contractor's Underwriting Department, from NASS, USDA QuickStats.

Table 9. NASS Horticulture Operations Sq. Ft. in Production by Type of Greenhouse

	2009	2014
Horticulture Totals, Under Protection, Greenhouse - Sq Ft In Production	859,063	894,907
Horticulture Totals, Under Protection, Greenhouse, Built Within Current Year	16,279	16,194
Horticulture Totals, Under Protection, Greenhouse, Film Plastic	624,736	640,216
Horticulture Totals, Under Protection, Greenhouse, Glass	114,037	122,502
Horticulture Totals, Under Protection, Greenhouse, Rigid Plastic	120,290	132,189

Source: Contractor's Underwriting Department, from NASS, USDA QuickStats.

NASS also publishes an annual report on Floriculture. “This annual full-text report presents data on floriculture crops including cut flowers, potted flowering plants, foliage plants, potted herbaceous perennials, annual bedding/garden plants, cut cultivated greens, propagative floriculture material and special Hawaiian crops. The data includes quantity sold, percent of sales at wholesale, wholesale price and value of sales at wholesale for 15 program states and growers having \$100,000 or more in sales. Additionally, the number of growers, growing area and operations with hired workers for growers with \$10,000 or more in sales is also included in the report.”⁶

There is a large volume of information concerning quantity and value of horticultural crops grown under protection reported by NASS. However, the capacity of this industry dedicated to CEA activity cannot be isolated from this mass of data. An insurance program based on a model like NVS may address this lack of data since coverage is based upon each insured's past production and sales; a producer's own data and elections are used to determine liability.

Tables 10 and 11 report Census and Survey of Organics data for organic crops. Table 10 displays the number of operations with production for years where data was available for a category and Table 11 displays total square feet by year and category in thousands.

⁶ <https://usda.library.cornell.edu/concern/publications/0p0966899?locale=en>, accessed June 2020.

Table 10. NASS Census of Agriculture & Survey of Organics. Total Operations with Production.

	2008	2014	2015	2016
Food Crop Totals, (Excl Mushrooms), Organic, Under Protection	838			
Nursery Totals, Organic, Under Protection	288	248	78	93
Propagative Material, Organic, Under Protection	72	56	53	69
Vegetables, Other, Incl Fresh Cut Herbs, Organic, Under Protection				666
Total	1,198	304	131	828

Source: Contractor’s Underwriting Department, from NASS, USDA QuickStats.

Table 11. NASS Census of Agriculture & Survey of Organics. Total Operations with Production. (Sq. Ft in Production) (Thousands)

	2008	2014	2015	2016
Food Crop Totals, (Excl Mushrooms), Organic, Under Protection	11,563			
Nursery Totals, Organic, Under Protection	2,317	4,483	1,696	1,480
Propagative Material, Organic, Under Protection	862	1,173	2,793	5,775
Vegetables, Other, Incl Fresh Cut Herbs, Organic, Under Protection				10,304
Total	14,743	5,655	4,489	17,560

Source: Contractor’s Underwriting Department, from NASS, USDA QuickStats.

Reviewing Tables 10 and 11, it can be seen there have been changes in the data categories tracked by NASS. These tables are intended to provide an overview of the organic data available from NASS relevant to CEA, as well as its limitations. Notice the first line of food crop totals (for both tables) only shows data for 2008. The next two lines show data for the last four Census reports. The final line of the table named “Vegetables...” was just added to the last census.

While most mushroom production is not reported by NASS as under protection or occurring in a greenhouse, most mushrooms are grown indoors in a highly-controlled environment. Mushroom production occurs in phases, from phase 1 composting to phase 6 “cropping.” These stages typically occur in different climate-controlled rooms in a production facility. Table 12 provides an overview of total mushroom production by operation and total square feet in the United States.

Table 12. NASS Census Total Mushroom Production

	2002	2007	2012	2017
Mushrooms - Operations With Area In Production	462	462	712	1,261
Mushrooms - Sq Ft In Production	48,339,412	45,308,740	37,416,059	36,281,409

Source: Contractor’s Underwriting Department, from NASS, USDA QuickStats.

Reviewing Table 12, the number of mushroom operations has increased notably over the last four Censuses of Agriculture. The Contractor speculates that this may be due to an increase in the number of specialty mushroom operations as demand for specialty types has increased. This theory is given particular credence if it assumed specialty operations are smaller and the fact that the total number of square feet in production has declined each year.

In summary, Contractor was not able to identify any comprehensive source of data regarding CEA production of commodities. While data that provide a snapshot of the total production of various CEA crops exist, no datasets with consistent production and loss observations required for any type of crop insurance policy development were found. Periodic survey reports and

censuses released by NASS do not provide sufficient disaggregation to identify CEA production. In addition, it is not clear from the census instructions whether production in structures without a glass roof is reported.

II.B. CEA Production Risks

The 2019 Global CEA Census, a joint project of Agritecture Consulting LLC and Autogrow Systems Limited, defined CEA as the practice of "...growing of crops while controlling certain aspects of the environment including lighting, temperature, humidity, irrigation, fertigation and other factors that influence plant physiological responses."⁷ This private Census defined characteristics of the industry, not quantities produced. The critical words of this definition are "controlling certain aspects." This infers that not all aspects of the environment need be controlled for a growing practice to qualify as CEA for the purposes of this census. This interpretation is enhanced by this source's identification of structures in which a form of CEA may be practiced, as listed below.

GREENHOUSE refers to a climate-regulated structure with walls and roof made out of a transparent material in which crops are grown.

ROOFTOP GREENHOUSE refers to greenhouse located on top of another building.

SHIPPING CONTAINER refers to a climate-regulated shipping container using only supplemental lighting (no sunlight) for crop production.

HIGH TUNNEL refers to crops covered with a canopy for protection against the elements and sometimes referred to as hoop houses or tunnel houses (not small backyard hobby tunnels).⁸

INDOOR FARM refers to crop production that utilizes artificial lighting instead of sunlight. This can include rooms, warehouses, factories and other converted indoor spaces.

VERTICAL FARMING is crop production that uses the vertical space. Plants can be stacked horizontally or in tall towers.⁹

Note the definition of greenhouse as used by this organization differs from that used by the NASS Census reports. Under the NASS definition, only the roof needs to be transparent; the definition above states both walls and roof are transparent. This report also noted a lack of standardization of the term "greenhouse" among countries.

The Sustainable Agriculture Research and Education Program (SARE)¹⁰ identifies high tunnels primarily as a season-extending method rather than as a fully functional year-around controlled

⁷ 2019 Global CEA Census. https://gallery.mailchimp.com/9a0e5ac03df5550dddf4bd821/files/e4f08841-b086-4976-ad53-81d613c2597c/2019_Global_CEA_Census_Report_Autogrow_Agritecture.pdf?utm_source=CEA+Census+2019&utm_campaign=d6dea4a854-AUTOMATION_Welcome_Message_1&utm_medium=email&utm_term=0_924fc70856-d6dea4a854-402728638&mc_cid=d6dea4a854&mc_cid=7f7af97e92, page 8. Accessed March 2020.

⁸ There is debate within the academic community regarding the sufficiency of high tunnels to meet the definition of CEA agriculture. They are included here as they are included in the referenced source material, but the reader should be aware that this inclusion is not representative of a broad consensus within the industry; in interviewing four experts, two included it and two did not.

⁹ Ibid, page 8. Accessed March 2020.

¹⁰ An activity based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award No. 2019-38640-29881. SARE Outreach operates under cooperative agreements with the University of Maryland to develop and disseminate information about sustainable agriculture. <https://www.sare.org/>.

environment.¹¹ This organization defines “High tunnels, or hoop houses, are simple greenhouse-like structures over bare ground, without the elaborate heating and cooling systems of a greenhouse. They rely primarily on passive solar heating and passive ventilation.”¹² This difference indicates that generic terminology (such as “greenhouse”) to identify CEA structures is not possible. Structures can range from plastic film covered frames to brick and mortar spaces. Production risks differ among type of structure and technology used. Development of a crop insurance policy for CEA activities will require definitions of structures within which CEA production can be insured. Ultimately, these definitions may vary based on the ‘zone’ in which the greenhouse is located, akin to the cold protection determinations used in nursery programs.

The amount of controls placed on the internal environment and the automation of those controls will have an impact. Production risks likely are substantially similar to those insured under the Nursery and NVS policies. Many of those production activities are conducted in greenhouses or similar structures dedicated to the growing of plants. The only difference is the emphasis of the coverage. Plants insured under the Nursery and NVS policies are largely ornamental in nature or are to be transplanted in a field to grow a crop. Much production in CEA structures is intended for human consumption – cut greens, hothouse tomatoes, and similar vegetables.

Some specific perils that can be postulated are:

- External temperatures that differ from the normal for the area in which the structure is located to such a degree that the system to regulate the temperature is overwhelmed and results in plant damage.
- Failure of the electrical power supply that cannot be corrected before damage to the insured plants occurs.
- Introduction of infested plant material from a third party that could not be detected by normal and usual quality control mechanisms.
- Unavoidable introduction of a pathogen by any vector. This pathogen may or may not be subject to destruction orders and protocols to clean and/or prepare facilities for housing plant material in future seasons.
- Windstorms or snowstorms that affect the structure, which then impacts the CEA production and/or inventory value.
- Products produced for human consumption that unknowingly have become contaminated, creating liability for recalls and potential sickness of buyers.

In listening sessions, participants acknowledged the variety of observed and potential risks, but also noted that any list would be inherently incomplete; the concept of Multi-peril crop insurance is to offer coverage for a broad range of potentially insurable causes. Moreover, this list or any other than could be developed can be criticized based on extenuating circumstances and management practices. For example, failure of the electrical power supply is a risk that can be minimized by including a standby generator on the property that automatically starts when the power fails. Offering crop insurance for this risk may cause a substitution of inputs: crop insurance premiums in lieu of capital investment. The scale of the operation has an effect on this

¹¹ <https://www.sare.org/Learning-Center/Topic-Rooms/High-Tunnels-and-Other-Season-Extension-Techniques>. Accessed March 2020.

¹² *Ibid.*, pages 1-2. Accessed March 2020.

decision. Introduction of infested plant material may not be considered a natural cause of loss in various scenarios. Third party liability for damages caused by this peril may exist.

As an example of a production risk, APHIS "... announced on April 21 [2020] that it has confirmed the detection of *Ralstonia solanacearum* race 3 biovar 2 (RSr3b2) in a single variety of geranium plants located in a Michigan greenhouse. This particular type of *Ralstonia*, a bacterial plant pathogen, can cause a wilt disease in several important agricultural crops such as potatoes, tomatoes, peppers and eggplant. This is the first confirmed case of RSr3b2 in a U.S. greenhouse since 2004."¹³ This is an example of unavoidable introduction of a pathogen. RSr3b2 affects the ability of the plant to utilize water by affecting its roots, leading to wilting and death of the plant. APHIS determined the disease was introduced via cuttings imported from a growing facility in Guatemala that were received by 288 growers in 39 states.¹⁴ The disease was introduced into the United States despite APHIS regulations governing the importation of "plants and vegetative parts that are for or capable of propagation, including buds, bulbs, corms, cuttings, layers, pollen, scions, seeds, tissue, tubers, and like structures."¹⁵

This is the second introduction of RSr3b2 since 2000. An incident in 2004 affected growers in 27 states.¹⁶ There are no known treatments for plants infected with *Ralstonia*. Infected plants must be destroyed. There does not appear to be any program to compensate growers for plants that are destroyed. On its website, APHIS states "APHIS makes sure that all imported agricultural products shipped to the United States from abroad meet the Agency's entry requirements to exclude pests and diseases of agriculture."¹⁷ The disease was introduced despite these controls, which illustrates the risks growers face from this threat. This can be viewed as a loss due to a "natural cause" as required by the Act. The pathogen exists in nature, but its introduction into U.S. greenhouses represents a failure of the system of import controls managed by APHIS. Its introduction into the greenhouse falls beyond the reasonable scope of biosecurity management undertaken by the producer. It is envisioned this is a loss to be indemnified if appropriate management activities and protocols were in place. Underwriting guidelines and loss adjustment materials would need to include guidelines for the loss adjuster to work the claim and verify the insurability of the proximate peril.

Quantification of these and other production risks is difficult, but not impossible to estimate. Very few if any data are available to establish the frequency that these production risks occur or, when any of these occur, the severity. There are two observations in the case of RSr3b2 in the last 15 years. Compensation may be provided by APHIS whenever livestock or poultry must be destroyed to control the spread of disease. The Contractor was not able to find a similar program for plants, as is detailed in the next section.

Severity is influenced by the mix of plant types growing in the controlled environment, the susceptibility of each plant type to the cause of loss, and the insurance structure that is created. For example, establishing each plant type as a separate basic unit rather than all plants in the

¹³ <https://www.greenhousemag.com/article/ralstonia-michigan-greenhouse-usda/>, reviewed June 2, 2020.

¹⁴ <https://huronhub.com/2020/05/12/usda-confirms-detection-of-destructive-plant-pathogen-in-michigan-greenhouse-geraniums/>, accessed June 2020.

¹⁵ APHIS, *Plants for Planting Manual*, p. 1-3.

https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/plants_for_planting.pdf, accessed July 2020.

¹⁶ *Ibid.*

¹⁷ <https://www.aphis.usda.gov/aphis/ourfocus/importexport>, accessed June 2020.

structure as a basic unit creates different risk environments. Experience from the existing nursery program may provide a basis for establishing initial premium rates that would be subject to updating as experience accrues. Analysis of the causes of loss under the nursery crop insurance program also may provide guidance.

By any traditional measure, the robust and detailed quantitative data that have traditionally been required to support a rate-making exercise for other crops (or classes of crops) do not exist for CEA. Loss events are infrequent and may be severe when they do occur. Previous developments, including that for the nursery and Whole Farm Revenue Protection programs (and their predecessors) provided the agency with broad discretionary authority to make rating assessments on often thin or broadly indicative data. This precedence offers a potential route to supporting ratemaking for CEA particularly if a single program to offer coverage for multiple species and growth processes are desired.

II.C. APHIS Compensation for Plant-Borne Pathogens

In the listening sessions and throughout the research effort, the Contractor was regularly confronted with questions regarding the potential for risks like those posed by *Ralstonia* and similar pathogens to be borne not by crop insurance, but instead by APHIS. APHIS staff were not interviewed for this report, but the Contractor obtained information that was useful in assessing the differences in the authority granted by Congress to compensate losses endured by animal and plant agriculture.

The Animal Health Protection Act (7 USC Chapter 109) states “The Secretary, in writing, may order the owner of any animal, article, facility, or means of conveyance referred to in subsection (a) or (b) of this section to maintain in quarantine, dispose of, or take other remedial action with respect to the animal, article, facility, or means of conveyance, in a manner determined by the Secretary” 7 USC 8306(c). 7 USC 8306(d) states the Secretary “... shall compensate the owner of any animal, article, facility, or means of conveyance that the Secretary requires to be destroyed...” Compensation is to be based on the fair market value of the animal or thing that is destroyed. The amount of compensation may not exceed the difference between the fair market value and the amount the owner may have received from any other source. 7 USC 8316 states “... the Secretary may transfer from other appropriations or funds available to the agencies or corporations of the Department of Agriculture such funds as the Secretary determines are necessary for the arrest, control, eradication, or prevention of the spread of the pest or disease of livestock and for related expenses.”

The Plant Protection Act (7 USC Chapter 104) provides the Secretary authority to “... quarantine, treat, or apply other remedial measures to any premises, including any plants, biological control organisms, plant products, articles, or means of conveyance on the premises, that the Secretary has reason to believe is infested with the plant pest or noxious weed...” (7 USC 7715(a)(2)). This authority is substantially the same as that granted by the Animal Health Protection Act. However, the Plant Protection Act states the Secretary “may pay compensation” (7 USC 7715(e)) rather than “shall compensate” as stated in the Animal Health Protection Act. 7 USC 7716(a) allows a grower to bring an action for just compensation but only if “... the owner establishes that the destruction or disposal was not authorized under this chapter.” 7 USC 7771 “Except as specifically authorized by law, no part of the money appropriated under this section

shall be used to pay indemnities for property injured or destroyed by or at the direction of the Secretary.”

The Contractor found the Animal Health Protection Act provides a framework for actions needed to provide compensation to growers whenever private property must be destroyed to prevent the spread of diseases. The Contractor found discussions of reasons for compensation for animal producers on the APHIS website.¹⁸ No discussions regarding the lack of compensation for growers of plants were found. Since destruction of plants such as necessitated by the introduction of *Ralstonia* in 2020 is in the public interest, Congress may consider amendments to the Plant Protection Act to authorize compensation for growers of plants who are affected by depopulation orders.

II.D. Gaps in Production Data

Since the Census of Agriculture and the Census of Horticultural Specialties each occur every five years, there is not a continuous annual history of production grown under protection. The Census of Agriculture occurs for years ending in 2 and 7; the Census of Horticultural Specialties occurs for years ending in 4 and 9. In both cases, the data are published several months after the end of the calendar year covered by the respective census. The Contractor was not able to identify any other source of data that would fill these gaps. As noted previously, the share of the production reported “under cover” in either census that qualifies as CEA is unknown.

II.E. Alternative Data Sources

An exhaustive search of the internet failed to identify any viable alternative data source. Attached in Appendix A are the numerous sites reviewed for usable state, regional, and national crop insurance data. None was found that would provide sufficient data to meet sufficiency standards for quantitative risk assessment.

II.F. CEA Risk Frequency and Severity

The lack of continuous reliable data concerning CEA production at a micro level makes it difficult to properly assess risk frequency and severity. As indicated previously, the most likely source of reliable data is the experience database for the Nursery Crop Insurance Program.

Several research institutions have dedicated resources to study CEA. The focus of this research revolves around the mechanics of producing crops in this manner and the applicability of the process to urban agriculture. Among these institutions are the Controlled Environment Agriculture Center at the University of Arizona (<https://ceac.arizona.edu/>); the Controlled Environment Agriculture (NEMALI Lab) at Purdue University (<https://www.purdue.edu/hla/sites/cea/>); the SARE organization previously cited; and others.

II.G. Identified Risk

Insurable weather risks that can affect CEA production result from infrequent climatic and meteorological events such as hurricanes, tornadoes, extreme events of heat or cold, and similar

¹⁸ See, for example, “Why Compensation?”

https://www.aphis.usda.gov/animal_health/emergingissues/compensation/downloads/appraisalclass_ycomp0209.ppt, accessed February 2021.

causes. Other causes beyond the control of the producer involve unavoidable introduction of contaminated materials or pathogens via unknown or uncontrollable disease vectors. The latter perils may be insurable under crop insurance. The introduction must be due to an unavoidable natural cause under the terms of the Act.

III. ISSUES ANALYSES

Since CEA as defined herein is conducted within buildings rather than in the open as is the case with most agricultural production, there is substantially lesser exposure to catastrophic events such as droughts. Exposures to windstorms are lessened but the degree of reduction is a function of the type of structure. The potential for collapse of the structure due to high winds or snow load is a function of the type of structure. A brick and mortar building such as a converted manufacturing facility provides much greater protection than a plastic film greenhouse. Many risks associated with the collapse of a structure are insurable with private sector insurance policies, but the damage to CEA plants within the building are not insured.

III.A. CEA Inventory Methodology

The 2019 NASS report previously cited identifies 19 different types or classes of products reported by respondents. Most are perishable products for direct human consumption of the entire plant (excluding roots) such as leafy greens, herbs, and mushrooms. However, some commodities are harvested fruits or seeds. The inventory methodology most likely differs among commodities. Leafy greens (various lettuces, arugula, etc.) are short-season commodities intended for consumption shortly after harvest. Growers likely have “crops” of more perishable commodities in various stages of growth to supply product continuously, especially if the CEA facility is in an urban area with a steady clientele. Tree nuts and similar commodities may tend to be of a seasonal nature, requiring a different inventory methodology. The Contractor was not able to find a discussion of inventory methodologies for CEA activities.

III.B. Causes of Damage

As with most other elements of this report, the Contractor was not able to unearth literature regarding specific causes of damage that may affect CEA activities. A CEA facility is an atmosphere within which the grower can control some or nearly all aspects of plant growth. Causes of loss most likely are similar to those covered by the Nursery and NVS policies, though may have a reduced frequency and potentially lesser severity. Causes of loss insured under the cited crop policies are: adverse weather conditions, fire, wildlife, earthquake, or volcanic eruption. Some of these have limitations or conditions upon applicability. In addition, loss in plant values is insured under specified conditions, as are failure of the irrigation water supply and loss of or reduction in power. Disease or insect infestation may be covered if there is no effective control measure. In practice, this also means the disease or insect infestation is covered if the control measure was applied but was rendered ineffective by a covered cause of loss, and re-application was not possible or allowed by the Environmental Protection Agency license before damage occurred. Damage due to cold temperatures is a covered cause of loss provided adequate cold weather protection has been provided but was not effective for reasons stated in these policies. Damage to plants due to collapse or failure of buildings or structures is covered if such damage was due to a cause of loss specified in the crop provisions. Damage to the structure itself is not insured under Federal crop insurance policies although commercial insurance is available.

These causes of loss have varying degrees of applicability for CEA production. Production in a masonry building with full control of all elements of plant growth will have relatively few applicable causes of loss. Production in a seasonal structure with more limited means of controlling all elements of plant growth will face greater potential for loss.

III.C. Potential Unit Structure and Underwriting Issues

The production practices employed by the CEA industry are comparable in most respects with those employed by the nursery industry. Indeed, NASS classifies nursery as a subset of horticultural specialties in its reports. The Nursery and NVS crop insurance policies define a basic unit as all plants in a practice, where practice is defined as container- or field-grown. Each of these basic units may be subdivided into additional basic units representing each insured plant type, where plant type is either defined as a specific grouping of identified plants (Nursery) or as plants with a specific scientific classification (NVS). In practice, since no additional premium cost exists for the choice of additional basic units, the grower is free to sub-divide the large basic unit (all plants of all insured plant types) into separate basic units each consisting of a specific group of plants.

The Contractor has not found any information that suggests the appropriate approach for CEA would differ from the precedent established by the Nursery and NVS policies. Unlike any other current Federal Crop Insurance program, seasonality of CEA production may be entirely independent of the conventional calendar. Plantings, growth, harvest, and resetting of the production cycle may occur simultaneously for different production cohorts of the same crop on any given day of the year in some CEA environments. While Nursery and NVS allow for continuous enrollment, there is unquestionably a seasonality in production cycles that would not necessarily apply to CEA. This provides special, but not insurmountable, challenges in integrating with RMA systems and procedures.

III.D. Appropriate Approach for Loss Adjustment

Since production under CEA conditions substantively is similar to nursery, it follows that the principles established for the Nursery and NVS crop insurance policies should guide determinations regarding loss adjustment for CEA.

The Nursery crop insurance policy requires the loss adjuster to determine the value of the plants in the basic unit prior to the occurrence of the loss event and the value of those same plants after the damage has occurred. Values per plant before damage occurs are based on the catalogs used by the grower to market the plants but that value cannot exceed the amount established by the Plant Price Schedule, a document published by RMA. The loss procedures require the loss adjuster to assign each plant in the basic unit to one of ten groups, ranging from no damage to total destruction to determine the value after damage has occurred. Over- and under-report factors must be established if the value of the plants before damage differs from the value established when insurance attached or as that value was increased by supplementary reports filed by the insured. The indemnity amount is the difference between the two values (pre- and post-loss) determined by the loss adjuster, with adjustments for over- or under-reporting.

NVS requires the grower to assign a total value to the plants in each basic unit. The loss adjuster determines the value of the plants in a unit before damage. The loss adjuster selects a random sample of the plants in each basic unit with damage and assigns each plant in the sample to one of four categories. The NVS procedure gives the grower the opportunity to determine that a damaged plant can be rehabilitated or that it cannot be rehabilitated. After agreement between the loss adjuster and the grower about the amount of damage, the amount of loss is determined. The overall percent of damage to the unit is determined from the samples. The indemnity is

based on the damage percentage determined by the loss adjuster and the lesser of the value of the plants declared by the grower or the pre-loss value the loss adjuster determined to exist.

While both are somewhat more complex than this general description infers, the process for Nursery is much more time-consuming.

The NVS procedure presently is in trial status since Crop Year 2021, the first year the plan has been offered. Based on the evidence obtained regarding production practices under CEA, the Contractor believes that a process similar to that used for NVS will be appropriate for CEA. Certain adjustments in the methods most likely would be needed since the plants may not be in individual pots or in individual plantings in-ground.

III.E. Price Determination Concerns

There are numerous plant crops within each category identified in Tables 1 and 2. For example, Agricultural Marketing Service (AMS) reports shipping point and wholesale market prices for fourteen different types of lettuce.¹⁹ Lettuce presumably is included in the category “cut cultivated greens” included in Tables 1 and 2. The category most likely includes more than lettuce. Spinach, kale, and other greens likely also are included, each of which also are likely to include several sub-types. The sheer number of products to be priced precludes any consideration of a standard Actual Production History (APH)-type policy wherein RMA is required to establish a price election prior to the sales closing date. Accordingly, the Contractor considered other approaches to establish an insurance guarantee.

There are no futures market for the commodities grown in the CEA environment. A market-based approach for projected and harvest prices such as that used for the Revenue Protection plan of insurance is not possible.

Another option considered is the Whole Farm Revenue Protection policy (WFRP). This insurance plan depends on the Schedule F filed with the filer’s Internal Revenue Service (IRS) Form 1040. Under this insurance plan, prices are not needed to establish the insurance guarantee or to determine the amount of losses. According to IRS Publication 225, “You are in the business of farming if you cultivate, operate, or manage a farm for profit, either as owner or tenant. A farm includes livestock, dairy, poultry, fish, fruit, and truck farms. It also includes plantations, ranches, ranges, and orchards and groves.” The principal agricultural activity codes used to identify the type of farming business include 11400, “Greenhouse, nursery, & floriculture production.”²⁰ The principal business codes for Schedule C of the IRS Form 1040 do not include these business groups.²¹ Thus, CEA activities appear to be included within the filers who must use Schedule F to report the profit and loss from farming activities.

While WFRP would be available to CEA operators, major modifications are needed to make it usable. The plan is oriented toward diverse farming operations within which a variety of crops present different risk profiles, increasing the potential for reduced indemnities due to the losses from one crop being offset by sales values greater than the guarantee from other crops.

¹⁹ <https://www.marketnews.usda.gov/mnp/fv-nav-byCom?navClass=VEGETABLES&navType=byComm>, accessed July 2020.

²⁰ <https://www.irs.gov/pub/irs-pdf/f1040sf.pdf>, accessed July 2020.

²¹ <https://www.irs.gov/instructions/i1040sc#idm140229426649440>, accessed July 2020.

Nursery/Greenhouse is a WFRP commodity code with a Rating Commodity Name Nursery (FG and C) (sic). Hence, all plants in a nursery/greenhouse are a single commodity with no diversification possible. Nursery operators have not expressed interest in WFRP.

The Nursery policy depends on a Plant Price Schedule (PPS) that establishes the maximum value of a specific plant whenever the grower's catalog establishes a higher price. The NVS policy, on the other hand, allows the grower to establish a stated amount of insurance for all plants within each insured plant type while the loss amount is based on the actual value of the plants that exist at the time of loss or the stated amount of insurance established by the grower. The grower is allowed to establish an amount of insurance based on a value less than the actual value under NVS whereas a penalty is assessed for loss adjustment purposes if the actual value at time of loss is less than the insurance value under the Nursery crop insurance program. Under NVS, sales invoices are the preferred method to establish the value of the plants when a loss occurs. However, for Nursery, the value is the lesser of the price (less the maximum possible discount) the producer lists in the nursery's catalog or the price contained in the PPS.

The method used for Nursery is costly to implement (developing the PPS), costly for establishing the guarantee, and costly for establishing the amount of loss. The approach used for NVS simplifies the process. It is less costly to deliver since the actual value of the inventory is established only at the time of loss, not twice as required by the Nursery policy.

The Actual Revenue History plan of insurance allows the grower to establish the insurance guarantee on the basis of historical earnings from sales of the commodity. The process for establishing the insurance guarantee is based on the grower's records of acreage planted or in production, quantity produced, and the value of sales. At issue with CEA is the measurement of a variable equivalent to acreage. The Contractor could not identify a variable that would reliably supplant acreage.

Another plan of insurance recently introduced is Production and Revenue History (PRH). This plan, effective for crop year 2021, is based on a per acre average of historical production or revenue. Again, the Contractor could not identify a variable for greenhouses that would reliably supplant acreage to apply across a range of potential insurable operations.

The information developed to this point of the project supports NVS as the basic model for insuring CEA as a crop insurance program.

III.F. Coverage Offered by Private Insurance Carriers and Federal/State Programs

Private insurance coverage is available for many of the business needs of the CEA industry. One policy in particular is described as follows. Hortica© a brand of the Sentry Insurance Group, offers a Business Package Policy that includes property coverage among other insurance coverage such as commercial liability, workman's compensation, etc. A spokesperson stated "The property coverage covers greenhouses, buildings, and what the company refers to as "business personal property," such as fixtures, equipment and the plants themselves... Plants are perishable, so growers need coverage for utility interruptions and equipment breakdowns to

protect them...”²² This description does not clearly state if damage to the structure or failure of utilities is required before damage to plants is insurable. Damage due to introduction of infected plant material may not be covered.

III.G. Limitations of Nursery/CEA Policies

A meaningful share of the commodities grown using CEA are produced using aeroponics, aquaponics, or hydroponics and, in some cases, by planting in soil.²³ These production techniques can be defined as follows:

- **Aeroponics** - the growing of plants by suspending their roots in the air and spraying them with nutrient solutions.²⁴
- **Aquaponics** - a system of growing plants in the water that has been used to cultivate aquatic organisms.²⁵ In many systems, water is first used to produce fish.
- **Hydroponics** - a specialized method of growing plants in a soil-free solution that provides all the nutrients necessary for growth.²⁶ Alternatively, “growing plants without soil & controlling the root zone conditions (water, nutrients, oxygen, temperature) using a complete nutrient solution with every watering (water + mineral nutrients) with or without an aggregate medium to support the roots (aggregates include sand, gravel, perlite, rockwool, coco coir, etc.)”²⁷

Commodities grown under CEA conditions include lettuces and other greens for salads, cucumbers, tomatoes, many other fresh vegetables, cut flowers, fruits, and others as demonstrated by Table 1. Many of these are severed from either the roots or the plant itself (e.g., tomatoes) when sold. The existing Nursery policies require the *plants* to be sold with roots attached. The existing Nursery programs do not attach to the product of a plant, such as a cucumber, a flower seed, a tomato, etc. Products of the insured plants under Nursery or NVS may be harvested and sold but insurance never attached to those products. The fundamental aim of these existing policies is to insure entire plants meant for sale.

The current nursery policies insure the container grown practice and the field grown practice. Container grown for the purposes of the Nursery policy is defined as “A nursery production practice in which plants are grown in standard nursery containers: above the ground; placed in the ground; or when placed in another standard nursery container in the ground (i.e., pot-in-pot).” Container grown for the purposes of the NVS policy is the same as the Nursery policy except the words “... or in an appropriate medium for production of nursery plants (e.g., in a hydroponic tank ...)” are inserted following the reference to standard nursery containers. Standard nursery containers are defined as “Rigid containers that have a minimum dimension greater than or equal to 5/8 inch, unless otherwise provided by the Special Provisions, at the widest point of the container interior, above-ground fabric grow bags, and other types of containers specified in the Special Provisions that are appropriate in size and provide adequate drainage for the plant. In-ground fabric ‘grow bags’, balled-and-burlapped, and trays (flats) without individual cells are not considered standard nursery containers.” Insurable plants cannot be “... produced in nursery

²² <https://www.greenhousemag.com/article/main-types-insurance-greenhouse-operations/>, accessed March 2020.

²³ 2019 Global CEA Census, pages 23-24.

²⁴ <https://www.merriam-webster.com/dictionary/aeroponics>

²⁵ <https://www.merriam-webster.com/dictionary/aquaponics>

²⁶ <https://ceac.arizona.edu/Node/28>

²⁷ https://ceac.arizona.edu/sites/default/files/Chapter%201_0.pdf, page 1.1.

containers that contain two or more different genera, species, subspecies, varieties or cultivars.” The plants must be “... grown in an appropriate medium.” (Nursery Crop Provisions, section 8(h)).

The plants insured by the current nursery policies must be sold with the roots attached and the plants must be offered for sale, among other conditions. Many plants are grown in the CEA environment to produce fruit and vegetables. The plants are not offered for sale.

Because of these substantive differences in production practice and the products offered for sale, substantial revisions to the terms of either the Nursery or the NVS crop insurance policies would be needed to extend coverage to CEA production.

III.H. Alternative Policy(ies) or Option(s) to Nursery/CEA

An option to the existing Nursery and NVS policies essentially would be a re-write of many terms and conditions of those policies. Those policies are oriented toward production of plants grown in a planting medium with the goal of marketing the plant itself. The Nursery and NVS policies allow harvesting of mature fruits from the plants, but that production is not insured. Only the plant itself is insured and it must be intended for sale as a living plant. Much CEA production does consist of plants for sale (e.g., lettuces) but the roots may be severed when harvesting occurs. Other plants, such as tomatoes or cucumbers, are harvested for the fruit and then discarded. The terms and conditions of the existing Nursery and NVS policies preclude coverage for many types of CEA production.

Insurance coverage for many CEA crops will be more closely related to existing crop insurance policies for fresh market production such as strawberries, fresh market tomatoes, peppers, fresh market sweet corn, and similar crops. The existing Nursery or NVS Crop Provisions have no correspondence to the Crop Provisions for these fresh market crops.

The Contractor does not believe CEA agriculture can be included in existing coverage through something as simple as an option or endorsement to either Nursery or NVS. Those policies are very specific to insuring plants for sale. Substantial changes would be needed to convert these to policies with flexibilities to insure either plants for sale or production of fruits and vegetables. Amending either to cover types of plants for sale other than those presently covered might be possible. Based on these analyses, it appears that a new plan, modeled conceptually on NVS, provides the greatest prospect for meeting the risk management needs of CEA agriculture through the Federal Crop Insurance program.

III.I. Issues Analysis Summary

There are four generally applicable areas into which insurance policy development for inventory-based coverage may be categorized: Inventory Timing, Price Determination, Loss Adjustment, and Underwriting.

III.I.1. Inventory Timing

The Contractor was not able to identify a written source that analyzed inventory methods used by the CEA industry. Available information does support informed judgements concerning this topic. The 2017 Census of Agriculture identifies 17 “commodities” grown under protection in

its report. Quotes around the term commodity denote that the classification is at an aggregate level. The commodities produced under protection as identified in the census report are:

- Aquatic plants
- Bedding plants
- Bulbs & corms & rhizomes & tubers, dry
- Cut flowers and cut cultivated greens
- Floriculture
- Flower seeds
- Flowering plants, potted
- Foliage plants
- Fruit
- Mushrooms
- Mushroom spawn
- Nursery
- Propagative material
- Tomatoes
- Transplants (tobacco)
- Transplants (commercial, vegetable and strawberry)
- Vegetable seeds

Note that nursery is a commodity included in these data. The crop insurance program has several decades of familiarity with the nursery industry and is aware of the diversity of operations and inventory management practices within it. There is no reason to believe producers of commodities produced under protection will have greater homogeneity of production and inventory management practices than has been observed with nursery.

Table 15 of the Horticultural Census (2014) identifies lettuce, all as a food crop grown under protection. Lettuce is a perishable crop with a short growing cycle and consists of multiple types (iceberg, romaine, green leaf, etc.). Producers harvest the entire plant when the stage of growth achieves the volume or weight wanted by retail grocers, restaurants, or other clients. The plant as sold may not have roots attached depending on the form in which the sale occurs (e.g., living lettuce has attached roots). The inventory of these plants likely consists of plants in varying stages of growth intended to produce a supply of finished product dictated by a harvesting schedule established by orders placed by buyers. Production may be relatively constant year-around or it may exhibit seasonal variations.

Transplants likely are for sale during a relatively short period at the beginning of the growing season appropriate for the region. The inventory first would consist of seeds planted into individual cells that evolve into plants that ultimately become ready for planting. Once the planting season has passed, there is no inventory until it is time to plant new seeds to produce the transplants for the next growing season. A grower who produces multiple crops in the operation may have multiple inventory management systems, each appropriate for the individual crop.

There is no one size fits all inventory plan for the CEA industry. The heterogeneity of plants and of marketing seasons dictates that an enterprise follow an inventory plan consistent with the

growing cycle of the finished product and the nature of consumer demand during a specific twelve month cycle. It is unlikely that the specific twelve months chosen by crop insurance as the crop year will perfectly fit every CEA horticultural operation.

How does the concept of inventory fit into a crop insurance model? A definition states “Inventory, often called merchandise, refers to goods and materials that a business holds for sale to customers in the near future.”²⁸ The purpose of crop insurance is to compensate the grower in part (after the deductible) in the event one or more causes of loss beyond the control of the grower result in a reduction of the amount of goods produced (inventory). Hence, there is need to estimate the amount of goods that can be produced under normal conditions (such as the approved yield) so the inventory actually produced can be measured against that baseline.

Inventory management has been an issue for federal crop insurance coverage of multiple crops that do not fit the one planting/one harvest model common to major field crops or the fixed acreage/one harvest model common to perennial crops. Under those models, the average productivity per acre or similar measure multiplied by the chosen coverage level, the price election or expected price, the number of acres, and share establishes the insurance guarantee. This model is straightforward because it uses a standardized measure of production potential: the planted acres (tree acres in the case of tree crops).

Crops that do not fit these inventory models have presented issues for establishing the insurance parameters on an equitable basis for the insurer and the insured. Crop insurance has used several “work-arounds” to deal with these issues.

Consider field-grown fresh market crops that have multiple plantings/multiple harvests in a twelve-month period. The insurance plans for fresh market tomatoes, for example, define two or three planting periods for the crop. The grower must report all acreage planted during each planting period on or before the acreage reporting date for that planting period. The acreage reporting date is after the end of the planting period. Under the dollar plan, RMA establishes the insurance value of each acre planted (total dollar value of the expected yield on a per-acre basis) and does so before the beginning of the crop year. Under the production plan, RMA establishes the insurance value (price) per carton of production before the crop year begins. The APH plan establishes the average productivity per acre. The expected values of these variables may vary by planting period. The grower may not know the exact acreage that will be planted for each season at the time of the sales closing date, but the insurance value is fixed at that time.

As another example, consider the Nursery crop insurance program. The grower must provide the “basic unit value” for each month of the crop year at least 30 days before insurance will attach. The basic unit value is declared by the grower, and it must be supported, at the option of the insurer, by “... A detailed plant inventory listing that includes the name, the number, and the size of each plant, ...” (Nursery Crop Provisions, Section 6(c)(2)(i)). The grower’s catalogs establish the price, but that price cannot exceed a price established by RMA in its Plant Price Schedule. The grower has two opportunities to increase the basic unit value during the crop year.

²⁸ <https://www.myaccountingcourse.com/inventory>

The NVS crop insurance program requires the grower to establish the expected dollar value of the inventory for each basic unit for each month of the crop year at least 30 days before the insurance attaches. This value may not be greater than the highest expected monthly inventory value. This insurance plan also provides two opportunities to increase the expected inventory value during the crop year.

The intent of these differing crop insurance designs to handle differing inventory issues is to avoid adverse selection against the insurer while treating the insured fairly. The goal of crop insurance is to provide a guarantee consistent with expected crop value (value of expected inventory). The insurance plan must establish the parameters for the guarantee before either party can reasonably predict the potential for an indemnity. This is the reason the nursery crop insurance programs require establishment of the amount of liability thirty days prior to the date insurance attaches. It also is the reason the sales closing date for most crops occurs several weeks before planting.

Which of these crop insurance designs best fits the variety of inventory management models followed by the CEA industry? Would an entirely new design be more appropriate?

The Nursery model is extremely expensive both in cost and in time. It requires an approved plant list and a Plant Price Schedule. Both are extremely detailed documents with thousands of entries. The agent and the grower must spend substantial amounts of time to complete a report of the value of the plant inventory for each month of the crop year. The result of multiplying the number and size of each plant that will be in the inventory by the approved price for that plant and size are needed to complete this report. If the grower files a claim for loss, the loss adjuster must create the valuation of the plants actually present in the inventory just prior to the loss event and the value after that event. The cost and complexity of these processes render the plan unpopular.

NVS, a new approach to establishing the value insured, eliminates the complexity of establishing the insured valuation by asking the grower to provide the expected dollar value of all plants in the basic unit for each month of the crop year. It does not require the detailed information specified in Section 6(c)(2)(i) of the Nursery Crop Provisions to establish coverage. The grower then may choose a dollar amount of valuation that is less than or equal to the maximum monthly value. The declared value determines the amount of premium. Indemnities are limited to the amount determined by multiplying the smaller of the declared value or the value of the inventory actually in existence at the time of the loss. This process simplifies the procedure for establishing the amount of insurance. The process for establishing the amount of indemnity is similar to Nursery although some steps of the process are simplified.

In summary, the inventory management practices of the CEA industry are substantially the same as those followed by the nursery industry. Seasonality of demand for certain products, differences in growing cycles, and other factors, result in varying inventory management methods. No standardized measure of production potential (such as planted acres and yield per acre) exists for CEA activities. What is the yield potential of a square foot (or indeed a cubic foot in the case of stacked production practices) of hydroponic production space? This depends on many factors, such as the nutrients provided in the water. The Contractor believes the

concepts of the NVS crop insurance policy are most compatible with the needs of the CEA industry. In addition, the conceptual basis of the NVS policy is compatible with the directive in the 2018 Farm Bill that a crop insurance policy for the industry "... have streamlined reporting and paperwork requirements that take into account short propagation schedules, variable crop years, and the variety of plants that may be produced in a single facility..."

III.I.2. Price Determination

There are numerous plant crops within each commodity identified by USDA reports. For example, AMS reports shipping point and wholesale market prices for 14 different types of lettuce.²⁹ Lettuce is a crop produced under protection as well as in the field. Production of spinach, kale, and other greens also occurs under protection. Each of these global names includes several sub-types such as baby spinach. The sheer number of products for which prices must be determined precludes any consideration of a standard APH-type policy wherein RMA is required to establish a price election prior to the sales closing date. The sheer number of crops grown under protection and spotty availability of reliable price data at a local level would overwhelm available staff.

There are no futures markets for the commodities grown in the CEA environment. A market-based approach for projected and harvest prices such as that used for the Revenue Protection plan of insurance is not possible. In addition, crops produced under CEA conditions are not contained in the list of market orders administered by AMS.³⁰ Market orders provide the basis for Revenue Protection for dry beans and dry peas.

Another option that has been explored is WFRP. This insurance plan depends on the Schedule F filed with the filer's IRS Form 1040. Under this insurance plan, only historical income establishes the insurance guarantee and is the base to determine the amount of losses. According to IRS Publication 225, "You are in the business of farming if you cultivate, operate, or manage a farm for profit, either as owner or tenant. A farm includes livestock, dairy, poultry, fish, fruit, and truck farms. It also includes plantations, ranches, ranges, and orchards and groves." The principal agricultural activity codes used to identify the type of farming business include 11400, "Greenhouse, nursery, & floriculture production."³¹ The principal business codes for Schedule C of the IRS Form 1040 do not include these business groups.³² Thus, CEA activities appear to be included within the filers who must use Schedule F to report the profit and loss from farming activities.

The description of WFRP states: "Whole-Farm Revenue Protection (WFRP) provides a risk management safety net for all commodities on the farm under one insurance policy and is available in all counties nationwide. This insurance plan is tailored for any farm ... including farms with specialty or organic commodities (both crops and livestock), or those marketing to local, regional, farm-identity preserved, specialty, or direct markets."³³ The commodity listing for WFRP identifies certain crops, such as lettuce, bok choy, tomatoes, and others, as WFRP

²⁹ <https://www.marketnews.usda.gov/mnp/fv-nav-byCom?navClass=VEGETABLES&navType=byComm>, accessed July 2020.

³⁰ <https://www.ams.usda.gov/rules-regulations/moa/commodities>, accessed August 2020.

³¹ <https://www.irs.gov/pub/irs-pdf/f1040sf.pdf>, accessed July 2020.

³² <https://www.irs.gov/instructions/i1040sc#idm140229426649440>, accessed July 2020.

³³ <https://www.rma.usda.gov/en/Policy-and-Procedure/Insurance-Plans/Whole-Farm-Revenue-Protection>, accessed August 2020.

commodity codes. However, Nursery/Greenhouse is a single WFRP commodity code. If the crops lettuce, bok choy, and tomatoes are grown in a field, the diversification index would be based on three different commodity codes. If grown under CEA conditions (i.e., nursery/greenhouse), there is one commodity code. This lessens the attraction of WFRP as an alternative insurance plan. Although a grower may have multiple crops under production in the CEA environment, it appears all will be considered as one commodity nursery/greenhouse.

The Nursery policy depends on a Plant Price Schedule (PPS) that establishes the maximum value for a specific plant and size whenever the grower's catalog establishes a higher price. The NVS policy, on the other hand, allows the grower to establish a stated amount of insurance for all plants within each insured plant type while the amount of any loss is based on the actual value of the plants that exist at the time of loss or the stated amount of insurance established by the grower. The grower may establish an amount of insurance based on a value less than the actual value under NVS whereas a penalty affects loss adjustment if the actual value at time of loss is smaller or larger than the insurance value under the Nursery crop insurance program.

The method used for Nursery is costly to implement (developing the PPS), costly for establishing the guarantee, and costly for establishing the amount of loss. The approach used for NVS simplifies the process. It also is less costly to deliver since the actual value of the inventory is determined only at the time of loss, not two or three times as required by the Nursery policy.

The Actual Revenue History plan of insurance allows the grower to establish the insurance guarantee using historical earnings from sales of the commodity. The insurance guarantee is determined from the grower's records of acreage planted or in production and the value of sales. These data determine the guarantee per acre, allowing variations in acres from year to year when determining the total guarantee. An issue with CEA is the measurement of a variable equivalent to acreage due to the existence of multiple production methods. The Contractor could not identify a variable that would reliably supplant acreage.

The information developed to this point of the project supports NVS as the basic model for insuring CEA if development of a crop insurance program were to proceed. Quarterly updating of the inventory value might be a simplification. The process could work in this manner. The first quarterly report is due 30 days prior to the attachment of insurance. This report includes the expected inventory values as of the first day of each month in the first quarter. As is the case with NVS, the grower would name the insured inventory value, which must be less than the largest monthly inventory value for the quarter. The grower would owe premiums for the entire crop year for this amount of insurance. Thirty days prior to the start of the next quarter, the producer may file expected inventory values for each of those three months and increase the amount of insurance. The producer would pay premium on the increase in value for the remainder of the crop year. The same actions would repeat for the next two quarters. The values established for the previous quarter continue for the remainder of the crop year if revised values are not filed for any quarter.

The concept outlined above does not require estimates of expected inventory values 12 months into the future. This process could prove to be more accurate due to the greater knowledge of likely current activities. It would supplant the two inventory adjustments authorized under

Nursery and NVS. It also would be less daunting in terms of the amount of information required to establish the initial guarantee.

III.I.3. Loss Adjustment

The loss adjuster must perform several actions when the insured files a notice of loss or damage. Among these important activities are:

- Verify that an insured cause of loss occurred;
- Determine the loss guarantee, which may differ from the premium guarantee;
- Examine the damage (plants, acres, etc.) to determine any damage due to uninsured cause(s) of loss; and
- Determine the damage amount.

Verification of the cause of damage is paramount. Any damage to the insured crop(s) must be due to a cause of loss as identified in the crop insurance policy. Loss adjusters must be able to use weather records and other public sources of information to determine that a specific cause of loss has occurred. The Contractor found nothing unique about CEA. Causes of loss are similar to those affecting the Nursery and the NVS crop policies. The Contractor believes adjusters will be able to verify whether an insured cause of loss has occurred.

Determining the loss guarantee replicates the parameters needed to establish the premium guarantee for most crops. The exception is NVS. Whereas the grower “names” the insured value under NVS (subject to conditions), the loss adjuster must establish the complete inventory of insured plants and establish a price for each specific plant. This process is the same as Nursery with the exception that the source of prices may differ. The Contractor believes CEA will be similar to NVS. Thus, this NVS loss function will present meaningful and helpful guidelines to the loss adjustment process.

Examining the damaged plants for uninsurable causes of loss is similar to many other crops. Again, the Contractor believes this function will follow NVS structure.

Determining the damage amount will require specific rules to establish the condition at which a plant is totally destroyed, partially destroyed but salvageable, or undamaged. This will vary according to the plants included in an insurance plan for one or more CEA crops. Plants such as lettuce and other salad greens will present one set of issues. Often a small amount of damage that adversely affects the appearance of the plant renders it unmarketable. Other crops, such as tomatoes and cucumbers planted to produce harvestable fruits introduce the issues associated with loss of potential production if the plant suffers damage. This differs from inability to market the plant, which is the foundation of Nursery and NVS. Damage to a plant that produces marketable product requires determinations of the amount of potential production not produced due to the damage. A plant that has not yet produced fruits is totally lost in terms of potential production. On the other hand, a plant that is at or nearing the end of its productive cycle will have little or no remaining value. These same issues exist regarding field-grown insurable crops such as strawberries. Loss determination procedures for this crop require establishment of the number of times the plant will be harvested under normal circumstances and the number of harvests lost due to damage. The percentage of a normal total harvest that is lost must be determined based on the expected versus remaining harvests since plant productivity lessens as

the plant ages. Plants in a CEA environment may behave differently than plants in a field environment.

Each type of plant produced in a CEA environment will introduce unique circumstances that the insurance developer must consider to determine any remaining value. However, the Contractor does not consider this an insurmountable obstacle although it likely will be time-consuming.

III.I.4. Underwriting

The CEA industry is substantially the same as the nursery industry that currently has crop insurance. The primary difference is that the nursery crop insurance policy does not designate any particular structure or, indeed, any structure to house the plants. Plants insured under the Nursery Crop Provisions can be grown in the open, under shade cloth, or in a greenhouse. The most restricting condition is that appropriate cold protection must be provided. The CEA industry produces its inventory within a structure that permits control of most or all of the variables that affect plant growth. The CEA operation may or may not use standard nursery pots, a requirement for the container grown practice under the Nursery Crop Provisions. The NVS Crop Provisions allow hydroponics as a growth medium.

Both the Nursery and the NVS Crop Provisions establish a basic unit as all insured plants in the nursery operation. Growers may insure certain groups of plants as defined in the Crop Provisions and not insure other groups. This definition of the basic unit is consistent with all other crops: all acreage of the crop in the county.

Both the Nursery and NVS Crop Provisions allow sub-division of the defined basic unit into additional basic units. Each insured group of plants is a basic unit if so elected by the insured. For most crops, sub-division of the policy basic unit creates optional units that cost an additional 11.1 percent of premium. There are differences among crops that justify this treatment. Most crops are homogeneous across planted acres. Production could be transferred from one unit to another. Nursery crops differ in botanical characteristics. It is not possible to move a plant from group A to group B. Hence, this potential for abuse does not exist.

The Contractor did not find any evidence that suggests CEA crops should be treated differently than nursery crops with regard to unit definition and unit division. Therefore, the unit definition and unit division procedures of the Nursery and the NVS crop policies are appropriate for CEA.

Written agreements are a process that allows insurance to attach under circumstances not included under the terms of the Crop or Special Provisions. The Nursery Crop Provisions allow written agreements to extend the insurance coverage to plants not listed in the Eligible Plant List and Plant Price Schedule. The NVS Crop Provisions do not allow written agreements under any circumstances. This is justified because NVS allows insurance to attach to all plants in the inventory of each plant classification. Therefore, no plants are unlisted. Consistent with our recommendation that any insurance coverage developed for CEA be modeled along the lines of NVS, the Contractor recommends no written agreements be allowed. This is consistent with general policy that written agreements are not allowed for pilot crop insurance policies.

The Basic Provisions define the term person in detail. A person is “An individual, partnership, association, corporation, estate, trust, or other legal entity, and wherever applicable, a State or a political subdivision or agency of a State. “Person” does not include the United States Government or any agency thereof.” Any person who has an insurable interest in an insurable crop may purchase crop insurance unless that person is disqualified for specific reasons such as debt on a crop insurance policy. The Contractor found no issues with covered entities. This definition of person is adequate.

A common issue that arises with regard to Federal crop insurance is assuring liability for policies with the Catastrophic Risk Protection Endorsement is not excessive. The grower pays only a fixed administrative fee regardless of the amount of liability reported by that grower. There is concern that this can result in wasteful spending since the premium is totally subsidized. The Nursery Crop Provisions limit the insurable value for CAT coverage to 110 percent of the larger of: 1) greatest amount of plant sales during the three previous crop years, or 2) the actual inventory value on the date insurance attaches for the current crop year. The NVS Crop Provisions limit the insurable value to the lesser of: 1) 110 percent of the greatest inventory value during the previous three crop years, or 2) the greatest monthly expected inventory value for the current crop year. The Contractor recommends inventory values as the appropriate variable to determine maximum insurable value. An operation that is growing and marketing crops with short growing cycles (such as lettuce) will have substantial turnover of inventory during a crop year. Annual sales will be several multiples of the value of commodity that is growing at any time during the crop year. From the other perspective, an operation growing commodities that require more than a single growing season to become marketable likely will have total inventory greater than annual sales. Accordingly, inventory values are a more appropriate variable for limiting insurable value for CAT policies.

IV. PILOT AREA

The current various definitions to what is a greenhouse and what are greenhouse crops preclude from choosing a possible pilot area. Pilot areas will be determined once the Contractor has discussed with RMA the greenhouse structures and greenhouse crops they want further research on for possible pilot crop insurance program. In the conduct of the listening sessions and based on the stakeholder feedback, there is certainly strong interest in including operations and the states of Michigan, Illinois, and Florida, but the nature of introduced disease perils is such that spatial diversification has little meaningful effect on losses incurred in any given year. A nationwide pilot may be appropriate if development is approved.

V. LISTENING SESSIONS/INTERVIEWS

This section addresses the following from the SOW:

Interviews/Listening Sessions Data – The Contractor shall contact leaders representing nursery greenhouse producers at the state and national levels to determine the potential interest in a crop insurance program for nursery crops grown in controlled environments that offers coverage mandated by the 2018 Farm Bill. Identify what insurance programs they are interested in and why. Examine their perceptions of any potential conflicts and difficulties. The Contractor shall not conduct surveys and listening sessions in such a manner that they could be construed as a survey.

V.A. Listening Sessions

Listening sessions are critical to collecting information from industry participants about the risks in their industry such as plant diseases, production, and price risks. The input assists in determining what type of product or program the industry needs and to review options with actual potential program participants. In previous contracts, the sessions have been held on-site with in-person participation. This year travel and on-site sessions were suspended due to the COVID-19 pandemic. As a substitute, listening sessions were completed as virtual listening sessions, conducted electronically. The Contractor worked closely with local and national producer groups to coordinate times and dates to maximize potential participation in sessions. Potential participants were then individually invited by the grower organizations and the Contractor to participate in one or more of three scheduled meetings (the text of the invitation sent to all identified stakeholders is provided in Appendix B). All listening session participants who logged in were able to view an agenda on their computer screens (the agenda used in the listening sessions is provided in Appendix C), chat in their questions or comments in written form, or participate in live dialog either through video conferencing or through dialing in to a concurrent conventional audio bridge conference. RMA staff participated in all three listening sessions.

The Contractor conducted three listening sessions with the industry, with participants representing all plant production stages of the greenhouse industry. This gave information encompassing all phases of production from cloning/grafting/rooting or seed development through to final wholesale sale of greenhouse plants and products. Sessions were conducted, based on grower organization input, on January 14, 2021, January 19, 2021, and January 22, 2021. In addition to the sessions themselves, six additional follow up discussions were conducted with individuals who could either not attend the scheduled sessions, or who did attend, but felt more comfortable providing input in a confidential one-on-one environment.

	Listening Session 1	Listening Session 2	Listening Session 3
CEA Representatives	5	12	4
Follow up Phone Interview	2	3	2
RMA Staff	7	4	5
W&Q Staff	2	2	2

Listening Sessions Notes

Stakeholders were provided several opportunities and venues to provide input and feedback. While many participants provided information in scheduled sessions, the Contractor scheduled dedicated calls with a number of industry experts and took careful notes from a number of unsolicited stakeholder calls regarding the project. The following sections are intended to provide a summary of the major themes that emerged from the stakeholder input. The notes are written to capture the consensus views of the participants, providing comments directly as they were shared, where appropriate. Where there are factual inconsistencies that could be identified, the Contractor has acknowledged these, but, in the interest of representing all views, has left all important comments and themes within the summaries.

V.A.1. History and Background

In 2004, a major *Ralstonia* outbreak occurred in the United States. This disease was devastating for many in the greenhouse industry. The costs for the disease were tremendous. Some greenhouses lost all their plants, all input costs into growing the plants, and destruction costs of the plants. This impact was born solely on the industry; there was no insurance available to CEA producers and no government programs were offered to assist them. Some greenhouses had to destroy all the plants they had in their greenhouses. Some greenhouses went bankrupt. The two organizations that began working on government programs for greenhouses after the 2004 *Ralstonia* outbreak were American Horticultural Society and Michigan Greenhouse Growers Council, which was formed in the aftermath of the 2004 outbreak. Both were involved in getting contract language for review of risk management products for greenhouses in the 2018 Farm Bill. The contract for this study was offered based upon that language. Both organizations consider development of programs to support the industry from the damage related to disease pathogens like *Ralstonia* to be a critical objective of the CEA insurance feasibility study.

V.A.2. Production, Financial and Economic Risks

Many natural and weather-oriented risks that affect other segments of agriculture are addressed by the nature of the CEA industry. Growing indoors keeps plants in a stable environment and CEA plants are not generally subject to the outside weather which can damage plants and retard growth. The biggest risk discussed by the participants was disease risk. The other risks referenced by participants include wildfires in western and southern United States and hurricanes in Florida and Texas. By far, disease (and in particular *Ralstonia*) was consistently raised as the biggest concern and the persistently identified need was for the greenhouse industry to obtain tools to mitigate that risk and compensate growers who are effected by an outbreak.

Plant pathogens and diseases can come from offshore or within the United States. There is a substantial amount of plant material that comes from other countries especially during early stages of plant growth. Overseas counter-seasonal production is a critical component of CEA agriculture. Diseases can be viral, bacterial, or fungal. The fungal diseases can generally be addressed by labeled crop protection products and appropriate biosecurity processes; these are not perceived as much of a concern. Bacterial and viral pathogens are much harder to control. Viral diseases, such as *Ralstonia*, may require destruction of the plants in a manner mandated by the government (APHIS). A disease may threaten or impact other types of plants, and not just the plants that were diseased. *Ralstonia* is particular is a threat to production of essential food crops in the *Solanacea* family (nightshade plants, including tomatoes, tobacco, peppers, and

potatoes). When diseases are considered a threat to the essential food supply, regulation can go beyond APHIS to engage the Department of Homeland Security and other emergency response agencies.

Even if all biosecurity, surveillance, and sanitation steps are followed, a disease outbreak may occur at no fault of the operation. Insurance should require all best management practices be implemented appropriately. If management practices are followed and the disease shows up, there should be insurance coverage and indemnification for losses. Producers believe diseases can just show up no matter how strong their biosecurity of testing and cleanliness.

Producers believe a key point where disease can spread is at the USDA inspection points where different plants from different companies can get cross contaminated.³⁴ Diseases are not generally apparent until plants reach their destination or sometime after arriving. These plants can have a clean Phytosanitary Certificate, complete with full biosecurity compliance and the diseases can show up. ‘Cross contamination at the USDA site can happen when boxes broke open in transit and then touched by inspectors.’³⁵

Cleanliness and biosecurity are the key tools that greenhouses use to limit disease. The participants want to note there are no labeled products for greenhouse use to disinfect hands and surfaces that will kill those diseases, particularly viral ones.

V.A.3. Specific Disease - Ralstonia

There have been several outbreaks of Ralstonia disease in the industry, including notable outbreaks in 2004 and 2020. Ralstonia outbreak costs escalate rapidly when it does occur. Ralstonia is first and main concern on the disease list. It can impact many plants. Geraniums are the top plants it can impact. Ralstonia can infect many other plants once it manifests itself. It can impact food plants which is why the United States Department of Homeland Security (DHS) may sometimes become involved. Federal destruction orders generally include the facility where the outbreak is detected as well as potential upstream and downstream segments of the plant development chain. The method(s) to destroy and clean facilities (including potential idle layout periods) is determined by the federal agencies involved.

V.A.4. Other Risks

Florida greenhouses perceive fewer concerns with diseases due to their growing conditions and climate. They are concerned about hurricanes and other big storms that may cause destruction and that the structure of the Nursery, NVS, and WFRP programs exclude much of their CEA production based on the structure and rules for those programs.

Another risk that just came up last year in Florida was the discovery of genetically-modified organism (GMO) petunias among imported young plant stock; which had to be destroyed. GMO plants are not accepted at the consumer level (yet). The greenhouse that bought the plants did not know they were GMO when purchased and found out later. They destroyed all GMO plants they had purchased. They asked if this would be covered. We do not see how we can insure

³⁴ The Contractor was unable to identify any incidence or evidence of outbreaks or cross contamination occurring at a USDA inspection point.

³⁵ The Contractor was unable to identify any evidence to support this stakeholder assertion.

GMO contamination when it is not accepted by the industry. This is a situation that must be handled between the buyer and the seller and not covered by the authority granted under the Act.

Georgia had issues with drift from farmers spraying cotton fields. It was explained that drift is not covered by Federal Crop Insurance and the impacted business must try to collect from the farmer who had the crop sprayed or the custom sprayers. In some instances, the manufacturers of the plant protection products have been held liable for drift damage.

Mites and pests can show up and cause losses. These are (generally) easily sprayed to prevent damage and there are products labeled for management if these pests are present. As is true of all crop insurance programs, if all appropriate management steps were followed and preventive spraying was made, then resulting damage would be insurable under the authority of the Act.

V.A.5. Testing and Quarantine

Nearly all plants are identity-preserved through their production process. Plants can be traced back to their origins or previous owner. Massive amounts of money (sic) are spent on testing these plants at different stages of the production cycle. Tests are for hundreds of diseases and pests are conducted in an ongoing active surveillance effort.

Participants indicated the following are the steps for testing and surveillance are undertaken.

1. Testing by the greenhouse when plants come into their facility. Testing is also done at the first stage of being sold.
2. If a disease is found, the greenhouse notifies government and, if sold, to whom plants were sold.
3. The USDA/APHIS inspects and tests. DHS may become involved if/when the disease can jump to a critical food product.
4. The government agency will confirm the disease and may issue a quarantine and/or destruction order.
5. Next the agency gives quarantine instructions to the greenhouse.
6. Greenhouse does not destroy until USDA says to destroy and by the means mandated in the order.

The government agency is in charge once the greenhouse notifies them of a possible disease. The agency inspects and tests the plants. They identify the disease then issue a quarantine order. The agency determines if plants can be treated and then shipped or sold (or if they must be destroyed). If the order is for destruction, the government states which plants must be destroyed and how they are to be destroyed. This destruction order may include plants that do not have the disease, but were exposed (or are suspected to have been exposed) to infected plants and may get the disease. The destruction method is generally burying or burning. The agency in charge decides the method and mandates the process. The destruction costs are paid for by the greenhouse and there is currently no Federal compensation program available. Insect pests have not historically been subject to quarantine orders in the CEA industry. It is the perception of the industry participants that insect pests can be sprayed (with currently available appropriately labeled products) to prevent or to treat infestations.

The participants repeatedly asked for insurance and/or a compensation program to cover destruction costs. This is not done in most Federal Crop Insurance programs, but there is precedent for programs of this type. For example, California avocado farmers have been offered a Quarantine Endorsement that provides for indemnification for fruit lost to destruction orders as the result of the presence of the quarantine pest.

V.A.6. Biosecurity

Most growers practice biosecurity at their facilities. The greenhouse can impact whether or not some diseases can come in and limit the nature and degree of losses with their practices. Suppliers to greenhouses (upstream young plant propagators) are more active in biosecurity than downstream and retail growers due to the impact a biosecurity breach can have; if suppliers get a disease it can have a much broader impact than a local greenhouse. Listening session participants requested that an insurance program require a certain level of biosecurity to cover risks with insurance and want to make sure no payouts are caused by management decisions.

Underwriting rules can be put in a crop insurance program to require a certain level of biosecurity. Participants stated not all greenhouses would participate in a program due to those requirements, but believe that biosecurity is a key to a successful insurance program. Most large and medium businesses have these biosecurity measures in place. The Act requires that insured producers adopt and maintain best management practices appropriate for their crop and production environment.

V.A.7. Value of Plants

A key part of an insurance program is determine the value of the plant. The plant cycle is set at stages where it is sold to the next level to another company or kept and grown at the same company.³⁶ Different practices of industry and for insurance could be:

1. Stage 1: Seeds, roots, cuttings or liners
2. Stage 2: Young plants
3. Stage 3: Finished plants

One participant captured the consensus impressions of the stakeholders well with the following testimony, “Valuation is key. Cuttings can be valued at \$0.50 and sold to be grown as young plants. The young plant greenhouse may have spent \$4.00 in costs to get it for sale as a young plant. If a disease hits it the wholesale/supplier may credit back to the buyer the 50 cents of the original cost. This is called a credit back. Credit back is not standard or required practice in the industry. It varies with each situation and company. The other issue is the diseased plant value as a young plant is valued at \$4.50, but now that it is identified as diseased it is unsaleable and must be destroyed. The greenhouse only receives a credit for the 50 cents. But is out the \$4.00 input costs and must pay the destruction costs. Insurance must take into account all the costs: Original plant, input costs and destruction costs.” There are important considerations in

³⁶ In Federal Crop Insurance, the concept of stages in the context of insurance guarantees is well established. Many programs provide differential value for crops at varying levels of development based on the input costs invested up to the given development phase when the crop was damaged or destroyed.

evaluating how to insure appropriately, but not over insure. CEA Producers believe their destruction cost need to be considered as insurable costs for a program.³⁷

In previous outbreaks, there have been examples of young plant companies paying for the gross value of destroyed cuttings, but not for the destruction cost for the inputs put on plants since they were received. If a plant is rooted and planted and then the disease is identified, young plants may have 4-6 weeks of input costs in them. Under current informal supplier compensation/credit schemes, diseased plants are limited to the value of the input (cutting, seed or other) and not the value that was spent on inputs before disease showed up. Credit back is not standard practice. It varies with each situation and company.

Participants noted that USDA/NASS does an annual survey that gives value of some classes and types of finished plants. There are regional cost differences in plant values. Participating greenhouses have historical prices for all stages in their records and these would likely provide the best basis for staged valuation.

Based on the provided input, different stages of valuation for insurance could be:

1. Seeds, roots, cuttings, clones, or liners
2. Young plants
3. Finished plants

Stage 1(First Seller)	Stage 2 (Intermediate Seller)	Stage 3 (Final Seller)
Seeds, roots, cuttings or liners	Young Plants/Pre-finish: (50% costs of finished plants are here when sold to next stage.	Finish Plants 100% costs are in.

All production at all levels are sold through brokers who will have access to detailed records of the valuation and wholesale pricing for plants at each stage of development.

V.A.8. Inventory

Many greenhouses remain as full as they can throughout their regionally-appropriate production season. Greenhouses say this is called “always filling.” This means they bring in plants when other plants are sold and space opens up. This is similar to a grain elevator that puts through three times the amount of grain that it can store. Even short-season greenhouses refill 2-4 times a year their total floor space.

Participants asked specifically about Easter lilies not sold due to COVID-19. Greenhouse sales missed the marketing window due to conditions beyond their control. The session moderators noted that losses of this nature (where the production itself is undamaged, but the market ceases to exist) are viewed as a business interruption loss and are not eligible for insurance coverage

³⁷ Although it is not a perfect precedence, there are Federal Crop Insurance programs (Downed Rice is one example) that provide additional payment of increased input costs as the result of insurable damage events. The Act does not specifically address authority to indemnify losses for costs incurred under Federal destruction orders.

under the Act, but if sale of inventory were delayed as a result of an insurable peril, the loss of valuation from delayed sale may be insurable in some situations.

V.A.9. Record Keeping

Record keeping must be a pre-requisite for insurance. Participants report that most greenhouses have records for all levels of the production cycle and can determine value at the weekly level. All will have some sort of record keeping. Smaller and downstream greenhouses generally maintain less rigorous records than larger and upstream operations. Greenhouse record keeping is done by most greenhouses at all stages/practices. Greenhouses report that they have electronic records and can make hard copies of inventory, contracts, invoices, prices, and plant numbers.

V.A.10. Participants Perspectives of Other Insurance Products

The participants were asked if they were familiar with other products that insure related industries, specifically Nursery, NVS, and WFRP insurance plans. Most were unfamiliar with WFRP. A few are familiar with Nursery and NVS since they have some part of their CEA operation that is eligible for NVS and they insure it. Most views on crop insurance is it only pays at a catastrophic level.

When the moderator reviewed the Nursery and (particularly) the NVS program, participants were interested in a similar type program based on the NVS model. They like the idea of insuring a value in their greenhouse for the types and categories they choose. There are concerns about the restrictions in the NVS program limiting or prohibiting eligibility for many of the CEA segments of interest.

V.A.11. APHIS or Insurance Programs

Nearly every listening session participant expressed strong interest in and support for an APHIS-based program to indemnify losses as a result of a quarantine destruction order. As was detailed in Section II.C., APHIS does not currently have the legal authority to compensate for destruction orders in plants as it does in livestock agriculture, but the changes to existing language to grant the authority would be needed (if such a program is deemed appropriate by Congress) are minor.

V.A.12. Premium

All groups were asked about a premium level they could pay. At the 3-5 percent of gross liability level, the consensus opinion was that 3 percent may draw interest, but 5 percent would likely be prohibitive. At current standard subsidy rates, a 3 percent producer retail premium implies a gross pure risk rate of roughly 7 percent, which would represent a very conservative premium in light of the low frequency of historical losses.

V.B. Interviews

The Contractor conducted interviews with four individuals who agreed to be identified and formally interviewed for this report. These individuals represent widely differing perspectives. As stated in the beginning of the report, the COVID-19 concerns eliminated most travel for many interested parties in this greenhouse research. These four interviews are conducted in addition to the follow up interviews from the listening sessions.

The list of topics for each interview was the same to assure consistency and comprehensiveness in each interview. The Contractor, with RMA input, drafted those topics (see Appendix D). Each interview has a sheet drafted that covers the discussion. A summary of those full interviews is provided below.

V.C. Interview Summary

The Contractor set up interview times to discuss the interview topics with the greenhouse stakeholders. All interviews were informative and helpful to the project. The key points from each interview and their responses to the ten key issues are shown for each interview at the end of this section. The original notes from a sampling of interviews are included in Appendix E, with minor edits to remove personally identifying information.

V.C.1. Summary of Key Points and Stakeholder Perspectives

Disease, specifically *Ralstonia* is the main concern raised by stakeholders. *Ralstonia* outbreaks have not occurred frequently, but each event makes a severe impact upon on greenhouses. The overall cost to those greenhouses hit by it is massive. Greenhouses lose the value of what they would have sold the plants and/or their production. The last time a *Ralstonia* outbreak occurred (a stakeholder commented that there was an outbreak in 2018, but the APHIS materials report the date as 2020), the wholesalers credited back the value of the lost plants to keep greenhouses operational. The greenhouses still had to handle the destruction costs and destruction protocols were based on very specific USDA APHIS instructions to either burn or bury potentially compromised material.

Stakeholders believe it is doubtful that wholesalers will attempt to (partially) cover the cost of a future outbreak. One wholesaler bought private insurance for the 2020 year, but will not buy it next year; the premium cost was just too high. Not many private insurance companies want to insure that peril, due to its high cost (severity) when it happens. The consensus was that greenhouses will be offered no buffer by wholesalers going forward and affected operations are unlikely to survive the event.

Government payments are unusual in the nursery and (especially) greenhouse industry. The recent narrowly defined greenhouse payments made under the Coronavirus Food Assistance Program (CFAP) are the first for which they have been included. These are considered disaster payments. Another possibility stakeholders have weighed is asking APHIS (likely through Congress) to build a program for greenhouse diseases.

The greenhouse industry does have well detailed accounting records for price, volume, and date of sale. These records are down to weekly level for many operations. Some of the companies sum these to monthly and quarterly.

A key item the greenhouse industry is looking for is a risk that has not historically been covered by crop insurance due to limitations to authority in the Act. That risk is the missing of sales due to event beyond the greenhouse control. A good example is COVID-19 shut down many business such as greenhouses and they could not sell their product. This is called business interruption insurance. It is not a coverable risk by the Act.

This risk is increased due to the business nature of greenhouses. Many greenhouse sales windows for most of their plants they grow for a year can have an optimum sales window only for a month or two. Sometimes 50 percent of annual sales are impacted by a 2 to 6-week delay on certain plants. That happened this year with the COVID-19 shutdown in many areas. April through June are key times for sales for seasonal operations, particularly in the northern two-thirds of the country. In 2020, shutdowns crippled both production and markets. While there were reports of exceptional demand in some areas of the country, the stakeholders all reported terrible setbacks related to shutdowns.

V.C.2. Interview Conclusions

Each stakeholder offered valuable perspectives about the nature of risk they face, the tools that are currently available and the need for additional protection. It is clear that the authority currently offered under the Federal Crop Insurance Act is an imperfect fit for the specific needs of controlled environment producers; the primary risk peril is catastrophic disease outbreaks, or more specifically of operation-wide depopulation controls imposed in light of disease outbreaks. As we have found previously in livestock and in quarantine studies, the low frequency, indirect effect, and overwhelming severity of these events also make it difficult for private markets to appropriately serve producers. Each of the stakeholders interviewed is highly motivated to see some form of protection made available and each believes that government should play a central role in offering or facilitating that coverage. It is the Contractor's interpretation, which has been corroborated by USDA legal counsel, that 2018 Farm bill language authorizes a "greenhouse" policy that can insure in addition to crop insurance risks already identified, diseases introduced into the facilities and contaminated cuttings.

VI. MARKETING ENVIRONMENT

This section of the report addresses the SOW stating:

“Data Availability and Price Methodologies – The Contractor shall conduct a search for price, and yield data at the national level and in each of the research study areas. Identify viable data series and formulate all reasonable alternative methods other than contract price or nursery greenhouse producers’ published catalog/price list prices to develop expected prices for each commodity. These methods shall include determinations of preharvest prices and the effects of quality deficiencies on prices.”

From the AMS Market News Website: “Specialty Crops Market News disseminates detailed information on marketing conditions for hundreds of agricultural commodities at major domestic and international wholesale markets, production areas, and ports of entry. Using direct contacts with sales persons, suppliers, brokers, and buyers, Market News reporters collect, validate, analyze, and organize unbiased data on price, volume, quality and condition, making it available within hours of collection at no cost to you.” In addition, “USDA Market News provides price, volume, and other related information for commodities and products that have been grown, processed and certified to USDA’s National Organic Program standards.”

Limited price information is available for greenhouse production. For example, the AMS market reports for tomatoes on September 8, 2020 include prices for greenhouse production delivered at terminal markets in Baltimore, Boston, Chicago, Columbia, Dallas, Detroit, Las Angeles, New York, Philadelphia, and San Francisco. Ontario, Canada is the predominant origin of the tomatoes for the eastern terminal markets. California and British Columbia, Canada are identified for the western part of the country. Mexico is a source of greenhouse tomatoes in several markets, both eastern and western. Maine is a source of greenhouse production delivered to the Boston market. Prices include tomatoes packed in single layers, double layers, loose, on the vine, heirloom, and 5, 10, and 15 kilogram cartons, and others. Prices include mature green, immature green, vine ripe, 85 percent U.S. #1, grade unspecified, and others.

Information for greenhouse-raised tomatoes is the most extensive of the commodities. There is limited information for greenhouse production of bell peppers and a few other crops. These reports present prices as a range with limited information regarding quantities sold at those prices. Packaging is a variable affecting the price for many commodities. In summary, pricing data for greenhouse-produced crops is very limited.

The extent of contract marketing is unknown. No literature on this topic discusses the extent that contracting plays a role in marketing of the output of CEA operations. A publication from PennState Extension discusses “Fruit and Vegetable Marketing for Small-Scale and Part-Time Growers.”³⁸ While not specific to greenhouse production, this document provides salient observations that pertain to small-scale production of any commodity. For example, “As a small-scale fresh fruit and vegetable grower, you may consider selling directly to retailers. Although some chain stores and independent retailers have buy-local programs for fresh produce, such stores and programs are not common. You must develop your own marketing

³⁸ <https://extension.psu.edu/fruit-and-vegetable-marketing-for-small-scale-and-part-time-growers>, accessed September 2020.

system. In effect, you must become the grower, packer, and wholesaler.” In this context, marketing of greenhouse commodities becomes a value-added operation in that packaging and marketing costs must be included in the sales price. Damaged or destroyed production not sold is over-priced if a loss is valued at the price that sales occurred. Estimating and eliminating the amount of mark-up contained in the sales price would be a challenge.

Critical marketing periods depend on the commodity and location. An operation producing transplants has a critical marketing period immediately prior to the onset of planting the crop. Production of the transplants must be staged so the seed or slips that are planted are ready for sale at that time. It is impossible to determine a critical marketing period. This depends on the commodity produced, the clientele purchasing that commodity, the season, and other variables.

Many plants grown in greenhouses are planted in standard nursery containers and are produced to sell the entire plant to buyers. Most of these are insurable under the Nursery or NVS crop insurance policies. Commodities produced using aeroponics, aquaponics, or hydroponics are not insurable under Nursery policy but hydroponics is allowed by the NVS policy. Many commodities produced by these methods are foods intended for direct human consumption. These include lettuces, peppers, cucumbers, tomatoes, and several others. These commodities include products consumed in the form that was produced (lettuce) or are the fruits of a plant harvested and sold apart from the plant (peppers, cucumbers, and tomatoes). Disposition may be to a retailer that supports a “buy-local” philosophy, to restaurants, directly to consumers, and others. Utilization of greenhouse produced commodities ranges from ornamental uses to upstream production (transplants) to direct human consumption (harvested fruits and vegetables). The Contractor did not find literature that identified quantities sold via any specified end-use.

VII. RESEARCH RECOMMENDATIONS, POSSIBLE DESIGN OPTIONS, AND IMPACT ANALYSES

The SOW states the following for this section:

Research Recommendations, Possible Design Options and Impact Analyses – The Contractor shall make recommendations on the viability and marketability of new product development or adding to the existing nursery crop insurance program. The Contractor shall provide a comprehensive discussion of crop insurance alternatives with an explanation of why the alternative is best. The Contractor shall include an outline of the model for the basis of the guarantee, preliminary premiums, formulate expected prices, methods of determining yields; recommend a year of implementation; units of exposure; types; practices; insurance dates; initial insurability requirements; pilot counties; insured causes of loss; uninsured causes of loss; a description of what triggers a loss and how indemnities will be calculated; and the availability of loss adjustment procedures. The Contractor shall identify and evaluate the potential impacts on nursery greenhouse producers, taxpayers and the market of any crop insurance programs which nursery greenhouse producers express an interest. The Contractor shall identify the risk of program fraud, abuse, and moral hazard faced by the Government. The Contractor shall identify any challenges associated with development of such a program and any areas or plants for which the program may not be suitable.

The Contractor, when recommending whether the items listed above are expected to be viable, needs to keep in mind the following criteria:

- 1. The insurance product must conform to RMA's enabling legislation, regulations, and procedures that cannot be changed;*
- 2. The nursery greenhouse insureds and their agents must be willing to pay the appropriate price for the insurance;*
- 3. The insurance product must provide coverage that is effective, meaningful and reflects the actual risks of the nursery greenhouse producers;*
- 4. The perils affecting production must be identified and categorized as insurable and non- insurable;*
- 5. The insurance product must be ratable and operable in an actuarially sound manner;*
- 6. The insurance product must contain appropriate and reliable underwriting, rating, pricing, loss measurement, and insurance contract terms and conditions;*
- 7. There must be an appropriate geographic distribution of production to ensure a sound financial insurance program;*
- 8. There must be enough interest for the risk to be spread over an acceptable pool of insureds;*
- 9. Customers must not be able to select insurance only when conditions are adverse;*
- 10. Moral hazards must be avoidable or controllable;*
- 11. There must be no change of beneficial gain; and*
- 12. There must be no change in market behavior or market distortions that change the quantity supplied or shift the supply curve.*

VII.A. Recommendation Overview

The Federal Crop Insurance program has grown from a humble set of yield-based offerings for wheat in a handful of states to the largest and most diverse component of American agricultural policy. Following ARPA (2000), RMA has worked diligently to increase the number and variety of offerings available to serve an ever-growing set of crops and agricultural production systems. While these efforts have been wildly successful, the program has also already developed and offered programs for all the crops and sectors that can be easily served (and a number of sectors that are not easily served). As a result, the proverbial ‘low hanging fruit’ has already been picked. The CEA agriculture industry most assuredly does not represent low hanging fruit; as the report details, there are particularly meaningful challenges to aspects of industry structure, program design, legal authority with regard to insurable perils, availability of data for application to ratemaking, and best management practice standards. There is not even a broadly accepted consensus definition of CEA.

For the purposes of this report, the Contractor will offer a frank appraisal of the challenges and opportunities for insuring the CEA risks associated with plants, with particular interest in the disease perils identified as critical both in the Farm Bill language upon which this contract was based and the industry feedback collected throughout this effort. The intent of these recommendations is both to affirm the fraught challenges detailed throughout the report and also provide actionable steps that might be undertaken by those who have dedicated so much time, effort, and energy into attempting to obtain risk mitigation tools for CEA.

To be clear, any development intended to serve CEA will be difficult and will require the same sort of initial flexibility regarding quantitative assessment of risk that has been applied to other new programs intended to serve specialty and nascent industries for which data are limited and/or largely proprietary. While the Federal Crop Insurance Corporation (FCIC) has extended this sort of flexibility to new programs like Hemp and WFRP, each prospective program must be considered independently and on its own merits. These recommendations are made with the assumption that unknown variables, including the success of future quantitative data collection efforts, and the verification of the application of authority to insure quarantine/disease perils will be achieved as part of a development effort.

VII.B. Viability and Marketability of a Program for CEA

Throughout the listening sessions, stakeholder feedback interviews, and discussions with industry experts, the desire for risk cover for catastrophic disease risk was discussed. These discussions were not limited to Federal Crop Insurance products and stakeholders expressed a high degree of flexibility regarding the venue and framework for such risk transfer. Stakeholders were specifically asked to assess their own willingness and ability to pay premiums for the risk cover, provided a range of retail premium rates between 3 percent and 5 percent of the potential insurable liability (implying rates at 75 percent coverage levels that are substantially higher than offers currently available in NVS, nursery, and dollar-based fresh vegetable programs). The stakeholders acknowledged the challenges rates in the 4 percent or 5 percent range would pose, but expressed strong interest if producer-paid rates were in the 3 percent range or less. Among those who provided feedback (a population that is unquestionably subject to survivor bias – disinterested parties are far less likely to respond at all), there was universal acceptance and interest in participation in a new risk mitigation tool.

VII.C. Crop Insurance Alternatives Considered

The crop insurance alternatives considered are detailed at length in the body of this report, but can be summarized to include models based on the WFRP program, the current Nursery program and the NVS program, with additional special consideration given to the quarantine program offered for avocados and citrus in California and parts of Arizona. Each of these programs is, for various reasons, unconventional relative to the vast majority of the offers in the Federal Crop Insurance portfolio and it is these unconventional attributes that offer the potential to addressing the many challenging idiosyncrasies of CEA.

While each of the considered alternative models offered potentially useful attributes, NVS was identified as having the greatest potential application as a model for CEA.

VII.C.1. Whole Farm Revenue Protection

The WFRP program has been heralded as a potential one-size-fits-all tool to address diverse and specialty operations. The program's offer is remarkably broad and specifically considers the implications of multiple crop/livestock enterprises within an operation. WFRP, however, draws premium rates from comprehensive tables of risk premiums for specific identified (and therefore explicitly rated) crops. Moreover, WFRP relies on tax records that would be very difficult to parse in CEA to segregate insurable segments of the value chain, and impose unacceptable delays in indemnification of losses. Finally, the WFRP program relies on complex and detailed underwriting controls that would have to be comprehensively reconsidered for application to CEA.

VII.C.2. Current Nursery Crop Insurance Program

The current nursery program provides broad inventory-based coverage for diverse operations including thousands of plant species. The program has been offered for decades and provides a wealth of (imperfectly applicable) experience data from which risk can be considered. Unfortunately, Nursery relies upon specific and comprehensive price listings for valuation of liability and requires insurance for all plant type/categories within a given operation, both of which render the program infeasible as a model for CEA.

VII.C.3. Nursery Value Select

NVS is a new program that was designed specifically to reduce the challenges posed by the existing nursery program. NVS is highly flexible, depending upon grower's own records for valuation and providing choices in plant categories to be insured. This flexibility allows an NVS-based design to potentially accommodate the unique attributes of CEA, making it the best potential model considered. The NVS model is not without shortcomings however; the program is new and no insurance experience will be available for more than a year from the date of this report; moreover the flexibility extended by NVS could also be interpreted as a potential program vulnerability without specifically targeted and well-designed underwriting controls which can be developed. The basis of the NVS design does nothing to address the paucity of quantitative data from which rates may be estimated or the challenges of the authority under the Act to compensate farmers for losses due to quarantine-based disease perils.

VII.C.4. Quarantine Pilot

The Quarantine Pilot Program was introduced as an endorsement to existing yield-based programs for citrus and avocados in California and Arizona in 2009 for a limited number of counties. The program offers a limited modification to the crop provisions to include losses as a result of deterioration or destruction of the crop based on a quarantine action.³⁹ This program does offer a precedence for providing coverage to losses as a result of a quarantine action, but it must be noted the coverage is structured as an endorsement to existing coverage and offers no stand-alone liability of loss adjustment process; this program does not provide a model for insuring a crop or industry for which no underlying coverage is already in place.

VII.D. Insurance Model Outline

The proposed basis for coverage of development for CEA is the NVS program, and therefore major aspects of the design have been conceptually tested. The guarantee would be based on the value of inventory present at the time of loss, subject to seasonal peaks, established deductibles, and liability limit elected by the insureds. Premiums cannot be estimated without a comprehensive data collection effort as an early phase of the development. Expected prices would be based on historical sales records and current contract values and ‘yields’ would be assessed as current value relative to pre-loss value at the time of a loss event. The year of implementation is unknown, but given the effort anticipated would likely be no earlier than 2024 and could readily adopt dates and unit structure based on category as is used in the NVS program. Insurable causes of loss would be a particularly critical aspect of the design as most natural weather perils are not applicable to CEA and the predominant risk (destruction orders as a result of a quarantine-actionable disease outbreak) is only currently offered coverage on a very limited basis under the existing authority of the Act.

VII.E. Potential Impacts

The potential impacts of a new program for CEA are difficult to estimate with confidence given the hypothetical nature of the design and the lack of precedence in this market. The cost of developing and maintaining a new specialized program will be meaningful given its specialized nature. While interest among stakeholders is very high, the risks of greatest interest display very low frequency and high severity characteristics and the target market is composed of producers who historically have not purchased crop insurance at all. Over time, Nursery growers have migrated their participation to CAT coverage, which has very high subsidy rates, but little premium, which would reduce both agents and insurance providers’ interest in promoting, supporting, and marketing the new program. In most years the program can be expected to have loss ratios of zero, but in the infrequent years when quarantine-based disease depopulation orders are made, loss ratios for the program will be extreme (a large loss divided into a very small annual premium) and it will take an extended number of years to establish meaningful experiential updates to premium rates. The pool of individual producers who could benefit from this coverage is limited but growing, and RMA has a mandate to extend coverage wherever practicable, but it can be expected that the cost of servicing each insured with a new specialized program will be substantially higher than that of conventional crop programs.

³⁹ Additional information is available here: <https://www.rma.usda.gov/en/Fact-Sheets/Davis-Regional-Office-Fact-Sheets/Quarantine-Avocado-and-Citrus-2018-CA>, accessed February 2021.

VII.F. Program Risks

In past research into quarantine pests, particularly boll weevil in cotton and avian influenza in broilers, there was extensive discussion of the potential for inappropriate incentives in indemnifying producers for quarantine-based losses. For instance, if the identification of a weevil resulted in the automatic destruction of surrounding crops for a 10,000 ft. radius of the site of discovery, but compensation were only offered to the unit in which a weevil was found, producers in surrounding fields would have an incentive to assure that weevils were found in their units as well. In the case of plant borne diseases like Ralstonia, the risks to critical food crops (potatoes, tomatoes, and others) are acute and the potential implications of an outbreak reaching the food supply are severe. Care must be taken in program design to assure producers have a strong incentive to maintain very high biosecurity standards, to conduct active surveillance of their operations, and to aggressively report vectors if and when they are found. If compensation is inadequate, producers would have short-term financial incentives to fail to report perils. If compensation is too generous, producers would have short-term incentives to relax biosecurity standards and fail to actively prevent outbreaks. Historically, in the absence of any compensation program, the industry has borne these responsibilities itself, at sometimes catastrophic cost to individual participants in past outbreaks. The most important risk in program design is development of appropriate incentives to prevent outbreaks to the greatest extent possible and fully and fairly compensate producers for the losses they are unable to prevent.

VII.G. Program Challenges

As has been noted throughout the report and this summary, the challenges to development of a new program for CEA are daunting. Good quantifiable data regarding the expected frequency and severity of disease outbreaks is currently unavailable and would either require an ambitious data collection effort or the application of an alternative rating approach like which was used in the Quarantine Pilot Program or the Adjusted Gross Revenue program (the predecessor to WFRP). The legal authority to insure losses that have been incurred based on destruction orders is largely untested, with only a single known and limited offer in this space currently available. The NVS program upon which the most promising insurance concepts are based is also untested and is now in its first year of availability.

VII.H. Concluding Considerations

The feasibility standard for a new insurance program has been developed over many years and represents a balance between the mandate to expand coverage to as many crops and sectors as practicable while carefully maintaining the interest of taxpayers and stakeholders. The needs of CEA agriculture are unique and serving this industry with a crop insurance program will require new approaches and applications of untested concepts. The contract outlined twelve attributes of feasibility and each warrant specific consideration.

1. *The insurance product must conform to RMA's enabling legislation, regulations, and procedures that cannot be changed;*

The proposed NVS-based concept would offer coverage based on the change in value of the inventory of a CEA operation following an insurable loss event, to include destruction mandated by an appropriate authority. This appears to conform with the authority of the Act (a program that offers such coverage is currently available, but only on a limited basis) and regulations.

2. *The nursery greenhouse insureds and their agents must be willing to pay the appropriate price for the insurance;*
Stakeholders indicated a willingness and ability to pay producer premiums in the 3-5 percent of insurable liability range; actual rates cannot be known prior to development.
3. *The insurance product must provide coverage that is effective, meaningful and reflects the actual risks of the nursery greenhouse producers;*
The proposed concept is specifically targeted to the needs identified in feedback sessions and in the Agricultural Act of 2018.
4. *The perils affecting production must be identified and categorized as insurable and non-insurable;*
All anticipated risks are believed to be insurable under the Act under appropriate circumstances, but the Contractor concedes this element of interpretation has little applicable precedent.
5. *The insurance product must be ratable and operable in an actuarially sound manner;*
The paucity of available quantifiable data implies that conventional ratemaking is unlikely to be practical. In previous development of specialty programs, special dispensations were made for ratemaking (Delphi processes, reference crops, etc.) to accommodate introduction of coverage to new sectors.
6. *The insurance product must contain appropriate and reliable underwriting, rating, pricing, loss measurement, and insurance contract terms and conditions;*
The most feasible program design is based on the newly introduced NVS program, which is specifically designed to offer the flexibility that would be needed to accommodate the special needs presented by sectors like CEA. The program is new and untested, but appears to be sound and appropriate in these respects.
7. *There must be an appropriate geographic distribution of production to ensure a sound financial insurance program;*
For the particular nature of the primary risk drivers of the anticipated program, geographic distribution is not a relevant variable.
8. *There must be enough interest for the risk to be spread over an acceptable pool of insureds;*
The number of young plant operations is relatively limited, but CEA represents an important and growing segment of U.S. agriculture. Assuming typical adoption curves, the Contractor anticipates an acceptable pool of insureds could be achieved within five years of program introduction.
9. *Customers must not be able to select insurance only when conditions are adverse;*
Given the nature of the perils involved, the Contractor recognizes no unique opportunities for adverse selection.
10. *Moral hazards must be avoidable or controllable;*
Given the nature of the perils involved, the Contractor recognizes no unique opportunities for moral hazard if indemnification criteria can be designed appropriately.
11. *There must be no chance of beneficial gain;*
Deductibles and program design limit opportunities for beneficial gain.
12. *There must be no change in market behavior or market distortions that change*

the quantity supplied or shift the supply curve.

Currently no private coverage is available for these risks; when risks strike the affected parties endure sharp losses and/or exit the business. The program can be expected to stabilize the industry, but should not be expected to induce new entrants or expansion of current operations.

In addition to these considerations, the Contractor feels it is appropriate to acknowledge in its conclusions that APHIS currently offers indemnification of losses for quarantine-based disease vectors and depopulation for livestock. While that authority does not currently exist for plants, the changes that would be required to support the authority to compensate plant losses to depopulation are minor, as detailed in Section II.C.

Appendix A

Greenhouse Links with Research Information

National Links

National Horticulture	The AmericanHort Mission is to unite, promote, and advance our industry through advocacy, collaboration, connectivity, education, market development, and research. Research done through “Horticultural Research Institute” https://www.americanhort.org
National Greenhouse Manufacturers Association	NGMA is a professional trade organization for the manufacturers and suppliers of greenhouses and greenhouse components. Contains complete list of all state groups. https://ngma.com/industry-links/
National Greenhouse Co.®	National Greenhouse Co.®, a division of Nexus Corporation.®, is a proven leader in the design and manufacture of greenhouse kits and other enclosed environments - not just for the home, yet also for schools, universities, and businesses across the U.S. and Canada. With over 80 years of experience, Nexus Corporation's greenhouses are designed and manufactured to stand the test of time. National Greenhouse Co. has earned a reputation as the leading supplier of quality home greenhouses and hobby greenhouse kits in the United States and Canada. https://nationalgreenhouse.com/
Southern Nursery Association	On January 1, 2014, AmericanHort was born by the consolidation of the American Nursery & Landscape Association and OFA – The Association of Horticultural Professionals https://sna.org/

* Information is quoted from each website’s page.

State Links

California: Plant California Alliance	The Plant California Alliance is an association of professionals who bring plants and landscape supplies to Californians and the world. http://www.plantcalifornia.com/
Florida: Florida Nursery, Growers and Landscape Association	Nation's largest state nursery and landscape association, FNGLA represents Florida's environmental horticulture industry which generated \$21 billion total output sales in 2015 and directly employed 232,000 people. Through FNGLA's efforts, the entirety of Florida's nursery and landscape industry benefits! http://www.fn gla.org/
Oregon: Oregon Association of Nurseries	The Oregon Association of Nurseries includes all members of the greenhouse industry for Oregon. http://nurseryguide.com/
New York: New York State Nursery and Landscape Association	New York State Nursery and Landscape Association is a statewide professional trade association. NYSNLA is dedicated to advancing New York's nursery and landscape industries through promotion of sound business practices supported by education, relationships and advocacy. https://nysnla.com/
Washington: Washington State Nursery & Landscape Association	The WSNLA works with its members to protect, promote and educate the horticulture community in Washington State. https://www.wsnla.org/default.aspx
North Carolina: North Carolina Nursery & Landscape Association	The North Carolina Nursery & Landscape Association is a 501(c)(5) non-profit membership organization of firms interested in the welfare of North Carolina's green industry with emphasis on the nursery and landscape industry https://www.ncnla.com/
Pennsylvania:	The Pennsylvania Landscape & Nursery Association (PLNA) is the leading trade association representing Pennsylvania's \$6.8 billion green industry. Founded in 1904, its member landscape contractors, retail garden centers, wholesale nurseries and greenhouses produce outdoor living environments that improve economic value, air quality, water quality and human health. https://www.plna.com/default.aspx
Texas: Texas Nursery & Landscape Association	The Texas Nursery & Landscape Association's Mission is to enhance Members' business success through legislative/regulatory advocacy, education, networking, and promotion of professionalism. https://www.tnlaonline.org/
Michigan: Michigan Nursery & Landscape Association	MNLA Represents: A wide range of Michigan Green Industry businesses on legislative and regulatory issues, education and events, certification programs, marketing and promotion, and member-only money saving programs. https://www.mnla.org
Ohio: Ohio Nursery & Landscape Association	Ohio Nursery and Landscape Association has a rich history of supporting and promoting Ohio businesses. Established in 1908 as the Ohio Nurserymen's Association, ONLA has grown to be Ohio's only state association that encompasses and welcomes the many businesses that make up the green industry. https://www.onla.org/default.aspx

<p>Colorado: Colorado Nursery and Greenhouse Association</p>	<p>CNGA helps elevate and strengthen independent nursery and greenhouse businesses in and around Colorado. We provide unparalleled education, legislative advocacy, fellowship, certification, training and operational support. https://www.coloradonga.org/</p>
<p>Maryland: Maryland Nursery, Landscape and Greenhouse Association</p>	<p>The Maryland Nursery, Landscape, and Greenhouse Association (MNLGA) has a distinguished history of supporting, promoting, and providing services and assistance to member businesses since 1934. https://www.mnlga.org/</p>

* Information is quoted from each website's page.

Regional and Additional Links

<p>Greenhouse Grower with top 100 grower list</p>	<p>Greenhouse website and magazine: Greenhouse Grower Greenhouse Grower® and GreenhouseGrower.com represent the best interests of the commercial controlled environment growing industry with a focus on the knowledge and tools to sustain and enhance the sector’s vitality and profitable growth. Our readers are growers of ornamental crops, greenhouse vegetables, cannabis, hemp, and other floriculture crops. https://www.greenhousegrower.com/</p> <p>Top 100 growers by name and state https://www.greenhousegrower.com/management/2020-greenhouse-grower-top-100-ornamentals-growers-the-complete-list/</p>
<p>Vegetable Growers News</p>	<p>The Vegetable Growers News is a monthly magazine that covers all aspects of the industry. https://vegetablegrowersnews.com/</p>
<p>Horticulture Daily</p>	<p>Hortidaily.com is an online meeting place for the international horticulture industry. The website is updated daily with interesting news from around the globe. HortiDaily intends to provide as much information as possible, which could help growers with the management of their horticultural enterprise. https://www.hortidaily.com/</p>
<p>New Mexico Vegetable Production</p>	<p>Resource for Greenhouse vegetable production in New Mexico. https://aces.nmsu.edu/pubs/_circulars/CR556/</p>
<p>Michigan Greenhouse Growers Council</p>	<p>As a statewide organization, Michigan Greenhouse Growers Council (MGGC) realizes the importance of having a strong, cohesive association that represents the grower segment of our industry and focuses on public policy, legislation and keeping Michigan growers informed about relevant issues. https://mggc.org/</p>
<p>North East Greenhouse</p>	<p>Northeast Greenhouse grower conference and expo is an annual meeting and expo for the Northeastern states. https://www.negreenhouse.org/</p>
<p>Multiple Groups</p>	<p>List of additional groups in the greenhouse industry. https://hbin.tamu.edu/greenhouse-firms/</p>
<p>NGMA List</p>	<p>The National Greenhouse Manufacturers Association Representing and advancing the interests of the greenhouse industry through education, networking and communication. https://ngma.com</p>

* Information is quoted from each website’s pages.

Appendix B

Stakeholder Information Gathering Invitation

Virtual Listening Session

Feasibility of Insuring Greenhouse and Controlled-Environment Agriculture

You are invited to participate in a virtual listening session with Watts & Associates (W&A), which is working under contract for USDA's Risk Management Agency (RMA).

Why? As part of the 2018 Farm Bill, Congress required RMA to study the feasibility of offering a new crop insurance program for controlled environment agriculture.

The feedback we receive will assist in determining if a crop insurance product or other program can be developed for growers who operate greenhouses and controlled-environment agriculture.

Who? The virtual listening sessions are primarily for growers who operate greenhouses and controlled-environment agriculture and their representatives in the federal crop insurance industry.

When? There are several sessions, which will be held in the next few weeks. You are invited to choose from the following sessions.

January 14th, Thursday 11:00 EST

January 19th, Tuesday 11:00 EST

January 22nd, Friday 2:00 EST

Listening sessions are critical to collecting information from industry participants about the risks in their industry such as plant diseases, production and price risks. Input at these meetings helps determine and support any changes that RMA may consider. We appreciate your participation at one of the sessions.

What is a Virtual Listening Session? It is a method to connect and talk with you via phone and/or an internet connection. If you are interested in participating in one or more of the sessions, please contact us for details about accessing the listening session:

Eric Henry at Watts and Associates

406-252-7776, Ext. 3006

EHenry@WattsandAssociates.com

Appendix C

Stakeholder Information Gathering Agenda

Greenhouse/Controlled Environment Agriculture Crop Insurance Study Virtual Listening Session Agenda

- Introductions
 - Watts and Associates, Inc.
 - Attendees

- Purpose
 - Gather stakeholder input in regard to the possible crop insurance approaches for Greenhouse/Controlled Environment Agriculture industry.

- Background
 - Paperwork Reduction Act constraints
 - Contract requirements and current status

- Stakeholder Input
 - Interest in new programs
 - Production, financial and economic risks
 - Naturally occurring production risks-diseases
 - Disease control methods including governmental requirements (APHIS, others)
 - Different production practices
 - Inventory values
 - Record keeping
 - Catalog values and discounts
 - Views about Nursery/NVS and WFRP insurance plans
 - Questions about insurance programs: guarantees, underwriting, prices and premiums
 - Commercial insurance limitations.
 - Other issues raised by the attendees

Appendix D

Greenhouse Interview Outline

Greenhouse/Controlled Environment Agriculture (CEA) FCIC Multi-Peril Crop Insurance Interview Session Outline

- Introductions
 - Watts and Associates, Inc. (Dr. James Driscoll and Eric Henry)
 - Interviewee

- Purpose
 - Gather input to obtain views and comments regarding production risks affecting operators of Greenhouse/CEA and prospects for crop insurance tools to address and mitigate these risks.

- Background
 - 2018 Farm Bill
 - Contract Requirements
 - Development Process/Timing – Data Needs

- Stakeholder Input
 - Naturally Occurring Risks Affecting Industry
 - Production Risks and Mitigation Options – Practices
 - Prevalence of Disease with no Control Measures, e.g., *Ralstonia*
 - Availability of Commercial Insurance
 - Gaps in Commercial Insurance
 - Considerations for APHIS or other Catastrophic Disease Compensation programs
 - Inventory Valuation
 - Record Keeping
 - Views about Nursery/NVS and WFRP Insurance Plans
 - Willingness and ability to pay premiums
 - Other issues raised by the attendees

- Questions

Appendix E

Interview Session Outlines

Company 1

Greenhouse/Controlled Environment Agriculture (CEA) FCIC Multi-Peril Crop Insurance Interview Session Outline

Stakeholder:

Interviewee owns and operates a multi-state CEA operation specializing, among other activities, in cloning, seeding, and young-plant development and propagation.

Interview Conducted: October 23, 2020

Notes and Key points:

They request risk management for diseases. Disease outbreaks do not happen often (such as *Ralstonia*), but when it does occur it is very expensive. For example in 2017 a petunia viral disease hit hundreds of growers in the United States. Besides the plants not reimbursed, the destruction and clean-up costs were tens of thousand dollars (burn or bury depends on disease) paid by the greenhouse who bought the plants. The destruction is overseen by federal and state agencies. Sometimes diseased plants are burnt. Sometimes diseased plants are buried at landfill, but must find landfill that will accept bio disease.

They request insurance should cover plant costs (value), costs to destroy. Not just cost of the plant the greenhouse pays.

They recommend the following to develop risk management or insurance coverage:

1. Insure the cost up to the expected value of the plants. Allow greenhouse to buy a dollar amount of coverage then apply a deductible.
2. Base the greenhouse program on template of the NVS program.
3. Make insureds have some skin in the game. This is accomplished by a deductible and producer paid premium.
4. Offer a catastrophic level policy to cover the rare but expensive large events.
5. The time period for insurance coverage must be spread out over a time period such as at least a quarter of a year (3 months) up to a year. Do not allow to insure only the big value times. Sometimes a greenhouse selling cycle for certain plant can be as short at 2-4 weeks.
6. Discuss possible program with all participants of the industry.
7. A key point is to offer the right coverage at the right time to make the coverage meaningful.
8. Three possible programs that this greenhouse sees. First could be a program based off the NVS type. Second, a disaster payment to the greenhouse. Third, is to have APHIS expand and cover diseases for greenhouses similar to what they do for other crops and livestock they cover now.
9. Must not over insure the value. Deductible must be less than 100 percent.
10. Require greenhouses to have coverage for the building and equipment. Otherwise growers could manufacture losses by not keeping up the buildings such as a glass roof and the roof breaks and damages the plants.

11. Greenhouse risk management needs to recognize the industry is cyclic in nature. For example if certain plants are only sold in one month of the year, would the greenhouse pay for coverage the entire year, when it only has risk for part of it.
12. Inventory and catalogs vary by company and by their part of industry. Some greenhouses may sell 50 percent of their stock in one month.

Risk management valuation for insurance can be difficult since the coverage of the plants can be different sizes, seeds, cuttings, wholesale plant or retail plant.

The chart below is one example of differences in the industry. A box truck can hold many more beginning plants compared to the much lower number of finish plants. Value of plants in the truck varies by the plants type and age.

A full 26-foot box truck can hold:

Plant	Value
Beginning plants	\$30-50,000
Whole sale in April/May	\$10,000
Finished in Aug	\$5-10,000

This organization is a supplier who imports the plant and does the role of the broker between the buyer and the seller. Most brokers charge 50 cents a plant if the plant value is \$15 when sold. With *Ralstonia*, they as middleman and importers responsible for entire costs.

They stated that the general consensus is with a disease the supplier of the plant credits back the price of the plant when sold to greenhouse. But there is no guarantee or anything in writing to force it. Many suppliers are outside of the United States. There is nothing in writing to cover the cost.

The industry believes sellers will not credit the cost of the plant back when future disease issues arise. The greenhouses expect if a disease hits their stock, the greenhouse will not be reimbursed for the cost of the plant and will pay for all costs to destroy those plants. For example, in *Ralstonia*, this company credited back the cost of the plant to the greenhouse. The expense was massive. This company credited back the cost of the plant. They stated they will not be able to do that again due to costs. For 2020, they purchased insurance to cover that exact type of situation. The insurance policy was bespoke and one-off underwritten specific coverage for *Ralstonia* in case of quarantine and destruction order. The cost was extremely high and will not purchase that policy. Note: This was not a general policy offered to all. It was built specific for disease for that company.

Insurance timing for revenue type program are short windows to time. Many greenhouses do most business as finished retail plants in the 4 weeks of April 30 to May 31. Strong sales may be 2, 4, or 6 weeks. Some do 50 percent of their business in those four weeks. The value of the

plant varies since the starter plants are not worth as much as the ready to sell retail plants. This company does 50 percent business for cuttings that are sold January through March and is cuttings which is 50 percent. April through June is 50 percent of their retail sales.

Stakeholder Input

1. **Naturally Occurring Production Risks Affecting Industry**
Disease.
2. **Production Risks and Mitigation Options – Practices**
Industry mitigation is they are naturally spread out from each other.
3. **Prevalence of Disease with no Control Measures, e.g., *Ralstonia***
Ralstonia disease is largest concern.
4. **Availability of Commercial Insurance**
None for plants.
Available for buildings.
5. **Gaps in Commercial Insurance**
No coverage for plants.
6. **Considerations for APHIS or other Catastrophic Disease Compensation programs**
Could APHIS add greenhouses to the program? Crop insurance would be better coverage.
7. **Inventory Valuation –**
Yes inventory is valued weekly, monthly and quarterly. Much of their business happens by quarter.
8. **Record Keeping**
Yes. They keep records. See #7 above.
9. **Views about Nursery/NVS and WFRP Insurance Plans**
Familiar with NVS, but not WFRP.
10. **Willingness and ability to pay premiums**
Yes. Believes the greenhouse industry must have risk for it to work. Deductibles are part of this.
11. **Other issues raised**
See Key Points above.

Company 2

Greenhouse/Controlled Environment Agriculture (CEA) FCIC Multi-Peril Crop Insurance Interview Session Outline

Stakeholder:

The stakeholder is a senior manager for a horticultural firm with operations in five states and distribution base on import, propagation, and resale of plant materials from several foreign and counter-seasonal sites.

Interview Conducted: October 22, 2020

Key points: This company is from the producer/distributor side. They grow seeds, cuttings and other materials to sell to greenhouses. They have a merchandising company that is the distributor (broker). For example, they bring in cuttings from their Nicaragua location and sell to greenhouses in the United States.

Interview discussion identified risks they request risk management for:

1. Diseases are the first risk. There is no coverage from APHIS for plant cost, plant value, or destruction costs. These plants were USDA approved with Phytosanitary certification. For example with recent *Ralstonia* outbreak this risk is on all greenhouses that purchased the plants or plant cuttings. Insuring these risks will help them with operating bank loans.
2. Sales timing risk is substantial in the greenhouse industry. If they do not sell the plants in the forecasted time and at their normal volume during sales periods, they cannot make up those sales. Some plants only sell during May/June or just the three weeks for mums each year, those missed sales do not come back later in the year.
3. Historically greenhouses do not receive disaster payments that other farm programs receive. This year a limited amount of CFAP payments were received by some in the nursery industry. They request that greenhouses receive more disaster type payments.
4. Revenue coverage is a possible program they would like. It would be a revenue coverage similar to NVS for greenhouses.

Stakeholder Input

Naturally Occurring Risks Affecting Industry

Disease.

Production Risks and Mitigation Options – Practices

Wholesale risk is a 1-2 percent damage of plants through shipping. Wholesalers reimburse full cost of plant to buyer (retailer). It is credited back. Industry does this to keep customers. Almost all wholesalers do this.

Prevalence of Disease with no Control Measures, e.g., *Ralstonia*

At the *Ralstonia* outbreak, this company covered all losses to the greenhouses they sold to for the value and destruction of the product. Very costly. This company does not believe they can do

the same next time. They grow product in numerous counties and import into the United States. They grow U.S. production too.

Many other diseases that cause plant damage happen each year. They say greenhouses are just like hogs when it comes to diseases. A disease can wipe out an entire building of hogs quickly. Same for greenhouse plants. Many diseases can wipe out a certain type of plants and can lead to a preemptive depopulation event.

Diseases can be bacterial or viral. The vector and treatment protocol varies by plant type. Example: This year geraniums had a disease (type of rust). Greenhouses isolated plants from others and were sprayed. Cannot sell those sprayed plants for 2-3 weeks. Some plants, such as mums, only have a 2-3 week selling period each year. If mums had the disease, they would have missed the marketing window for mums.

Availability of Commercial Insurance

Gaps in Commercial Insurance

Bought liability insurance for this coming year for diseases mainly for *Ralstonia*. Hard to get and extremely costly. Won't buy again after next year. It may not be offered next year.

Considerations for APHIS or other Catastrophic Disease Compensation Programs

Said no APHIS programs exist for them.

Inventory Valuation

Weekly inventory accounting is available.

Record Keeping

Have data on volumes of plants to sell or produce. Records are kept on prices for all plants.

Views about Nursery/NVS and WFRP Insurance Plans

Familiar with NVS not WFRP. NVS Doesn't work since their main industry is wholesale and sell seeds and cuttings. They merchandise that production to greenhouses.

Willingness and Ability to Pay Premiums

Yes, understand there would be premiums for coverage.

Other Issues and Comments

Received a small amount of CFAP, first time ever. But it was limited in scope.

Want an insurance product, but do not want an insurance product that interferes with purchases from wholesalers/growers and greenhouse retailers.

Other risk to view that they have. One example, a hail storm breaks glass. Plants underneath cannot be sold due to glass exposure. Plants must be destroyed. Their glass breakage is covered by building insurance policy. But nothing insures the damaged plants.

Greenhouses are not monoculture. Risk is spread out among many plants.

Greenhouse may only have a ¼ acre of one type of plants or acres with millions of plants of one type. (Mums is prime example.) One massive grower in United States, then many smaller ones. A positive point for insurance is greenhouse industry is spaced apart from each other and disease and pest risk is spread out.

Ralstonia the previous year cost them millions of dollars.

Specific comment on COVID this year: The greenhouses that sold to big box retailers had record sales since those places remained open. Small to medium independent greenhouses were not allowed to open and may not recover financially.

Company 3

Greenhouse/Controlled Environment Agriculture (CEA) FCIC Multi-Peril Crop Insurance Interview Session Outline

Stakeholder:

Stakeholder is a senior manager at a multi-state nursery and CEA operation with an emphasis on horticultural production and germplasm.

Interview Conducted: October 21, 2020

Key Points:

No disaster payments have been made available for the greenhouse industry. This year got a narrowly defined CFAP payment for limited greenhouse production. Company requests greenhouses be made eligible for disaster payments.

There are many positives to supporting payments or subsidizing a crop insurance program for greenhouses. Following is a list benefits greenhouses offer: Captures carbon, employs large number of people, have set prices levels and a pre-determined selling schedule that is consistent year to year. The exception is this year's COVID impact. This year highlights some of the greenhouses risk management that they need addressed.

Inventory tracking for an insurance greenhouse revenue product: This company does an inventory each week based on expected sales for the year. Sales will be value at the following calculation: pots sold x internal contract price to customers.

The key for developing an insurance program is the industry have prices, production and sales recordkeeping for all their greenhouse production.

Their risks are:

1. Not selling planned production in the planned marketing window due to COVID.
2. No reimbursement for disease that USDA allowed through with a clean Phytosanitary certification and no payment for destroying same production. Destruction costs vary depending on amount and if USDA states the plants are to be burned or buried at landfill. Greenhouse incur all costs for the plants destruction.

1. Naturally Occurring Risks Affecting Industry:

Plant diseases.

2. Production Risks and Mitigation Options – Practices

Risks are revenue loss if timing of sales is impacted and plants are not sold in the plants selling season (holidays for some). Example is certain flowers and plants with high sales only for Mother's Day. They do not sell after that holiday. COVID impacted them this year (possibly will in future years). Their retailers were shut down and no government programs to counter the unexpected losses. Cannot keep plants because costs as inventory, and sales never go back to what was missed.

3. Prevalence of Disease with no Control Measures, e.g., *Ralstonia*

This year example of *Ralstonia* outbreak at one of their locations. *Ralstonia* damage in geraniums. USDA gave Phytosanitary Certificate to importing of geraniums from other country. *Ralstonia* shows up later. No fault of anyone, except maybe country selling it, but they can't be positive where it came from. APHIS came out to inspect. Taped the area of damage. Then required them pile and burn the diseased plants which also took additional time and money. This company believes APHIS should cover the loss and the destruction costs. Greenhouse companies believe reimbursement should be the price it was contracted to be sold at, plus destruction costs for destroyed plants.

4. Availability of Commercial Insurance

There is building insurance available for greenhouses. Some companies have outside non-greenhouse plants that meet Nursery and NVS insurance (and buy it) on allowable nursery crops.

5. Gaps in Commercial Insurance

- No insurance for missing marketing window.
- No insurance for greenhouse production.
- No insurance for disease outbreaks that are beyond their control.

6. Considerations for APHIS or other Catastrophic Disease Compensation Programs

- See #3 above.

7. Inventory Valuation

Yes, they keep inventory records.

8. Record Keeping

Yes, have detailed inventory and prices for all greenhouse production. Contract prices are internal but may be used under confidential requirements.

9. Views about Nursery/NVS and WFRP Insurance Plans. Are you familiar with those programs? Both cover value.

Yes. Familiar with NVS. See #4 above.

10. Willingness and Ability to Pay Premiums

Yes. Understand there is a cost to them for coverage.

11. Other Issues Raised

None

Company 4

Greenhouse/Controlled Environment Agriculture (CEA) FCIC Multi-Peril Crop Insurance Interview Session Outline

Stakeholder:

The stakeholder is the owner and operator of a specialized horticultural propagation operation based in Michigan.

Interview Conducted: October 26, 2020

Key Points:

Biggest risk for their company is diseases. Some diseases such as bacterial and fungi are treatable. Virus disease outbreaks are not treatable and plants must be destroyed.

Disease can happen even though plants are tested and monitored. For example, *Ralstonia* is tested by wholesalers, distributors and buyers, but it can still show up. Some diseases such as *Ralstonia* can infect many other types of plants including potatoes. That is why the DHS becomes involved *Ralstonia* outbreaks due to the potential impact to the food supply.

A new risk became known this year. The COVID shutdowns impacted importing of product from Costa Rica, Canada and Mexico. Border shutdowns impacted volume available and prices. COVID is also a risk for greenhouses who sell at the retail level. Their retail outlets were shut down this year due to COVID rules. Weather is a not a direct risk. It can be secondary such as the breaking the glass roof and their plants are damaged by the falling glass. Labor can be an issue since greenhouse industry is labor intensive at certain peaks during the year. Greenhouses have busy times of the year, where additional labor is needed and other times little labor is needed.

Stakeholder Input

1. Naturally Occurring Production Risks Affecting Industry

Diseases. See key points above.

2. Production Risks and Mitigation Options – Practices

Testing is done to determine if diseases are present. They test the following method. There are three levels.

1st level is (*Ralstonia* is this) test every shipment with multiple samples from shipment.

2nd level takes a sample from each shipment.

3rd level is tested once a month.

3. Prevalence of Disease with no Control Measures, e.g., *Ralstonia*

Ralstonia disease is always a concern since there is only one option to fight it and that is destroy the plant. It is an aggressive disease that spreads quickly.

4. Availability of Commercial Insurance

Have insurance for buildings, roofs (or covering material) and other greenhouse equipment. Do not have insurance for the plants they grow and sell.

5. Gaps in Commercial Insurance

Current insurance will pay for a new roof if hail destroys it, but the damage to the plants by the roof, hail or other plant damage is not covered by insurance. They view this as a possible risk that insurance could cover.

6. Considerations for APHIS or Other Catastrophic Disease Compensation Programs

No APHIS or catastrophic disease insurance is available to them.

7. Inventory Valuation

Inventory is valued weekly. The inventory and value could be summarized to months and quarters.

8. Record Keeping

Yes. They keep records of price and volume. They buy cuttings, seeds and tissue culture to sell. Some they keep and grow to the young plant stage and sell to greenhouses that grow for retail.

9. Views about Nursery/NVS and WFRP Insurance Plans

Not familiar with either program.

10. Willingness and Ability to Pay Premiums

Yes, they understand there would be premiums charged for coverage. They have building insurance, which requires a premium.