

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SYNGENTA CROP PROTECTION AG,
Petitioner,

v.

UPL LIMITED,
Patent Owner.

Case PGR2023-00017
Patent 11,445,727 B2

**DECLARATION OF PHILLIP M. BRANNEN, Ph.D., IN SUPPORT OF
PETITION FOR POST-GRANT REVIEW OF U.S. PATENT NO. 11,445,727**

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	Scope of Work	1
B.	Qualifications	2
C.	Materials Reviewed	4
II.	SUMMARY OF OPINIONS	4
III.	LEGAL STANDARDS	6
A.	Unpatentability	6
B.	Anticipation	8
C.	Obviousness.....	9
D.	Written Description Requirement	11
E.	Enablement Requirement	12
IV.	BACKGROUND OF THE TECHNOLOGY AND THE LEVEL OF ORDINARY SKILL IN THE ART.....	13
A.	General Background.....	13
B.	The '727 Patent.....	18
V.	CLAIM TERMS	27
A.	Fungicidal Combination and Composition	28
B.	“Agrochemically acceptable excipient”	29
VI.	Overview of prior art	29
A.	Godoy (Ex. 1005)	29
B.	Gullino (Ex. 1010).....	30
C.	Tobler (Ex. 1006)	32
D.	De Oliveira (Ex. 1007)	34
E.	Wiglesworth (Ex. 1008)	38
F.	Elatius EPA Label (Ex. 1009)	39
VII.	GROUND FOR UNPATENTABILITY.....	40
A.	Ground 1: Claims 1, 3, 4, 5, 7, 9 and 10 of the '727 Patent are anticipated by Godoy (Ex. 1005).	40
B.	Ground 2: Claims 1-10 of the '727 Patent are anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005).....	47

C.	Ground 3: Claims 1-10 of the ‘727 Patent are rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005).....	67
D.	Ground 4: Claims 1-10 of the ‘727 Patent lack enablement	82
VIII.	CONCLUSION.....	87

I, Phillip M. Brannen, hereby declare as follows:

I. INTRODUCTION

A. Scope of Work

1. I have been retained by Baker & Hostetler LLP on behalf of Syngenta Crop Protection AG (“Syngenta” or “Petitioner”) as an independent expert to provide my opinions on the subject matter recited in U.S. Patent No. 11,445,727 (Exhibit 1001, “the ‘727 Patent”) in view of the state of the art at the time and various references that predate the ‘727 Patent, all of which I refer to in this declaration.

2. I understand that Syngenta is petitioning the Patent Trial and Appeal Board (PTAB) to institute a post-grant review (PGR) of the ‘727 Patent, and is requesting that the PTAB cancel each of claims 1-10 (the “Challenged claims”) as unpatentable due to lack of enablement, anticipation, and/or obviousness. I understand that this declaration is being filed as an Exhibit in the PGR.

3. I make this declaration based upon personal knowledge. I am over the age of 21 and otherwise competent to make this declaration.

4. I am being compensated at my normal and customary rate for work performed on this matter. My compensation does not depend on the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding. I have no financial interest in Petitioner or Patent Owner.

B. Qualifications

5. I am a Professor of Plant Pathology at the College of Agricultural and Environmental Sciences, University of Georgia.

6. In 1983, I received a Bachelor of Science degree in plant protection and pest management from the University of Georgia. In 1986, I earned my Master of Science degree in plant pathology, also from the University of Georgia. In 1996, I earned my Ph.D. in plant pathology from Auburn University.

7. I joined the faculty of the University of Georgia in 2000, first as an assistant professor and then as an associate professor. I was promoted to professor in 2012.

8. Before becoming a faculty member at the University of Georgia, I worked in industry and in other related jobs. From 1994 to 2000, I was a plant pathologist in the Biologicals Department of Gustafson LLC in McKinney, Texas. I also worked as a county agent for the Alabama Cooperative Extension Service in the College of Agriculture of Auburn University in Alabama.

9. I currently supervise three graduate students in the Plant Pathology department at the University of Georgia.

10. Since 2000, I have taught numerous undergraduate and graduate level courses in plant pathology, including integrated pest management, field plant pathology, and the history of plant diseases.

11. I have extensive experience with use of fungicides and developing fungicide programs for control of plant diseases. These experiences include my time with Gustafson LLC, where I developed lab, greenhouse and field trials to review chemical fungicides and biologicals individually and in combination for disease management of seed and soil borne diseases. My experience as a plant pathologist with the University of Georgia has mainly concentrated on experiments in the field with fungicides, but I have also conducted collaborative research relative resistance management. This research has involved the review of fungicides as solo applications and in mixtures (e.g., commercial products and tank mixes). I am well aware of the additive, antagonistic, or synergistic impact of fungicides, and I have had trials reviewing such in the field.

12. Over the course of my career, I have published extensively on the subject of plant pathology, including twelve book chapters, and 58 refereed articles and more than 151 peer-reviewed articles in scientific journals. In addition, I have authored a significant number of abstracts that are included in the proceedings of various scientific conferences. These publications have largely centered around the use of fungicides in solo applications and in combination for management of fungal diseases of plants.

13. I have given numerous talks or presentations at various scientific conferences, providing insights on a variety of topics in the field of plant pathology.

I am also an active member in a number of professional societies and frequently lead trainings and educational programs for the American Phytopathological Society and the Southern Region Small Fruit Consortium.

14. I have set forth particularly relevant qualifications to my testimony in these matters in the preceding paragraphs. Additional information regarding my background, qualifications and expertise is included in my *curriculum vitae*, which is attached as Appendix A.

15. It is for at least the foregoing reasons that I am an expert in plant pathology with experience in disease diagnosis and management.

C. Materials Reviewed

16. In forming my opinions, I have reviewed the '727 Patent and considered each of the documents listed in the Exhibit List appended to this declaration (Appendix B) and the other references cited in my declaration. In reaching my opinions, I have relied upon my experience in the field and also considered the viewpoint of a person of ordinary skill in the art at the time of the earliest claimed Priority Date of the '727 Patent, i.e., November 2016. As explained below, I am familiar with the level of skill of a person of ordinary skill in the art regarding the relevant technology at issue as of that time.

II. SUMMARY OF OPINIONS

17. I have been asked to consider and provide my opinions on certain

topics related to '727 Patent, including:

- The level of a person of ordinary skill in the art (POSA) at the time of the alleged invention described in the claims of the '727 Patent
- How a person of ordinary skill in the art (POSA) would interpret the claims of the '727 Patent;
- Whether any of the claims of the '727 Patent were anticipated by certain prior art references;
- Whether any of the claims of the '727 Patent were obvious in view of certain prior art references; and
- Whether the claims of the '727 Patent are enabled to their full scope.

18. In forming my opinions, I reviewed the documents cited in this declaration.

19. My opinions are based upon my education, training, and experience in the field of plant pathology, with an emphasis on fungicides and integrated disease management, as well as the documents I considered.

20. As I discuss below in more detail, it is my opinion that:

- Claims 1, 3, 4, 5, 7, 9 and 10 of the '727 Patent are anticipated by Godoy (Ex. 1005);
- Claims 1-10 of the '727 Patent are anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005);

- Claims 1-10 of the ‘727 Patent are rendered obvious by WO2015079334 (“De Oliveira”) (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005); and
- Claims 1-10 are unpatentable for lack of an enabling disclosure in the patent.

III. LEGAL STANDARDS

21. My understanding of relevant legal standards, as discussed throughout this declaration, is based on instructions from Petitioner’s counsel.

22. In this section I describe my understanding of certain legal standards. I have been informed of these legal standards by Petitioner’s counsel. I am not an attorney, and I am relying only on instructions from Petitioner’s counsel for these legal standards. I have applied these understandings in my analysis as detailed below.

A. Unpatentability

23. I understand that patent protection may be granted for any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof. I understand that a patent or other publication must first qualify as prior art before it can be used to invalidate a patent claim. I understand that the law provides categories of information that constitute prior art that may be used to anticipate or render obvious patent claims. To be prior art to a particular patent, a reference must have been made, known, used, published, or

patented, or described in a patent application by another, before the Priority Date of the patent at issue. I also understand that a POSA is presumed to have knowledge of the relevant prior art as of the Priority Date. I have reviewed the teachings of the prior art with the understanding of a POSA. I have also reviewed the '727 Patent and relevant portions of the '727 Patent's file history with this understanding.

24. I understand that documents and materials that qualify as prior art can be used to render a claim unpatentable as anticipated under 35 U.S.C. § 102 or as obvious under 35 U.S.C. § 103.

25. I have been told that Syngenta bears the burden of proving unpatentability by a preponderance of the evidence. I am informed that this preponderance of the evidence standard means that Syngenta must show that unpatentability is more probable than not. I have taken this principle into account when forming my opinions here.

26. I understand that the '727 Patent issued from an application filed in the U.S. Patent & Trademark Office (USPTO) based on international application (PCT/IB2017/056710) filed on October 30, 2017. I further understand the international application claims priority back to an application filed in India (IN 201631037704) on November 4, 2016. I understand that the application filed in India on November 4, 2016 is the earliest effective filing date of the '727 Patent, and it is the filing date I have considered for my analyses ("Priority Date").

However, my opinions would not change even if the ‘727 Patent is determined to have an effective filing date of October 30, 2017, the filing date of the international application.

27. I understand that the first step in comparing prior art to patent claims is to properly construe the claims to determine claim scope and meaning. I understand that in post-grant review proceedings, claim terms are given their ordinary and customary meaning, as understood by a person of ordinary skill in the art (POSA) in the context of the entire disclosure of the specification, as well as in view of statements made during the prosecution of the patent. I also understand that an inventor may act as his own lexicographer and define terms in the patent.

28. I understand once the claims of a patent have been properly construed, the second step in determining whether or not a claim is patentable requires a comparison of the properly construed claim to the prior art.

B. Anticipation

29. I understand that a prior art reference “anticipates” a claim, and thus renders the claim unpatentable, if all elements of the claim were disclosed in that prior art reference, either explicitly or inherently (i.e., necessarily present or implied).

30. I am told anticipation requires that each and every element of a challenged claim is present in a single reference. I also understand that an

anticipatory reference does not need to explicitly describe each element because anticipation can occur when a claimed limitation is necessarily inherent or otherwise implicit in the reference.

31. I understand that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed.

C. Obviousness

32. I have been informed that a claim is obvious (35 USC 103) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

33. I have been told the determination of obviousness is resolved on the basis of several underlying factual inquiries including: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) if in the record, objective evidence of non-obviousness.

34. Such objective evidence of non-obviousness may include: (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the claimed subject matter; (4) praise of the invention by others skilled

in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts.

35. I also understand that there must be a nexus between any such objective evidence of non-obviousness and the claimed subject matter. I further understand that any such objective evidence must be reasonably commensurate with the scope of the claimed subject matter.

36. I have also been informed that when there is some recognized reason to solve a problem—and there are a finite number of identified, predictable, known solutions—a POSA is motivated and has good reason to pursue the known options within his or her technical grasp. If this approach leads to the expected success, it is likely the product of ordinary skill and common sense rather than the product of innovation. Where a patent simply arranges old elements, with each element performing its known function and the whole yielding no more than would be expected, the combination is obvious.

37. I have also been informed that the USPTO supplies its examining corps with a Manual of Patent Examining Procedure that provides exemplary rationales that may support a conclusion of obviousness, including:

- (a) Combining prior art elements according to known methods to yield predictable results;

- (b) Simple substitution of one known element for another to obtain predictable results;
- (c) Use of known technique to improve similar devices (methods, or products) in the same way;
- (d) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- (e) “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- (f) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; or
- (g) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

MPEP § 2143. I apply these principles in my analysis below.

D. Written Description Requirement

38. I understand that claims of a patent are unpatentable under 35 U.S.C. § 112 if the specification of the patent does not contain adequate written description of the invention. I have been instructed that in the patent application process, the

Applicant may keep the originally filed claims, or change the claims between the time the patent application is first filed and the time a patent is issued. An Applicant may amend the claims or add new claims. The written description requirement ensures that the issued claims correspond to the scope of the written description as provided in the original application.

39. I also understand that the written description requirement is satisfied if a person having skill in the art reading the original patent application would have recognized that it describes the full scope of the claimed invention as it is finally claimed in the issued patent and that the inventor actually possessed that full scope by the filing date of the original application.

40. I have been additionally instructed that the written description requirement may be satisfied by a combination of the words, figures and formulae contained in the patent application. The full scope of a claim or any particular requirement in a claim need not be expressly disclosed in the original patent application if a person of skill in the art would have understood that the full scope is in the written description in the patent application.

E. Enablement Requirement

41. It is my further understanding that a claimed invention is not patentable under 35 U.S.C. § 112 for lack of enablement if the specification does not contain a sufficiently full and clear description of how to make and use the full

scope of the claimed invention. In order to be enabling, the patent must permit one of skill in the art to make and use the full scope of the claimed invention at the time of original filing without having to conduct undue experimentation. In deciding whether a person having skill in the art would have to experiment unduly in order to make and use of the invention, I understand several factors may be considered: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. I understand that no one or more of these factors alone is dispositive. Rather, whether the degree of experimentation required is undue requires weighing these factors in the context of the claimed invention and the state of the art at the time of the original application.

IV. BACKGROUND OF THE TECHNOLOGY AND THE LEVEL OF ORDINARY SKILL IN THE ART

A. General Background

42. Fungicides are compounds that are toxic to fungi and used to control fungal pathogens in plants. There are many commercially available fungicides; many of which are sold as products including a single fungicidal active ingredient and many of which are sold as products including a combination of fungicides. See, e.g., The Pesticide Manual (Ex. 1011); Gullino (Ex. 1010); Godoy (Ex. 1005);

Wiglesworth (Ex. 1008).

43. Fungicides are typically applied as sprays of aqueous solutions by mechanical sprayers, though other means are used such as by dusting. Mechanical sprayers can range in size and scale from a backpack sprayer to large tractor-mounted boom applicators or airblast sprayers.

44. Fungicides are typically categorized based on the location where they act to control fungi, e.g., whether they act “*on*”, or “*within*” the plant. For example, *contact* fungicides act on plants, whereas *systemic* fungicides act within plants. Fungicides can also be categorized based on the timing of the interaction of the fungicide with the fungus, so they are therefore listed as being preventative, curative or eradicant in nature.

45. Ethylene Bis Dithiocarbamate (EBDC) fungicides, such as mancozeb, are known as contact fungicides, whereas Quinone outside Inhibiting fungicides (QoI) and Demethylation Inhibitor (DMI) fungicides are generally considered systemic fungicides. The same is true for Succinate Dehydrogenase Inhibitor (SDHI) fungicides, though the level of systemic activity may be limited in some cases. Contact fungicides are generally more likely to be removed from the plant surface by rainfall or irrigation, whereas systemic or meso-systemic fungicides, once in the plant cells, are protected from wash off.

46. Fungicides control fungal disease by various modes of action – the

specific means by which a fungicidal compound disrupts fungal cellular processes. The modes of action are highly variable and range from very broad to very narrow and specific. The mode of action of a fungicide will determine its efficacy as well as whether fungi will develop resistance to the fungicide over its repeated use.

47. Certain fungicides have multiple modes of action (e.g., a multisite fungicide), and fungi are not likely to develop resistance to such multisite fungicides. There are likewise fungicides with very targeted modes of action in the fungus, and for these, the fungus can often develop resistance.

48. Examples of common fungicide classes with specific modes of action would include the Demethylation Inhibitors (DMIs), Quinone outside Inhibitors (QoIs), and Succinate Dehydrogenase Inhibitors (SDHIs). DMIs specifically inhibit a step in ergosterol biosynthesis. Both the QoIs and the SDHIs inhibit mitochondrial respiration, but the pathways sites are different; SDHIs interfere with the complex II while QoIs interfere with the complex III.

49. Individual fungicides have been used to control fungi, but it is conventional to combine fungicides to control fungal disease. Fungicides are combined for several reasons, but primary among these are: (1) to broaden the efficacy range of the fungicidal treatment against multiple fungal pathogens; (2) for resistance management; (3) to exploit the location of action (e.g., contact and systemic); and (4) to take advantage of either additive or synergistic interactions

that increase activity, while possibly allowing for reduced fungicide rates of the individual components (see, e.g., Gisi, Ex. 1013; Levy, Ex. 1014).

50. It is also well known how to determine whether a fungicidal combination acts additively or synergistically. Synergy is defined as when a combination of fungicides has an observed affect that is greater than the expected effect of the sum of the individual components (Colby, Ex. 1012; Gisi, Ex. 1013; Levy, Ex. 1014). Effects can also be antagonistic (negative interaction) or be simply additive (no interaction). Colby (Ex. 1012) is one of the primary initial documents that reviews synergy between chemical compounds when applied for agricultural purposes. While this document concentrated on herbicides (e.g., weedkillers), the article is equally applicable to studying the additive, synergistic, and antagonistic effects of fungicides. Colby (Ex. 1012) indicated that one of the difficulties in determining synergy or antagonism is that it is essential that the compounds in question be applied singly and in combination, and most studies only look at the efficacy of the combinations.

51. Depending on the number of combinations reviewed, the treatment list can become rather large, and there are statistical challenges that result from field trials with a large number of treatments. Synergy can be calculated by various methods in the lab and field (Colby, Ex. 1012; Levy, Ex. 1014; Gisi, Ex. 1013; Emery, Ex. 1016), but due to field variability, the requirement that individual

compounds be tested at the same time as the mixtures is a requirement for running trials in the field (Colby (Ex. 1012)). Factorial statistical designs can be utilized to determine significant interactions between compounds for disease control, and statistics can be performed to further determine the degree of synergy or antagonism (Emery, Ex. 1016).

52. Fungicidal combinations having synergistic activity have been reported. For example, Gisi (Ex. 1013) reported that mancozeb provides strong synergistic interactions with oxadixyl fungicides. U.S. Patent 9,314,022 (Ex. 1006) reported that benzovindiflupyr (compound A-1.1) showed synergistic activity with each of azoxystrobin and cyproconazole. See U.S. Patent 9,314,022 (Ex. 1006) at Tables B2, B3, B4, B6, B7. Fungicidal combinations not having synergistic activity have also been reported. For example, Koller (Ex. 1015) found mancozeb was additive with DMI fungicides for disease control of apple scab and Emery (Ex. 1016) found no synergy among two-way mixtures of propiconazole with either benomyl, captan, chlorothalonil, cyprodinil or vinclozolin in inhibiting *Monilinia fructicola*, the causal agent of blossom blight and brown rot of stone fruits, at low, medium and high concentrations in all possible pairwise combinations.

53. Lastly, it is noted that all of the fungicides listed in the '727 Patent were known before the Priority Date. See, e.g., The Pesticide Manual (Ex. 1011), U.S. Patent 9,314,022 (Ex. 1006).

B. The '727 Patent

1. Specification

54. The '727 Patent is directed to combinations of known fungicides for use in control of fungal disease in plants. In particular, the '727 Patent is directed to fungicidal combinations that include: (a) a dithiocarbamate fungicide, such as mancozeb, (b) a succinate dehydrogenase inhibitor (SDHI), such as benzovindiflupyr, (c) an ergosterol biosynthesis inhibitors and/or (d) a Quinone outside inhibitor (QoI). '727 Patent (Ex. 1001) at 3:41-62.

55. According to the '727 Patent, "Succinate dehydrogenase inhibitor (SDHI) fungicides are known in the art to be broad spectrum and have a high potency". '727 Patent (Ex. 1001) at 1:28-30. The '727 Patent further discloses that "[v]arious other classes of fungicides are also known in the art, such as Quinone outside inhibitors (QoIs), ergosterol biosynthesis . . ." and that "[t]hese fungicides have been mixed with SDHI fungicides to achieve a broad spectrum of disease control". '727 Patent (Ex. 1001) at 1:37-42. The '727 Patent continues to explain that dithiocarbamate fungicides, such as mancozeb, are known in the art and that "[m]ancozeb has been combined with various SDHI fungicides for disease control." '727 Patent (Ex. 1001) 1:50-62. These statements in the Background section of the '727 Patent are consistent with the prior art descriptions of fungicides as set out in Section IV.A above.

56. The ‘727 Patent, however, discloses there “is a need in the art to improve on the disease spectrum provided by these combinations” and that “there is a need for a combination of actives that allows for broader disease control spectrum that combines curative and preventive actives and has a lower dosage”. Id at 1:62-2:4.

57. As part of its embodiments, the ‘727 Patent provides “combinations of fungicides that possess an enhanced efficacy over the individual fungicides used in isolation.” ‘727 Patent (Ex. 1001) at 2:7-10. A POSA would understand from this statement that the fungicidal combinations showed synergy since the phrase “enhanced efficacy” is being equated with the definition of synergy, i.e., when the effect of the combination is greater than the individual fungicides used in isolation.¹

58. The ‘727 Patent then discloses Examples of commercially available fungicides which it asserts showed synergy. ‘727 Patent (Ex. 1001) at 20:15. According to the ‘727 Patent, certain combinations were tested for efficacy of disease control of Asian soybean rust and the trials were carried out at various locations in India. ‘727 Patent (Ex. 1001) at Tables 1 and 2 of the ‘727 Patent

¹ Enhanced efficacy and similar phrase are also used in the art to mean synergy.

For example, Emery describes synergistic interaction as correlating with “enhanced” disease control. Emery (Ex. 1016) at p.42, left column.

provide data when mancozeb was included with other fungicides. These tables are produced below with annotations.

Table 1 of '727 Patent (Ex. 1001 at col. 20)

	Treatment	Dose rates (ml/g/ha)	Mean percent disease control	
			2015/16	2016/17
A1	Prothioconazole + Benzovindiflupyr	150 + 200	88.04	71.04
A2	Prothioconazole + Benzovindiflupyr + Mancozeb	150 + 200 + 1500	95.07	95.07
B1	Prothioconazole + Isopyrazam	150 + 1000	87.14	70.23
B2	Prothioconazole + Isopyrazam + Mancozeb	150 + 1000 + 1500	93.4	93.07
C1	Prothioconazole + Penthiopyrad	150 + 1000	83.33	68.15
C2	Prothioconazole + Penthiopyrad + Mancozeb	150 + 1000 + 1500	93.07	92.18

Table 2 of '727 Patent (Ex. 1001 at col 21)

	Treatment	Dose rates (ml/g/ha)	Mean percent disease control	
			2015/16	2016/17
D1	Prothioconazole + Benzovindiflupyr + Azoxystrobin	150 + 200 + 500	93.07	91.07
D2	Prothioconazole + Benzovindiflupyr + Azoxystrobin + Mancozeb	150 + 200 + 500 + 1500	96.36	95.03

59. The ‘727 Patent discloses it was found that “the incorporation of mancozeb greatly increased efficacy and disease control of the succinate dehydrogenase inhibitor fungicide treatments when mixed with ergosterol biosynthesis inhibitors or quinone outside inhibitors” and concluded “that the addition of mancozeb enhanced the efficacy of the combination and surprisingly gave a synergistic effect”. ‘727 Patent (Ex. 1001) at 21:15-20; see also 20: 4-12.

60. While the text of the ‘727 patent discloses mancozeb gave certain effects, the Examples and data of the ‘727 Patent do not support the alleged finding of enhanced efficacy and disease control or the alleged conclusion of synergy.

61. A POSA cannot determine if any of the combinations disclosed in the ‘727 Patent achieved a synergistic effect, because there is insufficient information provided. For example, the Examples do not provide data for an untreated control. Further, there are no data shown for the response of the individual fungicides or values expected for a combined response from the individual fungicides. Nor is there any indication of statistical significance of the data or the statistics for the trials. Without such controls, individual responses and statistical analysis, it is not possible to make the findings and conclusion about enhanced efficacy and synergy.

62. An analysis of the data in Tables 1-2 is provided below.

Analysis of Data in Table 1 of '727 Patent (Ex. 1001)

Treatment	Mean percent disease control		Difference	
	2015/16	2016/17	2015/16	2016/17
A1	88.04	71.04	-	-
A2	95.07	95.07	+7	+24
B1	87.14	70.23	-	-
B2	93.4	93.07	+6	+23
C1	83.33	68.15	-	-
C2	93.07	92.18	+10	+24

Analysis of Data in Table 2 of '727 Patent (Ex. 1001)

Treatment	Mean percent disease control		Difference	
	2015/16	2016/17	2015/16	2016/17
D1	93.07	91.07	-	-
D2	96.36	95.03	+3	+4

63. Referring to the data above, there are differences in years relative disease control (i.e., disease control for 2015/16 season vs 2016/17 season). The results for the 2016/17 season of Table 1 are unusual, in that if the DMI and SDHI gave less disease control, the addition of mancozeb bringing up the disease control to the same level as the first year is odd. Furthermore, it is improbable to have identical values up to four significant digits for disease control as in A2, especially with such a large difference in disease control in the base formulation (A1) between the 2015/16 and 2016/17 season. Moreover, the difference in disease control in Table 2 (sets D1 vs D2) is about 3-4 percentage points which likely could be within

experimental error.

64. In addition, the Examples appear to disclose a dosage applied for the ergosterol biosynthesis inhibitor as a product dosage, rather than the active ingredient dosage, since the patent reports the dosage in “ml” per hectare (measurement of a liquid (ml) per hectare). That is, the ‘727 Patent discloses that “Doses tested were at rates of . . . 150 ml/ha for the ergosterol biosynthesis inhibitor . . .” However, the tested ergosterol biosynthesis inhibitor, prothioconazole, is a solid (melting point around 136 °C) not a liquid (See The Pesticide Manual, Ex. 1011, monograph 678, pp. 944-945.) and thus it appears the dosage reported for prothioconazole was based on applying the commercial product including the fungicide and not the dosage of the fungicide itself.

65. In addition, the ‘727 patent indicates with respect to the examples in Tables 1-2 that “the lower the mixture performance in the disease control, the greater the additional benefit of the mancozeb when added to the compositions of the present invention.” Ex. 1001 at 20:10-13. This is an unsupported conclusion. As I explained above, there is insufficient information provided in the ‘727 Patent to determine any “enhanced efficacy” or synergy due to mancozeb in the fungicidal combination. Moreover, the relative levels of disease were not provided across the years or locations in the examples, which inhibits an analysis between the years of

the examples.²

66. Furthermore, synergy depends on a mixture-by-mixture, ratio, dosage, pathogen and plant. Hence, tests for synergy with mancozeb must be conducted for each pathogen, plant, and chemical combination; synergy is very specific for each system. For example, Koller (Ex. 1015) examined mancozeb for interaction with demethylation inhibitor (DMI) fungicides when resistance had developed, and mancozeb was found to be additive with DMI fungicides for better disease control of apple scab. However, synergy with mancozeb has been reported when using phenylamide fungicides in combination for control of Oomycete pathogens (Gisi, Ex. 1013).

2. The Prosecution History

67. I understand the '727 Patent issued from an application that was originally filed with 17 claims and that the U.S. Patent & Trademark Office (USPTO) rejected the claims on various grounds and that UPL amended the claims and filed responses until the application was eventually allowed.

68. In one response made by UPL, UPL distinguished the prior art

² In determining the disease level of rust, one can look at the number of infected leaves per plant (incidence of disease) and severity which is typically an average percent of leaf area covered by the rust.

references of De Oliveira (WO2015079334) (Ex. 1007) and Grammenos (EP 2783569) that the prior art did not teach “[t]he technical effects achieved by the claimed combinations, i.e., an enhancement of the efficacy, and a surprising reduction in fungal disease incidence when mancozeb is added to the claimed combinations.” Ex. 1002 (2021-04-22 Amendment) at p. 138. In particular, UPL argued:

When De Oliveira [WO 2015079334, Ex. 1007] and Grammenos [EP 2783569] are read in a whole, they do not fairly teach one skilled in the art to select and pick among numerous possibilities disclosed therein to arrive at the specific combination as set forth in the instant claims. *The technical effects achieved by the claimed combinations, i.e., an enhancement of the efficacy, and a surprising reduction in fungal disease incidence when mancozeb is added to the claimed combinations.* For at least the above reasons, De Oliveira in view of Grammenos does not disclose or suggest the subject matter of instant claims.

Ex. 1002 (2021-04-22 Amendment) at p. 138. (Emphasis added.)

69. In my opinion a POSA would understand Applicant’s argument to mean mancozeb showed synergy when added to the claimed combinations. As explained in Section IV.B.1 above, the ‘727 Patent equates the phrase “enhanced efficacy” with the definition of synergy and similar phrases are used in the art to mean synergy.

3. The Claimed Subject Matter

70. Due to their length, the full language of each challenged claim (claims 1-10) is provided in attached Appendix C.

4. The Level of Skill in the Art

71. With respect to the level of ordinary skill in the art at the relevant times applicable to the subject patent, I understand that factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, the prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art. One with ordinary skill has the ability to understand the technology and make modest adaptations or advances. A person of ordinary skill in the art (“POSA”) is also a person of ordinary creativity, not an automaton.

72. In my opinion, a POSA at the time of the alleged invention described in the subject patent would have an advanced degree, preferably a Ph.D. level degree with several years of practical, applied experience in the field of plant pathology. Alternatively, a person possessing an M.S. degree in plant pathology with more years of experience can also be considered as a person of skill in the art. Virtually all degrees in plant pathology are now advanced degrees, as very few undergraduate programs are available. However, as another alternative, a person with a Bachelor of Science degree in plant pathology with 5-10 years of practical,

applied experience in the field of plant pathology could also qualify as a person of skill in the art. Further, one skilled in the art would have a good understanding of plant pathology, plant diseases, pathogens associated with plant diseases, experience with disease diagnosis and management on multiple commodities, and a firm understanding of integrated pest management. A person of ordinary skill in the art relevant to the '727 Patent would easily have understood the prior art references referred to herein and would have had the capacity to draw inferences from them.

73. In determining the qualifications of a POSA I considered, among other factors, the field of the alleged invention and use thereof described in the subject patent, and my experience with the educational level of practitioners in the fields of plant pathology. In addition, my opinion is based upon my background, education, and personal experience devoted to the field of disease diagnosis and management of multiple commodity plants.

74. I consider myself to be an expert in the art of the subject patent at the time of the alleged inventions claimed therein.

V. CLAIM TERMS

75. I understand that in construing terms, only those terms that are in controversy need be construed, and only to the extent necessary to resolve the controversy. I do not believe that there are any such terms. However, in an

abundance of caution, I note the following terms below and, to the extent a claim term needs to be interpreted by a POSA, the term is included in my analysis under the Grounds for Unpatentability.

A. Fungicidal Combination and Composition

76. The ‘727 Patent provides specific definitions for numerous terms related to disease control, plants, locus, etc. Exhibit 1001 at 2:49-64. The 727 Patent specification indicates that the fungicidal combinations disclosed therein terms “may be sold as a premix composition or kit of parts such that individual actives may be mixed before spraying” and the kit can alternatively include two fungicides pre-mixed and the “third active may be admixed with an adjuvant such that the two components may be tank mixed before spraying”. Exhibit 1001 (‘727 Patent) at 54-60. Further, the ‘727 Patent appears to use the term “composition” interchanged with “combination” when disclosing that “... the addition of a dithiocarbamate fungicide to a combination ...” and “the mancozeb when added to the compositions of the present invention.” Ex. 1001, col. 20, lines 4-13. Thus, I understand the terms “combination” and “composition” are used interchangeably.

77. The ‘727 Patent further indicates the composition of the Patent maybe applied simultaneously as a tank mix or a formulation or may be applied sequentially.

B. “Agrochemically acceptable excipient”

78. The ‘727 Patent does not explicitly define the term “agrochemically acceptable excipient”. However, the ‘727 Patent provides examples of non-active ingredients such as inert carriers, surfactants, adjuvants and example formulations such as wettable powders, granules, dusts, soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, ZC formulations, oil dispersions or other known formulation types. Exhibit 1001 (‘727 Patent) at 16:23-33.

79. Hence, a person of skill in the art would understand from the ‘727 Patent that any known, non-active ingredient that was agrochemically acceptable would qualify as an agrochemically acceptable excipient including oil and water.

VI. OVERVIEW OF PRIOR ART

A. Godoy (Ex. 1005)

80. I have reviewed the article “Efficiency of multisite fungicides in controlling Asian soybean rust, *Phakopsora pachyrhizi*, in the 2015/16 harvest: summarized results of cooperative trials”, authored by Godoy et al. in Londrina, PR August 2016 (Embrapa Soja, Circular Técnica, 121). I understand from Petitioner’s counsel that Godoy (Ex. 1005) qualifies as prior art to the ‘727 Patent because it was publicly accessible before the Priority Date.

81. Godoy (Ex. 1005) discloses the efficiency of multisite fungicides, such as mancozeb, in controlling a fungus that causes Asian soybean rust (ASR).

Two protocols were disclosed. One protocol involved evaluating multisite fungicides alone; the other protocol involved evaluating a multisite fungicide in combination with either (a) azoxystrobin + benzovindiflupyr or (b) picoxystrobin + cyproconazole.

82. Each of the combinations included fungicides with different modes of action. Godoy (Ex. 1005) explained the reasons for the study was that “Evaluating the efficiency of fungicides with different modes of action is essential to increase disease control options in soybeans crops. The use of multisite fungicides can be an option for both Asian soybean rust control and an anti-resistance strategy.” P.1.

83. Godoy (Ex. 1005) provided examples of fungicidal combinations with different modes of action in combination with a multisite fungicide. Godoy (Ex. 1005) specifically exemplified the fungicidal combination of azoxystrobin, benzovindiflupyr and mancozeb and explained and showed the addition of mancozeb to the combination improved disease control. See Ex. 1005 at Tables 3 and 5, Treatments 17 and 23, pp. 3 and 6.

B. Gullino (Ex. 1010)

84. I have reviewed the article “Mancozeb Past, Present, and Future” authored by Gullino et al. in Plant Disease (2010), Vol. 94, No. 9, pp. 1076-1087 (“Gullino”)(Ex. 1010). I understand from Petitioner’s counsel that Godoy (Ex.

1005) qualifies as prior art to the '727 Patent because it was publicly accessible before the Priority Date.

85. Gullino is a review article discussing the fungicide mancozeb and discloses that mancozeb “plays a significant role in the world fungicide market.” Gullino (Ex. 1010) at p.1076, left column. The article highlights and discusses “a number of key attributes” of mancozeb: 1) it has a direct effect on “core biochemical processes within the fungus;” 2) it works well as a multi-site protectant-only fungicide (it remains on the leaf surface and does not penetrate, thus no systemic redistribution within the plant; 3) it has an “excellent record of crop safety over a wide range of crops and environmental conditions;” 4) has no curative effect if disease is already present; and 5) it is stable. Ex. 1010 at p 1078.

86. The article then details and discusses the use of mancozeb “as a key tool in resistance management.” Ex. 1010 at p 1081, under Role of mancozeb in anti-resistance strategies. In particular, Gullino discloses that “mixtures of fungicides that combine a high resistance risk with a low risk multi-site compound or another single site fungicide that is not cross-resistant to its mixing partner are a common response to [the management of fungus resistance]”. Gullino (Ex. 1010) at 1081, left col., second paragraph. A POSA would understand that Gullino was explaining common ways to reduce resistance of fungi to particular fungicides, which included: (1) mixing fungicides that have a high resistance risk with a low

risk multisite compound, such as mancozeb, or (2) mixing fungicides that do not have cross-resistance, e.g., mixing fungicides with different modes of action. Gullino (Ex. 1010) at p. 1081; see also 1077 (left col.). Gullino then explained “mancozeb's role as a key tool within resistance management strategies is firmly grounded on the intrinsically low resistance risk of the molecule itself.” Id. Gullino further reported the improved resistance performance of mancozeb when combined with QoI fungicides, for example. Gullino (Ex. 1010) at p. 1081 (right col.).

87. Hence, a POSA would have understood as of the Priority Date that it was well known in the art and expected that the combination of mancozeb (a multisite, contact fungicide) with other fungicides would result in improved disease control, reduce resistance, and in certain instances synergistic interactions.

C. Tobler (Ex. 1006)

88. I have reviewed U.S. Patent No. 9,314,022 to Tobler et al. of Syngenta (“Tobler”) (Ex. 1006) which issued April 19, 2016. I understand from Petitioner’s counsel Tobler (Ex. 1006) qualifies as prior art to the ’727 Patent.

89. Tobler is directed to fungicidal compositions that include: (A) a compound of formula (I) and (B) at least one compound selected from compounds known for fungicidal activity. Ex. 1006, Abstract. Formula (I) includes benzovindiflupyr when R1 is difluoromethyl and X is fluoro. See Ex. 1006 at abstract and The Pesticide Manual (Ex. 1011), monograph 66, p. 93-94, which

provides the chemical structure for benzovindiflupyr.

90. Benzovindiflupyr is a preferred compound of formula (I). For example, Tobler identifies compound A-1.1 as a preferred compound of formula (I), which is given the chemical name of: 3-difluoromethyl-1-methyl-1H-pyrazole-4-carboxylic acid (dichloromethylidene-benzonorbornene-5-yl)amide. Tobler (Ex. 1006) at 13:9-11. I understand the chemical name provided in Tobler for compound A-1.1 is that of benzovindiflupyr. See, e.g., The Pesticide Manual which provides a Chemical Abstracts name for benzovindiflupyr that is equivalent to the name for A-1.1 in Tobler. (Ex. 1011, monograph 66, p. 93-94.) The Pesticide Manual further shows the chemical structure for benzovindiflupyr that matches a description in Tobler (Ex. 1006 at 13:5-11).

91. Tobler teaches benzovindiflupyr (compound A-1.1) is suitable for control of fungi, such as *Phakopsora pachyrhizi*, which is the causative agent for Asian soybean rust. Ex. 1006 at Col. 41, Example B-1. Tobler further teaches compositions including benzovindiflupyr (compound A-1.1) in combination with at least one compound selected from the group consisting of (B1) a strobilurin fungicide, (B2) an azole fungicide, etc. Ex. 1006 at 1:40-64 and 13:50-14:6.

92. Tobler further discloses and shows that compound A-1.1 (benzovindiflupyr) has synergistic activity with each of azoxystrobin and cyproconazole. See Ex. 1006 at Tables B2, B3, B4, B6, B7.

93. Tobler further discloses fungicidal combinations with two and three components (B) combined with component (A). Ex. 1006 at 27:65-28:5. For example, Tobler specifically discloses a three fungicidal mixture of mancozeb plus benzovindiflupyr plus a compound of group P (group P includes many of QoI and ergosterol biosynthesis inhibitor fungicides). Ex. 1006 at 28:6-11, 28:40; 22:60-25:67.

94. Tobler discloses numerous fungicidal combinations which fall within the claims of the '727 patent. For example, Embodiment E1 provides the combination of benzovindiflupyr, mancozeb, and prothioconazole. Ex. 1006, 28:6-11, 28:40, 22:58-62, 23:21. Embodiment E1 includes the combination of “mancozeb+TX1.” Ex. 1006, 28:40. “ The term ‘TX1’ means: ‘the compound A-1.1+a compound selected from the group P.’” *Id.*, 28:10-11. The complete combination of all three is finally taught at col. 23, ln. 21 where prothioconazole is listed as a group P compound. *Id.*, 22:58-62, 23:21.

D. De Oliveira (Ex. 1007)

95. I have reviewed the publication WO Application Pub. No. 2015/079334 to De Oliveira (“De Oliveira”)(Ex. 1007) which published June 4, 2015. I understand from Petitioner’s counsel that De Oliveira (Ex. 1007) qualifies as prior art to the '727 Patent.

96. De Oliveira is directed to a method for controlling Asian soybean rust

(ASR) and fungicidal combinations including a multi-site contact fungicide, a first systemic fungicide and optionally a second systemic fungicide. Abstract. In particular, the method includes treating the plant at the locus of the infection with a fungicidal combination including a first dithiocarbamate fungicide, and with at least another fungicide selected (systemic fungicide) from a demethylation inhibitor, quinone outside inhibitor, succinate dehydrogenase inhibitor, quinone inside inhibitor or combinations thereof. Ex. 1007 at p. 7, first two paragraphs.

97. Both the '727 patent and De Oliveira disclose use of a “quinone outside inhibitor,” which are commonly referred to as strobilurins. There is significant overlap between the quinone outside inhibitor of De Oliveira and those claimed in '727 patent. The '727 patent and De Oliveira further disclose the use of demethylation inhibitor (DMI). De Oliveira discloses the preferred DMIs are “preferably a conazole fungicides” (Ex. 1007, p 11) which are referred to as ergosterol biosynthesis inhibitors (EBIs) in the '727 patent. There is significant overlap between the conazoles disclosed in De Oliveira and the EBIs claimed in the '727 patent.

98. According to De Oliveira, the use of a contact protective dithiocarbamate fungicide along with at least one systemic fungicide results in a synergistic complementation that was not seen when either the foliar protective fungicide or the systemic fungicide was individually used in isolation but was

observed when the two fungicides were used in conjunction. Ex. 1007 at p.7, last paragraph bridging p. 8. De Oliveira further reports “This synergistic complementation between the contact preventive dithiocarbamate fungicide and a systemic fungicide for the treatment and control of *Phakopsora* species [i.e., causative fungi for ASR] of fungicides was unexpected and surprising.” Ex. 1007 at p. 7-8.

99. De Oliveira identifies succinate dehydrogenase inhibitor fungicide (SDHI) as systemic fungicides as an embodiment of his invention. Ex. 1007 at p. 15, second paragraph. Preferred SDHIs included bixafen, fluxapyroxad, furametpyr, isopyrazam, penflufen, penthiopyrad, and sedaxane. Id.

100. De Oliveira further provides comparative examples showing the effects of mancozeb in treating Asian soybean rust in combination with various systemic fungicides combinations. Reproduced below are data from the tables of De Oliveira (Ex. 1007) from pages 24-25.

S No.	Combination used	Dosage	Percent control	Difference
A(1)	Azoxystrobin (200 g/L) + Cyproconazole (80 g/L)	300 mL/Ha	36.0	-
A(2)	Mancozeb (750 WDG) + Azoxystrobin (200 g/L) + Cyproconazole (80 g/L)	1500 g/Ha + 300 mL/Ha	68.4	+ 32.4%
A(1)	Replicated		40.0	-
A(2)	Replicated		68.0	+ 28.0%
B(1)	Pyraclostrobin (85 g/L)+	500 mL/Ha	51.7	-

	Epoxiconazole (62.5 g/L)			
B(2)	Mancozeb (750 WDG) + Pyraclostrobin (85 g/L) + Epoxiconazole (62.5 g/L)	1500 g/Ha + 500 mL/Ha	71.3	+ 19.6%
B(1)	Replicated		55.6	-
B(2)	Replicated		71.7	+ 20.7%
C(1)	Cyproconazole (80g/L)+ Picoxystrobin (200g/L)	300 mL/Ha	47.0	-
C(2)	Mancozeb (750 WDG) + Cyproconazole (80g/L)+ Picoxystrobin (200g/L)	1500 g/Ha + 300 mL/Ha	74.0	+ 27.0%
C(1)	Replicated		44.3	-
C(2)	Replicated		54.4	+11.1%
D(1)	Picoxystrobin 200 g/L + Tebuconazole 80 g/L	300 mL/Ha	68.6	-
D(2)	Mancozeb 750 WDG + Picoxystrobin 200 g/L + Tebuconazole 80 g:/L	1500 g/Ha + 300 mL/Ha	90.2	+ 21.7%
D(1)	Replicated		44.6	-
D(2)	Replicated		52.0	+ 7.4%

101. Following the data on pages 24-25, De Oliveira reported:

It was thus found that the incorporation of mancozeb increased the rust control of the conventional strobilurin + conazole fungicide treatment standard. It was further found that the lower the mixture performance in the rust control, the greater the additional benefit of mancozeb. It was thus concluded that the addition of a multi-site contact fungicide such as mancozeb acted as a synergist to the combination products registered for the treatment of Asian soybean rust. The addition of a dithiocarbamate increased disease control and improved yield of plants. Ex. 1007 at p. 25.

E. Wiglesworth (Ex. 1008)

102. I have reviewed the article “Solatenol™ fungicide – a new SDHI fungicide from Syngenta” authored by Wiglesworth et al. (“Wiglesworth”) in *Phytopathology* (2015) 105(Supl. 2) No. 4, p. S2.11. I understand from Petitioner’s counsel that Wiglesworth (Ex. 1008) qualifies as prior art to the ’727 Patent because it was publicly accessible before the Priority Date.

103. Wiglesworth discloses that Syngenta discovered a new, broad spectrum foliar fungicide named Solatenol™ (ISO name benzovindiflupyr). Ex. 1008 at S2.11. The new fungicide is a FRAC Group 7 with high affinity for succinate dehydrogenase and its key strengths include activity on Asian soybean rust (*Phakopsora pachyrhizi*), among other fungi, with use rates as low as 30 g a.i./ha being extremely efficacious on soybean rust. Ex. 1008 at S2.11-S2.12. Wiglesworth reports benzovindiflupyr was already registered in Brazil and Paraguay with registration in the U.S. expected in 2015 and further reports four product launches including Aprovia™ (a benzovindiflupyr solo product), Aprovia™ Top (benzovindiflupyr plus difenoconazole), Elatus™ (benzovindiflupyr plus azoxystrobin), Trivapro™ (benzovindiflupyr co-pack with azoxystrobin and propiconazole). *Id.*

104. Hence, a POSA would have understood from Wiglesworth (Ex. 1008) that benzovindiflupyr is a systemic, succinate dehydrogenase inhibitor

(SDHI) fungicide with low use rates, it is extremely efficacious on soybean rust and it is combinable with azoxystrobin and azoxystrobin and propiconazole. A POSA would have further understood the product Trivapro combined three fungicides (benzovindiflupyr (FRAC 7), azoxystrobin (FRAC 11) and propiconazole (FRAC 3)) with three different modes of action. See, e.g., The Pesticide Manual (Ex. 1011, monographs 48, 66 and 668).

F. Elatus EPA Label (Ex. 1009)

105. I have reviewed the Elatus EPA Label, Reg. No. 100-1480 dated 8/28/2015 (“Elatus EPA Label”)(Ex. 1009). I understand from Petitioner’s counsel that Elatus EPA Label (Ex. 1009) qualifies as prior art to the ’727 Patent because it was publicly accessible before the Priority Date.

106. The Elatus EPA label discloses the product Elatus™ Fungicide contains two fungicides, which are (1) azoxystrobin, a strobilurin fungicide in FRAC Group 11, and (2) benzovindiflupyr, a succinate dehydrogenase inhibitor (SDHI) in FRAC Group 7. Ex. 1009 at p. 8. The product contains 30% azoxystrobin and 15% benzovindiflupyr with the remaining 55% other ingredients. Ex. 1009 at 1. A POSA would have understood the 55% of other ingredients to be non-active, agrochemically acceptable excipients since the Elatus Fungicide product was labeled for use as a fungicide for plant diseases and applied as a foliar spray (page 6). The label further discloses the Elatus product can be used on

soybeans for Asian soybean rust, among other crops and disease. Ex. 1009 at pp. 27, 31.

VII. GROUNDS FOR UNPATENTABILITY

107. A claim chart summarizing the unpatentability of each of claims 1 through 10 based on the prior art is provided in Appendix C.

A. Ground 1: Claims 1, 3, 4, 5, 7, 9 and 10 of the ‘727 Patent are anticipated by Godoy (Ex. 1005).

1. Claim 1 is anticipated by Godoy (Ex. 1005)

108. Independent claim 1 recites a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin.

109. Godoy explicitly disclosed the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin. No other fungicides were included with the combination of benzovindiflupyr, mancozeb and azoxystrobin. Such fungicidal combinations are shown in Table 3 as Treatments 17 and 23. See Godoy (Ex. 1005) Table 3 at p. 3.

110. The fungicidal combinations for Treatments 17 and 23 can be summarized as follows: Treatment 17: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 1500 (Dose g a.i. ha⁻¹)) (Elatus® and Unizeb Gold®) (0.2 and 2.0 (Dose L/kg C.P. ha⁻¹)); and Treatment 23: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 2000 (Dose g a.i. ha⁻¹)) (Elatus® and PNR) (0.2 and 2.5

(Dose L-kg C.P. ha-1)).³ Table 3 showing these Treatments is reproduced below with annotations.

Table 3. Active ingredients (a.i.), commercial product (C.P.) and dose of fungicides evaluated in associated treatments to control diseases in soybean crops, 2015/16 harvest.

Active ingredient (a.i.)	Dose g a.i. ha ⁻¹	Commercial product (C.P.)	Dose l-kg C.P. ha ⁻¹
1 control	-	Control	-
2 picoxystrobin + cyproconazole ¹	60+24	Aproach [®] Prima	0.3
3 picoxystrobin + cyproconazole ¹ and copper oxychloride	60+24 and 294	Aproach [®] Prima and Difere [®]	0.3 and 0.5
4 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1080	Aproach [®] Prima and Previnil [®]	0.3 and 1.5
5 picoxystrobin + cyproconazole ¹ and copper oxychloride	60+24 and 280	Aproach [®] Prima and PNR ²	0.3 and 0.4
6 picoxystrobin + cyproconazole ¹ and mancozeb	60+24 and 1500	Aproach [®] Prima and Unizeb Gold [®]	0.3 and 2.0
7 picoxystrobin + cyproconazole ¹ and copper sulfate	60+24 and 113,85	Aproach [®] Prima and PNR ²	0.3 and 0.75
8 picoxystrobin + cyproconazole ¹ and propineb	60+24 and 1400	Aproach [®] Prima and PNR ²	0.3 and 2.0
9 picoxystrobin + cyproconazole ¹ and fluazinam	60+24 and 500	Aproach [®] Prima and Frownicide [®] /Signal [®]	0.3 and 1.0
10 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1000	Aproach [®] Prima and Bravonil 500 [®]	0.3 and 2.0
11 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1000	Aproach [®] Prima and PNR ²	0.3 and 2.0
12 picoxystrobin + cyproconazole ¹ and mancozeb	60+24 and 2000	Aproach [®] Prima and PNR ²	0.3 and 2.5
13 azoxystrobin + benzoindiflupyr ¹	60+30	Elatus [®]	0.2
14 azoxystrobin + benzoindiflupyr ¹ and copper oxychloride	60+30 and 294	Elatus [®] and Difere [®]	0.2 and 0.5
15 azoxystrobin + benzoindiflupyr ¹ and chlorothalonil	60+30 and 1080	Elatus [®] and Previnil [®]	0.2 and 1.5
16 azoxystrobin + benzoindiflupyr ¹ and copper oxychloride	60+30 and 280	Elatus [®] and PNR ²	0.2 and 0.4
17 azoxystrobin + benzoindiflupyr ¹ and mancozeb	60+30 and 1500	Elatus [®] and Unizeb Gold [®]	0.2 and 2.0
18 azoxystrobin + benzoindiflupyr ¹ and copper sulfate	60+30 and 113,85	Elatus [®] and PNR ²	0.2 and 0.75
19 azoxystrobin + benzoindiflupyr ¹ and propineb	60+30 and 1400	Elatus [®] and PNR ²	0.2 and 2.0
20 azoxystrobin + benzoindiflupyr ¹ and fluazinam	60+30 and 500	Elatus [®] and Frownicide [®] /Signal [®]	0.2 and 1.0
21 azoxystrobin + benzoindiflupyr ¹ and chlorothalonil	60+30 and 1000	Elatus [®] and Bravonil 500 [®]	0.2 and 2.0
22 azoxystrobin + benzoindiflupyr ¹ and chlorothalonil	60+30 and 1000	Elatus [®] and PNR ²	0.2 and 2.0
23 azoxystrobin + benzoindiflupyr ¹ and mancozeb	60+30 and 2000	Elatus [®] and PNR ²	0.2 and 2.5

¹ Added Nimbus 0,6 L ha-1; ² PNR – Product not registered for the soybean crop, RET III.

Godoy (Ex. 1005) at p. 3.

³ Nimbus is a mineral oil used to improve spreadability of sprayed droplets applied to leaves of plants in the treatment of soybean rust. See Moura (Ex. 1016); see also Della Vechia (Ex. 1017).

111. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 1, I conclude that claim 1 is anticipated by Godoy (Ex. 1005).

2. Claim 3 and 4 are anticipated by Godoy (Ex. 1005)

112. Each of claims 3 and 4 depend on claim 1 and each of claims 3 and 4 recite a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin.

113. As explained above for claim 1 (incorporated herein by reference), Godoy (Ex. 1005) explicitly disclosed the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin.

114. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 3 and each and every limitation of claim 4, I conclude that claim 3 and claim 4 are anticipated by Godoy (Ex. 1005).

3. Claim 5 is anticipated by Godoy (Ex. 1005)

115. Claim 5 recites a composition consisting of at least one agrochemically acceptable excipient; and a fungicidal combination of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin.

116. As explained above for claim 1 (incorporated herein by reference), Godoy (Ex. 1005) explicitly disclosed the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin. Godoy further disclosed the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin in a

composition with an agrochemically acceptable excipient.

117. For example, Godoy disclosed that the products (e.g., the fungicidal combinations in Table 3, including azoxystrobin, benzovindiflupyr and mancozeb, Treatments 17 and 23) were applied by “a knapsack sprayer pressurized with CO₂ and a minimum application volume of 120 L ha⁻¹”. Godoy (Ex. 1005) at p. 4, left column.

118. A person of skill in the art would have understood the description by Godoy (Ex. 1005) to mean that the fungicidal combinations were mixed with water, or another agrochemically acceptable carrier, and applied by a knapsack sprayer to the soybean crops. Further, water is commonly used in to apply fungicidal combinations to crops. Water, or another agrochemically acceptable carrier, is an agrochemically acceptable excipient. Hence, a person of skill in the art would have understood the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin included at least one agrochemically acceptable excipient during application of the fungicidal combinations disclosed in Godoy.

119. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 5, I conclude that claim 5 is anticipated by Godoy (Ex. 1005).

4. Claim 7 is anticipated by Godoy (Ex. 1005)

120. Claim 7 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed by Godoy (Ex. 1005). Claim 7 adds “benzovindiflupyr and

mancozeb are admixed in ratio of 1:80 to 80:1”

121. Godoy (Ex. 1005) further disclosed ratios for benzovindiflupyr and mancozeb admixed in a ratio of 1:80 to 80:1.

122. For example, the fungicidal combinations shown for Treatments 17 and 23 in Table 3 of Godoy have a ratio of benzovindiflupyr (30 (Dose g a.i./ha⁻¹)) to mancozeb (1500 and 2000 (Dose g a.i./ha⁻¹)) of 30 to 1500 and 30 to 2000 or a ratio of 1:50 and 1:67, respectively. See Treatments 17 and 23 in Table 5 Godoy (Ex. 1005) at p. 3.

123. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 7, I conclude that claim 7 is anticipated by Godoy (Ex. 1005).

5. Claim 9 is anticipated by Godoy (Ex. 1005)

124. Claim 9 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed by Godoy (Ex. 1005). Claim 9 adds “applying the combination of claim 1 to the foliage of a plant”.

125. Godoy discloses applying the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin to the foliage of a plant. In particular, Godoy described the experimental design used to apply the fungicidal combinations to soybean plants as “started in the pre-closing of the sowing lines”. Godoy (Ex. 1005) at p. 4, left column. In regard to the fungicidal combinations listed in Table 3, Godoy explains:

In the second protocol (Table 3) three applications were carried out with average intervals of 21 and 15 days after the first and second application, respectively. Ex. 1005 at p. 4.

126. Godoy further explains that “[t]o apply the products, a knapsack sprayer pressurized with CO₂ and a minimum application volume of 120 L ha⁻¹ was used.” Id.

127. A POSA would have understood a knapsack sprayer is a foliar sprayer. Further, a POSA would have understood from the experimental design disclosed by Godoy that the fungicide applications were initiated prior to the leaves of the plants touching between rows (i.e., “pre-closing of the sowing lines”), which indicates the plants had grown to a certain stage before application of the fungicides. A POSA would have further understood from Godoy that the last application of the fungicidal combinations occurred on average 36 days (21+15) after the first application. Under such a protocol, the soybean plants would have grown at least 36 days, and therefore, would have had leaves and the applications of the fungicidal combinations were on the foliage of the plants.

128. My opinion that Godoy applied the disclosed fungicidal combinations to the foliage of soybean plants is supported by knowledge of a POSA. For example, it was well known to a POSA that the fungus which causes soybean rust (*Phakopsora pachyrhizi*) develops on the leaves of soybean plants and

thus the foliage of plants is treated to control the disease. See, e.g., Moura (Ex. 1016). Further, it was well known to POSAs that mancozeb is commonly applied to the leaves of plants. See, e.g., Gullino (Ex. 1010) at pp. 10078-79 under Biological activity and P. 1082 under Implications and use rate.

129. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 9, I conclude that claim 9 is anticipated by Godoy (Ex. 1005).

6. Claim 10 is anticipated by Godoy (Ex. 1005)

130. Independent claim 10 recites a “method of controlling fungal diseases in plants consisting of, applying to the locus of the plant a combination consisting of” benzovindiflupyr, mancozeb and at least one quinone outside inhibitor (such as azoxystrobin, picoxystrobin) and/or at least one ergostrol biosynthesis inhibitor (such as cyproconazole). The ’727 Patent defines the “locus” of a plant “to embrace the place on which the plants are growing, . . .” Exhibit 1001 at 2:55-59.

131. In my opinion, Godoy (Ex. 1005) disclosed a method of controlling fungal disease in plants by applying to the locus of the plant a combination of benzovindiflupyr, mancozeb and azoxystrobin.

132. Godoy explained: “The objective of this work is to present the summarized results of cooperative trials with multisite fungicides, carried out on 2015/16 harvest, to control diseases in soybeans crops.” Godoy (Ex. 1005) at p. 1. In particular, the study summarized the results of fungicides in controlling Asian

soybean rust caused by the fungus *Phakopsora pachyrhizi*. See Ex. 1005, title. Hence, a POSA would have understood Godoy related to methods of controlling fungal disease in plants.

133. As explained above for claim 1 (incorporated herein by reference), Godoy (Ex. 1005) disclosed and showed examples of using fungicides with different modes of action (azoxystrobin + benzovindiflupyr) in combination with a multisite fungicide (mancozeb) for disease control of Asian soybean rust.

134. As further explained above for claim 9 (incorporated herein by reference), the experimental design and protocol to apply the fungicidal combinations (including the combination of benzovindiflupyr, mancozeb and azoxystrobin) were carried out in the locus where soybean crops were grown.

135. Thus, because Godoy (Ex. 1005) discloses each and every limitation of claim 10, I conclude that claim 10 is anticipated by Godoy (Ex. 1005).

B. Ground 2: Claims 1-10 of the ‘727 Patent are anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

1. Claim 1 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

136. Claim 1 recites a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide selected from an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor

fungicide. The ergosterol biosynthesis inhibitor (EBI) fungicide and the quinone outside inhibitor (QoI) fungicide can be one, or a combination of, 55 possible known fungicides as shown below:

Ergosterol biosynthesis inhibitors (EBI)							
1	azaconazole	11	flusilazole	21	tebuconazole	31	triflumizole
2	bitertanol	12	flutriafol	22	tetraconazole	32	fenarimol
3	bromuconazole	13	hexaconazole	23	triadimefon	33	nuarimol
4	cyproconazole	14	imibenconazole	24	triadimenol	34	pyrifenox
5	difenoconazole	15	ipconazole	25	triticonazole	35	pyrisoxazole
6	diniconazole	16	metconazole	26	prothioconazole	36	triforine
7	epoxiconazole	17	myclobutanil	27	imazalil		
8	etaconazole	18	penconazole	28	oxpoconazole		
9	fenbuconazole	19	propiconazole	29	pefurazoate		
10	fluquinconazole	20	simeconazole	30	prochloraz		
Quinone outside inhibitor (QoI)							
37	azoxystrobin	42	pyraoxystrobin	47	kresoxim-methyl	52	famoxadone
38	coumoxystrobin	43	mandestrobin	48	dimoxystrobin	53	fluoxastrobin
39	enoxastrobin	44	pyraclostrobin	49	fenaminostrobin	54	fenamidone
40	flufenoxystrobin	45	pyrametostrobin	50	metominostrobin	55	pyribencarb
41	picoxystrobin	46	triclopyricarb	51	trifloxystrobin		

137. Tobler (Ex. 1006) is directed to fungicidal compositions that include:

(A) a compound of formula (I) and (B) at least one compound selected from

compounds known for fungicidal activity. Ex. 1006 at Abstract.

138. As I explained in Section VI.C above, benzovindiflupyr is a preferred compound of formula (I), which is identified as compound A-1.1 in Tobler (Ex. 1006 at 13:5-11).

139. Tobler discloses and shows that compound A-1.1 (benzovindiflupyr) is effective in controlling Asian soybean rust (*Phakopsora pachyrhizi*). See Ex. 1006 at Col. 41, Example B-1.

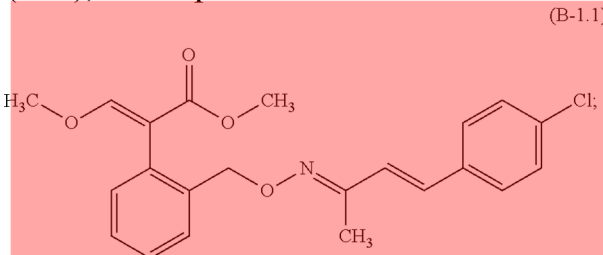
140. Tobler further discloses compositions including three or four fungicidal combinations. In particular, Tobler discloses:

The compositions according to the invention may also comprise more than one of the active components (B), if, for example, a broadening of the spectrum of phytopathogenic disease control is desired. For instance, it may be advantageous in the agricultural practice to combine two or **three components (B) with component (A)**. An example is a composition comprising a compound of formula (I), azoxystrobin and cyproconazole. Ex. 1006 at 27:65-28:5 (emphasis added).

141. Tobler further discloses, as embodiment E1: “Mancozeb+TX1” (Ex. 1006 at 28:40) (The term ‘TX1’ means: ‘the compound A-1.1+a compound selected from the group P’). Id. at 28:6-11).

142. Hence, Tobler disclosed the fungicidal combination of Mancozeb+ benzovindiflupyr + (Group P fungicides).

143. Group P components, which are “Especially Suitable Compounds as Component (B) in the Compositions According to the Invention,” are provided between col. 22, ln 61 to col. 25, ln 67 of Tobler. Ex. 1006 at 22:61-25:67. Among the 55 possible EBIs and QoIs of claim 1 of the '727 Patent, Tobler discloses 47 as Group P fungicides that are combined with mancozeb and benzovindiflupyr. The overlapping group P compounds of Tobler and the '727 patent are illustrated in the below table.

Ergosterol Biosynthesis Inhibitors or Quinone Outside Inhibitor of The '727 Patent	Tobler Group P Compounds
wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifeno, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from	Group P: Especially Suitable Compounds as Component (B) in the Compositions According to the Invention: a strobilurin fungicide selected from azoxystrobin (47), dimoxystrobin (226), fluoxastrobin (382), kresoxim-methyl (485), metominostrobin (551), oryastrobin, picoxystrobin (647), pyraclostrobin (690); trifloxystrobin (832), a compound of formula B-1.1  an azole fungicide selected from azaconazole (40), bromuconazole (96), cyproconazole (207), difenoconazole (247), diniconazole (267), diniconazole-M (267), epoxiconazole (298), fenbuconazole (329), fluquinconazole

azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	(385), flusilazole (393), flutriafol (397), hexaconazole (435), imazalil (449), imibenconazole (457), ipconazole (468), metconazole (525), myclobutanil (564), oxpoconazole (607), pefurazoate (618), penconazole (619), prochloraz (659), propiconazole (675), prothioconazole (685), simeconazole (731), tebuconazole (761), tetraconazole (778), triadimefon (814), triadimenol (815), triflumizole (834), triticonazole (842), diclobutrazol (1068), etaconazole (1129), furconazole (1198), furconazole-cis (1199) and quinconazole (1378); ... a fungicide selected from the group consisting of ... bitertanol (84), ... famoxadone (322), fenamidone (325), fenaminosulf (1144), fenamiphos (326), fenarimol (327), ... nuarimol (587), ... pyrifenoxy (703), ... triforine (838)....
---	---

144. Hence, a POSA would have understood Tobler (Ex. 1006) disclosed a fungicidal combination of mancozeb + benzovindiflupyr + (Group P fungicides), and that the Group P fungicides include 47 of the 55 EBIs and QoIs of claim 1. Further, because Tobler disclosed so many fungicidal combinations that overlap with claim 1 of the '727 Patent, a POSA would have immediately recognized Tobler as disclosing the fungicidal combinations set forth in claim 1.

145. In addition, a POSA would have been motivated to arrive at the fungicidal combination of claim 1 based on Tobler (Ex. 1006) in view of Godoy

(Ex. 1005).

146. Tobler discloses a fungicidal combination of mancozeb + benzovindiflupyr together with either or both of azoxystrobin and cyproconazole and further disclosed and showed that compound A-1.1 (benzovindiflupyr) has synergistic activity with each of azoxystrobin and cyproconazole. See Ex. 1006, Tables B2, B3, B4, B6, B7. Tobler further discloses and shows that compound A-1.1 (benzovindiflupyr) is effective in controlling Asian soybean rust (*Phakopsora pachyrhizi*). See Ex. 1006 at Col. 41, Example B-1.

147. Godoy teaches combining mancozeb with either benzovindiflupyr + azoxystrobin or benzovindiflupyr + cyproconazole for treating Asian soybean rust (*Phakopsora pachyrhizi*). Godoy (Ex. 1005) at p. 3, Table 3, Treatments 6, 12 17 and 23.

148. Godoy explains the rationale for its combinations, which includes combining fungicides with different modes of action (i.e., benzovindiflupyr + azoxystrobin or picoxystrobin + cyproconazole) increases disease control and including a multisite fungicide (i.e., mancozeb) in the combination reduces fungal resistance to the combination. In particular, Godoy discloses “Evaluating the efficiency of fungicides with different modes of action is essential to increase disease control options in soybeans crops. The use of multisite fungicides can be an option for both Asian soybean rust control and an anti-resistance strategy.” Godoy

(Ex. 1005) at p. 1.

149. Godoy further explained and showed that the addition of mancozeb to either the combination of azoxystrobin + benzovindiflupyr or the combination of cyproconazole + picoxystrobin improved disease control for Asian soybean rust.

150. In particular, Godoy explained the results of Treatments 17 and 23 under the Results and Discussion section at page 5 as follows: “For applications associated with fungicide azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹, the highest yields were observed for treatments with associations of mancozeb 1500 g a.i. ha⁻¹ and 2000 g a.i. ha⁻¹ (T17 – 3377 kg ha⁻¹; T23 – 3270 kg ha⁻¹, respectively), although the productivity of the association with mancozeb 2000 g a.i. ha⁻¹ was statistically similar to azoxystrobin + benzovindiflupyr 60 + 30 g a.i. isolated ha⁻¹ (T13 – 3186 kg ha⁻¹).” Godoy (Ex. 1005) at p. 5, see also Table 5 at p 6.

151. Further, Godoy’s data showed disease severity was negatively correlated with yield, meaning less disease resulted in increased yield. In the case or azoxystrobin + benzovindiflupyr, addition of mancozeb at 1500 or 2000 g a.i. ha⁻¹ resulted in statistically less disease than azoxystrobin + benzovindiflupyr alone.

152. Godoy (Ex. 1005) further explained and showed that adding mancozeb to the combination of cyproconazole and picoxystrobin also improved disease control for Asian soybean rust. In particular, Godoy explained under the

Results and Discussion section at pages 4-5: “For treatments with applications associated with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹, there was a significant reduction in severity with the association of multisite in all combinations. The lowest severity was observed for the association with mancozeb 2000 g a.i. ha⁻¹ (T12 – 29.2 %), followed by chlorothalonil 1080 g a.i. ha⁻¹ (T4 – 31.6 %), mancozeb 1500 g a.i. ha⁻¹ (T6 – 31.6 %) and copper oxychloride 294 g a.i. ha⁻¹ and 280 g a.i. ha⁻¹ (T3 and T5 – 32.9 %).” Godoy (Ex. 1005) at p. 4-5.

153. Thus, a POSA would have been motivated to arrive at a fungicidal combination of benzovindiflupyr, mancozeb, azoxystrobin, cyproconazole, and optionally picoxystrobin based on the teachings of Tobler and Godoy with a reasonable expectation of success. My opinion is supported by the disclosures of the references, including: (1) Tobler discloses and suggested a fungicidal combination of mancozeb + benzovindiflupyr together with either or both of azoxystrobin and cyproconazole and that benzovindiflupyr has synergistic activity with each of azoxystrobin and cyproconazole for a number of fungi, and that benzovindiflupyr is effective in controlling Asian soybean rust (*Phakopsora pachyrhizi*) and (2) Godoy teaches and shows combining mancozeb with either benzovindiflupyr + azoxystrobin or benzovindiflupyr + cyproconazole (fungicides with different modes of action) results in improved control of Asian soybean rust (*Phakopsora pachyrhizi*).

154. Thus, because Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005), discloses or suggests each and every limitation of claim 1, I conclude that claim 1 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

2. Claim 2 is rendered obvious by Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

155. Independent claim 2 recites a fungicidal combination that consists of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin).

156. As explained for claim 1 in Section VII.B.1 above (incorporated herein by reference), Tobler (Ex. 1006) discloses and suggests a fungicidal combination of mancozeb + benzovindiflupyr + (Group P, which include either or both of azoxystrobin and cyproconazole). In addition to disclosing the various three-way mixtures, Tobler also discloses that its fungicidal mixtures of compound A and at least one compound B can include three compound B fungicides giving rise to a fungicidal combination with four fungicides.

157. In particular, Tobler discloses:

The compositions according to the invention may also comprise *more than one of the active components (B), if, for example, a broadening of the spectrum of phytopathogenic disease control* is desired. For instance, it may be advantageous in the agricultural practice to combine two **or three**

components (B) with component (A). An example is a composition comprising a compound of formula (I), azoxystrobin and cyproconazole. Ex. 1006 at 27:65-28:5 (emphasis added).

158. In selecting the fungicides for compound B, a POSA would have selected fungicides with different modes of action for the combination. This would have been known by a POSA as of the Priority Date and is supported by Tobler, which discloses a rationale for including more than one component (B) for “broadening of the spectrum of phytopathogenic disease” See quote in paragraph immediately above.

159. As explained for claim 1 in Section VII.B.1 above, Tobler discloses various ergosterol biosynthesis inhibitor (EBIs) fungicides (*e.g.*, cyproconazole, prothioconazole); quinone outside inhibitor (QoIs) fungicides (*e.g.*, azoxystrobin, picoxystrobin);⁴ and mancozeb as acceptable (B) components. A POSA would have known the EBIs and QoIs and mancozeb have different modes of action. See, *e.g.*, The Pesticide Manual and monographs for each of the EBIs, QoIs and mancozeb. Tobler further discloses a fungicidal combination of mancozeb +

⁴ Tobler refers to the ergosterol biosynthesis inhibitor (EBIs) as azoles and the quinone outside inhibitor (QoIs) as strobilurins, which terms are sometimes used interchangeable in the art.

benzovindiflupyr together with either or both of azoxystrobin and cyproconazole and that benzovindiflupyr has synergistic activity with each of azoxystrobin and cyproconazole for a number of fungi, and that benzovindiflupyr is effective in controlling Asian soybean rust (*Phakopsora pachyrhizi*).

160. As such, a POSA would have been motivated to arrive at a fungicidal combination of (1) benzovindiflupyr (2) mancozeb, (3) an ergosterol biosynthesis inhibitor (EBIs) fungicides (i.e. cyproconazole or prothioconazole) and (4) a quinone outside inhibitor (QoIs) fungicides (i.e., azoxystrobin or picoxystrobin) with a reasonable expectation of success based on Tobler.

161. Godoy further supports the rationale to arrive at a fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicides (i.e., cyproconazole, prothioconazole); and a quinone outside inhibitor fungicides (i.e., azoxystrobin, picoxystrobin) as I explain for claim 1 in Section VII.B.1 above.

162. Thus, because Tobler (Ex. 1006) in view of Godoy (Ex. 1005) discloses or suggests each and every limitation of claim 2, I conclude that claim 2 is rendered obvious by Tobler (Ex. 1006) in view of Godoy (Ex. 1005).

3. Claims 3 and 4 are anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

163. Each of claims 3 and 4 depend on claim 1 and each of claims 3 and 4

recite a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide.

164. As explained for claim 1 in Section VII.B.1 above (incorporated herein by reference), Tobler (Ex. 1006) discloses and suggests a fungicidal combination of mancozeb + benzovindiflupyr and a Group P component. Each of the fungicides listed in claim 3 and in claim 4 of the '727 patent are provided in Group P of Tobler.

165. Thus, because Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005), discloses or suggests each and every limitation of claim 3 and each and every limitation of claim 4, I conclude that claims 3 and 4 are anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

4. Claim 5 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

166. Claim 5 recites a composition consisting of at least one agrochemically acceptable excipient; and a fungicidal combination of benzovindiflupyr, mancozeb and at least one ergostrol biosynthesis inhibitor (EBI) and/or at least one quinone outside inhibitor (QoI).

167. As explained for claim 1 in Section VII.B.1 above (incorporated herein by reference), Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) discloses and suggests a fungicidal combination of mancozeb + benzovindiflupyr

+ (Group P) in which Group P components include either or both of azoxystrobin (QoI) and cyproconazole (EBI)).

168. Tobler (Ex. 1006) further teaches its fungicidal compositions can include excipients. In particular, Tobler (Ex. 1006) discloses about its compositions that:

Such compositions may be produced in [a] conventional manner, e.g. by mixing the active ingredients with at least one appropriate inert formulation adjuvant (for example, diluents, solvents, fillers and optionally other formulating ingredients such as surfactants, biocides, anti-freeze, stickers, thickeners and compounds that provide adjuvancy effects). Ex. 1006 at 36:23-28

169. Tobler (Ex. 1006) further discloses “The composition of the invention may be employed in any conventional form . . . or any technically feasible formulation in combination with agriculturally acceptable adjuvants.” Tobler (Ex. 1006) at 36:4-22. Hence, a POSA would have been motivated to prepare the composition of claim 5 with a reasonable expectation of success.

170. Godoy further supports the motivation for arriving the composition of claim 5 for the reasons provided for claim 1 in Section VII.A.3 above.

171. Thus, because Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005), discloses or suggests each and every limitation of claim 5, I conclude that claim 5 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view

of Godoy (Ex. 1005).

5. Claim 6 anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

172. Claim 6 depends on claim 5. As discussed above, each limitation of claim 5 is disclosed or suggested by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005). Claim 6 adds “wherein the composition is formulated into wettable powders, granules, dusts, soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, a combination of a suspension concentrate (SC) and a capsule suspension (CS), or oil dispersions.”

173. Tobler (Ex. 1006) discloses its compositions can be in the form of “. . . a water dispersible powder for seed treatment (WS), a capsule suspension for seed treatment (CF), . . . a suspension concentrate (SC), . . . a capsule suspension (CS), a water dispersible granule (WG), . . . an oil dispersion (OD), . . . a soluble concentrate (SL), . . . a wettable powder (WP) or any technically feasible formulation in combination with agriculturally acceptable adjuvants.” Tobler (Ex. 1006) at 36:4-22. Hence, a POSA would have been motivated to formulate the fungicidal combinations disclosed and suggested by Tobler in any of the forms of claim 6 with a reasonable expectation of success.

174. Thus, because Tobler (Ex. 1006) alone, or in view of Godoy (Ex.

1005), discloses or suggests each and every limitation of claim 6, I conclude that claim 6 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

6. Claim 7 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

175. Claim 7 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed or suggested by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005). Claim 7 adds “benzovindiflupyr and mancozeb are admixed in ratio of 1:80 to 80:1”

176. Tobler (Ex. 1006) further teaches the more preferred weight ratio of component (A) (benzovindiflupyr) to component (B) (mancozeb and Group P) is from 20:1 to 1:50. In particular, Tobler discloses “In general, the weight ratio of component (A) to component (B) is from 2000:1 to 1:1000. A non-limiting example for such weight ratios is compound of formula I:compound of formula B-2 is 10:1. The weight ratio of component (A) to component (B) is preferably from 100:1 to 1:100; more preferably from 20:1 to 1:50.” (Ex. 1006 at 34:26-32). Hence, a POSA would have been motivated to prepare the fungicidal combination of claim 7 with a reasonable expectation of success.

177. Thus, because Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005) discloses or suggests each and every limitation of claim 7, I conclude that

claim 7 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

7. Claim 8 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

178. Claim 8 depends on claim 5. As discussed above, each limitation of claim 5 is disclosed or suggested by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005). Claim 8 adds “wherein the total amount of benzovindiflupyr in the composition is in the range of 0.1 to 99% by weight, the total amount of mancozeb in the composition is in the range of 0.1 to 99% by weight; the total amount of ergostrol biosynthesis inhibitor in the composition is in the range of 0.1 to 99% by weight; and the total amount of quinone outside inhibitor in the composition is in the range of 0.1 to 99% by weight.”

179. As explained for claim 1 in Section VII.B.1 above (incorporated herein by reference), Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) discloses and suggests a fungicidal combination of mancozeb + benzovindiflupyr + (Group P) in which Group P components include either or both of azoxystrobin (QoI) and cyproconazole (EBI)).

180. In addition, Tobler discloses:

In general, the formulations include from 0.01 to 90% by weight of active agent, from 0 to 20% agriculturally acceptable surfactant and 10 to 99.99% solid or liquid formulation inerts and adjuvant(s), the active agent

consisting of at least a compound of component (A) together with a compound of component (B), and optionally other active agents, particularly microbiocides or conservatives or the like. Concentrated forms of compositions generally contain in between about 2 and 80%, preferably between about 5 and 70% by weight of active agent. Application forms of formulation may for example contain from 0.01 to 20% by weight, preferably from 0.01 to 5% by weight of active agent. Whereas commercial products will preferably be formulated as concentrates, the end user will normally employ diluted formulations. Ex. 1006, 36:5 2-65

181. The ranges recited in claim 8 of the '727 patent overlap with the formulation ranges disclosed in Tobler. For instance, the composition of claim 8 of the '727 patent embraces a composition having 0.4-100% active agents, e.g., adding the lowest and highest amounts for the four fungicides. This 0.4-100% of active agents overlaps with the 0.01 to 90% active agents disclosed in Tobler, as well as, concentrated compositions disclosed by Tobler containing about 2 and 80% active agents. It would be routine for a person of ordinary skill in the art to formulate a composition having 0.1 to 99% by weight benzovindiflupyr, 0.1 to 99% by weight mancozeb, 0.1 to 99% by weight an ergostrol biosynthesis inhibitor, and/or 0.1 to 99% by weight a quinone outside inhibitor.

182. Godoy further supports that would be routine for a person of ordinary skill in the art to formulate a composition according to Tobler to arrive at the ranges of claim 8.

183. As explained for claim 1 in Section VII.B.1 above, Godoy (Ex. 1005) taught and showed examples of using fungicides with different modes of action (azoxystrobin + benzovindiflupyr) and (picoxystrobin + cyproconazole) in combination with a multisite fungicide (mancozeb). Godoy (Ex. 1005) further explicitly exemplified applying such fungicidal combinations in amounts of: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 1500 (g a.i. ha⁻¹) Treatment 17; and picoxystrobin + cyproconazole and mancozeb (60+30 and 1500 (g a.i. ha⁻¹) Treatment 6, Table 3. Godoy (Ex. 1005) at p. 3, Table 3.

184. Hence, a POSA would have arrived at a fungicidal combination in the dosage amounts suggested by Godoy such as 60+24 and 60+30 and 1500 (g a.i. ha⁻¹), respectively, which would result in a fungicidal combination with the following approximate percentages of active ingredients: 2.4% (60/(300+200+2000)) picoxystrobin, 0.96% (24/2500) cyproconazole, 2.4% (60/2500) azoxystrobin, 1.2% (30/2500) benzovindiflupyr and 60% (1500/2500) mancozeb.

185. Hence, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) suggests a fungicidal composition where the total amounts of the fungicidal combination of picoxystrobin, cyproconazole, azoxystrobin, benzovindiflupyr and mancozeb are within the ranges set out in claim 8. As such, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) renders claim 8 obvious.

8. Claim 9 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

186. Claim 9 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed or suggested by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005). Claim 9 adds “applying the combination of claim 1 to the foliage of a plant”.

187. Tobler (Ex. 1006) discloses applying its fungicidal combinations to the foliage of a plant. In particular, Tobler discloses: “Some compositions according to the invention have a systemic action and can be used as foliar, soil and seed treatment fungicides.” Ex. 1006 at 35:28-30. Hence, a POSA would have been motivated to applying the combination of claim 1 to the foliage of a plant with a reasonable expectation of success. Godoy supports the motivation to use the fungicidal combinations disclosed and suggested by Tobler to the foliage of a plant for the reasons explained in claim 9 in Section VII.A.5 above.

188. Thus, because Tobler (Ex. 1006) alone or in view of Godoy discloses or suggests each and every limitation of claim 9, I conclude that claim 9 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

9. Claim 10 is anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

189. Independent claim 10 recites a “method of controlling fungal diseases in plants consisting of, applying to the locus of the plant a combination consisting of” benzovindiflupyr, mancozeb and at least one quinone outside inhibitor and/or at least one ergostrol biosynthesis inhibitor.

190. As explained for claim 1 in Section VII.B.1 above (incorporated herein by reference), Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) discloses and suggests a fungicidal combination of mancozeb + benzovindiflupyr + (Group P) in which Group P components include either or both of azoxystrobin (QoI) and cyproconazole (EBI)). Further, in my opinion, Tobler (Ex. 1006) disclosed a method of controlling fungal disease in plants by applying to the locus of the plant the disclosed and suggested fungicidal combinations.

191. In particular, Tobler (Ex. 1006) discloses: “A further aspect of the present invention is a method of controlling diseases on useful plants or on propagation material thereof caused by phytopathogens, which comprises applying to the useful plants, the locus thereof or propagation material thereof a composition according to the invention.” Tobler (Ex. 1006) at 12:26-29. Hence, a POSA would have been motivated to control fungal diseases in plants according to claim 10 with a reasonable expectation of success.

192. Godoy supports the motivation to use the fungicidal combinations disclosed and suggested by Tobler to the foliage of a plant for the reasons explained in claim 9 in Section VII.A.5 above.

193. Thus, because Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005) discloses or suggests each and every limitation of claim 10, I conclude that claim 10 is anticipated or rendered obvious by Tobler (Ex. 1006) alone, or in view of Godoy (Ex. 1005).

C. Ground 3: Claims 1-10 of the '727 Patent are rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

1. Claim 1 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

194. Claim 1 recites a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin.

195. De Oliveira (Ex. 1007) is directed to a method for controlling Asian soybean rust (ASR). The reference provides examples of treating ASR with mancozeb in combination with various ergosterol biosynthesis inhibitors (EBI) and quinone outside inhibitors (QoI) and reported that the incorporation of mancozeb increased control of ASR. Ex. 1007 at p. 24.

196. In particular, De Oliveira proved the following examples:

S No.	Combination used	Dosage
A(2)	Mancozeb 750 WDG + 200 g/L azoxystrobin + 80 g/L cyproconazole	1500 g/Ha + 300 mL/Ha
B(2)	Mancozeb 750 WDG + 85 g/L pyraclostrobin + 62.5 g/L epoxiconazole	1500 g/Ha + 500 mL/Ha
C(2)	Mancozeb 750 WDG + Cyproconazole 80g/L+ Picoxystrobin 200g/L	1500 g/Ha + 300 mL/Ha
D(2)	Mancozeb 750 WDG + Picoxystrobin 200 g/L + Tebuconazole 80 g/L	1500 g/Ha + 300 mL/Ha

(Ex. 1007 at p. 24.)

197. De Oliveira concluded from the examples that “[i]t was thus found that the incorporation of mancozeb increased the [Asian soybean] rust control of the conventional strobilurin + conazole fungicide treatment standard.” Ex. 1007, p 25.

198. De Oliveira further discloses that its fungicidal combination for treating soybean rust can include other systemic fungicides such as an “succinate dehydrogenase inhibitor (SDHI)”. Ex. 1007 at pp. 7, 15. Preferred SDHIs included bixafen, fluxapyroxad, furametpyr, isopyrazam, penflufen, penthiopyrad, and sedaxane. Id. However, even though De Oliveira did not list benzovindiflupyr among the SDHIs, a POSA would have been motivated to use benzovindiflupyr as an SDHI in the fungicidal combinations of De Oliveira based on the general disclosure of De Oliveira and because benzovindiflupyr was known to be an SDHI

as of the Priority Date.

199. Moreover, each of Wiglesworth, Tobler, and Godoy further support the motivation to include benzovindiflupyr in the combinations of De Oliveira.

200. Wiglesworth (Ex. 1008) discloses that benzovindiflupyr is a new SDHI fungicide by Syngenta with registration in the U.S. expected in 2015. Ex. 1008 at S2. 11. Wiglesworth further discloses the new SDHI fungicide benzovindiflupyr is “extremely efficacious on soybean rust” and combinable with azoxystrobin. Ex. 1008 at S2. 11-12. Hence, a POSA would have combined benzovindiflupyr with any of the fungicidal combinations disclosed in De Oliveira as A(2), B(2), C(2) or D(2) since De Oliveira discloses such combinations controlled soybean rust and SDHIs could be used in the combinations of De Oliveira; and Wiglesworth discloses benzovindiflupyr (an SDHI) is “extremely efficacious on soybean rust”. A PSOA would have further been motivated to combine benzovindiflupyr with A(2) since Wiglesworth discloses combining benzovindiflupyr with azoxystrobin.

201. Alternatively, Tobler (Ex. 1006) discloses that benzovindiflupyr (compound A-1.1) is highly effective at controlling *Phakopsora pachyrhizi* (Asian soybean rust). Ex. 1006, 41:20-30, Table B1. In fact, claim 1 of Tobler claims “[a] composition ... comprising a synergistically effective amount of (A) a compound of formula I [which includes benzovindiflupyr]; and (B2) an azole fungicide.” Ex.

1006 at 61:20-41. Tobler further shows benzovindiflupyr is synergistic with cyproconazole an azole fungicide (i.e., the ergosterol biosynthesis inhibitors of the '727 patent).

202. Godoy (Ex. 1005) further supports the motivation to combine benzovindiflupyr with the fungicides taught and suggested by De Oliveira. Godoy taught and showed fungicidal combinations including benzovindiflupyr (an SDHI) in combination with mancozeb and azoxystrobin improved disease control for ASR. Hence, a POSA would have been motivated to include benzovindiflupyr as an SDHI with any of the fungicidal combinations disclosed in De Oliveira (Ex. 1007) as A(2), B(2), C(2) or D(2) since De Oliveira disclosed such combinations controlled ASR and De Oliveira disclosed its fungicidal combinations can include an SHDI and Godoy (Ex. 1005) disclosed benzovindiflupyr with azoxystrobin and mancozeb also controlled ASR.

203. Hence, the combination of De Oliveira (Ex. 1007) in view of either Wigglesworth, Tobler or Godoy or any combination thereof suggests the following fungicidal combinations.

Wigglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005) or	De Oliveira (Ex. 1007)
Benzovindiflupyr	A(2) mancozeb + azoxystrobin + cyproconazole
Benzovindiflupyr	B(2) mancozeb + pyraclostrobin + epoxiconazole

Benzovindiflupyr	C(2) mancozeb + cyproconazole + picoxystrobin
Benzovindiflupyr	D(2) mancozeb + picoxystrobin + tebuconazole

204. Further, the POSA would have reasonable expectation of success in such combinations based on the disclosures of De Oliveira (Ex. 1007) in view of either Wigglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005).

205. As such, De Oliveira (Ex. 1007) in view of either Wigglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005) renders claim 1 obvious.

2. Claim 2 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wigglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

206. Independent claim 2 recites a fungicidal combination that consists of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor (EBI) fungicide, and a quinone outside inhibitor (QoI) fungicide (as listed in the claim).

207. As explained above for claim 1 (incorporated herein by reference), the combination of De Oliveira in view of either Wigglesworth, Tobler, or Godoy suggested fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin).

208. As such, De Oliveira (Ex. 1007) in view of either Wigglesworth (Ex.

1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 2 obvious.

3. Claim 3 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

209. Claim 3 depends on claim 1 and recites a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin, cyproconazole, pyraclostrobin, epoxiconazole, picoxystrobin, tebuconazole and combinations thereof.

210. As explained above for claim 1 (incorporated herein by reference), the combination of De Oliveira in view of either Wiglesworth, Tobler, or Godoy suggested fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin).

211. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 3 obvious.

4. Claim 4 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

212. Claim 4 depends on claim 1 and recites a fungicidal combination that consists of benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin.

213. As explained for De Oliveira in Section VI.D above, De Oliveira discloses a “...dithiocarbamate fungicide, [such as mancozeb] with at least another fungicide selected from a demethylation inhibitor, quinone outside inhibitor, succinate dehydrogenase inhibitor, quinone inside inhibitor **or combinations thereof.**” Ex. 1007, p 7. As such, De Oliveira suggests mancozeb can be combined with two components. A POSA would be motivated to combine the fungicides disclosed and suggested by De Oliveira such as benzovindiflupyr + mancozeb + azoxystrobin for control of ASR since De Oliveira suggested mancozeb in combination with an SDHI and azoxystrobin would be useful to control ASR.

214. In addition, and as explained for claim 1 in Section VII.C.1 above, each of Wiglesworth, Tobler, and Godoy further supports the motivation to arrive at the fungicidal combination of benzovindiflupyr + mancozeb + azoxystrobin with a reasonable expectation of success.

215. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 4 obvious.

5. Claim 5 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

216. Claim 5 recites a composition consisting of at least one agrochemically acceptable excipient; and a fungicidal combination of benzovindiflupyr, mancozeb and at least one ergostrol biosynthesis inhibitor (EBI)

and/or at least one quinone outside inhibitor (QoI).

217. As explained above for claim 1 (incorporated herein by reference), the combination of De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) suggested fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin).

218. De Oliveira (Ex. 1007) further discloses its compositions can include agrochemically acceptable excipients. In particular, De Oliveira discloses: “In an embodiment, the present invention thus provides a composition comprising any of the fungicidal combinations such as herein described along with agriculturally acceptable excipients.” De Oliveira (Ex. 1007) at p. 23.

219. In fact, the exemplified combinations of De Oliveira use a water dispersible granule (WDG) for mancozeb. Ex. 1007 at p 24. WDGs include agrochemically acceptable excipients. Hence, it was obvious to include agrochemically acceptable excipients in the fungicidal compositions of De Oliveira because De Oliveira discloses using such with its examples.

220. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005) renders claim 5 obvious.

6. Claim 6 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

221. Claim 6 depends on claim 5. As discussed above, each limitation of claim 5 is disclosed or suggested by De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005). Claim 6 adds “wherein the composition is formulated into wettable powders, granules, dusts, soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, a combination of a suspension concentrate (SC) and a capsule suspension (CS), or oil dispersions.”

222. De Oliveira further discloses its compositions can be in various forms. In particular, De Oliveira discloses: “In an embodiment, the fungicides or the combinations thereof contemplated according to the present invention may be pre-formulated and may be in the form of Water Dispersible Granules (WDG), Wettable Powders, Suspension Concentrates, Emulsifiable Concentrate, Suspoemulsions, Capsule Suspensions etc. However, the choice of any preferred formulation type is not particularly limiting.” Ex. 1007 at p. 22.

223. Hence, a POSA would have had a reasonable expectation of success in preparing a formulation type of claim 6 since De Oliveira disclose overlapping formulation types and since De Oliveira discloses “the choice of any preferred formulation type is not particularly limiting”.

224. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005) renders claim 6 obvious.

7. Claim 7 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

225. Claim 7 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed or suggested by De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005). Claim 7 adds “benzovindiflupyr and mancozeb are admixed in ratio of 1:80 to 80:1”

226. De Oliveira discloses the appropriate amounts of fungicides is not limited and can be chosen by the skilled artisan. In Particular, De Oliveira discloses:

In an embodiment, the dithiocarbamate may be applied in an effective amount so as to act as a synergist to the systemic fungicides of the present invention. However, the appropriate amounts of the fungicides used in the present invention, whether multi-site contact fungicides or systemic fungicides, is not particularly limiting and may be conveniently chosen by a skilled artisan. Ex. 1007, p 22.

227. Hence selecting a ratio for the mancozeb and SDHI of De Oliveira would have been routine for a POSA.

228. Moreover, each of Wiglesworth, Tobler, and Godoy further support the motivation to include mancozeb and benzovindiflupyr within a ratio of 1:80 to

80:1.

229. For example, Wiglesworth discloses that benzovindiflupyr has use rates as low as 30 g a.i./ha being extremely efficacious on soybean rust. De Oliveira (Ex. 1007) provides examples with use rates for mancozeb to treat soybean rust as 1500 g/ha. Hence, a POSA would have used the same or similar use rates for the combination of benzovindiflupyr and mancozeb taught by the combination of De Olivera and Wiglesworth, e.g., 30:1500 or 1:50, which falls within the range of 1:80 to 80:1 set out in claim 7.

230. And as explained for claim 7 in Section VII.B.6 above, Tobler disclosed the weight ratio of component (A) to component (B) is preferably from 20:1 to 1:50; and as explained for claim 7 in Section VII.A.4 above, Godoy (Ex. 1005) disclosed ratios for benzovindiflupyr and mancozeb of 1:50 and 1:67

231. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 7 obvious.

8. Claim 8 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

232. Claim 8 depends on claim 5. As discussed above, each limitation of claim 5 is disclosed or suggested by the combination of De Oliveira (Ex. 1007) with either Godoy (Ex. 1005) or Wiglesworth (Ex. 1008). Claim 8 adds “wherein the total amount of benzovindiflupyr in the composition is in the range of 0.1 to 99%

by weight, the total amount of mancozeb in the composition is in the range of 0.1 to 99% by weight; the total amount of ergosterol biosynthesis inhibitor in the composition is in the range of 0.1 to 99% by weight; and the total amount of quinone outside inhibitor in the composition is in the range of 0.1 to 99% by weight.”

233. As explained for claim 7 above, De Oliveira discloses “the appropriate amounts of the fungicides used in the present invention, whether multi-site contact fungicides or systemic fungicides, is not particularly limiting and may be conveniently chosen by a skilled artisan.” Ex. 1007, p 22. Accordingly, it would be obvious to use 0.1 to 99% by weight of each fungicidal combination disclosed and suggested by De Oliveira in view of either Wiglesworth, Tobler, or Godoy.

234. For example, and as explained above for claim 1 (incorporated herein by reference), the combination of De Oliveira in view of either Wiglesworth, Tobler, or Godoy suggested the fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin).

235. De Oliveira discloses dosages for the fungicides used in its examples to treat ASR, i.e., the dosages used in Example A(2) can be determined as follows: 1500 g a.i. /ha of mancozeb, 60 g a.i./ha (200g/L x 300 ml/ha) of azoxystrobin, and

24 g a.i./ha (80 g/L x 300 ml/ha) of cyproconazole.

236. Godoy taught and showed fungicidal combinations including 30 g a.i./ha benzovindiflupyr, 60 g a.i./ha azoxystrobin and 1500 g a.i./ha mancozeb for treating ASR.

237. Alternatively, Wiglesworth discloses that benzovindiflupyr has use rates as low as 30 g a.i./ha being extremely efficacious on soybean rust.

238. Hence, a POSA would have been motivated to combine benzovindiflupyr and the fungicides disclosed in the examples of De Oliveira at the same or similar dosages to prepare fungicidal compositions in view of either Godoy or Wiglesworth. Such dosages and percentage amounts of fungicides in the examples suggested by De Oliveira in view of either Godoy or Wiglesworth are provided below.

Godoy (Ex. 1005) or Wiglesworth (Ex. 1008)	De Oliveira (Ex. 1007)		
	A(2) mancozeb	azoxystrobin	cyproconazole
Benzovindiflupyr ¹ 30 g a.i./ha (1.9%)	1500 g a.i./ha (93%)	60 g a.i./ha (3.7%)	24 g a.i./ha (1.5%)
Benzovindiflupyr 30 g a.i./ha (1.9%)	B(2) mancozeb 1500 g a.i./ha (94%)	pyraclostrobin 42.5 g a.i./ha (2.7%)	epoxiconazole 31.3 g a.i./ha (2%)
Benzovindiflupyr	C(2) mancozeb	cyproconazole	picoxystrobin

30 g a.i./ha (1.9%)	1500 g a.i./ha (93%)	24 g a.i./ha (1.5%)	60 g a.i./ha (3.7%)
Benzovindiflupyr 30 g a.i./ha (1.9%)	D(2) mancozeb 1500 g a.i./ha (93%)	picoxystrobin 60 g a.i./ha (3.7%)	Tebuconazole 24 g a.i./ha (1.5%)

239. The percentage amounts of fungicides in the examples above are determined by dividing a particular fungicide dosage by the sum of all of the dosages in the example. For example, the percent amount of benzovindiflupyr for example A(2) is $30/(30+1500+60+24) = 1.9\%$. The dosage for benzovindiflupyr is suggested by Godoy (Ex. 1005) or Wiglesworth (Ex. 1008) and the remaining dosages are determined from the examples of De Oliveira (Ex. 1007). As shown by the above examples, all of the fungicides fall within the ranges set out in claim 8.

240. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 8 obvious.

9. Claim 9 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

241. Claim 9 depends on claim 1. As discussed above, each limitation of claim 1 is disclosed or suggested by the combination of De Oliveira (Ex. 1007) with either Godoy (Ex. 1005) or Wiglesworth (Ex. 1008). Claim 9 adds “applying the

combination of claim 1 to the foliage of a plant”.

242. De Oliveira (Ex. 1007) discloses that its method “comprises treating the plant at the locus of the infection”. Ex. 1007 at p. 7. De Oliveira further discloses that the pathogen for Asian soybean rust (ASR) is found on the leaves of soybeans. Id. at p. 4. Hence, a POSA would have understood that a foliar application would have been used to treat ASR.

243. Wiglesworth (Ex. 1008) discloses that benzovindiflupyr is a foliar fungicide. Ex. 1008 at S2. 11.

244. As explained in claim 9 in Sections VII.B.9 and VII.A.5 above (incorporated herein by reference), both Tobler and Godoy, respectively, disclosed and suggested applying the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin to the foliage of soybean plants.

245. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 9 obvious.

10. Claim 10 is rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

246. Independent claim 10 recites a “method of controlling fungal diseases in plants consisting of, applying to the locus of the plant a combination consisting of” benzovindiflupyr, mancozeb and at least another fungicide such as azoxystrobin. The ’727 Patent defines the “locus” of a plant “to embrace the place

on which the plants are growing, . . .” Ex. 1001 at 2:55-59.

247. As explained above for claim 1 (incorporated herein by reference), De Oliveira (Ex. 1007) in view of either Wiglesworth, Tobler, or Godoy suggested fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin).

248. As explained above for claim 9 (incorporated herein by reference), De Oliveira discloses that its method “comprises treating the plant at the locus of the infection”. Ex. 1007 at p. 7. The disclosures of either Wiglesworth, Tobler or Godoy further disclosed and suggested a method of controlling fungal disease in plants by applying to the locus of the plant fungicidal combinations embraced by claim 10. The cited references further provide a reasonable expectation of success in controlling fungal disease in plants by applying to the locus of the plant fungicidal combinations embraced by claim 10.

249. As such, De Oliveira (Ex. 1007) in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006), or Godoy (Ex. 1005) renders claim 10 obvious.

D. Ground 4: Claims 1-10 of the ‘727 Patent lack enablement

250. In deciding whether a person having skill in the art would have to experiment unduly in order to make and use the invention, I understand several

factors may be considered: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

251. In my opinion, a person skilled in the art would have needed undue experimentation to determine whether any fungicidal composition disclosed in the ‘727 Patent had enhanced efficacy. Therefore, the invention of the ‘727 Patent is not enabled.

252. As explained in Section IV.B.2 above, I understand that UPL distinguished its claims during the prosecution of its application that lead to the ‘727 Patent by arguing the prior art did not enhance efficacy of the claimed fungicidal combination. In particular, I understand UPL made the following argument to distinguish its claims from the prior art:

When De Oliveira [WO 2015079334, Ex. 1007] and Grammenos [EP 2783569] are read in a whole, they do not fairly teach one skilled in the art to select and pick among numerous possibilities disclosed therein to arrive at the specific combination as set forth in the instant claims. *The technical effects achieved by the claimed combinations, i.e., an enhancement of the efficacy, and a surprising reduction in fungal disease incidence when mancozeb is added to the claimed combinations.* For at least the above reasons, De Oliveira in view of

Grammenos does not disclose or suggest the subject matter of instant claims. Ex. 1002 (2021-04-22 Amendment) at p. 138.

253. As I further explained in Section IV.B.2 above, a POSA would understand Applicant's argument to mean mancozeb showed synergy when added to the claimed combinations. In particular, the '727 Patent disclosed its invention may provide "combinations of fungicides that possess an enhanced efficacy over the individual fungicides used in isolation." Exhibit 1001 ('727 Patent) at 2:7-10. A POSA would understand from these statement that the fungicidal combinations showed synergy since the '727 Patent equates the phrase "enhanced efficacy" with the definition of synergy, i.e., when the effect of the combination is greater than the individual fungicides used in isolation. The '727 Patent further "concluded that the addition of mancozeb enhanced the efficacy of the combination and surprisingly gave a synergistic effect." Exhibit 1001 ('727 Patent) at 21:15-21.

254. However, a POSA cannot determine if any of the combinations disclosed in the '727 Patent achieved a synergistic effect. As I explained in Section IV.B.1 above, there is insufficient information provided in the '727 Patent to determine if any fungicidal combination achieved "an enhancement of the efficacy" when mancozeb was added to the combination.

255. For example, the Examples do not provide data for an untreated control. Further, there are no data shown for the response of the individual

fungicides or the values expected for the combined response from the individual fungicides. Nor is there any indication of statistical significance of the data or the statistics for the trials. Without such controls, individual responses and statistical analysis, it is not possible to make the findings and conclusion about enhanced efficacy and synergy.

256. Furthermore, synergy depends on a mixture-by-mixture bases, ratio, dosage, pathogen and plant. Hence, tests for synergy with mancozeb must be conducted for each pathogen, plant, and chemical combination; synergy is very specific for each system. However, the '727 Patent does not provide guidance on any combination, ratio, dosage, pathogen or plant that would be expected to show synergy. While there are four examples of the effect of adding mancozeb to certain fungicidal combinations in Tables 1-2, a POSA cannot determine if any synergy was observed and only two of the examples included benzovindiflupyr and mancozeb and at the same dosages. Hence, the '727 Patent only provides a single ratio for benzovindiflupyr + mancozeb combinations and without showing synergy. Furthermore, synergy in the art is highly unpredictable as I explained in Section IV.B.1 above and testing intensive.

257. In addition, the '727 Patent lists dozens of plants and dozens of diseases for such plants that the fungicidal combinations and compositions are supposed to be effective. See Exhibit 1001 ('727 Patent) at columns 17, 18, 19.

The '727 Patent provides no guidance as to which fungicidal combinations would be expected to show synergy or on which if any ratio, dosage, pathogen or plant. Hence, it would take an enormous amount of experimentation, well in addition to the experimentation typical in the field, to try and find which, if any, fungicidal combination or composition disclosed in the '727 Patent had enhanced efficacy or synergy. Such enormous experimentation would require extensive time and effort (e.g., seasons for field testing, growing plants, maintaining pathogens, qualified personnel, etc.) costs, the rigors of testing necessary (replications, statistics, data collection, etc.) to determine enhanced efficacy and synergy and all without guidance as to mixtures, ratios, concentration, plant or disease.

258. Furthermore, I reviewed the Declaration of Caio Prates (Ex. 1020), which presents and refers to the evaluation and field trial testing over two different seasons (202/2021 and 2021/2022) of three different combinations of fungicides. The combined fungicides were tested for disease control and to determine whether the combinations exhibited synergy, as defined by the Colby formula. For the combinations tested and presented in the Prates Declaration, no synergy was observed. Each of these combinations includes benzovindiflupyr and mancozeb and one of the following as a third component: azoxystrobin, prothioconazole, or difenoconazole. A four-way fungicidal combination was also tested. Notably, the combinations tested fall within the scope of claim 1. The fact

that all of the combinations tested in two different seasons showed no synergy demonstrates that the combinations claimed do not demonstrate “enhanced efficacy and synergy”, which further support my opinion that the claims are not enabled.

VIII. CONCLUSION

259. In sum, the fungicidal combinations, compositions and methods of their use as set forth in the claims of the ‘727 Patent were conventional, well known and routine prior to November 4, 2016 and thus the ‘727 Patent is not new and otherwise obvious to a POSA. Further, the ‘727 Patent and claims would not enable a POSA to determine enhanced efficacy. Should further information become available to me as this matter proceeds, I may revise my opinions.

260. I recognize this Declaration may be used as evidence in the above-captioned proceeding. I accordingly agree to appear for cross-examination within the scope of this Declaration at a convenient time and place within the United States, should the same be requested.

261. I hereby declare under penalty of perjury that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Phillip M. Brannen

Phillip M. Brannen, Ph.D.

1/31/2023

Dated

APPENDIX A

A. ACADEMIC HISTORY

Name: Phillip M. Brannen
Department: Plant Pathology
Present Rank: Professor; January 17, 2000 (initial appointment); July 1, 2007 (tenured); July 1, 2012 (last promotion)
Assignment: 75% Extension; 15% Instruction; 10% Research
Tenured Status: Tenured
Graduate Faculty: Full Member
Academic Record: (Dates and Institutions) **Ph.D. in Plant Pathology, Auburn University, 1996**
M.S. in Plant Pathology, University of Georgia, 1986
B.S. in Plant Protection and Pest Management, University of Georgia, 1983

ACADEMIC POSITIONS

<u>Year</u>	<u>Position Held</u>
1/00 - present	Assistant/Associate/Full Professor (Extension Plant Pathologist – Fruits), Department of Plant Pathology, College of Agricultural and Environmental Sciences, University of Georgia, Athens, GA

OTHER PROFESSIONAL EMPLOYMENT

<u>Year</u>	<u>Position Held</u>
5/94 – 1/00	Plant Pathologist, Gustafson LLC, McKinney, TX
1/88 – 9/90	County Agent, Alabama Cooperative Extension Service, College of Agriculture, Auburn University, Phenix City, AL
1/87 – 3/87	County Agent Intern, Georgia Cooperative Extension Service, College of Agriculture, University of Georgia, Athens, GA
5/84 – 9/84	Agricultural Research Intern, Eli Lilly Chemical Company, Albany, GA

MILITARY EXPERIENCE (Honorably discharged at rank of Captain)

<u>Year</u>	<u>Position Held</u>
8/88 – 2/97	Individual Ready Reserve
1/81 – 8/88	Georgia Army National Guard
3/87 – 8/87	Infantry Officer's Advance Course
1/84 – 4/84	Infantry Officer's Basic Course
9/81 – 6/83	Army R.O.T.C, University of Georgia
Organizations:	Scabbard and Blade Military Honor Society
Awards:	Distinguished Military Graduate, American Defense Preparedness Award, Commandant's List (IOBC), Honor Graduate (Nuclear, Biological, Chemical Course)

AWARDS AND ACADEMIC HONORS

<u>Recognition Level</u>	<u>Year</u>	<u>Honor or Recognition</u>	<u>Awarded by</u>
a. National	2012	Partnership Award Multistate Efforts (recognition for multistate efforts with small fruit regionalization)	NIFA
	2002	Certificate of Appreciation (recognition for <i>Plum pox virus</i> containment efforts)	CSREES
	2002	Group Honor Award for Excellence (recognition for <i>Plum pox virus</i> containment efforts)	USDA
b. Regional	2022	IPM Hall of Fame	Southern IPM Center
	2008	Extension Communication Award (recognition for Orange Felt of Blackberry circular)	Southern Region American Society for Horticultural Science
	2003	State and Regional Awards for Communication (recognition for Southeastern Regional Peach Newsletter)	GACAA and NACAA
	2001	Award for Excellence (recognition for <i>Plum pox virus</i> containment)	Northeastern Regional Association of State

c. State			Agricultural Experiment Station Directors
	2017	Senior State Extension Specialist Award	GACAA
	2016	Walter Barnard Hill Public Service and Outreach Award	University of Georgia
	2015	D.W. Brooks Excellence in Extension Award	CAES
	2014	Donnie H. Morris Excellence in Extension Award	Georgia Fruit and Vegetable Growers Association
	2013	AGHON Honorary Membership	AGHON
	2007	Outstanding Faculty Presentation	Georgia Association of Plant Pathologists
	2003	Outstanding Achievements in Extension and Research Award (recognition for support and growth of the Georgia blueberry industry through research and extension efforts)	Georgia Blueberry Growers Association

B. RESIDENT INSTRUCTION

1. Graduate Student Committees:

<u>Year</u>	<u>Student</u>	<u>Major Professor</u>	<u>Degree</u>	<u>Department</u>	<u>Awards**</u>
2022-present	Harleen Kaur	Schnabel (Clemson)	Ph.D.	Plant Sciences	
2022-present	Caleb Bollenbacher	Oliver	M.S.	Plant Pathology	
2021-present	William Gura	Schnabel (Clemson)	Ph.D.	Plant Sciences	
2021-present	Shae Taylor	Oliver	Ph.D.	Plant Pathology	
2021-present	Ashley Hopper	Kon	Ph.D.	Horticulture	
2019-present	Shane Breeden	Brannen	Ph.D.	Plant Pathology	
2019-present	Emily Sykes	Severns	Ph.D.	Plant Pathology	
2019-present	Katherine Martin	Brannen/Severns	M.S.	Plant Pathology	
2019-2021	Brooke Warres	Brannen/Brewer	M.S.	Plant Pathology	
2019-present	Kendall Johnson	Brannen/Bock	Ph.D.	Plant Pathology	2 nd and 3 rd place GAPP Student Speaker Competition; 3 rd place SDAPS Student Speaker Competition; E. Broadus Browne Award competitor
2019-2021	Owen Hudson	Ali	M.S.	Plant Pathology	
2018-2020	Annie Vogel	Hickey	M.S.	Horticulture	
2018-2019	Dario Di Genova	Oliver	M.S.	Plant Pathology	
2017-2020	Nicole Jozwiak	Gold	M.S.	Plant Pathology	
2017-2019	Sarah Campbell	Brannen/Scherm	M.S.	Plant Pathology	
2017-2019	Will Hemphill	Oliver/Brannen	M.S.	Plant Pathology	2019 Kuhn Award Recipient; 2 nd place E. Broadus Browne Award
2017-2018	Thad Glenn	Brannen	M.P.P.P.M	Plant Pathology	
2015-present	Renee Allen	Scherm/Brannen	Ph.D.	Plant Pathology	1 st place XI International Vaccinium Symposium Presentation Competition
2016-2017	Ben Reeves	Horton	M.S.	Entomology	
2015-2017	Frances Browne	Brannen/Scherm	M.S.	Plant Pathology	2 nd place GAPP Student Speaker Competition; APS Travel Award Recipient; 2 nd place Plant and Soil Science Interdisciplinary Graduate Student Symposium; 2017 Kuhn Award Recipient; E. Broadus Browne Award competitor

2014-2018	Cheng-Fang Hong	Scherm/Brannen	Ph.D.	Plant Pathology	3rd place GAPP Student Speaker Competition; APS Travel Award Recipient
2014-2018	Russell Ingram	Scherm	Ph.D.	Plant Pathology	
2014-2018	Minglu Gau	Gold/Glenn	Ph.D.	Plant Pathology	
2012-2014	Laura Williford	Scherm	M.S.	Plant Pathology	
2012-2016	Stephanie Bolton	Glenn/Brannen	Ph.D.	Plant Pathology	American Wine Society Scholarship 2013 and 2014; 2014 Outstanding UGA Teaching Assistant Award; Selected for 2014 Graduate School Emerging Leaders Program; 2015 Papa Award Recipient; 2015 Global Programs International Graduate Travel Award
2011-2013	Andy Shirley	Noe/Brannen	M.S.	Plant Pathology	
2010-2013	Tom Ingram	Brenneman	M.S.	Plant Pathology	
2010-2013	Renee Holland	Scherm	M.S.	Plant Pathology	
2010-2013	Tanisha Robinson	Deom/Brannen	M.S.	Plant Pathology	Alfred P. Sloan Foundation Fellowship
2009-2010	Lucky Mehra	Scherm	M.S.	Plant Pathology	
2008-2010	Lorna Nissen	Denny/Brannen	M.S.	Plant Pathology	
2008-2010	Kimberly Jackson	Ji	M.S.	Plant Pathology	
2008-2012	Sydney Everhart	Scherm	Ph.D.	Plant Pathology	
2009-2010	Leanne Wells	Shelley Cannady	M.S.	Environment and Design	
2008-2009	Danielle Wedral	Frank	M.S.	Food Science	
2006-2009	Jeremy Haralson	Brannen/Scherm	M.S.	Plant Pathology	1 st place GAPP Student Speaker Competition; APS Travel Award Recipient; Dept. Nominee for Broadus Brown Competition
2003-2004	Sandra Roberts	Brannen	M.P.P.P.M.*	Plant Pathology	
2003-2005	Tara Tarnowski	Scherm	M.S.	Plant Pathology	
2003-2005	Holly Thornton	Scherm	M.S.	Plant Pathology	
2003	Zhiwen Lan	Scherm	M.S.	Plant Pathology	
2001-2004	Peter Ojiambo	Scherm	Ph.D.	Plant Pathology	
2001-2004	Kerik Cox	Scherm	Ph.D.	Plant Pathology	

*Internship Report: "Observation of operations within USDA-APHIS-PPQ, Atlanta, Georgia"

**Awards listed are only for students for whom Dr. Brannen was a major professor or co-major professor.

2. Courses Taught:

<u>Semester/Year</u>	<u>Course ID</u>	<u>Course Title</u>	<u>Enrollment</u>	<u>Credit Hours</u>
Fall/2022	PATH 8000	Field Plant Pathology	25	1
Summer/2022	PATH 8000	Field Plant Pathology	32	1
Maymester/2022	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	30	4
Fall/2021	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	43	1
Fall/2021	FYOS 1001	FYO History of Plant Diseases	15	1
Fall/2021	PATH 8000	Field Plant Pathology	27	1
Fall/2020	FYOS 1001	FYO History of Plant Diseases	16	1
Fall/2020	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	39	1
Fall/2020	PATH 8000	Field Plant Pathology	13	1

Spring/2020	PATH 8150	Graduate Seminar	3	1
Fall/2019	FYOS 1001	FYO History of Plant Diseases	12	1
Fall/2019	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	34	1
Fall/2019	PATH 8000	Field Plant Pathology	21	1
Summer/2019	PATH 8000	Field Plant Pathology	20	1
Maymester/2019	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	30	4
Fall/2018	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	28	1
Fall/2018	FYOS 1001	FYO History of Plant Diseases	15	1
Fall/2018	PATH 8000	Field Plant Pathology	19	1
Summer/2018	PATH 8000	Field Plant Pathology	21	1
Maymester/2018	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	30	4
Spring/2018	FYOS 1001	FYO History of Plant Diseases	12	1
Fall/2017	FYOS 1001	FYO History of Plant Diseases	15	1
Fall/2017	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	40	3
Fall/2017	PATH 8000	Field Plant Pathology	17	1
Summer/2017	PATH 8000	Field Plant Pathology	17	1
Maymester/2017	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	29	4
Fall/2016	FYOS 1001	FYO History of Plant Diseases	15	1
Fall/2016	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	31	3
Fall/2016	PATH 8000	Field Plant Pathology	16	1
Summer/2016	PATH 8000	Field Plant Pathology	21	1
Maymester/2016	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	28	4
Fall/2015	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	31	3
Fall/2015	PATH 8000	Field Plant Pathology	6	1
Summer/2015	PATH 8000	Field Plant Pathology	9	1
Maymester/2015	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	27	4
Fall/2014	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	26	3
Fall/2014	PATH 8150	Graduate Seminar*	7	1
Fall/2014	PATH 8000	Field Plant Pathology	12	1
Summer/2014	PATH 8000	Field Plant Pathology	11	1
Maymester/2014	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	26	4
Fall/2013	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	28	3
Fall/2013	PATH 8000	Field Plant Pathology	15	1
Summer/2013	PATH 8000	Field Plant Pathology	13	1
Maymester/2013	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	36	4
Fall/2012	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	22	3
Fall/2012	PATH 8000	Field Plant Pathology	13	1
Summer/2012	PATH 8000	Field Plant Pathology	9	1
Maymester/2012	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	28	4
Spring/2012	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	23	3
Fall/2011	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	16	3

Fall/2011	PATH 8000	Field Plant Pathology	6	1
Summer/2011	PATH 8000	Field Plant Pathology	8	1
Maymester/2011	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	30	4
Spring/2011	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	17	3
Fall/2010	PATH 8000	Field Plant Pathology	12	1
Summer/2010	PATH 8000	Field Plant Pathology	12	1
Maymester/2010	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	19	4
Spring/2010	ENTO (CRSS/PATH) 4740/6740	Integrated Pest Management	20	3
Spring/2010	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	18	3
Fall/2009	PATH 8000	Field Plant Pathology	9	1
Summer/2009	PATH 8000	Field Plant Pathology	9	1
Spring/2009	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	9	3
Fall/2008	PATH 8150	Graduate Seminar**	11	1
Fall/2008	PATH 8000	Field Plant Pathology	12	1
Summer/2008	PATH 8000	Field Plant Pathology	8	1
Maymester/2008	PATH (HORT) (FDST) 3050	Enology and Viticulture in the Mediterranean Region	14	3
Spring/2008	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	8	3
Fall/2007	PATH 8000	Field Plant Pathology	5	1
Summer/2007	PATH 8000	Field Plant Pathology	6	1
Spring/2007	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	18	3
Summer/2006	PATH 8000	Field Plant Pathology	8	1
Spring/2006 (4 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	10	3
Summer/2005	PATH 8000	Field Plant Pathology	3	1
Spring/2005 (4 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	18	3
Fall/2004	PATH 8000	Field Plant Pathology	8	1
Summer/2004	PATH 8000	Field Plant Pathology	8	1
Spring/2004	PATH 8150	Graduate Seminar***	11	1
Spring/2004 (3 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	24	3
Fall/2003	PATH 8000	Field Plant Pathology	9	1
Summer/2003	PATH 8000	Field Plant Pathology	6	1
Spring/2003 (3 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	28	3
Fall/2002	PATH 8000	Field Plant Pathology	7	1
Summer/2002	PATH 8000	Field Plant Pathology	10	1
Spring/2002 (3 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	25	3
Summer/2001	PATH 8000	Field Plant Pathology	5	1
Spring/2001 (3 lectures)	ENTO (CRSS/PATH) 4250/6250	Pesticide Management	26	3
Summer/2000	PATH 8000	Field Plant Pathology	13	1

* Schedule included six guest speakers (five from out of state) and seven graduate student seminars.

**Schedule included four guest speakers (three from out of state) and eleven graduate student seminars.

***Schedule included six guest speakers (five from out of state) and nine graduate student seminars.

3. Major Revisions to Existing Courses:

Dr. Brannen developed an FYO course, "History of Plant Diseases and their Impact on Human Societies," taught for the first time in fall 2016. Dr. Brannen developed the Maymester course, "Viticulture and Enology in the Mediterranean Region," taught for the first time in May 2008 in Cortona, Italy. The course was expanded from a 3 hr credit to a 4 hr credit course in 2009 (full Maymester). Under Dr. Brannen's direction and suggestion, the PATH 8000 Field Plant Pathology Course was revised in 2001. It is now offered twice a year, summer and fall semesters (1 hr credit per course offering). The summer course concentrates on diseases of horticultural crops, whereas the fall course concentrates on diseases of traditional row crop agriculture. Each course now has a lab experience, which was not offered previously.

4. Other Teaching Activities:

<u>Semester/Year</u>	<u>Course ID</u>	<u>Course Title</u>
Fall/2021	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Fall/2020	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Fall/2020	PATH 8160; guest lecturer	Professionalism and Career Development in Plant Pathology
Fall/2019	PATH 2010; guest lecturer	Plants, Pathogens, and People
Fall/2019	FYOS 1001; guest lecturer	Growing Wine Grapes and Muscadines
Fall/2019	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Spring/2019	FYOS 1001; guest lecturer	Growing Wine Grapes and Muscadines
Fall/2018	PATH 2010; guest lecturer	Plants, Pathogens, and People
Fall/2018	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Fall/2018	PATH 8160; guest lecturer	Professionalism and Career Development in Plant Pathology
Spring/2018	PATH 3530; guest lecturer	Introductory Plant Pathology
Fall/2017	PATH 2010; guest lecturer	Plants, Pathogens, and People
Fall/2017	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Fall/2017	PATH 8160; guest lecturer	Professionalism and Career Development in Plant Pathology
Fall/2016	PATH 2010; guest lecturer	Plants, Pathogens, and People
Fall/2016	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Fall/2015	PATH 4280/6280; guest lecturer	Diagnosis and Management of Plant Diseases
Spring/2009	FANR(MARS) 1100; guest lecturer	Natural Resources Conservation
Fall/2008	HORT 2000; guest lecturer	Horticultural Science
Spring/2008	FDST 4000; guest speaker on wine grape production	Seminar
Fall/2007	ALDR 3910; Wine grape intern special problems reviewer	Special Problems
Summer/2014	ALDR 3910; wine grape intern training and tour (day of training)	Internship in Leadership
Summer/2013		
Summer/2012		
Summer/2011		
Summer/2010		
Summer/2009		
Summer/2008		
Summer/2007		
Fall/2010	PATH 4280/6280; guest lecturer and guest lab	Diagnosis and Management of Plant Diseases
Fall/2008		
Fall/2007		
Fall/2004		
Spring/2004	PATH 8160; guest lecturer	Biology of Plant Pathogenic Fungi

C. SCHOLARLY ACTIVITIES**1. Publications**

*	Denotes refereed (blind review) publications.
**	Denotes peer-reviewed, non-refereed publications.
†	Indicates invited papers.
◇	Indicates section editor responsibility.
◇◇	Indicates senior editor responsibility.

a. Chapters in Books:

- ** 1. Adaskaveg, J.E., H. Forster, T. Miles, and **P.M. Brannen**. Postharvest Diseases of Blueberries. In: Postharvest Pathology of Fruit and Nut Crops: Principles, Concepts, and Management Practices. 2022. Ed. J.E. Adaskaveg, H. Forster, and D.B. Prusky. APS Press, St. Paul, MN. p 329-345.
- ** 2. Schnabel, G., **P.M. Brannen**, Herve Avenot, Themis J. Michailides, and J.E. Adaskaveg. 2019. Fungicide resistance in fungal pathogens of stone fruits. In: Fungicide Resistance in North America, Second Edition. Ed. K.L. Stevenson, M.T. McGrath, and C.A. Wyenandt. APS Press, St. Paul, MN. p 209-221.
- ** 3. **Brannen, P.M.** and M.A. Ellis. 2017. Raspberry Leaf Spot. In: Compendium of Raspberry and Blackberry Diseases

- and Pests, Second Edition. Ed. R.R. Martin, M.A. Ellis, B. Williamson, and R.N. Williams. APS Press, St. Paul, MN, p 30-31.
- ** 4. **Brannen, P.M.** and M.A. Ellis. 2017. Septoria Leaf Spot of Blackberry. In: Compendium of Raspberry and Blackberry Diseases and Pests, Second Edition. Ed. R.R. Martin, M.A. Ellis, B. Williamson, and R.N. Williams. APS Press, St. Paul, MN, p 31-32.
- ** 5. **Brannen, P.M.**. 2017. Orange Felt Disease. In: Compendium of Raspberry and Blackberry Diseases and Pests, Second Edition. Ed. R.R. Martin, M.A. Ellis, B. Williamson, and R.N. Williams. APS Press, St. Paul, MN, p 69-70.
- ** 6. **Brannen, P.M.**, P.R. Bristow and A.W. Stretch. 2016. Leaf Rust. In: Compendium of Blueberry, Cranberry, and Lingonberry Diseases and Pests, Second Edition. Ed. J.J. Polashock, F.L. Caruso, A.L. Averill, A.C. Schilder. APS Press, St. Paul, MN, p 27-30.
- ** 7. **Brannen, P.M.**, H. Scherm and R. Martin. 2016. Necrotic Ring Blotch. In: Compendium of Blueberry, Cranberry, and Lingonberry Diseases and Pests, Second Edition. Ed. J.J. Polashock, F.L. Caruso, A.L. Averill, A.C. Schilder. APS Press, St. Paul, MN, p 64-66.
- ** 8. **Brannen, P.M.**, C.J. Chang and D.L. Horton. 2016. Bacterial Leaf Scorch. In: Compendium of Blueberry, Cranberry, and Lingonberry Diseases and Pests, Second Edition. Ed. J.J. Polashock, F.L. Caruso, A.L. Averill, A.C. Schilder. APS Press, St. Paul, MN, p 79-81.
- ** 9. Schnabel, G., A. Amiri and **P.M. Brannen**. 2012. Field kit- and internet-supported fungicide resistance monitoring. In: Fungicide Resistance in Crop Protection: Risk and Management. Ed. T.S. Thind. CAB International, Oxfordshire, UK p 116-132.
- ** 10. Schnabel, G., A. Amiri and **P.M. Brannen**. 2011. Location-specific fungicide resistance profiles aid peach growers in managing fungicide resistant strains of *Monilinia fructicola*. In: Modern Fungicides and Antifungal Compounds VI, Eds. H.W. Dehne, H.B. Deising, U. Gisi, K.H. Kuck, P.E. Russell, H. Lyr. Lebenshilfe gGmbH, Braunschweig, Germany, p 264-266.
- ** 11. Scherm, H. and **P.M. Brannen**. 2005. Peach Scab. In: Southeastern Peach Growers Handbook. Eds. D. Horton and D. Johnson. pp. 134-136. University of Georgia Cooperative Extension Handbook 1.
- ** 12. **Brannen, P.M.** and G. Schnabel. 2005. Brown rot. In: Southeastern Peach Growers Handbook. Eds. D. Horton and D. Johnson. pp. 127-132. University of Georgia Cooperative Extension Handbook 1.
13. **Brannen, P.M.** 2001. Creating safe and natural biocontrol agents to augment chemical fungicides: a focus on *Bacillus* species for control of soilborne diseases. In: Biotechnology International III. Ed. B.N. Alizadeh. pp. 83-88. University Medical Press, Inc., San Francisco, CA.

b. Journal Articles:

- * 1. Holland, R.M., C.J. Peterson, P.F. Harmon, **P.M. Brannen** and H. Scherm. 2022. Bark inclusions in canes of southern highbush blueberry and their impact on cane union strength and association with *Botryosphaeria* stem blight. *Horticulturae* 8,733. <https://doi.org/10.3390/horticulturae8080733>
- * 2. Johnson, K.A., C.H. Bock, E.L. Vinson, and **P.M. Brannen**. 2022. Prevalence and distribution of phony peach disease (caused by *Xylella fastidiosa*) in the United States. *Plant Disease* (accepted for publication).
- * 3. Martin, K., **P.M. Brannen**, T. Holladay, and P.M. Severns. 2022. Non-efficacy of post-plant nematicides in *Vitis vinifera* wine grapes in Georgia, USA. *Plant Health Progress* (accepted for publication).
- * 4. Johnson, K.A., C.H. Bock, **P.M. Brannen**, and J. Chen. 2022. A genome resource for *Xylella fastidiosa* subspecies *multiplex* strain P5A2 causing phony peach disease in the southeastern United States. *Phytopathology* (accepted for publication).
- * 5. Schnabel, G., and P. Brannen. 2022. Biology, epidemiology, and management of diseases of peach driving the spray program in the southeastern United States. *Scientia Horticulturae* 295:110818. <https://doi.org/10.1016/j.scienta.2021.110818>
- * 6. Haralson, J.C., **P.M. Brannen**, and H. Scherm. 2022. Survey of potential root pathogens in softwood cuttings collected from Georgia blueberry nurseries. *Plant Health Progress* 23:87–92. <https://doi.org/10.1094/PHP-06-21-0094-S>
- * 7. Johnson, K.A., C.H. Bock, and **P.M. Brannen**. 2021. Phony peach disease: past and present impact on the peach industry in the southeastern U.S.A. *CABI Agriculture and Bioscience*. 2(29):1-23. <https://doi.org/10.1186/s43170-021-00049-4>
- * 8. Bock, C.H., C.A. Young, M. Zhang, C. Chen, **P.M. Brannen**, J. Adaskaveg, and N.D. Charlton. 2021. Mating type idiomorphs, heterothallism and high genetic diversity in *Venturia carpophila*, cause of peach scab. *Phytopathology* 111:408-424. <https://doi.org/10.1094/PHYTO-12-19-0485-R>
- * 9. Oliver, C.L., M.L. Cooper, M.L.L. Ivey, **P.M. Brannen**, T.D. Miles, W.F. Mahaffee, and M.M. Moyer. 2021. Assessing the United States Grape Industry's Understanding of Fungicide Resistance Mitigation Practices. *American Journal of Enology and Viticulture* 72(2):181-193.
- * 10. Campbell, S.E., **P.M. Brannen**, H. Scherm, N. Eason, and C. MacAllister. 2021. Efficacy of fungicide treatments for *Plasmopara viticola* control and occurrence of strobilurin field resistance in vineyards in Georgia, USA. *Crop Protection* 139(2021):1-6. <https://doi.org/10.1016/j.cropro.2020.105371>
- * 11. Campbell, S.E., **P.M. Brannen**, H. Scherm, and M.T. Brewer. 2020. Fungicide sensitivity survey of *Plasmopara viticola* populations in Georgia vineyards. *Plant Health Progress* 21:256-261. <https://doi.org/10.1094/PHP-05-20-0039-RS>

- * 12. Hong, C.F., M.T. Brewer, **P.M. Brannen**, and H. Scherm. 2020. Temporal disease dynamics and relative importance of sexual and asexual reproduction of grape downy mildew *Plasmopara viticola* in an isolated vineyard in the North Georgia Mountains, U.S.A. Plant Pathology. DOI: 10.1111/ppa.13263
- * 13. Bock, C.H., G.C. Rains, M.W. Hotchkiss, C. Chen, and **P.M. Brannen**. 2020. The effect of tractor speed and canopy position on fungicide spray deposition and peach scab incidence and severity. Plant Disease 104(7):2014–2022. <https://doi.org/10.1094/PDIS-10-19-2225-RE>
- * 14. Ali, M.E., O. Hudson, S. Waliullah, J. Cook, and **P.M. Brannen**. 2020. Sensitivity of *Colletotrichum* isolates collected from strawberries in Georgia to pyraclostrobin, a quinone outside inhibitor (QoI) fungicide. Plant Health Progress 21:69–70. <https://doi.org/10.1094/PHP-12-19-0090-BR>
- * 15. Severns, P.M., G.B. Jagdale, T. Holladay, **P.M. Brannen**, J.P. Noe, and W.O. Cline. 2020. Potential for the pathogenicity of plant-parasitic nematodes associated with blueberries in Georgia and North Carolina. Plant Health Progress 21:9–12. <https://doi.org/10.1094/PHP-09-19-0069-S>
- * 16. Jagdale, G.B., P.M. Severns, **P.M. Brannen**, and W.O. Cline. 2019. Occurrence and distribution of plant-parasitic nematodes on muscadine grapes in Georgia and North Carolina. Plant Health Progress 20:194–199. <https://doi.org/10.1094/PHP-06-19-0042-S>
- * 17. Browne, F.B., **P.M. Brannen**, H. Scherm, E.A. Richardson, and J.R. Taylor. 2019. Yield response to orange cane blotch of blackberry grown in the Georgia Coastal Plain. Plant Disease 104(1):161–167. <https://doi.org/10.1094/PDIS-02-19-0389-RE>
- * 18. Hong, C.F., M.T. Brewer, **P.M. Brannen**, and H. Scherm. 2019. Prevalence, geographic distribution, and phylogenetic relationships among cryptic species of *Plasmopara viticola* in grape-producing regions of Georgia and Florida, U.S.A. Journal of Phytopathology 167:422–429. DOI: 10.1111/jph.12813.
- * 19. Browne, F.B., **P.M. Brannen**, H. Scherm, J.R. Taylor, J.S. Shealey, L.A. Fall, and E.D. Beasley. 2019. Evaluation of disinfectants, algicides, and fungicides for control of orange cane blotch of blackberry in the field. Crop Protection 122 (2019):112–117.
- * 20. Waliullah, S., O. Hudson, J.E. Oliver, **P.M. Brannen**, P. Ji, and E. Ali. 2019. Comparative analysis of different molecular and serological methods for detection of *Xylella fastidiosa* in blueberry. PLOS ONE 14(9): e0221903. <https://doi.org/10.1371/journal.pone.0221903>
- * 21. Browne, F.B., **P.M. Brannen**, H. Scherm, M.T. Brewer, S.B. Wilde, and E.A. Richardson. 2019. Orange cane blotch of commercial blackberry in the southeastern United States. Plant Health Progress 20:67–69.
- * 23. Shirley, A.M., J.P. Noe, A.P. Nyczepir, **P.M. Brannen**, B.J. Shirley, and G.B. Jagdale. 2019. Effect of spirotetramat and fluensulfone on population densities of *Mesocriconema xenoplax* and *Meloidogyne incognita* on peach. Journal of Nematology 51e2019-12; DOI: 10.21307/jofnem-2019-012.
- * 24. Chen, C., C.H. Bock, and **P.M. Brannen**. 2019. Novel primers and sampling for PCR detection of *Xylella fastidiosa* in peach. Phytopathology 109(2):307–317.
- * 25. **Brannen, P.M.**, C.M. Deom, O.J. Alabi, and R.A. Naidu. 2018. Prevalence of viruses in commercial wine grape vineyards in Georgia. Plant Health Progress 19(4):342–346.
- * 26. Chen, C., C.H. Bock, **P.M. Brannen**, and J.E. Adaskaveg. 2018. Mining and characterization of microsatellites from a genome of *Venturia carpophila*. Mycological Progress <https://doi.org/10.1007/s11557-018-1401-x> (11 pp.).
- * 27. Scott, S.W., A. Gregory, **P.M. Brannen**, and D. Royal. 2018. Graft-transmissible agents in oriental persimmons (*Diospyros kaki* L) in the southeastern US. Australasian Plant Disease Notes 13:22 <https://doi.org/10.1007/s13314-018-0306-5> (6 pp.).
- * 28. Bolton, S.L., T. Mitchell, **P.M. Brannen**, and A.E. Glenn. 2017. Assessment of Mycotoxins in *Vitis vinifera* wines of the southeastern United States. American Journal of Enology and Viticulture.
- * 29. Bolton, S.L., **P.M. Brannen**, and A.E. Glenn. 2016. A novel population of *Fusarium fujikuroi* isolated from southeastern U.S. winegrapes reveals the need to re-evaluate the species' fumonisin production. Toxins 8:254; doi:10.3390/toxins8090254 (14 pages).
- * 30. Dowling, M.E., P.K. Bryson, H.G. Boatwright, J.R. Wilson, Z. Fan, S. Everhart, **P.M. Brannen**, and G. Schnabel. 2016. Effect of fungicide applications on *Monilinia fructicola* population diversity and transposon movement. Phytopathology 106:1504–1512.
- * 31. Robinson, T. S., H. Scherm, **P.M. Brannen**, R. Allen, and C. M. Deom. 2016. *Blueberry necrotic ring blotch virus* in southern highbush blueberry: insights into in-plant and in-field movement. Plant Disease 100:1575–1579.
- * 32. Stewart, J.E., K. Brooks, **P.M. Brannen**, W.O. Cline, and M.T. Brewer. 2015. Elevated genetic diversity in the emerging blueberry pathogen *Exobasidium maculosum*. PLoS ONE 10(7): e0132545 doi: 10.1371/journal.pone.0132545.
- * 33. Yang, J.H., **P.M. Brannen**, and G. Schnabel. 2015. Resistance in *Alternaria alternata* to SDHI fungicides causes rare disease outbreak in peach orchards. Plant Disease 99:65–70.
- * 34. Chen, Chunxian, C.H. Bock, **P.M. Brannen**, J.E. Adaskaveg, M.W. Hotchkiss, M.T. Brewer, and B.W. Wood. 2014. Genetic variability among populations of *Fusicladium* species from different host trees and geographic locations in the USA. Mycol. Progress 13:1179–1190.
- * 35. Nyczepir, A.P., **P.M. Brannen**, J. Cook, and S. Meyer. 2014. Management of *Meloidogyne incognita* with Jesup (Max-Q) tall fescue grass prior to peach orchard establishment. Plant Disease 98:625–630.
- * 36. Fernandez-Ortuno, D., A. Grabke, K.P. Bryson, E. Beasley, L. Fall, **P. Brannen**, and G. Schnabel. 2014. First report of fludioxonil resistance in *Botrytis cinerea* from a blackberry field in Georgia. Plant Disease 98(6):848.
- * 37. Brewer, M.T., A.N. Turner, **P.M. Brannen**, W.O. Cline, and E.A. Richardson. 2014. *Exobasidium maculosum*, a new species causing leaf and fruit spots on blueberry in the southeastern USA, and its relationship with other *Exobasidium* spp. parasitic to blueberry and cranberry. Mycologia 106(3):415–423.

- * 38. Jagdale, G.B., T. Holladay, **P.M. Brannen**, W.O. Cline, P. Agudelo, A.P. Nyczepir, and J.P. Noe. 2013. Incidence and pathogenicity of plant-parasitic nematodes associated with blueberry (*Vaccinium* spp.) replant disease in Georgia and North Carolina. *Journal of Nematology* 45(2):92-98.
- * 39. De La Fuente, L., J.K. Parker, J.E. Oliver, S. Granger, **P.M. Brannen**, E. van Santan, and P.A. Cobine. 2013. The bacterial pathogen *Xylella fastidiosa* affects the leaf ionome of plant hosts during infection. *PLoS ONE* 8(5): e62945, doi:10.1371/journal.pone.0062945.
- * 40. Quito-Avila, D.F., **P.M. Brannen**, W.O. Cline, P.F. Harmon, and R.R. Martin. 2013. Genetic characterization of Blueberry necrotic ring blotch virus, a novel RNA virus with unique genetic features. *Journal of General Virology* 94:1426-1434.
- * 41. Haralson, J.C., **P.M. Brannen**, D.S. NeSmith, and H. Scherm. 2012. Chemical control of *Cylindrocladium* and *Rhizoctonia* root rots in blueberry propagation. *Crop Protection* 44(2013):1-5.
- * 42. Schnabel, G., A. Amiri, and **P.M. Brannen**. 2010. Sustainable brown rot management of peaches in the southeastern United States. *Outlooks on Pest Management* (Oct): 208-211.
- * 43. Amiri, A., **P.M. Brannen**, and G. Schnabel. 2010. Reduced sensitivity in *Monilinia fructicola* field isolates from South Carolina and Georgia to respiration inhibitor fungicides. *Plant Dis.* 94(6):737-743.
- * 44. Chang, C.J., R. Donalson, **P.M. Brannen**, G. Krewer, and R. Boland. 2009. Bacterial leaf scorch, a new blueberry disease caused by *Xylella fastidiosa*. *HortScience* 44(2):413-417.
- * 45. Amiri, A., **P.M. Brannen**, and G. Schnabel. 2009. Validation of the lipbalm tube assay for evaluation of fungicide sensitivity in field isolates of *Monilinia fructicola*. Online. *Plant Health Progress* doi:10.1094/PHP-2009-1118-01-RS.
- * 46. Anas, O., U.J. Harrison, **P.M. Brannen**, and T.B. Sutton. 2008. The effect of warming winter temperatures on the severity of Pierce's disease in the Appalachian Mountains and Piedmont of the southeastern United States. Online. *Plant Health Progress* doi:10.1094/PHP-2008-0718-01-RS.
- * 47. Scherm, H., A.T. Savelle, **P.M. Brannen**, and G. Krewer. 2008. Occurrence and prevalence of foliar diseases on blueberry in Georgia. *Plant Health Progress* (Online:10.1094/PHP-2008-0421-01-RS).
- * 48. Amiri, A., H. Scherm, **P.M. Brannen**, and G. Schnabel. 2008. Laboratory evaluation of three rapid, agar-based new assays to assess fungicide sensitivity in *Monilinia fructicola*. *Plant Dis.* 92:415-420.
- * 49. Ojiambo, P.S., H. Scherm, and **P.M. Brannen**. 2007. Temporal dynamics of Septoria leaf spot of blueberry and its relationship to defoliation and yield. *Plant Health Progress* (Online: doi:10.1094/PHP-2007-0726-05-RS).
- * 50. Sydorovych, O., C.D. Safley, L.M. Ferguson, E.B. Poling, G.E. Fernandez, **P.M. Brannen**, D.M. Monks, and F.J. Louws. 2006. Economic evaluation of methyl bromide alternatives for the production of strawberries in the southeastern United States. *HortTechnology* 16(1):1-11.
- * 51. Ojiambo, P.S., H. Scherm, and **P.M. Brannen**. 2006. Septoria leaf spot reduces flower bud set and yield of rabbiteye and southern highbush blueberries. *Plant Dis.* 90:51-57.
- * 52. Schnabel, G., P.K. Bryson, W.C. Bridges, and **P.M. Brannen**. 2004. Reduced sensitivity in *Monilinia fructicola* to propiconazole in Georgia and implications for disease management. *Plant Dis.* 88:1000-1004. (I,E,W = 50%)
- * 53. Scherm, H., **P.M. Brannen**, and K.C. Taylor. 2004. Georgia's peach industry in a historical context. *Journal of Tree Fruit Production* 3(2):1-9.
- * 54. Elliot, M.L., E.A. Des Jardin, W.E. Batson, Jr., J. Cacerres, **P.M. Brannen**, et al. 2001. Viability and stability of biological control agents used for disease management on cotton and snap bean seeds. *Pest Management Science* 57(8):695-706.
- * 55. Keinath, A.P., W.E. Batson, J. Caceres, M.L. Elliott, D.R. Sumner, **P.M. Brannen**, et al. 2000. Evaluation of biological and chemical seed treatments to improve stand of snap bean across the southern United States. *Crop Protection* 19(7):501-509.
- * 56. **Brannen, P.M.** and D.S. Kenney. 1997. Kodiak -- a successful biological-control product for suppression of soil-borne plant pathogens of cotton. *Journal of Industrial Microbiology* 19:169-171.
- * 57. Bauske, E.M., P.A. Backman, K.M. Harper, **P.M. Brannen**, R. Rodriguez-Kabana, and J.W. Kloepper. 1997. Effect of botanical aromatic compounds and seed-surface pH on growth and colonization of cotton plant growth-promoting rhizobacteria. *Biocontrol Science and Technology* 7:415-421.
- * 58. Jacobi, J.C., P.A. Backman, D.P. Davis, and **P.M. Brannen**. 1995. AU-Pnuts advisory. I. Development of a rule-based system for scheduling peanut leaf spot fungicide applications. *Plant Disease* 79:666-671.

c. Other Scientific Publications:

Note: "Fungicide and Nematicide Tests Reports," "Biological and Cultural Control Tests Reports," and "Plant Disease Management Reports" are official peer-reviewed publications of the American Phytopathological Society Press. Further information on the review process can be found at www.APSnet.org.

- ** 1. Brannen, P.M., T. Rios, W. Sanders, A. Cheh, R. Covington, and D. Rogers. 2022. Performance of fungicide spray regimens for control of Glomerella leaf spot of apples in Georgia, 2021. *Plant Disease Management Reports* 16:PF032.
- ** 2. Brannen, P.M., S. Breeden, W. Sanders, T. Rios, A. Cheh, and C. Bock. 2022. Efficacy of new fungicides for control of brown rot of peach in middle Georgia, 2021. *Plant Disease Management Reports* 16:PF031.
- ** 3. Bailey, J.B., S. Breeden, W. Sanders, T. Rios, A. Cheh, and P.M. Brannen. 2022. Comparison of long-term activity of fungicides applied early season for peach scab management, 2021. *Plant Disease Management Reports* 16:PF030.
- ** 4. Breeden, S., W. Sanders, T. Rios, A. Cheh, and P.M. Brannen. 2022. Evaluation of copper and biological treatments for control of bacterial spot of peach in Georgia, 2021. *Plant Disease Management Reports* 16:PF029.

- ** 5. Breeden, S., A. Cheh, T. Rios, W. Sanders, J. Winkles, P.M. Brannen, and R. McNeill. 2022. Efficacy of minimal-, moderate-, and high-input disease management regimens for cluster rots in Pierce's disease resistant hybrids, 2021. Plant Disease Management Reports 16:PF011.
- ** 6. Warres, B., S. Breeden, W. Sanders, T. Rios, A. Cheh, P. Brannen, D. Rogers, and R. Covington. 2022. Assessment of interactions between sulfur and DMI fungicides to control powdery mildew in the presence of a DMI-resistant *Erysiphe necator* population in Georgia, 2021. Plant Disease Management Reports 16:PF010.
- ** 7. Warres, B., S. Breeden, W. Sanders, T. Rios, A. Cheh, P. Brannen, D. Rogers, and R. Covington. 2022. Efficacy of DMI (FRAC 3) fungicides for control of powdery mildew in a DMI-tolerant *Erysiphe necator* population, 2021. Plant Disease Management Reports 16:PF009.
- ** 8. Cline, W.O., **P.M. Brannen**, and S. Breeden. 2021. Evaluation of fungicides for control of muscadine grape diseases in North Carolina and Georgia, 2020. Plant Disease Management Reports 15:PF006.
- ** 9. S. Breeden, B. Warres, C. Cameron, K. Busher, and **P.M. Brannen**. 2021. Efficacy and crop safety of minimal-, moderate-, and high-input disease management systems for Pierce's disease resistant hybrids, 2020. Plant Disease Management Reports 15:PF011.
- ** 10. Warres, B., K. Johnson, K. Busher, C. Cameron, **P.M. Brannen**, D. Rogers, R. Covington, W. Mahaffee, and T. Neil. 2021. Fungicide comparisons for powdery mildew management in a fungicide-resistant *Erysiphe necator* population, 2020. Plant Disease Management Reports 15:PF012.
- ** 11. Warres, B., K. Johnson, K. Busher, C. Cameron, **P.M. Brannen**, D. Rogers, R. Covington, W. Mahaffee, and T. Neil. 2021. Assessment of interactions between sulfur and DMI fungicides to control powdery mildew in the presence of a DMI-resistant *Erysiphe necator* population in Georgia, 2020. Plant Disease Management Reports 15:PF013.
- ** 12. Warres, B., K. Johnson, K. Busher, C. Cameron, **P.M. Brannen**, D. Rogers, R. Covington, W. Mahaffee, and T. Neil. 2021. Efficacy of DMI (FRAC 3) fungicides for control of powdery mildew in a DMI-tolerant *Erysiphe necator* population, 2020. Plant Disease Management Reports 15:PF014.
- ** 13. Breeden, S., P.M. Brannen, K. Busher, C. Cameron, R. Covington, and D. Rogers. 2021. Performance of fungicide spray regimens for control of bitter rot of apples in Georgia, 2020. Plant Disease Management Reports 15:PF025.
- ** 14. Breeden, S., K. Busher, C. Cameron, and **P.M. Brannen**. 2021. Evaluation of various treatments for control of bacterial spot of peach in Georgia, 2020. Plant Disease Management Reports 15:PF029.
- ** 15. **Brannen, P.M.**, K. Busher, C. Cameron, S. Breeden, C.H. Bock and M.W. Hotchkiss. 2021. Efficacy of new fungicides for control of brown rot of peach in middle Georgia, 2020. Plant Disease Management Reports 15:PF030.
- ** 16. **Brannen, P.M.**, K. Busher, C. Cameron, S. Breeden, C.H. Bock and M.W. Hotchkiss. 2021. Comparison of new and established fungicides for control of brown rot of peach in middle Georgia, 2020. Plant Disease Management Reports 15:PF031.
- ** 17. Blaauw, B.R., C. Hickey, S.M. Breeden, **P.M. Brannen**, and N. Eason. 2020. Review of IPM strategies to improve sour rot and Botrytis management in Chardonnay, 2019. Plant Disease Management Reports 14:PF012.
- ** 18. Breeden, S., B. Warres, J. Winkles, **P.M. Brannen**, D. Rogers, and R. Covington. 2020. Efficacy of fungicide treatments for downy mildew control in Georgia, 2019. Plant Disease Management Reports 14:PF013.
- ** 19. Warres, B., S. Breeden, J. Winkles, P. Severns, **P.M. Brannen**, D. Rogers, R. Covington, W. Mahaffee, and T. Neil. 2020. Fungicide comparisons for powdery mildew management in a fungicide-resistant *Erysiphe necator* population, 2019. Plant Disease Management Reports 14:PF014.
- ** 20. Warres, B., S. Breeden, J. Winkles, P. Severns, **P.M. Brannen**, D. Rogers, R. Covington, W. Mahaffee, and T. Neil. 2020. Efficacy of sulfur and myclobutanil combinations for control of grapevine powdery mildew in Georgia, 2019. Plant Disease Management Reports 14:PF015.
- ** 21. **Brannen, P.M.**, J. Winkles, and S. Breeden. 2020. Efficacy of new experimental fungicides for control of brown rot of peach in middle Georgia, 2019. Plant Disease Management Reports 14:PF016.
- ** 22. **Brannen, P.M.**, J. Winkles, and S. Breeden. 2020. Efficacy of new fungicides for control of brown rot of peach in middle Georgia, 2019. Plant Disease Management Reports 14:PF017.
- ** 23. **Brannen, P.M.**, S. Breeden, B. Warres, J. Winkles, C.H. Bock and M.W. Hotchkiss. 2020. Efficacy of new chemical fungicides for peach scab control in Georgia, 2019. Plant Disease Management Reports 14:PF018.
- ** 24. **Brannen, P.M.**, J. Winkles, R. Covington, and D. Rogers. 2020. Evaluation of Luna series fungicides for control of bitter rot of apples in Georgia, 2019. Plant Disease Management Reports 14:PF019.
- ** 25. Hemphill, W.H., J.E. Oliver, and **P.M. Brannen**. 2020. Evaluation of early-season, late-season, and long-season applications of potassium phosphite for management of orange cane blotch on blackberry primocanes in Georgia, 2019. Plant Disease Management Reports 14:PF031.
- ** 26. Hemphill, W.H., J.E. Oliver, and **P.M. Brannen**. 2020. Evaluation of fungicides for reducing cane dieback on blackberry canes after pruning in Georgia, 2019. Plant Disease Management Reports 14:PF032.
- ** 27. Hemphill, W.H., J.E. Oliver and **P.M. Brannen**. 2020. Evaluation of late-season and early-season applications of potassium phosphite for management of orange cane blotch on blackberry floricanes in Georgia, 2019. Plant Disease Management Reports, 14:PF069.
- ** 28. **Brannen, P.M.**, T. Glenn, K. Baldino, and Z. Williamson. 2019. Evaluation of bactericide treatments for control of bacterial spot in Georgia, 2018. Plant Disease Management Reports 13:PF037.
- ** 29. **Brannen, P.M.**, E.J. Sikora, M. Price, C.H. Bock, and M.W. Hotchkiss. 2019. Efficacy of dormant and late dormant applications of mineral oil and chlorothalonil for peach scab control in Alabama, 2018. Plant Disease Management Reports 13:PF036.

-
- ** 30. Williamson, Z., K. Baldino, T. Glenn, and **P.M. Brannen**. 2019. Efficacy of dormant and late dormant applications of mineral oil and chlorothalonil for peach scab control in Georgia, 2018. Plant Disease Management Reports 13:PF035.
- ** 31. **Brannen, P.M.**, K. Baldino, Z. Williamson, C.H. Bock, U. Stokes, and M.W. Hotchkiss. 2019. Efficacy of new fungicides and Captan cover sprays for control of brown rot of peach in middle Georgia, 2018. Plant Disease Management Reports 13:PF034.
- ** 32. **Brannen, P.M.**, K. Baldino, Z. Williamson, C.H. Bock, U. Stokes, and M.W. Hotchkiss. 2019. Efficacy of new chemical fungicides for peach scab control in Georgia, 2018. Plant Disease Management Reports 13:PF033.
- ** 33. Hickey, C., M. Hoffman, K. Blaedow, and **P. Brannen**. 2019. Hand and mechanical fruit zone leaf removal reduces the severity of Botrytis bunch rot in Chardonnay grown in a high-elevation vineyard in western North Carolina, 2018. Plant Disease Management Reports 13:PF032.
- ** 34. Blaauw, B.R., C. Hickey, and **P. Brannen**. 2019. Review of IPM strategies to improve sour rot management in Georgia bunch grapes, 2018. Plant Disease Management Reports 13:PF031.
- ** 35. Campbell, S., K. Baldino, Z. Williamson, and **P.M. Brannen**, and C. MacAllister. 2019. Efficacy of fungicide treatments for downy mildew management in a commercial Georgia vineyard, 2018. Plant Disease Management Reports 13:PF028.
- ** 36. Campbell, S., K. Baldino, Z. Williamson, and **P.M. Brannen**, and N. Eason. 2019. Efficacy of chemical treatments in a commercial vineyard for downy mildew management in Georgia, 2018. Plant Disease Management Reports 13:PF026.
- ** 37. Campbell, S., K. Baldino, Z. Williamson, and **P.M. Brannen**. 2019. Efficacy of fungicide treatments for downy mildew control and strobilurin field resistance in Georgia, 2018. Plant Disease Management Reports 13:PF025.
- ** 38. Hickey, C., R. White, A. Vogel, **P. Brannen**, C. MacAllister, N. Eason, S. Patrick, and J. Scaduto. 2019. Fruit zone leaf removal regulates sour rot and Botrytis bunch rot in Georgia-grown Chardonnay, 2018. Plant Disease Management Reports 13:PF024.
- ** 39. **Brannen, P.M.**, R. Covington, and D. Rogers. 2019. Evaluation of surfactants combined with fungicides for control of bitter rot of apples in Georgia, 2018. Plant Disease Management Reports 13:PF013.
- ** 40. Hemphill, W., **P.M. Brannen**, J.E. Oliver. 2019. Efficacy of potassium phosphite for control of orange cane blotch of blackberry in Georgia, 2018. Plant Disease Management Reports 13:PF010.
- ** 41. **Brannen, P.M.**, T. Glenn, R. Covington, and D. Rogers. 2018. Evaluation of fungicide programs for control of bitter rot of apples in Georgia, 2017. Plant Disease Management Reports 12:PF013.
- ** 42. **Brannen, P.M.**, R. Covington, and D. Rogers. 2018. Evaluation of copper hydroxide applications for control of fire blight in Georgia, 2017. Plant Disease Management Reports 12:PF012.
- ** 43. C. Hickey, R. White, A. Vogel, **P.M. Brannen**, C. MacAllister, and N. Eason. 2018. The effect of leaf removal timing and magnitude on sour rot and Botrytis bunch rot in Georgia-grown Chardonnay, 2017. Plant Disease Management Reports 12:PF014.
- ** 44. C. Hickey, R. White, and **P.M. Brannen**. 2018. The effect of leaf removal timing on Botrytis bunch rot in North Carolina-grown Cabernet franc clones 214 and 327, 2017. Plant Disease Management Reports 12:PF015.
- ** 45. T. Glenn and **P.M. Brannen**. 2018. Efficacy of a single late dormant application of mineral oil and chlorothalonil for peach scab control in Georgia, 2017. Plant Disease Management Reports 12:PF033.
- ** 46. M. Dowdy, R.J. Ingram, and **P.M. Brannen**. 2018. Efficacy of fungicides for management of peach rust, Brooks County, Georgia, 2017. Plant Disease Management Reports 12:PF032.
- ** 47. **Brannen, P.M.**, R. Covington, and D. Rogers. 2017. Evaluation of fungicide programs for control of bitter rot of apples in Georgia, 2016. Plant Disease Management Reports 11:PF022.
- ** 48. R.J. Ingram, **P.M. Brannen**, and J. Taylor. 2017. Efficacy of fungicides for management of blueberry rust, Clinch County, Georgia, 2016. Plant Disease Management Reports 11:SMF017.
- ** 49. R.J. Ingram, **P.M. Brannen**, and M.J. Slusher. 2017. Efficacy of fungicides for management of blueberry rust, Ware County, Georgia, 2016. Plant Disease Management Reports 11:SMF018.
- ** 50. R.J. Ingram, **P.M. Brannen**, W. Lovett, and S. Curry. 2017. Efficacy of fungicides for management of blueberry rust, Appling County, Georgia, 2016. Plant Disease Management Reports 11:SMF019.
- ** 51. **Brannen, P.M.**, J. Hansel, and R. McNeil. 2017. Efficacy of agricultural oil and fungicide combinations as a late-dormant treatment for control of peach scab in Georgia, 2016. Plant Disease Management Reports 11:STF004.
- ** 52. **Brannen, P.M.**, J.O. Yost, C.H. Bock, and M.W. Hotchkiss. 2017. Effectiveness of agricultural oils alongside fungicides in the late dormant treatment for suppression of peach scab in Georgia, 2016. Plant Disease Management Reports 11:STF003.
- ** 53. E.J. Sikora, J. Pitts, **P.M. Brannen**, C.H. Bock, M.W. Hotchkiss, and T. Gottilla. 2017. Efficacy of agricultural oil and fungicide combinations as a late dormant treatment for control of peach scab in Alabama, 2016. Plant Disease Management Reports 11:STF002.
- ** 54. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2016. Efficacy of agricultural oil and fungicide combinations as a late dormant treatment for control of peach scab in Georgia, 2015. Plant Disease Management Reports 10:STF014.
- ** 55. **Brannen, P.M.** and T. Putzke. 2016. Brown rot control in peach with Topguard EQ (flutriafol) fungicide, 2015. Plant Disease Management Reports 10:STF013.
- ** 56. T. Putzke and **P.M. Brannen**. 2016. Brown rot control in peach with isofetamid in solo and tank mix applications, 2015. Plant Disease Management Reports 10:STF012.
-

-
- ** 57. E.J. Sikora, J. Pitts, **P.M. Brannen**, C.H. Bock, and M.W. Hotchkiss. 2016. Efficacy of agricultural oil and fungicide combinations as a late dormant treatment for control of peach scab in Alabama, 2015. Plant Disease Management Reports 10:STF011.
- ** 58. F. Connelly and **P.M. Brannen**. 2016. Mummy berry and Exobasidium leaf spot management in rabbiteye blueberry with chemical fungicides, 2015. Plant Disease Management Reports 10:SMF020.
- ** 59. E.J. Sikora, J. Pitts, **P.M. Brannen**, C.H. Bock, M.W. Hotchkiss. 2015. Efficacy of Prophyt when combined with Captac for control of peach scab in Alabama, 2014. Plant Disease Management Reports 9:STF005.
- ** 60. G. Schnabel, **P.M. Brannen**, C.H. Bock, and M.W. Hotchkiss. 2015. Efficacy of ProPhyt mixed with a low rate of Captac for control of peach scab in South Carolina, 2014. Plant Disease Management Reports 9:STF006.
- ** 61. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2015. Efficacy of Prophyt and Captan when combined for control of peach scab in Georgia, 2014. Plant Disease Management Reports 9:STF007.
- ** 62. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2015. Efficacy of Prophyt plus Captan when combined for control of peach scab in Georgia, 2014. Plant Disease Management Reports 9:STF008.
- ** 63. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2015. Efficacy of Prophyt and Captan as a tank mix when combined for control of peach scab in Georgia, 2014. Plant Disease Management Reports 9:STF009.
- ** 64. **Brannen, P.M.**, D. Wilson, and L. Fall. 2015. Evaluation of fungicide programs for control of flyspeck and sooty blotch diseases of apples in Georgia, 2013. Plant Disease Management Reports 9:PF007.
- ** 65. **Brannen, P.M.**, A. Payton, B. Shirley, C. Drury, J. Jacobs, J. Neuman, J. Taylor, L.A. Fall, P. Edwards, R. Holland, S. Curry, and T. Varnedore. 2015. Efficacy of late-dormant fungicide applications for control of Exobasidium fruit and leaf spot of blueberry in Georgia, 2014. Plant Disease Management Reports 9:SMF011.
- ** 66. F. Connelly and **P. M. Brannen**. 2015. Mummy berry management in rabbiteye blueberry with chemical fungicides, 2014. Plant Disease Management Reports 9:SMF012.
- ** 67. **P.M. Brannen**, D. Rogers, and S. Mullis. 2014. Evaluation of potential antibiotic resistance-management programs for control of fire blight in Georgia, 2013. Plant Disease Management Reports 8:PF030.
- ** 68. G. Schnabel, **P.M. Brannen**, and L.A. Fall. 2014. Efficacy of azoxystrobin and chlorothalonil at petal fall and shuck split for control of peach scab in South Carolina, 2013. Plant Disease Management Reports 8:STF012.
- ** 69. E.J. Sikora, J. Pitts, **P.M. Brannen**, L.A. Fall, C.H. Bock, and M.W. Hotchkiss. 2014. Efficacy of Prophyt, a phosphonate fungicide, when combined with other fungicides for control of peach scab in Alabama, 2013. Plant Disease Management Reports 8:STF013.
- ** 70. E.J. Sikora, J. Pitts, **P.M. Brannen**, and L.A. Fall. 2014. Relative efficacy of Abound and Captan fungicides for control of peach scab in Alabama, 2013. Plant Disease Management Reports 8:STF014.
- ** 71. **Brannen, P.M.**, L.A. Fall, C.H. Bock, and M.W. Hotchkiss. 2014. Efficacy of fungicides for control of scab on a mid-ripening peach variety in middle Georgia, 2013. Plant Disease Management Reports 8:STF015.
- ** 72. **Brannen, P.M.**, L.A. Fall, C.H. Bock, and M.W. Hotchkiss. 2014. Efficacy of fungicides for control of peach scab in middle Georgia, 2013. Plant Disease Management Reports 8:STF016.
- ** 73. C.H. Bock, M.W. Hotchkiss, **P.M. Brannen**, and L.A. Fall. 2014. Efficacy of Prophyt, a systemic phosphonate fungicide, when mixed with contact fungicides for control of peach scab in Georgia, 2013. Plant Disease Management Reports 8:STF017.
- ** 74. H. Scherm, **P.M. Brannen**, A.T. Savelle, J.E. Smith, and R.D. Stanaland. 2014. Efficacy of fungicides for control of Exobasidium fruit and leaf spot of blueberry in Georgia, 2013. Plant Disease Management Reports 8:SMF024.
- ** 75. J.R. Taylor, L.M. Fall, E.D. Smith, and **P.M. Brannen**. 2014. Efficacy of fungicides for control of orange cane blotch disease of blackberry in Georgia, 2013. Plant Disease Management Reports 8:SMF016.
- ** 76. F. Connelly, **P. Brannen**, and L. Fall. 2014. Mummy berry management in rabbiteye blueberry with chemical and organic fungicides, 2013. Plant Disease Management Reports 8:SMF023.
- ** 77. **Brannen, P.M.**, H. Scherm, A.T. Savelle, J.E. Smith, and R.D. Stanaland. 2014. Efficacy of fungicides for control of Exobasidium leaf and fruit spot of blueberry in Georgia, 2012. Plant Disease Management Reports 8:SMF022.
- ** 78. **Brannen, P.M.**, D. Wilson, L. Fall, and R. McNeil. 2014. Efficacy of experimental fungicides for control of brown rot of peach in northeast Georgia, 2013. Plant Disease Management Reports 8:STF003.
- ** 79. **Brannen**, C.H. Bock, and M.W. Hotchkiss. 2013. Efficacy of fungicides for control of scab on a mid-ripening peach variety in middle Georgia, 2012. Plant Disease Management Reports 7:STF021.
- ** 80. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2013. Efficacy of fungicide applications at petal fall and shuck split for control of scab on peach in middle Georgia, 2012. Plant Disease Management Reports 7:STF022.
- ** 81. **Brannen, P.M.**, C.H. Bock, and M.W. Hotchkiss. 2013. Efficacy of fungicides for control of scab on a mid-ripening peach variety in middle Georgia, 2011. Plant Disease Management Reports 7:STF023.
- ** 82. **Brannen, P.M.**, J.C. Garner, and D. Rogers. 2013. Comparison of new and established fungicides for control of downy mildew of grape in Georgia, 2012. Plant Disease Management Reports 7:SMF001.
- ** 83. **Brannen, P.M.**, B. Shirley, and J. Morgan. 2013. Control of brown rot of peach in middle Georgia through use of Merivon and Fontelis fungicides, 2012. Plant Disease Management Reports 7:STF005.
- ** 84. **Brannen, P.M.**, B. Shirley, and J. Morgan. 2013. Efficacy of fungicides for control of brown rot of peach in middle Georgia, 2012. Plant Disease Management Reports 7:STF006.
- ** 85. **Brannen, P.M.**, B. Shirley, and J. Morgan. 2013. Efficacy of Quadris Top and Inspire Super for control of brown rot of peach in middle Georgia, 2012. Plant Disease Management Reports 7:STF007.
- ** 86. **Brannen, P.M.**, B. Shirley, and J. Morgan. 2013. Control of brown rot of peach in northeast Georgia with chemical fungicides, 2012. Plant Disease Management Reports 7:STF008.
-

-
- ** 87. **Brannen, P.M.**, B. Shirley, and J. Morgan. 2013. Review of three chemical fungicides for control of brown rot of peach in northeast Georgia, 2012. Plant Disease Management Reports 7:STF009.
 - ** 88. **Brannen, P.M.**, L. Williford, J.C. Garner and D. Rodgers. 2012. Efficacy of fungicides for control of summer rot diseases of apples in Georgia, 2011. Plant Disease Management Reports 6:PF029.
 - ** 89. **Brannen, P.M.**, A. Shirley, and E. Durden. 2012. Evaluation of fungicide programs for control of summer rot diseases of apples in Georgia, 2010. Plant Disease Management Reports 6:PF030.
 - ** 90. **Brannen, P.M.**, J.C. Garner, and D. Rodgers. 2012. Evaluation of fungicides for control of downy mildew of grape in Georgia, 2011. Plant Disease Management Reports 6:SMF003.
 - ** 91. **Brannen, P.M.**, H. Scherm, A.T. Savelle, and R. McNeil. Efficacy of fungicides for control of brown rot of peach in northeast Georgia, 2011. Plant Disease Management Reports 6:STF016.
 - ** 92. **Brannen, P.M.**, H. Scherm, and R. Auman. 2012. Efficacy of fungicides for control of late-season brown rot of peach in middle Georgia, 2011. Plant Disease Management Reports 6:STF017.
 - ** 93. **Brannen, P.M.**, L. Williford, and R. Auman. 2012. Efficacy of Topguard and Fontelis fungicides for control of brown rot of peach in middle Georgia, 2011. Plant Disease Management Reports 6:STF018.
 - ** 94. **Brannen, P.M.** and R. Auman. 2012. Efficacy of fungicides for control of brown rot of peach in middle Georgia, 2011. Plant Disease Management Reports 6:STF019.
 - ** 95. **Brannen, P.M.** and R. Auman. 2012. Efficacy of chemical products for control of brown rot of peach in middle Georgia, 2011. Plant Disease Management Reports 6:STF020.
 - ** 96. **Brannen, P.M.**, R. Christiano, and R. McNeil. 2011. Efficacy of chemical products for control of brown rot of peach in north Georgia, 2010. Plant Disease Management Reports 5:STF005.
 - ** 97. **Brannen, P.M.**, J.C. Garner, and D. Rodgers. 2011. Evaluation of fungicides for control of powdery mildew of grape in Georgia, 2010. Plant Disease Management Reports 5:SMF005.
 - ** 98. **Brannen, P.M.**, J.C. Garner, and D. Rodgers. 2011. Evaluation of fungicides for control of downy mildew of grape in Georgia, 2010. Plant Disease Management Reports 5:SMF004.
 - ** 99. **Brannen, P.M.** and J.C. Garner. 2010. Evaluation of fungicide programs for control of summer rot diseases of apple in Georgia, 2009. Plant Disease Management Reports 4:PF027.
 - ** 100. **Brannen, P.M.** and J.C. Garner. 2010. Evaluation of ProPhyt fungicide for control of black rot of grape in Georgia, 2009. Plant Disease Management Reports 4:SMF050.
 - ** 101. **Brannen, P.M.** and R. McNeil. 2010. Efficacy of chemical control products for control of brown rot of peach in north Georgia, 2009. Plant Disease Management Reports 4:STF015.
 - ** 102. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2010. Efficacy of chemical products for control of brown rot of peach in middle Georgia, 2009. Plant Disease Management Reports 4:STF016.
 - ** 103. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2009. Fungicide efficacy for control of DMI-resistant *Monilinia fructicola* on peach in middle Georgia, 2008. Plant Disease Management Reports 3:STF019.
 - ** 104. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2009. Efficacy of metconazole for control of *Monilinia fructicola* and *Tranzschelia discolor* on peach in middle Georgia, 2008. Plant Disease Management Reports 3:STF018.
 - ** 105. **Brannen, P.M.** and R. McNeil. 2009. Efficacy of metconazole for control of brown rot and rust on peach in north Georgia, 2008. Plant Disease Management Reports 3:STF017.
 - ** 106. **Brannen, P.M.** and R. McNeil. 2009. Efficacy of chemical products for control of brown rot and rust of peach in north Georgia, 2008. Plant Disease Management Reports 3:STF016.
 - ** 107. Haralson, J.C., **P.M. Brannen**, S. Scherm, and D.S. NeSmith. 2009. Evaluation of fungicides for the control of Cylindrocladium root rot in blueberry cuttings, 2008. Plant Disease Management Reports 3:SMF039.
 - ** 108. Haralson, J.C., **P.M. Brannen**, S. Scherm, and D.S. NeSmith. 2009. Evaluation of fungicides for the control of Rhizoctonia root rot in blueberry cuttings, 2008. Plant Disease Management Reports 3:SMF038.
 - ** 109. **Brannen, P.M.**, M. Hotchkiss, C. Reilly, and A. Amiri. 2008. Evaluation of fungicide programs to manage a DMI-resistant *Monilinia fructicola* population on peach, 2007. Plant Disease Management Reports 2:STF003.
 - ** 110. **Brannen, P.M.**, M. Hotchkiss, C. Reilly, and K. Taylor. 2008. Efficacy of chemical products for control of DMI-resistant *Monilinia fructicola* on peach in middle Georgia, 2007. Plant Disease Management Reports 2:STF002.
 - ** 111. Haralson, J.C., **P.M. Brannen**, S. Scherm, and D.S. NeSmith. 2008. Use of fungicides for control of Cylindrocladium root rot in blueberry cuttings, 2007. Plant Disease Management Reports 2:SMF038. (I,E,W,S = 50%)
 - ** 112. Ross, J., G.W. Krewer, and **P.M. Brannen**. 2008. Efficacy of pre-harvest fungicides for control of gray mold of blackberries in Georgia, 2006. Plant Disease Management Reports 2:SMF001.
 - ** 113. **Brannen, P.M.** and J.C. Garner. 2008. Evaluation of products for control of fire blight in Georgia, 2007. Plant Disease Management Reports 2:PF019.
 - ** 114. R.J. Byrne, D.W. Clark, and **P.M. Brannen**. 2008. Control of hawthorn leaf blight of mayhaw with chemical fungicides, 2007. Plant Disease Management Reports 2:PF018.
 - ** 115. **Brannen, P.M.**, S. NeSmith, and P.F. Harmon. 2007. Fungicidal control of Phytophthora root rot of blueberry in a high-density bark bed planting in north Georgia, 2006. Plant Disease Management Reports 1:SMF038.
 - ** 116. **Brannen, P.M.**, S. NeSmith, and P.F. Harmon. 2007. Fungicidal control of Phytophthora root rot of blueberry in a high-density bark bed planting in south Georgia, 2006. Plant Disease Management Reports 1:SMF039.
 - ** 117. **Brannen, P.M.**, M. Hotchkiss, C. Reilly, and A. Amiri. 2007. Evaluation of fungicide programs to manage a DMI-resistant *Monilinia fructicola* population in an early-ripening peach, 2006. Plant Disease Management Reports 1:STF002.
-

-
- ** 118. **Brannen, P.M.**, M. Hotchkiss, C. Reilly, and A. Amiri. 2007. Evaluation of fungicide programs to manage a DMI-resistant *Monilinia fructicola* population in a late-ripening peach, 2006. Plant Disease Management Reports 1:STF003.
 - ** 119. **Brannen, P.M.** and J.C. Garner. 2006. Evaluation of non-antibiotic products for control of fire blight in Georgia, 2006. Fungicide and Nematicide Tests Reports 61:PF036.
 - ** 120. **Brannen, P.M.** and J.C. Garner. 2006. Evaluation of fungicide programs for control of Alternaria leaf blotch and summer diseases of apples in Georgia, 2005. Fungicide and Nematicide Tests Reports 61:PF026.
 - ** 121. **Brannen, P.M.**, R.D. Stanaland, J.E. Smith, and C. Meister. 2006. Fungicidal control of Septoria and anthracnose leaf spots of blueberry, 2005. Fungicide and Nematicide Tests Reports 61:SMF018.
 - ** 122. **Brannen, P.M.** and S. NeSmith. 2006. Fungicidal control of Pythium root rot of blueberry in a bark-bed, high-density planting, 2005. Fungicide and Nematicide Tests Reports 61:SMF016.
 - ** 123. **Brannen, P.M.** and J.C. Garner. 2006. Efficacy of products for control of fire blight in Georgia, 2005. Fungicide and Nematicide Tests Reports 61:PF027.
 - ** 124. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2006. Efficacy of fungicides for control of post-harvest brown rot in Georgia, 2005. Fungicide and Nematicide Tests Reports 61:STF011.
 - ** 125. **Brannen, P.M.**, M. Hotchkiss, C. Reilly, and G. Schnabel. 2006. Evaluation of fungicide programs to manage a DMI-resistant *Monilinia fructicola* population in a Georgia peach research block, 2005. Fungicide and Nematicide Tests Reports 61:STF001.
 - ** 126. **Brannen, P.M.**, E. Andrews, and C. Meister. 2006. Fungicides for control of Septoria leaf spot of blueberry, 2005. Fungicide and Nematicide Tests Reports 61:SMF017.
 - ** 127. Stanaland, R.D., **P.M. Brannen**, and H. Scherm. 2005. Fungicidal control of mummy berry disease of blueberry, 2004. Fungicide and Nematicide Tests Reports 60:SMF031.
 - ** 128. Ngugi, H.K., **P.M. Brannen**, T. Watson, and H. Scherm. 2005. Evaluation of alternatives to oxytetracycline for control of bacterial spot of peach during the cover sprays, 2004. Fungicide and Nematicide Tests Reports 60:STF009.
 - ** 129. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2005. Efficacy of fungicides for control of brown rot in a mid-ripening peach variety in middle Georgia, 2004. Fungicide and Nematicide Tests Reports 60:STF005.
 - ** 130. **Brannen, P.M.** and J.C. Garner. 2005. Efficacy of fungicides for control of summer rot diseases with varied fungicide programs in Georgia, 2004. Fungicide and Nematicide Tests Reports 60:PF035.
 - ** 131. **Brannen, P.M.**, H. Scherm, and R.D. Stanaland. 2005. Fungicidal control of Septoria and anthracnose leaf spots of blueberry, 2004. Fungicide and Nematicide Tests Reports 60:SMF037.
 - ** 132. Stanaland, R.D., **P.M. Brannen**, and H. Scherm. 2004. Fungicidal control of mummy berry disease of blueberry, 2003. Fungicide and Nematicide Tests Reports 59:SMF022.
 - ** 133. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2004. Efficacy of fungicides for control of brown rot on a mid-ripening peach variety in north Georgia, 2003. Fungicide and Nematicide Tests Reports 59:STF004.
 - ** 134. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2004. Efficacy of fungicides for control of brown rot on an early-ripening peach variety in middle Georgia, 2003. Fungicide and Nematicide Tests Reports 59:STF005.
 - ** 135. **Brannen, P.M.**, L.M. Ferguson, and F.J. Louws. 2004. Alternatives to methyl bromide use for control of black root rot of strawberry in Georgia, 2003. Fungicide and Nematicide Tests Reports 59:SMF007.
 - ** 136. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2003. Efficacy of fungicides for control of brown rot on a mid-ripening peach variety in north Georgia, 2002. Fungicide and Nematicide Tests Reports 58:STF022.
 - ** 137. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2003. Efficacy of fungicides for control of scab on a mid-ripening peach variety in middle Georgia, 2002. Fungicide and Nematicide Tests Reports 58:STF024.
 - ** 138. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2003. Efficacy of fungicides for control of scab on a late-ripening peach variety in middle Georgia, 2002. Fungicide and Nematicide Tests Reports 58:STF023.
 - ** 139. **Brannen, P.M.**, L. Ferguson, and F.J. Louws. 2003. Alternatives to methyl bromide use for control of black root rot of strawberry in Georgia, 2002. Fungicide and Nematicide Tests Reports 58:SMF020.
 - ** 140. **Brannen, P.M.**, H. Scherm, and M.D. Bruorton. 2003. Fungicidal control of Septoria leaf spot of blueberry, 2002. Fungicide and Nematicide Tests Reports 58:SMF019.
 - ** 141. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2002. Efficacy of fungicides for control of brown rot on a mid-ripening peach variety in middle Georgia, 2001. Fungicide and Nematicide Tests Reports 57:STF 32.
 - ** 142. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2002. Efficacy of fungicides for control of brown rot on a late-ripening peach variety in north Georgia, 2001. Fungicide and Nematicide Tests Reports 57:STF30.
 - ** 143. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2002. Efficacy of fungicides for control of brown rot on a late-ripening peach variety in middle Georgia, 2001. Fungicide and Nematicide Tests Reports 57:STF 34.
 - ** 144. **Brannen, P.M.**, M. Hotchkiss, and C. Reilly. 2002. Efficacy of fungicides for control of brown rot on an early-ripening peach variety in middle Georgia, 2001. Fungicide and Nematicide Tests Reports 57:STF33.
 - ** 145. **Brannen, P.M.**, H. Scherm, and M. D. Bruorton. 2002. Use of selected fungicides for control of septoria leaf spot of blueberry, 2001. Fungicide and Nematicide Tests Reports 57:SMF46.
 - ** 146. **Brannen, P.M.** and F.J. Louws. 2002. Alternatives to methyl bromide use for control of black root rot of strawberry in Georgia, 2001. Fungicide and Nematicide Tests Reports 57:SMF47.
 - ** 147. **Brannen, P.M.**, H. Scherm, and M.D. Bruorton. 2001. Use of selected fungicides for control of septoria leaf spot of blueberry, 2000. Fungicide and Nematicide Tests Reports 56:SMF1.
 - ** 148. **Brannen, P.M.** 2001. Use of thiram granuflow for control of sooty blotch, flyspeck and bitter rot summer diseases of apple. Fungicide and Nematicide Tests Reports 56:PF1.
-

- ** 149. **Brannen, P.M.** 2001. Efficacy of commercial preparations of *Bacillus subtilis* for control of peach diseases, 2000. Biological and Cultural Control Tests Reports N61.
- ** 150. Batson, W., Caceres, J., Benson, M., Cubeta, M., **Brannen, P.**, Kenny, D., Elliott, M., Huber, D., Hickman, M., Keinath, A., Dubose, V., Ownley, B., Newman, M., Rothrock, C., Schneider, R., and Summer, D. 2000. Evaluation of biological seed treatments for control of the seedling disease complex of cotton. Biol. and Cult. Tests 15:31-32.
- ** 151. Batson, W., Caceres, J., Benson, M., Cubeta, M., **Brannen, P.**, Kenny, D., Elliott, M., Huber, D., Hickman, M., Keinath, A., Dubose, V., Ownley, B., Newman, M., Rothrock, C., Schneider, R., and Summer, D. 1999. Biological seed treatments for control of the seedling disease complex of cotton. Biological and Cultural Tests 14:25-26.

d. Bulletins or Reports:

- ** 1. Scherm, H., **P.M. Brannen**, and K.C. Taylor. 2004. Optimizing postharvest wax and fungicide treatments. Annual Peach Research Report (South Carolina Peach Council) 4:27-32.
- ** 2. Scherm, H., **P.M. Brannen**, and H.K. Ngugi. 2004. Evaluating a new systemic copper for bacterial spot control. Annual Peach Research Report (South Carolina Peach Council) 4:22-26.
- ** 3. **Brannen, P.M.** 2003. Use of selected fungicides for control of early-season scab (*Cladosporium carpophilum*) on peach. Annual Peach Research Report (South Carolina Peach Council) 3:5-8.
- ** 4. **Brannen, P.M.** 2003. Use of selected fungicides for control of brown rot (*Monilinia fructicola*) on peach. Annual Peach Research Report (South Carolina Peach Council) 3:1-4.
- ** 5. **Brannen, P.M.** 2002. Field validation of a bacterial spot bactericide timing model. Annual Peach Research Report (South Carolina Peach Council) 2:6-11.
- ** 6. Rodriguez-Kabana, R., P.A. Backman, **P.M. Brannen**, and J.C. Jacobi. 1994. AU-Pnuts – AAES developed expert system helps manage peanut pests. Research Report Series (Alabama Ag. Exp. Station; Auburn University) 9:47-49.
- ** 7. **Brannen, P.M.** and P.A. Backman. 1993. Bacteria-treated seed promotes better season-long health in cotton. Highlights of Agricultural Research. Alabama Ag. Exp. Station, 40(1):3.
- ** 8. **Brannen, P.M.** and P.A. Backman. 1992. On-farm tests demonstrate value of AU-Pnuts. Highlights of Agricultural Research. Alabama Ag. Exp. Station, 39(4):5.

e. Abstracts & Proceedings of Research Conferences:

1. M. Panth, E. Noh, M. Rich, G. Schnabel, **P.M. Brannen**, and H. Wang. Prevalence and persistence of oxytetracycline resistant and copper tolerant strains of *Xanthomonas arboricola* pv. *pruni* in peach orchards in the Southeast. Phytopathology (accepted for publication).
2. N. Sharma, T. Neill, W.F. Mahaffee, K. Gold, D. Combs, **P.M. Brannen**, C. Oliver, M.M. Moyer, L. Holland, W. McFadden, L. Heger, and T.D. Miles. 2022. Investigating QoI and CAA resistance in grape powdery mildew and downy mildew populations in vineyards of the eastern United States and Canada. Phytopathology (accepted for publication).
3. K. Johnson, C. Bock, and **P.M. Brannen**. 2022. Evaluating the accuracy of visual estimation of the incidence of phony peach disease (caused by *Xylella fastidiosa*). Phytopathology (accepted for publication).
4. K. Johnson, C. Bock, and **P.M. Brannen**. 2022. *Xylella fastidiosa*: a re-emerging bacteria of peach. Phytopathology (accepted for publication).
5. S. Breeden and **P.M. Brannen**. 2022. Efficacy and crop safety of minimal-, moderate-, and high-input disease management systems for Pierce's disease resistant hybrids. American Society of Enology and Viticulture Conference (San Diego, CA) (accepted for publication).
6. K. Gasic, C. Saski, A. Calle, J. Adleberg, K. Baumgartner, R. Hammerschmidt, P. Devkota, A. Iezzoni, and **P. Brannen**. 2022. Short- and long-term solutions for Armillaria root rot in Prunus. Proceedings of the X International Peach Symposium (Naoussa [Greece]), May 30 - June 3 2022 (accepted for publication).
7. K. Johnson, **P. Brannen**, and C. Bock. 2022. Historic and current prevalence of phony peach disease (caused by *Xylella fastidiosa*) in the United States. Proceedings of the X International Peach Symposium (Naoussa [Greece]), May 30 - June 3 2022 (accepted for publication).
8. **P. Brannen** and C. Bock. 2022. Historical 1929 and 1930 phony peach disease (caused by *Xylella fastidiosa*) incidence data and relationships to physical variables and climatological data. Proceedings of the X International Peach Symposium (Naoussa [Greece]), May 30 - June 3 2022 (accepted for publication).
9. G. Schnabel and **P. Brannen**. 2022. Biology, epidemiology and management of diseases of peach driving the spray program in the southeastern United States. Proceedings of the X International Peach Symposium (Naoussa [Greece]), May 30 - June 3 2022 (accepted for publication).
10. K. Johnson, C.H. Bock, and **P.M. Brannen**. 2021. Spatial analysis of phony peach disease in commercial and research peach orchards and Georgia. Phytopathology 111:S1.8.
11. C.H. Bock, C.A. Young, M. Zhang, C. Chen, **P.M. Brannen**, J.E. Adaskaveg, and N.D. Charlton. 2020. *Venturia carpophila*, cause of peach scab -- mating type idiomorphs and genetic diversity. Phytopathology.
12. C. Oliver, M. Moyer, W. Mahaffee, M. Cooper, I. Lewis, T. Miles, and **P. Brannen**. 2020. Grower knowledge and perception of fungicide resistance in US vineyards. Phytopathology.
13. W.H. Hemphill, **P.M. Brannen**, and J. Oliver. 2020. The impact of potassium phosphite on *Cephauros virescens* and management of orange cane blotch disease of blackberry (*Rubus fruticosus*). Phytopathology.
14. W.H. Hemphill, **P.M. Brannen**, and J. Oliver. 2020. Identification of organisms associated with cane dieback of cultivated blackberry (*Rubus fruticosus*) in Georgia. Phytopathology.

15. B. Warres, T. Neil, W. Mahaffee, M. Brewer, and **P. Brannen**. 2020. Field efficacy of fungicides for management of grape powdery mildew in the presence of fungicide-resistant populations of *Erysiphe necator* in Georgia. *Phytopathology*.
16. C. Bock, **P.M. Brannen**, and M. Hotchkiss. 2019. Tractor speed and concentration of active ingredient affect the incidence and severity of scab on peach fruit. *Phytopathology* 109:S2.57.
17. G. Jagdale, **P.M. Brannen**, and P. Severns. 2019. Occurrence and distribution of plant-parasitic nematodes of muscadine grapes in Georgia and North Carolina. *Phytopathology* 109.
18. S. Campbell, **P.M. Brannen**, and H. Scherm. 2019. Fungicide sensitivity and efficacy profiling of Georgia *Plasmopora viticola* isolates causing grapevine downy mildew. *Phytopathology* 109:S2.59.
19. R. Allen, **P.M. Brannen**, H. Scherm and P.F. Harmon. 2018. Understanding and mitigating Botryosphaeria stem blight and crown dieback in blueberry. *Proceedings of the NABREW Meeting*.
20. C. Hong, H. Scherm and **P.M. Brannen**. 2018. Phylloxera galls as *Plasmopara viticola* infection and sporulation sites on leaves of grapevines partially resistant to downy mildew. *Phytopathology* 108:S1.223.
21. G. Jagdale and **P.M. Brannen**. 2018. Occurrence and distribution of plant-parasitic nematodes of blueberry in Georgia. *Phytopathology* 108:S1.48.
22. **P.M. Brannen**. 2018. Management of bitter rot of apple under optimal conditions for disease development in Georgia orchards. *Phytopathology* 108:S1.149.
23. R.J. Ingram, **P.M. Brannen**, M. Slusher, J. Taylor, W. Lovett, and S. Curry. 2017. Efficacy of fungicide-based management of blueberry rust in southern Georgia. *Phytopathology* 107:S5.44.
24. H. Scherm, R.M. Allen, R.J. Ingram, and **P.M. Brannen**. 2017. Non-target effects of horticultural and pest management practices in fall and winter on development of Exobasidium leaf and fruit spot of blueberry. *Phytopathology* 107:S5.76.
25. C. Chen, **P.M. Brannen**, J.E. Adaskaveg, and C.H. Bock. 2017. Characterization of microsatellites from a genome of *Venturia carpophila*. *Phytopathology*:107:S5.124.
26. T. Glenn, **P.M. Brannen**, C.H. Bock, M.W. Hotchkiss, J. Pitts, and E.J. Sikora. 2017. Efficacy of a single late-dormant application of mineral oil plus chlorothalonil for control of peach scab, caused by *Venturia carpophila*. *Phytopathology* 107:S5.41.
27. **P.M. Brannen**, H. Scherm, and R.M. Allen. 2017. Management of Exobasidium leaf and fruit spot disease of blueberry in the southeastern United States. XI International Vaccinium Symposium. ISHA Acta Horticulturae. 10.17660/ActaHortic.2017.1180.28
28. **P.M. Brannen**. 2016. Leaf scorch, caused by the bacterium *Xylella fastidiosa*, and other diseases of potential importance to maturing blueberry systems in Mexico. VI Simposio Nacional y V Internacional de Bacterias Fitopatogénas y II Simposio de bacterias benéficas de las plantas. <http://www.simposiumbacterias.mx/memories-list.php>
29. F. Browne, **P. Brannen**, H. Scherm, L. Fall, J. Taylor, J. Shealey, and E. Beasley. 2016. Yield loss and management of orange cane blotch of blackberry, caused by the alga *Cephaleuros virescens*. *Phytopathology* 106:S4.67.
30. M. Dowling, H. Boatwright, G. Schnabel, P. Bryson, J. Wilson, Z. Fan, S. Everhart, and **P. Brannen**. 2016. Effect of fungicide applications on *Monilinia fructicola* population diversity and transposon movement. *Phytopathology* 106:S4.62.
31. C. Hong, **P. Brannen**, and H. Scherm. 2016. Epidemiology and population biology of grape downy mildew. *Phytopathology* 106:S4.11.
32. F.B. Browne, L.A. Fall, **P.M. Brannen**, J. Taylor, J. Shealey, and E.D. Beasley. 2016. Assessment of algicides, disinfectants and fungicides for control of orange cane blotch caused by the alga *Cephaleuros virescens*. pp. 497-502 in the *Proceedings of the XI International Rubus Ribes Symposium*. ISHS Acta Horticulturae 1133, DOI:10.17660/ActaHortic.2016.1133.77.
33. W.O. Cline, B.K. Bloodworth, **P.M. Brannen**, and C.M. Mainland. 2015. Exobasidium update and control. NC Blueberry Council, *Proceedings of the 49th Annual Open House*, pp. 46-51.
34. **P.M. Brannen**, H. Scherm, A. Savelle, B. Shirley, J. Jacobs, J. Taylor, P. Edwards, R. Holland, S. Curry, and T. Varnedore. 2015. Efficacy of late-dormant calcium polysulfide applications for control of Exobasidium leaf and fruit spot of blueberry. *Phytopathology* 105:S4.19.
35. S.L. Bolton, **P.M. Brannen**, and A.E. Glenn. 2015. A *Fusarium fujikuroi* population isolated from grapes reveals the need to re-evaluate the species fumonisin production potential. *Phytopathology* 105:S4.17.
36. J.P. Noe, G.B. Jagdale, W.T. Holladay, and **P.M. Brannen**. 2015. Management of blueberry, *Vaccinium* spp. replant disease with pine bark soil amendment and pre-plant fumigation. *Phytopathology* 105:S4.102.
37. J. Noe, G.B. Jagdale, W.T. Holladay, and **P.M. Brannen**. 2015. Fluensulfone for management of *Mesocriconema xenoplax* on peach. *Proceedings of the 54th Annual Meeting of the Society of Nematologists*.
38. S.L. Bolton, **P.M. Brannen**, and A.E. Glenn. 2015. Mycotoxin potential in high-risk American *Vitis vinifera* vineyards and wines. *Proceedings of the ASEV Conference*.
39. S.L. Bolton, **P.M. Brannen**, and A.E. Glenn. 2015. Analysis of the mycotoxigenic fungi associated with southeastern U.S. wine grapes reveals a large population of *Fusarium fujikuroi* isolates producing high levels of fumonisins. *Proceedings of the 13th Fusarium Seminar*, Martina Franca, Italy.
40. **P.M. Brannen** and L.A. Fall. 2014. The endocrine disruptor screening program and a potential relationship to future plant disease control efforts. *Phytopathology* (11):S3.143.

41. C. Chen, C.H. Bock, **P.M. Brannen**, J.E. Adaskaveg, M.W. Hotchkiss, M. Brewer, and B.W. Wood. 2014. Characteristics of genetic variability among isolates of *Fusicladium* species from peach, almond and pecan in the USA. *Phytopathology* 104(11):S3.316.
42. R. Holland, G. Rains, and **P.M. Brannen**. 2014. Initial identification of issues with spray coverage in south Georgia blueberries. Proceedings of the 2014 North American Blueberry Research and Extension Workers Conference <http://dx.doi.org/doi:10.7282/T3PG1TDT>.
43. J.P. Noe, **P.M. Brannen**, W.T. Holladay, and G.B. Jagdale. 2014. Management of blueberry replant disease caused by *Mesocriconema ornatum* in the early establishment phase of growth. *Phytopathology* 104(11):S3.183.
44. J.P. Noe, G. Jagdale, T. Holladay, and **P. Brannen**. 2014. Susceptibility of blueberry cultivars to replant disease associated with *Mesocriconema ornatum*. Proceedings of the 6th International Congress of Nematology.
45. **P.M. Brannen**, H. Scherm, M. Deom, and J. Noe. 2014. New and emerging blueberry diseases in the southeastern United States. Proceedings of the 48th North Carolina Blueberry Council Meetings. p. 25-33.
46. **P.M. Brannen**. 2013. A brief history of vinifera wine grape production in Georgia. In: The Dahlenega Wine and Gold District: Geology and Terroir of Viticulture in Northeastern Georgia. Eds. Schroeder, P.A., J.T. Forrest, and J.M. German. Georgia Geological Society Guidebook, Volume 33(1):1-8.
47. **P.M. Brannen**, C.M. Deom, M. Westmoreland, P. Collins, O. Alibi, and N. Rayapati. 2013. Prevalence of grapevine (*Vitis vinifera*) viruses in Georgia. *Phytopathology* 103(6):S2.20.
48. A.P. Nyczepir, S.L.F. Meyer, and **P. Brannen**. 2013. Management of *Meloidogyne incognita* with tall fescue grass rotations prior to peach orchard establishment. *Phytopathology* 103(6):S2.104.
49. **P. Brannen**, B. Cline, H. Scherm, and M. Brewer. 2013. Exobasidium leaf and fruit spot development in southern environments and development of initial management strategies with fungicides. Proceedings of the 47th North Carolina Blueberry Council Meetings. p 5-14.
50. **P. Brannen**. 2012. Bacterial diseases in blueberry. Proceedings of the IV National Symposium /III International plant pathogenic bacteria/Minisymposium HLB in citrus (Quadalajara, Mexico). p 65-73.
51. **P. Brannen**, G. Schnabel, and T. Michailides. 2012. Fungicide resistance in stone fruits. Fungicide Resistance Development in North America for the 21st Century Workshop. p 23.
52. T.S. Robinson, **P.M. Brannen**, and C.M. Deom. 2012. Blueberry necrotic ring blotch: a new disorder of southern highbush blueberries. *Phytopathology* 102(7):S4.101.
53. D. Hopkins, P. Harmon, and **P. Brannen**. 2012. Host range of *Xylella fastidiosa* strains that cause blueberry leaf scorch. *Phytopathology* 102(7):S4.55.
54. J.P. Noe, **P.M. Brannen**, W.T. Holladay, and G.B. Jagdale. 2012. Preplant soil treatments to manage blueberry replant disease caused by *Mesocriconema ornatum*. *J. Nematol* 44(4):482.
55. A. Shirley, J.P. Noe, A.P. Nyczepir, and **P.M. Brannen**. 2012. Use of spirotramat in the post-plant management of root-knot nematode in eggplant and peach. Proceedings of the Society of Nematology Meetings, Savannah, GA.
56. G.B. Jagdale, T. Holladay, **P.M. Brannen**, B. Cline, A.P. Nyczepir, and J.P. Noe. 2011. Occurrence and damage potential of plant parasitic nematodes associated with blueberries (*Vaccinium* spp.) in Georgia and North Carolina. Proceedings of the Society of Nematology Meetings, Boise, ID.
57. R.R. Martin, D. Quito-Avila, H. Scherm, W. Cline, and **P. Brannen**. 2011. Blueberry necrotic ring blotch, a new blueberry disease caused by a virus. *Phytopathology* 101(6):S115.
58. **P. Brannen**. 2011. Bacterial leaf scorch of blueberry: an emerging disease of blueberry and potential for spread. Proceedings of the Atlantic Coast Ag Convention (Atlantic City, NJ; 11-13 Jan 2011).
59. G. Schnabel, A. Amiri, and **P. Brannen**. 2010. Location-specific fungicide resistance profiles aid peach growers in managing fungicide resistance in *Monilinia fructicola*. Proceedings of the Reinhardtsbrunn Symposium on Modern Fungicides and Antifungal Compounds (Friedreichroda, Germany; 26-29 April 2010).
60. D. Hopkins and **P. Brannen**. 2010. Biological control with *Xylella fastidiosa* strain EB92-1 for the prevention of Pierce's disease development in mature, producing grapevines. *Phytopathology* 100:S52.
61. **P.M. Brannen**, J. Garner, J. Smith, and S. NeSmith. 2010. Phytotoxicity danger of phosphorous acid generating fungicides and fertilizer products applied to blueberry and grapes. *Phytopathology* 100:S16.
62. G.B. Jagdale, **P.M. Brannen**, J.P. Noe, B. Cline, and A.P. Nyczepir. 2010. Pathogenicity of ring nematodes: an emerging pest of blueberries (*Vaccinium* spp.). *J. Nematol.* 42:249.
63. **P.M. Brannen**. 2010. Bacterial leaf scorch of blueberries: a new threat to the southeastern industry. *Phytopathology* 100:S199.
64. **P.M. Brannen** and C.J. Chang. 2009. Expansion of *Xylella fastidiosa* into blueberries in Georgia and Florida. *Phytopathology* 99:S170.
65. L. Nissen, T. Denny, **P. Brannen**, and C. Chang. 2009. *Xylella fastidiosa* strains causing bacterial leaf scorch of blueberry in Georgia are genetically distinct from those causing Pierce's disease of grape. *Phytopathology* 99:S93.
66. A. Amiri, **P.M. Brannen**, and G. Schnabel. 2009. Resistance to respiration inhibitor fungicides in *Monilinia fructicola* field isolates from South Carolina and Georgia. *Phytopathology* 99:S3.
67. **P.M. Brannen**, H. Scherm, and C.J. Chang. 2009. Update on bacterial leaf scorch (*Xylella*) in southern highbush blueberries and cultivar field resistance. Pages 71-77 in: Proceedings of the 2009 Southeastern Blueberry Convention, Savannah, GA.
68. **Brannen, P.M.**, Harmon, P. and NeSmith, D.S. 2009. Utility of phosphonate fungicides for management of Phytophthora root rot of blueberry. *Acta Hort.* (ISHS) 810:331-340
http://www.actahort.org/books/810/810_43.htm

69. **P.M. Brannen**, K. Taylor, M. Hotchkiss, C. Reilly, G. Schnabel, and A. Amiri. 2008. Evolving management strategies for *Monilinia fructicola* populations with reduced sensitivity to DMIs in Georgia and implications for brown rot control recommendations. *Phytopathology* 98(6):S25
70. J.C. Haralson, **P.M. Brannen**, and H.W. Scherm. 2008. Efficacy of fungicides for suppressing *Cylindrocladium* stem and root rot of blueberry in Georgia. *Phytopathology* 98(6):S65
71. A. Amiri, **P.M. Brannen**, and G. Schnabel. 2008. Development of a selective medium for recovery of *Monilinia fructicola* from peach fruit. *Phytopathology* 98(6):S12
72. A. Amiri, **P.M. Brannen**, and G. Schnabel. 2008. Monitoring resistance in *Monilinia fructicola* populations in the southeastern United States for enhanced brown rot control in peach. *Phytopathology* 98(6):S12
73. **P.M. Brannen**. 2008. Suggestions for controlling *Xylella* (bacterial leaf scorch) in southern highbush blueberries. Proceedings of the 2008 Southeastern Blueberry Convention, Savannah, GA.
74. G. Schnabel and **P.M. Brannen**. 2008. Fungicide resistance in the brown rot pathogen *Monilinia fructicola* causes concern among specialists and growers. Pages 9-11 in: Proceedings of the 2008 Southeastern Peach Convention, Savannah, GA.
75. R.M. Welker, J.G. Driver, J.P. Smith, **P.M. Brannen**, C. Schiemann and F.J. Louws. 2007. On-farm research to implement MB alternatives: an area wide initiative. Page 22/1-221/4 in: Proceedings of the 14th Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reduction; San Diego, CA.
76. **P.M. Brannen**, S. NeSmith, and P. Harmon. 2007. Use of phosphonates for control of *Phytophthora* root rot of blueberry. *Phytopathology* 97(7):S13
77. A. Amiri, H. Scherm, **P.M. Brannen**, and G. Schnabel. 2007. Accuracy of three new agar-based assays to assess fungicide sensitivity in *Monilinia fructicola*. *Phytopathology*
78. C.J. Chang, **P.M. Brannen**, G. Krewer, B. Boland, and R. Donaldson. 2007. Bacterial leaf scorch of blueberry: a new disease caused by *Xylella fastidiosa*. *Phytopathology* 97(7):S20
79. K.C. Taylor and **P.M. Brannen**. 2007. Preliminary assessment of captan impact on fruit finish. 67th Annual Meeting of the Southern Region of the American Society for Horticultural Science.
- † 80. **P.M. Brannen** and G. Schnabel. 2007. Brown rot and DMI fungicide resistance update. Pages 1-3 in: Proceedings of the 2007 Southeastern Peach Convention, Savannah, GA.
81. **P.M. Brannen** and G. Schnabel. 2006. A survey for *Monilinia fructicola* populations with reduced sensitivity to DMIs in Georgia and implications for brown rot control recommendations in the Southeast. *Phytopathology* 96(6).
82. O. Anas, **P.M. Brannen**, and T.B. Sutton. 2006. The effect of warming winter temperatures on the severity of Pierce's disease in the southeastern United States. *Phytopathology* 96(6).
83. **P.M. Brannen**, D. Stanaland, and D.S. NeSmith. 2006. Use of phosphite fungicides for control of blueberry diseases in Georgia. Pages 129-138 in: Proceedings of the 10th North American Blueberry Research & Extension Workers' Conference, Tifton, GA.
- † 84. **P.M. Brannen**. 2006. Current disease control issues for southeastern blackberries. Pages 1-5 in: Proceedings of the 2006 North American Bramble Growers Association Meeting, Savannah, GA.
- † 85. **P.M. Brannen** and G. Schnabel. 2006. 2005 bacterial spot incidence and observations in Georgia and South Carolina. Pages 13-15 in: Proceedings of the 2006 Southeastern Peach Convention, Savannah, GA.
86. **Brannen, P.M.** and D. Stanaland. 2005. Dipotassium phosphonate, dipotassium phosphate, and potassium phosphate materials for control of Septoria and anthracnose leaf spots of blueberry. *Phytopathology* 95(6):S13.
87. Driver, J.G., **P.M. Brannen**, M. Seitz, C. Schiemann, R. Welker, and F. Louws. 2005. Growers implement methyl bromide alternatives. Pages 38-39 in: Proceedings of the 2005 Southeast Strawberry Exposition; Durham, NC.
88. Driver, J.G., **P.M. Brannen**, M. Seitz, C. Schiemann, R.M. Welker, and F.J. Louws. 2005. On-farm fumigation trials for strawberries in the Southeast. Page 101 in: Proceedings of the 12th Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reduction; San Diego, CA.
89. Cline, W.O., **P.M. Brannen**, and H. Scherm. 2004. Blueberry disease management in the Southeastern United States. Proceedings of the 8th International Vaccinium Conference.
90. **Brannen, P.M.**, L.M. Ferguson, and F.J. Louws. 2004. Methyl bromide alternatives for control of black root rot of strawberry in Georgia. *Phytopathology* 94(6):S10.
91. Schnabel, G. and **P.M. Brannen**. 2003. Fungicide efficacy trials for brown rot control and DMI fungicide resistance issues. Proceedings of the 79th Cumberland-Shenandoah Fruit Workers Conference, Winchester, VA.
92. Scherm, H., **P.M. Brannen**, P.S. Ojiambo, A.T. Savelle, G. Krewer, and M.D. Bruorton. 2003. Blueberry leaf spots: epidemiology, yield losses, and control. Pages 57-66 in: Proceedings of the 11th Biennial Southeastern Blueberry Conference.
93. Ferguson, L.M., F.J. Louws, Z.G. Abad, G.E. Fernandez, E.B. Poling, and **P.M. Brannen**. 2003. Strawberry root colonization by pathogens in transplants and field-set plants. *Phytopathology* 93(6):S25.
94. Ferguson, L.M., F.J. Louws, Z.G. Abad, G.E. Fernandez, E.B. Poling, and **P.M. Brannen**. 2003. Impacts of alternatives on strawberry yield and root colonization by fungal pathogens. Ann. Int. Research Conference on Methyl Bromide Alternatives and Emissions Reductions. 56/1-56/6.
95. **Brannen, P.M.** and J. Garner. 2003. Validation of fire blight prediction systems for Georgia apple production. *Phytopathology* 93(6):S11.
- † 96. **Brannen, P.M.** 2003. Strawberry anthracnose – identification and control. Pages 91-93 in: Proceedings of the 2003 Georgia-South Carolina Strawberry Conference.
- † 97. **Brannen, P.M.** 2003. Plum Pox Virus Update. Pages 55-56 in: Proceedings of the 2003 Southeastern Peach Convention.

98. Scherm, H., **P.M. Brannen**, and K.C. Taylor. 2002. Georgia's peach industry: Reflections on past and present progress. Pages 20-25 in: Proceedings of the 21st Horticulture Industries Show.
99. Poling, E.B., G.S. Miner, R.D. Schiavone, F.J. Louws, G.E. Fernandez, L.M. Ferguson, **P.M. Brannen**, O.B. Sydorovych, C.D. Safley, D.W. Monks, Z. Pesic-VanEsbroeck, D.C. Sanders and J.P. Smith. 2002. The influence of planting date and fumigant on field nursery production of 'Chandler' strawberry fresh dug plants. Abstr. Southern Association of Agricultural Scientists.
100. Ojiambo, P.S., H. Scherm, and **P.M. Brannen**. 2002. Septoria leaf spot intensity, defoliation, and yield loss relationships in southern blueberries. *Phytopathology* 92(9):1025.
101. Kemeraite, P.L., G. Krewer, P. Lewis, and **P. Brannen**. 2002. Effect of number of branch crowns on yield of 'Chandler' and 'Camarosa' strawberries in South Georgia. *HortScience* 37(5):749.
102. Ferguson, L.M., F.J. Louws, G.E. Fernandez, D.C. Sanders, D.W. Monks, Z. Pesic-VanEsbroeck, E.B. Poling, **P.M. Brannen**, J.P. Smith, C.D. Safley, and O.B. Sydorovych. 2002. Management of soilborne pests in strawberry and vegetable plasticulture systems. *Phytopathology* 92(6):S25.
103. Ferguson, L.M., F.J. Louws, G.E. Fernandez, **P.M. Brannen**, E.B. Poling, O.B. Sydorovych, C.D. Safley, D.W. Monks, A. Pesic-Van Esbroeck, D.C. Sanders, and J.P. Smith. 2002. Chemical and biological alternatives to methyl bromide for strawberry in the southeastern US. Proceedings of the International Research Conference on Methyl Bromide Alternatives and Emissions Reduction. 103/1-103/4.
- † 104. **Brannen, P.M.**, G. Schnabel, B. Boozer, and E. Sikora. 2002. Fruit pathology issues associated with peach production in the southeast. Pages 8-12 in: Proceedings of the 2002 Southeastern Peach Convention.
105. **Brannen, P.M.** and C.J. Chang. 2002. Survey of North Georgia wine grapes for Pierce's disease as related to elevation. *Phytopathology* 92(6):S9.
106. Ferguson, L.M. G.E. Fernandez, **P.M. Brannen**, F.J. Louws, E.B. Poling, O.B. Sydorovych, C.D. Safley, D.W. Monks, Z. Pesic-Van Esbroeck, D.C. Sanders and J.P. Smith. 2001. Alternative soil treatments for strawberry in the southeastern United States. Proceedings of the International Research Conference on Methyl Bromide Alternative and Emissions Reduction. 42/1-42/4.
107. Driver, J.G., L.M. Ferguson, F.J. Louws, G.E. Fernandez, **P.M. Brannen** and E.B. Poling. 2001. Drip vs. shank application of chemical alternatives to methyl bromide. Proceedings of the International Research Conference on Methyl Bromide Alternatives and Emissions Reduction. 87/1-87/2.
108. **Brannen, P.M.** 2001. Fungicidal control of Septoria leaf spot of blueberry in Georgia. *Phytopathology* 91(6):S10.
- † 109. **Brannen, P.M.** 2001. Leaf spots of blueberries, how to identify and control them. Pages 18-19 in: Proceedings of the 10th Biennial Southeastern Blueberry Conference, Savannah, GA, 4-6 January 2001.
- † 110. **Brannen, P.M.** 1998. Commercialization of seed bacterization for biological control of seedling and root diseases. 7th Intl. Congr. Plant Pathol., Edinburgh, UK, Invited Papers Abstracts 5.2.4S.
- † 111. **Brannen, P.M.** 1998. Biological control of wilt pathogens with bacterial antagonists. Proceedings Beltwide Cotton Conferences 1:125.
112. **Brannen, P.M.** 1997. Suppression of *Rhizoctonia solani* by Kodiak®, a *Bacillus subtilis* biocontrol seed treatment. Proceedings Beltwide Cotton Conferences 1:87.
- † 113. **Brannen, P.M.** and D.S. Kenney. 1996. Biological seed treatment as a component in maintaining seedling health. Proceedings Beltwide Cotton Conferences 1:244-247.
114. Brannen, P.M. 1995. Potential modes of action for suppression of root diseases and yield enhancement when using *Bacillus subtilis* seed inoculants on cotton. Proceedings Beltwide Cotton Conferences 1:205-208.
115. **Brannen, P.M.** and P.A. Backman. 1994. Suppression of Fusarium wilt of cotton with *Bacillus subtilis* hopper box formulations. In: Improving Plant Productivity with Rhizosphere Bacteria – Proceedings of the Third International Workshop on Plant Growth-Promoting Rhizobacteria. Eds. Ryder, M.H., P.M. Stephens, and G.D. Bowen. pp. 83-85. CSIRO. Adelaide, South Australia.
116. **Brannen, P.M.** and P.A. Backman. 1994. Rhizosphere colonization patterns observed with two *Bacillus subtilis* seed inoculants of cotton. *Phytopathology* 84:1084.
117. **Brannen, P.M.** and P.A. Backman. 1994. Decrease in *Fusarium oxysporum* f.sp. *vasinfectum* incidence through use of *Bacillus subtilis* seed inoculants. Proceedings Beltwide Cotton Conferences 1:244-245.
118. **Brannen, P.M.** and P.A. Backman. 1994. Decrease in cotton seedling disease through neutralization of acid-delinted seed. Proceedings Beltwide Cotton Conferences 1:250-251.
119. Bauske, E.M., K.M. Harper, **P.M. Brannen**, and P.A. Backman. 1994. Effects of residual acidity from delinting and fungicide seed treatments on colonization of biological control agents. Proceedings Beltwide Cotton Conferences 1:240-243.
120. Backman, P.A., **P.M. Brannen**, and W.F. Mahaffee. 1994. Plant response and disease control following seed inoculation with *Bacillus subtilis*. In: Improving Plant Productivity with Rhizosphere Bacteria – Proceedings of the Third International Workshop on Plant Growth-Promoting Rhizobacteria. Eds. Ryder, M.H., P.M. Stephens, and G.D. Bowen. pp. 3-8. CSIRO. Adelaide, South Australia.
121. **Brannen, P.M.** and P.A. Backman. 1993. Fusarium Wilt Report. In: Report of the Verticillium and Fusarium Wilt Committee-1992. Proceedings Beltwide Cotton Conferences. 1:160.
122. **Brannen, P.M.** and P.A. Backman. 1993. Cotton colonization of *Bacillus subtilis* inoculants to augment seedling disease control and promote season-long root health. Proceedings Beltwide Cotton Conference 1:194-196.
123. Brannen, P.M. and P.A. Backman. 1993. Colonization by *Bacillus subtilis* inoculants to augment seedling disease control and season-long root health of multiple cotton varieties. *Phytopathology* 12:1348.

124. **Brannen, P.M.** and P.A. Backman. 1992. On-farm evaluation of AU-Pnuts; an expert system for control of leaf spot diseases of peanut. *Proceedings of the American Peanut Research and Education Society, Inc.* 24:18.
125. **Brannen, P.M.** and P.A. Backman. 1992. Field validation study of an expert system for control of leaf spot diseases of peanut. *Phytopathology*. 82:496.

f. Extension Publications:

- ** 1. Johnson, K., **P.M. Brannen**, and C. Bock. 2022. Phony Peach Disease. University of Georgia Circular 1253.
- ** 2. Haralson, J., **P.M. Brannen**, and J. Oliver. 2021. Propagating Disease-Free Blueberry Plants from Softwood Cuttings. University of Georgia Bulletin 1540.
- ** 3. Vogel, A, S. Breeden, **P. Brannen**, B. Blaauw, and Cain Hickey. 2020. Grape Sour Rot. University of Georgia Cooperative Extension Circular 1212.
- ** 4. Muscadine Grape Production Guide for the Southeast. 2020. Authors/Editors: M. Hoffmann, C. Hickey, P. Conner, **P.M. Brannen**, H. Burrack, W. Mitchem, B. Cline, P. Perkins-Veazie and B. Poling. North Carolina State AG-94.
- ** 5. Hickey, C., **P.M. Brannen**, B. Blaauw, M. Hoffman, M. Nita, and D. Pfeiffer. 2019. Manejo del Vinedo. University of Georgia Cooperative Extension Circular 1151-SP.
- ** 6. Hickey, C., B. Blaauw, and **P. Brannen**. 2019. Pierce's Disease of Grape – Identification and Management. University of Georgia Cooperative Extension Bulletin 1514.
- ** 7. Hickey, C., **P.M. Brannen**, B. Blaauw, M. Hoffman, M. Nita, and D. Pfeiffer. 2018. Viticulture Management. University of Georgia Cooperative Extension Circular 1151.
- ** 8. Ingram, R., J. Oliver, **P.M. Brannen**, and R. Allen. 2018. Exobasidium leaf and fruit spot of blueberry. University of Georgia Cooperative Extension Circular 1142.
- ** 9. **Brannen, P.M.** and W. Cline. 2017. MyIPM Blueberry App Pathology Section. In collaboration with G. Schnabel, Clemson, University.
- ** 10. Thornton, H. and **P.M. Brannen**. 2008. Diagnostic guide to common home orchard diseases. University of Georgia Cooperative Extension Bulletin B1336.
- ** 11. **Brannen, P.M.**, G. Krewer, B. Boland, D. Horton, and C.J. Chang. 2008. Bacterial leaf scorch of blueberry. University of Georgia Cooperative Extension Circular 922.
- ** 12. **Brannen, P.M.** 2006. Orange felt (orange cane blotch) of blackberry. University of Georgia Cooperative Extension Circular 892.
- ** 13. **Brannen, P.M.** and G. Krewer. 2005. Cane blight of blackberry. University of Georgia Cooperative Extension Circular 894.
- ** 14. Taylor, K.C., **P.M. Brannen**, D.L. Horton, W. Mitchem, and A. Nyczepir. 2004. Peach Orchard Management Calendar for Georgia. University of Georgia Extension Bulletin 1250.
- ** 15. Krewer, G.W., M. Fonseca, **P.M. Brannen**, and D. Horton. 2004. Home garden raspberries and blackberries. University of Georgia Extension Circular 766.
- ** 16. Krewer, G.W., M. Fonseca, and **P.M. Brannen**. 2004. Home garden strawberries. University of Georgia Extension Circular 883.
- ** 17. Krewer, G.W., **P.M. Brannen**, M. Czarnota, D.S. NeSmith. 2003. Calendar for high density southern highbush blueberry production in pine bark beds. University of Georgia Extension Bulletin 1247.

g. Extension Special Bulletins and Miscellaneous Publications:

Note: “Southeast Regional Integrated Management Guides” are peer-reviewed extension publications, supported by a grant from the Southern Region Small Fruits Consortium, and they can be found at www.smallfruits.org under IPM Production Guides. Senior Editorship represents responsibility for initiating and obtaining grant support, format establishment and regional interaction, planning meetings, guide development and review ($\geq 75\%$ responsibility and/or dedicated effort). Commodity Editor or Section Editor responsibility would represent a 10-25% dedicated effort). **Dr. Brannen initiated and directed this regional effort.** The “Southeastern Peach, Nectarine, and Plum Pest Management and Culture Guide” is likewise a peer-reviewed extension publication, for which Senior Editor responsibility represents a 10-25% effort.

- ◇◇ **Brannen, P.M.** 2015-present. Southeast Regional Organic Blueberry Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 1440-01. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Pathology Section Editor <http://www.smallfruits.org>
- ◇◇ **Brannen, P.M.** 2005-present. Southeast Regional Blueberry Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 48. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Pathology Section Editor <http://www.smallfruits.org>
- ◇◇ **Brannen, P.M.** 2005-present. Southeast Regional Brambles Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 47. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Commodity Section Editor <http://www.smallfruits.org>

- ◇◇ **Brannen, P.M.** 2005-present. Southeast Regional Bunch Grape Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 46. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Pathology Section Editor <http://www.smallfruits.org>
- ◇◇ **Brannen, P.M.** 2005-present. Southeast Regional Muscadine Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 45. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Pathology Section Editor <http://www.smallfruits.org>
- ◇◇ **Brannen, P.M.** 2005-present. Southeast Regional Strawberry Integrated Management Guide. Eds. **P.M. Brannen** and P. Smith. University of Georgia Cooperative Extension Service Special Bulletin 44. (*online publication; revised annually and as needed during the year*)
Note: Senior editor and Pathology Section Editor <http://www.smallfruits.org>
- ** **Brannen, P.M.** 2001-present. Integrated Orchard Management Guide for Commercial Apples in the Southeast. Ed. J. Walgenbach. North Carolina Cooperative Extension Service Bulletin AG-572. (*revised and reprinted annually*)
Note: Contributor
- ◇◇ **Brannen, P.M.** 2001-present. Southeastern Peach, Nectarine, and Plum Pest Management and Culture Guide. Eds. D. Horton, **P. Brannen**, B. Bellinger, and D. Ritchie. University of Georgia Cooperative Extension Service Bulletin 1171. (*revised and reprinted annually*)
Note: Contributor (2001-2004), senior publication editor (2005), senior editor (2006-present)
- Brannen, P.M.** 2001-2006. Apple, peach, blueberry, strawberry, bunch grape, and muscadine disease loss estimates. In: Georgia Plant Disease Loss Estimates. Eds. J.L. Williams-Woodward (2001-2004), M.J. Pearce (2005), A. Martinez (2006). University of Georgia Cooperative Extension Service Special Bulletins 41-03 – 41-08. (*revised and reprinted annually*)
- Brannen, P.M.** 2000-2004. Commercial bunch grape IPM guide. In: Georgia Pest Control Handbook. Ed. P. Guillebeau. University of Georgia Cooperative Extension Service Special Bulletin 28. (*revised and reprinted annually*)
- Brannen, P.M.** 2000-2004. Blackberry and raspberry IPM guide. In: Georgia Pest Control Handbook. Ed. P. Guillebeau. University of Georgia Cooperative Extension Service Special Bulletin 28. (*revised and reprinted annually*)
- Brannen, P.M.** 2000-2004. Commercial blueberry insect and disease spray guide. In: Georgia Pest Control Handbook. Ed. P. Guillebeau. University of Georgia Cooperative Extension Service Special Bulletin 28. (*revised and reprinted annually*)
- Brannen, P.M.** 2000-2004. Commercial muscadine grape insect and disease spray guide. In: Georgia Pest Control Handbook. Ed. P. Guillebeau. University of Georgia Cooperative Extension Service Special Bulletin 28. (*revised and reprinted annually*)
- Brannen, P.M.** 2000-2004. Commercial strawberry disease and insect control. In: Georgia Pest Control Handbook. Ed. P. Guillebeau. University of Georgia Cooperative Extension Service Special Bulletin 28. (*revised and reprinted annually*)

2. Research Grants and Gifts

Dr. Brannen's extension and research program has generated a total of **\$2,096,436** in grants and gifts. Funding includes **\$1,051,548** in competitive research grants, **\$387,272** in non-competitive grants, and **\$657,616** in unrestricted industry or commodity gifts.

3. Professional Meetings Attended and Papers Presented at Professional and Learned Societies:

(‡ Indicates invited papers)

- 2022 American Phytopathological Society Meeting; Pittsburg, PA (6-10 Aug). Served as a panel speaker in the special session **“Grower, Extension, and Industry Panel: Bio-fungicides, Advancements in Technology and Challenges to Adoption.”** Nancy Sharma presented co-authored poster **“Investigating QoI and CAA resistance in grape powdery mildew and downy mildew populations in vineyards of the eastern United States and Canada.”** Milan Panth presented co-authored paper **“Prevalence and persistence of oxytetracycline resistant and copper tolerant strains of *Xanthomonas arboricola* pv. *pruni* in peach orchards of the Southeast.”** Kendall Johnson presented a co-authored poster **“Evaluating the accuracy and visual estimation of the incidence of phony peach disease (caused by *Xylella fastidiosa*)”** and a co-authored presentation **“*Xylella fastidiosa*: a re-emerging bacteria of peach”** in the special session **“Plant Foes New and Old.”**
- 2022 Georgia Association of Plant Pathologists Meeting; Savannah, GA (23-25 May). Katherine Martin presented **“Pathogenic nematodes colonizing Georgia wine grapes.”**
- 2022 Xylellaaphile Seminar Presentation; Virtual (26 Apr). Presented **“A brief history of Georgia peach production and phony peach — a dragon that must be slain.”**
- 2022 FRAME Powdery Mildew Grape Meeting; Hood River, OR (6-7 Apr).
- ‡ 2022 Georgia Wine Producers Conference; Virtual (11 Jan). Presented **“Fungicide resistance in powdery and downy mildews, PD-resistant variety disease management, and nematodes.”**
- ‡ 2022 Southeastern Regional Peach Conference; Savannah, GA (6-9 Jan). Presented **“Disease management update for southeastern peach production.”**

- 2021 PD Research Symposium; Virtual (14-15 December).
- 2021 Cumberland-Shenandoah Fruit Workers Conference; Virtual (1-3 December).
- ‡ 2021 Alabama Fruit and Vegetable Growers Association Meeting; Gulf Shores, AL (18-19 November). Presented **“Strawberry pest alert: scouting and managing Neopestalotiopsis,” “Scab disease management update for southeastern peach production,” and “Apple disease management for Alabama.”**
- 2021 Southeastern Professional Fruitworkers Meeting (Virtual). Presented **“Utility of Miravis for peach scab management.”** “Frannie Martin presented co-authored presentation **“Survey results of pathogenic nematodes throughout Georgia wine grapes.”**
- 2021 Regional Small Fruit Guide Meeting; Fletcher, NC (14-16 Jul). (organizer and meeting chair)
- 2021 Georgia Association of Plant Pathologists Meeting; Virtual (12-13 May). Kendall Johnson presented co-authored presentation **“Can you spot the phony?: Detection of phony peach disease in Georgia.”** Brooke Warres presented co-authored presentation **“Fungicide resistance survey of Georgia wine grapes and fungicide efficacy in the presence of a resistant *Erysiphe necator* population.”** Katherine Martin presented co-authored presentation **“Survey and post plant nematode response of pathogenic nematodes on wine grapes in Georgia.”**
- ‡ 2021 Georgia Wine Producers Conference; Virtual (30 Mar). Presented **“Downy and powdery mildew resistance management update.”**
- 2021 Southern Fruit Workers Meeting; Virtual (23-24 Mar). Kendall Johnson presented co-authored presentation **“Phony peach disease in commercial and research peach orchards in the United States.”** Brooke Warres presented a co-authored presentation **“Survey of QoI fungicide resistance in *Erysiphe necator* populations in Georgia.”**
- 2021 Maryland Grape and Wine Industry Annual Conference; Virtual (13 Jan). Presented **“Fungicide resistance management for powdery and downy mildews.”**
- 2021 FRAME Powdery Mildew Grape Meeting; Virtual (23-24 Mar).
- 2021 Southern Division of the American Phytopathological Society Meeting; Virtual (19 Feb). Kendall Johnson presented co-authored presentation **“Spatial analysis of phony peach disease in commercial and research peach orchards in Georgia.”**
- ‡ 2021 Maryland Grape and Wine Industry Annual Conference; Virtual (13 Jan). Presented **“Fungicide resistance management for powdery and downy mildews.”**
- ‡ 2021 Southeastern Regional Peach Conference; Virtual (5 Jan). Presented **“Bacterial spot management with copper and antibiotics.”** Kendall Johnson presented co-authored presentation **“Phony peach disease in southeastern research and commercial orchards.”**
- 2020 Cumberland-Shenandoah Fruit Workers Conference; Virtual (2-3 December). Presented **“Brown rot management and incorporation of new fungicides in Georgia peach spray programs.”** Kendall Johnson presented a co-authored presentation **“Survey of incidence and quick detection of phony peach in the Southeast.”** Brooke Warres presented a co-authored presentation **“Efficacy of fungicides for grape powdery mildew control in the presence of a fungicide-resistant *Erysiphe necator* populations in Georgia.”** Shane Breeden presented a co-authored presentation **“Efficacy and crop safety of minimal-, moderate-, and high-input disease management systems for Pierce’s disease resistant hybrids.”** Katherine Martin presented a co-authored presentation **“Survey of pathogenic nematodes on wine grapes in Georgia.”**
- 2020 Georgia Association of Agricultural Agents Meeting; Virtual (9 November). Nathan Eason presented a co-authored poster **“Evaluation of efficacy and phytotoxicity of Hydroshield applied to Georgia wine grapes for control of sour rot.”**
- 2020 IPM App Meeting; Zoom virtual meeting (6-7 Oct). (Peach Contributor).
- 2020 American Phytopathological Society Meeting; Virtual (10-14 Aug). Will Hemphill presented co-authored posters **“Identification of organisms associated with cane dieback of cultivated blackberry (*Rubus fruticosus*) in Georgia” and “The impact of potassium phosphite on *Cephaleuros virescens* and management of orange cane blotch disease of blackberry (*Rubus fruticosus*).”** Brooke Warres presented co-authored poster **“Field efficacy of fungicides for management of grape powdery mildew in the presence of fungicide-resistant populations of *Erysiphe necator* in Georgia.”** Charlotte Oliver presented co-authored poster **“Grower knowledge and perception of fungicide resistance in U.S. vineyards.”** Clive Bock presented co-authored poster **“*Venturia carpophila*, cause of peach scab – mating type idiomorphs and genetic diversity.”**
- 2020 Regional Small Fruit Guide Meeting; Zoom; (23-26 Jun). (organizer and meeting chair)
- 2020 Georgia Association of Plant Pathologists Meeting; Augusta, GA (9-11 Mar). Kendall Johnson presented **“Molecular detection and visual estimation of the incidence of phony peach disease in Georgia.”**
- 2020 FRAME Powdery Mildew Grape Meeting; Napa, CA (11-13 Mar). Brooke Warres presented **“National powdery mildew survey for QoI resistance.”**
- 2020 Hedgerow Workshop; Lodi, CA (10 Mar).
- ‡ 2020 Southeast Virginia Fruit and Vegetable Conference; Suffolk, VA (27 Feb). Presented **“Peach and apple disease control update.”**
- ‡ 2020 Georgia Wine Producers Conference; Braselton, GA (4 Feb). Shane Breeden and Brooke Warres presented co-authored presentation **“Downy and powdery mildew resistance management.”**
- ‡ 2020 Southeastern Regional Peach Conference; Savannah, GA (10-11 Jan). Presented **“Peach disease management update.”**
- 2019 Alabama Fruit and Vegetable Growers Association Meeting; Clanton, AL (20-22 November). Presented the keynote address **“Challenges and opportunities in the future of the fruit and vegetable industry”** and **“Scab and brown rot management update for southeastern peach production.”**

- 2019 Georgia Association of Agricultural Agents Meeting; Dublin, GA (6 November). Thad Glenn presented a co-authored poster **“Efficacy of a single late-dormant application of mineral oil plus chlorothalonil for control of peach scab, caused by *Venturia carpophila*.”**
- 2019 Southeastern Professional Fruitworkers Conference; Tifton, GA (5-7 November). Presented **“Update on fungicide resistance in downy and powdery mildew diseases of grape in Georgia.”** Shane Breeden presented co-authored paper **“Brown rot and scab trial results from Georgia.”** Will Hemphill presented co-authored paper **“Impact of potassium phosphite on orange cane blotch of blackberry.”** Renee Allen presented co-authored paper **“Understanding and mitigating *Botryosphaeria* stem blight and crown dieback of blueberry.”**
- 2019 IPM App Meeting; Clemson, SC (8-9 Oct). (Peach Contributor).
- 2019 American Phytopathological Society Meeting; Cleveland, OH (2-7 Aug). Presented poster **“Fungicide sensitivity and efficacy profiling of Georgia *Plasmopara viticola* isolates causing grapevine downy mildew.”** Ganpatti Jagdale presented co-authored poster **“Occurrence and distribution of plant-parasitic nematodes of muscadine grapes in Georgia and North Carolina.”** Clive Bock presented co-authored poster **“Tractor speed and concentration of active ingredient affect the incidence and severity of scab on peach fruit.”**
- 2019 Regional Small Fruit Guide Meeting; Fletcher, NC (17-18 Jul). (organizer and meeting chair)
- ‡ 2019 Florida Grape Meeting; Citra, FL (16 Jul). Presented **“Disease management in muscadines and Pierce’s disease resistant hybrids.”**
- 2019 National Viticulture and Enology Extension Leadership Conference; Fredericksburg, TX (7-10 April).
- 2019 Georgia Association of Plant Pathologists Meeting; Savannah, GA (11-13 Mar). Sarah Campbell presented **“Fungicide sensitivity and efficacy profiling of Georgia *Plasmopara viticola* isolates causing grapevine downy mildew.”** Will Hemphill presented **“Orange cane blotch of blackberry: disease cycle insights and management using potassium phosphate.”**
- 2019 FRAME Powdery Mildew Grape Meeting; Prosser, WA (27-29 Feb).
- ‡ 2019 South Carolina Strawberry Meeting; Spartanburg, SC (21 Feb). Presented **“Strawberry Disease Management.”**
- 2019 Southern Division of APS Meeting; Gainesville, FL (7-9 Feb). Will Hemphill presented **“New insights into the disease cycle of orange cane blotch of blackberry and its management using potassium phosphite.”**
- ‡ 2019 Georgia Wine Producers Conference; Braselton, GA (4-5 Feb). Presented **“Powdery and Downy Mildews – Identification, Management and Fungicide Resistance Issues.”** Brett Blaauw presented co-authored paper **“Preliminary results from sour rot trials in Chardonnay.”**
- ‡ 2019 Southeastern Regional Peach Conference; Savannah, GA (11-13 Jan). Presented **“Scab and brown rot management: tweaking the programs.”**
- ‡ 2019 Southeastern Regional Muscadine Conference; Savannah, GA (11-13 Jan). Presented **“The state of the art in muscadine disease management.”**
- ‡ 2019 Southeastern Apple Meeting; Asheville, NC (8-9 Jan). Presented **“Useful tidbits for apple disease management - a review of recent apple disease control information generated in Georgia.”**
- 2018 Georgia County Agents Association Meeting; Lake Lanier, GA (5-7 November). Nathan Eason presented **“Downy Mildew Fungicide Resistance in *Vitis vinifera* Wine Grapes in the Blue Ridge Mountains.”**
- 2018 Southeastern Professional Fruitworkers Conference; Manchester, TN (23-25 October). Presented **“Fungicide sensitivity profiling of grapevine downy mildew in Georgia.”**
- 2018 National Association of Blueberry Research and Extension Workers Conference; Orono, ME (12-15 August). Renee Allen presented co-authored paper **“Understanding and mitigating *Botryosphaeria* stem blight and crown dieback in blueberry.”**
- 2018 International Congress of Plant Pathology; Boston, MA (29 Jul – 3 Aug). Presented poster **“Management of bitter rot of apple under optimal conditions for disease development in Georgia orchards.”** Ganpatti Jagdale presented co-authored poster **“Occurrence and distribution of plant-parasitic nematodes of blueberry in Georgia.”** ChengFang Hong presented co-authored poster **“Phylloxera galls as *Plasmopara viticola* infection and sporulation sites on leaves of grapevines partially resistant to downy mildew.”**
- 2018 Regional Small Fruit Guide Meeting; Fletcher, NC (18-19 Jul). (organizer and meeting chair)
- ‡ 2018 Arkansas Peach Workshops; Clarksville, AR (12 July). Presented **“A review of the major peach spot diseases, scab and bacterial spot, and their management.”**
- ‡ 2018 Michigan Peach Conference; remote presentation to Benton Harbor, MI (13 Mar). Presented **“Peach disease management.”**
- 2018 Georgia Association of Plant Pathologists Meeting; Hiawassee, GA (12-14 Mar).
- ‡ 2018 Tennessee Farm Winegrowers Alliance Meeting; Chattanooga, TN (16-17 Feb). Presented **“Disease management in grapes”** and **“Vineyard spray program optimization.”**
- ‡ 2018 Southeastern Regional Blueberry Conference; Savannah, GA (11-14 Jan). Presented **“The current status of disease management challenges for the southeastern blueberry industry.”**
- ‡ 2018 Southeastern Regional Peach Conference; Savannah, GA (11-14 Jan). Presented **“Stressed out over peaches: challenges from 2017,” “Peach disease management and expectations for 2018,”** and **“Tweaking the programs: scab and bacterial spot management.”**
- ‡ 2018 Southeastern Apple Meeting; Asheville, NC (9-10 Jan). Presented **“Bitter rot of apple: the good, the bad, and the ugly.”**
- 2017 Georgia Association of County Agents Meeting; Columbus, GA (6-8 Nov). Michasia Dowdy presented co-authored presentation **“Efficacy of fungicides for management of peach rust, *Tranzschelia discolor*, in south**

Georgia.” [Third place in presentation competition]. Will Lovett presented co-authored poster “Efficacy of fungicides for management of blueberry rust.” [Second place in the poster competition].

2017 IPM App Meeting; Clemson, SC (10 Oct). (Blueberry and Blackberry Contributor).

2017 Southeastern Professional Fruitworkers Conference; Mills River, NC (3-5 Oct). Michasia Dowdy presented co-authored presentation “Efficacy of fungicides for management of peach rust, *Tranzschelia discolor*, in south Georgia.”

2017 American Phytopathological Society Meetings, San Antonio, TX (5-10 Aug). R. Ingram presented co-authored poster “Efficacy of fungicide-based management of blueberry rust in southern Georgia.” H. Scherm presented co-authored poster “Non-target effects of horticultural and pest management practices in fall and winter on development of *Exobasidium* leaf and fruit spot of blueberry.” C. Chen presented co-authored paper “Characterization of microsatellites from a genome of *Venturia carpophila*.” T. Glenn presented co-authored poster “Efficacy of a single late-dormant application of mineral oil plus chlorothalonil for control of peach scab, caused by *Venturia carpophila*.”

2017 Regional Small Fruit Guide Meeting; Fletcher, NC (2-3 Aug). (organizer and meeting chair)

2017 8th International Workshop on Grapevine Downy and Powdery Mildew; Portland, OR (17-19 July). Cheng-fang Hang presented co-authored posters “Who can swim? A new approach for determining sporangia viability of *Plasmopara viticola*” and “Epidemiology and population biology of grape downy mildew (*Plasmopara viticola*)”

2017 Georgia Association of Plant Pathologists Meeting; Jekyll Island, GA (6-8 Mar).

‡ 2017 Ontario Fruit and Vegetable Convention; Niagara Falls, Ontario, Canada (21-23 Feb). Presented “Integrated disease management in peaches – how to get more for your fungicide buck.”

2017 Southeastern Apple Meeting; Asheville, NC (10-11 Jan).

‡ 2017 Southeastern Strawberry Conference; Savannah, GA (7-8 Jan). Presented “Methods for minimizing fungicide resistance in plasticulture strawberry systems.”

‡ 2017 Southeastern Raspberry and Blackberry Conference; Savannah, GA (7-8 Jan). Presented “Rust and cane blight: major disease challenges for southeastern blackberries.”

‡ 2017 Southeastern Regional Blueberry Conference; Savannah, GA (6-7 Jan). Presented “The current status of disease management for the southeastern blueberry industry.” Russell Ingram presented co-authored paper “Efficacy of fungicides for management of blueberry rust.”

2016 Alabama Fruit and Vegetable Conference; Clanton, AL (17 Nov). Presented “Sprayers and Sprayer Use for Disease Management in the Southeast.”

2016 Plant Center Retreat; Unicoi State Park, Helen, GA (27 Oct). Cheng-Fang Hong presented co-authored poster “Who can swim? Proof of concept for a novel method to determine sporangia viability of a phytopathogenic oomycete.”

2016 IPM App Meeting; Clemson, SC (11 Oct). (Blueberry Section Organizer)

2016 Southeastern Professional Fruitworkers Conference; Gainesville, FL (4-6 Oct). Rene Allen presented co-authored presentation “Plant disease considerations associated with mechanical harvesting and hedging of blueberries.”

‡ Russel Ingram presented co-authored presentation “Efficacy of fungicides for management of blueberry rust.”

‡ 2016 VI Simposio Nacional y V Internacional de Bacterias Fitopatógenas y II Simposio de bacterias benéficas de las plantas, Guadalajara, Jalisco, Mexico (21-24 Sep). Presented “Leaf scorch, caused by the bacterium *Xylella fastidiosa*, and other diseases of potential importance to maturing blueberry systems in Mexico.”

2016 American Phytopathological Society Meetings, Tampa, FL (29 Jul-4 Aug). F. Browne presented co-authored poster “Yield loss and management of orange cane blotch of blackberry, caused by the alga *Cephaleuros virescens*.”

M. Dowling presented a co-authored poster “Effect of fungicide applications on *Monilinia fructicola* population diversity and transposon movement.” C. Hong presented a co-authored presentation “Epidemiology and population biology of grape downy mildew.”

2016 Regional Small Fruit Guide Meeting; Fletcher, NC (22-23 Jul). (organizer and meeting chair)

2016 XI International Vaccinium Symposium; Orlando, FL (12-13 Apr). Renee Allen presented co-authored paper “Management of *Exobasidium* leaf and fruit spot disease of blueberry in the southeastern United States.”

2016 Georgia Association of Plant Pathologists Meeting; Amicalola Falls, GA (7-9 Mar). Frances Browne presented co-authored paper “Management of orange cane blotch of blackberries, caused by the alga *Cephaleuros virescens*, and a review of yield losses associated with the disease.”

2016 National Raspberry and Blackberry Association Conference; Williamsburg, VA (3 Mar). Frances Browne presented co-authored paper “Evaluation of algicides, disinfectants and fungicides for management of orange cane blotch of blackberries, caused by the alga *Cephaleuros virescens*, and yield losses associated with the disease.”

‡ 2016 North Carolina Blackberry Meeting; Shelby, NC (19 Feb). Presented “Blackberry disease management.”

‡ 2016 Southeastern Raspberry and Blackberry Conference; Savannah, GA (7-8 Jan). Presented “Basics of blackberry disease management.” Frances Browne presented co-authored paper “Algicides and fungicides for management of orange cane blotch.”

‡ 2016 Southeastern Regional Blueberry Conference; Savannah, GA (8-9 Jan). Presented “Georgia blueberry pathology update.”

‡ 2016 Southeastern Regional Peach Conference; Savannah, GA (8-9 Jan). Presented “Brown rot and scab management update.”

‡ 2015 Alabama Fruit and Vegetable Association Conference, Clanton, AL (19-20 Nov). Presented “Emerging disease-management issues in fruit production.”

- ‡ 2015 Southeastern United Grape and Wine Symposium, Dobson, NC (4-5 Nov). Presented **“Electrostatic spraying: where does it fit in southeastern wine grape production?”**
- 2015 Georgia County Agents Association Meeting, Tifton, GA. (2 Nov). Clark McAllister presented co-authored poster **“Evaluation of pruning methods to control bud break in *Vitis vinifera* wine grapes.”**
- 2015 Southeastern Professional Fruitworkers Conference, Montgomery, AL (6-8 Oct). Presented **“Management of Exobasidium leaf and fruit spot of blueberry.”**
- ‡ 2015 Clemson University Plant Pathology Seminar Series, Clemson, SC (21 Sep). Presented **“Extension fruit pathology in Georgia: a case study in outreach and technology transfer in the 21st century.”**
- ‡ 2015 Florida Fall Peach Seminar, Wimauma, FL (17 Sep). Presented **“Peach disease management”** and **“Peach tree shortlife.”**
- 2015 American Phytopathological Society Meetings, Pasadena, CA (1-5 Aug). Presented **“Efficacy of late-dormant calcium polysulfide applications for control of Exobasidium leaf and fruit spot of blueberry.”** S. Bolton presented co-authored poster **“A *Fusarium fujikuroi* population isolated from grapes reveals the need to re-evaluate the species fumonis production potential.”** G. Jagdale presented a co-authored poster **“Management of blueberry, *Vaccinium* spp. replant disease with pine bark soil amendment and pre-plant fumigation.”** Presided over the **“Small Fruits Diseases Breakfast.”**
- 2015 Regional Small Fruit Guide Meeting; Fletcher, NC (22-23 Jul). (organizer and meeting chair)
- 2015 54th Annual Meeting of the Society of Nematologists; East Lansing, MI (19-24 Jul). Ganpatti Jagdale presented **“Fluensulfone for management of *Mesocriconema xenoplax* on peach.”**
- 2015 XI International Rubus and Ribus Symposium; Asheville, NC (21-24 June). Moderated the **“Healthful Harvest: Diseases Session.”** Frances Browne presented **“Assessment of algicides, disinfectants and fungicides for control of orange cane blotch caused by the alga *Cephaleuros virescens*.”**
- 2015 ASEV Meeting; Portland, OR (15-18 June). Stephanie Bolton presented **“Mycotoxin potential in high-risk American *Vitis vinifera* vineyards and wines.**
- 2015 13th European Fusarium Seminar; Martina Franca, Italy (10-14 May). Stephanie Bolton presented **“Analysis of the mycotoxigenic fungi associated with southeastern U.S. winegrapes reveals a large population of *Fusarium fujikuroi* isolates producing high levels of fumonisins.”**
- ‡ 2015 IPM Lecture Series; Università Cattolica del Sacro, Piacenza, Italy, (5 May). Presented **“Overview of the Georgia Wine Grape Industry and Disease Issues.”**
- ‡ 2015 Berry Marketing and Production Conference; Virginia State University, Petersburg, VA, (13 Mar). Presented **“Blueberry and blackberry disease management.”**
- 2015 Georgia Association of Plant Pathologists Meeting; Savannah, GA (10-11 Mar). Stephanie Bolton presented co-authored paper **“Occurrence of mycotoxigenic *Fusarium* spp. on *Vitis vinifera* winegrapes in the southeastern United States.”**
- ‡ 2015 Florida Spring Blueberry Short Course (17 Feb). Presented **“New disease issues in Georgia that may impact Florida growers.”**
- 2015 Southern Division of the American Phytopathological Society Meetings (1-3 Feb).
- ‡ 2015 Southern Association of Agricultural Scientists Horticultural Sciences Meeting (30 Jan – 3 Feb). Presented **“New blueberry disease issues in Georgia”** in the blueberry session.
- 2015 Southeastern Apple Growers Meeting; Asheville, NC (13-14 Jan).
- ‡ 2015 Southeastern Raspberry and Blackberry Conference; Savannah, GA (8-9 Jan). Presented **“Caneberry disease update.”**
- ‡ 2015 Southeastern Regional Blueberry Conference; Savannah, GA (8-9 Jan). Presented **“Organic blueberry disease management.”**
- 2014 GACAA Meeting, Statesboro, GA (5 Nov). Ben Shirley presented co-authored poster **“Efficacy of late-dormant fungicide applications for control of Exobasidium leaf and fruit spot of blueberry in Georgia.”**
- ‡ 2014 University of Arkansas Plant Pathology Seminar Series, Fayetteville, AR (30 Sep). Presented **“Extension fruit pathology in Georgia: a case study in outreach and technology transfer in the 21st century.”**
- ‡ 2014 Georgia Olive Growers Meeting, Lakeland, GA (25 Sep). Presented **“2014 olive survey results.”**
- 2014 Southeastern Professional Fruit Workers Conference, Clemson, SC (15-17 Sep). Presented **“Control of Exobasidium leaf and fruit spot of blueberry with calcium polysulfide products applied during the late dormant phenology.”** Renee Holland presented co-authored paper **“Initial identification of issues with spray coverage in South Georgia blueberries.”**
- 2014 Bacterial Challenges Mini-Summit, Atlanta, GA (11 Sep).
- ‡ 2014 American Phytopathological Society Meetings, Minneapolis, MN (9-13 Aug). Presented **“The endocrine disruptor screening program and a potential relationship to future plant disease control efforts”** in the Special Session, **EPA’s Endocrine Disruptor Screening Program and Its Relationship to Plant Protection Products.** C. Bock presented co-authored paper **“Characteristics of genetic variability among isolates of *Fusicladium* species from peach, almond and pecan in the USA.”**
- 2014 Regional Small Fruit Guide Meeting; Fletcher, NC (6-7 Aug). (organizer and meeting chair)
- 2014 North American Blueberry Research and Extension Workers Conference (23-24 Jun). Bill Cline presented co-authored paper **“Exobasidium leaf and fruit spot of blueberry in the southeastern United States.”** Renee Holland presented co-authored paper **“Initial identification of issues with spray coverage in south Georgia blueberries.”**
- 2014 Georgia Association of Plant Pathologists Meeting; Helen, GA (11-12 Mar).

- ‡ 2014 North Carolina Winegrowers Association Conference; Winston Salem, NC (30 Jan - 2 Feb). Presented **“Vineyard spray program optimization”** and **“Spray technology and chemical advances.”**
- ‡ 2014 48th Annual North Carolina Blueberry Council Meeting; Clinton, NC (14-15 Jan). Presented **“New and emerging blueberry diseases in the southeastern U.S.”** and **“Research on Exobasidium leaf and fruit spot in Georgia.”**
- ‡ 2014 North American Raspberry and Blackberry Conference; Savannah, GA (10-12 Jan). Presented **“Cane diseases and their management.”**
- ‡ 2014 Southeastern Regional Blueberry Conference; Savannah, GA (10-12 Jan). Presented **“Blueberry diseases in 2013: an overview.”** Harald Scherm presented co-authored paper **“Exobasidium: Georgia research and learning points.”**
- ‡ 2014 Southeastern Regional Peach Conference; Savannah, GA (10-12 Jan). Presented **“Report of peach scab trials from three states.”**
- ‡ 2014 Southeastern Regional Muscadine Conference; Savannah, GA (10-12 Jan). Presented **“Disease management update for muscadines in the Southeast.”**
- 2013 Georgia Association of County Agents Meeting; Lake Lanier Island, GA (5 Nov). F. Connelly presented co-authored paper **“Mummy berry disease suppression in rabbiteye blueberries.”**
- ‡ 2013 Georgia Geological Society Field Meeting; Dahlonega, GA (11-13 Oct). Presented **“A brief history of vinifera wine grape production in Georgia.”**
- 2013 Southeastern Professional Fruit Workers Conference; Athens, GA (17-19 Sep). **Conference Organizer.** Presented **“Strange but true: multi-state peach scab trial results from the Southeast”** and **“Vinifera wine grapes in Georgia: history, challenges, and opportunities.”** F. Connelly presented co-authored paper **“Mummy berry management in rabbiteye blueberry with chemical and organic fungicides.”** H. Scherm presented co-authored paper **“Exobasidium leaf and fruit spot of blueberry reaching epidemic proportions.”**
- 2013 American Phytopathological Society Meetings, Austin, TX (10-14 Aug.). Presented **“Prevalence of grapevine (*Vitis vinifera*) viruses in Georgia.”** A. Nyczepir presented co-authored paper **“Management of *Meloidogyne incognita* with tall fescue grass rotations prior to peach orchard establishment.”**
- 2013 Regional Small Fruit Guide Meeting; Fletcher, NC (31 Jul-1 Aug). (organizer and meeting chair)
- ‡ 2013 American Peanut Research and Education Society Meetings; Blairsville, GA (8 Jul). Presented **“Wine grape diseases and their historical impact on peanut disease management.”**
- ‡ 2013 University of Florida Stone Fruit Field Day; Citra, FL (18 Apr). Presented **“Peach Disease Update.”**
- 2013 Fungal Genetics Conference; Pacific Grove, CA (12-17 Mar). M.T. Brewer presented co-authored poster, **“Evolutionary history and genetic diversity of an emerging fungal disease of blueberry.”**
- 2013 Georgia Association of Plant Pathologists Meeting; Jekyll Island, GA (12-13 Mar).
- ‡ 2013 North American Raspberry and Blackberry Conference; Savannah, GA (10-13 Jan). Presented **“Orange rust in canberries”** and **“Disease CSI: the process of turning mysterious symptoms into positive identification.”**
- ‡ 2013 Southeastern Regional Blueberry Conference; Savannah, GA (10-13 Jan). Presented **“Field ID of blueberry diseases.”** Harald Scherm presented co-authored paper **“Exobasidium update.”**
- ‡ 2013 Southeastern Regional Peach Conference; Savannah, GA (10-13 Jan). Presented **“Effective strategies to combat scab”** and **“Effective strategies to combat brown rot.”**
- 2012. Southeastern Professional Fruit Workers Conference; Clarksville, AR (22-25 Oct). Presented **“Bacterial diseases of blueberry in the Southeast.”**
- ‡ 2012. IV National Symposium /III International plant pathogenic bacteria/Minisymposium HLB in citrus; Guadalajara, Mexico (24-26 Sep). Presented **“Bacterial diseases of blueberry.”**
- ‡ 2012 WERA-20: Virus and Virus-like Diseases of Fruit Trees, Small Fruits, and Grapevines; Clemson, SC (18-20 Sep). Presented **“2012 Georgia virus disease report”** and co-organized the **“North Georgia grape virus diseases tour.”**
- 2012 Regional Small Fruit Guide Meeting; Fletcher, NC (15-16 Aug). (organizer and meeting chair)
- 2012 American Phytopathological Society Meetings, Providence, RI (4-8 Aug).
- ‡ 2012 Fungicide Resistance Development in North America for the 21st Century Workshop; Providence, RI (3-4 Aug). Presented **“Fungicide resistance in stone fruit.”**
- 2012 Georgia Association of Plant Pathologists Meeting; Dillard, GA (13-14 Mar).
- ‡ 2012 Southeastern Regional Peach Conference; Savannah, GA (6-8 Jan). Presented **“A discussion of peach scab and new chemistries for brown rot control.”**
- ‡ 2012 Southeastern Regional Blueberry Conference; Savannah, GA (6-8 Jan). Presented **“Necrotic ring blotch and red ringspot virus.”** Jim Noe presented co-authored paper **“Blueberry nematodes update.”**
- ‡ 2011 Florida Blueberry Growers Symposium. Plant City, FL (1 Nov). Presented **“Blueberry disease management”** and **“New and emerging blueberry diseases in the southeastern United States.”**
- 2011 Regional Small Fruit Guide Meeting; Fletcher, NC (3-4 Aug). (organizer and meeting chair)
- 2011 Georgia Association of Plant Pathologists Meeting; Callaway Gardens, GA (15-16 Mar).
- ‡ 2011 Sunny Ridge Conference; Orlando, FL (14-16 Jan). **“New disease control information for the blueberry industry.”**
- ‡ 2011 Atlantic Coast Ag Convention; Atlantic City, NJ (11-13 Jan). **“Bacterial leaf scorch of blueberry: an emerging disease of blueberry and potential for spread.”**
- ‡ 2011 Southeastern Regional Blueberry Conference; Savannah, GA (7-9 Jan). Presented **“Blueberry necrotic ring blotch, viruses, and Xylella update.”** Elvin Andrews presented co-authored paper **“Experiments with replanting blueberry sites in south Georgia.”**
- ‡ 2011 North American Raspberry and Blackberry Conference; Savannah, GA (6-7 Jan). Presented **“Disease challenges for the blackberry and raspberry industries.”**

- 2010 Georgia Association of County Agents Meeting; Athens, GA (8-10 Nov). E. Andrews presented co-authored paper **“Response of rabbiteye blueberries to fumigation in replant sites as associated with ring nematode populations.”**
- 2010 Southern Professional Fruitworkers Conference; Fletcher, NC (13-14 Oct). Presented **“Copper applications in peach cover sprays: the truth be told.”**
- ‡ 2010 Clemson University Seminar; Clemson, SC (27 Sep). Presented **“Development of extension programs in Georgia to address the needs of the blueberry industry.”**
- 2010 American Phytopathological Society Meetings, Charlotte, NC (7-9 Aug.). Presented **“Phytotoxicity danger of phosphorous acid generating fungicides and fertilizer products applied to blueberry and grapes.”** D. Hopkins presented co-authored paper **“Biological control with *Xylella fastidiosa* strain EB92-1 for the prevention of Pierce’s disease development in mature, producing grapevines.”**
- 2010 Regional Small Fruit Guide Meeting; Fletcher, NC (27-28 Jul). **(organizer and meeting chair)**
- ‡ 2010 Auburn University Seminar; Auburn, AL (12-13 Apr). Presented **“Blueberry extension plant pathology in Georgia: addressing the disease-control needs of a rapidly developing commodity.”**
- 2010 Georgia Association of Plant Pathologists Meeting; Savannah, GA (9-11 Mar).
- ‡ 2010 Southern Division of the American Phytopathological Society Meeting; Orlando, FL (6-7 Feb). Presented **“Bacterial leaf scorch of blueberries: a new threat to the southeastern industry”** in the symposium **“The enemy within: current status and future outlook for diseases caused by fastidious vascular plant pathogens.”**
- ‡ 2010 Southeastern Regional Strawberry Conference; Savannah, GA (9-10 Jan). Presented **“Phytophthora crown and root rot control.”**
- ‡ 2010 Southeastern Regional Blueberry Conference; Savannah, GA (9-10 Jan). Presented co-authored papers with D. Horton **“Update on *Xylella* in blueberries”** and **“Low cost pest control programs for blueberries.”**
- 2010 Southeastern Peach Convention; Savannah, GA (8-10 Jan). Presented co-authored paper with G. Schnabel **“Brown rot management and survey results.”**
- 2009 Southern Professional Fruitworkers Conference, Clemson, SC (21-22 Oct). Presented **“Current state of *Monilinia fructicola* fungicide resistance throughout Georgia and implications for new fungicides.”** G. Schnabel presented co-authored paper **“Introduction to the ‘Profile’ resistance management program.”**
- 2009 Regional Small Fruit Guide Meeting; Fletcher, NC (11-12 Aug). **(organizer and meeting chair)**
- ‡ 2009 American Phytopathological Society Meetings, Portland, OR (2-4 Aug). Coordinated and moderated the symposium **“Challenges for Managing Insect-Vectored Diseases.”** Presented **“Expansion of *Xylella fastidiosa* into blueberries in Georgia and Florida.”** A. Amiri presented co-authored paper **“Resistance to respiration inhibitor fungicides in *Monilinia fructicola* field isolates from South Carolina and Georgia.”** L. Nissen presented co-authored paper **“*Xylella fastidiosa* strains causing bacterial leaf scorch of blueberry in Georgia are genetically distinct from those causing Pierce’s disease of grape.”**
- 2009 Georgia Association of Plant Pathologists Meeting; St. Simons Island, GA (10-11 Mar).
- ‡ 2009 Southeastern Regional Blueberry Conference; Savannah, GA (8-11 Jan). Presented **“Update on bacterial leaf scorch (*Xylella*) in southern highbush blueberries and cultivar field resistance.”**
- 2008 Pierce’s disease symposium; San Diego, CA (17 Dec). D. Hopkins presented co-authored paper **“Biological control of Pierce’s disease: influence of grape genotype, plant growth stage, and geographic location.”**
- 2008 GACAA Annual Meeting; Gainesville, GA (17-19 Nov). J. Jacobs presented co-authored poster **“A new challenge for southern highbush growers: bacterial leaf scorch (*Xylella fastidiosa*).”**
- ‡ 2008 Sunny Ridge Grower Conference; Orlando, FL (17-19 Oct); Presented **“Update on blackberry and blueberry disease management.”**
- 2008 Southern Professional Fruitworkers Conference (22-23 Oct). Harald Scherm presented co-authored paper **“Prevalence and significance of blueberry red ringspot virus and other, new systemic diseases in southern blueberries.”** Jeremy Haralson presented co-authored paper **“Chemical control of *Cylindrocladium* stem and root rot in blueberry propagation systems.”** Dan Horton presented co-authored paper **“Preliminary survey of leafhopper species in Georgia southern highbush blueberries.”** Achour Amiri presented co-authored paper **“Update on resistance monitoring in *Monilinia fructicola* to three key fungicides in the Southeast.”**
- 2008 Regional Small Fruit Guide Meeting; Fletcher, NC (12-13 Aug). **(organizer and meeting chair)**
- 2008 American Phytopathological Society Meetings, Minneapolis, MN (25-30 Jul); Presented co-authored paper with Kathy Taylor, Achour Amiri, Guido Schnabel, Michael Hotchkiss, and Chuck Reilly **“Evolving management strategies for *Monilinia fructicola* populations with reduced sensitivity to DMIs in Georgia and implication for brown rot control recommendations.”** Achour Amiri presented co-authored papers **“Monitoring resistance in *Monilinia fructicola* populations in the southeastern United States for enhanced brown rot control in peach”** and **“Development of a selective medium for recovery of *Monilinia fructicola* from peach fruit.”** Jeremy Haralson presented co-authored paper **“Efficacy of fungicides for suppressing *Cylindrocladium* stem and root rot of blueberry in Georgia.”**
- 2008 9th International Vaccinium Symposium; Portland, OR (13-16 Jul). Presented co-authored paper with Scott NeSmith and Phil Harmon **“Utility of phosphonate fungicides for management of *Phytophthora* root rot of blueberry.”**
- 2008 Georgia Association of Plant Pathologists Meeting; Amicalola Falls State Park and Lodge, GA (10-12 Mar). Jeremy Haralson presented co-authored paper **“Chemical control of *Cylindrocladium* stem and root rot in blueberry propagation systems.”**
- ‡ 2008 Southeastern Regional Blueberry Conference; Savannah, GA (10-13 Jan). Presented **“Suggestions for controlling *Xylella* (bacterial leaf scorch) in blueberries.”**

- 2008 Southeastern Peach Convention; Savannah, GA (10-13 Jan). Simon Scott presented co-authored paper “**Virus testing program: mission and management.**” Guido Schnabel presented co-authored paper “**Approaches to brown rot resistance management.**”
- 2008 Southeastern Fruit and Vegetable Conference; Savannah, GA (10-13 Jan). R.J. Byrne presented co-authored poster “**Discovering new tools for mayhaws: Thomas County research.**”
- 2007 Southern Professional Fruit Workers Conference; Byron, GA (24-26 Oct). Presented “***Monilinia fructicola* resistance management options – where do we go from here?**” H. Scherm presented co-authored paper “**Occurrence and prevalence of foliar diseases on blueberry in Georgia.**”
- ‡ 2007 Sunny Ridge Grower Conference; Orlando, FL (28-30 Sep); Presented “**Bacterial scorch of blueberry**” and “**Black and blue root disease solutions.**”
- 2007 Regional Small Fruit Guide Meeting; Fletcher, NC (14-15 Aug). (organizer and meeting chair)
- 2007 American Phytopathological Society Meetings, San Diego, CA (28 Jul-1 Aug); Presented co-authored paper with Scott NeSmith and Phil Harmon “**Use of phosphonates for control of *Phytophthora* root rot of blueberry.**” Achour Amiri presented co-authored paper “**Accuracy of three new agar-based assays to assess fungicide sensitivity in *Monilinia fructicola*.**” C.J. Chang presented co-authored paper “**Bacterial leaf scorch of blueberry: a new disease caused by *Xylella fastidiosa*.**”
- ‡ 2007 Georgia Association of Plant Pathologists Meeting; Fort Gaines, GA (12-14 Mar); Presented “**Disease management issues for *Vinifera* wine grapes in north Georgia.**”
- 2007 Southern Region of the American Society for Horticultural Sciences Annual Meeting; Mobile, AL (2-4 Feb). Kathy Taylor presented co-authored paper “**Preliminary assessment of captan impact on fruit finish.**”
- 2007 Southeastern Apple Growers Meeting; Asheville, NC (10-11 Jan).
- ‡ 2007 Southeastern Strawberry Conference; Savannah, GA (5-7 Jan). Presented “**Preventive maintenance of diseases of strawberry.**”
- ‡ 2007 Southeastern Blueberry Conference; Savannah, GA (5-7 Jan). Presented co-authored paper with Scott NeSmith “**Use of Phosphite fungicides for control of blueberry root rot diseases in Georgia.**”
- ‡ 2007 Southeastern Bramble Conference; Savannah, GA (4-7 Jan). Presented “**Current disease control issues for blackberry in the Southeast.**”
- 2007 RAMP Stakeholder Meeting; Savannah, GA (4 Jan).
- ‡ 2007 Southeastern Peach Convention; Savannah, GA (5-7 Jan). Presented co-authored paper with G. Schnabel “**Brown rot and DMI fungicide resistance update.**” Simon Scott presented co-authored paper “**Plum Pox Virus – status and regulations**” and acted as discussion leader.
- 2006 Southern Professional Fruit Workers Conference; Fletcher, NC (23-24 Oct). Presented “**Management options for DMI-resistant *Monilinia fructicola* populations in Georgia peach orchards.**” A. Amiri presented co-authored paper “**Development and evaluation of field technique to monitor fungicide sensitivity in *Monilinia fructicola* populations.**” K. Taylor presented co-authored paper “**The effect of captan on fruit finish.**”
- 2006 Regional Small Fruit Guide Meeting; Fletcher, NC (15-16 Aug). (organizer and meeting chair)
- 2006 American Phytopathological Society Meetings, Quebec City, Quebec (28 Jul-2 Aug); Presented co-authored paper with G. Schnabel, “**A survey for *Monilinia fructicola* populations with reduced sensitivity to DMIs in Georgia and implications for brown rot control recommendations in the Southeast.**”
- 2006 10th North American Blueberry Research & Extension Worker’s Conference; Tifton, GA (4-6 Jun); Presented “**Use of phosphite fungicides for control of blueberry diseases in Georgia.**”
- 2006 Georgia Association of Plant Pathologists Meeting; Lake Lanier Islands, GA (13-14 Mar); Presented “***Monilinia fructicola* resistance to DMI fungicides and implications for brown rot control recommendations in Georgia.**”
- 2006 Statewide Extension Professionals Conference; Rock Eagle, GA (18-19 Jan).
- ‡ 2006 North American Bramble Growers Association Meeting; Savannah, GA (5-8 Jan). Presented “**Current disease control issues for blackberry in the Southeast.**”
- ‡ 2006 Southeastern Peach Convention; Savannah, GA (5-8 Jan). Presented “**2005 bacterial spot incidence and observations in Georgia and South Carolina.**”
- ‡ 2006 Georgia Blueberry Meeting; Savannah, GA (5-8 Jan). Presented “**Suggestions for the 2006 blueberry spray program**” and “**Update on root rots found in southern highbush blueberries.**”
- 2005 Georgia Association of County Agricultural Agents Meeting; Tifton, GA (14-15 Nov). Frank Funderburke presented co-authored poster “**Fludioxonil residue studies in middle Georgia peaches.**” (25%)
- 2005 Southern Professional Fruit Workers Conference; Decatur, AL (17-20 Oct). Presented “**Review of 2005 Georgia peach disease issues.**”
- 2005 American Phytopathological Society Meetings; Austin, TX, (30 Jul-3 Aug). Presented “**Dipotassium phosphonate, dipotassium phosphate, and potassium phosphite materials for control of Septoria and anthracnose leaf spots of blueberry.**” Served as a co-moderator in the Diseases – Fruits and Nuts II Session.
- 2005 Regional Small Fruit Guide Meeting; Clemson, SC (28-29 Jun). (organizer and meeting chair)
- 2005 Incident Command System (ICS200); Athens, GA (9-10 May).
- 2005 Level 1 AgroSecurity Awareness Training; Athens, GA (30-31 Mar).
- 2005 Georgia Association of Plant Pathologists Meeting; Cordele, GA (14-15 Mar).
- 2005 Statewide Extension Professionals Conference; Rock Eagle, GA (18-19 Jan).
- ‡ 2005 Southeastern Peach Convention; Savannah, GA (9-10 Jan). Presented co-authored paper with H. Scherm, “**Update on Scholar application technology.**” (50%)

-
- ‡ 2005 Georgia-South Carolina Wine Grape Conference; Savannah, GA (7-8 Jan). Presented **“Trouble-shooting wine grape diseases – what we have learned from the school of hard knocks.”**
 - ‡ 2005 Georgia Blueberry Meeting; Savannah, GA (7-8 Jan). Presented **“Root rot in southern highbush blueberries and nursery issues.”**
 - 2005 Southeastern Apple Conference Meeting; Ashville, NC (5-6 Jan). Presented **“Fire blight management: optimizing your control.”**
 - 2004 Georgia Association of County Agents Meeting; Jekyll Island, GA (8-10 Nov).
 - 2004 Southern Professional Fruitworkers’ Conference; McMinnville, TN (12-14 Oct). Presented **“Methyl bromide alternatives for black root rot control in strawberry.”** H. Scherm presented co-authored paper, **“Packinghouse postharvest fungicide survey 2004.”** (25%) H. Ngugi presented co-authored paper, **“Evaluation of products for control of bacterial spot of peach during the cover sprays.”** (10%)
 - 2004 American Phytopathological Society Meetings; Anaheim, CA (31 Jul – 4 Aug). Presented **“Methyl bromide alternatives for control of black root rot of strawberry in Georgia.”**
 - 2004 Regional Small Fruit Meeting; Clemson, SC (6-7 Jul). **(organizer and meeting chair)**
 - 2004 Georgia Association of Plant Pathologists Meeting; Jekyll Island, GA (11-12 Mar).
 - ‡ 2004 Southeastern Peach Convention; Savannah, GA (9-10 Jan). Presented **“Brown rot management in 2004.”**
 - ‡ 2004 Georgia-South Carolina Wine Grape Conference; Savannah, GA (9-10 Jan). Presented **“Controlling downy mildew of grape.”**
 - ‡ 2004 Georgia-South Carolina Strawberry Meeting; Savannah, GA (9-10 Jan). Presented **“New recommendations for strawberry anthracnose control.”**
 - ‡ 2004 Georgia Blueberry Meeting; Savannah, GA (9-10 Jan). Presented **“Fungicide spray recommendations for 2004.”**
 - 2003 Georgia Association of County Agents Meeting; Valdosta, GA (10-12 Nov).
 - 2003 Southern Professional Fruitworker’s Conference; Clemson, SC (15-16 Oct). Presented **“Overview of 2003 Georgia fungicide trials for peach disease management.”** H. Scherm presented co-authored paper, **“Commercial postharvest disease control with Scholar fungicide, 2003.”** (25%)
 - 2003 Eastern Peach Pest Management Strategy Meeting; Clemson, SC (14 Oct).
 - 2003 American Phytopathological Society Meeting; Charlotte, NC (9-13 Aug). Presented **“Validation of fire blight prediction systems for Georgia apple production.”**
 - 2003 National Association of County Agricultural Agents Meeting; Green Bay, WI (13-16 July).
 - 2003 Georgia Association of Plant Pathologists Meeting; Augusta, GA (17-18 Mar).
 - 2003 Southern Association of Agricultural Scientists Meeting; Mobile, AL (1 Feb).
 - ‡ 2003 Southeastern Peach Convention; Savannah, GA (10-11 Jan). Presented **“2003 Plum Pox Virus update.”**
 - ‡ 2003 Georgia-South Carolina Wine Grape Conference; Savannah, GA (11 Jan). Presented **“Petri disease update.”**
 - ‡ 2003 Georgia-South Carolina Strawberry Meeting; Savannah, GA (11 Jan). Presented **“Strawberry anthracnose, angular leaf spot, and Botrytis.”**
 - ‡ 2003 Georgia Blueberry Meeting; Savannah, GA (10-12 Jan). H. Scherm presented co-authored paper **“Blueberry leaf spots: epidemiology, yield losses and control.”** (25%)
 - 2003 Southeastern Apple Growers Meeting; Ashville, NC (8-9 Jan).
 - 2002 NE1006 Regional Plum Pox Virus Meeting; Shepherdstown, WV (15-18 Dec).
 - 2002 Georgia Association of County Agents Meeting; Augusta, GA (12 Nov).
 - 2002 Southern Professional Fruitworker’s Conference; Byron, GA (9-10 Oct). Presented **“Peach fruit disease management results from 2002 field trials.”**
 - 2002 American Phytopathological Society Meetings; Milwaukee, WI (26-31 Jul). Presented **“Survey of north Georgia wine grapes for Pierce’s disease as related to elevation.”**
 - 2002 Georgia Association of Plant Pathologists Meeting; Macon, GA (21-22 Mar).
 - ‡ 2002 Southeastern Peach Convention; Savannah, GA (11-12 Jan). Presented **“Pathology issues for peach.”**
 - ‡ 2002 Georgia-South Carolina Wine Grape Conference; Savannah, GA (11-12 Jan). Presented **“Update on Pierce’s disease in the Southeast.”**
 - ‡ 2002 Georgia-South Carolina Strawberry Meeting; Savannah, GA (12 Jan). Presented **“Update on the strawberry spray program for 2001-2002.”**
 - ‡ 2002 Georgia Blueberry Meeting; Savannah, GA (11-12 Jan). Presented **“Benlate replacement and Indar situation.”**
 - 2001 NE1006 Regional Plum Pox Virus Meeting; St. Catharines, Ontario (13-14 Nov).
 - 2001 Georgia Association of County Agents Meeting; Rome, GA (1-2 Nov).
 - 2001 Southern Professional Fruitworker’s Conference; Fletcher, NC (18-19 Sep). Presented **“The southeastern peach budwood testing program – update and analysis.”**
 - 2001 American Phytopathological Society Meetings; Salt Lake City, UT (25-29 Aug). Presented **“Fungicidal control of Septoria leaf spot of blueberry in Georgia.”**
 - 2001 Georgia Association of Plant Pathologists Meeting; Stone Mountain, GA (8-9 Mar).
 - 2001 Southeastern Apple Growers Meeting; Ashville, NC (10-11 Jan).
 - ‡ 2001 Georgia Wine Grape Conference; Savannah, GA (6-7 Jan). Presented **“New fungicides for bunch grapes.”**
 - ‡ 2001 Southeastern Peach Convention; Savannah, GA (5-7 Jan). Presented **“Disease control strategies for peach” and “Regional virus testing/implementation.”**
 - ‡ 2001 Georgia - South Carolina Strawberry Meeting; Savannah, GA (5 Jan). Presented **“Suggestions for strawberry disease control.”**
-

- ‡ 2001 Georgia - South Carolina Muscadine Conference; Savannah, GA (5 Jan). Presented **“The new grape fungicides, do they have a place in muscadine disease control?”**
- ‡ 2001 Southeast Blueberry Conference; Savannah, GA (4-5 Jan). Presented **“Leaf spots, how to identify and control them.”**
- 2000 California Pierce’s Disease Conference; Riverside, CA (16 Dec).
- 2000 NE501 Regional Plum Pox Virus Meeting; Gettysburg, PA (30 Oct – 1 Nov). **Chair of the Extension and Outreach Committee.**
- 2000 Strawberry Plasticulture Short Course; Columbia, SC (23-25 Oct).
- 2000 Southern Professional Fruitworker’s Conference; McMinnville, TN (19-21 Sep). Developed the **“Focus on Plum Pox Virus Session”** and subsequent discussions of PPV (nine hours total session time). Presented **“Plum pox overview”** and **“Overview of previous virus certification programs and proposal of new voluntary multistate virus programs and homeowner awareness programs.”**
- 2000 Southern Division of APS Meeting; Gainesville, FL (5-7 Mar).
- 2000 Georgia Association of Plant Pathologists Meeting; Gainesville, FL (4 Mar).
- 2000 Georgia Fruit and Vegetable Conference; Savannah, GA (6-8 Jan).
- 2000 Southeastern Peach Convention; Savannah, GA (7-9 Jan).
- 1999 American Phytopathological Society Meetings; Montreal, Quebec (7-11 Aug).
- 1999 Eastern Regional Conference on the Ecology of Root-Infecting Microorganisms; West Lafayette, IN (14-16 Mar).
- ‡ 1998 American Phytopathological Society Meetings; Las Vegas, NV (8-12 Nov). Presented **“Technology transfer regarding commercialized biological control: an industry perspective”** in the colloquium **“The Role of Extension in Implementing Biological Control.”**
- ‡ 1998 International Congress of Plant Pathology Meetings; Edinburgh, Scotland (9-16 Aug) Presented **“Commercialization of seed bacterization for biological control of seedling and root diseases”** in the symposium **“The Practical Status of Biological Control Approaching the 21st Century.”**
- ‡ 1998 Beltwide Cotton Conferences; San Diego, CA (5-9 Jan). Presented **“Biological control of wilt pathogens with bacterial antagonists”** in the symposium **“Cotton Wilt Diseases.”**
- ‡ 1997 American Phytopathological Society Meetings; Rochester, NY (9-13 Aug). Presented **“Marketing considerations for live microbial products”** in the colloquium **“Development and Commercialization of Live Microbial Products.”**
- 1997 Beltwide Cotton Conferences; New Orleans, LA (6-10 Jan). Presented **“Suppression of *Rhizoctonia solani* by Kodiak®, a *Bacillus subtilis* biocontrol seed treatment.”**
- ‡ 1996 Texas Biological Control Workshop; San Antonio, TX (4-6 Nov). Presented **“Utilization of biological control agents for seed treatment.”**
- ‡ 1996 Society of Industrial Microbiology Meetings; Research Triangle Park, NC (4-8 Aug). Presented **“Development of ‘Kodiak’ – its use to promote plant growth and control of plant pathogens”** in the symposium **“Biologically-based technology for the control of plant diseases – from the cradle to the marketplace.”**
- 1996 American Phytopathological Society Meetings; Indianapolis, IN (27-31 Jul).
- 1996 Western Regional Conference on Control of Soil Fungi; Portland, OR (12-14 Mar).
- ‡ 1996 Beltwide Cotton Conferences; Nashville, TN (8-12 Jan). Presented **“Biological seed treatment as a component in maintaining seedling health”** in the symposium **“Maintaining Seedling Health.”**
- ‡ 1995 American Phytopathological Society Meetings; Pittsburgh, PA (12-16 Aug). Presented **“Influence of plant genotype and plant-produced compounds on the efficacy of biocontrol agents”** in the colloquium, **“Influence of the Plant on Biological Control Agents.”**
- 1995 Beltwide Cotton Conferences; San Antonio, TX (4-7 Jan). Presented **“Potential modes of action for suppression of root diseases and yield enhancement when using *Bacillus subtilis* seed inoculants on cotton.”**
- 1994 Tomato Disease Workshop; Lansing, MI (7-8 Dec).
- 1994 American Phytopathological Society Meetings; Albuquerque, NM (6-10 Aug). Presented **“Rhizosphere colonization patterns observed with two *Bacillus subtilis* seed inoculants of cotton.”** Presided over the session **“Education outside of the classroom: a discussion of mentoring.”**
- 1994 APS Pythium Species Identification Workshop; Las Cruces, NM (5-6 Aug).
- 1994 Plant Growth-Promoting Rhizobacteria Conference; Adelaide, Australia (6-11 Mar). Presented **“Suppression of Fusarium wilt of cotton with *Bacillus subtilis* hopper box formulations”** and **“Plant response and disease control following seed inoculation with *Bacillus subtilis*.”** Presided over the discussion session **“Technology Transfer and Commercialization.”**
- 1994 Beltwide Cotton Conferences; San Diego, CA (Jan 5-8). Presented **“Decrease in cotton seedling disease through neutralization of acid-delinted seed”** and **“Decrease in *Fusarium oxysporum* f.sp. *vasinfectum* incidence through use of *Bacillus subtilis* seed inoculants.”**
- 1993 American Phytopathological Society Meetings; Nashville, TN (6-10 Nov). Presented **“Colonization by *Bacillus subtilis* inoculants to augment seedling disease control and season-long root health of multiple cotton varieties.”**
- ‡ 1993 Cotton Field Day; Belle Mina, AL (29 Jul). Presented **“Changes in disease management – biological and chemical control of cotton seedling diseases.”**
- 1993 American Peanut Research and Education Society Meeting; Huntsville, AL (13-16 Jul).
- 1993 Beltwide Cotton Conferences; New Orleans, LA (10-14 Jan). Presented **“Colonization by *Bacillus subtilis* seed inoculants to augment seedling disease control and promote season-long plant health in cotton”** and **“Achieving plant health – Fusarium in cotton.”**

1992 American Peanut Research and Education Society Meeting; Norfolk, VA (7-10 July). Presented **“On-farm evaluation of AU-Pnuts; an expert system for control of leaf spot diseases of peanut.”**

1992 Southern Division of APS Meeting; Lexington, KY (2-5 Feb). Presented **“Field validation study of an expert system for control of leaf spot diseases of peanut.”**

‡ 1992 Alabama Fertilizer and Pesticide Conference; Auburn, AL (28-29 Jan). Presented **“Results of AU-Pnuts on-farm leaf spot control studies in 1991.”**

‡ 1992 Tri-state Disease Management Symposium; Auburn, AL (9-10 Jan). Presented **“Performance of fungicide application advisory program for peanuts.”**

1991 Tri-state Peanut Tour; Alabama, Georgia and Florida (Aug).

1988-1990 Alabama County Agent Association Meetings.

1986 Georgia Association of Plant Pathologists Meeting; Macon, GA (Mar). Presented **“A parasexual cycle in *Aspergillus clavatus*.”**

D. PUBLIC AND PROFESSIONAL SERVICE

1. Extension In-service Trainings (conducted for agents or other professionals):

<u>Date</u>	<u>Type of Training and Location</u>	<u>Attendance</u>
1/5/22	Fumigation and biologically based strategies to manage soilborne pests in vegetables and strawberry (Savannah, GA)	(50)
9/15/21	*Blueberry Agent IPM Training (virtual; Southeast)	(70)
8/18/21	*Blackberry Agent IPM Training (virtual; Southeast)	(70)
11/3/20	Disease Management in Muscadines and Pierce's Disease Tolerant Hybrids (virtual; UFL)	(50)
2/18/20	Grape Spray Program Design Workshop (Blairsville, GA)	(6)
1/9/20	Strawberry Diseases, Identification and Management (Savannah, GA)	(75)
8/14/19	*Optimizing Grape IPM through cultural management, sprayer selection, calibration and use for production and on-farm research trials (Blairsville, GA)	(7)
10/2/18	Extension Specialists Foundations Training (Athens, GA)	(9)
8/29/18	*Amplify RP XRT + for Xylella Training (Dahlongega, GA)	(2)
8/28/18	*Amplify RP XRT + for Xylella Training (Alma, GA)	(5)
8/16/18	Managing Insect Pests and Diseases in Georgia (Blairsville, GA)	(7)
6/21/17	*Management of Diseases and Insects of Peach (Fort Valley, GA)	(6)
3/10/17	Vineyard Issues: Diseases, Pests, Nutrition, and Quality Management (Perry, GA)	(25)
1/19/17	Blueberry Nutrition, Disease, and Farm Management Practices Training (Alma, GA)	(5)
10/26/16	Extension Specialist Foundations (Athens, GA)	(20)
9/12-9/15/16	SRSFC Agent Training for Blueberries, Blackberries, and Muscadines (Shelby, NC)	(35)
8/11/15	*Wine Grape Diseases (Blairsville, GA)	(10)
9/3-9/4/14	Value-Added Fruit Production	(23)
6/17/14	Blueberry Production Training	(18)
10/23/13	Extension Specialist Foundations (Athens, GA)	(20)
9/17-9/19/13	*Southeastern Professional Fruit Workers Conference (Athens, GA)	(60)
4/25-26/12	*Blueberry Mechanical Harvesting Workshop (Gainsville, FL)	(26)
1/20/12	Identification of Fungal Pathogens from Plant Material (WS)	(10)
1/19/12	Distance Diagnostics through Digital Imaging: Submission of Digital and Physical Samples to the Plant Disease Clinic (WS)	(5)
5/24-26/11	SRSFC Sponsored Insect and Disease Identification and Management for Small Fruit Crops Field In-service Training for County Extension Agents (Charlotte, NC)	(25)
1/6/11	*SRSFC Sponsored Insect and Disease Identification and Management for Small Fruit Crops In-service Training for County Extension Agents (Savannah, GA)	(35)
3/26/10	Pesticide Recertification Workshop (webinar)	(200)
8/25/09	*Wine Grape Diseases (Blairsville, GA)	(15)
6/25/08	*Blueberry Horticultural and IPM Practices (Alma, GA)	(20)
4/9/08	*Georgia Brown Rot Resistance Management Training (Byron, GA)	(8)
1/23/08	*DDDI Microscopy Training (WS)	(10)
12/5/07	Blueberry IPM Training (Alma, GA)	(20)
7/18/07	*Peach Disease Clinic (Byron, GA)	(6)
1/17/07	*DDDI Microscopy Training (WS)	(15)
1/17/07	Homeowner Fruit Session (WS)	(20)
1/18/06	*DDDI Microscopy Training (3 classes) (WS)	(36)
1/11/06	*DDDI Introduction (Foundation Training) (Athens, GA)	(20)
1/21/04	High Risk Pathogens for Georgia Agriculture (WS)	(30)
1/21/04	*Distance Diagnostics through Digital Imaging (WS)	(5)
1/21/04	*Extension Agent Blackberry Production Training (WS)	(17)
1/23/03	*Extension Agent Blueberry Production Training (WS)	(10)
12/10/02	Southern Region Bunch and Muscadine Grape Agent Training (Braselton, GA)	(40)
11/4/02	New Agent Training (Athens, GA)	(15)

9/15/02	Plant Disease Clinic (Tifton, GA)	(25)
6/12/02	Plant Disease Clinic (Millen, GA)	(15)
6/11/02	Plant Disease Clinic (Athens, GA)	(25)
6/4/02	Identification of Fungi from Plant Materials (Tifton, GA)	(10)
5/21/02	Identification of Fungi from Plant Materials (Athens, GA)	(15)
1/24/02	*Extension Agent Strawberry Production Training (WS)	(20)
1/14-15/02	Extension Agent Wine Grape Training Short Course (Fletcher, NC)	(40)
6/13/01	Plant Disease Clinic (Tifton, GA)	(50)
6/12/01	Plant Disease Clinic (Millen, GA)	(30)
6/6/01	Plant Disease Clinic (Griffin, GA)	(50)
6/5/01	Plant Disease Clinic (Athens, GA)	(50)
4/20/01	*Blueberry Virus Training (Alma, GA)	(7)
3/15/01	*Plum Pox Virus Overview and Sampling Techniques	(5)
1/18/01	Identification of Fungi from Plant Materials (WS)	(10)
1/18/01	Common Fruit Diseases (WS)	(20)
1/17/01	Commercial Blackberry Diseases (WS)	(25)
6/7/00	Plant Disease Clinic (Tifton, GA)	(50)
6/6/00	Plant Disease Clinic (Millen, GA)	(30)
5/23/00	General Fruit Diseases Overview for County Agents (Fort Valley, GA)	(25)
4/11/00	*Plum Pox Virus Overview and Sampling Techniques (Byron, GA)	(3)
1/21/00	Evaluation of Disease Diagnostic Images (WS)	(11)
1/21/00	Identification of Fungi from Plant Material (WS)	(18)

*Denotes principle program coordination and leadership role.

2. Statewide Educational Programs Initiated and Conducted (workshops or short courses):

<u>Date</u>	<u>Type of Training and Location</u>	<u>Attendance</u>
2/1/05	*Methyl Bromide Alternatives for Strawberries/Vegetables (Tifton, GA)	(75)
2/27/02	*Methyl Bromide Alternatives for Strawberries (Fort Valley, GA)	(30)

*Denotes principle program coordination and leadership role.

3. Local or County Educational Programs:

<u>Date</u>	<u>Type of Training and Location</u>	<u>Attendance</u>
3/15/22	North Georgia Wine Grape Meeting (Cleveland, GA)	(30)
3/2/22	Wine Grape Spray Program Workshop (Dahlonega, GA)	(15)
2/23/22	Wine Grape Spray Program Workshop (Ellijay, GA)	(25)
2/11/22	North Georgia Apple Meeting (Ellijay, GA)	(25)
2/3/22	Middle Georgia Peach Meeting (Fort Valley, GA)	(25)
1/27/22	Central Alabama Peach Production Meeting (Jemison, AL)	(75)
8/18/21	Peach Season Review (Fort Valley, GA)	(20)
8/3/21	Vineyard Field Day (Ellijay, GA)	(30)
7/20/21	SRSFC Strawberry Webinar Training (SRSFC Zoom Meeting)	(100)
3/18/21	SRSFC Strawberry Webinar Training (SRSFC Zoom Meeting)	(100)
2/25/21	North Georgia Wine Grape Meeting (Georgia Zoom Meeting)	(35)
2/16/21	North Georgia Apple Meeting (Georgia Zoom Meeting)	(30)
1/26/21	Chilton County Peach Meeting (Alabama Zoom Meeting)	(100)
1/11/21	Middle Georgia Peach Meeting (Georgia Zoom Meeting)	(50)
8/19/20	Strawberry Meeting (Georgia Zoom Meeting)	(40)
7/29/20	Muscadine Disease Management (North Carolina Zoom Meeting)	(37)
3/5/20	Wine Grape Spray Schedule Workshop (Dahlonega, GA)	(12)
3/3/20	Wine Grape Spray Schedule Workshop (Carrollton, GA)	(12)
2/19/20	Middle Georgia Peach Meeting (Byron, GA)	(50)
2/17/20	North Georgia Apple Meeting (Ellijay, GA)	(35)
1/28/20	Grapevine Pruning Workshop (Cleveland, GA)	(35)
6/8/19	Southern Winegrape Symposium (Carrollton, GA)	(70)
3/19/19	Georgia Wine Grape IPM Meeting (Ellijay, GA)	(50)
2/14/19	North Georgia Apple Meeting (Ellijay, GA)	(25)
2/7/19	Middle Georgia Peach Meeting (Reynolds, GA)	(75)
12/11/18	New Grape Growers Workshop (Athens, GA)	(45)
12/6/18	South Georgia Peach Meeting (Quitman, GA)	(4)
10/31/18	Grape Post Harvest Round Table (White, GA)	(15)
9/19/18	Commercial Fruit Training (Calhoun, GA)	(10)
8/14/18	Muscadine Extension Team Meeting (Elizabethtown, NC)	(50)
7/28/18	Muscadine Workshop (Americus, GA)	(35)
7/20/18	Peach Inking Meeting (Fort Valley, GA)	(15)
6/9/18	West Georgia Wine Grape Meeting (Carrollton, GA)	(75)

4/27/18	Vineyard Spray Program Meeting (Dahlonega, GA)	(50)
4/19/18	Surry County Wine Grape Meeting (Elkin, NC)	(25)
3/14/18	Grape IPM Workshop (Tiger, GA)	(50)
2/21/18	North Georgia Apple Meeting (Ellijay, GA)	(35)
2/20/18	Middle Georgia Peach Meeting (Byron, GA)	(50)
11/1/17	Wine Growers Round Table (Cleveland, GA)	(30)
8/16/17	New Wine Grape Growers Workshop (Blairsville, GA)	(60)
6/28/17	Mid-season Considerations for Vineyard Management Workshop (Dahlonega, GA)	(40)
6/10/17	West Georgia Wine Grape Meeting (Carrollton, GA)	(75)
3/14/17	North Georgia Vineyard Meeting (Cleveland, GA)	(50)
2/2/17	North Georgia Apple Meeting (Ellijay, GA)	(35)
1/4/17	Bacon County Blueberry Meeting (Alma, GA)	(200)
12/7/16	North Georgia Wine Grape Meeting (Dahlonega, GA)	(60)
10/28/16	Ware County Blueberry Meeting (Manor, GA)	(75)
8/24/16	Phony Peach Meeting (Byron, GA)	(20)
8/17/16	North Georgia Wine Grape Meeting (Dahlonega, GA)	(30)
7/6/16	North Georgia Wine Grape Meeting (Cleveland, GA)	(30)
6/11/16	West Georgia Wine Grape Meeting (Carrollton, GA)	(55)
4/22/16	Wine Grape Growers Seminar (Cumming, GA)	(10)
3/17/16	North Georgia Wine Grape Meeting (Cleveland, GA)	(30)
2/25/16	North Georgia Apple Meeting (Ellijay, GA)	(30)
2/2/16	Middle Georgia Peach Meeting (Fort Valley, GA)	(50)
1/6/16	Bacon County Blueberry Meeting (Alma, GA)	(150)
12/9/15	North Georgia Wine Grape Meeting (Dahlonega, GA)	(30)
11/18/15	Brooks County Peach Meeting (Barney, GA)	(10)
11/9/15	Clinch County Blueberry Disease Update (Homerville, GA)	(55)
8/12/15	Rabun County Wine Grape Disease Meeting (Tiger, GA)	(35)
6/10/15	White County Wine Grape Disease Meeting (Cleveland, GA)	(20)
3/5/15	North Georgia Wine Grape Disease Update (Blairsville, GA)	(40)
2/10/15	White County Wine Grape Meeting (Cleveland, GA)	(12)
1/22/15	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/21/15	North Georgia Apple Meeting (Ellijay, GA)	(30)
1/7/15	Bacon County Blueberry Meeting (Alma, GA)	(150)
12/16/14	Brooks County Peach Meeting (Quitman, GA)	(10)
12/15/14	Clinch County Blueberry Disease Update (Homerville, GA)	(100)
10/14/14	Brantley County Blueberry Disease Update (Nahunta, GA)	(30)
8/5/14	Georgia Strawberry Disease Update (Ashburn, GA)	(15)
3/20/14	North Georgia Wine Grape Update (Blairsville, GA)	(40)
2/28/14	North Georgia Apple Meeting (Ellijay, GA)	(25)
2/27/14	Sprayer Calibration Field Day (Alma, GA)	(125)
2/4/14	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/8/14	Bacon County Blueberry Meeting (Alma, GA)	(150)
10/29/13	Oconee County Blueberry Meeting (Watkinsville, GA)	(15)
10/15/13	Clinch County Blueberry Meeting (Homerville, GA)	(100)
9/12/13	Blueberry Sprayer Field Day (Alma, GA)	(100)
8/23/13	Wine Grape Field Training (Ellijay, GA)	(15)
2/12/13	North Georgia Wine Grape Update (Blairsville, GA)	(30)
2/7/13	Strawberry Training (Macon, GA)	(30)
2/6/13	North Florida/Georgia Peach Meeting (Quitman, GA)	(30)
2/5/13	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/29/13	North Georgia Apple Meeting (Ellijay, GA)	(25)
1/9/13	Bacon County Blueberry Meeting (Alma, GA)	(150)
10/18/12	Clinch County Blueberry Meeting (Homerville, GA)	(100)
3/14/12	North Georgia Wine Grape Meeting (Blairsville, GA)	(30)
3/8/12	Appling County Blueberry Meeting (Baxley, GA)	(15)
2/8/12	North Florida/Georgia Peach Meeting (Quitman, GA)	(20)
2/7/12	Middle Georgia Peach Meeting (Byron, GA)	(50)
2/6/12	North Georgia Apple Meeting (Ellijay, GA)	(20)
1/4/12	Bacon County Blueberry Meeting (Alma, GA)	(125)
7/30/11	West Georgia Wine Grape Symposium Meeting (Carrollton, GA)	(100)
5/5/11	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(50)
3/23/11	North Georgia Wine Grape Update (Blairsville, GA)	(30)
2/23/11	Clinch/Lanier County Blueberry Meeting (Homerville, GA)	(75)
2/17/11	Georgia Peach Commission Training (Fort Valley, GA)	(15)
2/11/11	Strawberry Training (Macon, GA)	(20)

2/2/11	North Florida/Georgia Peach Meeting (Quitman, GA)	(15)
2/1/11	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/27/11	North Georgia Apple Meeting (Ellijay, GA)	(25)
1/24/11	West Georgia Wine Grape Meeting (Carrollton, GA)	(50)
1/5/11	Bacon County Blueberry Meeting (Alma, GA)	(125)
11/18/10	Blueberry Profit Maker Course (Douglas, GA)	(60)
4/14/10	Small Fruit Meeting (distance education to Ocilla, GA)	(9)
3/5/10	North Georgia Wine Grape Update (Blairsville, GA)	(40)
2/2/10	Strawberry Training (Macon, GA)	(20)
1/27/10	North Florida/Georgia Peach Meeting (Quitman, GA)	(10)
1/26/10	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/21/10	North Georgia Apple Meeting (Ellijay, GA)	(15)
1/6/10	Bacon County Blueberry Meeting (Alma, GA)	(120)
9/17/09	Georgia Blueberry Growers Association Disease Update (Waycross, GA)	(50)
2/25/09	North Georgia Wine Grape Update (Blairsville, GA)	(40)
2/18/09	Strawberry Training (Macon, GA)	(20)
1/28/09	North Florida/Georgia Peach Meeting (Quitman, GA)	(20)
1/27/09	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/13/09	North Georgia Apple Meeting (Ellijay, GA)	(15)
1/7/09	Bacon County Blueberry Meeting (Alma, GA)	(100)
11/6/08	Blueberry Diseases Course (Douglas, GA)	(80)
5/1/08	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)
3/26/08	Blueberry Propagation and Disease Issues Meeting (Alma, GA)	(30)
3/20/08	North Georgia Wine Grape Update (Blairsville, GA)	(25)
2/21/08	Strawberry Training (Macon, GA)	(20)
2/13/08	Blueberry Training for New Producers (Nashville, GA)	(20)
1/31/08	North Georgia Apple Meeting (Ellijay, GA)	(15)
1/30/08	Middle Georgia Peach Meeting (Byron, GA)	(30)
1/29/08	North Florida/Georgia Peach Meeting (Quitman, GA)	(10)
1/9/08	Bacon County Blueberry Meeting (Alma, GA)	(150)
11/27/07	North Georgia Wine Grape Fall Meeting (Blairsville, GA)	(40)
5/3/07	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)
2/21/07	North Georgia Wine Grape Meeting (Blairsville, GA)	(50)
2/6/07	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/31/07	North Georgia Apple Meeting (Ellijay, GA)	(20)
1/3/07	Bacon County Blueberry Meeting (Alma, GA)	(80)
12/5/06	North Florida/Georgia Peach Meeting (Quitman, GA)	30
11/8/06	North Georgia Wine Grape Fall Meeting (Blairsville, GA)	40
9/29/06	Advanced Master Gardener Training (microscopy) (Augusta, GA)	50
2/16/06	*North Georgia Wine Grape Meeting (Blairsville, GA)	(35)
2/7/06	Middle Georgia Peach Meeting (Byron, GA)	(50)
2/2/06	Georgia Strawberry Growers Association Meeting (Macon, GA)	(15)
1/17/06	North Georgia Apple Meeting (Ellijay, GA)	(20)
1/4/06	Bacon County Blueberry Meeting (Alma, GA)	(80)
12/1/05	North Florida/Georgia Peach Meeting (Quincy, FL)	(30)
10/11/05	Georgia Peach School (Byron, GA)	(20)
5/5/05	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(50)
2/16/05	*North Georgia Wine Grape Meeting (Dahlonega, GA)	(35)
2/3/05	Middle Georgia Peach Meeting (Byron, GA)	(50)
1/27/05	*North Georgia Apple Meeting (Ellijay, GA)	(20)
1/4/05	*Bacon County Blueberry Meeting (Alma, GA)	(80)
5/13/04	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(50)
4/29/04	Bramble Management Meeting (Alma, GA)	(75)
4/1/04	Organic Blueberry Production Workshop (Alma, GA)	(50)
3/24/04	Wine Grape Production Meeting (Dahlonega, GA)	(20)
3/11/04	Georgia Blueberry Growers Meeting (Baxley, GA)	(50)
2/19/04	Gilmer/Fannin County Apple Production Meeting (Ellijay, GA)	(25)
2/12/04	Middle Georgia Peach Production Update (Byron, GA)	(30)
1/7/04	Bacon County Blueberry Meeting (Alma, GA)	(75)
12/11/03	South Georgia/North Florida Peach Meeting (Quitman, GA)	(30)
9/17/03	Georgia Peach School (Byron, GA)	(40)
8/5/03	Muscadine Twilight Tour and Training Session (Tifton, GA)	(40)
6/2/03	Grape Production Meeting (Dahlonega, GA)	(15)
5/29/03	Vidalia Onion Research and Extension Center Field Day (Reidsville, GA)	(50)
5/1/03	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)

2/13/03	Gilmer/Fannin County Apple Production Meeting (Ellijay, GA)	(25)
1/28/03	Middle Georgia Peach Production Update (Byron, GA)	(30)
1/7/03	Bacon County Blueberry Meeting (Alma, GA)	(50)
12/5/02	South Georgia/North Florida Peach Meeting (Quitman, GA)	(30)
6/13/02	Vidalia Onion Research and Extension Center Twilight Tour (Reidsville, GA)	(20)
6/6/02	Grape Production Meeting (Dahlonega, GA)	(10)
4/2/02	*Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)
4/18/02	Vidalia Onion Research and Extension Center Field Day (Reidsville, GA)	(50)
3/6/02	Grape Production Meeting (Dahlonega, GA)	(20)
2/12/02	Gilmer/Fannin County Apple Production Meeting (Ellijay, GA)	(25)
2/7/02	Middle Georgia Peach Production Update (Byron, GA)	(30)
1/17/02	Northeast Georgia Apple Meeting (Clarksville, GA)	(10)
1/8/02	Bacon County Blueberry Meeting (Alma, GA)	(50)
11/29/01	North Florida/South Georgia Peach Meeting (Quitman, GA)	(35)
9/28/01	Georgia Muscadine Meeting (Griffin, GA)	(80)
8/7/01	Blairsville Mountain Station Field Day (Blairsville, GA)	(100)
7/31/01	Grape Production Meeting (Dahlonega, GA)	(25)
6/14/01	Vidalia Onion Research and Extension Center Field Day (Reidsville, GA)	(45)
5/29/01	Disease Issues for Small Scale Fruit Production (Forsyth, GA)	(10)
5/3/01	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)
2/22/01	Gilmer/Fannin County Apple Production Meeting (Ellijay, GA)	(26)
2/14/01	Northeast Georgia Apple Production Meeting (Gainesville, GA)	(25)
2/8/01	Georgia Peach Production Meeting (Byron, GA)	(50)
12/7/00	North Florida/South Georgia Peach Production Meeting (Madison, FL)	(35)
10/18/00	Sunbelt Agricultural Exposition (DDDI Exhibit; Moultrie, GA)	(>1000)
10/17/00	Clinch County Blueberry Meeting (Homerville, GA)	(100)
9/7/00	Peach Season Overview Meeting (Byron, GA)	(10)
7/25/00	Grape Production Field Day (Dahlonega, GA)	(15)
5/30/00	Apple Production "Tailgate" Meeting (Ellijay, GA)	(25)
5/4/00	Alapaha Research Station Twilight Blueberry Tour (Alapaha, GA)	(100)
2/22/00	Gilmer/Fannin County Apple Production Meeting (Ellijay, GA)	(22)
2/21/00	Brantley County Blueberry Production Meeting (Nahunta, GA)	(17)
2/3/00	Georgia Peach Production Meeting (Byron, GA)	(50)

*Denotes principle or keynote speaker role.

4. Regional Invited Extension Presentations:

<u>Date</u>	<u>Type of Training and Location</u>
7/13/21	Eastern Viticulture and Enology Forum Q&A Session (Virtual)
6/8/21	Eastern Viticulture and Enology Forum Q&A Session (Virtual)
3/7/12	Orange cane blotch and other diseases of interest to Florida blackberry producers; Florida Blackberry Growers' Association (Ocala, FL; distance education)
5/3/10	Blueberry diseases; Auburn University Horticulture Agent and Specialists Training (distance education).
2/19/10	Blackberry disease update; North Carolina Blackberry and Raspberry Growers Association Annual Meeting; Shelby, NC.
1/24/08	Diseases of Blackberries in the southeastern region; North Carolina Blackberry and Raspberry Growers Association Annual Meeting; Shelby, NC.
3/21/06	Alternatives to methyl bromide training for county agents and other professionals; North Carolina State University, Raleigh, NC.
2/21/06	Apple and peach disease control for producers and county agents; Musser Tree Fruit Station, Clemson University, Clemson, SC.
1/31/06	Disease control recommendations for bacterial spot and brown rot of peach; Clanton, AL.
3/22/05	Apple disease control for producers and county agents; Musser Tree Fruit Station, Clemson University, Clemson, SC.
2/11/04	Clemson Peach School; peach disease control recommendations for producers and county agents; Clemson Conference Center, Clemson University, SC.
2/11/03	Peach disease control recommendations for producers and county agents; Edgefield, SC.
2/3/03	Muscadine disease control recommendations for producers and county agents; Clemson, SC.

5. Professional Service:

<u>Year(s)</u>	<u>Level</u>	<u>Organization and Position</u>
2019-present	National	American Phytopathological Society Small Fruit Workers Group (Chair)

2017	Regional	Southeastern Peach Convention Educational Program Committee (member)
2017	State	GACAA Fruit Award Selection Committee
2009	State	Georgia Association of Plant Pathologists (President)
2008	State	Georgia Association of Plant Pathologists (Vice President)
2008	Regional	Southeastern Peach Convention Educational Program Committee (member)
2007	Regional	Southeastern Peach Convention Educational Program Committee (member)
2006-present	Regional	Southern Region Small Fruit Consortium Steering Committee (member)
2005-present	State	Georgia Association of Plant Pathologists Industry Affairs Committee (member)
2004	State	Georgia Association of County Agricultural Agents (North District State Staff Director)
2003-present	Regional	Southern Region Small Fruit Consortium IPM Guides Committee (Co-Chair)
2003	State	Georgia Association of County Agricultural Agents (North District State Staff Junior Director)
2006-present	National	American Phytopathological Society IPM Committee (Member)
2003-2005	National	American Phytopathological Society B&C Reports Committee (Section Editor)
2003	National	American Phytopathological Society Chemical Control Committee (Chair)
2002	National	American Phytopathological Society Chemical Control Committee (Vice-Chair)
2001	Regional	Southeastern Peach Convention Educational Program Committee (member)
2001-present	State	Georgia Association of County Agricultural Agents Horticulture Committee (member)
2000-present	National	American Phytopathological Society Small Fruit Diseases Working Group (committee chair)
2000	Regional	Southeastern Peach Convention Educational Program Committee (member)
2000	Regional	Southeastern Blueberry Conference Educational Program Committee (member)
2000-2002	National	APHIS Plum Pox Virus Scientific Issues Working Group (adjunct member)
1994-1999	National	American Phytopathological Society Biological Control Committee (member)

6. Current Membership in Professional Societies:

American Phytopathological Society (APS)

Georgia Association of Plant Pathologists (GAPP)

National Association of County Agricultural Agents (NACAA)

Georgia Association of County Agricultural Agents (GACAA)

7. Consulting:

<u>Year</u>	<u>Client</u>	<u>Work Performed</u>
2020	Monsanto	Expert Witness
2019	Monsanto	Expert Witness
2019	Cooly	Expert Witness
2018	Monsanto	Expert Witness
2018	Henry Buchanan	Expert Witness
2017	Monsanto	Expert Witness
2015	Dole	Pathology Consultation
2014	BASF	Expert Witness
2013	BASF	Expert Witness
2010	BASF	Expert witness
2009	BASF	Expert witness
2007	Valent	Classroom instruction relative management of peach diseases in the Southeast

APPENDIX B

LIST OF EXHIBITS

Ex. No.	Description
1001	U.S. Patent No. 11,445,727 (“the ’727 Patent”).
1002	Selected Excerpts of the File History of the ’727 Patent
1003	Reserved
1004	Godoy et al. “Eficiência de fungicidas multissítios no controle da ferrugem-asiática da soja, <i>Phakopsora pachyrhizi</i> , na safra 2015/16: resultados sumarizados dos ensaios cooperativos”, Londrina, PR Agosto 2016 (Embrapa Soja, Circular Técnica, 121) (“Godoy”)
1005	Certified Translation of Godoy “Efficiency of multisite fungicides in controlling Asian soybean rust, <i>Phakopsora pachyrhizi</i> , in the 2015/16 harvest: summarized results of cooperative trials”, Londrina, PR August 2016 (Embrapa Soja, Circular Técnica, 121)
1006	U.S. Patent No. 9,314,022 to Tobler et al. of Syngenta (“the ’022 Patent” or Tobler)
1007	WO Application Pub. No. 2015/079334 to De Oliveira of UPL, Ltd (“De Oliveira”)
1008	Wiglesworth et al. “Solatenol™ fungicide – a new SDHI fungicide from Syngenta” <i>Phytopathology</i> (2015) 105(Supl. 2) No. 4, p. S2.11 (“Wiglesworth”)
1009	Elatus EPA Reg. No. 100-1480 dated 8/28/2015 (“Elatus EPA Label”)
1010	Gullino et al. “Mancozeb Past, Present, and Future”, <i>Plant Disease</i> (2010) Vol. 94, No. 9, pp. 1076-1087 (“Gullino”)
1011	The Pesticide Manual, 17 th Ed. Turner, J.A. Editor (2015), excerpted monographs

Ex. No.	Description
1012	Colby, S.R., “Calculating Synergistic and Antagonistic Responses of Herbicide Combinations”, Weeds, Vol. 15, No. 1 (1967) pp. 20-22 (“Colby”)
1013	Gisi et al. “Synergistic Interactions of Fungicides with Different Modes of Action”, Trans. Br. Mycol. Soc. (1985) 85(2), pp. 299-306 (“Gisi”)
1014	Levy et al. “The joint action of fungicides in mixtures: comparison of two methods for synergy calculation”, European and Mediterranean Plant Protection Organization (EPPO) Bulletin (1986) 16(4), pp 651-657 (“Levy”)
1015	Koller et al. “Evaluation of Tactics for Managing Resistance of <i>Venturia inaequalis</i> to Sterol Demethylation Inhibitors”, Plant Disease (1999) pp 857-863 (“Koller”)
1016	Emery et al. “Assessment of interactions between components of fungicide mixtures against <i>Monilinia fructicola</i> ”, Crop Protection (2002) 21, pp 41–47 (“Emery”)
1017	Moura et al., “Effects of cyproconazole, azoxystrobin and mineral oil on soybean leaf anatomy”, Dourados (2013) v.6, n.20, p.154-160 (“Moura”)
1018	Della Vechia et al., “Physical characteristics of insecticide spraying liquids with mineral oil and droplets formed on citrus leaves”, Citrus Research & Technology, (2016) v. 37, n. 1, pp. 102-107 (Della Vechia’)
1019	Reserved
1020	Declaration of Caio Prates

APPENDIX C

Claim Chart for 11,445,727

Claims 1, 3, 4, 5, 7, 9 and 10 of the '727 Patent are anticipated by Godoy (Ex. 1005).

Claim Language	Godoy (Ex. 1005)
1. A fungicidal combination consisting of benzovindiflupyr, mancozeb, and <u>at least another</u> fungicide selected from an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	Godoy explicitly discloses a fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin. No other fungicides were included with the combination of benzovindiflupyr, mancozeb and azoxystrobin. Such combinations are shown in Table 3 as Treatments 17 and 23 and can be summarized as follow: Treatment 17: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 1500 (Dose g a.i. ha⁻¹)) (Elatus® and Unizeb Gold®) (0.2 and 2.0 (Dose L-kg C.P. ha⁻¹)); and Treatment 23: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 2000 (Dose g a.i. ha⁻¹)) (Elatus® and PNR) (0.2 and 2.5 (Dose L-kg C.P. ha⁻¹)). “Evaluating the efficiency of fungicides with different modes of action is essential to increase disease control options in soybeans crops. The use of multisite fungicides can be an option for both Asian soybean rust control and an anti-resistance strategy.” P. 1 “For applications associated with fungicide azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹, the highest yields were observed for treatments with associations of mancozeb 1500 g a.i. ha⁻¹ and 2000 g a.i. ha⁻¹ (T17 – 3377 kg ha⁻¹; T23 – 3270 kg ha⁻¹, respectively), although the productivity of the association with mancozeb 2000 g a.i. ha⁻¹ was statistically similar to azoxystrobin + benzovindiflupyr 60 + 30 g a.i. isolated ha⁻¹ (T13 – 3186 kg ha⁻¹).” Godoy (Ex. 1005) at p. 5, see also Table 5 at p 6. “For treatments with applications associated with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹, there was a significant reduction in severity with the association of multisite in all combinations. The lowest severity was observed for the

	association with mancozeb 2000 g a.i. ha ⁻¹ (T12 – 29.2 %), followed by chlorothalonil 1080 g a.i. ha ⁻¹ (T4 – 31.6 %), mancozeb 1500 g a.i. ha ⁻¹ (T6 – 31.6 %) and copper oxychloride 294 g a.i. ha ⁻¹ and 280 g a.i. ha ⁻¹ (T3 and T5 – 32.9 %).” Godoy (Ex. 1005) at p. 4-5.
2. A fungicidal combination consisting of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenoxy, pyrisoxazole, trifenox, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxystrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	See citation of claim 1 Godoy further taught and showed examples of using such fungicides with different modes of action in combination with a multisite fungicide. For example, in addition to the fungicidal combination of azoxystrobin + benzovindiflupyr + mancozeb, Godoy further explicitly discloses and shows other fungicidal combinations with mancozeb including cyproconazole + picoxystrobin. See Treatments 6, 12, 17 and 23 of Table 3, Godoy (Ex. 1005) at p. 3.
3. The combination as claimed in claim 1, wherein the at least another fungicide	See citation of claim 1

is cyproconazole, difenoconazole, epoxiconazole, hexaconazole, tebuconazole, tetraconazole, prothioconazole, azoxystrobin, picoxystrobin, pyraclostrobin, kresoxim-methyl, trifloxystrobin, or a combination thereof.	
4. The combination as claimed in claim 1, wherein the at least another fungicide is prothioconazole and/or azoxystrobin.	See citation of claim 1
5. A composition consisting of: at least one agrochemically acceptable excipient; and a fungicidal combination of: (a) benzovindiflupyr; (b) mancozeb; and (c) at least one ergosterol biosynthesis inhibitor and/or at least one quinone outside inhibitor; wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenoxy, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb,	See citation of claim 1 For example, Godoy discloses that the products (e.g., the fungicidal combinations in Table 3, including azoxystrobin, benzovindiflupyr and mancozeb, Trials 17 and 23) were applied by “a knapsack sprayer pressurized with CO₂ and a minimum application volume of 120 L ha⁻¹”. Ex. 1005 at p. 4

kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	
6. The composition as claimed in claim 5, wherein the composition is formulated into wettable powders, granules, dusts, soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, a combination of a suspension concentrate (SC) and a capsule suspension (CS), or oil dispersions.	
7. The combination as claimed in claim 1, wherein the benzovindiflupyr and mancozeb are admixed in ratio of 1:80 to 80:1.	See citation of claim 1 Treatment 17: azoxystrobin + benzovindiflupyr and mancozeb (60+ <u>30</u> and <u>1500</u> (Dose g a.i. ha ⁻¹)) (Elatus® and Unizeb Gold®) (0.2 and 2.0 (Dose L-kg C.P. ha ⁻¹)); and Treatment 23: azoxystrobin + benzovindiflupyr and mancozeb (60+ <u>30</u> and <u>2000</u> (Dose g a.i. ha ⁻¹)) (Elatus® and PNR) (0.2 and 2.5 (Dose L-kg C.P. ha ⁻¹)). Ex. 1005 at p. 3.
8. The composition as claimed in claim 5, wherein the total amount of benzovindiflupyr in the composition is in the range of 0.1 to 99% by weight, the total amount of mancozeb in the composition is in the range of 0.1 to 99% by weight; the total amount of ergostrol biosynthesis inhibitor in the composition is in the range of 0.1 to 99% by weight; and the total amount of quinone outside inhibitor in the composition is in the range of 0.1 to 99% by weight.	See citation of claim 1 Treatment 17: azoxystrobin + benzovindiflupyr and mancozeb (60+30 and 1500 (Dose g a.i. ha ⁻¹)) (Elatus® and Unizeb Gold®) (0.2 and 2.0 (Dose L-kg C.P. ha ⁻¹)) Ex. 1005 at p. 3. Treatment 6: picoxystrobin + cyproconazole and mancozeb (60+24 and 1500 (Dose g a.i. ha ⁻¹)) (Aproach®Prima and Unizeb Gold®) (0.3 and 2.0 (Dose L-kg C.P. ha ⁻¹)) Ex. 1005 at p. 3.
9. A method of foliar application, consisting of applying the combination of claim 1 to the foliage of a plant.	See citation of claim 1 Godoy discloses applying the fungicidal combination of benzovindiflupyr, mancozeb and azoxystrobin to the foliage of a plant. In particular, Godoy described the experimental design used to apply the fungicidal combinations

	to soybean plants as “started in the pre-closing of the sowing lines”. P. 4, left column. In regard to the fungicidal combinations listed in Table 3, Godoy explains “three applications were carried out with average intervals of 21 and 15 days after the first and second application, respectively” in the second protocol. P.4. Godoy further explains that “To apply the products, a knapsack sprayer pressurized with CO₂ and a minimum application volume of 120 L ha⁻¹ was used.”
10. A method of controlling fungal diseases in plants consisting of, applying to the locus of the plant a combination consisting of: (a) benzovindiflupyr; (b) at least one quinone outside inhibitor and/or at least one ergosterol biosynthesis inhibitor; and (c) mancozeb, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenoxy, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin,	The '727 Patent defines the “locus” of a plant “to embrace the place on which the plants are growing, . . .” See citation of claim 1 Godoy explained: “The objective of this work is to present the summarized results of cooperative trials with multisite fungicides, carried out on 2015/16 harvest, to control diseases in soybeans crops.”

picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	
--	--

Claims 1-10 of the '727 Patent are anticipated by, or in the alternative rendered obvious by, Tobler (Ex. 1006) alone or in view of Godoy (Ex. 1005)

Claim Language	US Patent 9,314,022 (Ex. 1006)
1. A fungicidal combination consisting of benzovindiflupyr, mancozeb, and at least another fungicide selected from an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	Tobler is directed to fungicidal compositions that include: (A) a compound of formula (I) and (B) at least one compound selected from compounds known for fungicidal activity. (Abstract). Benzovindiflupyr is a preferred compound of formula (I). For example, the '022 patent identifies compound A-1.1 as a preferred compound of formula (I), which is given the chemical name of: 3-difluoromethyl-1-methyl-1H-pyrazole-4-carboxylic acid (dichloromethylidene-benzonorborene-5-yl)amide. Ex. 1006 at 13:5-11. Compound A-1.1 is also known as benzovindiflupyr. Tobler discloses and shows that compound A-1.1 (benzovindiflupyr) is effective in controlling Asian soybean rust (<i>Phakopsora pachyrhizi</i>). See Ex. 1006 at Col. 41, Example B-1. The compositions according to the invention may also comprise more than one of the active components (B), if, for example, a broadening of the spectrum of phytopathogenic disease control is desired. For instance, it may be advantageous in the agricultural practice to combine two or three components (B) with component (A). An example is a composition comprising a compound of formula (I), azoxystrobin and cyproconazole. Ex. 1006 at 27:65-28:5 (emphasis added). "Further examples for compositions according to the present invention which comprise three active ingredients are defined as embodiments E1 and E2:" Embodiment E1:

The term 'TX1' means: 'the compound A-1.1+a compound selected from the group P'. ('022 Patent at 28:6-11).

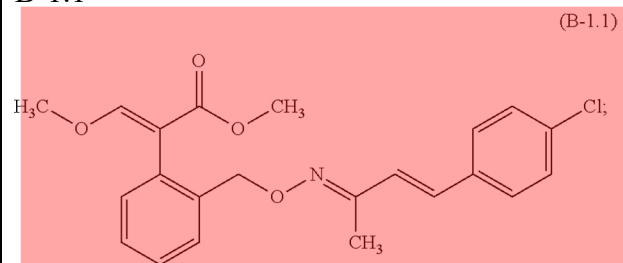
In embodiments E1, '022 discloses:

Mancozeb+TX1 ('022 at 28:40).

Group P includes:

Group P: Especially Suitable Compounds as Component (B) in the Compositions According to the Invention:

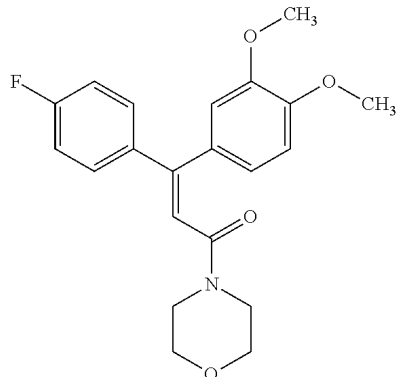
a strobilurin fungicide selected from azoxystrobin (47), dimoxystrobin (226), fluoxastrobin (382), kresoxim-methyl (485), metominostrobin (551), orysastrobin, picoxystrobin (647), pyraclostrobin (690); trifloxystrobin (832), a compound of formula B-1.1



an azole fungicide selected from azaconazole (40), bromuconazole (96), cyproconazole (207), difenoconazole (247), diniconazole (267), diniconazole-M (267), epoxiconazole (298), fenbuconazole (329), fluquinconazole (385), flusilazole (393), flutriafol (397), hexaconazole (435), imazalil (449), imibenconazole (457), ipconazole (468), metconazole (525), myclobutanil (564), oxpoconazole (607), pefurazoate (618), penconazole (619), prochloraz (659), propiconazole (675), prothioconazole (685), simeconazole (731), tebuconazole (761), tetraconazole (778), triadimefon (814), triadimenol (815), triflumizole (834), triticonazole (842), diclobutrazol (1068), etaconazole (1129), furconazole (1198), furconazole-cis (1199) and quinconazole (1378);

a morpholine fungicide selected from aldimorph, dodemorph (288), fenpropimorph (344), tridemorph (830), fenpropidin (343), spiroxamine (740), piperalin (648) and a compound of formula B-3.1

(B-3.1)



an anilino-pyrimidine fungicide selected from cyprodinil (208), mepanipyrim (508) and pyrimethanil (705);

a fungicide selected from the group consisting of anilazine (878), arsenates, benalaxyl (56), benalaxyl-M, benodanil (896), benomyl (62), benthiavalicarb, benthiavalicarb-isopropyl (68), biphenyl (81), **bitertanol** (84), blasticidin-S (85), bordeaux mixture (87), boscalid (88), bupirimate (98), cadmium chloride, captan (114), carbendazim (116), carbon disulfide (945), carboxin (120), carpropamid (122), cedar leaf oil, chinomethionat (126), chlorine, chloroneb (139), chlorothalonil (142), chlozolate (149), cinnamaldehyde, copper, copper ammoniumcarbonate, copper hydroxide (169), copper octanoate (170), copper oleate, copper sulphate (87), cyazofamid (185), cycloheximide (1022), cymoxanil (200), dichlofluanid (230), dichlone (1052), dichloropropene (233), diclocymet (237), diclomezine (239), dicloran (240), diethofencarb (245), diflumetorim (253), dimethirimol (1082), dimethomorph (263), dinocap (270), dithianon (279), dodine (289), edifenphos (290), ethaboxam (304), ethirimol (1133), etridiazole (321), **famoxadone** (322), **fenamidone** (325), fenaminosulf (1144), fenamiphos (326), **fenarimol** (327), fenfuram (333), fenhexamid (334), fenoxanil (338),

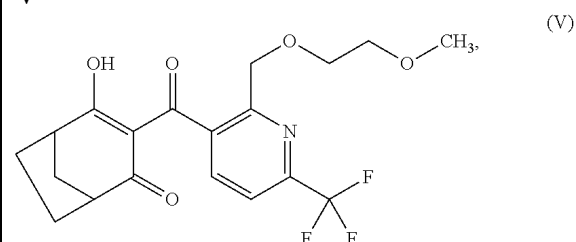
	fenpiclonil (341), fentin acetate (347), fentin chloride, fentin hydroxide (347), ferbam (350), ferimzone (351), fluazinam (363), fludioxonil (368), flusulfamide (394), flutolanil (396), folpet (400), formaldehyde (404), fosetyl-aluminium (407), fthalide (643), fuberidazole (419), furalaxyl (410), furametpyr (411), flyodin (1205), fuazatine (422), hexachlorobenzene (434), hymexazole, iminoctadine (459), iodocarb (3-Iodo-2-propynyl butyl carbamate), iprobenfos (IBP) (469), iprodione (470), iprovalicarb (471), isoprothiolane (474), kasugamycin (483), mancozeb (496), maneb (497), manganous dimethyldithiocarbamate, mefenoxam (Metalaxyl-M) (517), mepronil (510), mercuric chloride (511), mercury, metalaxyl (516), methasulfocarb (528), metiram (546), metrafenone, nabam (566), neem oil (hydrophobic extract), nuarimol (587), octhilinone (590), ofurace (592), oxadixyl (601), oxine copper (605), oxolinic acid (606), oxycarboxin (608), oxytetracycline (611), paclobutrazole (612), paraffin oil (628), paraformaldehyde, pencycuron (620), pentachloronitrobenzene (716), pentachlorophenol (623), penthiopyrad, perfurazoate, phosphoric acid, polyoxin (654), polyoxin D zinc salt (654), potassium bicarbonate, probenazole (658), procymidone (660), propamocarb (668), propineb (676), proquinazid (682), prothiocarb (1361), pyrazophos (693), pyriifenox (703), pyroquilon (710), quinoxifen (715), quintozone (PCNB) (716), silthiofam (729), sodium bicarbonate, sodium diacetate, sodium propionate, streptomycin (744), sulphur (754), TCMTB, tecloftalam, tecnazene (TCNB) (767), thiabendazole (790), thifluzamide (796), thiophanate (1435), thiophanate-methyl (802), thiram (804), tolclofos-methyl (808), tolylfluanid (810), triazoxide (821), <i>trichoderma harzianum</i> (825), tricyclazole (828), triforine (838), triphenyltin hydroxide (347), validamycin (846), vinclozolin (849), zineb (855), ziram (856),
--	---

zoxamide (857), 1,1-bis(4-chlorophenyl)-2-ethoxyethanol (IUPAC-Name) (910), 2,4-dichlorophenyl benzenesulfonate (IUPAC-/Chemical Abstracts-Name) (1059), 2-fluoro-N-methyl-N-1-naphthylacetamide (IUPAC-Name) (1295), 4-chlorophenyl phenyl sulfone (IUPAC-Name) (981),

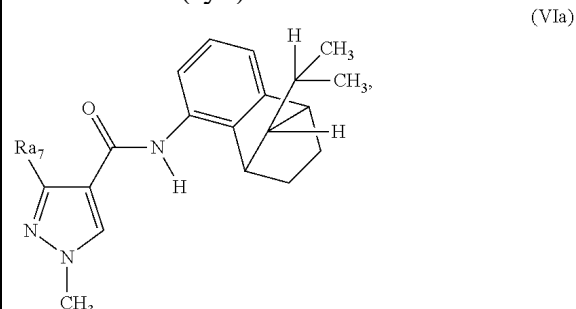
a compound of formula B-5.1, a compound of formula B-5.2, a compound of formula B-5.3, a compound of formula B-5.4, a compound of formula B-5.5, a compound of formula B-5.6, a compound of formula B-5.7, compound B-5.8, compound B-5.9, compound B-5.10, compound B-5.11, compound B-5.12, compound B-5.13, compound B-5.14, compound B-5.15, compound B-5.16, compound B-5.17 and compound B-5.18;

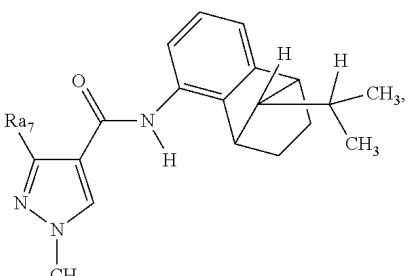
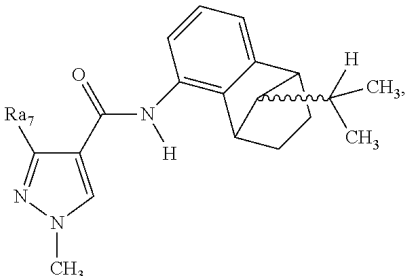
a plant-bioregulator selected from the group consisting of acibenzolar-S-methyl (6), chlormequat chloride (137), ethephon (307), mepiquat chloride (509) and trinexapc-ethyl (841);

an insecticide selected from the group consisting of abamectin (1), clothianidin (165), emamectin benzoate (291), imidacloprid (458), tefluthrin (769), thiamethoxam (792), and glyphosate (419), a compound of formula V



fomesafen, and (B9) a racemic compound of formula VIa (syn)



	wherein Ra₇ is trifluoromethyl or difluoromethyl; a racemic mixture of formula VIb (anti) (VIb)  wherein Ra₇ is trifluoromethyl or difluoromethyl; a compound of formula VIc (VIc)  which is an epimeric mixture of racemic compounds of formulae F-10 (syn) and F-11 (anti), wherein the ratio from racemic compounds of formula F-10 (syn) to racemic compounds of formula F-11 (anti) is from 1000:1 to 1:1000 and wherein Ra₇ is trifluoromethyl or difluoromethyl. Ex. 1006 at 22:61-25:67. Godoy further taught and showed examples of using such fungicides with different modes of action in combination with a multisite fungicide. For example, in addition to the fungicidal combination of azoxystrobin + benzovindiflupyr + mancozeb, Godoy further explicitly discloses and shows other fungicidal combinations with mancozeb including cyproconazole + picoxystrobin. See Treatments 6, 12, 17 and 23 of Table 3, Godoy (Ex. 1005) at p. 3.
2. A fungicidal combination consisting of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide,	See citation of claim 1

wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifeno, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	
3. The combination as claimed in claim 1, wherein the at least another fungicide is cyproconazole, difenoconazole, difenoconazole, hexaconazole, tebuconazole, tetraconazole, tetraconazole, azoxystrobin, picoxystrobin, pyraclostrobin, kresoxim-methyl, trifloxystrobin, or a combination thereof.	See citation of claim 1
4. The combination as claimed in claim 1, wherein the at least another fungicide is prothioconazole and/or azoxystrobin.	See citation of claim 1
5. A composition consisting of: at least one agrochemically acceptable excipient; and a fungicidal combination of:	See citation of claim 1

(a) benzovindiflupyr; (b) mancozeb; and (c) at least one ergosterol biosynthesis inhibitor and/or at least one quinone outside inhibitor; wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenoxy, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	Such compositions may be produced in conventional manner, e.g. by mixing the active ingredients with at least one appropriate inert formulation adjuvant (for example, diluents, solvents, fillers and optionally other formulating ingredients such as surfactants, biocides, anti-freeze, stickers, thickeners and compounds that provide adjuvancy effects). Also conventional slow release formulations may be employed where long lasting efficacy is intended. Particularly formulations to be applied in spraying forms, such as water dispersible concentrates (e.g. EC, SC, DC, OD, SE, EW, EO and the like), wettable powders and granules, may contain <u>surfactants such as wetting and dispersing agents and other compounds that provide adjuvancy effects</u>, e.g. the condensation product of formaldehyde with naphthalene sulphonate, an alkylarylsulphonate, a lignin sulphonate, a fatty alkyl sulphate, and ethoxylated alkylphenol and an ethoxylated fatty alcohol.” Ex. 1006 at 36:23-39. The ‘022 Patent further discloses “The composition of the invention may be employed in any conventional form . . . or any technically feasible formulation in combination with agriculturally acceptable adjuvants.” Ex. 1006 at 36:4-22. Throughout this document the expression ‘composition’ stands for the various mixtures or combinations of components (A) and (B), for example in a single ‘ready-mix’ form, in a combined spray mixture composed from separate formulations of the single active ingredient components, such as a ‘tank-mix’, and in a combined use of the single active ingredients when applied in a sequential manner, i.e. one after the other with a reasonably short period, such as a few hours or days. The order of applying the components (A) and (B) is not essential for working the present invention. Ex. 1006, 27:55-64.
--	---

6. The composition as claimed in claim 5, wherein the composition is formulated into wettable powders, granules, dusts, soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, a combination of a suspension concentrate (SC) and a capsule suspension (CS), or oil dispersions.	See citation of claim 5 “The composition of the invention may be employed in any conventional form, for example in the form of a twin pack, a powder for dry seed treatment (DS), an emulsion for seed treatment (ES), a flowable concentrate for seed treatment (FS), a solution for seed treatment (LS), a water dispersible powder for seed treatment (WS), a capsule suspension for seed treatment (CF), a gel for seed treatment (GF), an emulsion concentrate (EC), a suspension concentrate (SC), a suspo-emulsion (SE), a capsule suspension (CS), a water dispersible granule (WG), an emulsifiable granule (EG), an emulsion, water in oil (EO), an emulsion, oil in water (EW), a micro-emulsion (ME), an oil dispersion (OD), an oil miscible flowable (OF), an oil miscible liquid (OL), a soluble concentrate (SL), an ultra-low volume suspension (SU), an ultra-low volume liquid (UL), a technical concentrate (TK), a dispersible concentrate (DC), a wettable powder (WP) or any technically feasible formulation in combination with agriculturally acceptable adjuvants. Ex. 1006 at 36:4-22
7. The combination as claimed in claim 1, wherein the benzovindiflupyr and mancozeb are admixed in ratio of 1:80 to 80:1.	See citation of claim 1 “In general, the weight ratio of component (A) to component (B) is from 2000:1 to 1:1000. A non-limiting example for such weight ratios is compound of formula I:compound of formula B-2 is 10:1. The weight ratio of component (A) to component (B) is preferably from 100:1 to 1:100; more preferably from 20:1 to 1:50.” Ex. 1006 at 34:26-32.
8. The composition as claimed in claim 5, wherein the total amount of benzovinidiflupyr in the composition is in the range of 0.1 to 99% by weight, the total amount of mancozeb in the composition is in the range of 0.1 to 99% by weight; the total amount of ergostrol biosynthesis inhibitor in the composition is in the range of 0.1 to 99%	See citation of claim 1 In general, the formulations include from 0.01 to 90% by weight of active agent, from 0 to 20% agriculturally acceptable surfactant and 10 to 99.99% solid or liquid formulation inerts and adjuvant(s), the active agent consisting of

by weight; and the total amount of quinone outside inhibitor in the composition is in the range of 0.1 to 99% by weight.	at least a compound of component (A) together with a compound of component (B), and optionally other active agents, particularly microbiocides or conservatives or the like. Concentrated forms of compositions generally contain in between about 2 and 80%, preferably between about 5 and 70% by weight of active agent. Application forms of formulation may for example contain from 0.01 to 20% by weight, preferably from 0.01 to 5% by weight of active agent. Whereas commercial products will preferably be formulated as concentrates, the end user will normally employ diluted formulations. Ex. 1006, 36:2-65. In addition, Godoy (Ex. 1005) taught and showed examples of using fungicides with different modes of action (azoxystrobin + benzovindiflupyr) and (picoxystrobin + cyproconazole) in combination with a multisite fungicide (mancozeb). Godoy suggested a fungicidal combination with the following approximate percentages of active ingredients: 2.4% (60/(300+200+2000)) picoxystrobin, 0.96% (24/2500) cyproconazole, 2.4% (60/2500) azoxystrobin, 1.2% (30/2500) benzovindiflupyr and 60% (1500/2500) mancozeb.
9. A method of foliar application, consisting of applying the combination of claim 1 to the foliage of a plant.	See citation of claim 1 “Some compositions according to the invention have a systemic action and can be used as foliar, soil and seed treatment fungicides.” Ex. 1006 at 35:28-30
10. A method of controlling fungal diseases in plants consisting of, applying to the locus of the plant a combination consisting of: (a) benzovindiflupyr; (b) at least one quinone outside inhibitor and/or at least one ergostrol biosynthesis inhibitor; and (c) mancozeb,	See citation of claim 1 A further aspect of the present invention is a method of controlling diseases on useful plants or on propagation material thereof caused by phytopathogens, which comprises applying to the useful plants, the locus thereof or propagation material thereof a composition

wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	according to the invention. Ex. 1006 at 12:26-29
--	---

Claims 1-10 of the '727 Patent are rendered obvious by De Oliveira (Ex. 1007) alone or in view of either Wiglesworth (Ex. 1008), Tobler (Ex. 1006) or Godoy (Ex. 1005)

Claim Language	De Oliveira (WO2015079334) (Ex. 1007)			
1. A fungicidal combination consisting of benzovindiflupyr, mancozeb, and at least another fungicide selected from an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifeno, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	De Oliveira is directed to a method for controlling Asian soybean rust (ASR) and fungicidal combinations including a multi-site contact fungicide, a first systemic fungicide and optionally a second systemic fungicide. Ex. 1007 at Abstract. It has surprisingly been found that the use of a contact protective dithiocarbamate fungicide along with <u>at least one systemic fungicide</u> effectively penetrates the dense canopy barrier of the infected leguminous plant while simultaneously not allowing the rust pathogen to move up the plant foliage. Without wishing to be bound by theory, it is believed that the contact protective dithiocarbamate fungicide component of the combination effectively penetrates the dense plant foliage, while the systemic fungicide component effectively prevents the rust pathogen from infecting the remaining portion of the plant effectively reducing the susceptibility of the plant towards the infection. This synergistic complementation was not seen when either the foliar protective fungicide or the systemic fungicide were individually used in isolation, but was observed when the two fungicides were used in conjunction. This synergistic complementation between the contact preventive dithiocarbamate fungicide and a systemic fungicide for the treatment and control of Phakopsora species of fungicides was unexpected and surprising. Ex. 1007 at p. 7. In another embodiment, the systemic fungicide of the present invention is a succinate dehydrogenase inhibitor fungicide (SDHI). Preferably, the succinate dehydrogenase inhibitor is selected from the group consisting of benodanil, flutolanil, mepronil, fluopyram, fenfuram, carboxin, oxycarboxin, thifluzamide, bixafen, fluxapyroxad, furametpyr, isopyrazam, penflufen, penthiopyrad, sedaxane and boscalid. Ex. 1007 at p. 15. Ex. 1007 at page 24: <table><tr><td>A(2)</td><td>Mancozeb 750 WDG + 200 g/L azoxystrobin + 80 g/L cyproconazole</td><td>1500 g/Ha + 300 mL/Ha</td></tr></table>	A(2)	Mancozeb 750 WDG + 200 g/L azoxystrobin + 80 g/L cyproconazole	1500 g/Ha + 300 mL/Ha
A(2)	Mancozeb 750 WDG + 200 g/L azoxystrobin + 80 g/L cyproconazole	1500 g/Ha + 300 mL/Ha		

	B(2)	Mancozeb 750 WDG + 85 g/L pyraclostrobin + 62.5 g/L epoxiconazole	1500 g/Ha + 500 mL/Ha
	C(2)	Mancozeb 750 WDG + Cyproconazole 80g/L + Picoxystrobin 200g/L	1500 g/Ha + 300 mL/Ha
	D(2)	Mancozeb 750 WDG + Picoxystrobin 200 g/L + Tebuconazole 80 g/L	1500 g/Ha + 300 mL/Ha
	It was further found that the lower the mixture performance in the rust control, the greater the additional benefit of mancozeb. It was thus concluded that the addition of a multi-site contact fungicide such as mancozeb acted as a synergist to the combination products registered for the treatment of Asian soybean rust. The addition of a dithiocarbamate increased disease control and improved yield of plants. Ex. 1007 at p. 25 Wiglesworth further discloses the new SDHI fungicide benzovindiflupyr is “extremely efficacious on soybean rust” and combinable with azoxystrobin. Ex. 1008 at S2. 11-12. Tobler (Ex. 1006) discloses that benzovindiflupyr (compound A-1.1) is highly effective at controlling <i>Phakopsora pachyrhizi</i> (Asian soybean rust). Ex. 1006, 41:20-30, Table B1. In fact, claim 1 of Tobler claims “[a] composition ... comprising a synergistically effective amount of (A) a compound of formula I [which includes benzovindiflupyr]; and (B2) an azole fungicide.” Ex. 1006 at 61:20-41. Godoy (Ex. 1005) taught and showed fungicidal combinations including benzovindiflupyr (an SDHI) in combination with mancozeb and azoxystrobin improved disease control for ASR.		
2. A fungicidal combination consisting of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide, and a quinone outside inhibitor fungicide, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole,	See citation of claim 1		

difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	
3. The combination as claimed in claim 1, wherein the at least another fungicide is cyproconazole, difenoconazole, epoxiconazole, hexaconazole, tebuconazole, tetraconazole, prothioconazole, azoxystrobin, picoxystrobin, pyraclostrobin, kresoxim-methyl, trifloxystrobin, or a combination thereof.	See citation of claim 1
4. The combination as claimed in claim 1, wherein the at least	See citation of claim 1

another fungicide is prothioconazole and/or azoxystrobin.	
5. A composition consisting of: <u>at least one agrochemically acceptable excipient</u>; and a fungicidal combination of: (a) benzovindiflupyr; (b) mancozeb; and (c) at least one ergosterol biosynthesis inhibitor and/or at least one quinone outside inhibitor; wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenoxy, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone,	See citation of claim 1 “In an embodiment, the present invention thus provides a composition comprising any of the fungicidal combinations such as herein described along with <u>agriculturally acceptable excipients</u>.” De Oliveira (Ex. 1007) at p 23.

pyribencarb, and mixtures thereof.	
6. The composition as claimed in claim 5, wherein the composition is formulated into <u>wettable powders</u> , <u>granules</u> , dusts, soluble (liquid) concentrates, <u>suspension concentrates</u> , oil in water emulsion, water in oil emulsion, <u>emulsifiable concentrates</u> , capsule suspensions, a combination of a suspension concentrate (SC) and a capsule suspension (CS), or oil dispersions.	See citation of claim 1 “In an embodiment, the fungicides or the combinations thereof contemplated according to the present invention may be pre-formulated and may be in the form of <u>Water Dispersible Granules (WDG)</u> , <u>Wettable Powders</u> , <u>Suspension Concentrates</u> , <u>Emulsifiable Concentrate</u> , <u>Suspoemulsions</u> , <u>Capsule Suspensions</u> etc. However, the choice of any preferred formulation type is not particularly limiting.” Ex. 1007 at p. 22
7. The combination as claimed in claim 1, wherein the benzovindiflupyr and mancozeb are admixed in ratio of 1:80 to 80:1.	See citation of claim 1 Godoy (Ex. 1005) disclosed ratios for benzovindiflupyr and mancozeb admixed in a ratio of 1:80 to 80:1. The fungicidal combinations shown for Treatments 17 and 23 in Table 3 of Godoy (Ex. 1005) have a ratio of benzovindiflupyr (30 (Dose g a.i./ha ⁻¹)) to mancozeb (1500 and 2000 (Dose g a.i./ha ⁻¹)) of 30 to 1500 and 30 to 2000 or a ratio of 1:50 and 1:67, respectively. Alternatively, Wiglesworth (Ex. 1008) discloses that benzovindiflupyr has use rates as low as 30 g a.i./ha being extremely efficacious on soybean rust. De Oliveira (Ex. 1007) provides examples with use rates for mancozeb to treat soybean rust as 1500 g/ha. Hence, a POSA would have used the same or similar use rates for the combination of benzovindiflupyr and mancozeb taught by the combination of De Olivera and Wiglesworth, e.g., 30:1500 or 1:50, which falls within the range of 1:80 to 80:1 set out in claim 7.
8. The composition as claimed in claim 5, wherein the total amount of benzovindiflupyr in the composition is in the range of 0.1 to 99% by weight, the total amount of mancozeb in the composition is in the range of 0.1 to 99% by weight; the total amount of ergosterol biosynthesis inhibitor in the composition is in the range of 0.1 to 99% by weight; and	As explained above for claim 5 (incorporated herein by reference), the combination of De Oliveira in view of either Godoy or Wiglesworth suggested the fungicidal combination of benzovindiflupyr, mancozeb, an ergosterol biosynthesis inhibitor fungicide (such as cyproconazole, epoxiconazole, tebuconazole), and a quinone outside inhibitor fungicide (such as azoxystrobin, picoxystrobin, pyraclostrobin)

the total amount of quinone outside inhibitor in the composition is in the range of 0.1 to 99% by weight.	De Oliveira (Ex. 1007) discloses dosages for the fungicides used in its examples to treat ASR. For example, the dosages used in Example A(2) can be determined as follows: 1500 g a.i. /ha of mancozeb, 60 g a.i./ha (200g/L x 300 ml/ha) of azoxystrobin, and 24 g a.i./ha (80 g/L x 300 ml/ha) of cyproconazole. Godoy (Ex. 1005) taught and showed fungicidal combinations including 30 g a.i./ha benzovindiflupyr, 60 g a.i./ha azoxystrobin and 1500 g a.i./ha mancozeb for treating ASR. Alternatively, Wiglesworth (Ex. 1008) discloses that benzovindiflupyr has use rates as low as 30 g a.i./ha being extremely efficacious on soybean rust.
9. A method of foliar application, consisting of <u>applying the combination of claim 1 to the foliage of a plant.</u>	See citation of claim 1 De Oliveira (Ex. 1007) discloses that its method “comprises treating the plant at the locus of the infection”. Ex. 1007 at p. 7. De Oliveira further discloses that the pathogen for Asian soybean rust is found on the leaves of soybeans. Id. at p. 4. Page 7: It has surprisingly been found that the use of a contact protective dithiocarbamate fungicide along with at least one systemic fungicide <u>effectively penetrates the dense canopy barrier of the infected leguminous plant while simultaneously not allowing the rust pathogen to move up the plant foliage. Without wishing to be bound by theory, it is believed that the contact protective dithiocarbamate fungicide component of the combination effectively penetrates the dense plant foliage, while the systemic fungicide component effectively prevents the rust pathogen from infecting the remaining portion of the plant effectively reducing the susceptibility of the plant towards the infection.</u> This synergistic complementation was not seen when either the foliar protective fungicide or the systemic fungicide were individually used in isolation, but was observed when the two fungicides were used in conjunction. This synergistic complementation between the contact preventive dithiocarbamate fungicide and a systemic fungicide for the treatment

	and control of Phakopsora species of fungicides was unexpected and surprising. Page 22: The method of control of the present invention may be carried out by spraying the suggested tank mixes, or the individual fungicides may be formulated as a kit-of-parts containing various components that may be mixed as instructed prior to spraying.
10. <u>A method of controlling fungal diseases in plants</u> consisting of, applying to the <u>locus</u> of the plant a combination consisting of: (a) benzovindiflupyr; (b) at least one quinone outside inhibitor and/or at least one ergosterol biosynthesis inhibitor; and (c) mancozeb, wherein the ergosterol biosynthesis inhibitor is selected from azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine, and mixtures thereof; and wherein the quinone outside inhibitor fungicide is selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin,	See citation of claim 1 and claim 9 The present invention relates to a method for the prevention and/or treatment of phytopathogenic fungi. Ex. 1007 at p. 1. De Oliveira (Ex. 1007) discloses that its method “comprises treating the plant at the locus of the infection”. Ex. 1007 at p. 7. As explained above for claim 9 (incorporated herein by reference), the combination of De Oliveira (Ex. 1007) in view of either Godoy (Ex. 1005) or Wiglesworth (Ex. 1008) suggested a method of controlling fungal disease in plants by applying to the locus of the plant fungicidal combinations embraced by claim 10. De Oliveira (Ex. 1007) in view of either Godoy (Ex. 1005) or Wiglesworth (Ex. 1008) further provide a reasonable expectation of success in controlling fungal disease in plants by applying to the locus of the plant fungicidal combinations embraced by claim 10.

picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim- methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb, and mixtures thereof.	
--	--