

## 2020 WSSA Committee Progress Report Summary for 2019 and Action Plan for 2020

Committee Code and Name: E6 Research and Competitive Grants

Committee Chair: Steve Fennimore

Committee Members - 2020:

Al-Khatib, Kassim	2020-W, <a href="mailto:kalkhatib@ucdavis.edu">kalkhatib@ucdavis.edu</a>
Besijn, Joost	2021-W, <a href="mailto:Noxiousweeds@co.jefferson.wa.us">Noxiousweeds@co.jefferson.wa.us</a>
Brainard, Daniel,	2021-NC, <a href="mailto:brainar9@msu.edu">brainar9@msu.edu</a>
Boyd, Nathan	2021-S, <a href="mailto:nsboyd@ufl.edu">nsboyd@ufl.edu</a>
Clay, Sharon	2021-NC, <a href="mailto:sharon.clay@sdstate.edu">sharon.clay@sdstate.edu</a>
Devkota, Pratap	2022-S, <a href="mailto:pdevkota@ufl.edu">pdevkota@ufl.edu</a>
Doohan, Doug	2021-NC, <a href="mailto:doohan.1@osu.edu">doohan.1@osu.edu</a>
Fennimore, Steven *	2020-W, <a href="mailto:safennimore@ucdavis.edu">safennimore@ucdavis.edu</a>
Jugulam, Mithila	2021 NC, <a href="mailto:mithila@ksu.edu">mithila@ksu.edu</a>
Kumar, Vipin	2021 W, <a href="mailto:vipan.kumar@montana.edu">vipan.kumar@montana.edu</a>
Nandula, Vijay	2019-S, <a href="mailto:Vijay.Nandula@ars.usda.gov">Vijay.Nandula@ars.usda.gov</a>
Senseman, Scott	2020-S, <a href="mailto:ssensema@utk.edu">ssensema@utk.edu</a>
Young, Steve	2022-W, <a href="mailto:steve.young@usu.edu">steve.young@usu.edu</a>

Kells, Jim, NIFA Fellow

Van Wychen, Lee, Ex. off.

Board Coordinator: Open

Committee Members Rotating Off: none

### Summary of Activities

- What were the committee's goals for 2019?
  - 1) To develop a special session on "**Genomics of Weedy and Invasive Species-2025 and Beyond**" for the 2020 meeting in Lahaina, HI. Below is the proposal:

**Title: Genomics of Weedy and Invasive Species-2025 and Beyond**

**Organizer:** Research and Extramural Grants Committee

**Contact Person:** Mithila Jugulam; **Phone:** 785-532-2755; **Email:** [mithila@ksu.edu](mailto:mithila@ksu.edu)

### Justification and Objectives:

In the last two decades, tremendous progress has been made across several disciplines of weed science (e.g., weed biology/ecology, herbicide physiology, integrated weed management, herbicide resistance evolution, etc.). However, the research in molecular biology and genomics of weeds and their interaction with herbicides is still in its infancy. Investigation of basic aspects encompassing the genomics and molecular biology of weeds is vital to understand the biology and genetics of weedy and invasive species. More importantly, such information will help address the fundamental mechanisms of evolution of herbicide resistance in weeds, which is a challenging constraint to sustainable crop production. The outcome of such research can offer valuable tools/information to develop viable strategies for weed management. This

symposium will address the progress made in genomics of weedy and invasive species in recent years, but more importantly, the speakers are expected to provide a vision for this area of research beyond 2025. The objectives of this symposium are to 1) bring speakers across the globe to provide an overview of current advancements made in genomics of weedy and invasive species and also a vision for the prospects of research in this area; 2) have a panel discussion to identify the most promising aspects of weed genomics that can advance agricultural enterprise. Importantly, since this type of research needs funding support from federal grant agencies, this symposium is also aimed at developing a white paper by the WSSA Research and Competitive Grants Committee to propose this as a weed research priority area to NIFA and other funding agencies. After the symposium, the conclusions will be summarized in a review paper, "Genomics of Weedy and Invasive Species-2025 and Beyond," coauthored by all speakers and published in Weed Science.

**Target Audience:** All WSSA members, and ultimately NIFA decision makers

### **Publication or Outreach Plans associated with symposium presentations**

As mentioned above, the objective is to summarize the symposium topics as a review paper for publication in Weed Science journal. Importantly, several speakers have agreed to contribute towards this publication.

**Length of Proposed Program:** Half-day Symposium (1-5 pm)

### **Proposed Titles and Speakers (\* confirmed):**

**1:00-1:15 pm: Introduction:** Mithila Jugulam (Kansas State University)

**1:15-1:45 pm:**

\*Vision and Strategy for the International Weed Genomics Consortium: **Todd Gaines** (CSU-WSSA member)

**1:45- 2:15 pm:**

\*Functional Genomics of Horseweed (non-WSSA member): **Neal Stewart** (U of Tennessee)

**2:15-2:45 pm:**

\*Whole Genome Sequence of Palmer Amaranth and its Application: **Chris Sasaki** (Clemson University)

**2:45-3:15 pm**

\*Use of Genomics to Understand Dioecy in Amaranthus species: **Patrick Tranel** (U of IL); (WSSA member)

**2:45-3:15 pm**

\*Development and Application of Transient Expression Systems for Black-Grass: **Dana MacGregor** (Rothamsted Research, UK)

**3:15-3:30-** Coffee Break

**3:30-4:00 pm**

\*Whole Genome Sequence of Kochia: **Eric Patterson** (MSU); (WSSA member)

**4:00-4:30 pm**

\*Genomics of Canadian Weedy and Invasive species: **Martin Laforest** (Agriculture and Agri-Food Canada) (WSSA member)

**4:30-5:00 pm**

\*Use of genomics and molecular cytogenetics to understand glyphosate resistance in weeds: **Dal-Hoe** (Kansas State University); (WSSA member)

5:00 to 5:40 pm: Discussion with the speakers and audience.

**Budget Requested:** (Please specify the expenditure of the funds as opposed to submitting an overall amount. The more detailed the budget, the better the WSSA Board of Directors can evaluate the proposal.)

**\$5,000 Total request: (we request the maximum funds allowed for a half-day symposium)**

- Speaker (Dana MacGregor) from the UK: (Non-WSSA member)  
Airfare + Hotel (3 nights plus tax)= **\$1,800**
- Speaker (Chris Saski) from Clemson University: (Non-WSSA member)  
Airfare + Hotel (3 nights plus tax)= **\$1,300**
- Speaker (Neal Stewart) from U of Tennessee (Non-WSSA member)  
Airfare + Hotel (3 nights plus tax)= **\$1,300**

**\$ 600** Page charges to defray the cost of publishing symposium summary in Weed Science

We request a total of **\$5000**, to cover partial costs of travel and lodging to Maui, Hawaii, for the speakers who are not WSSA members.

2. To develop a symposium on “**The Role of Intelligent Machines in Weed Management**” to be presented in Lahaina, HI at the 2020 meeting.

**2020 Annual WSSA Meeting, Maui, HI**

**Title: The Role of Intelligent Machines in Weed Management**

**Organizer:** Research and Extramural Grants Committee

**Contact Persons:** Steve Fennimore and Sharon Clay

**Phone:** 831-755-2896; 605-688-4757

**Email:** [safennimore@ucdavis.edu](mailto:safennimore@ucdavis.edu); [Sharon.Clay@sdstate.edu](mailto:Sharon.Clay@sdstate.edu)

**Justification and Objectives:**

Much progress has been made in the past decade on the mechanization of weed recognition, mapping and removal. In vegetable crops the drive for automation of weed removal has been intense, driven by lack of labor and few effective herbicides. In major crops the drivers are herbicide resistant weeds, need for greater efficiency on large acreages, and slim profit margins. In all areas there is need for a trained workforce with the background needed to operate intelligent machinery and to keep up with the fast pace of change in agricultural technology. We propose to bring together academic and industry professionals to update WSSA members on these issues. The objective of the symposium is to discuss the applications of intelligent machines in weed management. Speakers will address topics such as technology used to detect, identify, map and remove weeds as well as the socioeconomic aspects of this technology. The presenters with perspectives from major and specialty crops will describe the status of current technologies, challenges and opportunities as well as future directions.

**Target Audience:** All WSSA members

**Publication or Outreach Plans associated with symposium presentations**

The symposium itself will serve as a basis for a Weed Science symposium paper with all presenters participating as co-authors.

**Length of Proposed Program:** 7 hours

**Proposed Titles and Speakers:** (All listed speakers have been confirmed)

1. **Introduction to Symposium** – Steve Fennimore, University of California Davis 8-8:15 am
2. **Machine learning: data acquisition, analysis and actuation.** Methods such as artificial neural networks (ANN) are algorithms used in machine learning to teach a machine to recognize crops and weeds then control the weeds. Data acquisition processing will be discussed as well.  
8:15-8:45 William Patzoldt, BlueRiver Technologies. “Machine learning and crop recognition”.  
8:45-9:15 Mohsen Mesgaran, University of California, Davis, “Data acquisition and analysis”.
3. **Autonomous weeders.** These are weeders that operate without a tractor driver. These machines identify crops or weeds, then cultivate or spray weeds while protecting the crop.  
9:15-9:45 Girish Chowdhary, University of Illinois, “Teams of small autonomous robots for weed control in corn, soybean and specialty crops”.  
9:45-10:00 break  
10:00-10:30 Thomas Palomares, Farmwise, “Autonomous weeding in vegetable crops”.
4. **Social, economic and regulatory aspects of automated weeding.**  
10:30-11:00 Laura Tourte, University of California, “Economics of automated weeders in vegetable crops”.  
11:00-11:30 Scott Fausti California State University Monterey Bay / South Dakota State University.  
Title “Survey of dealer needs in the Western Corn Belt”.
5. **Weed and crop detection with machine vision.** This section would deal with detection of crops with machine vision and differentiation of crops from weeds.  
11:30-12:00 Lie Tang, Iowa State University, “2D and 3D vision techniques for crop plant detection”.  
12:00-13:00 Lunch break  
13:00-13:30 Mark Siemens, University of Arizona, “Machine vision systems for robotic weed control in vegetable crops”.
6. **Precision weed management.** This section will focus on real-world examples of application of weed maps to manage herbicide resistance, precise spray application and other related topics.  
13:30-14:00 Anita Dille Kansas State University, “Precision Crop Protection: Soil Management Zones for Optimizing Weed Control Efficacy”.  
14:00-14:30 W. Wade Robey – Raven Industries, “Precision sprayer applications and connectivity”.
7. **Panel and open discussion.** Steve Fennimore University of California, Davis will moderate.  
14:30-15:00 facilitated discussion

#### **Budget request**

**\$6,000 Total request: (we request the maximum funds allowed for a 3/4-day symposium)**

- Speaker (Lie Tang) from Iowa State University: (Non-WSSA member)  
Airfare + Hotel (3 nights plus tax)= **\$1,200**
- Speaker (Mark Siemens) from University of Arizona: (Non-WSSA member)  
Airfare + Hotel (3 nights plus tax)= **\$1,200**
- Speaker (Girish Chowdhary) from the University of Illinois (Non-WSSA member)

Airfare + Hotel (3 nights plus tax)= \$1,200

- Speaker (Laura Tourte) from the University of California (Non-WSSA member)

Airfare + Hotel (3 nights plus tax)= \$1,200

- Speaker (Scott Fausti) from the California State University and South Dakota State University (Non-WSSA member) Airfare + Hotel (3 nights plus tax)= \$1,200

- List the committee's accomplishments (since the last annual meeting):

Following our recommendations to USDA NIFA in November 2018 to emphasize funding in genomics of weedy species and intelligent weeding devices, the committee has developed the two symposia listed above.

With respect to the WSSA Strategic Plan (2015-2020), the E6 Committee is addressing those goals within its purview:

*Goal 3A: Identify key weed science research areas with strategic importance*

- The committee provided guidance to USDA NIFA regarding future funding priorities for weed science. This guidance will be emphasized by the two symposia presented at the 2020 meeting and possible manuscripts that will be written after the meeting.

*Goal 3B: Provide information to WSSA members on research funding opportunities.*

- We will ensure that WSSA members are informed of any future changes in funding opportunities at USDA NIFA.

*Goal 3C: Provide a forum for research and information exchange through publications and meetings including international weed science research and collaboration with other science societies.*

- Not addressed in 2019.

*Goal 3D: Provide information and committee participation in key research and policy areas to improve funding opportunities for weed science research.*

- This was addressed in goal 3A above

- What is the current state of the committee's projects and activities?

The committee is focused on holding the two symposia at the 2020 meeting. The committee will meet at the 2020 WSSA conference to discuss new projects.

## 2020 Plan for Committee Activities

- Goals for 2020:

Steve Fennimore will rotate off as committee chair and turn it over to Dan Brainard. Steve will work with Dan to plan an orderly transition.

- Plan of Action:

Work with WSSA members and leadership on the above goals.

## Recommendations for Board/Society Action:

- Funds requested for 2020:

\$11,000 in travel funds for the two 2020 symposia.

- Other requests for the Board:

The board should consider means to involve technology companies in the society. Weed Science will become more integrated with robotics, machine learning, genomics and many other technologies that

will arise in the future. The concern is that our primary focus on the agricultural chemical industry limits our vision of technologies that can potentially revolutionize our discipline.