General Blower Calibration and Uniform Blowing Procedure 2022 Survey Report

Purity Subcommittee
Deborah J. Lionakis Meyer (SCST Co-chair) and Nishit Patel (AOSA Co-chair)

Background

A brief history of the application of the Uniform Blowing Procedure in the AOSA Rules can be found in the introduction section of Volume 2 of the AOSA Rules. The current version of the procedure for General type seed blower calibration and measurement of the equivalent air velocity (EAV) in the air column of the blower was adopted into the AOSA Rules in 2006. Measurement of the EAV was subsequently adopted into the ISTA Rules. A comparison of the similarities and differences in the ISTA Rules and AOSA Rules for General type seed blower calibration is provided in Table 1.

The kinds of seed requiring use of the UBP under the AOSA Rules include *Bouteloua gracilis* (blue grama), *B. curtipendula* (side oats grama), *Dactylis glomerata* (orchardgrass), *Paspalum notatum* 'Pensacola' (Pensacola bahiagrass), *Poa compressa* (Canada bluegrass), *P. pratensis* (Kentucky bluegrass), *P. trivialis* (rough bluegrass), and *Puccinellia distans* (weeping alkaligrass). Calibration of the General type seed blower is based on Master Calibration Samples (MCS) for Kentucky bluegrass, orchardgrass, and Pensacola bahiagrass available on loan from the USDA Seed Regulatory and Testing Branch in Gastonia, North Carolina (USDA). The quality of each MCS is verified and adjusted as needed by USDA after each loaned sample is used and returned to USDA to insure uniformity among the available calibration samples. Under the Canadian Methods and Procedures for Testing Seed (M&P), the UBP is required for Canada bluegrass, Kentucky bluegrass, rough bluegrass, orchardgrass, redtop (*Agrostis gigantea*), and bentgrasses (*Agrostis* spp. other than *A. gigantea*). According to the M&P the procedure for the UBP is based on the AOSA Rules with a few differences (Table 2) and blower calibration is based on the USDA MCS. Under the ISTA Rules, the UBP is required only for Kentucky bluegrass, rough bluegrass, and orchardgrass and blower calibration is based on ISTA developed calibration samples that are purchased from the ISTA Secretariat. Once an ISTA calibration sample is purchased from the ISTA Secretariat it is the responsibility of the purchaser to maintain the integrity of the calibration sample. A comparison among the AOSA Rules, ISTA Rules, and Canadian M&P for blower adjustment factors for certain species is shown in Table 2.

Establishment of the calibrated gate opening and EAV for each General type seed blower, as well as the proper use of this information for routinely testing species that require the UBP for purity analysis is critical to uniformity of test results within and among seed testing laboratories. The survey was developed to begin exploring potential issues with the application of the blower calibration procedure, establishment of the EAV, and use of the EAV to maintain proper calibration of seed blowers.

Survey Responses and Discussion

A survey of AOSA and SCST member laboratories on calibration of the General type seed blower and seed testing using the Uniform Blowing Procedure (UBP) was conducted in July 2022. The survey consisted of 30 questions and labs were instructed to submit one completed survey per lab. Survey responses were received from 21 US labs and one Canadian lab. Of these respondent labs (labs), three are ISTA accredited, five are ISO accredited, six are accredited or in the process to become accredited by USDA-ASL, one is CFIA accredited, and 13 of the labs are not accredited.

Labs were asked which kinds of seed requiring the UBP do they test (Figure 1). Twenty-one labs indicated they test Kentucky bluegrass and twenty labs indicated they test orchardgrass. Of the other kinds tested that require the UBP under the AOSA Rules, generally less than ten labs test such kinds. It was not clear whether the ten labs indicating they test bentgrass and redtop were doing so via the UBP as described in the Canadian M&P.

Most labs (54.6 percent) indicated they test less than 100 samples per year that require the UBP. Of the remaining labs, three labs test between 100 to 199 samples per year, two labs test between 200 to 299 samples per year, two labs test between 300 to 499 samples per year, and three labs test more than 500 samples per year that require the UBP.

Eleven labs have only one General type seed blower, six labs have two blowers, three labs have three blowers, and two labs have four blowers. All labs but one indicated they use the USDA MCS to calibrate their blower(s) when testing under the AOSA Rules, US Federal Seed Act Regulations, or the Canadian M&P. Of these labs, 100 percent indicated they use the Kentucky bluegrass MCS, 86 percent indicated they use the orchardgrass MCS, and 29 percent use the Pensacola bahiagrass MCS when calibrating their General type seed blowers. When asked how often the labs routinely calibrate their seed blowers using the USDA MCS, seven labs perform calibration at intervals of greater than every five years, four labs perform blower calibrations between every two to five years, six labs perform annual blower calibrations, two labs calibrate blowers every six months, and three labs claim to never calibrate with the USDA MCS (Figure 2). Although a specific time interval between blower calibrations is not provided in the AOSA Rules, it is recommended that a complete recalibration using the USDA MCS be performed anytime purity separations are suspected of being inaccurate or when a blower has undergone repair.

Two labs indicated they use the ISTA calibration samples for both Kentucky bluegrass and orchardgrass when testing samples of these species according to the ISTA Rules. One of the labs indicated their ISTA calibration samples are between 1-5 years old, and the other lab indicated their calibration samples are between 6-10 years old. One lab indicated they calibrate their blower annually using the ISTA calibration samples, and the other indicated they calibrate their blower with the ISTA calibration samples when requested to test Kentucky bluegrass or orchardgrass under the ISTA Rules (no time reference reported). The remaining labs indicated they do not use the

ISTA calibration samples or do not test using the ISTA Rules. The ISTA Rules strongly recommend that blower calibration be verified annually using the ISTA calibration samples and require such verification any time repairs are made to a blower. Additionally, the ISTA Rules provide a warning to users regarding deterioration of calibrations sample due to frequent use. The ISTA Purity Technical Committee provides blower calibration procedure guidelines that instruct users how to check the integrity of the calibration samples (ISTA 2021).

During the blower calibration process, nineteen of twenty labs indicated they used an anemometer to determine the equivalent air velocity (EAV) in meters per second (m/s) for the calibrated gate opening of the blower, and two labs declined to answer this question. When asked the brand and model of anemometer used, eighteen labs indicated they use a model name similar to that stated in the AOSA Rules, and four respondents declined to answer this question. It should be noted that labs are free to select the brand and model of anemometer used to establish the EAV provided it meets the criteria described in the AOSA Rules (i.e., rotary fan anemometer that will fit precisely over the opening at the base of the air stream column after the sample cup is removed and measures air speed in m/s). The ISTA Rules similarly state that labs may use any suitable anemometer as long as it fits the sample cup holder compartment and the scale used to measure the air velocity is in m/s.

Five labs indicated they calibrate their anemometers or obtain a calibration certificate from an external ISO 17025 accredited calibration laboratory on an annual basis, one lab indicated calibration occurs after five year or more years, and seventeen labs indicated they never calibrate the anemometers. The AOSA Rules do not currently require anemometers to be calibrated. The ISTA Rules specify the anemometer should be calibrated at intervals set by the laboratory. The overwhelming majority of labs change the batteries in their anemometers only when they no longer have power, while three labs change them annually. The AOSA Rules recommend checking the working condition of the batteries each time the device is turned on, while the ISTA Rules state the batteries should be replaced at least once per year.

According to the AOSA Rules, preconditioning of the calibration samples is important to bring the samples into equilibrium with atmospheric moisture. Changes in atmospheric pressure, humidity and temperature may alter the calibration point (i.e., gate setting) and the AOSA Rules recommend that a high-quality thermometer-hygrometer combination be kept in the blower room and the temperature and humidity be recorded each time the calibration is performed. The ISTA guidelines for blower calibration provide similar information on the need for preconditioning the calibration samples. While no questions related to preconditioning calibrations samples were included in the survey, labs were asked if they measure the relative humidity (RH) and/or barometric pressure (BP) at the time of blower calibration and/or during use of the blower for purity testing. Five labs indicated they check the RH and/or BP, while 16 labs do not. Of the five labs that check RH and/or BP, only one indicated they see a significant change in the RH or BP in their lab. All five of these labs indicated they do not adjust their blower gate settings because of changes in RH and/or BP.

When preparing the seed blower for use during a purity analysis, seventeen labs indicated they open the blower gate to the calibrated setting first and then measure the air velocity at that setting using an anemometer, four labs do not, and one lab declined to answer. When the air velocity at the calibrated gate opening setting is not the same as the EAV, seventeen labs indicated they adjust the gate opening until the air velocity is equal to the EAV, two labs do not, and three labs declined to answer. Following the AOSA Rules, once the optimum calibration point is determined and the EAV value is established the blower gate is set to the calibrated gate opening and then checked with the anemometer. The gate opening can be adjusted until the appropriate EAV is achieved. Additionally, if it can be demonstrated that a blower has a stable EAV value at a particular gate opening, then the blower can be set using only the calibrated gate opening. The ISTA Rules require the use of either an established EAV measured with an anemometer to set the blower, or a laboratory can opt to use the ISTA calibration sample to set the blower.

Labs were asked to provide the most current blower gate setting and EAV for each blower and each calibration sample they used (both AOSA and ISTA). Nineteen labs provided data for the USDA MCS and two labs for the ISTA calibration samples for Kentucky bluegrass and orchardgrass (Figures 3 and 4). Six labs provided data for the USDA MCS for Pensacola bahiagrass (Figure 5). Some labs only provided the EAV data, and some labs only provided the gate setting data. Assuming the blower calibrations performed by each lab were done correctly, this data demonstrates that blower settings and EAV values based on the three types of USDA MCS and two types of ISTA calibration samples across blowers vary considerably and supports the claim that each blower must be individually calibrated (both AOSA Rules and ISTA Rules state the EAV of one blower is not transferrable to another blower). Only two of twenty labs indicated they have noticed a significant change in their blower settings over the last ten years.

Three accredited labs indicated they have been asked questions regarding calibration of the blowers during their accreditation audits. Three accredited labs were asked questions during their accreditation audit regarding the calibration of their anemometers.

Questions for Further Consideration

While the survey provided considerable information regarding calibration of blowers and use of the UBP by labs in North America, further questions could be asked. These may include:

- Are the calibration instructions in the AOSA Rules, Volume 2 sufficient and easy to follow?
- Should a specific time interval for blower calibration using the USDA MCS be added to the AOSA Rules?
- Is the recommended anemometer accurate enough for the purpose of the UBP? Should we investigate other types of anemometers that provide more precise air

velocity readings even if more expensive (reading to two decimal places)? It should be noted that the ISTA Purity Committee has discussed concerns with the accuracy of the currently recommended anemometer model used for establishing the EAV value.

- How do you determine if the "purity separations are suspected of being inaccurate" and the blower needs to be recalibrated?
- Are there other species that could be added to the UBP in the AOSA Rules?

References

AOSA. 2022. AOSA Rules for Testing Seeds. Volume 1: Principles and Procedures. Association of Official Seed Analysts.

AOSA. 2022. AOSA Rules for Testing Seeds. Volume 2: Uniform Blowing Procedure. Association of Official Seed Analysts.

CFIA. 2021. Canadian Methods and Procedures for Testing Seed (M&P). Edition 2021, Version 1.1. Canadian Food Inspection Agency.

ISTA. 2023. International Rules for Seed Testing. International Seed Testing Association.

ISTA. 2021. TCOM-P-08-Blower Calibration. Version 2.0. ISTA Secretariat. www.seedtest.org.

Table 1. Comparison of ISTA and AOSA Rules for General Blower Calibration

The differences are noted in red text.

ISTA Rules 2023	AOSA Rules 2022
Purchase calibration samples from ISTA Secretariat. *Poa pratensis* and *Dactylis glomerata*. Sec. 3.4.2.1	Borrow the Master Calibrations Samples from USDA Federal Seed Laboratory, Master Calibration Sample Program Administrator. *Poa pratensis, Dactylis glomerata, and Paspalum notatum* 'Pensacola.' V1, sec. 3.6c; V2, sec. 2.3
Laboratory/owner of calibration sample is responsible for maintaining the integrity of the calibration sample. Sec. 3.4.2.2 Note	USDA is responsible for maintaining the Master Calibration Samples between loans among laboratories.
Establish blower air gate setting based on calibration sample. Sec. 3.4.2.1	Establish blower air gate setting based on calibration sample. V2, sec. 2.4, 4.1.
Establish equivalent air velocity (EAV) for the calibrated air gate setting using a fan type anemometer inserted into the air column. Sec. 3.4.2.2 Any suitable anemometer as long as the anemometer fits in the sample cup holder compartment of the blower and measures air flower in meters per second. Sec. 3.4.2.3	Establish equivalent air velocity (EAV) for the calibrated air gate setting using a fan type anemometer inserted into the air column. V2, Sec. 4.1 V. 2 sec. 4.1 specifies the recommended brand and model of anemometer that should be used.
Once the EAV is established, the blower can be recalibrated using the anemometer by adjusting the blower setting until the optimum air velocity for the blower is reached. Sec. 3.4.2.2	Subsequent blower calibrations can (V2, sec. 4.1)/shall (V2, sec. 4.3) be checked using the EAV by adjusting the blower gate opening until the air speed on the anemometer is equal to the EAV value.
For species or varieties with adjustment factor: Establish KY bluegrass blower air gate setting first, multiple by factor for establish the blower air gate setting that species, set air gate at adjusted setting, then determine the EAV for that air gate setting. Sec.3.4.2.1, 3.4.2.2	For species with adjustment factor: Establish KY bluegrass blower air gate setting first, multiple by factor for establish the blower air gate setting that species, set air gate at adjusted setting, then determine the EAV for that air gate setting. V2, Sec. 4.1
The optimum blowing point must be verified using the ISTA uniform calibration sample after major serving of the blower. Also, strongly recommended that blowing point be verified annually using the ISTA uniform calibration sample. Sec. 3.4.2.2	Complete recalibration using the Master Calibration Sample should be done any time the purity separations are suspected of being inaccurate, or when a blower has undergone repair. V2, sec. 4.3
Different ways to set the blower without using the EAV and anemometer calibration	
For labs that do not use the EAV – calibration can be done using the ISTA uniform calibration sample. Note: frequent use of the calibration sample can cause a shift in blowing point due to deterioration and monitoring the blowing point simply by air gate opening may be reliable in some blowers and not in others. Sec. 3.4.2.2	Once EAV value is established via calibration and it can be demonstrated that the EAV value is stable at a particular air gate setting it is permissible to set the blower using the air gate setting alone. V2, Sec. 4.3 If the blower produces erratic air velocity readings at a particular air gate opening, the blower must be set by adjusting the air gate opening to the EAV value using an anemometer. V2, Sec. 4.3
Anemometer calibration should be done at intervals set by the laboratory. Batteries should be replaced at least once a year. Sec. 3.4.2.4	No instructions or requirements for anemometer maintenance or calibration were provided. The working condition of the batteries should be checked when the anemometer is turned on. V2, Sec. 4.1.b.

Table 2. Comparison of General-type blower settings based on each set of Rules.

The differences from the AOSA Rules are noted in red text.

Species requiring UBP	Species in AOSA Rules 2022	AOSA Rules 2022 Factor applied to *Poa pratensis* gate setting	Species in Canadian M&P 2021	M&P 2021 Factor applied *to Poa pratensis* gate setting	Species in ISTA Rules 2023	ISTA Rules 2023 Factor applied to *Poa pratensis* gate setting
Kentucky bluegrass *Poa pratensis*	Yes	Blower setting based on USDA MCS *Poa pratensis*	Yes	Blower setting based on USDA MCS *Poa pratensis*	Yes	Blower setting based on AOSA *Poa pratensis* calibration sample; 0.82 factor applied to small-seeded varieties of *Poa pratensis* (as specified in ISTA Table 3A)
Rough bluegrass *Poa trivialis*	Yes	0.82	Yes	0.82	Yes	0.82
Canada bluegrass *Poa compressa*	Yes	Same setting as *Poa pratensis*	Yes	0.97	Yes	UBP not required
Weeping alkaligrass *Puccinellia distans*	Yes	0.76	Yes	UBP not required	No	NA
Side oats grama *Bouteloua curtipendula*	Yes	1.480	No	NA	No	NA
Blue grama *Bouteloua gracilis*	Yes	1.157	No	NA	Yes	UBP not required
Redtop *Agrostis gigantea*	Yes	UBP not required	Yes	0.68	Yes	UBP not required
Bentgrasses *Agrostis* spp. other than *A. gigantea*	Yes	UBP not required	Yes	0.49 for first blowing and 0.65 for second blowing	Yes	UBP not required
Orchardgrass *Dactylis glomerata*	Yes	Blower setting based on USDA MCS *Dactylis glomerata*	Yes	Blower setting based on USDA MCS *Dactylis glomerata*	Yes	Blower setting based on ISTA *Dactylis glomerata* calibration sample
Pensacola bahiagrass *Paspalum notatum* 'Pensacola'	Yes	Blower setting based on USDA MCS Pensacola bahiagrass	No	NA	Yes	Only *P. notatum* listed in Table 2C Part 1. UBP not required

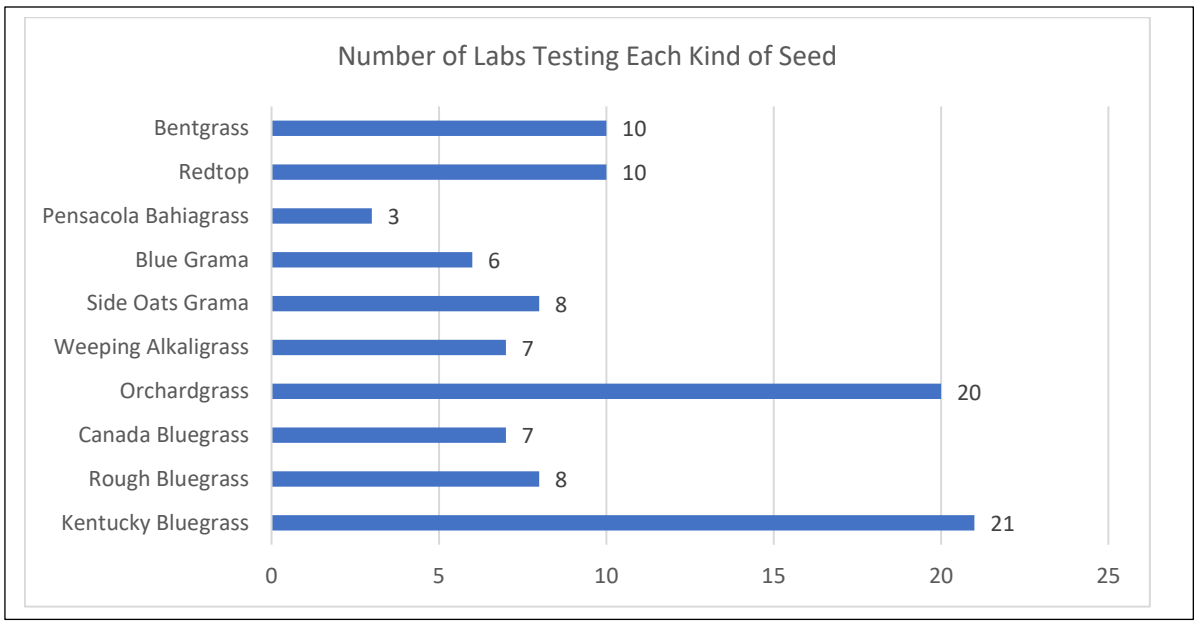

Figure 1. Number of labs testing various kinds of seed that require application of the Uniform Blowing Procedure.

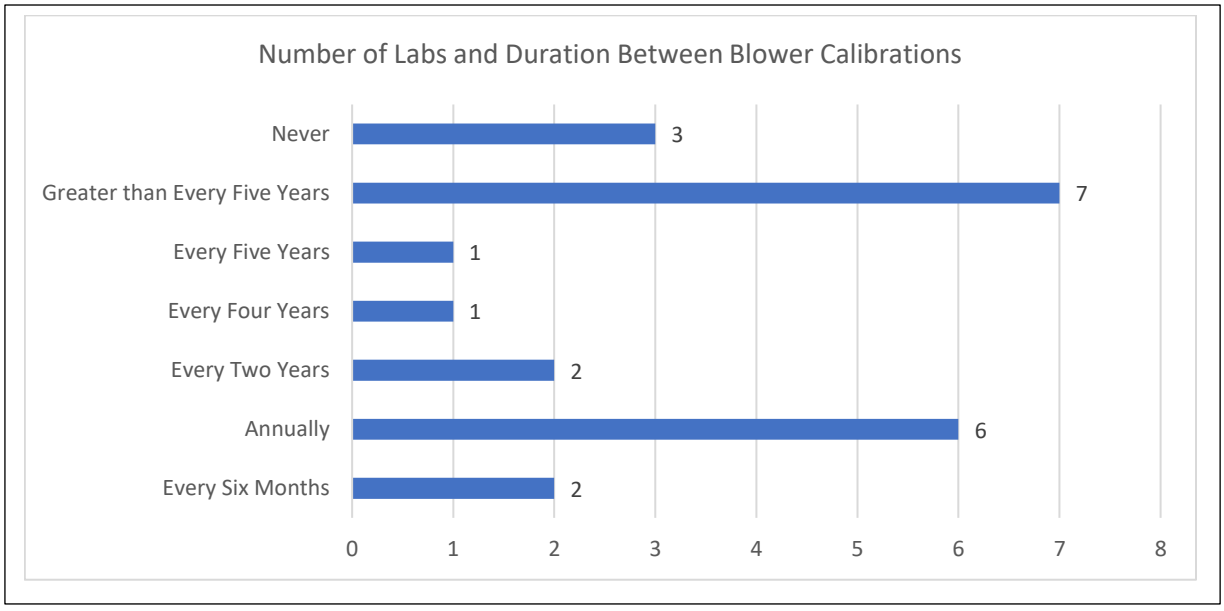

Figure 2. Duration between blower calibrations by respondent labs using the USDA Master Calibration Samples.

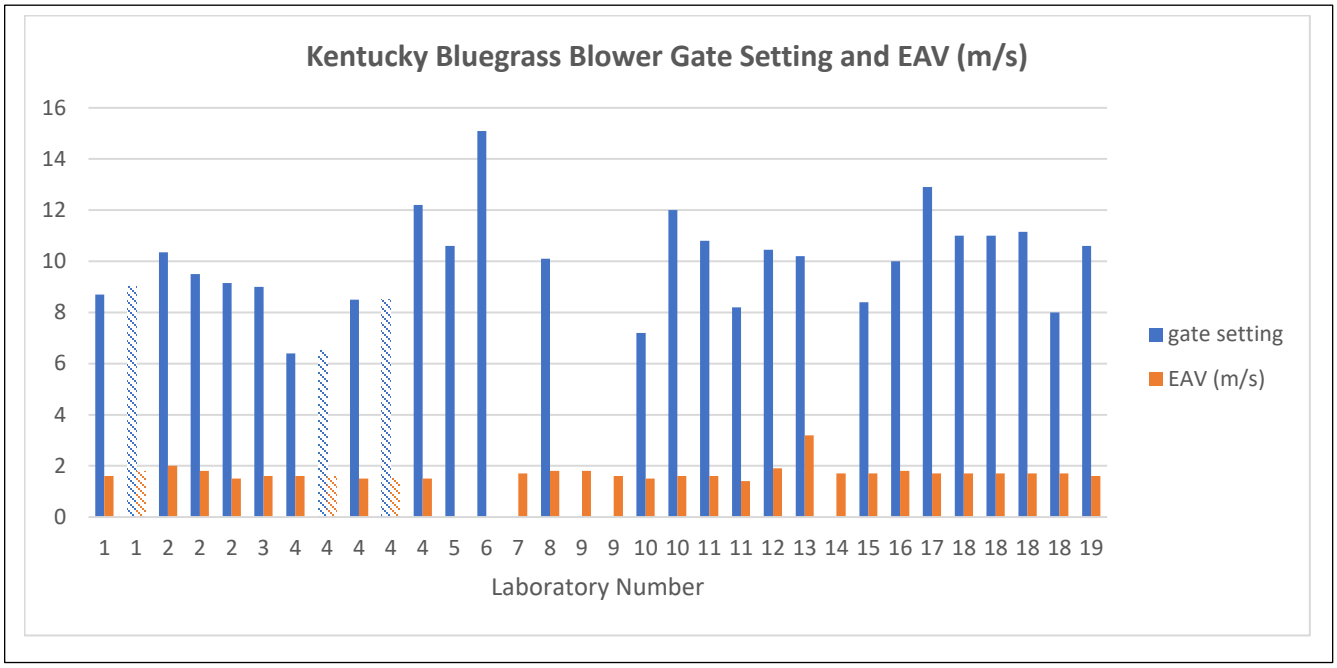

Figure 3. Kentucky bluegrass blower gate setting values and EAV (m/s) for nineteen labs. The same lab numbers are used for labs with multiple seed blowers (e.g., lab 2 has three seed blowers). In cases where a lab used both the USDA MCS and the ISTA calibration sample the gate settings and EAV are paired next to each other for the same blower (e.g., lab 1 has one blower and used both calibration samples). Calibrated blower gate settings are shown as solid blue bars for USDA MCS and as blue striped bars for ISTA calibration samples. Equivalent air velocity values for each gate setting are shown as solid orange bars for USDA MCS and as orange striped bars for ISTA calibration samples. In cases where a lab has only a blue bar or only an orange bar the lab did not provide both data points.

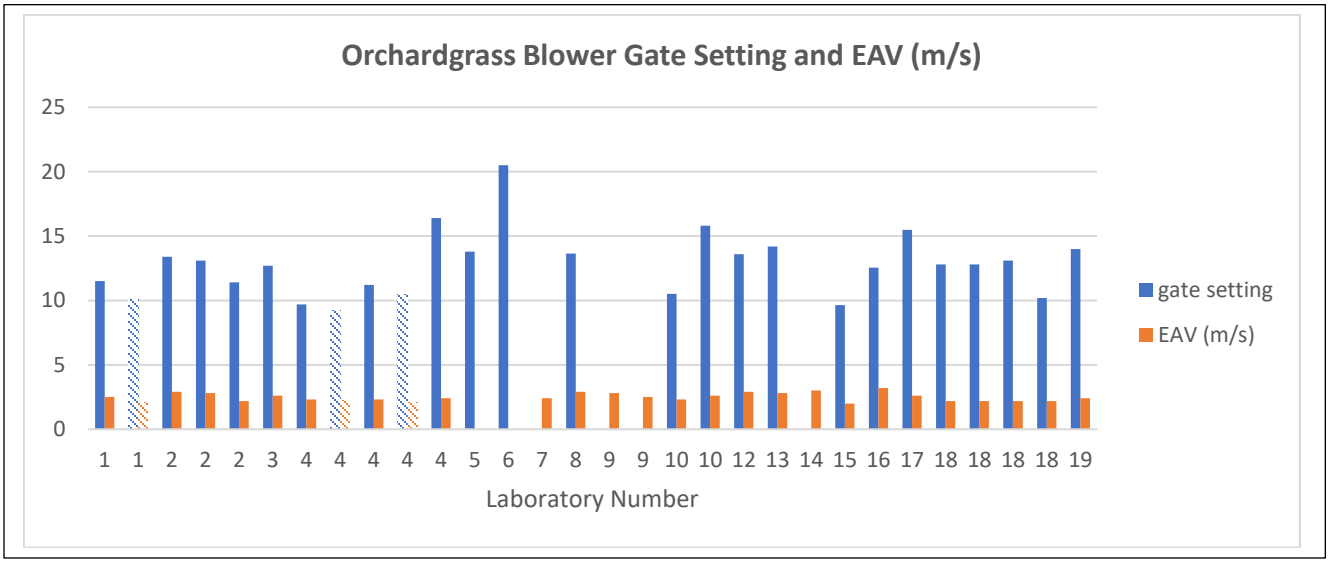

Figure 4. Orchardgrass blower gate setting values and EAV (m/s) for nineteen labs. The same lab numbers are used for labs with multiple seed blowers (e.g., lab 2 has three seed blowers). In cases where a lab used both the USDA MCS and the ISTA calibration sample the gate settings and EAV are paired next to each other for the same blower (e.g., lab 1 has one blower and used both calibration samples). Calibrated blower gate settings are shown as solid blue bars for USDA MCS and as blue striped bars for ISTA calibration samples. Equivalent air velocity values for each gate setting are shown as solid orange bars for USDA MCS and as orange striped bars for ISTA calibration samples. In cases where a lab has only a blue bar or only an orange bar the lab did not provide both data points.

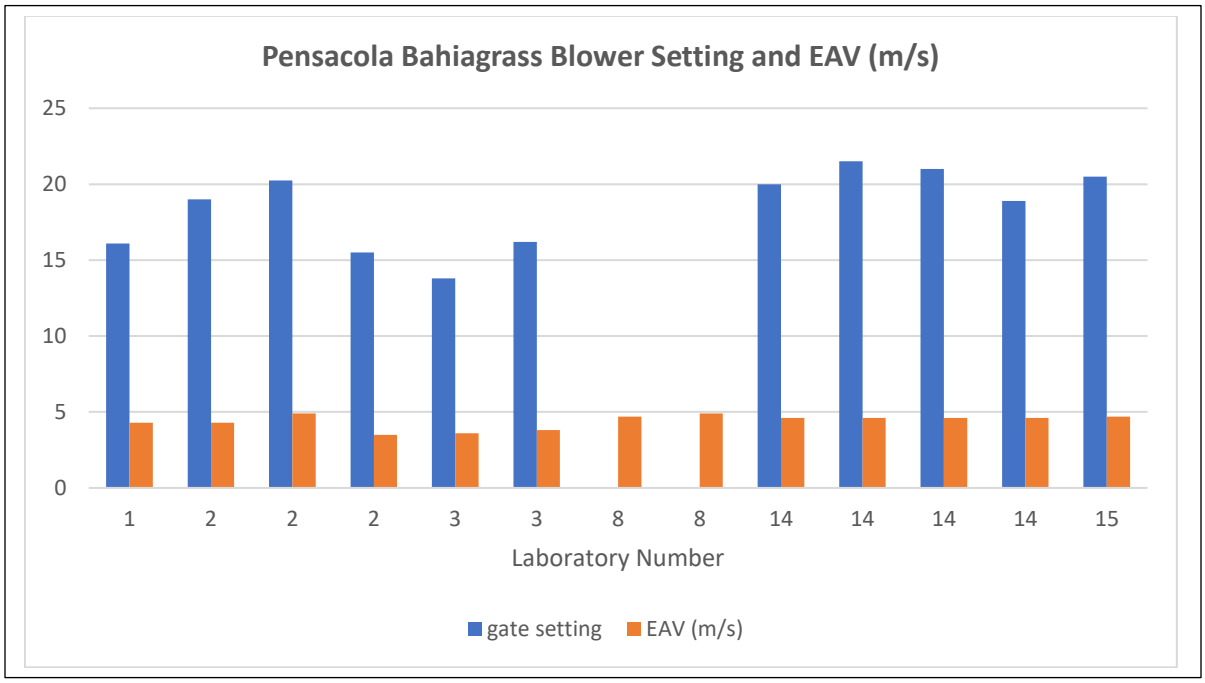

Figure 5. Pensacola bahiagrass blower gate setting values and EAV (m/s) for six labs. The same lab numbers are used for labs with multiple seed blowers (e.g., lab 2 has three seed blowers). Calibrated blower gate settings are shown as solid blue bars for USDA MCS. Equivalent air velocity values for each gate setting are shown as solid orange bars for USDA MCS. Lab 8 only provided data for EAV values.