CAN PORTABLE NIR BE USED FOR SEED MOISTURE TESTING IN GRASS SEED CROPS?

T.G. Chastain and N.P. Anderson

Introduction

Seed moisture content is the most reliable indicator of seed maturity and harvest timing in grass seed crops. Swathing within the correct range of seed moisture content will maximize harvestable seed yield and minimize seed loss due to shattering during harvest (Silberstein et al., 2010). Taking an accurate measurement of seed moisture content is a key part of economic management of grass seed crops.

Since pollination and seed maturation are not uniform processes in grass seed crops, a range of seed maturity can be found in a single field. Moreover, unlike cereal grain crops, grass seed crops have a high level of natural genetic variability. This variability contributes to the large differences in crop maturity and seed moisture content found in grass seed fields.

Unfortunately, the most widely adopted seed moisture testing methodologies are slow (Silberstein and Anderson, 2011). Thus, it is difficult to make timely management decisions. Harvest is a busy time, and often several crops are reaching maturity at or near the same time in fields spread across the farming operation. A rapid and reliable method to test seed moisture content could increase seed yield and profitability of Oregon's grass seed production enterprises.

Rapid seed moisture testers currently available for use in grass seed crops utilize electrical properties of seeds and are accurate only at seed moisture contents that are too low for determining timing for seed harvest. As a consequence, grass seed growers mostly use air-oven or microwave oven methods that are time consuming and cannot be used in the field.

Near-infrared reflectance spectroscopy (NIR) has been widely used for determining moisture content in agricultural products, including grains and oilseeds. Grain elevators and warehouses sometimes use NIR to test moisture content of cereal grain. Seed moisture determination by NIR in cereal grains and oilseed crops has proven to be rapid and reliable, but no information is available on the testing of grass seed for moisture content under field conditions. Since seed moisture testing by NIR is a secondary method, calibration against a primary seed moisture testing method such as the laboratory air-oven is needed before this technology can be used as a harvest timing tool in grass seed crops. Technological advancements have made it possible to use a portable field-based NIR device for forage and silage analysis at the farm level. Our objective was to determine the feasibility of using portable NIR spectroscopy as a rapid alternative to air drying for determining seed moisture content in grass seed crops.

Materials and Methods

Four grass seed crops were tested in trials conducted at OSU's Hyslop Research Farm near Corvallis in three harvest seasons: 2016, 2017, and 2018. These seed crops were perennial ryegrass, turf-type tall fescue, forage-type tall fescue, and orchardgrass. Together, these four grass seed crops represent more than 60% of the total seed crop acreage in Oregon. The influence of common agronomic practices on seed moisture content and harvest maturity in the grass seed crops was also assessed. These practices included plant growth regulators (PGRs), nitrogen (urea) application rate, and fungicides for stem rust control.

Seed moisture content was determined frequently on each seed crop by use of a Digi-Star Moisture Tracker NIR and by air-oven methods. Operation of the NIR was done per the manufacturer's recommendations, with modifications as needed to accommodate grass seed moisture content determination. Seed sampling for moisture testing by the NIR is the same as for the oven: seeds are stripped from the inflorescences and collected in a container with a tightly fitting lid. Testing began a couple of days past peak flowering of the crops and continued until swathing. Additional seed moisture content measurements were made on seed taken from the swath before combining and on seed that was past harvest maturity in unharvested plots.

Results and Discussion

The seed moisture content of perennial ryegrass as measured by NIR was highly related to the oven test results (Figure 1). Although agronomic treatments such as foliar fungicide products (Quilt and Trivapro) delayed crop maturity for a short time in perennial ryegrass, they had no effect on the ability of the NIR device to measure seed moisture content as compared to the untreated control in all 3 years of testing.

Seed moisture content values measured by the NIR device also showed a very good relationship to the oven test in orchardgrass and tall fescue. Timely, accurate readings of seed moisture content are especially important in orchardgrass, which is very susceptible to seed shattering losses prior to and during harvest.

Trinexapac-ethyl PGR and nitrogen (N) are two of the important agronomic practices in grass seed production. These results show that the use of PGRs and rate of N application had no effect on the ability of the NIR device to measure seed moisture content.

Individual seed moisture tests showed some variability, but less than that observed for other electric moisture meters tested in grass seed crops. Some of this variation in seed moisture content likely resulted from the high degree of natural variability typical of grass seed crops.

Moisture content readings on the NIR device did not correspond directly to oven test results. For example, a harvest recommendation of 35% seed moisture content for perennial ryegrass would correspond to an NIR reading of 24.9%. Measurement of seed moisture content with the NIR was closest to the oven results at low seed moisture content; deviations of the NIR from the oven test ranged from 0 to 5.3% in the seed moisture content increment from 10 to 20% (Figure 2). At high seed moisture content, the values diverged more, with the divergence ranging from 13.2 to 25.3% in the 50–60% seed moisture content increment (Figure 2). In both tall fescue seed crops, seed moisture content measured by the NIR diverged quickly with increased seed moisture content. For perennial ryegrass and orchardgrass, this deviation in NIR seed moisture content from the oven test results was less marked.

Conclusion

The portable Digi-Star NIR device is a promising tool for rapidly measuring seed moisture content for determination of harvest timing in grass seed crops. Spring agronomic practices including PGRs, foliar fungicides, and N application had no influence on NIR determination of seed moisture content.

Deviations of NIR seed moisture content from oven test results are systematic in nature and can be easily corrected with a software update and calibration for these grass seed crops. Specific calibration of the device and measurement protocols are needed before commercial application of this device in grass seed moisture testing.

References

Silberstein, T.B. and N.P. Anderson. 2011. *Using Seed Moisture as a Harvest Management Tool* (video). Oregon State University, EM 9030.

Silberstein, T.B., M.E. Mellbye, T.G. Chastain, and W.C. Young III. 2010. *Using Seed Moisture as a Harvest Management Tool.* Oregon State University, EM 9012.

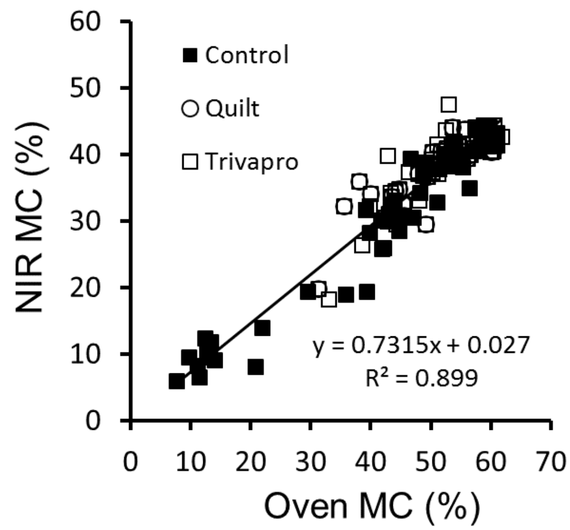

Figure 1. Relationship of seed moisture content from NIR and air-oven methods in perennial ryegrass. Quilt and Trivapro are fungicides applied for rust control. Control was not treated with a fungicide.

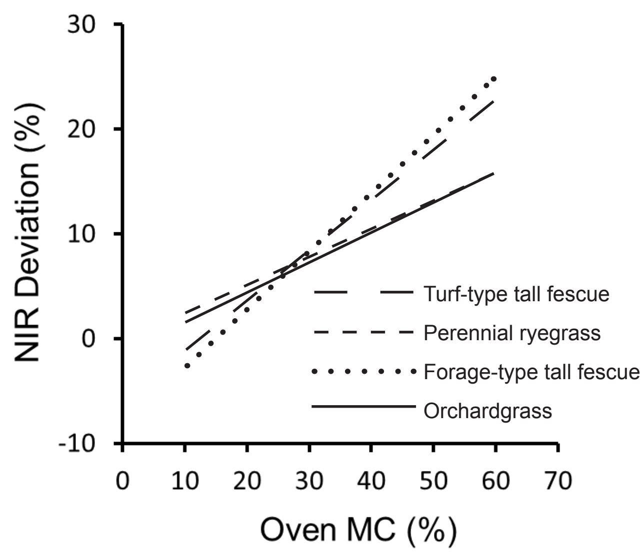

Figure 2. Deviation of NIR reading (seed moisture content) from air-oven seed moisture content in four grass seed crops.