Use a Microwave Oven to Determine the Moisture Content of Sunflower

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Much of the sunflower crop in the major producing areas of the United States requires artificial drying because of late crop maturity. Plant growth regulators permit earlier harvest by accelerating the maturation rate of the plant; research indicates that use of the growth regulator would result in approximately 10-14 days earlier maturation. Effectiveness of the chemical is dependent on timely application at relatively high moisture contents (50 to 55 percent).

A rapid means of determining seed moisture content is required so the chemical can be applied at the proper growth stage. Additionally, sunflower is often harvested at moisture contents of more than 17 percent. Most electronic moisture meters are not calibrated for moisture contents this high and the accuracy of most moisture meters decreases with increasing moisture content.

A recent study has shown that a conventional microwave oven can successfully be used to very rapidly determine the moisture content of high moisture sunflower seeds to indicate proper growth stage for the application of plant growth regulators. The microwave oven could also be used with reasonable accuracy to check harvest moisture content down to about 15 percent. At lower moisture contents, it would be advisable to use a calibrated electronic moisture meter.

The microwave oven has been shown to be a satisfactory method of determining moisture content of some products where rapid results are necessary. Okabe et al. (1973) found that microwave ovens can be used with high accuracy for both rice and wheat with moisture contents in the range of 10 to 30 percent.

Perrin et al. (1980) used microwave energy for rapidly determining moisture in snap beans. They noted that further testing is needed to compare microwave drying with conventional oven drying but the microwave energy appears to have much potential for moisture determination because of its ability to reduce drying time. They also found that burning of the sample was a problem at high power levels.

Beewar et al. (1977) dried blended samples of sweet corn with the microwave oven. A drying time of three minutes gave consistent moisture values. Longer time did not appreciably change moisture values and charred the samples.

This study was done to determine if a conventional microwave oven could be used for determining sunflower seed moisture content at levels greater than 17 percent. The microwave oven results were compared to those found using the standard mechanical convection air oven. Microwave power levels of 50 percent and 100 percent were used in the study. Sunflower seeds at moisture contents ranging from 17 percent to 80 percent were used in the tests.

RESULTS AND DISCUSSION

The results of the tests indicate that there is no statistical difference between the moisture content of sunflower as determined with the air oven and the microwave oven at the 100 percent power level but there is at the 50 percent power level.

Linear regression indicates that the microwave oven at the 50 percent power level would generally underestimate the moisture content by about 1.0 to 2.5 percentage points compared to the air oven. At the 100 percent power level, we would expect the microwave oven to overpredict the moisture content compared to the air oven by less than 0.5 percentage point at the lower moisture contents and underpredict by about 0.5 percentage point at higher moisture content of the range tested. At the critical moisture content range of 50 to 55 percent necessary for the application of the plant growth regulator, the microwave at 50 percent power level would indicate about 2 percentage points low and at 100 percent power level would indicate very nearly the same as the air oven. Samples at less than 17 percent were not tested with the microwave oven. However, it appears that accuracy decreases with decreasing moisture content. Even so, at 17 percent moisture, the microwave oven at the 100 percent power level gave results within 0.5 percent of the conventional oven. This is as good or better than many electronic moisture meters. Figure 1 shows calibration plots for the microwave oven for both power levels.

At seed moisture contents of about 80 percent, the air oven method took a minimum of eight hours for complete moisture removal and the microwave oven took approximately 42 minutes at the 50 percent power level and about 30 minutes at the 100 percent power level. At about 17 percent, the air oven took about five hours compared to about 11 and 10 minutes for 50 percent and 100 percent power levels, respectively. Microwave oven results are better and the time for determination is shorter at the 100 percent power level.

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A PRACTICAL PROCEDURE

The following procedure is suggested for testing the moisture content of high moisture sunflower with the microwave oven.

1. Harvest seed samples from different parts of the field and mix all samples together. Separate this total sample into at least four 50 gram samples for the tests. Make sure the samples are clean, hand pick out foreign material if necessary.

2. First, dry a paper towel. (The amount of moisture in the paper towel is very small and will not make much difference if this step is omitted.)

3. Weigh the paper towel using a gram scale and record the weight.

4. With the towel on the scale, pour a sample of seeds onto the scale and record that weight.

5. Place the towel and seeds into the microwave oven; spread the seeds on the towel to a thickness of no more than about two seeds. It is very important to spread the seeds to a thickness of nor more than about two seeds.

6. Microwave for four-minute intervals; take out the sample and weigh it after each period. When the difference in weighings becomes small, start weighing at two-minute intervals until there is no weight change. Lack of weight change indicates that the moisture has been removed.

7. If running repeated samples for a long time, check to see if the glass tray in the oven is getting hot. If so, let the tray cool before running another test. If a sample starts to smoke or appears charred after a test, discard this sample and start another test after the oven and tray cool.

8. Calculate the original seed moisture content of the sample by using the following equation. Be sure to subtract the weight of the paper towel from the initial and final sample weights before you begin the calculations. Moisture content = \((\text{Initial weight} - \text{Final weight}) / \text{Initial weight} \times 100\).

9. Be sure to run a minimum of four tests and average the results.

10. Do not leave the microwave oven unattended during the tests.

REFERENCES

