OPTICAL PEANUT YIELD MONITOR: DEVELOPMENT AND TESTING

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ABSTRACT: An optical peanut yield monitor was developed, fabricated, and field-tested. The overall system includes an optical mass-flow sensor, a GPS receiver, and a data acquisition system. The concept for the mass-flow sensor is based on that of the cotton yield-monitor sensor developed previously by Thomasson and Sui (2000). A modified version of the sensor was designed to be specific to peanut mass-flow measurement. Field testing of the peanut yield monitor was conducted in Australia during the May 2003 harvest. After subsequent minor modifications, the system was more extensively tested in Mississippi in October of 2003 and November of 2004. Test results showed that the output of the peanut mass-flow sensor was very strongly correlated with the harvested load weight, and the system's performance was stable and reliable during the tests.

Keywords: Sensors, Yield monitor, Peanut, Precision agriculture, Reflectance.

Precision agriculture is a management practice intended to optimize profit on relatively small-scale management zones, within the constraints of environmental considerations. Economic benefits of precision-agriculture practices have been proven in certain areas, such as in minimizing the amounts of fertilizers and herbicides by placing them only where needed. Economic-driven practices like this go hand in hand with minimizing the environmental impact of production agriculture. The principal requirement in evaluating the economic effects of precision-agriculture is the ability to create yield maps. Furthermore, yield maps allow producers to plan management practices on a zone-by-zone basis within fields.

LITERATURE REVIEW

Yield monitors for grains were developed early in the move to precision agriculture, mainly because the volume of grains is the highest of any crop type grown in the United States, giving incentive for rapid development. Grain yield monitors, which are typically based on the measurement of mechanical forces like weight, have performed reasonably well because the mass flow of grain is fairly easy to measure. These yield monitors have become widely used throughout the United States.

Yield monitors have been developed more recently and slowly for lesser crops. Several cotton yield monitor systems have been developed and tested in recent years (Durrence et al., 1998; Sassenrath-Cole et al., 1999; Thomasson et al., 1999; Wolak et al. 1999; Roades et al., 2000; Wilkerson et al., 1994, 2002; Thomasson and Sui, 2000; Perry et al., 2001; Vellidis et al., 2003), and several versions of a cotton yield monitor have come to market since 1997: AgLeader® (Ames, Iowa), FarmScan (Perth, Western Australia), MicroTrak® (Eagle Lake, Minn.), and Zycom/AGRIplan (Stow, Mass.). All commercial cotton yield monitors use the principle of optical attenuation. Each sensor unit has two parts, a light-emitter array and a light-detector array mounted opposite each other on a cotton picker’s pneumatic duct. The sensors measure light attenuation caused by the passing of cotton particles through the ducts. The light attenuation signal is then converted by the data acquisition system to an estimate of the cotton mass flow.

In an effort to advance the state of the art, Thomasson and Sui (2000, 2003, 2004) designed, fabricated, and patented an optical-reflectance-based mass-flow sensor to be used as part of a cotton yield monitor at Mississippi State University. The sensor was comprised of light-emitters and light-detectors in one unit that can be affixed to only one side of a pneumatic duct. Such a configuration minimizes the difficulty of installation and maintenance and removes any requirement for alignment of sensor parts. Extensive tests of the sensor and the cotton yield monitor have been reported (Thomasson and Sui, 2003; Vellidis et al., 2003; Sui et al., 2004; Perry and Vellidis, 2005), and the results have been quite promising.

Yield monitors for other pneumatically conveyed crops such as sugar cane and peanuts have also been researched. Benjamin et al. (2001) designed and tested a sugar cane yield-monitoring system mounted on a Cameco sugar cane combine. A weight scale was used as the yield sensor in the system, which had fair results in a research setting. Vellidis et al. (2001) developed the Peanut Yield Monitoring System (PYMS), which was a load-cell based instantaneous weight measurement system. Reported field-test error of PYMS was 2% to 3% on a trailer-load basis. However, the reported resolution of the system, calculated from full-scale output of the sensor, bit number of the analog-to-digital converter (ADC), and the pixel area of the system, was 700 kg/ha. This
relatively low resolution means that it would be difficult to use PYMS data for management on a fine scale. The overall assessment of the field evaluation (Vellidis et al., 2001) indicated that PYMS was accurate enough for differentiating yield trends and evaluating management practices, but basing management decisions on the yield of individual pixels in PYMS yield maps was not recommended. To date, all published research on harvester-based mass-flow measurements of other pneumatically conveyed crops like peanuts has been based on weight-measuring systems. However, the increasing weight of a large storage basket of harvested material is very difficult to measure accurately on a moving vehicle, partly because isolating the weight of the basket is difficult due to large movements in three-dimensional space, but also because the sensing method is cumulative rather than instantaneous.

**OBJECTIVES**

Based on the limitations of weight-measurement systems it was deemed reasonable to consider optical technologies, which have proven useful in cotton, for measuring harvester-based mass flow of peanuts. The objectives of this study were thus (1) to develop a peanut yield monitor by adopting the technologies of the optical-reflectance-based mass-flow sensor developed for cotton; (2) to test and evaluate the peanut yield monitor in the field in terms of correlation between peanut mass flow and sensor output, ease of operation and maintenance, and reliability; and (3) to refine the system as necessary and field test it again.

**METHODS AND MATERIALS**

**SYSTEM DEVELOPMENT AND OPERATION**

Similar to the optical-reflectance-based mass-flow sensor used in the Mississippi cotton yield monitor, the new peanut mass-flow sensor had to be capable of detecting peanuts conveyed pneumatically through the duct of a peanut harvester. To adapt the cotton mass-flow sensor for use with peanuts, three issues had to be considered: spectral similarity, sensor sensitivity, and sensor linearity. Regarding spectral similarity, the reflectance spectra of cotton and peanut samples (fig. 1) were measured with a Cary 500 UV/Vis/NIR spectrophotometer (Varian Inc., Palo Alto, Calif.). The curve shapes from 250 to 2500 nm are similar for cotton and peanuts, so a sensor operating in this spectral range with appropriate characteristics for cotton should also be applicable for peanuts. Regarding sensor sensitivity, peanuts have much lower reflectance than cotton. The sensor in the Mississippi cotton yield monitor incorporates near-infrared-reflectance (NIR) based detection. The NIR light-emitting diodes (LEDs) used as the illumination source have a center wavelength of 880 nm and an 80-nm bandwidth. At 880 nm, the reflectance values of the cotton and peanut samples were 90.0% and 42.5%, respectively, roughly a two to one correspondence. Since more energy is required to achieve a reasonable level of sensitivity for peanuts, the sensor’s core was reconfigured by adding more LEDs to provide a stronger illumination source.

Regarding sensor linearity, it is known that the relationship between a unidirectional reflectance measurement and mass flow is not perfectly linear; as mass flow increases, reflected energy in the sensor direction does not increase proportionally, because the additional material in the flow stream is often obscured from the view of the sensor. For this reason, it became known while developing the Mississippi cotton yield monitor that sensor sensitivity was not perfectly linear; i.e., the ratio of the weight of material passing the sensor to the signal response (weight-to-signal ratio, WSR) increased with increasing mass flow. However, over the range of mass flows expected for the duct of a cotton harvester, this factor was not considered to be a major source of error. The effect of this phenomenon on peanut mass-flow sensor linearity was unknown.

Figure 1. Reflectance spectrum of cotton and peanuts. (Reflectance values near 800 nm are erroneous because of noise associated with a change in the energy source of the Cary 500 UV/Vis/NIR spectrophotometer near that wavelength.)
In addition to strengthening the illumination source, the sensor was also improved to allow it to produce a stronger, low-noise, analog voltage signal instead of a weak AC current, and thus increase the sensor’s signal-to-noise ratio. To do this, all the electronic components were integrated with the optical components so that they could be housed in the same enclosure. In addition to modification of the sensor, a new data acquisition system was developed for collecting and processing data from the sensor and a GPS receiver. Compared with the system developed for the cotton yield monitor, the new system was more portable, and it was capable of alerting the user visually and audibly if the GPS receiver were not working properly. The data acquisition system is based on a single-board-computer (SBC) with a color touch screen. The system includes a 206-MHz, 32-bit, low-power CPU and a complete set of Windows CE compatible peripherals suitable for embedded low power and battery applications. The data acquisition system also has two serial ports, a PCMCIA controller, audio output, and an 8-channel, 12-bit, analog-to-digital converter (ADC). The analog signals from the peanut mass-flow sensors are input to the ADC and then collected and analyzed by the SBC in real time based on predetermined algorithms that relate peanut mass flow to energy reflected by the peanuts to the sensors. Embedded Visual Basic was used as the programming language for the system operation code.

The entire peanut yield monitor consists of two peanut mass-flow sensors, a data acquisition system, and a GPS receiver (fig. 2). Each sensor includes energy sources and detectors mounted in one housing unit to be affixed to one wall of a peanut harvester’s duct, thus requiring only one port to be cut in a duct for each sensor installation. During operation, the sensors detect the peanuts flowing in the duct and provide an analog output signal to the data acquisition unit. A Trimble AgGPS 132 receiver was used in this study, but any standard external GPS receiver producing NMEA output strings can be employed to provide spatial data that can be read directly by the data acquisition system. The GSA and RMC sentences from the GPS receiver are recorded to provide location, PDOP (position dilution of precision), and speed data. Yield and spatial information are displayed on the color screen and stored on a PCMCIA card in the data acquisition box. These data can later be downloaded to a laboratory computer and processed with GIS software such as ArcView®.

**Test Procedures**

Two prototype sets of the peanut yield monitor were fabricated for field-testing in 2003. The first set was tested near Kingaroy, Queensland, Australia in May 2003. This early test was conducted as a preliminary accuracy assessment and as a way to discover problems that might be encountered with the peanut yield monitor, so that modifications might be made prior to a more extensive test in the United States during the fall harvest. A second test in 2003 and a final test in 2004 were conducted with the second prototype peanut yield monitor at Lucedale, Mississippi (fig. 4).

In all the tests, a data file was created within the yield-monitor system’s computer to store sensor output data corresponding to each basket load of peanuts. The sum of sensor output associated with each load was calculated, and the correlation between the sums of sensor output and load weights was determined. In order to be able to compare sensitivity among field tests, WSR was computed for each field test by dividing the total peanut weight by the output signal sum.

**Test Near Kingaroy, Queensland, Australia, 2003**

Peanuts were harvested with a Hobbs combine on a large commercial field near Kingaroy in May 2003. The combine...
The peanut yield-monitor system was then field-tested at Test at Lucedale, Mississippi, 2003. Weights were recorded for a total of fourteen harvested loads. Spatial data were recorded with significant error in Australia, apparently because the harvester speed was low, causing algorithms in the GPS unit to calculate position incorrectly. Therefore, while it was possible to create yield maps with these data, spatial accuracy would have been poor.

Another issue of concern, requiring modification of the peanut yield-monitor system, was discovered during this test. The configuration for mounting the sensors on the duct allowed air to be pulled in around the sensor housing. This configuration had helped keep the sensor window clean with the cotton yield monitor, but allowed a space for peanuts and rocks to lodge with the peanut yield monitor, potentially obscuring the sensor window.

In order to consider peanut mass-flow sensor linearity, this first prototype system remained in Australia after the period of data collection during harvesting so that several sets of data could be collected with the combine sitting stationary, while 13-kg bins of peanuts would be emptied into the combine’s duct inlet at different rates. These data sets were collected in three runs, with bin-emptying time periods as follows: (1) 45, 45, 80, 15, and 10 s; (2) 60, 40, 30, 20, and 10 s; and (3) 20 s, two bins in 20 s, and three bins in 20 s. The runs corresponded to mass flows of roughly 0.22 to 2.0 kg/s. Each data set was collected such that the entire 13-kg bin was emptied into the combine duct during the given time period. While data set 3 in run 3 relates to a high mass flow that is unlikely in the field, it was determined that in general these mass flows were within the realm of possibility for mass flows in a combine during harvesting. Each run was conducted such that a few seconds of delay were imposed before emptying the next bin, theoretically allowing enough time for all the peanuts in the duct to pass the sensor before the next data set would begin.

**Test at Lucedale, Mississippi, 2003**

Based on the experience from the test in Australia, the mounting bracket was redesigned to eliminate the air gap. The peanut yield-monitor system was then field-tested at Lucedale, Mississippi in early October of 2003. Two commercial peanut fields, Lee’s field (6.1 ha, heavier soil) and Courtney’s field (3.2 ha, sandier soil), were harvested with an Amadas Industries peanut combine. In both fields, every harvested basket load was weighed with three truck scales (Model PT300DW, Intercomp) on which a harvest transport buggy had been placed. Nine loads were harvested and weighed in Lee’s field, and 12 loads were harvested and weighed in Courtney’s field. The moisture content of peanuts in Lee’s field was higher than that in Courtney’s, mainly due to the soil type.

A second issue that required further modification of the peanut yield-monitor system was discovered while data from this test were being processed. In order to ensure adequate response to peanuts that would pass the sensor, the sensitivity level had been set to be high. This situation could possibly cause saturation of the detector, potentially leading to loss of information during high mass flows. As the crop is being harvested, the mass-flow regime of pneumatically conveyed peanuts or seedcotton particles within the harvester’s duct is two-phase pipe flow. Many different flow patterns can be created depending on particle properties, air pressure, duct configuration, harvester operating mechanisms, etc. The differences in mass-flow behavior between peanuts and seedcotton particles were not studied in detail in this work and are not yet fully understood. However, it was found that peanuts tend to flow in a granular fashion, while seedcotton tends to flow in slugs.

Early development work with the cotton mass-flow sensor had indicated that the flow of seedcotton never saturated the sensor and often presented no seedcotton to the sensors, generating a consistent zero-flow baseline (fig. 5a). This baseline value was collected on a regular basis and was subtracted from the non-zero-flow output values to account for drift in sensor response. During the work with peanuts, it became clear that the difference in flow characteristics between seedcotton and peanuts meant that no zero-flow baseline was available with peanuts. Therefore, the algorithm was modified so as to remove the baseline feature after the 2003 test.

Furthermore, in the early work with cotton, data were sampled at high frequency (> 50 Hz), but later they had been recorded as 1.0-s averages. Since peanut data were also recorded as 1.0-s averages, individual high-frequency data were not recorded, and so it was possible that high mass-flow conditions would saturate the sensor and not be detectable. Typical 1.0-s averages of sensor output for cotton (fig. 5b) were distributed fairly evenly within the entire output range, while for peanuts (fig. 5c) they tended to cluster in the top portion of the output range. Thus, there was additional concern with peanuts that the high sensitivity level may cause the sensor to saturate during high flows. Therefore, prior to the 2004 study one of the two sensors was covered with a Teflon coating to reduce its sensitivity. This modification allowed comparison of the two sensors at different sensitivity levels.

**Test at Lucedale, Mississippi, 2004**

After the data processing algorithm had been changed, and one of the peanut mass-flow sensors had been covered with a Teflon coating to reduce its sensitivity, the peanut yield monitor was field-tested again at Lucedale, Mississippi in...
November of 2004. Two other commercial peanut fields, field 1 (3.5 ha, heavier soil) and field 2 (4.4 ha, sandier soil), were harvested and weighed with the same equipment and methods used in 2003. Eight loads were harvested and weighed in field 1, and ten loads in field 2. The moisture content in the peanuts was higher than normal as field 1 was harvested, but the peanuts in field 2 were fairly dry as they were harvested.

Spatial data were not collected in field 1, because the GPS receiver could not receive the signals properly in that field. Based on information from the owner of the field, the same problem occurred earlier in 2004 when peanuts were planted there with a GPS guidance device. Possible reasons for the problem with GPS reception in field 1 include its close proximity to buildings in a small town as well as being surrounded by trees. Nonetheless, even though yield maps could not be generated for field 1, the load-level accuracy test of the peanut yield monitor was still obtainable.

**RESULTS**

**TEST NEAR KINGAROY, QUEENSLAND, AUSTRALIA, 2003**

A strong correlation ($R^2 = 0.89$) was observed between peanut weight and sensor output signal in the 2003 Australia field test (fig. 6). Among the fourteen basket loads weighed, peanut weight varied from 83 to 517 kg, and the integrated output signal from the sensors varied from 305 to 2118 VDC (scale based on sensor calibration). The average WSR was calculated to be 0.28 kg/V.

Data from the three stationary runs, averaged over the two sensors, are shown in figures 7a through 7c. Periods of peanut mass flow are clearly visible in each. In very few cases – most notably between data sets 3 and 4 in run 1 (fig. 7a), and between data sets 2 and 3 in run 3 (fig. 7c) – was delay time between bins adequate to provide clear separation between consecutive data sets. The delay was typically inadequate, resulting in some overlap between data sets and some uncertainty about the time periods and signal sums associated with them. While this situation was not anticipated, and no graphical display of the data had been available during the test, it was apparently related to the occurrence of mixing and delay in agricultural conveying systems that is commonly observed with yield-monitoring systems on grain combines. Another problem related to mixing and delay is that the time over which bins were emptied did not correspond to the time over which peanuts were passing by the sensor. Therefore, WSR was calculated for all the data sets and plotted in two ways for this portion of the study. First, it was plotted against the mass flow calculated based on the time used to empty the bin into the duct. Second, it was plotted against the mass flow calculated based on the time during which the peanuts were actually passing the sensor, as estimated from the data plots (figs. 7a through 7c). Figure 8a shows that WSR goes up as mass flow based on bin-emptying time increases, and that 84% of the variation in WSR can be explained with a linear regression equation. However, Figure 8b shows that 97% of the variation can be explained when WSR is linearly regressed against mass flow based on actual sensor-response

![Figure 5a. Pattern of cotton mass-flow sensor output at 100 Hz. A consistent zero-flow baseline can be easily seen at 0.25 V.](image)

![Figure 5b. Typical pattern of cotton mass-flow sensor output at 1.0 Hz.](image)

![Figure 5c. Typical pattern of peanut mass-flow sensor output at 1.0 Hz.](image)

![Figure 6. Plot of sensor output versus peanut weight from the test near Kingaroy, Queensland, Australia, 2003.](image)
time. Both plots, but particularly figure 8b, give a strong indication that as mass flow increased, the sensor experienced reduced sensitivity, demonstrating that data-processing algorithms may be needed in the future to compensate for the change in the sensor’s output as mass flow increases.

**Test at Lucedale, Mississippi, 2003**

Strong correlations ($R^2 = 0.96$) were also found between peanut load weights and sensor output for both Mississippi fields in 2003 (figs. 9 and 10). Among the nine loads harvested from Lee’s field at Lucedale, Mississippi, weights varied from 333 to 2846 kg and sums of output signal from 510 to 2848 VDC. Average yield of this field was 2555 kg/ha. In Courtney’s field, weights of the twelve loads varied from 231 to 2474 kg, corresponding to an output signal range from 297 to 2487 VDC. The average yield was 4352 kg/ha. Values of WSR for Lee’s and Courtney’s fields were 0.98 and 1.07 kg/V, respectively. Whereas only 1.0-s averages of sensor output were collected, no attempt was made to correct WSR values according to changes in mass flow.

**Test at Lucedale, Mississippi, 2004**

The correlations between peanut load weight and sensor output in the 2004 Mississippi tests were again very strong, with $R^2 = 0.93$ for field 1 (fig. 11) and 0.96 for field 2 (fig. 12). The average yield of field 1 was 3504 kg/ha, while that of field 2 was 4598 kg/ha. The load weights and signal sums in fields 1 and 2 varied similarly to those of the other

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**Figure 7a.** Sensor signal vs. time for stationary test 1 in Australia. Five data set collection periods of differing durations can clearly be seen.

**Figure 7b.** Sensor signal vs. time for stationary test 2 in Australia. Five data set collection periods of differing durations can clearly be seen.
two Mississippi fields in 2003. The WSR values for fields 1 and 2 were 1.00 and 0.92 kg/V, respectively. Again, since only 1.0-s averages of sensor output were collected, no attempt was made to correct WSR values according to changes in mass flow.

**SENSOR SENSITIVITY ISSUES**

As mentioned previously, in order to reduce its sensitivity, one of the two sensors had a Teflon covering placed over its
CALIBRATION ISSUES

From the stationary tests conducted in Australia, it is known that WSR changes with flow. As pointed out before, such non-linearity was found not to be a significant issue with the cotton mass-flow sensor. In the case of peanut mass-flow measurement during harvest, it appears that the non-linearity is again not a major source of error. There are two probable explanations: (1) the mass flow of peanuts during harvesting varied over a small enough range that the change in sensitivity had no major effect, and (2) the level of variability in flow during harvest was fairly consistent from one plot to the next. While the system appears to work reasonably well, this non-linearity remains a concern that should be addressed in future research.

Additionally, as mentioned before, average WSR values were calculated for each field. Ideally, the WSR averages would be the same if the tests were conducted under the same conditions. However, one factor that can cause a change in WSR is a difference in moisture content in peanuts from field to field. Peanuts with higher moisture content tend to reflect less light in the near-infrared wavelength range, which was employed in the peanut mass-flow sensor. Therefore, the signal output generated by peanuts with higher moisture content is smaller than that by peanuts with lower moisture content. Since a difference in field moisture conditions was noted at harvest in 2003 and 2004, this difference was likely a significant reason for the difference in WSR between Lee’s field and Courtney’s field in 2003 and between fields 1 and 2 in 2004. It is worth noting that while WSR values were approximately 1.00 in 2003 and 2004 for the sensor used in the Mississippi tests, these values are not comparable because of the modification of one of the sensors and the data-processing algorithm prior to 2004.

Furthermore, the WSR value was 0.28 for the sensor used in the Australia test, while the WSR value in Mississippi in 2003 was roughly 1.00 with a similar set of sensors and data-processing algorithms. There are two probable reasons for the difference. First and most important, the Australian combine had a smaller duct. The smaller the duct is, the closer the peanuts pass by the sensor, and thus the more light that is reflected directly to the sensor by the peanuts, producing a stronger sensor output signal. Second, while attempts were made to calibrate the sensors such that they would have similar sensitivity levels, calibrations are not perfect, and hence one sensor could be expected to have a slightly different WSR value than another sensor.

To compensate for field-to-field differences – such as in peanut pod moisture content – and obtain the best absolute accuracy for a given field, peanut yield data may be post-processed on a field-by-field basis by using the total peanut weight for the given field. In this case, the total field weight would be divided by the sum of sensor output signal for the entire field in order to obtain a field-based WSR. Yield at each field location could then be calculated with this field-specific WSR. This method amounts to an *a posteriori* scale adjustment and was recommended for cotton by Thomasson and Sui (2003), and was the method used in this work as yield maps were constructed.

**YIELD MAPS**

Due to the poor quality of GPS data in the Australia field and the GPS signal in field 1 in Mississippi, yield maps were not generated for these fields. However, yield maps of the other three Mississippi fields were created with data from the peanut yield-monitor system. Each map realistically exhibited the yield variations within the field, according to the producer’s expectations regarding information such as soil type, soil moisture, soil fertility, etc. Figure 13 is a yield map of Lee’s field, and serves as an example of the others. It is obvious that the yield was generally lower in the northwestern and southeastern corners than in the middle of the field. The farmer involved attributed the differences...
Figure 13. Peanut yield map of Lee’s field, Lucedale, Mississippi, 2003

primarily to hydrological variation in the field. Other smaller-scale trends in yield variability are also evident.

SENSOR RESOLUTION

Compared to the load-cell based system reported by Vellidis et al. (2001), the resolution of the optical-sensor-based peanut yield-monitor system reported here was high: 0.6 kg/ha when the harvester travels 4.02 km/h with a swath width of 3.66 m and data-recording frequency of 1 Hz. Accurate data collected with such high resolution can be used with confidence for precision-agriculture, including management at fine scales.

PROBLEMS IN FIELD EXPERIMENTS

As mentioned, a few problems were discovered and dealt with during this study: the gap in the mounting bracket that allowed peanuts to lodge, possibly obscuring the sensor; high sensor sensitivity possibly allowing sensor saturation and loss of information; and GPS issues. Another issue of concern was noted in the Mississippi field tests in 2003: the sensor cable must be long enough to easily span the distance between the duct and the cab, which changes during turns; otherwise, field maneuvers can cause the cable to stretch and break. To address this issue, the original sensor cable was replaced by a longer one. After that point, no significant hardware failures occurred during testing. Both the peanut mass-flow sensor and data acquisition system performed well. The sensor window remained fairly clean throughout one day of harvesting except in field 1 in Mississippi, where, as noted before, peanut moisture levels were high, apparently contributing to dust and dirt build-up on sensor windows.

FUTURE RESEARCH

In addition to concerns about sensor non-linearity, some other issues not addressed in this study warrant further research. Examples of these include effects of foreign matter in the flow stream, mass-flow delay in the harvester and associated filtering effects, appropriate sensor mounting location, and effect of harvester speed.

SUMMARY AND CONCLUSIONS

A peanut yield-monitor system was developed by adapting the Mississippi cotton yield-monitor technology for use with peanuts. The system was tested near Kingaroy, Queensland, Australia in 2003 and at Lucedale, Mississippi in 2003 and 2004, with very promising results. Minor problems were encountered during testing, and minor modifications were made to the sensor along the way. Fifty-three loads of peanuts in five fields were harvested and weighed, and data analysis was conducted on a load-by-load basis. Results showed that the sum of the sensor output was very strongly correlated with the load weight ($R^2$ values ranging from 0.89 to 0.96). Data collected by the system were used to create peanut yield maps that accurately exhibited yield variations within the fields. No major problems occurred during the tests, and minor problems were overcome with minor modifications to sensor-mounting hardware and data transmission cables. Variations in moisture content in the peanut pods apparently affected the output of the peanut mass-flow sensor and system accuracy, so post-processing of yield data was recommended for the best accuracy in developing yield maps. Sensitivity of the peanut mass-flow sensor was found to be non-linear, with decreasing sensor response as mass flow increases. Future research in optical peanut mass-flow sensing should attempt to compensate for this non-linearity.

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