Title: The affect of irrigation rate on peanut pod rot.
Cooperators: Terry Wheeler, Dana Porter, Mike Schubert, Vijay Kumar Choppakatla
Cooperating institutions: TAES (Wheeler, Porter, and Schubert), TAEX (Porter) and West Texas A&M University (Choppakatla).

Objectives:
1) Was there a relationship between irrigation rate in 2002 (50, 75, and 100 % ET) and pod rot at harvest?

2) Was there an impact of the amount of pod rot from the previous year on pod rot in 2002?

3) How did irrigation rate and fungicide treatments affect pod rot and yield

Variety: Flavorunner 458

Results:
1) Pod rot was evaluated at 162 locations at harvest in the first two spans (54 locations per irrigation rate). There was more pod rot as the irrigation rate increased from 50 to 75 % ET. There were no consistent differences in the amount of *Pythium* pod rot between 75 and 100 % ET. Overall, the average rate of pod rot at 50, 75, and 100 % ET was 1.2, 4.4, and 6.3 % respectively. However, only 1/3 of the area in the first two spans was irrigated with peanut ET rates, the other 2/3 area in this test was actually in the "cotton" pies and were irrigated with cotton ET rates. This means they received less water, particularly toward the end of the season than the peanut ET areas. The relationship was similar in both cotton and peanut ET areas with irrigation leading to more pod rot, however, pod rot increased more under peanut ET rates, particularly in 75 and 100 % ET irrigation rates (Table 1).These results indicate that those producers who use higher irrigation rates can expect some increases in their pod rot, compared to reduced irrigation. The question then becomes what rate of water will allow a producer to reach their yield goals, without being hit hard by pod rot. We addressed this question in objective 3.

2) In 2001, pod rot averaged 3, 8, and 9 % in areas irrigated with 50, 75, and 100 % ET. In 2002, each of these three areas were subdivided into three more areas and irrigated with 50, 75, and 100 % ET. We did this to test for the importance of previous disease levels on the next year's crop.
Pod rot in 2002 was affected by disease patterns in 2001, however, only in the cotton ET areas (Table 1). In the peanut ET area, disease levels were higher than the cotton ET area, and not related to 2001 pod rot (Table 1).

Table 1. Affect of 2001 and 2002 irrigation rates (% ET = evapotranspiration) on 2002 pod rot. Means are divided into "cotton" and "peanut" sections. The entire test area was planted to peanut, but in 1/3 of the area, the irrigation rates were based on peanut ET values and in the rest of the area on cotton ET values

% POD ROT at Harvest in 2002

	Peanut ET Values			Cotton ET Values		
Year of Irrigation	50	75	100	50	75	100
2002	1.0	6.3	9.6	1.3	3.5	4.6
2001	3.6	7.8	5.5	1.1	3.3	4.9

*2001 areas were subdivided into 50, 75, and 100 % ET areas for 2002.

3) There are only two fungicides labeled for control of *Pythium* pod rot: Abound FL and Ridomil Gold. Ridomil Gold EC is suppose to go out through the pivot, but we could not duplicate that treatment in small plots, so we are only presenting data from Abound FL as a preventative (at 60 and 90 days after planting) and as a curative once pod rot symptoms were observed (at 111 days after planting). These treatments were repeated six times over each of the three irrigation rates. The results were consistent across irrigation rates with Abound FL at 60 and 90 days having the least amount of pod rot, the best grades, highest yields, and most dollar value/acre (Table 2). The curative treatment of Abound FL had more pod rot and disease, than the preventative treatments, though differences were inconsistent (not significantly different). Both methods of using Abound FL had higher yields than not using a fungicide. The results are averaged across water treatments in Table 2 with statistical separations, and also presented separately by irrigation rate (without statistics). Yields across all fungicide treatments averaged 3,200, 3,970, and 5,343 lbs/acre for 50, 75, and 100 % ET. The most profitable combination was to use 100 % ET irrigation and Abound FL (24.6 oz/acre) at 60 and 90 days after planting. This treatment yielded 5,980 lbs/acre compared with the untreated plots which averaged 4,464 lbs/acre (with 100 % ET).

Pod rot differences between the best Abound treatment and the untreated plots were < 5 %, yet yield differences averaged 1,077 lbs between these two treatments. In other words, there was a 23 % increase in yield (averaged across all water treatments) with the best fungicide treatment. Yet we can account for < 5 % of that increase with pod rot at harvest. Another explanation is necessary! The losses from peg rot may be greatly underestimated.

Table 2. The affect of Abound FL and irrigation rate on pod rot and yield.

Treatment*	Irrigation rate in 2002 (% ET)	% Pod rot at harvest	Grade	Diseased Kernals (%)	Yield lbs/acre	$-value per acre
Abound 2x	averaged	0.5 b**	78.9 a	0.2 b	4,640 a	1,778 a
Abound 1x	averaged	2.5 ab	78.1 ab	1.3 b	4,263 a	1,640 a
none	averaged	4.6 a	76.0 b	3.3 a	3,563 b	1,377 b
Abound 2x	50	0.8	78.6	0.1	3,706	1,445
Abound 1x	50	2.4	77.9	1.0	3,356	1,317
none	50	1.7	78.6	1.4	2,735	1,093
Abound 2x	75	0.0	80.0	0.1	4,456	1,713
Abound 1x	75	2.9	78.4	1.6	4,162	1,606
none	75	5.5	75.8	3.6	3,640	1,402
Abound 2x	100	0.7	78.0	0.4	5,980	2,255
Abound 1x	100	2.1	78.0	1.2	5,556	2,102
none	100	7.0	73.0	5.2	4,464	1,687

*Abound FL was applied at 24.6 fl oz/acre in 10 gallons of water. Abound 2x indicates that two applications were made (at 60 and 90 days after planting), while Abound 1x indicates one application at 111 days after planting was made.
**Different letters after a mean value indicate that means are significantly different with a 95 % level of confidence.

Title: Use of a hyperspectral sensor to identify stresses in peanuts and cotton.
Cooperators: Terry Wheeler, Harold Kaufman, Dana Porter, Mike Schubert
Cooperating Institutions: TAES (Wheeler, Porter, and Schubert), TAEX (Kaufman, Porter)

Objectives:

1) Acquire images using an aerial hyperspectral sensor

2) Analyze data collected to identify stress patterns from irrigation treatments, root-knot nematode, and soil parameters with respect to spectral reflectance.

The GPS component of the hyperspectral sensor malfunctioned all season. Only one image was obtained late in the season that could be used, and it was without GPS. The field was photographed on July 9 (Fig. 1) and August 9 (Fig 2) using infrared photography. The location of soil samples collected in 2000 and analyzed for physical and chemical differences are seen in Fig. 1. Irrigation treatments are shown in Fig. 2. There were three peanut varieties planted as shown in Fig. 2. A hyperspectral image was taken on September 26 (Fig. 3).

Fig. 1. Taken on July 9, 2002 with infrared photography. Darker areas in northern part of the image are clouds. Black dots indicate location of soil samples taken in 2000.

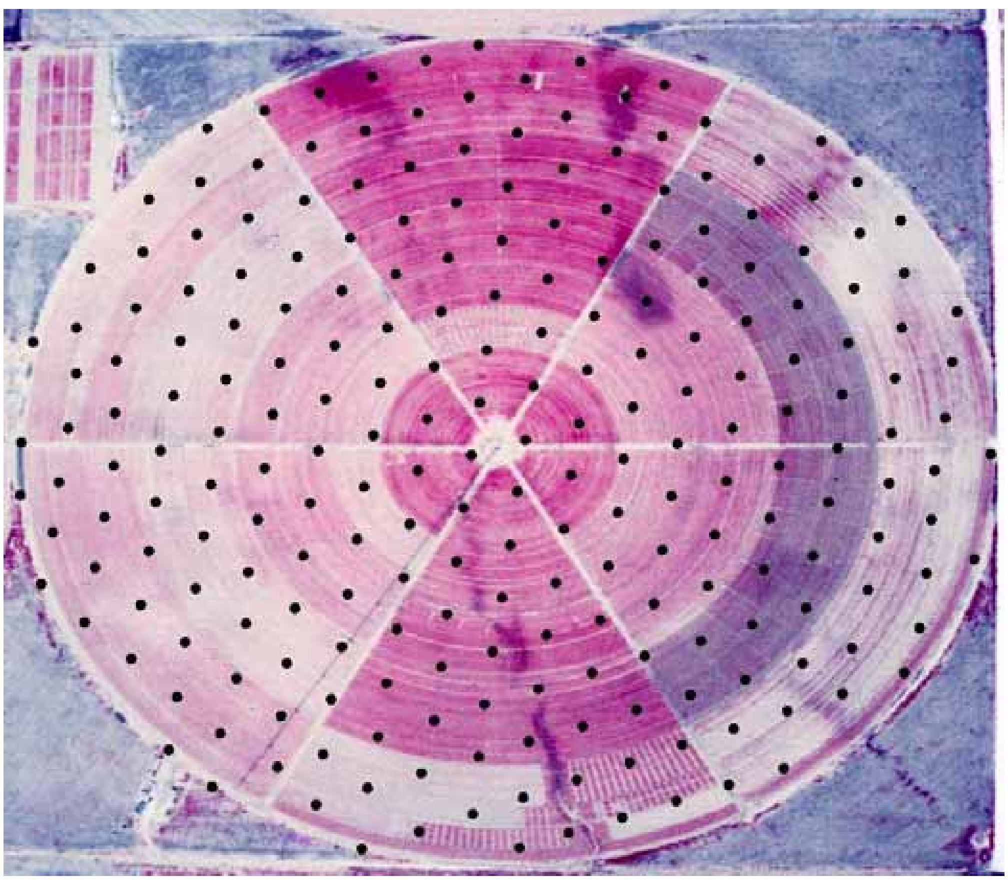


Fig. 2. Western Peanut Growers Field on August 9, 2002 with aerial infrared photography.

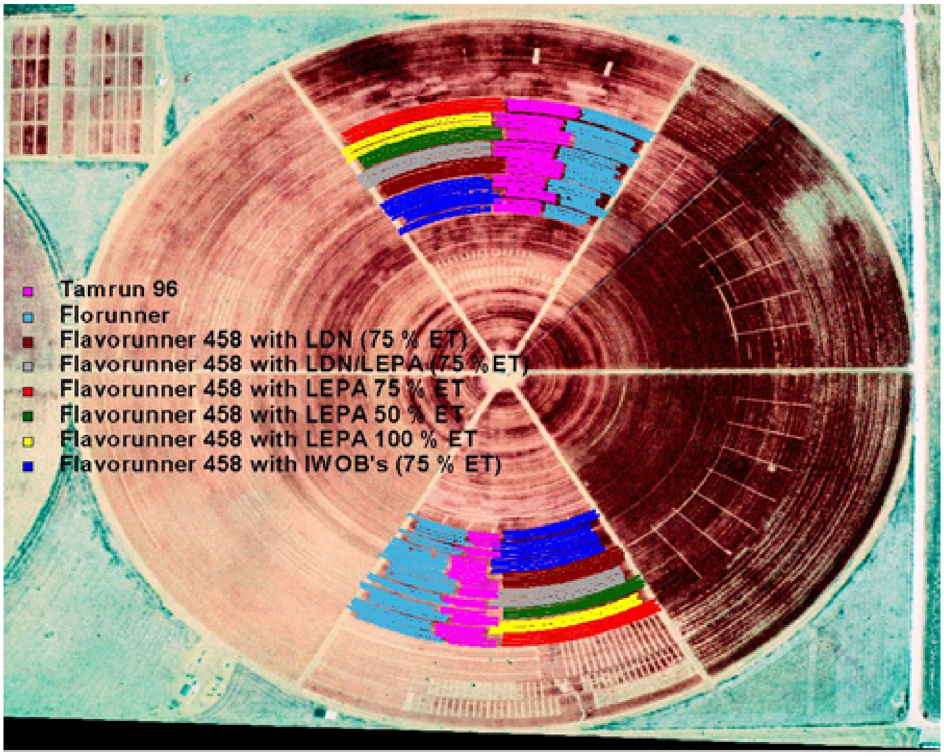
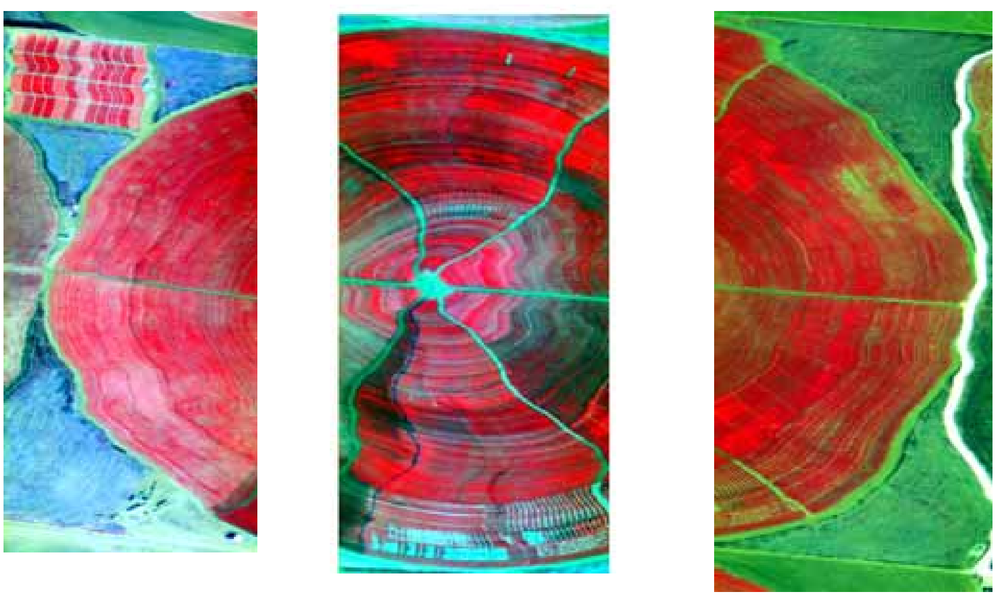


Fig. 3 Hyperspectral images taken on September 26, 2002

A B C



Visual inspection of the infrared color photographs is useful for looking at the health of the cotton. Color infrared film results in three broad bands of reflected light (green, red, and near-infrared spectrum). The north and south pies are peanuts. The two western most pies are cotton in their second year after peanuts. In Fig. 1, these pies show a lighter color in spans 6 and 7 than in spans 8 and 9 or 4 and 5. That can be interpreted as poorer growth in early July. In the two most eastern pies, which are in their first year following peanut, the dark strips through the entire 6th and 7th span is a variety test, which reflect light differently than the variety planted in the rest of the circle (Paymaster 2326 BG/RR). The 8th and 9th span appear to be growing poorly at this time, with an especially bad spot (white area) around the 2:00 position of the picture. In the southern pie with peanuts, a drainage area is seen in the center of the pie.

A month (Fig. 2) later the overall reflectance was much darker, particularly on the eastern part of the field. Part of the darkness is due to that area being most recently irrigated, but part is also due to excellent growth by the cotton (as compared to the western side of the circle). The poorly growing spot in the 2:00 position is now distinctly seen. In this area a lot of cotton died, though we were not able to determine the cause of plant death. In the north and south pies where peanuts were grown, various variety and irrigation treatments are shown. Flavorunner 458 is shown with the position of the irrigation treatments in spans 5 - 7. Those treatments continued around the entire circle, even though they are not shown with the other two varieties, Florunner and Tamrun 96. Florunner was impacted by the position of the pivot in the southern pie at the time the hyperspectral image was taken (Fig. 3B), so that variety was dropped from any spectral comparisons. The affect of wind on the airplane is clearly visible with the distortions in the hyperspectral images. Having the GPS working is necessary to get full value of the images.

<u>Analysis of hyperspectral image</u>: Reflectance was impacted by irrigation method (LEPA vs LDN vs IWOB) with an interaction between varieties. For Flavorunner 458, the IWOB method had lower reflectance values than other irrigation methods, particularly in the green (500 - 600 nm) and red wavelengths (600 - 700 nm) (Fig. 4). The differences in the green spectrum probably are related to the color green. The IWOB peanuts had a darker green than the LEPA and LDN treated peanuts, which were brighter and probably more yellow in color. The red spectrum often is related to soil properties, and may represent actually shading of the soil by more plant growth or a darker soil color due directly to wetting. The areas with IWOB peanut irrigation had darker color soil. With Tamrun 96 there was no impact of irrigation method on reflectance. The highest yields for Flavorunner 458 were with the IWOB method (4,301 lbs/a [IWOB], 4,280 lbs/a [LEPA], 4,165 lbs/a [LDN]). With Tamrun 96, yields were more similar between irrigation methods (4,383 lbs/a [LEPA], 4,378 lbs/a [IWOB], and 4,300 lbs/a [LDN]).

The LEPA method was tested at 50, 75, and 100 % ET for both varieties. With Flavorunner 458, reflectance was similar across all irrigation rates. Average peanut yields for these three treatments with Flavorunner 458 were 4,027, 4,280, 4,324 lbs/a for 50, 75, and 100 % ET. So there was a range of almost 300 lbs, yet no reflectance differences. With Tamrun 96, reflectance difference were seen from 597 to 673 nm. The ET rates separated out with the lowest irrigation rate having the highest reflectance (Fig. 5). The average yields with Tamrun 96 were 3,864, 4,383, and 4,552 lbs/a for 50, 75, and 100 % ET, respectively. So there was a range of nearly 700 lbs between the irrigation rates.

Fig. 4

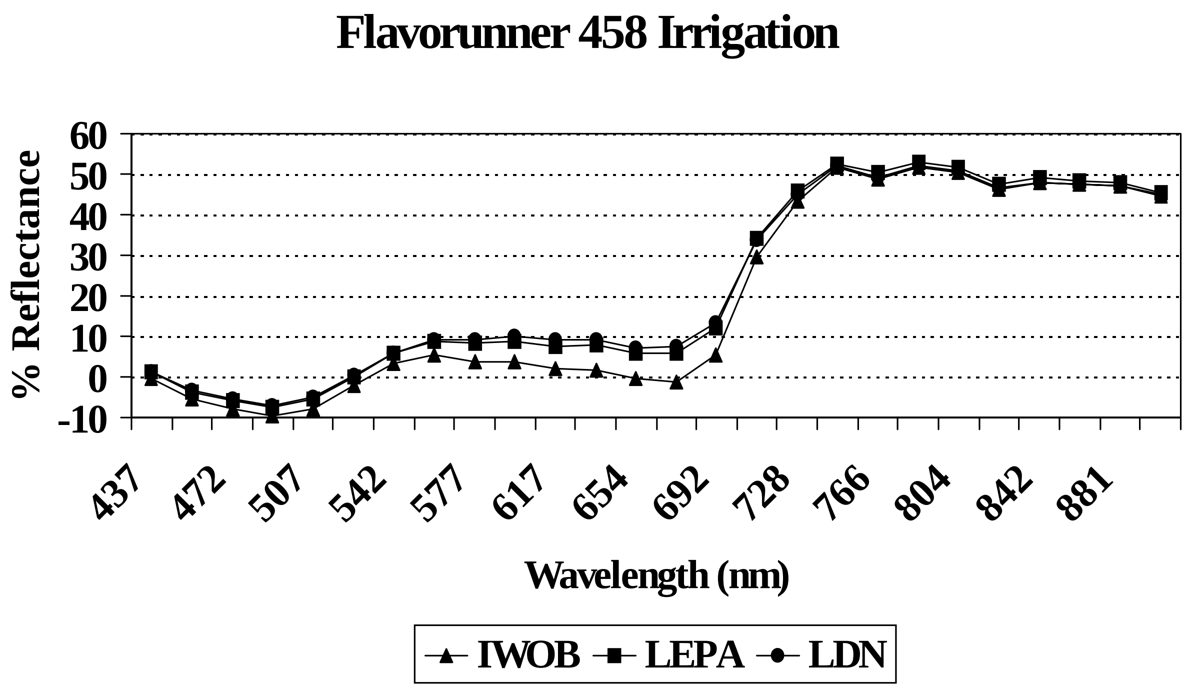
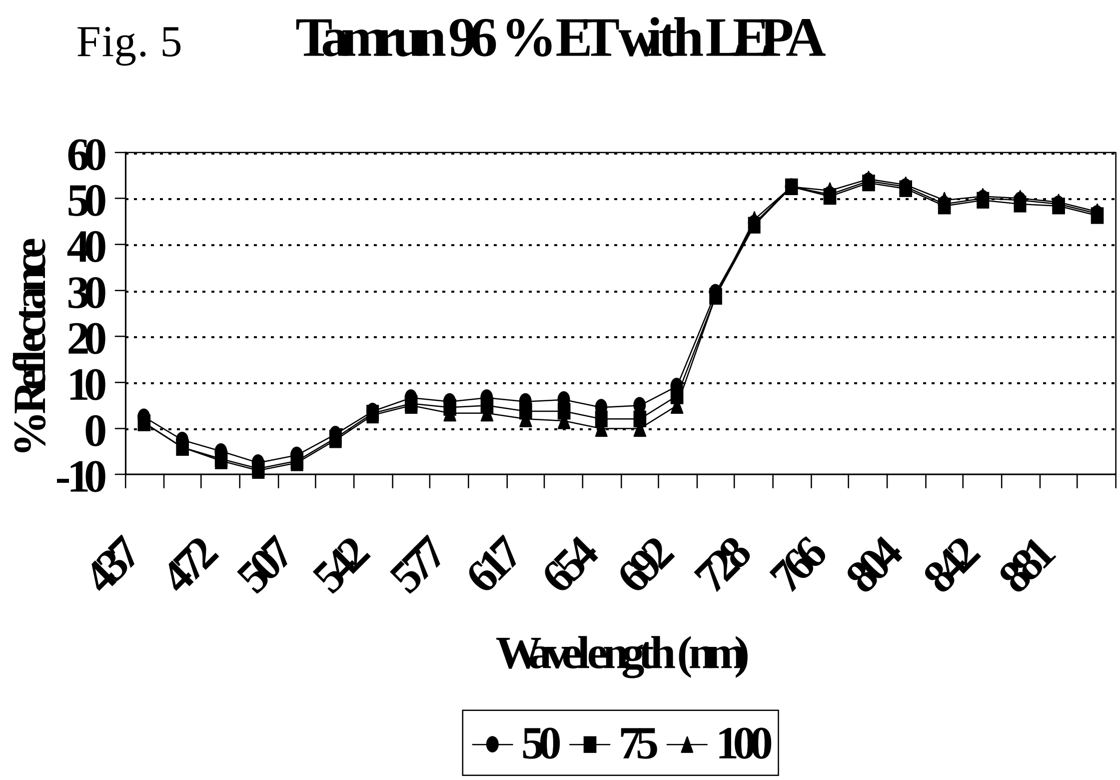

Flavorunner 458 Irrigation
60
50
40
30
20
10
0
-10
% Reflectance
437
472
507
542
577
617
654
692
728
766
804
842
881
Wavelength (nm)
IWOB
LEPA
LDN

Fig. 5


Tamrun 96 % ET with LEPA
60
50
40
30
20
10
0
-10
% Reflectance
437
472
507
542
577
617
654
692
728
766
804
842
881
Wavelength (nm)
50
75
100

Assays of soil samples taken in 2000 were compared with 2002 reflectance values in peanut areas. Significant correlations at various reflectance values were found with soluble salts, pH, phosphorus (Meh3P), potassium, sodium, and sand and clay content from 6 to 12" depth. Correlations were weak for all soil factors with R^2 values typically < 0.20.

Cotton spectral analysis: Type of irrigation application (IWOB's vs LEPA vs LDN) was compared at 75 % ET. LEPA application had a much different reflectance pattern than LDN and IWOB types in the northwest pie for cotton (Fig. 6). LEPA had a darker reflectance in the green and red wavelengths. In the near-infrared wavelengths, all three applications had significantly different reflectance values, with the highest reflectance for LEPA and the lowest reflectance for IWOB method. However, the magnitude of these differences, was smaller than seen in the green and red wavelengths (Fig. 6). With the southwest cotton pie, which had much lower yields overall, than the northwest pie, reflectance differences were seen only in the near-infrared spectrum. LEPA had higher reflectance than LDN and IWOB nozzles (Fig. 7). So in this spectrum, both pies, though very different in yield, responded with similar reflectance patterns to irrigation application. In pies 1 and 6, IWOB averaged 1,206 and 777 lbs of lint/a, LDN averaged 749 and 769 lbs of lint/a, and LEPA averaged 1,024 and 842 lbs of lint/a. So reflectance differences were not related to yield differences.

Fig. 6

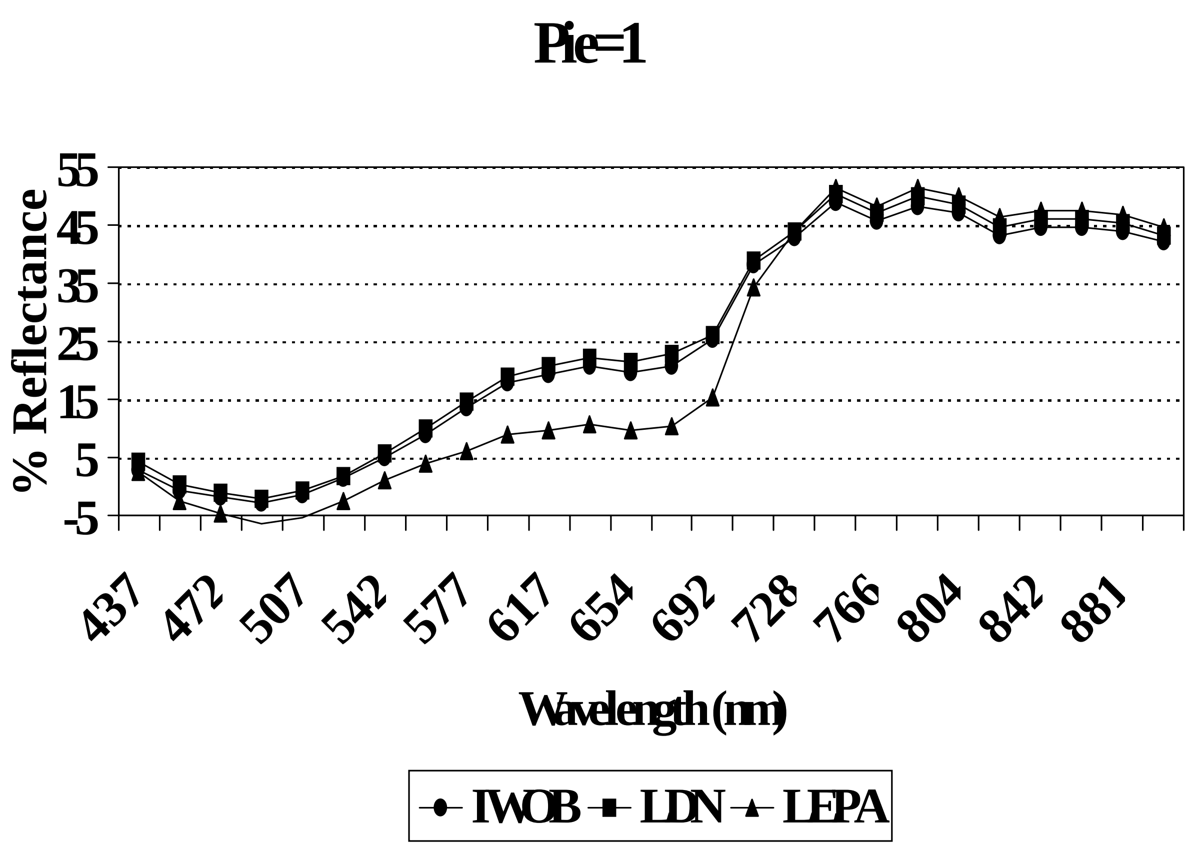
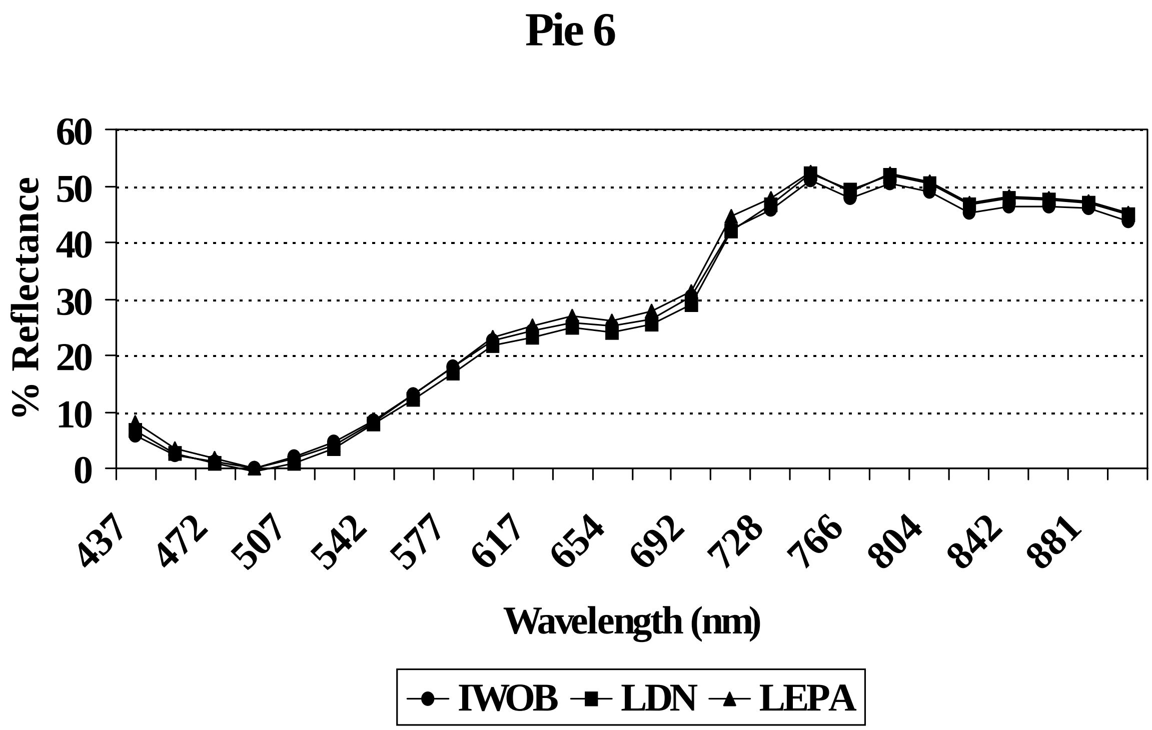
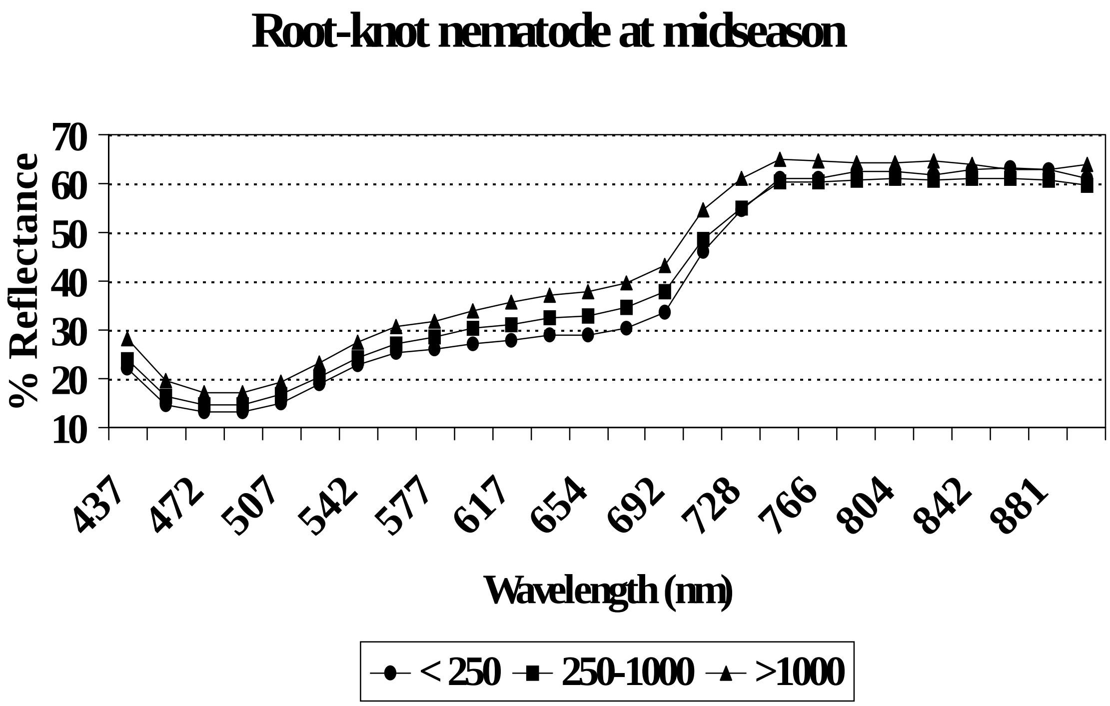


Fig. 7



Root-knot nematode density at midseason was correlated with reflectance (Fig. 8) only in the poorest yielding area (pie 6), which probably is under a greater degree of water and possibly fertility stress than the other areas of the field. Reflectance was also compared against soil pH, salts, organic matter, and the depth to a change in soil color (to red). There was a poor, but significant correlation with soil pH from 485 to 704 nm (R^2 ranges from 0.04 to 0.07) and with organic matter from 432 to 723 nm (R^2 = 0.06 to 0.08). Soil salts were correlated with reflectance from 432 to 742 nm (R^2 = 0.23). An R^2 value refers to how well you can predict a factor with a model. For example, if the goal was to predict soil salt concentration by reflectance, then the best model from a single wavelength would predict 23 % of the variation in the field as salt concentration changed from the average salt concentration.

Fig. 8


Root-knot nematode at midseason
% Reflectance
70
60
50
40
30
20
10
437
472
507
542
577
617
654
692
728
766
804
842
881
Wavelength (nm)
< 250
250-1000
>1000