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**R&D  
on a  
Fertilizer Sensor  
and  
Control System**

Phase II/IIA Final Report  
Contract DE-AC07-84ID12518

Aguila Research & Development Corporation

1811 Upland Drive  
Houston, Texas  
77043

(713) 973 - 2767

31 July 1988

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## Conclusions and Recommendations

Major Finding and Conclusions Derived from the Phase IIA Program Include:

- Using SOIL DOCTOR Technology Easily Allows Over 50% Savings of Sidedress Nitrogen Fertilizer, Without Any Ill-Effect to Crops.
- Using SOIL DOCTOR Technology Enables Yield Increases with Fertilizer Savings. Saved Nitrogen Fertilizer Can be Locally Applied, Where Needed.
- Variability of All Soil Nutrients is a Commonly Known Fact. Since Nitrate is Highly Soluble, Soil Nitrate is Highly Variable, moving with soil water.
- High CV Nitrate Variability Mandates the Need for a Soil Nitrate Sensor.
- High CV Nitrate Variability Allows the SOIL DOCTOR to Easily Increase Crop Yield.
- Plants Do Not Respond Linearly to Additional Amounts of Nitrogen Fertilizer. The More N Fertilizer is Applied, the Smaller the Subsequent Increases in Yield.
- The Law of Diminishing Returns Allows the SOIL DOCTOR to Increase Crop Yield, by applying N saved in areas with excess N to those with low N status.
- The Same Amount of Nitrogen Fertilizer Can Produce Triple the Yield Increase, When Applied to Low Nitrate Soils as When Applied to High Nitrate Soils.
- Recorded Nitrate Variability was Easily Observed to be Topography Related. It was Repeatable and Followed the Contours of the Fields Recorded.
- A Real Commitment by DOE to the Technology Effort Requires More Than Three Months of Preparation Time by researchers.

- Three Months is Barely Enough Time to Design and Construct Test Equipment. If the Equipment is to Hold Together During Tests, Far More Time is Required.
- Off the Shelf Component Parts Cannot Be Used in 100% Confidence. Their Failures Require Even More Preparation Time.
- Farmers Will Only Accept a New Technology, If it is in a Familiar, Convenient, and Effortless Package.
- Sidedress is a Hectic Season. No More Than One Pass Through the Field Is Tolerable to Farmers.
- The SOIL DOCTOR System Concept is Readily Acceptable to Farmers.



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