



## The Impact of Soil Texture on Nitrogen Diffusion in the Texas Gulf Coast

The following article is based on a paper submitted to the *Communications in Soil Science and Plant Analysis* journal.

### *Importance of Nitrogen and Use Efficiency*

Nitrogen is one of the most important nutrients required for rice growth and development (Fig. 1) (Champagne et al., 2004). It is an important component of many enzymes, including Ribulose-1,5-bisphosphate carboxylase oxygenase (RuBisCO), a key enzyme in photosynthesis. Because of its importance in photosynthesis, low rice grain yield is commonly observed under N deficiency or stress. Fertilizers are already a major portion of the operation cost in the U.S. rice industry (Fig. 2), with nitrogen being an expensive input for rice producers because of the amount applied as fertilizer and its price (USDA-ERS, 2010). Hence, there is a need to improve nitrogen use efficiency (NUE), that is, the ratio of N taken up by the crop to the N fertilizer applied. Current NUE values are quite variable, ranging from 35 to 90% (Cassman et al., 1998), while NUE values under the best production management range from 65 to 75% (Norman, et al., 1994; Wilson et al., 1994). Worldwide, however, the nitrogen use efficiency is low at approximately 33% (Raun and Johnson, 1999). Because of these factors, determining the underlying mechanisms of improving NUE is one of our primary objectives.

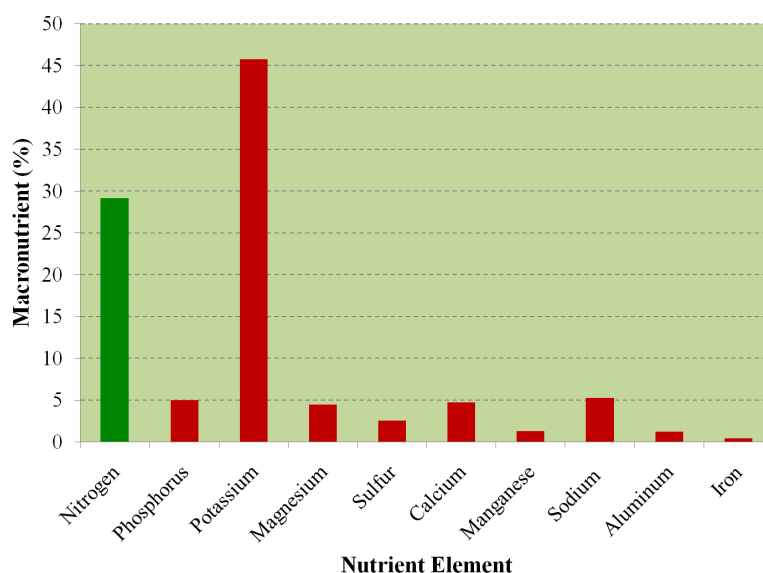


Fig. 1. Total nutrient removal by grain, hull, and straw after main crop harvesting (Adopted from Champagen et al., 2004, with modification).

### *Available Soil Nitrogen*

Rice soils along the Texas Gulf Coast have demonstrated vastly different abilities to supply N to a growing rice crop (Chen et al., 1989). Similar observations have been reported among 31 soil sites in Louisiana, where soil texture varies from fine sandy loam to clay. Similarly, in Mississippi, there a wide range of total N (540 to 5,460 mg N kg<sup>-1</sup> soil) in rice soils (Walker et al., 2003).

An interesting observation noted is that rice grain yields in 0 N plots correlate more closely with

# From the Editor ...



## Nitrogen Diffusion and the Use of Crop Models in Quantifying the Physiology of Light Interception

Welcome to the May issue of *Texas Rice*. The cover story by Lee Tarpley and colleagues addresses the movement and storage of nitrogen in the soil and how the availability of nutrients to rice plants is influenced by the soil clay content. The clay composition of soil governs soil nutrient storage and availability to the growing rice roots. Lighter soils have a lesser amount of clay with a greater frequency of larger size soil particles. This allows for greater pore size between the particles, which in turn allows easier movement of both water and nitrogen through the soil. This is somewhat analogous to a wide mesh screen, which allows larger particles to flow through the screen. From a positive perspective, larger particle size results in larger pore size that allows greater oxygen movement to the roots and less CO<sub>2</sub> buildup in the root zone, which is beneficial to the roots. A negative aspect of lighter soils is their lesser ability to hold water and nutrients. As a result, water and nutrients are lost at a relative high rate via percolation down through the soil profile. This can result in decreased nitrogen utilization efficiency for rice, and transient water stress in a non-flooded production system.

In contrast, heavier soils that have greater amounts of clay have a greater frequency of finer particles sizes, which tends to hold water and nutrients more tightly and as a result do not allow water and nutrients to move as freely. This characteristic is both a benefit and a challenge for clay soils when used to produce rice. Heavy soils help to seal the soil profile thereby reducing the otherwise unavoidable loss of water and

nutrients through percolation through the soil profile. The sealing of soils provided by heavy clay soils can cause problems during early stages of rice growth if the soil is flooded prematurely or too great of a depth. When this happens, the young rice plants can become stunted due to clouding of the water and reduction of oxygen in the root zone. Both of these results delay plant growth and reduce stand establishment, which increase the prevalence of weeds, and reduces subsequent grain yield.

An ideal soil for rice might be a foot or two of a loamy-clay or clay-loam soil in the upper profile, and a foot or more of heavy clay soil beneath. The moderately light soil in the upper profile would allow a moderate rate of movement of water and nutrients, while a heavier soil below the moderately light soil would help to seal the profile thereby reducing loss of water and nutrients.

The second article in this issue describes research that focuses on how the architecture of rice canopies affect the interception of light and the use of physiological-based crop models to aid plant breeding in developing improved rice varieties. The interception of light is the basis for photosynthesis, which in turn has a profound effect on subsequent processes that control crop growth, development, maturation, and yield. Research at the Center has identified major differences in canopy architecture when comparing 12 inbred rice varieties and 16 hybrid varieties. Research such as this has been used in the development of a rice model that captures detailed physiological processes. We have been using this model for a number of years to help improve our understanding of rice physiology. About 9 years ago, we also began to use the model as part of the

Continued on page 5

### Inside This Issue

|  |   |
|--|---|
| The Impact of Soil Texture on Nitrogen Diffusion in the Texas Gulf Coast .....                                     | 1 |
| Editorial: Nitrogen Diffusion and the Use of Crop Models in Quantifying the Physiology of Light Interception ..... | 2 |
| Light Interception and Plant Architectural Modeling .....  | 3 |
| Rice Crop Update .....   | 9 |

# Farming Rice

## A monthly guide for Texas growers

*Providing useful and timely information to Texas rice growers, so they may increase productivity and profitability on their farms.*

## Light Interception and Plant Architectural Modeling

The efficiency with which different rice varieties intercept light is a fundamental starting point for a myriad of processes involved with rice crop growth, development, maturation, and yield. Research by our team has shown that the architecture of the rice plant has a tremendous impact on the efficiency with which a rice variety intercepts light. Four major factors that impact light interception efficiency are the angle of tillers within a plant, the position of tillers with respect to mother plants and other daughter tillers, the average distance between nodes on each tiller, and the curvature of leaves within the canopy. Genotypes whose leaves are less erect intercept a greater amount of light in the upper part of the canopy during times of day near solar noon, while genotypes that have leaves that are more erect intercept a relatively greater amount of light further down into the canopy (Wilson et al., 2010). The upper leaves are better at converting light into usable energy due to their higher concentration of chlorophyll. As a result, unless the light intensity that strikes the leaf surface is higher than what is referred to as a variety's light saturation point, higher light interceptions by upper leaves results in a higher rate of plant photosynthesis.

Three years of field research conducted at the Beaumont Center representing 12 inbred rice varieties and 16 hybrid varieties has shown that leaf light extinction coefficients range from 0.24 to 0.64, when correcting for light interception by leaf sheaths and culms (stems). The value of a variety's leaf light extinction coefficient is directly related to leaf curvature; the greater the leaf curvature, the greater the value of the light extinction coefficient. In our experiments, the variety that has the highest leaf light extinction coefficient requires only about 40% as much leaf area to intercept the same amount of light as the variety with the lowest coefficient.

This relationship is a bit more complicated due to the interception of light by leaf sheaths and stems, which contain some photosynthetic tissue, although not as much as do actively producing leaves.

Canopy structure also affects a variety's ability to compete with weed species for light, while the distribution of roots in the soil affects their efficiency at taking up nutrients from the soil. Rice varieties that are more efficient at capturing light, either via leaf or stem tissue, reduce the amount of light reaching the ground, in the process "shading-out" slower developing weed species more effectively.

A major part of our research focuses on integrating plant physiology and plant architecture to better understand which factors have the greatest impact on crop growth and to better predict how genes that affect expression of different plant traits affect crop growth, development, and yield performance under diverse production and environmental conditions. The better we are able to predict how a particular combination of plant traits affect crop physiological processes, the better we will be able to identify superior performing rice genotypes and more quickly we will be able to develop new varieties. Figure 1 provides a schematic overview of some of the major model features. Our physiologically-based rice model incorporates major mechanistic processes governing light interception, photosynthesis, respiration, soil nitrogen transformation, plant nitrogen uptake, carbohydrate and nitrogen demand, metabolite assimilation, partitioning, and remobilization, and organ initiation, growth, and senescence (Wu and Wilson, 1997; 1998), and represents the rice plant as groups of mother tillers, each with daughter tillers, and daughters of daughter tillers. This model allows us to simulate the seasonal development of a rice

*Continued on the next page*

## Functional-Architectural Modeling Framework

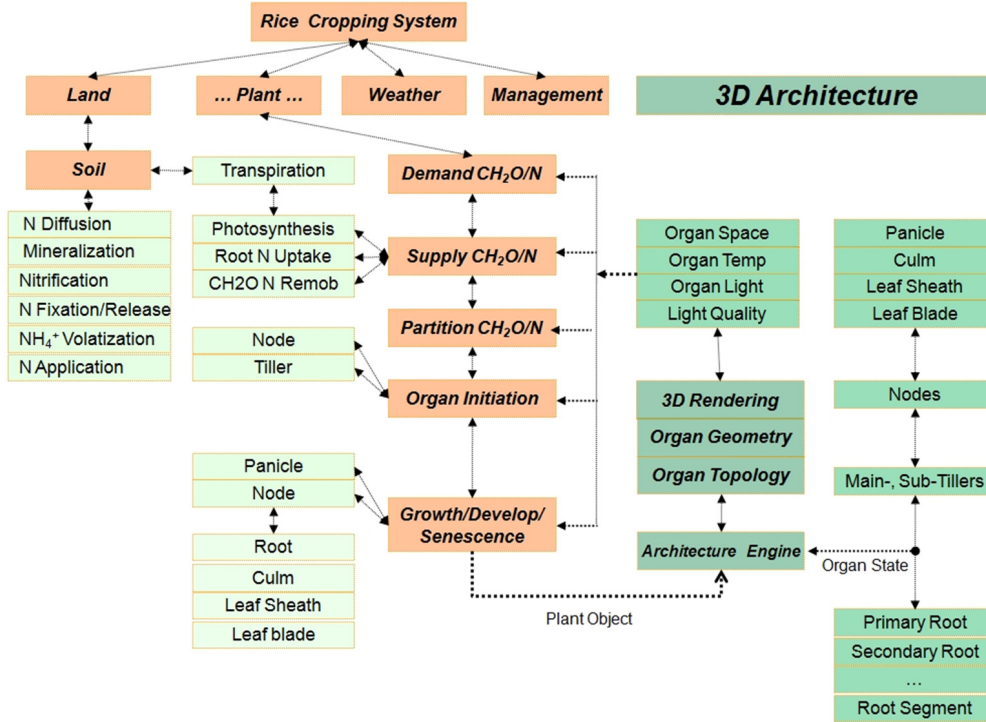


Fig. 1. Modeling framework for a 3-D physiological-based rice model.

crop for a very large number of temperature and soil nutrient conditions.

### Integrated Rice Physiological-Architectural Modeling

Increasingly integral to the Center's plant breeding research is our rice physiological-architectural modeling system, which takes the modeling approach described earlier one step further. This second modeling effort incorporates the 3-D dimensionality of different plant organs in determining how a rice variety intercepts light, captures nutrients from the soil, and competes with other organs and adjacent plants during the hourly and daily time course of growth and development. Each tiller is represented by nodes, with each node containing a leaf blade, a leaf sheath, a culm, and accompanying roots. Tillers that have reached the reproductive state end in an apical fluorecence, also known as a panicle, with each panicle having spikelets (flower buds), flowers, developing grain, and mature grain over the course of development. A rice plant maintains this hierarchical relationship throughout its development from the

birth of new tillers and successive production of nodes to the senescence of individual organs, which occurs throughout the growing season.

The major characteristics possessed by each organ include organ age, stage, biomass, amount of structural and non-structural carbohydrates ( $\text{CH}_2\text{O}$ ) and nitrogen (N). The major physiological processes are the same as was described for the physiological model, but occur at the organ level. The architectural component of the system includes organ shape, organ spatial position in the plant, and the hierarchical

relationships of individual organs to other organs in 3-dimensional space. The shape, curvature, angle, size, elongation, and color, of individual organs as they develop are based on data collected from our field studies.

Our 3-D physiological rice model simulates the growth, development, and spatial location of each of the individual organs of a rice plant at each time step. Organ biomass is mapped to each organ as it develops. The model predicts carbohydrate and nitrogen demand, supply, allocation, and organ birth, aging, growth, development, and mortality, in the process changing the plant and individual organ architectural and development (Fig. 2). Currently, the model estimates the light captured by individual organs. Research is under way to extend the model to estimate microenvironment data such as organ temperature, light quality, and  $\text{CO}_2$  concentration, to more accurately capture detailed physiological processes involving the initiation of tiller buds and the transition from vegetative development to panicle

Continued on the next page



Fig. 2. Representation of a rice plant in 3-dimensional space with light interception and shadows of organs.

differentiation, initiation, and development. Research addressing how insects and diseases injure different parts of the rice plant will soon be addressed using this approach as well.

### ***Advantages of Integrating Physiological with Architectural Modeling***

Most crop models included crop physiological processes without consideration for plant architecture. As a result, they have limited capability to realistically simulate the competition for space and light above ground and for space and nutrient below ground. Nor are such models able to capture some of the more detailed processes involved with organ birth and organ aging and senescence. Integration of physiological modeling with plant architecture allows us to study the intra- and inter-plant interactions at a more refined scale and to understand the mechanisms of the forms and functions of plant organs. The 3-D architectural model allows us to refine the light interception, photosynthesis, and supply/demand/allocation processes in the crop model. The system can be used in: 1) making virtual experiments and

measurements, such as nutrient movement, shade avoidance response, yield prediction under different water and fertilizer applications, 2) simulating the morphogenesis and structure changing with the environment such as light quality (blue light, red/far red light), 3) incorporating genetic control of key physiological processes, 4) incorporating injury by insects and disease and competition by weeds, and 5) selecting suitable plant types for breeding varieties with desirable genes, such as those controlling photosynthesis and lodging.

### ***References Cited***

- Wilson, L. T, S. O. PB. Samonte, J. C. Medley, Y. Yang, Xiaobao Li, J. Lv, and R. E. Tabien. 2010. An overview of light interception in rice: Implications for modeling photosynthesis. Biological System Simulation Group. \*\*\*
- Wu, G. W., and L. T. Wilson. 1997. Growth and development response of rice to rice water weevil injury. *Environ. Entomol.* 26: 1191-1201.
- Wu, G. W., and L. T. Wilson. 1998. Parameterization, verification, and validation of a physiologically complex age-structured rice simulation model. *Agr. Syst.* 56: 483-511. \*

\*Article by Lloyd (Ted) Wilson, Yubin Yang, S. Omar PB. Samonte, Xiaobao Li, Jim Medley, Jiale Lv, and Jenny Wang. For additional information, please contact Ted Wilson or Yubin Yang at [lt-wilson@aesrg.tamu.edu](mailto:lt-wilson@aesrg.tamu.edu) or [yyang@aesrg.tamu.edu](mailto:yayang@aesrg.tamu.edu).

## From the Editor ...

Center's rice plant breeding program to predict how 1,000s of different sets of plant traits interact to impact yield. When combined with focused field screening of promising rice germplasm, we are able to more quickly identify which lines to keep due to either having a desirable combination of plant characteristics, or quickly discard due to having an undesirable combination.

A very new version of the model has been

Continued on the next page

## From the Editor ...

developed by our team, which captures the detailed 3-D spatial organization of tillers, leaves, and panicles. We have begun to use this model to investigate the distribution and quality of light as it penetrates, reflects, and diffuses throughout the rice canopy. The sky is the limit on where this research could lead.

Please keep on sending us your suggestions for future research articles.

Sincerely,



L.T. Wilson

Professor & Center Director  
Jack B. Wendt Endowed

Chair in Rice Research

## Nitrogen Diffusion ...

available soil N than with total soil N (coefficient of determination,  $R^2 = 0.62$  vs.  $0.41$ ) (Dolmat et al., 1980). Sandy surface soils and some silt loam soils, which are inherently lower in native soil N (980 to 1,340 lb/acre total N in the top surface 6 inches), supply more N to rice than clayey soils, which have much greater total N (2,230 to 3,200 lb/acre total N in the surface 6 inches) (Fig. 3). This ability of soils with lower total soil N to supply more N is reflected in the increased rice plant growth and grain production, such that, without fertilizer N, sandy soils can produce twice the rice grain yield compared to clay soils.

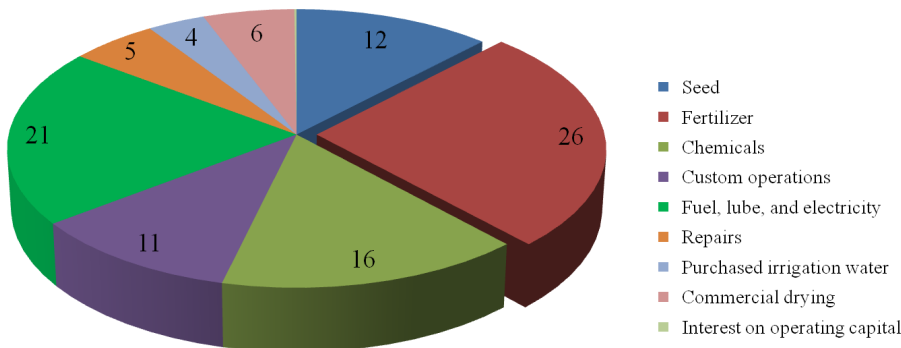


Fig. 2. Rice operation cost (%) analysis of Gulf Coast for 2009 (Results adopted from USDA-RES, 2010).

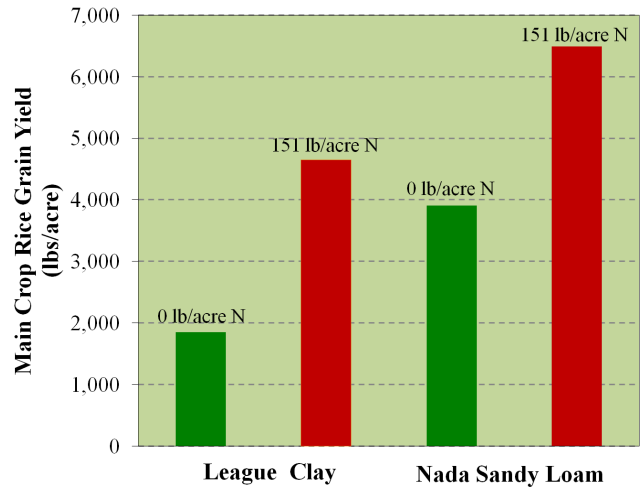


Fig. 3. Rice yield differences with or without fertilizer N suggest differences in soil N supply of clay and sandy loam rice soils of the Southern U.S. (3-year average  $\pm 1$  s.d.). (Results from this study.)

The flood-irrigated culture under which rice is grown makes ammonium-N ( $\text{NH}_4\text{-N}$ ) the primary N source for the rice plant, since nitrate-N ( $\text{NO}_3\text{-N}$ ) can be lost through denitrification. Rice plants obtain N from  $\text{NH}_4\text{-forming}$  N fertilizers, such as urea or ammonium sulfate, or from  $\text{NH}_4$  released from the soil exchange sites and from organic matter. This makes N supplied by the soil an important N source for rice. As mentioned earlier, worldwide NUE is about 33% (Raun and Johnson, 1999), implying that 67% of N that a plant takes up comes from soil N.

Soil parameters that influence ammonium uptake are nutrient concentration, soil buffering capacity (cations or nutrients on the soil's exchange sites that serve as a source of resupply for those in soil water that are removed by plant roots or lost through

leaching), and effective diffusion coefficient (also defined as apparent diffusion coefficient, referring to how easy a molecule or ion can pass through porous media like soil) (Barber, 1984). The effective  $\text{NH}_4$  diffusion coefficient ( $D_e$ ) is affected by soil  $\text{NH}_4$  buffer capacity ( $b$ ) and soil volumetric water content ( $q$ ), and it is estimated as  $D_e = D_p / (q + b)$ , where  $D_p$  is

Continued on the next page

# Nitrogen Diffusion ...

soil  $\text{NH}_4$  diffusivity, which is an inherent measure of solute movement in soils (Kemper, 1986).

Ammonium fixation by clay minerals typically limits N availability in soils. However, the water-saturated conditions under which flood-irrigated rice is grown may facilitate the release of some fixed  $\text{NH}_4$ , particularly for non-smectitic 1:1 clay minerals such as kaolinite (Chen et al., 1989). The increased availability of  $\text{NH}_4$ -N in the soil can allow increased plant uptake of  $\text{NH}_4$ . Saturated soil conditions also reduce the tortuosity of the diffusion path (Hillel, 1980). The diffusion path is created when the nutrient concentration at the root surface is lower than that found in areas extending away from the root. Tisdale et al. (1993) described diffusion as the major mechanism by which  $\text{NH}_4$  is transported to plant roots. In greenhouse studies using a Crowley silt loam soil, Teo et al. (1994) found that diffusion accounts for 86% of the  $\text{NH}_4$ -N taken up by rice plants. This is in contrast to root interception and mass flow, which supply minimal levels of  $\text{NH}_4$  to the root zone. Collectively, many of the soils in the southern U.S. rice growing region, represented by test soils in this experiment, have a wide range of clay contents that may greatly influence soil diffusion of  $\text{NH}_4$  and potential N supply to rice.

## Soil Diffusion Studies at Texas AgriLife Research

Using Texas rice soils (Table 1) that are representative of the southern U.S., one of the objectives of our research was to determine if

Table 1. Chemical and physical properties and N fractionation of five major Southern U.S. rice soils from 0 to 15 cm deep.

| Soil Type                 | Soil pH (1:1 $\text{H}_2\text{O}$ ) | Water Holding Capacity (%) | Soil Bulk Density ( $\text{g cm}^{-3}$ ) | $\text{NO}_3$ (lb/acre N) | Exchangeable $\text{NH}_4$ (lb/acre N) | Non-exchangeable $\text{NH}_4$ (lb/acre N) | Organic N (lb/acre N) | Total N (lb/acre N) |
|---------------------------|-------------------------------------|----------------------------|--|---------------------------|--|--|-----------------------|---------------------|
| Katy <sup>a</sup>         | 5.7                                 | 33                         | 1.52                                     | 18                        | 5                                      | 31   | 1,223                 | 1,227               |
| Nada <sup>b</sup>         | 5.0                                 | 33                         | 1.56                                     | 22                        | 21                                     | 26   | 911                   | 982                 |
| Edna <sup>c</sup>         | 6.5                                 | 37                         | 1.49                                     | 6                         | 5                                      | 74   | 1,197                 | 1,286               |
| Lake Charles <sup>d</sup> | 7.8                                 | 51                         | 0.91                                     | 34                        | 10                                     | 248  | 1,938                 | 2,233               |
| League <sup>e</sup>       | 5.8                                 | 60                         | 0.97                                     | 39                        | 9                                      | 260  | 2,366                 | 2,977               |

<sup>a</sup> Fine sandy loam, kaolinitic thermic, Albaquic Paleudalf.

<sup>b</sup> Fine sandy loam, siliceous, thermic, Albaquic Hapludalf.

<sup>c</sup> Fine silt loam, smectitic, thermic, Aquertic Hapludalf.

<sup>d</sup> Fine, montmorillonitic Typic Pelludert.

<sup>e</sup> Clay, smectitic hyperthermic, Oxyaquic Dystrudert.

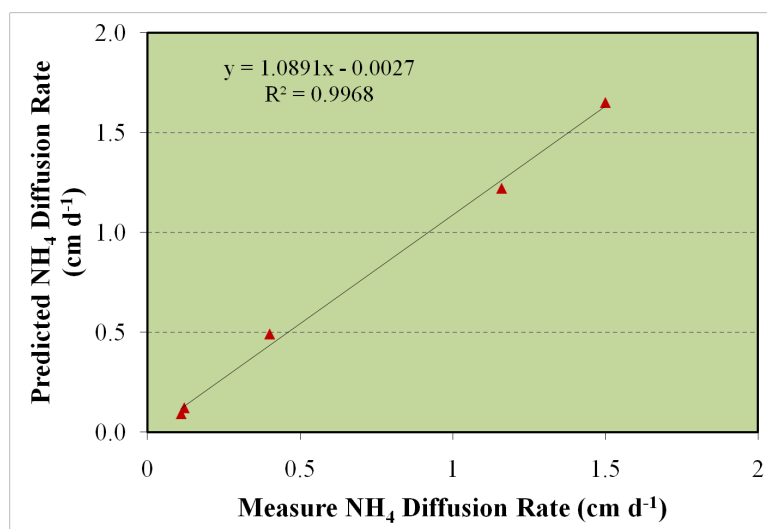


Fig. 4: Relationship between predicted soil  $\text{NH}_4$  diffusion rates based on % clay vs. measured soil  $\text{NH}_4$  diffusion rate ( $\pm 1$  s.d.) in five Southern U.S. rice soils. (Results from this study).

diffusion of soil  $\text{NH}_4$  explains why many sandy soils have higher N supplying capacity than clay soils. A laboratory procedure using transient state methods measured the linear movement of soil  $\text{NH}_4$  in tubes packed with five field soils under aerobic conditions. Ammonium diffusion was measured by sectioning the tubes after 48 h of equilibration, then measuring  $\text{NH}_4$  by steam distillation. Effective diffusion coefficients

Continued on the next page

# Nitrogen Diffusion ...

Table 2. Clay content, NH<sub>4</sub> diffusion coefficient (D<sub>e</sub>), and daily NH<sub>4</sub> diffusion distance of five major Southern U.S. rice soils.

| Soil Series          | Clay Content (%) | Effective NH <sub>4</sub> Diff. Coeff. (D <sub>e</sub> ) (cm <sup>2</sup> s <sup>-1</sup> ) | Daily NH <sub>4</sub> Diffusion Distance (cm d <sup>-1</sup> ) |
|----------------------|------------------|---|--|
| Katy fine sandy loam | 5.7              | 4.6 x 10 <sup>-5</sup>  | 1.50   |
| Nada fine sandy loam | 7.6              | 2.6 x 10 <sup>-5</sup>  | 1.16   |
| Edna silt loam       | 17.0             | 3.6 x 10 <sup>-6</sup>  | 0.40   |
| Lake Charles clay    | 46.5             | 3.6 x 10 <sup>-7</sup>  | 0.12   |
| League clay          | 53.9             | 2.9 x 10 <sup>-7</sup>  | 0.11   |

(D<sub>e</sub>) and NH<sub>4</sub> diffusion distance (d) per day ranged from D<sub>e</sub> = 7.1 x 10<sup>-6</sup> in<sup>2</sup>/day and d = 0.6 in/day for Katy sandy loam to D<sub>e</sub> = 4.5 x 10<sup>-8</sup> in<sup>2</sup>/day and d = 0.04 in/day for League clay (Table 2). Ammonium diffusion distance was strongly related to soil clay content, which is predicted by  $d = Y \times ([100/\% \text{ clay}] - 1)$ , where Y is set to 0.1. Predicted d and measured d were highly related (R<sup>2</sup> = 0.99) (Fig. 4), indicating that the proposed prediction equation can correctly predict the diffusion coefficient. In many areas of the Southern U.S. rice-growing region, the clay content of the soil can be used to predict soil NH<sub>4</sub> diffusion distance, and thus potentially soil N availability. This method can assist in determining fertilizer N requirements for rice grown in these areas.

For more information, please consult the following references:

Barber, S.A. 1984. Soil Nutrient Bioavailability: A mechanistic approach. p. 114-134. Wiley-Interscience, NY.

Cassman, K.G., S. Peng, D.C. Olk, J.K. Ladha, W. Reichardt, A. Dobermann, and U. Singh. 1998. Opportunities for increased nitrogen-use efficiency from improved resource management in irrigated rice systems. *Field Crop Res.* 56: 7-

39.

Champagne, E.T., D.F. Wood, B.O. Juliano, and D.B. Bechtel. 2004. The rice grain and its gross composition. p. 77-107. *Rice Chemistry and Technology*, 3rd Edn. American Association of Cereal Chemists, Inc., St. Paul, MN.

Chen, C.C., F.T. Turner, and J.B. Dixon. 1989. Ammonium fixation by high-charge smectite in selected Texas Gulf Coast soils. *Soil Sci. Soc. Am. J.* 53: 1035-1040.

Dolmat, M.T., W.H. Patrick, and F.J. Peterson. 1980. Relation of available soil nitrogen to rice yield. *Soil Sc.* 129: 229-237.

Hillel, D. 1980. *Fundamentals of soil physics*. p. 233-261. Academic Press, NY.

Kemper, W.D. 1986. Solute diffusivity. p. 1007-1024. *Methods of soil analysis: Part 1—physical and mineralogical methods*, 2nd Edn. Soil Science Society of America, Madison, WI.

Norman, R.J., B.R. Wells, R.S. Helms, C.E. Wilson, N.A. Slaton, and C.A. Beyroudy. 1994. Influence of split applying the pre-flood nitrogen fertilizer on rice growth and accumulation and partitioning of nitrogen by the rice plant. *In* B.R. Wells (ed.), *Arkansas Rice Research Studies*, 1993. Univ. Ark. Agricultural Experimental Station Research Series. 439: 138-145.

Raun, W.R., and G.V. Johnson. 1999. Improving nitrogen use efficiency for cereal production. *Agron. J.* 91: 357-363.

USDA-RES. 2010. <http://www.ers.usda.gov/Data/CostsAndReturns/testpick.htm>.

Teo, Y.H., C.A. Beyroudy, R.J. Norman, and E.E. Gbur. 1994. Nutrient supplying capacity of a paddy rice soil. *J. Plant Nutr.* 17: 1983-2000.

Tisdale, S.L., W.L. Nelson, J.D. Beaton, and J.L. Havlin. 1993. *Soil fertility and fertilizers*. Macmillan, NY. 694 p.

Walker, T.W., W.L. Kingery, J.E. Street, M.S. Cox, J.L. Oldham, P.D. Gerard, and F.X. Han. 2003. Rice yield and soil chemical properties as affected

Continued on the next page

# Nitrogen Diffusion ...

by precision land leveling in alluvial soils. Agron. J. 95: 1483-1488.

Wilson, C.E., B.R. Wells, and R.J. Norman. 1994. Fertilizer nitrogen uptake by rice from urea-ammonium nitrate solution vs. granular urea. Soil Sci. Soc. Am. J. 58: 1825-1828. \*

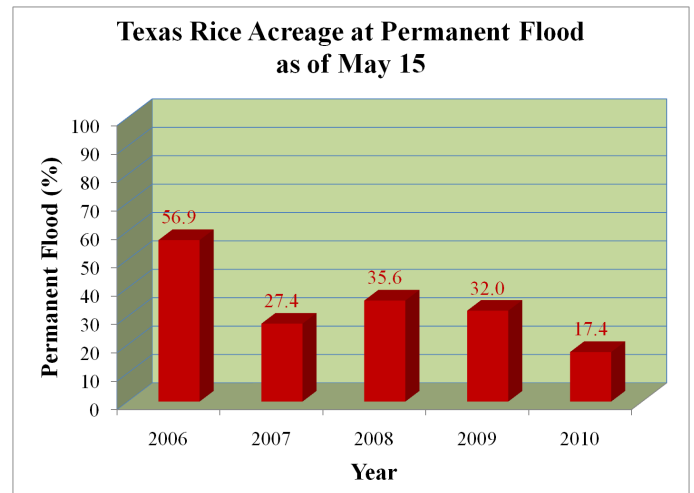
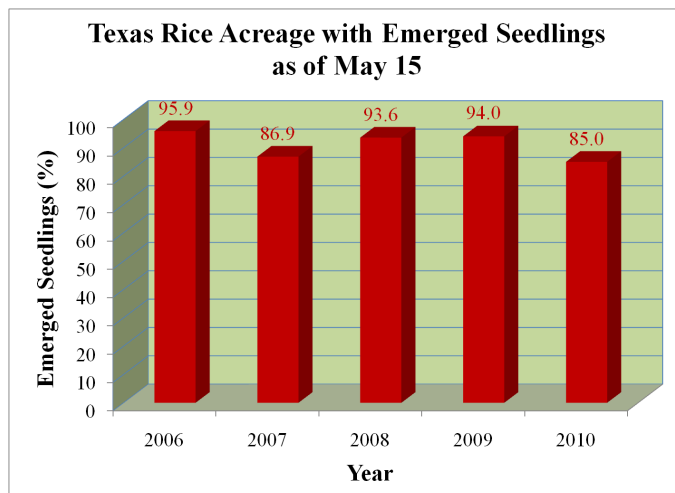
\* Article by Lee Tarpley, Calvin L. Trostle, Fred Turner, and Fugen Dou. Lee Tarpley and Fugen Dou ([f-dou@aesrg.tamu.edu](mailto:f-dou@aesrg.tamu.edu)) work at the Texas AgriLife Research and Extension Center, while Fred Turner previously worked there. Calvin Trostle works with the Texas AgriLife Research and Extension Center at Lubbock, TX.

## Rice Crop Update

As of May 15, 2010, the main crop rice acreage in Texas having emerged seedlings was 85.0%. In comparison, 95.9, 86.9, 93.6, and 94.0% had emerged seedlings by May 15 in 2006, 2007, 2008, and 2009, respectively. About 17.4% of the main crop rice acreage in Texas was at permanent flood by May 15, 2010. In comparison, 56.9, 27.4, 35.6, and 32.0% had emerged seedlings by May 15 in 2006, 2007, 2008,

and 2009, respectively. The figures below show the comparison in rice acreage percentage that had emerged seedlings and were at permanent flood by May 15 in 2006 to 2010.

Weekly updates on the acreage and percentage of rice grown in Texas that are in the various growth stages are available at our website at <http://beaumont.tamu.edu/CropSurvey/CropSurveyReport.aspx>.



Professor and Center Director: L.T. (Ted) Wilson  
[lt-wilson@aesrg.tamu.edu](mailto:lt-wilson@aesrg.tamu.edu)  
Technical Editor: S.O.P.B. Samonte  
[sosamonte@aesrg.tamu.edu](mailto:sosamonte@aesrg.tamu.edu)  
Texas A&M University System  
AgriLife Research and Extension Center  
1509 Aggie Drive, Beaumont, TX 77713  
(409)752-2741  
Access back issues of Texas Rice at  
<http://beaumont.tamu.edu>

Texas Rice is published 9 times a year by The Texas A&M University System AgriLife Research and Extension Center at Beaumont. Writing, layout, and editing by Lloyd T. Wilson and S. Omar P.B. Samonte; with additional support by James C. Medley and Brandy Morace. Information is taken from sources believed to be reliable, but we cannot guarantee accuracy or completeness. Suggestions, story ideas and comments are encouraged.

Texas A&M University System  
AgriLife Research and Extension Center  
1509 Aggie Dr.  
Beaumont, TX 77713



NONPROFIT  
ORG.  
U.S. POSTAGE  
PAID  
BEAUMONT, TX  
PERMIT NO. 367