Prescription of nitrogen topdressing rate at panicle initiation stage based on fresh weight and SPAD value

Hung T. Nguyen[1], Thanh D Nguyen[2], Lan T Nguyen[2], Anh T. Nguyen[2] and Byun-Woo Lee[1]

[1]*Department of Plant Science, Seoul National University, Korea, Seoul 151-742*

[2]*Faculty of Agronomy, Thai Nguyen University, Thai Nguyen City, Vietnam*

Introduction

Crop growth and N status at panicle initiation stage (PIS) were highly related to crop growth rate after the stage and, therefore, to yield and yield components, and grain quality. Different crop growth and N status indicators have been applied to yield and protein prediction, N topdressing prescription (Kim, 2004, Nguyen, 2005), of which shoot N uptake (Nup) was most frequently used. Characterization of Nup was laborious and time consuming. Although prediction of Nup by canopy reflectance was reported as reliable, fast and nondestructive (Nguyen and Lee, 2004), it is still beyond farmers' perspectives. Therefore, our study intended to prescript N topdressing based on shoot fresh weight (PFW) and SPAD value (PSpad) measured by chlorophyll meters (SPAD-502, Minota Co. LTD, Japan)

Materials and Methods

Two experiments, one in 2003 and one in 2004 were conducted in Experimental Station, Seoul National University, Suwon, Korea with variable N rates applied at tillering (Ntill) and PIS (Npi). Shoot FW (g m^{-2}) and PSpad at PIS and grain yield (g m^{-2}) and milled rice protein content (%) were recorded for formulation of N topdressing rates at PIS of rice Stepwise multiple regression was applied to predict yield and protein using PFW, PSpad and N rate (Npi) applied at PIS (linear and quadratic). Based on predicted equations and target yield and protein content, we may estimate required N rates at PIS.

Results and Discussion

Yield and protein content were significantly correlated with PFW and Npi (Table 1). However, PSpad was significantly correlated with grain yield but protein content. Although PSpad did not show correlation with protein content but it stayed in stepwise linear regression model to predict grain yield and protein content (Eq 1-2) as follows

Yield = 59.03 + 54.5Npi - 4.85Npi^2 + 0.338PFW – 7 75x10^{-5}1PFW^2 + 6.24PSPAD (*n = 66 and* R^2 *= 0 85*)

Protein = 6 47 + 0 112Npi + 0.0115Npi^2 - 0.00133PFW + 3 09 x $10^{-7}PFW^2$ + 0.035PSPAD (*n = 66 and* R^2 *= 0 87*)

Based on Eq 1 we may see that maximum yield may be obtained at Npi = 5.62 g m^{-2}, PFW = 2180 g m^{-2}, and PSpad as high as possible. However, protein content will increase with an increase of Npi and SPAD but obtained minimum protein content is at PFW = 2151 g m^{-2} which was quite similar to optimum PFW for maximum yield (2180). Therefore other agronomic measures before PIS for 2151 g fresh weight m^{-2} is recommended for rice production. For example, if PFW = 2151 g m^{-2} and PSpad value range of 30-40, we should apply 5.3 to 3.7 g N m^{-2} to obtain target protein content of 7.0% (Eq.2). Substitution of these values into Eq. 1 we will get rice grain yield of 7.76 to 8.12 ton ha^{-1}. The use of Eq.1-2, we may estimate Npi at any given values of PFW and PSpad

---

Corresponding author *Byun-Woo Lee* *Email leebw@snu.ac.kr* *Tel 02-880-4544*

Acknowledgement

Financial support from Agricultural Research Promotion Center (ARPC), Ministry of Agriculture and Forestry, Korea, Korean National Institute for International Education Development (NIIED), and Miss Thuong Huyen's fieldwork assistance are highly appreciated

Key references

Kim M H 2004. PhD thesis, Seoul National University, Korea.

Nguyen T. A. 2005. PhD thesis, Seoul National University, Korea.

Nguyen T. H and Lee B. W 2004. Korean J Crop Sci. 49(5): 394-406.

Table 1. Means and correlation among crop parameters

Crop variable	Unit	Mean	CV[$] (%)	Correlation coefficient			
				Yield	Protein	PFW	PSpad
Yield	g m^{-2}	645 0	15.6	1			
Protein	%	6.8	8.5	0.11^{NS}	1		
PFW	g m^{-2}	1591	39.8	0 52***	-0 54***	1	
PSpad		32 6	6.4	0 40***	-0 19^{NS}	0.57***	1
Npi	g m^{-2}	2 45	50 0	0 49***	0 82***	-0.24*	-0.10^{NS}

[$] *CV Coefficient of variation, Hnup N uptake at harvest, Protein. milled rice protein content, PFW shoot fresh weight at PIS, PSpad SPAD value at PIS, Npi N applied at PIS*

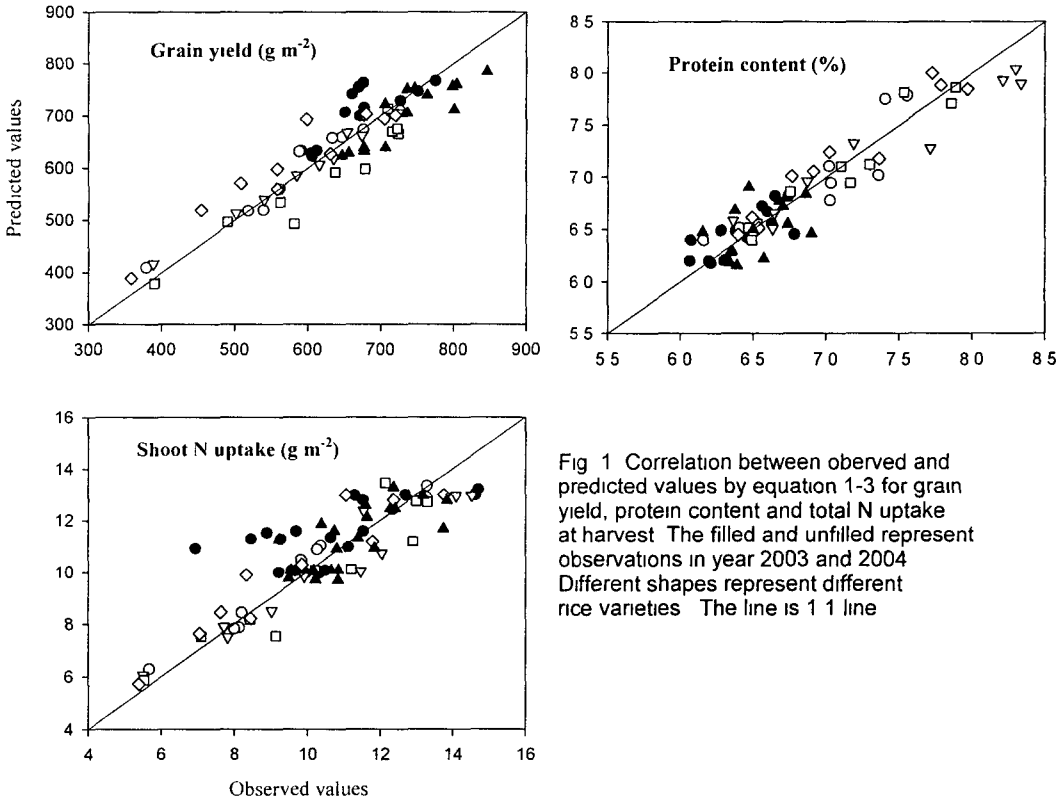

Fig 1 Correlation between oberved and predicted values by equation 1-3 for grain yield, protein content and total N uptake at harvest The filled and unfilled represent observations in year 2003 and 2004 Different shapes represent different rice varieties The line is 1 1 line