

# Site-Specific Nutrient Management (SSNM): An Approach for Optimizing Nutrient Use in Rice Production

Site-specific nutrient management (SSNM) is a low-technology, plant-based approach for managing the nutrient requirements of rice. It provides principles and tools for supplying rice with nutrients as and when needed to achieve high yields while optimizing use of nutrients from indigenous sources ([www.irri.org/irrc/ssnm](http://www.irri.org/irrc/ssnm)).

## 1. SSNM in three steps

### Step 1 Establish a grain yield target.

- Select a yield target attainable in a typical season (climate) with farmers' crop management when NPK constraints are overcome.
- It reflects the total amount of nutrients that must be taken up by the crop until maturity.
- It is location- and season-specific (depending on climate, cultivar, and crop management).

### Step 2 Effectively use existing nutrients.

- Estimate the supply of existing (indigenous) nutrients from sources other than fertilizer.
- Use nutrient omission plots, fertilizer use history, soil type, and residue and crop management to estimate indigenous nutrient supply.
- Define indigenous nutrient supply based on nutrient-limited yields:
  - N-limited yield: no added N, with ample added PK
  - P-limited yield: no added P, with ample added NK
  - K-limited yield: no added K, with ample added NP
- Calibrate soil tests for P and K against the omission plot technique, considering the need to maintain soil fertility.

### Step 3 Apply fertilizer to fill the deficit between crop needs and indigenous supply.

- Distribute the required fertilizer N in several applications during the growing season to best feed the crop need for supplemental N.
- Apply sufficient P and K to overcome deficiencies and maintain soil fertility.

## 2. Optimizing N use efficiency

- Estimate the total fertilizer N required for rice in a typical season.
  - It is based on the expected yield response to N (yield target minus N-limited yield) and efficiency of fertilizer N use ( $AE_N$ ).
  - Estimate the current  $AE_N$  achieved by farmers and select a slightly higher  $AE_N$  for the new and improved N recommendation.

Agronomic efficiency (kg grain increase/kg N applied) →	15	18	20	25
Yield response (t ha <sup>-1</sup> ) ↓	Fertilizer N rate (kg ha <sup>-1</sup> )			
1	65	55	50	40
2	130	110	100	80
3	195	165	150	120
4		220	200	160
5			250	200

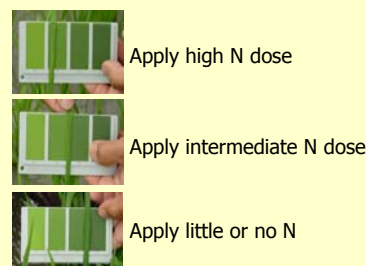
### Reference

Witt C, Buresh RJ, Peng S, Balasubramanian V, Dobermann A. 2007. Nutrient management, pp 1-45. In Fairhurst TH, Witt C, Buresh R, Dobermann A (eds.) Rice: A practical guide to nutrient management. Los Baños (Philippines) and Singapore: International Rice Research Institute (IRRI), International Plant Nutrition Institute (IPNI), and International Potash Institute (IPI).

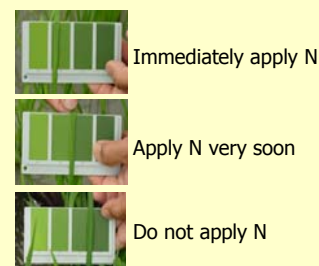
- Distribute fertilizer N to best match the crop need for N.

- Apply only a moderate amount of fertilizer N to young rice.
- Use the leaf color chart (LCC) to either (a) adjust the dose of fertilizer N applied at predetermined key growth stages or (b) apply fertilizer N whenever the leaf color is less green than a critical level (Witt et al. 2007).

### (a) Fixed-time N management



### (b) Real-time N management



## 3. Optimizing fertilizer P use

- Estimate the requirement for fertilizer P based on yield target and P-limited yield as shown in the table below (Witt et al., 2007).
- Apply all fertilizer P to young rice within 14 d after transplanting (DAT) or 21 d after sowing (DAS).

Yield target (t ha <sup>-1</sup> ) →	4	5	6	7	8
P-limited yield (t ha <sup>-1</sup> ) ↓	Fertilizer P <sub>2</sub> O <sub>5</sub> (kg ha <sup>-1</sup> )				
3	20	40	60		
4	15	25	40	60	
5	0	20	30	40	60
6	0	0	25	35	45
7	0	0	0	30	40
8	0	0	0	0	35

## 4. Optimizing fertilizer K use

- Estimate the requirement for fertilizer K based on yield target and K-limited yield as shown for medium straw input in the table below (Witt et al., 2007).
- Typically apply fertilizer K twice with about 50% before 14 DAT or 21 DAS and 50% at early panicle initiation.

Yield target (t ha <sup>-1</sup> ) →	4	5	6	7	8
K-limited yield (t ha <sup>-1</sup> ) ↓	Fertilizer K <sub>2</sub> O (kg ha <sup>-1</sup> )				
3	30	60	90		
4	0	35	65	95	
5	0	20	50	80	110
6	0	0	35	65	95
7	0	0	0	50	80
8	0	0	0	0	65

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