INCREASING MAIZE FARMING PROFITABILITY IN THE PHILIPPINES THROUGH THE USE OF NUTRIENT EXPERT® for MAIZE

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Fertilizer application comprises the largest component of farmers’ overall cost of production

But farmers often do not achieve the full benefit or profit from the fertilizers they apply

✓ Too little or too much fertilizer application
✓ Fertilizer nutrients are not applied in the growth stages that they are needed by the crop
✓ Unbalanced application of N, P and K

→ Need for science-based fertilizer application
Development of Science-Based Fertilizer Recommendation with 4R and SSNM
Applying the right source of plant nutrients at the right rate, at the right time and in the right place

1. Diagnose nutrient deficiencies
2. Supply in plant available forms
3. Suit soil properties
4. Recognize synergisms among elements
5. Blend compatibility

1. Appropriately assess soil nutrient supply
2. Assess all available indigenous nutrient sources
3. Assess plant demand
4. Predict fertilizer use efficiency

1. Assess timing of crop uptake
2. Assess dynamics of soil nutrient supply
3. Recognize timing of weather factors
4. Evaluate logistics of operations

1. Recognize root-soil dynamics
2. Manage spatial variability
3. Fit needs of tillage system
4. Limit potential off-field transport
Site-specific nutrient management (SSNM)  

A set of nutrient management principles, which aims to supply a crop’s nutrient requirements tailored to a specific field or growing environment.  

It aims to:  

- account for indigenous nutrient sources, and  
- apply fertilizer at optimal rates and at critical growth stages – to meet the deficit between the nutrient needs of a high-yielding crop and the indigenous nutrient supply.
A decision support tool for developing science-based fertilizer recommendations
- It uses the principles of 4R and SSNM
- Intended for extension staff or crop advisers
- Does not require a lot of data or detailed information. Information can be easily provided by target users
What information does Nutrient Expert Maize provide?

- Field-specific fertilizer recommendation
  - variety type (hybrid, OPV, traditional)
  - site characteristics (soil, climate, water availability)
  - crop management practices (cropping system, residue management, fertilizer inputs)
  - Integration of organics
- Options for risk management (drought situations)
- Options based on farmer’s budget and expected benefits → cost-profit scenarios
Sample NE Maize recommendation to be given to farmers

Tailored to field-specific conditions
- Variety type
- Site characteristics
- Farmer’s crop management practices

Nutrient Expert® for Hybrid Maize

- Name and/or location: Isabela
- Field size: 1 ha
- Current yield: 5.0 ton (FW) 4.9 t/ha (15.5% MC)
- Growing environment: Favorable rainfall

Recommended alternative practice for hybrid maize
- Yield goal: 7.2 ton (FW) 7.0 t/ha (15.5% MC)
- Planting density: 69,444 plants/ha
- Distance between rows: 60 cm
- Distance between plants: 24 cm

Integration of organics
- Right time
- Right source
- Right rate

Micronutrients

<table>
<thead>
<tr>
<th>Growth stage</th>
<th>Days after planting</th>
<th>Soil moisture</th>
<th>Fertilizer sources</th>
<th>Weight of full bag (kg)</th>
<th>Amount (bags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal</td>
<td>0</td>
<td>sufficient</td>
<td>14-14-14 MOP</td>
<td>50</td>
<td>3.5</td>
</tr>
<tr>
<td>V6</td>
<td>25</td>
<td>sufficient</td>
<td>Urea</td>
<td>50</td>
<td>0.5</td>
</tr>
<tr>
<td>V10</td>
<td>35</td>
<td>sufficient</td>
<td>Urea</td>
<td>50</td>
<td>1</td>
</tr>
</tbody>
</table>

Other sources of nutrients:
- Crop residue (maize): low
- Organic fertilizer: 1 t
  - N: 10 kg
  - P₂O₅: 10 kg
  - K₂O: 6 kg

Deficient Nutrient | Recommendation to correct deficiency
-------------------|--------------------------------------------------
Zinc               | Apply 25-30 kg/ha zinc sulfite as basal.
Development of Nutrient Expert® for Maize Philippines
Field Performance of Nutrient Expert® for Maize Philippines
Nutrient Expert (NE) increased hybrid maize yield and profit through balance application of N, P and K in Region 1, Philippines (2011-13)

<table>
<thead>
<tr>
<th></th>
<th>2011−2012 (n = 76)</th>
<th>2012−2013 (n = 83)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FFP</td>
<td>NE</td>
</tr>
<tr>
<td>Grain yield (t/ha)</td>
<td>9.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Fertilizer N (kg/ha)</td>
<td>173</td>
<td>173</td>
</tr>
<tr>
<td>Fertilizer P₂O₅ (kg/ha)</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>Fertilizer K₂O (kg/ha)</td>
<td>27</td>
<td>48</td>
</tr>
<tr>
<td>Seed &amp; fertilizer cost (Php/ha)</td>
<td>18,618</td>
<td>19,998</td>
</tr>
<tr>
<td>GRFa (Php/ha)</td>
<td>87,262</td>
<td>97,650</td>
</tr>
</tbody>
</table>

***, **, *: significant at <0.001, 0.01, and 0.05 level; ns = not significant

aGRF = gross return above seed and fertilizer costs
Plot size = 0.1 to 1 ha; >20 municipalities in 4 provinces

Data source: DA RFU-1, Philippines
NE Maize increased farmers’ yields and profits through balanced application of N, P, and K (2010-14)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Philippines¹ (n = 190)</th>
<th>NE</th>
<th>FFP</th>
<th>(NE – FFP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain yield</td>
<td>t/ha</td>
<td>9.4</td>
<td>8.3</td>
<td>+1.10</td>
<td>***</td>
</tr>
<tr>
<td>Fertilizer N</td>
<td>kg/ha</td>
<td>162</td>
<td>159</td>
<td>+3</td>
<td>ns</td>
</tr>
<tr>
<td>Fertilizer P₂O₅</td>
<td>kg/ha</td>
<td>48</td>
<td>30</td>
<td>+18</td>
<td>***</td>
</tr>
<tr>
<td>Fertilizer K₂O</td>
<td>kg/ha</td>
<td>43</td>
<td>25</td>
<td>+18</td>
<td>***</td>
</tr>
<tr>
<td>Fertilizer cost</td>
<td>PHP/ha</td>
<td>13775</td>
<td>12204</td>
<td>+1571</td>
<td>***</td>
</tr>
<tr>
<td>Gross profit</td>
<td>PHP/ha</td>
<td>98832</td>
<td>87348</td>
<td>+11484</td>
<td>***</td>
</tr>
</tbody>
</table>

¹NE field validation conducted by DA-RIARCS

*** significant at P<0.001; ns = not significant
Quick Guide for Maize for a municipality – output of the NE field validation trial

**General crop management recommendations:**
- Distance between rows: 60 cm
- Distance between plants: 22 cm
- Soil pH: maintain at 5.3 to 7.3 pH units

Fertilizer rates are adjusted to 1 hectare
- Target grain yield based on total dry weight
- 1 bag fertilizer = 50 kg

**Fertilizer guidelines for dry season hybrid maize in:**

### A. Higher yield with rice-corn cropping system

**Target grain yield:** 10-11 t/ha

<table>
<thead>
<tr>
<th>Days after planting</th>
<th>0-7</th>
<th>20-26</th>
<th>26-32</th>
<th>32-38</th>
<th>50-55</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>With Bio-N application (6 packs/ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5 bags 14-14-14</td>
<td>3 bags urea</td>
<td>3 bags urea</td>
<td>3 bags urea</td>
<td>4.5 bags urea</td>
<td>2 bags urea</td>
</tr>
<tr>
<td>0.5 bags MOP</td>
<td>2 bags urea</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
</tr>
</tbody>
</table>

### B. Typical yield with rice-corn cropping system

**Target grain yield:** 8-9 t/ha

<table>
<thead>
<tr>
<th>Days after planting</th>
<th>0-7</th>
<th>20-26</th>
<th>26-32</th>
<th>32-38</th>
<th>50-55</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without Bio-N application</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 bags 14-14-14</td>
<td>2.5 bags urea</td>
<td>2.5 bags urea</td>
<td>2.5 bags urea</td>
<td>1 bag urea</td>
<td></td>
</tr>
<tr>
<td>0.5 bags MOP</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
<td>0.5 to 1 bag urea</td>
<td></td>
</tr>
</tbody>
</table>

These fertilizer guidelines are applicable to dry season hybrid maize fields in Sto. Domingo, Ilocos Sur with:
- enough water supply (from rainfall or supplemental irrigation)
- medium soil fertility
- favorable soil pH*
- residue returned from the previous crop
- no application of organic fertilizer

*To correct the acidity of soils with pH less than 5.3, apply 400 kg lime per hectare for every 0.1 unit until soil pH reaches 5.3. For example, apply 1,200 kg lime per hectare in soils with pH 5.0. Lime should be broadcast and plowed under 3-4 weeks before planting.

Fertilizer sources in these recommendations are locally-available and meet the guidelines for optimal splitting of nutrients to provide the requirements of the maize crop at critical growth stages during the season.

For fields with other conditions or to use other locally-available fertilizer sources, use ‘Nutrient Expert for Hybrid Maize’ to develop a field-specific guideline. Consult IILRC, local DA office, and MAO in your municipality.
Current Status and Future Directions of Nutrient Expert® for Maize Philippines
A farmer can receive the Nutrient Expert recommendation through SMS (text message) in **English and Tagalog** at http://software.ipni.net
Nutrient Expert captures farmer data and can generate strategic information for decision makers and agri-business providers.

**Data**
- Yield
- Crop Management Practices
- Location
- Site Characteristics

**Strategic Information**
- Attainable yield
- Yield response to fertilizer N, P, and K
- N, P, and K rates to attain specific yield goals

**Decision makers**
Summary

✧ NE enables farm advisors to rapidly provide economically optimum 4R fertilizer recommendations.

✧ NE can help in increasing maize farming profitability in the Philippines

✧ NE can be used by decision makers to develop national agricultural strategies, or by agri-business providers to effectively develop markets in favor of maize production profitability
Acknowledgements: