

NUTRIENT EXPERT:

Creating Fertilizer Recommendations When Soil Testing is Not Available



Nutrient Expert® training to local cooperators.

In much of the world, farmers do not have access to soil testing for making fertilizer recommendations. This traditional approach requires soil sampling, chemical analysis in the lab, statistical correlation with field research, and data interpretation. These resources are not available on many smallholder farms due to constraints such as limited access to laboratories, the relatively high cost of analysis, and inadequate timeliness in multiple cropping systems.

Small and resource-poor farmers of the world have a great need for accurate agronomic information, just like larger-scale farmers. Indeed, their needs may even more urgent, given the tight economic conditions and poverty that many small farmers operate in.

Meeting the challenge of making science-based fertilizer recommendations for small and family farmers has been a major focus of IPNI over the past several decades. A major effort of the IPNI-China program over the past 30 years has been

the development and introduction of new approaches to managing nutrients for crop production. The development of the Nutrient Expert® software-based decision support tool addresses this critical information gap for farms of all size.

Nutrient Expert® provides guidelines on fertilizer management that are tailored to specific fields using nutrient sources that are locally available. The information required to use Nutrient Expert® is easily obtained even without access to soil test information. The data gathering starts by asking the farmer or local crop expert questions to determine their crop yield history and to estimate yield responses to fertilizer. If the results from soil testing are available, they are used to further refine the fertilizer recommendations. Finally, the software then integrates 4R Nutrient Stewardship principles (right source, right rate, right time, and right place) into each fertilizer recommendation.

An example of the advantages gained by making the change from farmer traditional practices or generalized regional



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The effect of using Nutrient Expert® nutrient recommendations on crop yield, profitability, and N recovery efficiency in three cereals grown in China based on multiple locations and years (compared with current farmer practices; FP).

Crop	Treatment	Grain yield, t/ha	Fertilizer rate, kg/ha			Gross profit, US\$/ha	Nitrogen recovery efficiency, %
			N	P ₂ O ₅	K ₂ O		
Maize	FP	9.9	230	62	49	2,972	18.3 b
	NE	10.3	158	52	68	3,114	29.1 a
Wheat	FP	7.9	279	119	49	2,377	17.3 b
	NE	8.2	165	84	74	2,580	29.9 a
Rice	FP	7.9	168	61	86	3,218	25.6 b
	NE	8.4	156	69	79	3,356	37.8 a

recommendations to Nutrient Expert®-based fertilizer recommendations is shown in the table above. Many wheat, maize, and rice farmers in China are adding excessive amounts of nitrogen (N) and phosphorus (P) fertilizer, an observation supported by the scientific literature. Potassium (K) generally remains underutilized and still limits grain production in many regions of China.

Our work has demonstrated that most Chinese small farmers can both increase crop yield and nutrient use efficiency from well-timed N fertilization, often reducing their P application, and greater K application. Nutrient Expert® generally recommends that N fertilizer to be split throughout the growing season to meet the crop’s N requirements during the critical growth stages, which significantly improves N recovery by the crop. The Nutrient Expert® software accounts for the indigenous soil nutrient supply and any residual nutrients from previous crops in order to avoid excessive nutrient accumulation. This shift to Nutrient Expert®-based recommendations consistently translates to better profits for farmers and reduced nutrient carryover at risk to loss in the environment.

Our successful demonstration of Nutrient Expert® in China is now being expanded to many additional

agronomic and horticultural crops to improve the livelihoods of hundreds of millions small farmers across Asia and Africa. The use of this relatively easy-to-use software is empowering this important group of farmers to make better decisions for crop nutrition and to implement 4R Nutrient Stewardship to accomplish economic, environmental, and social goals.

Nutrient Expert Availability

Crop-specific versions of Nutrient Expert® have been developed for maize, rice, soybean, and wheat in China. Local versions of Nutrient Expert® have also been developed for use in India, Africa, and other parts of Asia. The software and supporting information is available for free download at: <http://china-zh.ipni.net/topic/nutrient-expert>.

There are many scientific publications documenting the development and the success of Nutrient Expert. Two examples are included here.

- Zhang et al. 2017. *Agronomy Journal*, 109:1-9.
- Pampolino et al. 2012. *Computers and Electronics in Agriculture* 88: 103-110.