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STUDY ON SITE-SPECIFIC NUTRIENT MANAGEMENT (SSNM) FOR HIGH-YIELDING RICE IN THE MEKONG DELTA

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ABSTRACT

The study was conducted in two seasons (Dry and Wet season) at three soil series (alluvial, acid sulfate, and saline-acid sulfate soil) in the Mekong Delta. The results of study showed that: SSNM provided an increase in grain yield about 0.5 t/ha and gave higher benefit than FFP. Fertilizer rate as estimated by SSNM is almost met the requirement of crop, therefore it could save nutrients, especially nitrogen which was applied too high by farmers. SSNM is a simple technique that farmers can be easily applied.

FERTILIZER USING IN THE MEKONG DELTA: A REALITY

Total amounts of inorganic fertilizers consumption for rice crop in the Mekong Delta area are around 400,000 tones of nitrogen, 180,000 tones of phosphorus, and 120,000 tones of potassium yearly. Most of these are imported and only small quantity is produced in the country (Pham 2005). Fertilizer use efficiency is low due mainly to losses through volatilization, leaching, run off etc. The amount of fertilizer losses is around 1.2-1.3 M tons out of the total fertilizer application (2 M tons) (Nguyen 2002).

In fact, fertilizers consumption is varied depending on rice variety, soil condition and farmer practices. Although, there are specified fertilizer recommendations for each soil type but still practice as their ways.

Nitrogen fertilizer recommendation for specific rice regions are proposed for areas of Tien and Hau rivers, nitrogen fertilizer dose ranges from 100 to 120 kg N/ha in dry season and 80 to 100 kg N/ha in wet season.

In acid sulphate soils such as Long Xuyen quadrangle, West Hau river and Dong Thap Muoi, N-fertilizer recommendation is lower than the area of alluvium soils *i.e.* 80-100 kg N/ha in dry season and 60 to 80 kg N/ha in wet season. However a small area of the coastal region from Long An to Ca Mau, N-fertilizer recommendation is as low as 30-50 kg N/ha.

Actually, farmers in the Mekong Delta prefer to apply nitrogen fertilizer more than recommendation dose. In many cases, they applied nitrogen fertilizer higher in wet than in dry season because they perceive that nitrogen content is lower in wet season than dry season due to shortage of sediment. However, according to many researches, unfavorable weather conditions such as high temperature, low pH value or organic acid toxicity etc. are the main constraints for rice production in this season. Moreover, farmers do not pay much attention on phosphorus and potassium fertilizers resulting in unbalanced nutrient content for wet season crop.

Normally, farmers divide fertilizers in to 3 to 4 splits (even 6-7 times) to apply in a crop season. According to many recommendations, nitrogen fertilizer is suggested to apply by 3 times/crop depending upon the crop growth stages. With the longer crop duration (120 days), nitrogen fertilizer is applied at 10-15 day after sowing (DAS), 30-35 DAS and 65-70 DAS. Nowadays, with the short-duration rice genotypes (90-110 days) or the ultra-short genotypes (below 90 days), rates and timing for nitrogen application are also changed. So far, we do not have a suitable fertilizer recommendation for the ultra-short rice genotypes (<90 days). However, recent investigations suggested the time of nitrogen application for the ultra-short rice varieties as: 7-10 DAS, 18-22 DAS and 37-40 DAS (Pham 2005).

Studies on improvement of phosphorus and potassium fertilizers use efficiency have been caring out since 1985. Application of phosphorus at the rates of 40-80 kg P_2O_5/ha gave higher grain yield and economic efficiency. Lower rates of fertilizer application reduced grain yield and nitrogen use efficiency. Application of fertilizer beyond the optimal doses did not improve grain yield and reduced economic efficiency of phosphorus fertilizer (Pham and Nguyen 1995). The recommendation rates of phosphorus fertilizers range from 40 to 80 kg P_2O_5/ha depending upon soil type. The recommendation rates of phosphorus fertilizer for alluvium soil ranges from 40 to 60 kg P_2O_5/ha and from 60-80 kg/ha for acid sulphate soils. Normally, single super phosphate is applied as basal application while, di-ammonium phosphate (DAP) is applied as top dressing at 7-10 days after sowing (DAS). In the acid sulphate soil area, phosphorus fertilizer is recommended to apply one more time at 25 DAS. Normally, phosphorus fertilizer is applied more in wet season (WS) than dry season (DS) because content of available phosphorus in soils is lower in WS as compared to DS. Rice crop requires phosphorus at early growth stages, any shortage of phosphorus nutrition or late application may affect rice yield. In WS, phosphorus fertilizer is therefore recommended to be applied more quantity at early crop growth stages.

So far, potassium did not show significant effect on rice yield, farmers do not pay much attention on this fertilizer. However, for the last 10 years, especially after the high quality program (1M ha project) started, farmers in the Mekong Delta have changed their practice of potassium fertilizers. They have realized the role of potassium on rice quality and production. In some area, farmers apply potassium fertilizers higher than the recommendation dose because potasium balance between out put and in put is negative. This will cause an unsustainable development for a long-tern aspect. In that case, it will take much time to enrich potassium to soils. In contrast, application of potassium at 100 kg K_2O/ha give an increment in crop yield about 0.5 to 0.6 t/ha but economic effciency is negative. In contrast foliar application is a better way to supply potassium to rice crop in term of both production and economic. Application of potassium nitrate at the rate 2% before and after of flowering give an increment in crop yield about 8 to 10% while, benefit is acceptable (Tran and Pham 1997).

The blanket recommendations for fertilizer application has been suggesting by extension officers in the region. Yet, farmers do not follow this guideline they practice as their ways because they have different soil types and local environment characteristics. In many cases their practices do not meet the demand of crop for potassium. Survey data showed that the amounts of fertilizers applied are different in different area (Pham and Cassman 1997; Cao *et al.* 2005).

According to recent investigations, the blanket recommendations cannot improve fertilizer efficiency for different regions. It is therefore suggested that fertilizer application should be based on local conditions and field sites. A new concept, called site-specific nutrient management (SSNM) suggested by IRRI scientists, in which fertilizer application is based on time and quantity plant need. Base on this technique, rice yield and fertilizer efficiency can been improved significantly.

Imbalanced fertilizers application (NPK) can not meet plant need in different ecosystems. Exceeded nitrogen fertilizer application, especially in the spring-summer and summer-autumn season, created more severe diseases, lodging and resulting in low efficiency of nitrogen fertilizer application. According to Cassman *et al.* (1993), N-use efficiency under field condition is less than 40%.

There is a large variable in the sources and quantity of nitrogen fertilizer application depending on farmer field condition. The amount of nitrogen fertilizer application and supply from indigenous soils also depend on crop season (Pham 1997). The author also emphasized that amount of nitrogen fertilizer application and amount of nitrogen supply from indigenous soils should be fit to meet the crop demand (Pham *et al.* 1999). From another investigation, Pham *et al.* (2000) also concluded that adjusting amount of nitrogen application and indigenous nitrogen is a key factor to get higher yield of rice and sustainability. Fertilizer application with the help of leaf color chart not only increased crop yield up to

10% but, also saved 20-25 kg N/ha (Pham *et al.* 2000). To maintain the current rice production in the delta, farmers have to change their nutrient management practices for intensive rice system (Pham 2000). High nitrogen application in combination with high temperature and humidity increased the red yellow leaf disease severity (Cao and Luu 2000).

In the wet season, phosphorus fertilizer increased rice yield more clearly than other seasons (Nguyen and Pham 1986). Besides this, it also improved seed germination and head rice recovery (Nguyen 1998). The results of a long-term experiment (20 years) in the CLRRI showed that potassium fertilizers has not significantly affected rice production in both dry and wet seasons. According to Dilday (1988) and Hou (1988), time of nitrogen application and water drainage before harvesting influence head rice recovery percentage (HRR). Application of nitrogen fertilizer at two times (before sowing and 30 DAS) gave lower HRR% and 1000-grain weight than those of three times (before sowing, 30 and 60 DAS). However, the effects on gel-consistency are reversed.

THE NEW OPINIONS OF FERTILIZER MANAGEMENT FOR RICE CROP

Site specific nutrients managementbases on: first, crop yield without fertilizer application and target yield (attainable yield); second, farmer's fertilizer management skill. The plot without fertilizer called omission plot, nutrients supply to crop mainly come from soils. Amounts of nutrient highly vary from site to site and farmer practices. In the target plots, Mainly come from indigenous soil supply capacity and fertilizers. Total nutrients required to get the target yield is the same but nutrients come from indigenous soils are different. Thus, fertilizer recommendation should be based on the indigenous soil nutrients supply capacity. In addition, the new opinions of fertilizer management also base on the farmer practice. This means that with a skillful farmer can save fertilizer application and *vice-versa.* Thus, fertilizer recommendation will be more usefull and can improve crop yield and hence profit to farmers.

To adopt this technique, the most important factor to be considered is to set up standard for different micro-ecosystems including soil type, cropping system, water management, disease, pest and micro-climate. They must be in similar conditions. Thus, fertilizer recommendation should base on local conditions, variety and crop season.

The next step is to determine target yield. This is very important work because it will decide the amounts of fertilizer application. Target yield is put about 0.5 t/ha higher than actual yield for the last few crop seasons.

For example: If actual yield is 7.0 t/ha then the target yield will be 7.5 t/ha. Based on the target yield we can estimate quantity of nitrogen, phosphorus and potassium to meet the plant need. Normally, 1 ton of rice has about 15 kg N, 6 kg P_2O_5 and 18 kg K_2O. In order to get a target yield of 7.5 t/ha rice plants must be sullied with 116 kg N, 45 kg P_2O_5 and 135 kg K_2O. The major sources of nitrogen to rice crop are fertilizers and soils, also a small amount come from irrigation water, rain and microorganism. To calculate the amounts of nutrient plant need we base on the following equation:

$$FR = \frac{Nu - (Nss + Nso)}{RE}$$

While, FR: amounts of fertilizer needed

Nu: amounts of nutrient needed to get target yield

Nss: amounts of indigenous nutrient soils

Nso: amounts of nutrient come from other sources

RE: fertilizer recovery

The major steps involved in the calculation of fertilizers (N, P, K) for HYVs (OM1490) grown in the alluvium soils (O Mon District. Can Tho City) are given below:

Step 1: Estimating target yield

If the actual yield of OM1490 on alluvial soils (O Mon, Can Tho) is 6.5 t/ha (DS) and 4 t/ha (WS), then the target yield will be 7 t/ha (DS) and 4.5 (WS).

Step 2: Estimating nutrient requirements to get the target yield

- If the target yield in dry season is 7 t/ha, then nutrient demand will be: 105 kg N, 42 kg P_2O_5 and 126 kg K_2O/ha.
- If the target yield in wet season is 4 t/ha, then nutrients demand will be: 68 kg N, 27 kg P_2O_5 and 81 kg K_2O/ha.

Step 3: Estimating indigenous nutrient supply from soils

Indigenous nutrient defined as nutrients that crop uptake and accumulate to produce grain yield in the plots without fertilizer application. To determine indigenous nitrogen supply from soil we have to use the called omission plots, in which no any more nitrogen fertilizer is added to the plots. The contribution of nitrogen to produce grain yield in this plot is called indigenous nitrogen (means from soils and other sources).

The grain yield in the omission plots (-N) ranges from 3.5-4.5 t/ha (DS) and 2.0-2.5 t/ha (WS). The grain yield in the omission plots (-P) ranges from 5.0-5.5 t/ha (DS) and 2.5-3.0 t/ha (WS). The grain yield in the omission plots (-K) ranges from 5.5-6.0 t/ha (DS) and 3.5-4.0 t/ha (WS). Based on these data, we can estimate amounts of nitrogen, phosphorus and potassium supply from soils in wet and dry seasons as followed:

For dry season:

- If grain yield in omission plots for nitrogen is 4.0 t/ha, then the amount of nitrogen supply from soils will be 60 kg N/ha.
- If grain yield in omission plots for phosphorus is 5.3 t/ha, then the amounts of phosphorus supply from soils will be 32 kg P_2O_5/ha.
- If grain yield in omission plots for potassium is 5.8 t/ha, then the amounts of potassium supply from soils will be 104 kg K_2O/ha.

For wet season:

- If grain yield in omission plots for nitrogen is 2.3 t/ha, then the amount of nitrogen supply from soils will be 35 kg N/ha.
- If grain yield in omission plots for phosphorus is 2.8 t/ha, then the amounts of phosphorus supply from soils will be 17 kg P_2O_5/ha.
- If grain yield in omission plots for potassium is 3.8 t/ha, then the amounts of potassium supply from soils will be 68 kg K_2O/ha.

Step 4: Calculating fertilizer requirements

a. Nutrient requirement: defined as the amounts of nutrients needed by a crop for producing the target yield minus the amounts of indigenous nutrient (soils and other sources).

b. Fertilizer recovery (%): defined as the percentages of nutrients absorbed by a crop out of the total amounts of fertilizers applied.

Suppose the amounts of nutrients come from other sources are small, then the nutrient requirements for the OM1490 rice variety in the alluvium soils (O Mon Dist.) will be:

For dry season:

Nitrogen requirements: 105 – 60 = 45 kg N/ha.
Phosphorus requirements: 42 – 32 = 10 kg P_2O_5/ha.

Potassium requirements: 126 – 104 = 22 kg K_2O/ha.
Fertilizer recovery % for nitrogen in DS about 45-50%, 25-30% for phosphorus and 40-50% for potassium. Thus, the amounts of fertilizers required to apply in the DS are:
The amounts of nitrogen required: 45:50x100 = 90 (kg N/ha)
45:45x100 = 100 (kg N/ha)
The amounts of phosphorus required: 10:30x100 = 100 (kg P_2O_5/ha)
10:25x100 = 40 (kg P_2O_5/ha)
The amounts of potassium required: 22:50x100 = 44 (kg K_2O/ha)
22:40x100 = 55 (kg K_2O/ha)

For wet season:

Nitrogen requirements: 68 – 35 = 33 kg N/ha.
Phosphorus requirements: 27 – 17 = 10 kg P_2O_5/ha.
Potassium requirements: 81 – 68 = 13 kg K_2O/ha.
Fertilizer recovery % for nitrogen in the DS about 45-50%, 25-30% for phosphorus and 40-50% for potassium. Thus, the amounts of fertilizers required to apply in the WS are:

The amounts of nitrogen required: 33:50x100 = 73 (kg N/ha)
33:40x100 = 83 (kg N/ha)
The amounts of phosphorus required: 10:25x100 = 40 (kg P_2O_5/ha)
10:20x100 = 50 (kg P_2O_5/ha)
The amounts of potassium required: 13:50x100 = 26 (kg K_2O/ha)
13:40x100 = 33 (kg K_2O/ha)

Therefore, fertilizer recommendation for the OM1490 or other varieties same as OM1490 grown in the alluvium soil at Omon Dist., Cantho Prov will be:
- In dry season: 90-100 kg N/ha, 33-40 kg P_2O_5/ha and 44-55 kg K_2O/ha.
- In wet season: 73-83 kg N/ha, 40-50 kg P_2O_5/ha and 26-33 kg K_2O/ha.

In fact, farmers apply fertilizers higher than this recommendation dose because they do not follow guidelines or their practices are poor resulting in a low fertilizer recovery %. They prefer to apply more fertilizers, in some cases they get a higher yield but the economic efficiency is low.

Following this technique we can calculate the amounts of fertilizers required by a variety or a group of variety basing on the local soil conditions. However, the amounts of fertilizers can also be adjusted with the help of the chlorophyll parameter (Peng *et al.* 1996; Huan *et al.* 1998 and Balasubramaniam *et al.* 2000). A more simple tool called leaf colour chart (LCC). A LCC is consisted of 4 or 6 color panels ranging from greenish to yellowish colour similarly to the colour of the rice leaf in the cases of a deficit or exceeded nitrogen symptom (Fig.1&2).

The results of field experiment at IRRI indicated a close relationship between the rice leaf colour and nitrogen content, According to several studies at IRRI and CLRRI, if the colour of rice leaf is similar to the colour of panel No. 5 or 6 then the nitrogen in the rice leaf is exceeded while, colour in the panel No. 3 indicates a slight deficit symptom of nitrogen and panel No. 1 & 2 indicate a severity deficit symptom of nitrogen.

We can adjust the amounts of nitrogen based on colour of the rice leaf at different crop growth stages i.e. the mid-tillering, panicle initiation and flowering stage. We should apply nitrogen fertilizer in a way that it can maintain the leaf colour similarly to panel No.4 so that rice crop can produce a higher grain yield.

According to the new opinion of fertilizer management, the scientists in the CLRRI have been developed a fertilizer management program for high yielding variety with a short duration (95-100 days) on alluvium soils (Fig.3)

THE NEW OPINIONS OF FERTILIZER MANAGEMENT: A REALITY IN THE MEKONG DELTA

Several activities relating to the new fertilizer management method such SSNM and LCC have been carried out in An Giang, Can Tho and Tien Giang from 2001 to 2004.

The soil samples in these areas have been taken before experiments (2002 DS) and analyzed for various chemical parameters.

Table 1. The chemical parameters of the soils in the experiment sites

Experiment site	pH (H_2O) 1:1	Organic carbon (%)	Total nitrogen Kjeldalh (%)	Available phosphorus		Exchangeable potassium (cmol/kg)	CEC (cmol/kg)
				Olsen's (ppm)	Bray / Kurtz		
Binh Thanh (AG)	5.86	2.81	0.23	5.47	1.22	7.22	21.4
Dinh Mon (CT)	5.53	2.68	0.22	2.80	2.88	5.92	20.1
Binh Tay (TG)	5.47	1.85	0.17	2.00	0.55	3.43	14.7

In An Giang, the experiment was cunducted in the Binh Thanh Village, Chau Phu District. The soil type is alluvium enriched with a high sediment accumulation yearly. The irrigation water is available combining with the good farmer practices resulting in a good rice production. The Jasmine 85 rice variety is very common under double rice cropping. It can produce up to 7-8 t/ha in the DS and 5-6 t/ha in WS. Based on the experiment data we have found out the fertilizer dose for this area as: 130N-28 P_2O_5-48 K_2O (DS) and 88N-37 P_2O_5-48 K_2O (WS) kg/ha.

In Can Tho, the experiment was located in the Dinh Mon Village, O Mon District. The soil type is also alluvium. OM1490 rice variety is widely grown under triple rice cropping. It can give up to 6-7 t/ha in the DS and 4-5 t/ha in the WS. Based on the experiment data we have found out the fertilizer dose for this area as: 101N-32 P_2O_5-48 K_2O (DS) and 84N-50P_2O_5-48 K_2O (WS) kg/ha.

In Tien Giang, the experiment was located in the Binh Tay Village, Go Cong Tay District. The soil is poor in nutrients without sediment supplementation. The cropping system here is rice-rice-rice, few farmers following rice-rice and 2 upland crops. The irrigation water is availble in the Winter-Spring and Autumn-Winter but is difficult in the Summer-Autumn season. However, farmer practices here are so good that is why rice production here is also very high. The VD20 rice variety is grown very common. It can produce up to 5.5-6.5 t/ha in the DS and 3.5-4.5 t/ha in the WS. Based on the experiment data we have found out the fertilizer dose for this area as: 116N-37P_2O_5-48K_2O (DS) and 104N-55P_2O_5-48K_2O (WS) kg/ha.

The experiments have been carried out at the 10 farmer sites with different farmer practice skill (including good, fair, medium and bad) following the SSNM method.

The experiment design: rice field is divided in to 2 parts. In one part, fertilizer management is based on the SSNM method while, in another part, fertilizer management is based on the farmer practice called FFP. The objectives of experiment are to compare the effects of two methods of fertilizer management on rice production while, the other cultivation practice are in the same to both sites.

The table 2 showed that farmers applied more nitrogen in the FFP plots than those of the SSNM plots in both the dry and wet seasons about 10% and 20-30%, respectively. Since the available phosphorus is higher in DS, then phosphorus fertilizer requirement is lower (about 30-40%). In contrast, the available phosphorus is lower in the WS, then we have to apply more phosphorus fertilizer in this season.

In fact, farmers usually apply phosphorus fertilizers as much as those in the WS. Thus, application of phosphorus fertilizers is higher than crop demand. These results indicated that application of phosphorus fertilizer by farmer practices was two times higher than the crop requirement. In the wet season, the difference in phosphorus application between FFP and SSNM method is about 10 kg P_2O_5/ha Which is equal to 20-25%. This investigation also revealed that phosphorus management by farmers is poor resulting in low economic efficiency.

The response of potassium on rice crop has been recognized recently. Application of potassium fertilizers in a range of 50-100 kg K_2O/ha did not significantly affect on rice yield, but further application of this fertilizer reduced economical efficiency (Tran and Pham 1997). Therefore, application of potassium at the rate of 30-50 kg K_2O/ha is recommended. The results also showed that fertilizer investment by two methods (FFP and SSNM) is not different.

Table 2. Results from the experiments at three locations in the 2003 DS and 2003 WS

Parameters	Location	Treatments		Differences
		SSNM (1)	FFP (2)	(1) – (2)
2003 DS				
* Grain yield (t/ha)	Binh Thanh (AG)	7.97	7.41	0.56
	Dinh Mon (CT)	6.58	5.96	0.62
	Binh Tay (TG)	6.06	5.72	0.34
Nitrogen fertilizer	Binh Thanh (AG)	103	110	-07
	Dinh Mon (CT)	105	118	-13
	Binh Tay (TG)	116	121	-05
Phosphorus fertilizer (kg P_2O_5/ha)	Binh Thanh (AG)	28	49	-21
	Dinh Mon (CT)	32	47	-15
	Binh Tay (TG)	38	54	-16
Potassium (kg K_2O/ha)	Dinh Mon (CT)	60	52	8
	Binh Tay (TG)	48	50	-2
	Binh Thanh (AG)	45	48	-3
2003 WS				
* Grain yield (t/ha)	Binh Thanh (AG)	5.84	5.47	0.37
	Dinh Mon (CT)	4.53	4.29	0.24
	Binh Tay (TG)	4.22	3.83	0.39
Nitrogen fertilizer	Binh Thanh (AG)	88	105	-17
	Dinh Mon (CT)	78	103	-25
	Binh Tay (TG)	104	118	-14
Phosphorus fertilizer (kg P_2O_5/ha)	Binh Thanh (AG)	37	44	-7
	Dinh Mon (CT)	50	55	-5
	Binh Tay (TG)	55	41	14
Potassium (kg K_2O/ha)	Dinh Mon (CT)	48	54	-6
	Binh Tay (TG)	41	37	4
	Binh Thanh (AG)	48	48	0

THE NEW OPINIONS OF FERTILIZER MANAGEMENT: PROSPECT AND EXPANSION

Fertilizer recommendations following the new opinions increased rice yield and improved fertilizer used efficiency. Calculating fertilizer requirements based on plant, crop season and soil type really met the plant demand. Therefore, fertilizer recommendations based on SSNM and LCC seems to be a promising guide on nutrient management.

The integrated crop management package recommended by CLRRI scientists also deals with the use of LCC to adjust nitrogen application. Moreover, a project named "the three reductions – three gains" lasting from 2002 to 2004 also emphasized the benefit of reducing nitrogen application and seeding rate on grain yield, besides can also reduced pest pressure and pesticide usage. So far, the integrated crop management package which has been adopted throughout the country under a simplified name "the three reductions – three gains".

Nowadays, with the helps of extension network, seed producing agencies, etc. in whole country, the new techniques and models can be transferred and trained to farmers efficiently. The new opinions of fertilizer management will be more meaningful in the case of increasing in nitrogen price. Applications of nitrogen fertilizer in a right quantity and right way not only increase crop yield but also improve fertilizer use efficiency. Another benefit of this technique is that they are easy transferred and trained to the extension workers and farmers.

CONCLUSIONS AND SUGGESTIONS

So far, the blanket fertilizer recommendations in the Mekong Delta are too general to crop to crop and season to season. By this way, we cannot meet the plant need for their nutrients resulting in low rice production and investment efficiency.

To overcome the limitations, CLRRI and IRRI scientists have suggested a new opinion for fertilizer management basing on SSNM and LCC techniques. By this way, we can meet the plant demand for their nutrients in specific local sites.

Fertilizer recommendations based on SSNM and LCC techniques are more flexible and fit to meet the crop demand resulting in an increment of crop yield up to 0.3-0.5 t/ha and saving up to 20-30% fertilizer application.

A limitation of this technique is that we have to estimate the indigenous nutrients supply from soils. It requires good operation and cultural practice.

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Nghiên cứu biện pháp bón phân cho lúa theo từng vùng chuyên biệt

Hiện nay, khuyến cáo phân bón cho lúa của các địa phương ở ĐBSCL đều có điểm tương đồng nhau và dùng cho cả vùng rộng lớn. Điểm hạn chế của khuyến cáo phân bón như thế này là không sát với điều kiện thực tế của từng tiểu vùng, từng cánh đồng, đặc biệt là từng chân ruộng. Do vậy, bón phân theo khuyến cáo này nhiều trường hợp không đúng với yêu cầu của cây trồng trên từng vùng đất đặc thù, kết quả là năng suất và hiệu quả đầu tư phân bón đạt không cao.

Để khắc phục hạn chế này, Viện Lúa ĐBSCL phối hợp với Viện Lúa quốc tế IRRI nghiên cứu đề xuất khuyến cáo bón phân theo quan điểm mới, bón phân theo SSNM và LCC cho lúa ở ĐBSCL, thực hiện từ năm 1997 đến 2004 đã cho kết quả rất khả quan. Theo quan điểm mới, khuyến cáo phân bón này rất sát với yêu cầu thực tế của từng tiểu vùng, từng cánh đồng thậm chí cho từng thửa ruộng.

Khuyến cáo bón phân theo SSNM và LCC linh hoạt hơn rất nhiều so với khuyến cáo đang phổ biến hiện nay, lượng phân khuyến cáo sát với yêu cầu thực tế hơn. Chính nhờ điều đó mà cho năng suất cao hơn 0,3-0,5 T/ha và tiết kiệm phân bón khoảng 20-30% so với bón phân theo thực tế của nông dân.

Điểm hạn chế của bón phân theo SSNM là ước lượng phần dinh dưỡng cung cấp từ đất, vì triển khai thực tế trên ruộng của nông dân nên không phải nông dân nào cũng làm cẩn thận để ước lượng một cách chính xác lượng dinh dưỡng cung cấp từ đất.