

1. SUBJECT CLASSIFICATION
A. PRIMARY
Agriculture **AF25-0000-0000**
B. SECONDARY
Soil fertility, fertilizers, and plant nutrition

2. TITLE AND SUBTITLE
Comparative effects of urea-rockphosphate and other compound fertilizers on rice

3. AUTHOR(S)
Jugsujinda, Aroon; Suwanwaong, Sombhot

4. DOCUMENT DATE
1972

5. NUMBER OF PAGES
11p.

6. ARC NUMBER
ARC **TH633.18072.J93**

7. REFERENCE ORGANIZATION NAME AND ADDRESS

TVA

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)
(Presented at 4th meeting, TVA Advisory Committee on Rice Fertilization, Bangkok)

9. ABSTRACT

10. CONTROL NUMBER
PN-RAA- 155

11. PRICE OF DOCUMENT

12. DESCRIPTORS
**Assimilation, Urea
Complex fertilizers
Phosphate deposits
Rice**

13. PROJECT NUMBER

14. CONTRACT NUMBER
PASA RA(QA)5-69 Res.

15. TYPE OF DOCUMENT

Comparative Effects of Urea-Rockphosphate and Other
Compound Fertilizers on Rice 1/

By

Aroon Jugsujinda and Sombhot Suwanwaong

Technical Division, Rice Department, Bangkok, Thailand.

Introduction

Previous experiments on sources of rockphosphate for flooded rice in Thailand have shown that some sources of rockphosphate were as good as the readily soluble superphosphate form. Thailand possesses some natural of phosphate rock in the Kingdom. Furthermore although no extensive explorations have yet been conducted, factory facilities are capable of producing up to 30,000 tons of Urea annually. In order for both urea and phosphate to be of benefit to Thai rice farmers, the Rice Department of Thailand in close cooperation with the Tennessee Valley Authority (TVA) and the International Rice Research Institute (IRRI) initiated investigations on the effect of urea rockphosphate and other compound fertilizers on response of rice in Thailand.

Experiments were conducted at 4 locations in Thailand during the 1970 and repeated in 1971 wet seasons namely, Rangsit Rice Experiment Station, Petchaburi Farm Demonstration Center (both are located in

1/ Paper presented at the 4 th meeting of the Advisory Committee on Rice Fertilization, Tennessee Valley Authority (TVA), Liberty Hotel, Bangkok, May 15-16, 1972.

the Central Plain), Kuan Gut Rice Experiment Station (Southern Thailand) and Sakolnakorn Rice Experiment Station (Northeast Thailand).

The physical and chemical analysis of soils at the experimental sites were as follows :

	Locations			
	Rangsit	Petchburi	Kuan Gut	Sakolnakorn
pH (1 : 1)	4.1	7.1	5.0	4.6
O.M. (%)	3.5	2.2	1.6	1.0
Available P (ppm)	5.6	27.9	2.6	7.7
Available K (ppm)	250	137	30	30
C.E.C. (mg/100 g)	26.8	12.4	8.8	3.6
Base saturation (%)	56.6	92.4	60.8	127.5
Soil texture	clay	clay	clay	Sandy loam

Objectives

1. To evaluate the effects of five sources of compound fertilizers containing nitrogen and phosphorus in different forms.
2. To evaluate the effects of the five fertilizers when applied at different stages of growth.
3. To determine whether interactions occur between the sources and times of application.

Materials and Methods

1. Fertilizer used

<u>S. No.</u>	<u>Fertilizer material</u>	<u>Analysis</u>
1)	Urea (U) + Triple superphosphate (TSP)	U * 45% N, TSP = 46% P ₂ O ₅ N - P ₂ O ₅ - K ₂ O 25 - 2 - 0
2)	Urea - rockphosphate (U - R) 1*	26 - 13 - 0
3)	Urea - rockphosphate (U - R) 2*	18 - 18 - 0
4)	Ammonium phosphate (AP)	16 - 20 - 0
5)	Ammonium nitrate phosphate (ANP)	20 - 20 - 0

2. Experimental method The design of the experiment was

originally suggested by IRRI and consisted of a balanced - lattice design with 5 replications. The fertilizer treatments were as follows :

<u>Treatment number</u>	<u>Fertilizer sources</u>	<u>Time & rate of appln. (Kg/ha)</u>			<u>Wt. of fertilizer materials grams/plot (3 x 6 m)</u>		
		N	P ₂ O ₅	N	<u>Urea + Phosphate</u>		<u>Urea</u>
		1/	2/	3/	1/	2/	3/
1.	U+TSP	75-25	-	-	300+98	-	-
2.	U-R(1)	75-25	-	-	100+346	-	-
3.	U-R (2)	75-25	-	-	162+345	-	-

(to be Continued)

* fertilizer materials received from TVA. The urea and uncalcined North Carolina phosphate rock were granulated by pan granulation process to produce products of 26-13-0 and 18-18-0 grades. The granular product was coated with 2 percent Celatom as a conditioning, bagged and stored.

Treatment number	Fertilizer sources	Time & rate of appln. (Kg/ha)			Wt. of fertilizer materials grams/plot (3 x 6 m)		
		N	P O ₂ 5	N	Urea + Phosphate		Urea
		1/	2/	3/	1/	2/	3/
4.	AP	75-25	-	-	220+225	-	-
5.	ANP	75-25	-	-	200+225	-	-
6.	U+ TSP	50-25	-	25	200 + 98	-	100
7.	U-R (1)	50-25	-	25	0+346	-	100
8.	U-R (2)	50-25	-	25	62+346	-	100
9.	AP	50-25	-	25	120+225	-	100
10.	ANP	50-25	-	25	100+225	-	100
11.	U+TSP	-	50-25	25	-	200 + 98	100
12.	U-R(1)	-	50-25	25	-	0 + 346	100
13.	U-R(2)	-	50-25	25	-	62 + 346	100
14.	AP	-	50-25	25	-	120 + 225	100
15.	ANP	-	50-25	25	-	100 + 225	100
16.	CHECK	-	-	-	-	-	-

1/ Basal N - P application at transplanting.

2/ N - P application at 3 weeks after transplanting.

3/ N application at panicle initiation.

Remarks Apply potassium chloride (60% K₂O) to all plots except check plots at the rate of 25 kg/ha just before last of land preparation.

3. Rice Variety

The rice variety used is a hybrid cross between Leuang Tawng, a local non-photoperiod sensitive variety recommended by the Rice Department and IR8. This hybrid now known as RDL (formerly called LT x IR8 56-1-2), normally matures in about 125 days and is similar to IR8 in fertilizer responsiveness and exhibits high resistance to lodging.

Three to six 21-day old seedling per hill were transplanted 20 x 20 cm apart in straight rows. Hand weeding was used and sufficient pesticides were applied for good control. Plot size was 3 x 6 square meters. Grain yield at 14 % moisture was measured by sampling from 5 square meters of each plot. Excluding the border rows.

Results

The preliminary results on the first crop, 1970 wet season of 4 locations have already been reported by Aron and Sombhot 1/

The experiments were repeated during the 1971 wet season. The experiment was conducted in the manner similar to that followed in the first crop. The data obtained are presented in Table 1, 2, 3 and 4. The results may be summarized as follows :-

1/ Comparative effects of urea-rock phosphate and other compound fertilizers on rice. Paper presented at the 3th meeting of the Advisory Committee on Rice Fertilization, Tennessee Valley Authority, Muscle Shoals, Alabama, U.S.A., April 22 - 23, 1971.

1) In all four locations, the application of fertilizer, regardless of sources or times of application, gave significant increases in yield over control although the magnitude of increase varied with location. The overall increases by locations are as follows:

Locations	Yield (kg/ha)		
	Mean/ of fertilized plots	Control	Difference
Rangsit	1019	364	655
Sakolnakorn	1718	1133	585
Phetchaburi	3266	1514	1752
Kuan Gut	3149	1323	1826

1/ Over all 5 sources and 3 times of application.

2) Sources : While at Phetchaburi, no significant differences among sources were shown, some differences among sources were seen at other locations. S₄ (AP) gave the lowest yield at Sakolnakorn and Rangsit but the highest yield at Kuan Gut. Among other sources, there was no appreciable difference; except at Kuan Gut where S₂ (U-R₁) And S₃ (U-R₂) gave the lowest yields.

3) Times : There was no appreciable difference among times of application at any location except at Kuan Gut where a slightly lower yield (although significant) was observed when fertilizer was applied at mid tillering and at panicle initiation but the difference was very small.

- 4) In all cases, the interaction between source and time was not significant. That is, the effect of sources remained the same at any times of application. Similarly, the effect of times of application remained the same for all sources.

NOTES :

Of the four locations, Kuan Gut station exhibited the lowest coefficient of variation of about 10 %. Rangsit and Phetchaburi, had very high cv's of 29 % and 22 %, respectively.

Table 1 Comparative effects of urea-rock phosphate and other compound fertilizers on rice Rangsit Thailand, 1971 wet season

Anova for Grain Yield (kg/ha)

SV	df	MS	F-value
Replication	4	986,462	
Treatment	15	220,145	2.77**
Control vs Treated	(1)	2,014,741	25.37**
Source (S)	(4)	188,315	2.37ns
Time of Application (A)	(2)	99,939	1.26ns
S x A	(8)	41,788	<1
Error	60	79,422	
TOTAL	79		

cv = 28.8 %

Source x Time of Application Table of Means^{1/} (kg/ha)

Source	Time of application			Source mean	
	A ₁	A ₂	A ₃		
S ₁	1180	990	1191	1120 ab	- 756
S ₂	1184	1120	1177	1160 a	- 796
S ₃	868	900	1010	926 b	- 562
S ₄	1142	791	995	959 ab	- 595
S ₅	875	932	985	931 b	- 567
Time mean	1050 a	947 a	1062 a	1019	

Control mean = 364 kg/ha

Comparison among means :

1. LSD values for S x A means :

LSD (5 %) = 356

LSD (1 %) = 474

2. Comparing any S x A mean to the control mean :

Any S x A mean higher than 720 (or 838) is significantly greater than the control mean at 5 % (or 1 %), respectively.

^{1/}Data are averages of 5 replicates.

Table 2 Comparative effects of urea-rock phosphate and other compound fertilizers on rice Sakolnakorn, Thailand, 1971 wet season.

Anova for Grain Yield (kg/ha)

SV	df	MS	F-value
Replication	4	844,390	
Treatment	15	250,840	3.82**
Control vs Treated	(1)	1,607,066	24.53**
Source (S)	(4)	436,390	6.66**
Time of Application (A)	(2)	95,497	1.45ns
S x A	(8)	27,373	<1
Error	60	65,499	
TOTAL	79		

cv = 15.2 % Relative efficiency over RCB = 108.9 %

Source x Time of Application Table of Means^{1/} (kg/ha)

Source	Time of application			Source mean
	A ₁	A ₂	A ₃	
S ₁	1827	1719	1537	1694 a - 561
S ₂	1768	1746	1641	1718 a - 585
S ₃	1836	1894	1869	1866 a - 733
S ₄	1482	1525	1341	1449 b - 316
S ₅	1804	1938	1854	1865 a - 732
Time mean	1743 a	1764 a	1648 a	1718

Control mean = 1133 kg/ha.

Comparison among means :

1. LSD values for S x A means :

LSD (5 %) = 326

LSD (1 %) = 436

2. Comparing any S x A mean to the control mean :

Any S x A mean higher than 1459 (or 1569) is significantly greater than the control mean at 5 % (or 1 %), respectively.

^{1/}Data are averages of 5 replicates.

Table 3 Comparative effects of urea-rock phosphate and other compound fertilizers on rice Kuan Gut, Thailand, 1971 wet season.

Anova for Grain Yield (kg/ha)

SV	df	MS	F-value
Replication	4	480,092	
Treatment	15	1,627,793	18.04**
Control vs Treated	(1)	15,657,189	173.34**
Source (S)	(4)	1,757,509	19.48**
Time of Application (A)	(2)	303,743	3.36*
S x A	(8)	142,773	1.58ns
Error	60	90,208	
TOTAL	79		

cv = 9.9 % Relative efficiency over RCB = 108.0 %

Source x Time of Application Table of Means^{1/} (kg/ha)

Source	Time of application			Source mean
	A ₁	A ₂	A ₃	
S ₁	3238	3609 ✓	3388	3412 ab
S ₂	2840 ✓	3105	2807 ✓	2917 c
S ₃	2927 ✓	2690	2437 ✓	2685 d
S ₄	3482	3661 ✓	3357	3500 a
S ₅	3433	3127	3141	3234 b
Time mean	3184 ab	3238 a	3026 b	3149

2089
- 1594
- 1362
- 2177
- 1911

Control mean = 1323 kg/ha.

Comparison among means :

1. LSD values for S x A means :

LSD (5 %) = 383

LSD (1 %) = 512

2. Comparing any S x A mean to the control mean :

Any S x A mean higher than 1706 (or 1835) is significantly greater than the control mean at 5 % (or 1%), respectively.

^{1/}Data are averages of 5 replicates.

Table 4 Comparative effects of urea-rock phosphate and other compound fertilizers on rice Phetchaburi, Thailand, 1971 wet season.

Anova for Grain Yield (kg/ha)

SV	df	MS	F-value
Replication	4	3,559,184	
Treatment	15	1,158,660	2.60**
Control vs Treated	(1)	13,137,761	29.45**
Source (S)	(4)	392,529	<1
Time of Application (A)	(2)	483,468	1.08ns
S x A	(8)	213,154	<1
Error	56	446,078	
TOTAL	75 ^{a/}		

cv = 21.6 % a/ 4 values were estimated

Source x Time of Application Table of Means^{1/} (kg/ha)

Source	Time of application			Source mean	
	A ₁	A ₂	A ₃		
S ₁	3257	3534	3250	3347 a	- 1833
S ₂	3143 ^{2/}	3624	3033 ^{2/}	3267 a	- 1753
S ₃	3192	3464 ^{2/}	3458 ^{2/}	3371 a	- 1857
S ₄	3186	3516	3181	3294 a	- 1780
S ₅	2886	3272 ^{2/}	2992	3050 a	- 1536
Time mean	3133 a	3482 a	3183 a	3266	

Control mean = 1514 kg/ha.

Comparison among means :

1. LSD values for S x A means:

LSD (5 %) = 848

LSD (1 %) = 1131

2. Comparing any S x A mean to the control mean:

Any S x A mean higher than 2362 (or 2645) is significantly greater than the control mean at 5 % (or 1 %), respectively.

^{1/} Data are averages of 5 replicates.

^{2/} Averages of 4 replicates