Table 5. Effect of Air-Drying on The Availability of Soil Nitrogen and Soil Phosphorus for Rice (1938)[a]

Fertilizers applied	Soil Treatment before flooding	Yield[b] per pot (grams)	Nitrogen (N) in crop		Phosphorus (P_2O_5) in crop	
			Mg per pot	percent	Mg per pot	percent
Potassium sulfate only	Air-Dried	4.3	68.1	1.57	19.3	0.45
Potassium sulfate only	None	1.5	19.7	1.36	5.9	0.41
Ammonium sulfate (0.1 gram as N), Potassium sulfate	None	4.1	84.0	2.07	12.7	0.31
Ammonium sulfate (0.3 gram as N)[c], Potassium sulfate	None	3.5	76.1	2.15	9.5	0.27

a. Experimental details: Soil was obtained from furrow slice of paddy field Agricultural Experiment Station, Konosu, Saitama Prefecture. This field was fertilized each year with ammonium sulfate and potassium sulfate. Calculate amount of soil corresponding to 1.69 kilograms of wet soil was placed in pots (0.125 square meters in area). After fertilizers were applied, the soil in each pot was covered with water (24 June 1939). On 27 June, three selected rice seedlings were transplanted to each pot, the soil in each pot was covered with water until the rice plants were harvested on 31 July 1938.

b. Oven dried.

c. 0.2 gram N added before planting and 0.1 gram N added as top dressing on 26 July 1938.

Table 6. Relationship between Thickness of Soil Layer and Nitrogen Transformation in Flooded Paddy Price Soil (1940)[a]
(mg N per 100 g dry soil)

Nigrogenous Fertilizer Added	Depth of Soil (cm)	Number of Days of Flooding: 0 Ammonium-Nitrogen	0 Nitrate-Nitrogen	0 Total Nitrogen	16[b] Ammonium-Nitrogen	16[b] Total Nitrogen	16[b] Increase or decrease in Total N	33[b] Ammonium Nitrogen	33[b] Total Nitrogen	33[b] Increase or decrease in Total N
None	1	1.1	2.0	307.8	0.7	304.8	-3.0	1.0	305.0	-2.8
Soybean meal	1	1.1	2.0	317.8	2.2	312.6	-5.2	1.7	305.6	-12.2
Ammonium sulfate	1	10.5	2.0	318.5	3.3	308.3	-10.2	1.0	306.7	-11.8
Ammonium chloride	1	10.5	2.0	318.5	2.5	310.1	-8.4	0.7	307.7	-10.8
Di-Ammonium phosphate	1	10.5	2.0	318.0	2.9	307.2	-10.8	1.2	307.7	-10.3
None	4	1.1	2.0	307.0	1.4	ND	ND	2.9	305.0	-2.0
Soybean meal	4	1.1	2.0	317.0	7.9	ND	ND	8.2	311.5	-5.5
Ammonium sulfate	4	10.5	2.0	317.0	8.9	ND	ND	8.0	312.3	-4.8
Ammonium chloride	4	10.5	2.0	317.0	8.9	ND	ND	8.0	312.3	-4.8

ND: No data available.

a Experimental details: Soil obtained before flooding (16 June 1947) from furrow slice of paddy field, Agricultural Experiment Station, Konosu, Saitama Prefecture. This field was fertilized each year with ammonium sulfate only. For samples incubated at 1 cm depth, glass vessels of 15 cm diameter were used, and for samples of 4 cm depth, 250 cc beakers were used. After mixing nitrogenous fertilizer (equivalent to 10 mg N) with wet soil (corresponding to 100 g dry soil), soil sample was placed in container, covered with distilled water, and incubated at 30° C.

b Surface water contained only a trace of Nitrate nitrogen.

Table 7. Relationship between Nitrogen Loss and Soil Reaction of Oxidized Layer of Flooding Paddy Rice Soils (1942)
(mg N per 100 g dry soil)

Materials added	Number of Days of Flooding											
	0			14			50					
	Depth (cm)	Ammonium Nitrogen (mg)	Total Nitrogen (mg)	Depth (cm)		Ammonium Nitrogen (mg)	Depth (cm)		Ammonium Nitrogen (mg)	Total Nitrogen (mg)	E_6 Volt	pH
None	0-1.3)	1.0)	116.0	0-0.2	OL[b]	0.4	0-0.4	OL[b]	0.5)	114.9	ND	7.8
	1.3-2.6)RL[c]	1.0)		0.2-1.5)		0.5	0.4-1.6)		0.9)		ND	ND
	2.6-4.0)	1.0)		1.5-2.8)	RL[c]	1.7	1.6-2.8)	RL[c]	1.7)		ND	ND
				2.8-4.0)		2.5	2.8-4.0)		2.3)		ND	ND
Mono Sodium Phosphate	0-1.3)	1.0)	ND	0-0.2	OL[b]	0.0	0-0.4	OL[b]	0.0)	ND	ND	6.8
	1.3-2.6)RL[c]	1.0)		0.2-1.5)		0.6	0.4-1.6)		1.1)		ND	ND
	2.6-4.0)	1.0)		1.5-2.8)	RL[c]	1.2	1.6-2.8)	RL[c]	1.6)		ND	ND
				2.8-4.0)		1.5	2.8-4.0)		1.9)		ND	ND
Sodium Sulfate	0-1.3)	1.0)	ND	0-0.2	OL[b]	3.2	0-0.5	OL[b]	3.8)	ND	ND	5.1
	1.3-2.6)RL[c]	1.0)		0.2-1.5)		2.4	0.5-1.7)		2.3)		ND	ND
	2.6-4.0)	1.0)		1.5-2.8)	RL[c]	2.3	1.7-2.9)	RL[c]	2.4)		ND	ND
				2.8-4.0)		2.3	2.9-4.0)		4.0)		ND	ND
Ammonium Sulfate	0-1.3)	18.1)	136.4	0-0.2	OL[b]	15.7	0-0.5	OL[b]	4.4)	135.8	0.51	4.9
	1.3-2.6)RL[c]	18.1)		0.2-1.5)		17.5	0.5-1.7)		16.3)		ND	ND
	2.6-4.0)	18.1)		1.5-2.8)	RL[c]	16.5	1.7-2.9)	RL[c]	16.7)		0.17	7.2
				2.8-4.0)		16.1	2.9-4.0)		17.5)		0.17	7.2
Ammonium sulfate Mono sodium Phosphate	0-1.3)	18.1)	ND	0-0.2	OL[b]	15.1	0-0.5	OL[b]	9.8)	ND	ND	5.1
	1.3-2.6)RL[c]	18.1)		0.2-1.5)		17.3	0.5-1.7)		14.9)		ND	ND
	2.6-4.0)	18.1)		1.5-2.8)	RL[c]	16.8	1.7-2.9)	RL[c]	17.4)		ND	ND
				2.8-4.0)		16.1	2.9-4.0)		17.0)		ND	ND
Di Ammonium Phosphate	0-1.3)	17.0)	135.0	0-0.2	OL[b]	10.0	0-0.5	OL[c]	4.6)	123.2	0.50	6.3
	1.3-2.6)RL[c]	17.0)		0.2-1.5)		10.8	0.5-1.7)		4.4)		ND	ND
	2.6-4.0)	17.0)		1.5-2.8)	RL[c]	12.1	1.7-2.9)	RL[c]	6.3)		0.17	7.8
				2.8-4.0)		14.6	2.9-4.0)		7.4)		0.17	7.8

Table 7. (Cont'd)

Materials added	Number of Days of Flooding										
	0			14			50				
	Depth (cm)	Ammonium Nitrogen (mg)	Total Nitrogen (mg)	Depth (cm)	Ammonium Nitrogen (mg)		Depth (cm)	Ammonium Nitrogen (mg)	Total Nitrogen (mg)	E_6 volt	pH
Di ammonium Phosphate, sodium Sulfate	0-0.2			0-0.2 OL[b]	13.2		0-0.5 OL[b]	11.2		ND	4.9
	0-1.3	17.0		0.2-1.5	13.3		0.5-1.7	11.7		ND	ND
	1.3-2.6 RL[c]	17.0	ND	1.5-2.8 RL[c]	15.0		1.7-2.9 RL[c]	13.5	ND	ND	ND
	2.6-4.0	17.0		2.8-4.0	15.0		2.9-4.0	14.0		ND	ND
Mono Ammonium Phosphate	0-0.2 OL[b]			0-0.2 OL[b]	13.0		0-0.5 OL[b]	1.3	ND	ND	6.5
	0-1.3	17.0		0.2-1.5	13.0		0.5-1.7	4.5		ND	ND
	1.3-2.6 RL[c]	17.0	ND	1.5-2.8 RL[c]	14.1		1.7-2.9 RL[c]	7.1	ND	ND	ND
	2.6-4.0	17.0		2.8-4.0	14.1		2.9-4.0	8.3		ND	ND
Mono Ammonium Phosphate, sodium Sulfate	0-0.2 OL[b]			0-0.2 OL[b]	13.0		0-0.5 OL[b]	16.0		ND	4.9
	0-1.3	17.0		0.2-1.5	15.2		0.5-1.7	11.5		ND	ND
	1.3-2.6 RL[c]	17.0	ND	1.5-2.8 RL[c]	14.6		1.7-2.9 RL[c]	16.9	ND	ND	ND
	2.6-4.0	17.0		2.8-4.0	14.5		2.9-4.0	16.8		ND	ND

a Experimental details: Soil samples were obtained in november 1942 from lysimeter tank flooded throughout the year at the Central Agricultural Experimental Station, Nishigahara, Tokyo. Wet soil equivalent to 100 g dry soil was placed in beaker 250 cc capacity, Nitrogenous fertilizers, sodium sulfate and mono sodium phosphate were added at the rates of 17 mg N, 58.2 mg SO_4 and 33.7 mg P_2O_5, respectively. The soil samples were covered with distilled water to a depth of 1 cm and incubated at 30° C. Depth of soil was 4 cm.

b Oxidized layer

c Reduced layer

ND: No data available

Table 8. Denitrification in Paddy Rice Soils under Flooded Conditions (1942)[a]

(mg N per 30 g dry soil)

Soil Sample	Fertilizer Added	Depth of Soil (cm)	Amount of Nitrogen at Beginning		Amount of Nitrogen After 24 Days of Flooding			Increase in Nitrogen Gas over Check (mg)
			NH_4-N (mg)	NO_3-N (mg)	NH_4-N (mg)	NO_3-N	N_2 Gas in O_2 Gas[c] (mg)	
A	None	1	0.32	0	0.05	Trace	11.0	
B	Ammonium sulfate	1	10.32	0	4.66	Trace	15.5	4.5

a Soil sample was taken on 20 December 1942 from furrow slice of paddy field, agricultural experiment station, Konosu, Saitama Prefecture. This field was fertilized each year with organic fertilizers.

b Content in surface water.

c Determined by Henspel's method.[32]

Table 9. Influence of Tillage Practices on The Efficiency of Nitrogen Applied on Paddy Rice Field (1941)[a]

Plot[b]	Time of Application of ammonium sulfate	Yield of Rice Crop		
		Grain (brown) (Kg per ha)	Straw (Kg per ha)	Relative Yield of Grain
A_1	Two days before flooding[d]	2.933	3.576	111
A_2	Before second harrowing after flooding	2.771	3.119	106
A_3	Before third harrowing after flooding	2.638	3.119	100
B_1	Two days before flooding[d]	2.963	3.735	105
B_2	Before second harrowing after flooding	2.742	3.073	97
B_3	Before third harrowing after flooding	2.830	3.508	100
C_1	Two days before flooding[d]	3.066	3.508	110
C_2	Before second harrowing after flooding	2.786	3.145	100
C_3	Before third harrowing after flooding	2.005	1.958	72
D_1	Two days before flooding[d]	2.933	3.485	104
D_2	Before second harrowing after flooding	2.830	3.417	100
D_3	Before third harrowing after flooding	2.815	3.417	100

a Experiment conducted at agricultural experiment station, Konosu, Saitama Prefecture.

b History of fertilizers applied (1931-1940)
Plot A - Ammonium sulfate, superphosphate, potassium sulfate
Plot B - Ammonium sulfate, superphosphate, potassium sulfate
Plot C - Ammonium sulfate, superphosphate
Plot D - Ammonium sulfate, superphosphate.

c Kind and data of tillage practices
First plowing - early May
Second plowing - 3 June
Harrowing - 14 June
Flooding - 16 June
First harrowing after flooding-18 June
Second harrowing after flooding-22 June
Third harrowing after flooding-30 June
Transplanting - 1 June
Harvesting - 18 October.

d Applied before harrowing.

Table 10. Distribution of Ammonium Nitrogen in The Soil of The Furrow Slice after Fertilization (1941)[a]

Plot	Time of Application of Ammonium sulfate	Depth (cm)	Ammonium-Nitrogen Content (mg per 100 g dry soil) 22 June	27 June	5 July
A_1	Two days before flooding	0-3	5.2	4.7	3.4
		3-6	4.5	4.2	4.6
		6-9	2.7	2.0	2.3
A_2	Before second harrowing after flooding	0-3	ND	6.2	ND
		3-6	ND	2.4	ND
		6-9	ND	1.4	ND
B_1	Two days before flooding	0-3	6.0	4.6	3.6
		3-6	3.5	3.6	3.4
		6-9	1.4	1.4	1.0
B_2	Before second harrowing after flooding	0-3	ND	5.9	4.3
		3-6	ND	1.1	1.9
		6-9	ND	0.4	1.0
B_3	Before third harrowing after flooding	0-3	ND	ND	6.2
		3-6	ND	ND	2.0
		6-9	ND	ND	0.5

ND: No data available.
a Table 9. gives experimental details.

Table 11. Relationship Between Rice Yields and Depth of Application of Nitrogenous Fertilizer (1941)[a]

Plot[b] Plot No	Nitrogenous Fertilizers Added	Depth of Application	Yield (Kg per hectare) Grain (unhulled)	Straw
1	None		2404	2688
2	Ammonium sulfate	0-2	4770	5927
3	Ammonium sulfate	0-5	5201	5965
4	Ammonium sulfate	0-9	6055	6868
5	Soybean meal	0-2	3855	5107
6	Soybean meal	0-9	5640	5783
7	None		1458	2056
8	Soybean meal	0-2	3576	4336
9	Soybean meal	0-9	4279	4770

a Experiments conduced with lysimeter tanks at the Agricultural Experiment Station Nishigahara, Tokyo. Rates of fertilizer application per hectare were nitrogen (N) 80 Kg, phosphoric acid (P_2O_5), 100 Kg. and potash (K_2O), 100 Kg. Potassic and phosphatic fertilizers applied were KH_2PO_4 and K_2HPO_4. Area of each plot was 0.5 Square meter.
b Plots 1-6: Lysimeter tanks flooded only during rice season.
Plots 7-9: Lysimeter tanks flooded throughout the year.