

Table 20. Effect of method of application of Ammonium sulfate on the yield of paddy rice (1940)^a

Plot	Method of Application of Ammonium Sulfate	Yield (grams)		Total Nitrogen (N) in head and straw (grams)	Percent of Applied Nitrogen (N) Assimilated by rice crop
		Head	Straw		
A ₁	In surface water	196.0	294.9	4.165	51
A ₂	In surface water, then mixed with soil	237.4	327.5	4.733	63
A ₃	Mixed with soil after surface water was drained	224.5	344.2	5.546	79
A ₄	In inner soil layer, 3-6 cm depth	242.4	370.0	6.062	89
A ₅	None	90.8	106.0	1.600	0
B ₁	In surface water	227.5	300.2	4.829	72
B ₂	In surface water, then mixed with soil	239.2	319.6	4.896	75
B ₃	Mixed with soil after surface water was drained	233.4	324.1	5.219	80
B ₄	In inner soil layer, 3-6 cm depth	246.0	336.5	5.547	86
B ₅	None	62.3	72.8	1.241	0

a Experiment details: Soils for plots A₁-A₅ were in lysimeter tanks which were flooded during rice growing season only. Soils for plots B₁-B₅ were in lysimeter tanks which were flooded throughout the year. Both tanks were at Nishigahara Agricultural Experiment Station, Tokyo. Area of each plot was 0.5 square meter. On 24 June 1940, 0.5 g P₂O₅ and 0.5 g K₂O as KH₂PO₄ and K₂HPO₄ were applied to each plot. Ammonium sulfate was applied to all plots except the check plot. The rate of application was 0.5 g N per plot. Rice seedlings were transplanted on 26 June 1940. Rice crop was harvested on 8 October 1940.

Table 21. Composition of Degraded Paddy Rice Soils and Normal Paddy Rice Soils (1942)

Soil ^a	Depth cm	Free Fe ₂ O ₃ ^b (Percent)	Fe ₂ O ₃ soluble in hot conc.HCl (percent)	P ₂ O ₅ soluble in hot conc.HCl (percent)	Total N (Percent)	Total C (Per- cent)	Produ- tion of NH ₄ -N after Air-Dry- ing (mg N/100 g dry soil) ^c	Presence of H ₂ S in reduced layers
A	0-12 (Furrow slice, A ₁ horizon)	0.14	0.69	0.075	0.22	1.97	9.0	+
	12-16 (Plow sole, A ₂ horizon)	0.19	0.79	0.052	0.08	0.48	4.5	+
	16-20 (Subsoil, B horizon)	1.77	3.01	0.142	0.08	0.44	3.9	-
	C-20	ND	ND	ND	ND	ND	ND	-
B	0-10 (Furrow slice, A ₁ horizon)	0.21	1.13	0.128	0.24	2.47	9.0	ND
	10-14 (Furrow slice, A ₁ horizon)	0.30	1.17	0.103	0.23	2.17	7.2	ND
	14-18 (Plow sole B horizon)	1.54	3.06	0.080	0.08	0.47	2.4	ND
C	0-13 (Furrow slice, A horizon)	0.66	ND	0.195	0.29	ND	15.0	-
	13-16 (Plow sole, B horizon)	ND	ND	0.140	0.16	ND	6.9	ND
	16-20 (Subsoil, B horizon)	0.46	ND	0.117	0.10	ND	4.8	ND

ND: No data available.

- a Soil A - Highly degraded paddy soil. Gunge, Kagawa Prefecture.
Soil B - Slightly degraded paddy soil. Gunge, Kagawa Prefecture.
Soil C - Normal paddy soil. Agricultural Experiment Station, Konosu,
Saitama Prefecture.

b Determined by Truog's method 9.

c Air-Dried samples were incubated at 30° C for 30 days. NH₄-N produced was determined.

Table 22. Distribution of active manganese and free ferric oxide in profiles of degraded paddy rice soils and normal paddy rice soils (1945)

Soil ^a	Depth cm	Manganese content (mg Mn per 100 g dry soil)				Presence of MnO ₂ ^d	Free Fe ₂ O ₃ ^e (percent)
		Manganese Soluble in hot conc HCl	Active Mn ⁺⁺⁺	Manganese ^c Mn ⁺⁺⁺	Total		
		A	0-15 (Furrow slice)	26.0	6.2		
	15-20 (Plow sole)	53.8	31.0	17.8	48.8	+++	1.72
	20-25 (Subsoil)	42.9	23.4	2.0	23.4	++	0.83
	0-12 (Furrow slice)	29.0	1.7	0	1.7	-	0.19
	12-36 (Subsoil bleached)	29.0	1.7	0	1.7	-	0.18
	36-56 (Subsoil II, not bleached)	24.0	0	1	0	-	0.30
B	56-60	81.5	49.7	18.5	68.2	++	2.23
	60-64	244.3	104.4	19.6	174.0	++	2.30
	64-72	253.0	86.5	100.5	187.0	+++	1.08
	72-82	269.8	79.8	123.2	203.0	+++	1.04
	60-64 (Brown flecking)	416.0	218.6	167.9	386.5	++++	ND

ND: No data available.

a Soil A - Normal paddy soil, Anjo, Aichi Prefecture.
Soil B - Degraded paddy soil. Seto, Akatsu, Aichi Prefecture.

b Active manganese determined by Brewer and Can's method 3.

c Tested by Feigel's method 11: Feigel, F. Quantitative Analyse mit Hilfe von Tüpfelreaktion.

d, e Free ferric oxide determined by Truog's method.

Table 23. Velocity of cataphoresis of colloids from paddy rice soils under flooded conditions (1942)^a

Soil ^b	Soil layer	Conditions of Incubation	E_6 (volt)	Velocity of Cataphoresis of soil colloids $\times 10^{-4}$ cm/V. cm, sec.)	Velocity of Endosmosis of Soil water at Surface of glass walls $\times 10^{-4}$ cm/V. cm, sec.)	pH
A	Oxidized layer	Thin layer under air	0.36	-0.93	-2.30	6.0
	Reduced layer	Sealed	0.14	-0.88	-1.07	7.2
B	Furrow slice	Sealed	0.05	-0.69	-1.20	6.7
	Subsoil	Sealed	0.38	-1.09	-2.58	7.2

a For experimental details, see text.

b Soil A - wet soil from lysimeter tank.

Soil B - paddy soil, Agricultural Experiment Station, Konosu, Saitama Prefecture. This soil was fertilized annually with organic fertilizers.

Table 24. Effect on Rice yields of air-Drying Soil (1940) a/

Plot	History of Fertilization (1936-1939)	Fertilizers Applied (Kg per hectare)				Degree of air-Drying <u>b/</u>	Yield (Kg per hectare)		N absorbed by crop (Kg per hectare)
		Compost	N (as ammonium sulfate)	P ₂ O ₅ (as Superphosphate)	K ₂ O (as potassium sulfate)		Brown Rice	Straw	
17	NK (inorganic)	0	0	0	0	(None)	3125	3629	57.83
						(Slight)	3700	5216	74.84
						(High)	3685	5179	73.71
18	NPK (inorganic)	0	0	0	0	(None)	3508	4186	66.91
						(Slight)	3950	5783	85.51
						(High)	4127	6388	95.63
19	NK (organic)	0	0	0	0	(None)	3626	4460	71.06
						(Slight)	3891	5179	76.36
						(High)	4068	6086	89.59
20	NPK (organic)	0	0	0	0	(None)	3788	4725	77.49
						(Slight)	4157	6010	91.48
						(High)	4407	6691	103.57
21	N (inorganic)	0	18.90	0	75.6	(None)	3302	4347	66.91
						(Slight)	3788	5216	77.87
						(High)	3906	5821	88.83
22	NP (inorganic)	0	18.90	75.6	75.6	(None)	3582	4687	75.22
						(Slight)	4009	5557	86.56
						(High)	4230	6464	97.52
23	N (organic)	7.560	18.90	0	75.6	(None)	3759	4687	71.82
						(Slight)	4008	5859	83.92
						(High)	4490	6502	93.37
24	NP (organic)	7.560	18.90	75.6	75.6	(None)	4112	5027	75.98
						(Slight)	4437	6161	98.28
						(High)	4643	6653	104.33
Ave						(None)	Not Calculated	Not Calculated	70.31
						(Slight)	Not Calculated	Not Calculated	84.29
						(High)	Not Calculated	Not Calculated	93.37

ND: Not determined

a/ Experimental details: Field experiments were conducted at the Agricultural Experiment Station Konosu, Saitama Prefecture, in 1940.

Compost was applied on 20 June one day before second harrowing after the fields were flooded NP, and K were applied 28 June before third harrowing.

Rice seedlings were transplanted on 30 June.

b/ Methods used to dry soil: None field was plowed on 28 May 1940 and was flooded on 31 May 1940.

Slightly-dried-field was plowed on 1 May 1940 and was flooded on 31 May 1940.

Well-dried-field was plowed on 1 May 1940, covered during rainy days and at night and was flooded on 31 May 1940.

Table 25 Ammonium-nitrogen Distribution in the Furrow Slice after air-drying and the Application of Ammonium Sulfate (1940-1941)^a
(mg N per 100 g dry soil)

Degree plot of air-drying	Ammonium-nitrogen Content in 1940 Days of Flooding					Effect of air ^v -Drying on Ammonium nitrogen production from residual soil nitrogen (N) ^b
	5		14		29	
	0-10 cm Depth	0-10 cm Depth	0-10 cm	0-3 cm	3-10 cm	
None	1.0	0.9	1.1	ND	ND	5.5
17 Slight	1.4	2.0	2.1	ND	ND	4.0
High	1.7	2.8	3.1	ND	ND	5.4
None	1.2	0.9	ND	1.0	2.5	7.6
18 Slight	1.6	2.1	ND	1.5	3.5	5.5
High	1.7	3.4	ND	1.3	3.6	4.0
None	1.1	1.5	1.2	ND	ND	8.0
19 Slight	1.5	2.2	3.0	ND	ND	6.7
High	1.8	3.5	3.3	ND	ND	5.9
None	1.4	1.6	ND	1.1	2.2	9.2
20 Slight	1.8	2.7	ND	1.2	3.7	7.8
High	2.3	3.6	ND	1.6	4.8	5.9
None	0.9	0.8	ND	ND	ND	5.8
21 Slight	1.4	1.7	ND	ND	ND	5.9
High	1.4	3.2	ND	ND	ND	4.6
None	0.9	1.3	ND	ND	ND	7.1
22 Slight	1.1	2.7	ND	ND	ND	7.4
High	1.7	3.5	ND	ND	ND	6.1
None	0.9	1.3	ND	ND	ND	8.1
23 Slight	1.2	2.2	ND	ND	ND	5.9
High	1.7	3.8	ND	ND	ND	5.0
None	0.7	1.2	ND	ND	ND	9.4
24 Slight	1.4	2.4	ND	ND	ND	8.4
High	2.0	3.9	ND	ND	ND	7.5
None	ND	ND	ND	ND	ND	7.6
Lable	ND	ND	ND	ND	ND	6.5
High	ND	ND	ND	ND	ND	5.6

a. For experimental details, see Table 24. Soil samples from the furrow slice (depth 0-10 cm) were taken on 11 April 1941, one year after the field experiment.

b. After air drying, the samples were placed in Erlenmeyer flasks at about 5 cm depth and incubated under flooded condition at 25° for 28 days.

ND: No data available.

Table 26. Potential Availability of Soil Nitrogen in Paddy Rice Fields at Prefectural Agricultural Experiment Station (1940) a/

Prefecture		Flooded without air-Drying				Flooded after air-Drying				Total N in Dry soil (Percent)	
		PH	Eh (volt)	Exchange acidity of Wet Soil (Yl)	Ammonium- Nitrogen Production mg N/100g dry soil	PH	Eh (volt)	Exchange acidity of Wet soil (Yl)	Ammonium- Nitrogen Production (mg N/100g dry soil)		Ammonification coefficient b of soil Nitrogen
Hokkaido	c/	5.4	0.20	19.5	3.5	6.5	0.02	35.7	8.8	3.10	0.284
Aomori	c/	6.2	0.12	6.3	3.3	6.3	0.05	6.9	8.1	3.58	0.226
Iwate	c/	5.9	0.21	16.3	2.9	6.5	0.08	24.3	7.5	3.46	0.217
Miyagi	c/	6.4	0.15	3.0	2.4	6.6	0.08	22.4	5.6	2.00	0.280
Akita	c/	5.8	0.16	22.6	3.0	6.4	-0.01	65.0	15.2	5.51	0.276
Yamagata	c/	6.0	0.12	14.6	2.6	6.3	0.06	19.0	10.0	3.52	0.284
Tochigi	c/	6.0	0.19	2.1	1.4	6.3	0.11	7.0	11.0	1.84	0.647
Ibaragi	c/	5.9	0.10	18.5	4.5	6.5	-0.02	25.0	10.5	4.39	0.239
Gunma		6.2	0.16	1.9	1.6	6.4	0.07	1.9	4.9	1.98	0.248
Saitama	c/	6.5	0.06	3.0	1.8	6.6	0.03	5.1	3.7	2.22	0.167
Chiba	c/	6.3	0.14	1.2	2.8	6.8	-0.05	6.0	20.0	3.44	0.599
Tokyo	c/	6.0	0.19	4.9	1.4	6.4	0.14	6.9	11.8	2.68	0.441
Kanagawa	c/	5.7	0.19	1.8	5.7	7.2	0.06	10.9	12.6	4.81	0.262
Yamanashi		6.0	0.18	3.0	2.2	6.1	0.03	3.6	4.1	2.38	0.188
Nagano	c/	5.8	0.23	11.0	3.5	5.9	0.14	11.3	4.7	4.16	0.113
Shizuoka		5.4	0.24	6.0	1.4	6.2	-0.08	9.2	7.0	3.45	0.203
Gifu		5.9	0.20	3.6	1.1	6.2	0.02	5.1	6.0	4.03	0.149
Niigata	c/	5.6	0.24	17.1	4.7	6.9	0	58.1	16.1	7.89	0.204
Ishikawa	c/	6.2	0.07	18.3	2.1	6.6	0.02	19.6	18.2	8.20	0.222
Toyama	a/	6.4	0.06	4.2	3.9	6.8	0.03	5.5	9.3	6.79	0.137
Shiga		6.1	-0.02	8.3	2.3	6.4	0.06	8.3	6.7	4.62	0.145
Mie	c/	6.0	0.10	2.7	2.9	6.6	0.04	3.4	6.8	4.02	0.169
Nara		6.4	0.11	0.5	2.3	6.8	0.02	0.9	3.1	2.54	0.112
Wakayama		6.0	-0.10	6.5	5.1	6.0	0.06	6.5	7.1	3.36	0.211
Kyoto		6.5	0.06	7.3	2.1	6.3	0.07	7.8	6.3	3.09	0.204
Osaka		6.3	-0.03	8.3	4.0	6.3	-0.01	8.2	5.0	2.96	0.109
Hyogo		6.2	0.06	4.9	2.5	6.5	-0.04	5.4	5.0	2.69	0.186
Okayama		6.0	0	4.2	3.5	6.5	-0.07	4.2	4.1	2.59	0.158
Yamaguchi		6.5	-0.02	1.8	4.1	6.6	-0.09	1.8	5.2	2.67	0.199
Tottori		5.7	0.08	17.5	2.5	6.4	0	19.6	6.6	3.40	0.194
Shimane No.1		6.2	ND	13.0	3.1	6.2	ND	14.7	13.0	3.32	0.392
Shimane No.2	d/	6.2	0.04	8.5	4.0	6.2	0.02	14.4	20.5	7.17	0.285

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