https://doi.org/10.29321/MAJ.10.A04349

Influence of Nitrogen, Phosphorus and Potash on the incidence of Blast disease of Rice

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Introduction : The blast disease of rice caused by *Piricularia oryzae* Cav. is a disease of great economic importance in South India. The intensity of its incidence and the severity of the damage caused by it are profoundly influenced, apart from the varietal susceptibilty, by several environmental factors. Among these, the factor relating to the nutrition of the host plant is of considerable practical importance to the rice grower. Previous investigations in Coimbatore by Thomas (1932) and in Japan by Suzuki (1335) and Sawada (1937) have shown that application of heavy doses of nitrogenous manures is conducive to the development of the disease. With a view to obtaining further information relating to this aspect a series of field experiments were carried out as part of the programme of a special scheme sponsored by the Indian Council of Agricultural Research for the investigation of blast and foot-rot disease of rice in the Madras State. In this paper an account is given of the experiments carried out during the last seven years with the object af determining the effect of application of varying levels of nitrogen phosphorus and potash on the incidence of blast in different varieties of rice.

Experimental. *Venue :* The field experiments were carried out in the Central Farm wetlands, Coimbatore under channel irrigated conditions over a period of seven years.

Material and Methods. *Series I—Influence of nitrogen on the incidence of blast disease.*

Material. Rice varieties : The five varieties tested were pure line selections and comprised the following types: (a) Highly susceptible to blast — Adt. 10, (b) Moderately susceptible—Co. 11 and (c) Resistant — Co. 4, Co. 25 and Co. 26. All the five are long duration varieties.

Manures : Two nitrogenous manures were used namely, ammonium sulphate and groundnut cake, at three levels. The quantity of the manures at each level varied according to the nature of the experiment in different years and is mentioned in the table corresponding to each year. All the experimental plots including the outskirts received a basal dressing of 5,000 pounds of green leaf per acre.

Layout : Randomized block (Split plot), replicated. Details are furnished in the appended tables.

Method : Seedlings were raised in separate nursery plots and transplanted after an interval of forty to fortyfive days in rows one foot apart and with a spacing of 6 inches between plants in the row. Care was taken to see that equal number of plants were planted in each sub-plot. After the plants were well established, the plots were bunded on all sides to prevent irrigation water from passing from one plot to another. The manures were applied one month after transplanting, as a top dressing.

Observations: Periodic observations were recorded on the incidence of disease. Observations for leaf incidence were recorded for forty random selected plants in each plot, as light, medium and heavy as per a guide chart and arithmetical values were assigned to these categories when computing data. Neck infection was recorded for each tiller as a unit and computed as a percentage. Each sub-plot was harvested separately and the yield of grain and straw recorded.

RESULTS.

TABLE I.

Effect of varying levels of nitrogen on incidence of disease, 1944–45.

Layout: Randomised block (Split plot).

Treatments:

(1) Amm. sulphate at 1 cwt. per acre
(2) ,, ,, 2 cwt. ,,
(3) ,, ,, 3 cwt. ,,
(4) Groundnut cake 3 cwt. ,,
(5) ,, ,, 6 cwt. ,,
(6) ,, ,, 9 cwt. ,,
(7) Control (No Manure).

Varieties tested:

(1) Adt. 10 (Susceptible).
(2) Co. 4 (Resistant).

Replications: 6.
Area of plot: 20' x 10'
Area of sub-plot: 20' x 5'.
Spacing between rows.: 1 foot.
Spacing between plants in rows: 6 inches.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)		Incidence of neck infection (in percentage)		Yield of grain in ounces	
		Adt. 10	Co. 4	Adt. 10	Co. 4	Adt. 10	Co. 4
1	Ammonium sulphate 1 cwt.	142·2	0.0	47·36	8·34	52·8	101·9
2	,, ,, 2 cwt.	226·5	0·0	58·78	4·85	47·4	103·8
3	,, ,, 3 cwt.	270·5	0·0	60·85	3·70	49·1	113·0
4	Groundnut cake 3 cwt.	164·5	0 0	47·28	5·67	55·8	100 9
5	,, ,, 6 cwt.	175·2	0·0	54·13	4·43	49·2	105·7
6	,, ,, 9 cwt.	154·3	0·0	61·02	6·41	56·8	124·6
7	Control (No manure)	145·7	0·0	53·89	6·14	41·5	109·4
	Standard Error:	20·9					
	Critical difference:	60·3					
	Significance at 5 per cent level						

TABLE II.

Effect of varying levels of nitrogen on incidence of disease, 1945–46.

Details as in Table I.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)		Incidence of neck infection (in percentage)		Yield of grain in ounces	
		Adt. 10	Co. 4	Adt. 10	Co. 4	Adt. 10	Co. 4
1	Ammonium sulphate 1 cwt.	76·2	0 0	13·6	0·0	94·5	102·5
2	,, ,, 2 cwt.	99·7	0·0	15·1	0·0	108·7	112 3
3	,, ,, 3 cwt.	138·0	0·0	21·8	0·0	116·8	132·2
4	Graundnut cake 3 cwt.	69·2	0·0	12·8	0 0	97·8	97·2
5	,, ,, 6 cwt.	107·5	0·0	18·8	0·0	103·8	113 0
6	,, ,, 9 cwt.	121·3	0·0	18·8	0·0	108·0	110·0
7	Control (No manure)	53·0	0·0	13·9	0·0	92·7	105·4
	Standard Error:			0·9		3·6	
	Critical difference:			2·6		10·4	
	Significance at 5 percent level		No	Yes		Yes	

TABLE III.

Effect of varying levels of nitrogen on incidence of disease, 1946-47.

Layout: Randomised block (split plot).

Treatments:

(1) Ammonium sulphate 1 cwt. per acre
(2) ,, ,, 2 cwt. ,,
(3) ,, ,, 3 cwt. ,,
(4) Groundnut cake 3 cwt. ,,
(5) ,, ,, 6 cwt. ,,
(6) ,, ,, 9 cwt. ,,
(7) Control (No manure)

Varieties tested:

(1) Adt. 10 (Susceptible).
(2) Co. 11 (Moderately resistant)

Replications 6.
Area of plot: 20' x 10'.
Area of sub-plot: 20' x 5'.
Spacing between rows: 1 foot.
Spacing between plants in rows: 6 inches.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)		Incidence of neck infection (in percentage)		Yield of grain in ounces	
		Adt. 10	Co. 11	Adt. 10	Co. 11	Adt. 10	Co. 11
1	Ammonium sulphate 1 cwt. per acre	139·7	59 0	33·4	3·9	73·5	87·5
2	,, ,, 2 cwt. ,,	254·3	93·8	36·7	6·1	66 8	103·0
3	,, ,, 3 cwt. ,,	312·7	125·8	48·2	7·7	60·7	109·0
4	Groundnut cake 3 cwt. ,,	114·5	55·2	38·2	5·9	70·7	94·1
5	,, ,, 6 cwt. ,,	206·3	69 8	43·1	7·7	73·0	108·5
6	,, ,, 9 cwt. ,,	268·0	87·5	47·2	16.5	69·0	102.0
7	Control (No manure) ,,	100·7	31·7	30·6	6·5	64·3	78·7
	Standard Error:	13·3		2·1		3·6	
	Critical difference:	37·1		6·2		10·6	
	Significance at 5 percent level	Yes		Yes		Yes	

TABLE IV.

Effect of varying levels of nitrogen on the incidence of disease, 1947–48

Layout: Randomized blocks (split plot).

Treatments:

(1) Amm. sulphate 2 cwt. per acre.
(2) ,, 3 cwt. per acre.
(3) ,, 4 cwt. ,,
(4) Groundnut cake 6 cwt. ,,
(5) ,, 9 cwt. ,,
(6) ,, 12 cwt. ,,
(7) Control (No manure)

Varieties tested:

(1) Adt. 10 (Susceptible)
(2) Co. 11 (Moderately resistant)

Replications: 6
Size of main plot: 20' x 10'
Size of sub-plot: 20' x 5'
Spacing between rows: one foot.
Spacing between plants in rows: 6 inches.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)		Incidence of neck infection (in percentage).		Yield of grain in ounces	
		Adt. 10	Co. 11	Adt. 10	Co. 11	Adt. 10	Co. 11
1.	Amm. sulphate 2 cwt.	30·0	0·0	6·5	0·2	119·2	121·0
2.	,, ,, 3 cwt.	52·0	3·7	13·0	0·0	133·3	124·5
3.	,, ,, 4 cwt.	120·5	4·7	19·7	0·2	132·3	134·0
4.	Groundnut cake 6 cwt.	35·1	0 0	6·1	0·2	123·7	124·7
5.	,, 9 cwt.	46·5	3·3	11·3	0 1	134·5	125·8
6.	,, 12 cwt.	102·3	4 0	20·6	0·2	137·0	149·7
7.	Control (No manure)	27·5	0·0	7·0	0·1	103·0	111·8
	Standard Error:	6·9		1·1		4·1	
	Critical difference:	20·4		3·2		12·0	
	Significance at 5 percent level:	Yes		Yes		Yes	

TABLE V.

Effect of varying levels of nitrogen on the incidence of disease, 1948-49.

Layout: Split plot design (Randomized block)

Treatments:

(1) Amm. sulphate 2 cwt. per acre.
(2) ,, 4 cwt. ,,
(3) ,, 6 cwt. ,,
(4) Groundnut cake 6 cwt. ,,
(5) ,, 12 cwt. ,,
(6) ,, 18 cwt. ,,
(7) Control (No manure)

Varieties tested:

(1) Adt. 10 Susceptible)
(2) Co. 4 (Resistant)
(3) Co. 25 ,,
(4) Co. 26 ,,

Replications: 4
Area of plot: 18' x 8'
Spacing between rows: one foot.
Spacing between plants in rows: 6 inches

S. No.	Treatments	Incidence of leaf infection (Category values assigned.)				Incidence of neck infection (in percentage.)				Yield of grain in ounces.			
		Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26
1.	Amm. sulphate 2 cwt.	0 0	0·0	0·0	0·0	0·0	0·0	0·0	0 0	160·8	181·5	187·5	161.5
2.	,, 4 cwt.	0·0	0 0	0·0	0·0	0 0	0·0	0 0	0 0	198·8	210·0	211·8	216·3
3.	,, 6 cwt.	0·0	0·0	0·0	0·0	0·0	0·0	0 0	0 0	259·8	222·3	219·8	284·5
4.	Grundnut cake 6 cwt.	0 0	0·0	0·0	0 0	0·0	0 0	0·0	0 0	164·8	175·0	189·3	180·0
5.	,, 12 cwt.	0·0	0·0	0 0	0·0	0·0	0·0	0 0	0·0	234·3	217·3	240·8	219·0
6.	,, 18 cwt.	0·0	0 0	0·0	0·0	0·0	0·0	0·0	0·0	302 8	223·8	281·0	268·0
7.	Control (No manure)	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	113·0	151·0	136·5	121·9
	Standard Error:										6·06		
	Critical difference:										17·09		
	Significant at 5 percent level										Yes.		

The leaf and neck infection in both susceptible and resistant varieties was negligible this year owing to unfavourable weather conditions

TABLE VI.

Effect of varying levels of nitrogen on the incidence of disease, 1949—'50

Layout: Split plot design (Randomized blocks)

Treatments:

(1) Ammonium sulphate 2 cwt. per acre.
(2) ,, 4 cwt. per acre.
(3) ,, 6 cwt. ,,
(4) Groundnut cake 6 cwt. ,,
(5) ,, 12 cwt. ,,
(6) ,, 18 cwt. ,,
(7) Control (No manure)

Varieties tested:

(1) Adt. 10 (Susceptible)
(2) Co. 4 (Resistant)
(3) Co. 25 ,,
(4) Co. 26 ,,

Replications: 4.
Size of plot: 18' x 8'.
Spacing between rows: one foot.
Spacing between plants in rows: 6 inches.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)				Incidence of neck infection (in percentage				Yield of grain in pounds.			
		Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26
1.	Amm. sulphate 2 cwt.	0·0	0 0	0·0	0·0	0 0	0 0	0·0	0·0	12·3	13·5	14·9	14·9
2.	,, ,, 4 cwt.	0·0	0·0	0·0	0·0	0·0	0·0	0 0	0·0	12·8	13 6	17·3	15·5
3.	,, ,, 6 cwt.	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0 0	13·8	14·6	17·8	17·3
4.	Groundnut cake 6 cwt.	0·0	0·0	0·0	0·0	0·0	0 0	0·0	0·0	12·6	13·6	14·8	15·3
5.	,, ,, 12 cwt.	0·0	0·0	0·0	0 0	0·0	0·0	0 0	0 0	14·7	14·7	15 S	15·7
6.	,, ,, 18 cwt.	0·0	0·0	0·0	0·0	0·0	0 0	0·0	0·0	15·8	15·0	18·6	16·4
7.	Control (No manure)	0·0	0 0	0·0	0 0	0·0	0·0	0·0	0·0	1·2	12·0	13·7	14·2

Standard Error:	0·43
Critical difference:	1·21
Significance at 5 per cent level	Yes

The leaf and neck infection in both the susceptible and resistant varieties was negligible this year owing to unfavourable weather conditions.

TABLE VII.

Effect of varying levels of nitrogen on the incidence of disease, 1950—'51

Details as in Table VI above.

S. No.	Treatments	Incidence of leaf infection (Category values assigned)				Incidence of neck infection (in percentage)				Yield of grain in pounds			
		Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26	Adt. 10	Co. 4	Co. 25	Co. 26
1.	Amm. sulphate 2 cwt.	293·5	0·0	2·0	2·0	82·4	0·0	0·0	0·0	3·3	16·1	18·3	17·7
2.	,, ,, 4 cwt.	352·5	0·0	4·5	3·0	87·5	0 0	0·0	0·0	2·3	18·1	20·9	19·6
3.	,, ,, 6 cwt.	420·0	0·0	13·0	12·0	90·3	0·0	0·02	0·0	1·7	17 9	19·5	20·0
4.	Groundnut cake 6 cwt.	235·5	0·0	5·0	3·0	70·9	0·0	0·0	0·01	5·5	15·0	17·5	15·9
5.	,, 12 cwt.	357·5	0·0	0·0	5·0	85·3	0·0	0·0	0·0	2·3	17·9	19 8	18·3
6.	,, 18 cwt.	410·0	0·0	8·0	7·5	89·3	0 0	0 0	0·01	2·4	18·2	20·5	19·5
7.	Control (No manure)	193·0	0·0	0·0	0·5	63·4	0·0	0·0	0·0	6·0	14·4	18·2	16·9

Analysis of neck infection:

Critical difference: 3·0 (For comparing manures with in Adt. 10 alone)
Critical difference: 2·24 (For comparing varieties)
Critical difference: 3·25 (For comparing any two manures)

In this experiment there is infection only in Adt. 10; in the other three resistant varieties the infection is practically nil. Therefore the results of the Adt. 10 alone are analysed and given separately and this may be taken as valid.

Conclusions: The main plot treatments, namely, the manurial treatments appear to be significant with respect to neck infection. When this is broken up into different components:

(1) Overall response to manure is found to be highly significant, indicating that manuring with nitrogenous manures induces the disease.

(2) 'Form of manure' is not significant, indicating that there is no difference between the two forms of manures namely, ammonium sulphate and groundnut cake.

(3) The significant effect due to levels of nitrogen was broken up into linear and quadratic effects. The linear effect being significant, it may be concluded that the disease increases in a linear fashion with the increase in levels of nitrogen, irrespective of the form in which it is applied.

Analysis of Adt. 10 only as randomised block design:

Critical difference: 13·1.

Bar diagram

Control	A. S. 2 cwt,	A. S. 4 cwt.	A. S. 6 cwt.
63·4	82·4	87·5	90·3

The conclusion from this analysis is the same as given above, where it is analysed on the basis of split plot design.

Analysis of grain yield: Critical difference: 0·96 (for comparing varietal means).

Conclusion: The differences due to manures are not significant. This may be due to the higher incidence of neck infection at higher levels of nitrogen, which consequently reduces the yield in the susceptible variety Adt. 10.

Series II – Effect of application of varying levels of potash and phosphorus alone and in combination with each other.

The object of the experiment was to find out if the application of corresponding levels of potash and phosphorus will offset the effect of application of excessive doses of nitrogen, which results in increased incidence of blast.

The preliminary experiments relating to this aspect were first carried out in pots but as it was found that the spread of disease was erratic, the experiments were later laid out in the field where conditions were more favourable for uniform spread of the disease in all the experimental plots. The experiments were carried out for three years.

Material and Methods: The variety chosen for this experiment was Adt. 10, a variety highly susceptible to blast disease. The manures applied were ammonium sulphate at three levels to supply 20, 40 and 60 pounds of nitrogen and potassium sulphate at three levels to supply 43, 86 and 129 pounds of K_2O and superphosphate at three levels to supply 22, 44 and 66 pounds of P_2O_5, per acre.

RESULTS.

TABLE VIII.

Effect of varying levels of nitrogen, potash and phosphorus on the incidence of blast disease and grain yield, 1948—49.

Layout: Randomized blocks.
Treatments: 19
Replications: 8
Variety: Adt. 10.
Area of plots: 4' x 3'
Spacing between rows: one foot.
Spacing between plants in rows: 3 inches.

S. No.	Treatments	Incidence of leaf infection.	Percentage of neck infection.	Yield of grain in ounces.
1.	Amm. sulphate 1 cwt. per acre.	0·0	0·0	36·4
2.	,, 2 cwt. ,,	0·0	0·0	36·4
3.	,, 3 cwt. ,,	0·0	0·0	43·1
4.	Potassium sulphate 1 cwt. per acre	0·0	0·0	33·9
5.	,, 2 ,,	0·0	0·0	31·5
6.	,, 3 ,,	0·0	0·0	31·9
7.	Superphosphate 1 cwt. per acre	0·0	0·0	32·1
8.	,, 2 ,,	0·0	0.0	33·0
9.	,, 3 ,,	0·0	0·0	32·8
10.	N3 K1	0·0	0·0	41·5
11.	N3 K2	0·0	0·0	39·8
12.	N3 K3	0·0	0·0	37·8
13.	N3 P1	0·0	0·0	40·4
14.	N3 P2	0·0	0·0	43·5
15.	N3 P3	0·0	0·0	36·8
16.	N_3 K_1 P_1	0·0	0·0	34·8
17.	N3 K2 P2	0·0	0·0	35·5
18.	N3 K3 P3	0 0	0·0	39·1
19.	Control (No manure)	0·0	0·0	27·0
	Standard Error;			3·47
	Critical difference:			6·91
	Significance at 5 per cent level.			Yes.

The leaf and neck infection was negligible owing to unfavourable weather conditions this year.

TABLE IX.

Effect of varying levels of nitrogen, potash and phosphorus on the incidence of blast and grain yield, 1949—50.

Details as given in Table VIII.

S. No.	Treatments	Incidence of leaf infection	Percentage of neck infection	Yield of grain in ounces
1	Amm. sulphate 1 cwt. per acre	0 0	0 0	33·8
2	,, ,, 2 cwt. ,,	0 0	0·0	39·4
3	,, ,, 3 cwt. ,,	0·0	0 0	38·5
4	Potassium sulphate 1 cwt. per acre	0·0	0·0	35·8
5	,, ,, 2 cwt. per acre	0·0	0·0	31·5
6	,, ,, 3 cwt. per acre	0·0	0·0	33·5
7	Superphosphate 1 cwt. ,,	0·0	0·0	34·4
8	,, ,, 2 cwt. ,,	0 0	0 0	35·0
9	,, ,, 3 cwt. ,,	0·0	0·0	35·8
10	N3 K1	0·0	0 0	40·8
11	N3 K2	0·0	0·0	40·3
12	N3 K3	0·0	0 0	39·0
13	N3 P1	0·0	0·0	43·1
14	N3 P2	0·0	0 0	36·9
15	N3 P3	0·0	0 0	41·5
16	N3 K1 P1	0 0	0·0	41·9
17	N3 K2 P2	0·0	0·0	40·0
18	N3 K3 P3	0·0	0·0	44·0
19	Control (No manure)	0·0	0 0	34·0
	Standard Error :			2·54
	Critical difference :			7·10
	Significance at 5 per cent level :			Yes

The leaf and neck infection was negligible this year, owing to weather conditions that were unfavourable for the development of the fungal parasite.

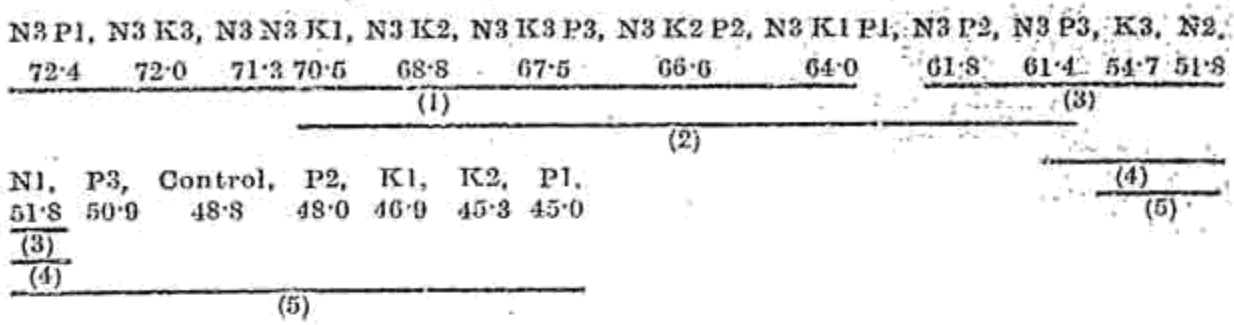
TABLE X.

Effect of varying levels of nitrogen, potash and phosphorus on the incidence of blast and grain yield, 1950—51.

Details given as in Table IX.

S. No.	Treatments	Incidence of leaf (Category values assigned)	Percentage of neck infection	Yield of grain in ounces
1	Ammonium sulphate 1 cwt. per acre	249	51·8	14·1
2	,, ,, 2 cwt. ,,	475	51·8	13·9
3	,, ,, 3 cwt. ,,	720	71·3	13 3
4	Potassium sulphate 1 cwt. ,,	249	45·0	15·9
5	,, ,, 2 cwt. ,,	306	48·0	11·7
6	,, ,, 3 cwt. ,,	252	50·9	13·9
7	Superphosphate 1 cwt. ,,	275	46·9	13·4
8	,, ,, 2 cwt. ,,	271	45·3	15 8
9	,, ,, 3 cwt. ,,	291	54·7	11·9
10	N3 K1	631	70·5	12·3
11	N3 K2	740	68·8	13·1
12	N3 K3	679	72·0	12·3
13	N3 P1	717	72·4	13·9
14	N3 P2	705	61·8	18·2
15	N3 P3	727	61·1	15·2
16	N3 K1 P1	745	64·0	13·2
17	N3 K2 P2	735	66·6	12·5
18	N3 K3 P3	765	67·5	15·4
19	Control (No manure)	222	48·8	14·9
	Critical difference :		10·0	2·17
	Significance at 5 per cent level		Yes	Yes

Bar diagram for neck infection.



Discussion. The results of the above experiments show that in years when the disease is absent increase in yields due to manuring is seen in both the susceptible and resistant varieties. In years of heavy infection the application of increasing levels of nitrogen beyond a certain level increases the incidence of blast in the susceptible variety Adt. 10. In the case of moderately susceptible varieties the same tendency is noticed but in respect of the three resistant varieties it is noteworthy that even in years when heavy incidence was recorded in the control variety, a dosage of 120 pounds of nitrogen per acre over a basal dressing of 5000 pounds of green leaf had no effect in breaking down their resistance. Under the conditions of the experiment, potash and phosphorus do not seem to exert any influence on the incidence of the disease nor there is any indication that they are able to off-set the effects of excessive nitrogenous manuring.

Stakman and Aamodt (1924) carried out experiments on the effect of various soil nutrients in relation to the incidence of stem rust of wheat (*Puccinia graminis triticii*). Their results showed increased incidence of disease in plots receiving higher doses of nitrogenous fertilisers under certain conditions. In their experiments the harmful effects of excessive nitrogenous fertilization were not counteracted either by acid phosphate or by potassium. They concluded from these observations, that nitrogenous fertilizers did not alter the inherent resistance or susceptibility of the host plant but only altered the external conditions which favoured the development of the disease. Nitrogenous manuring favoured vegetative growth which increased the density of the stand, providing favourable microclimatic conditions for the development of the disease. It also delayed the maturity of the plants allowing for a longer period of exposure to infection. Hursh (1924) as a result of his anatomical studies of material grown under varying manurial treatments, came to the conclusion that nitrogen has the effect of reducing the sclerenchyma and increasing the collenchyma tissues of the plant which result in increasing the susceptibility of the plant to the disease. Gassner and Hassebrank (1931) found that nitrogen promoted the development of rust, especially when it was applied in excess of potash and phosphoric acid. Phosphoric acid in excess over potash and nitrogen was condusive in increasing the resistance to rust. Sawada (1937) found profound anatomical changes in the leaf and stem as a result of excessive nitrogenous manuring which had the effect of increased susceptibility of the plants to infection.

Anatomical studies made at Coimbatore by the writer and his colleagues have showed that the number of silicated epidermal cells tends

to get reduced with increasing levels of nitrogen applied. It is also possible that C/N ratio is altered with a higher nitrogen content of the cells, which favours the development of the disease. But further studies in this direction are indicated. It would appear therefore that increased susceptibility induced by nitrogen is at least partly due to the structural alteration of the host plant which modifies its resistance to penetration and development of the pathogen.

As regards the practical importance of the findings, it is evident that great care should be exercised in the application of nitrogenous manures in tracts where the disease is prevalent and susceptible varieties are grown. The results of the above experiments show that excessive nitrogen, irrespective of the form in which it is applied, either organic or inorganic, has the effect of increasing the incidence in the susceptible variety. In the resistant varieties, even very high doses of nitrogen do not appreciably alter their powers of resistance and the safety limit is beyond the quantity of nitrogen that is likely to be applied to the rice crop under South Indian conditions.

Summary: A series of field experiments were carried out at Coimbatore with the object of ascertaining the effect of application of varying levels of nitrogen, phosphorus and potash on the incidence of 'blast' disease of rice caused by *Piricularia oryzae* Cav. The results of the experiments showed that application of increasing levels of nitrogen increased the incidence of disease in the susceptible variety Adt. 10. Plots receiving a dose of 20 pounds of nitrogen per acre over a basal dose of 5,000 pounds of green leaf however did not show higher incidence than the control plots which received only the basal dose of manure. The effect of application of nitrogen either in the form of ammonium sulphate or groundnut cake were more or less the same in all the experiments. In the resistant vearieties namely, Co. 4, Co. 25 and Co. 26 the application of nitrogen upto 120 pounds per acre did not result in increased incidence of the disease. Under the conditions of the experiment, potash and phosphorus did not appear to exert any appreciable influence on blast disease, either by themselves or in combination with nitrogen.

Acknowledgements: The scheme under which the above work was done is partly financed by the Indian Council of Agricultural Research and partly by the Government of Madras and the author wishes to express his indebtedness to both of them for the facilities provided. Acknowledgements are due to the Statistician, Indian Council of Agricultural Research for the scrutiny of the statistical analyses and the staff of the Paddy Blast Scheme for help rendered in laying out the experiments and in recording observations and to Mr. K. M. Thomas and Sri. D. Marudarajan, for helpful suggestions.

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