

QUANTITATIVE CHANGES IN NITROGEN CONTENT DUE TO LIGNITE HUMIC ACID APPLICATION

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ABSTRACT

The effect of LHA at graded levels viz., 0, 10, 20, 30 and 40 kg/ha and *Pyricularia oryzae* inoculation on the alteration of nitrogen content (Total and amino nitrogen) of leaves of rice varieties IR 50 (Blast susceptible) and IR 20 (Moderately resistant) was studied under the pot culture condition. It was observed that LHA upto 20 kg/ha increased the content of total nitrogen levels and thereafter it gradually decreased in both the varieties tested. Pathogen inoculation also increased the native nitrogen content of leaves in both IR 50 and IR 20. Whereas, amino nitrogen content in both the varieties decreased upto 20 kg level and thereafter in increasing trend was observed. Invariably inoculation of leaves with blast pathogen decreased the content of amino nitrogen.

KEY WORDS: *Nitrogen content, Humic acid, Blast Infection*

Nitrogenous compounds are vital for the growth and multiplication of invading pathogens. Changes in nitrogen metabolism during pathogenesis has been reported widely. Reduced amino nitrogen and increased total nitrogen content usually confer resistance to plant pathogens (Sridhar, 1975; Jayaraj et. al., 1989b). The application of LHA has been reported to be involved in the uptake of several macro and micro nutrients of crop plants. Hence it was tried to explore the possible role of LHA application on the changes in nitrogen contents and the resultant reaction to blast pathogen in two rice varieties IR 50 and IR 20.

MATERIALS AND METHODS

This investigation was carried out under the pot culture condition. The varieties chosen were IR 50 (susceptible to blast) and IR 20 (moderately resistant). Humic acid was extracted from lignite (Neyveli mines) according to the fractionation procedure by Stenvenson (1965). Required quantity of LHA was dissolved in 0.01 KoH for converting it to potassium humate (at pH 7). The respective solutions were poured in the pots filled with clay soil and mixed thoroughly. Previously the recommended dose fertilizers were applied. On 50th day after sowing the plants were inoculated with the spore suspension prepared from 7 days old, OMA grown, virulent

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pyricularia oryzae culture. Sampling was done on the 0, 7, 14 and 21 days after inoculation and the amino nitrogen (Moore and Stein, 1968) and total nitrogen (Bremner, 1960) contents were estimated.

RESULTS AND DISCUSSION

Generally LHA application reduced the amino nitrogen levels significantly in both the varieties. However it was more in IR 50 (6.36 mg/g) compared to IR 20 (5.81 mg/g). The content of amino nitrogen decreased gradually at all levels of LHA tested and maximum mean content was noted at 'O' level and the minimum at 20 kg level. The amino nitrogen level gradually decreased in both the varieties with rise in plant age. Pathogen inoculation significantly increased the level of amino nitrogen in both the varieties. However it was more in IR 50 recording 7.27 mg/g than that of IR 20 (6.28 mg/g) (Table-1). Total nitrogen content however increased due to LHA application unlike amino nitrogen in both the varieties. Compared to IR 50 (12.65 mg/g), IR 20 recorded the maximum amount of total nitrogen (14.62 mg/g). Among the levels of LHA tested 10 and 20 kg levels increased the total nitrogen content recording 14.18 and 14.32 mg/g respectively. Thereafter it decreased to 13.79, 13.24 and 12.63 mg/g at 30, 40 and 'O' levels of HA, recording the minimum at 'O' level. Invariably upto 7th day, the content of total nitrogen marked by increased and then decreased gradually with rise in plant age. *Pyricularia oryzae* inoculation augmented the total nitrogen level in the

leaves of both the varieties. However the amount of total nitrogen was more in IR 20 (15.60 mg/g) than that of IR 50 (14.19 mg/g) (Table 2).

Alterations in the soluble and insoluble nitrogenous compounds in response to pathogenic invasion was studied by several workers (Rao et.al., 1979 and Kamlesh et. al., 1987). Amino acids acted as building blocks for the cellular synthesis of the host and pathogens. The decreased amino nitrogen levels at optimal dose (20 kg/ha) of LHA application might have provided resistance to the host against the disease through,

- (i) Reduced amino acid synthesis
- (ii) Diversion of free amino acids for protein synthesis
- (iii) Synthesis of phenols and indole compounds from the aromatic amino acids
- (iv) Increasing the efficiency of phenols and their activity. Paradoxically the toxicity of phenols was reduced when the tissues contained excess of amino nitrogen, which intum made the plant prone to the disease (Flood and Kirkham, 1960).

The increased total nitrogen content due to humic acid application might be due to the enhanced synthesis of proteins and organic nitrogenous compounds such as enzymes and non-enzymatic proteins in the host. According to Guminski (1968) humic acid application had a definite impact on the protein synthesis and nucleic acid synthesis. They get intensified under the influence of LHA

Table 1. Effect of different levels of humic acid and *P. oryzae* inoculation on amino nitrogen*

Varieties Vs HA levels

Varieties HA levels	Healthy				Mean	Inoculated				Mean		
	H ₀	H ₁	H ₂	H ₃		H ₄	H ₀	H ₁	H ₂		H ₃	H ₄
V ₁	6.75	6.20	6.09	6.42	6.42	6.36	8.08	7.04	6.51	7.28	7.43	7.27
V ₂	6.25	5.59	5.37	5.84	5.99	5.81	6.94	5.93	5.71	6.31	6.50	6.28
Mean	6.50	5.90	5.73	6.10	6.20		7.51	6.49	6.11	6.80	6.96	

CD - HA levels = 0.012

Interaction = 0.017

Varieties Vs sampling intervals (Plantage)

Varieties Sampling Intervals	Healthy				Mean	Inoculated				Mean
	D ₀	D ₁	D ₂	D ₃		D ₀	D ₁	D ₂	D ₃	
V ₁	6.87	6.34	6.17	6.08	6.36	6.87	7.87	7.18	6.65	7.27
V ₂	6.11	5.88	5.70	5.53	5.81	6.11	6.61	6.40	5.99	6.28
Mean	6.49	6.11	5.94	5.81		6.49	7.24	7.04	6.32	

CD - Healthy Inoculated

Varieties - 0.002 - 0.001

Sampling - 0.005 - 0.005

Intervals Interaction - 0.008 - 0.008

Sampling intervals Vs HA levels

Samplings HA levels intervals	Healthy					Mean	Inoculated					Mean
	H ₀	H ₁	H ₂	H ₃	H ₄		H ₀	H ₁	H ₂	H ₃	H ₄	
D ₀	7.29	6.20	6.11	6.35	6.50	6.49	7.29	6.20	6.11	6.35	6.50	6.49
D ₁	6.40	5.95	5.80	6.16	6.23	6.11	7.85	7.00	6.40	7.39	7.57	7.24
D ₂	6.21	5.79	5.59	6.00	6.11	5.94	7.70	6.81	6.08	7.25	7.38	7.04
D ₃	6.10	5.65	5.42	5.89	5.99	5.81	7.20	5.93	5.85	6.20	6.41	6.32
Mean	6.50	5.90	5.73	6.10	6.20	6.20	7.51	6.49	6.11	6.80	6.96	6.96

CD = Sampling intervals = 0.005

Interaction = 0.024

* Intems. of glutamic acid equivalents in mg/g of oven dry tissue.

Table 2. Effect of different levels of Humic acid and *P. oryzae* inoculation on total nitrogen* Varieties Vs HA levels

Varieties HA levels	Healthy				Inoculated				Mean			
	H ₀	H ₁	H ₂	H ₃	H ₄	H ₅	H ₆	H ₇		H ₈		
V ₁	11.64	13.11	13.28	12.89	12.32	12.65	13.10	14.57	14.74	14.42	14.13	14.19
V ₂	13.62	15.25	15.35	14.69	14.17	14.62	14.41	16.36	16.68	15.66	14.92	15.60
Mean	12.63	14.18	14.32	12.79	13.24	13.76	15.46	15.71	15.04	14.53,		

CD = HA. levels = 0.001

Interaction = 0.016

Varieties Vs sampling intervals (Plantage)

Varieties Sampling Intervals	Healthy				Inoculated				Mean	
	D ₀	D ₁	D ₂	D ₃	D ₀	D ₁	D ₂	D ₃		
V ₁	12.63	12.78	12.64	12.55	12.65	12.63	14.58	14.74	14.82	14.19
V ₂	14.45	15.12	14.48	14.42	14.62	14.45	15.92	16.00	16.04	15.60
Mean	13.54	13.95	13.56	13.48	13.54	15.25	15.37	15.43		

CD = Healthy Inoculated

Varieties - 0.005 0.006

Sampling intervals - 0.008 0.008

Interaction - 0.011 0.011

which influenced greatly the plant growth and health. In addition LHA application also increased the uptake of various nutrient elements especially, N, K and

Ca which had an unique influence over total nitrogen content and protein synthesis.

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