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STUDY OF IMPACTS OF PLANT DISEASE ON GROWTH RATE PARAMETERS OF RICE PLANT IN TERMS OF AGR, RGR AND NAR

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ABSTRACT: Rice is the most important food crop of the developing world. Reduction in growth and photosynthetic activity are among the most conspicuous effects of disease. Present investigation is aimed to study the effect of blast pathogen on photosynthetic efficiency of paddy plant, in terms of Absolute Growth Rate (AGR), Regulatory Growth Rate (RGR) and Net Assimilatory Rate (NAR).

KEYWORDS: Photosynthetic efficiency, Growth Rate, rice blast, foliar, diseases, AGR, RGR, NAR

I.INTRODUCTION

Rice is the most important food crop of the developing world. To feed the increasing global population the world's annual rice production must increase from the present 520 x 106 tons to 760 x 106 tons by the year 2020. (Mahaddesi *et al* 2011). Rice Blast is a major foliar disease of rice growing area, interfere with the physiological and biochemical processes of healthy plant Growth is conspicuous characteristic of a living being. Reduction in growth and photosynthetic activity are among the most conspicuous effects of disease. Foliar diseases like blast can influence photosynthesis (hence growth), through affecting total leaf area itself. In rice, optimum leaf area to maximize photosynthetic efficiency and growth rate of crop at various parameters had been identified as the major determinants of yield (Sun *et al*1999). Present investigation is aimed to study the effect of blast pathogen on photosynthetic efficiency of paddy plant, in terms of Absolute Growth Rate (AGR), Regulatory Growth Rate (RGR) and Net Assimilatory Rate (NAR).

II.MATERIAL AND METHODS

Plant physiology of healthy and *P. oryzae* infected plants was studied, during the growth period from 30- 60, 60-90 and 90-120 days in terms of photosynthetic efficiency. Growth rates were calculated in the terms of Absolute growth rate (AGR), Regulatory Growth Rate (RGR), and Net Assimilatory Rate (NAR). To calculate the growth rate, plant dry weights (PW1 and PW2) of aerial parts had taken at the beginning and end of time intervals t1 and t2 at the intervals of 30 to 60, 60- 90 and at 90-120 days interval. The growth rates were calculated by using following formulae :- (Radford, 1967)

Where

AGR = Absolute Growth Rate

W_2 = Plant weight at t_2 time in mg.

W_1 = Plant weight at t_1 time in mg.

T_1 = Time at initial level i.e. '0' days

T_2 = Time after day interval i.e. '30' days

RGR = Relative Growth Rate

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Here Log values of plant weight at the different intervals were used. The log values are having its base 'e'

Where

NAR = Net Assimilatory Rate

La_1 = Leaf area /Plant in cm^2. at initial time period

La_2 = Leaf area / Plant in cm^2.at final time period

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III.OBSERVATION

The investigation was analyzed in both healthy and blast infected rice plants and results are presented in the tables. Absolute Growth Rate (AGR), Relative Growth Rate (RGR) and Net Assimilatory Rate (NAR) was analyzed to represent the effect of blast disease on photosynthetic efficiency of the rice plant.

Table– Effect of *Pyricularia oryzae* on photosynthetic efficiency of *Oryza sativa* cultivar-Pusa Basmati-1121. (Observations are mean of three replicates): -

S.N	Growth Value	Plant Type	30 to 60 Days	decrease over healthy control (%)	60 to 90 Days	decrease over healthy control (%)	90 to 120 Days	decrease over healthy control (%)	Mean
1	**AGR** mg/d	**H**	11.06	27.12	16.56	28.56	25.26	27.55	27.74
		I	8.06		11.83		18.3		
2	**RGR** d-1	**H**	0.33	18.18	0.22	9.09	0.18	5.55	10.94
		I	0.27		0.20		0.17		
3	**NAR** $mgcm^2$ d^{-1}	**H**	0.504	7.34	0.347	8.08	0.404	5.05	6.82
		I	0.467		0.319		0.384		

H = Healthy ;I=Infected
AGR=Absolute Growth Rate (mg day^{-1}) ;RGR= Relative Growth Rate (day^{-1});NAR= Net Assimilatory Rate (mg cm^{-2} d^{-1})

IV.RESULT AND DISCUSSION

Data depicted in Table revealed that there was an increase in Absolute Growth Rate during progressive growth of the plant .When growth rates of the healthy plant was compared with infected plant at the same growth stage (at 30-60, 60-90 and 90-120 days) there was significant decline in the values of AGR at every growth stage. The value of AGR calculated to be 11.06mg/days at 30 -60 days of growth of rice plant, followed by 16.56mg/day and 25.26mg/day as the growth progresses from 60-90 days and from 90-120 days respectively. When values of AGR of healthy plants were compared with the infected condition, there was significant decline in value i.e. from 11.06mg/day to 8.06mg/day at 30-60 days, 16.56mg/day to 11.83mg/day at 60-90 days and from 25.26mg/day to 18.30mg/day at 90 -120 days as shown in the table-7.

In the present investigation relative growth rates were found to be inversely proportional to the time factor that is, as the plant growth progressed, reduction in the values of RGR was observed. As shown in the Table the value of RGR was 0.33 $d^{-1,}$ at 30-60 days, 0.22 d^{-1},at 60-90 days and 0.18 d^{-1} at 90-120 days of growth in healthy plants .The values of RGR in infected plants were 0.27 d^{-1} at 30-60 days ,0.20 d^{-1} at 60-90 days and 0.17 d^{-1} 90-120 days of growth. On comparing the values of healthy plant with that of blast infected plants there was significant decline in the values of RGR. The values of RGR thus observed were declined from 0.33 d^{-1} to 0.27 $d^{-1}0^{1}$ at 30-60 days, 0.22 d^{-1} to 0.20 d^{-1} at 60-90 days and 0.18 d^{-1} to 0.17 d^{-1} at90-120 days of growth.

NAR or Net Assimilatory rate is the true photosynthetic efficiency of a plant. The value of NAR investigated in healthy plants found to be 0.504 mg /cm^2d at 30-60 days, 0.347 mg /cm^2d at 60-90 days and 0.404 mg /cm^2d at 90-120 days of growth period. The values calculated in infected plants were 0.467 mg /cm^2d at30-60 days, 0.319 mg /cm^2d at 60-90 days, 0.384 mg /cm^2d at 90-120 days of growth period. When a comparison was made in the values of NAR between healthy and blast infected plant, there seemed to be decline in respective NAR values as shown in Table-7. The values

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of NAR thus observed were declined from 0.504 mg /cm^{2}d to 0.467 mg /cm^{2}d at 30-60 days, 0.347 mg /cm^{2}d to 0.319 mg /cm^{2}d at 60-90 days and 0.404 mg /cm^{2}d to 0.384 mg /cm^{2}d at 90-120 days of growth. Green leaves and dry matter production per plant were found to be reduced with the increase in diseased condition. The above results were similar as observed by Penj *et al* (1999), Dutta *et al* (2002) and Horie (2003). Sachiko *et al* (1997) who examined the effect of Tobacco Leaf Curl Virus (TLCV) infection on *Eupatorium makinoi* (Compositae family) and observed lowered growth rates. Among growth components, productive tillers, number of panicles and amount of grains in panicles are very important .because the final growth is mainly a function of the number of panicles bearing tillers per unit area but in diseased condition the number of panicles bearing tillers per unit area decreases so it may result in the reduction of growth rates

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