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Effect of nitrogen fertilizer on progressive maturity of panicle in rice

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ABSTRACT

A decline in the activity of Succinic dehydrogenase in rice grain was evident during progressive maturity of panicle in all the treatments of nitrogen i.e., N source and N dose as top dressing at 10 days before flowering (DG) with concomitant increase in panicle weight. The ammoniacal source of nitrogen as against nitrate nitrogen exhibited delayed progressive maturity of panicle resulting retention of higher Succinic dehydrogenase activity in grain and greater panicle weight tiller^{-1}. However, application of higher dose of nitrogen was more effective in maintaining greater Succinic dehydrogenase activity in grain resulting in increase panicle weight tiller^{-1} in both the early rice varieties.

Key words: *Nitrogen, maturity of panicle, Succinic dehydrogenase*

The application of higher nitrogen input retarded rate of panicle senescence during ripening period. High nitrogen dose increased the photosynthetic ability in leaf during ripening period. High nitrogen dose increased the photosynthetic ability in leaf and mobilization of carbohydrates to grains and enhanced the filling of grains (Yamada *et al.,* 1957 and Murata, 1969). Higher nitrogen level increased the number of glumes formed as well as production of carbohydrate (Yamada *et al.,* 1957).

The response to high dose of nitrogen (160 kg n ha^{-1}) over that of 80 kg N ha^{-1} was mostly associated with increased panicle number hill^{-1}. (Sahu and Murty, 1975). It has been reported that the N use efficiency of ammoniacal nitrogen was higher than nitrae nitrogen in rice grown under submerged conditions (Datta *et al.,*).

The present investigation aims to find out the effective means of applying different sources and doses of nitrogen to delay leaf senescence during progressive maturity phase of panicle in two early rice varieties leading to enhanced average panicle weight. The study was undertaken during dry season of 2006 with two early rice varieties i.e., Ratna and Rasi grown in porcelain pots (with 9 kg of soil) under net house condition. The treatment consisted of application of two sources of nitrogen i.e., Ammonium sulphate, (NH4)2 SO_4 and Potassium nitrate, KNO_3 and three doses of nitrogen i.e., No, N1 (20 kg ha^{-2}) and N_2 (40 kg ha^{-1}) at 10 days before flowering (DF), over a basal dose of 50 kg N ha^{-1} applied at planting. Three pots variety^{-1} were taken for each treatment with three plants pot^{-1}. Uniform tillers those flowered synchronized were tagged. Panicle samples from tagged tillers were drawn at two weeks intervals from flowering to harvest i.e., at flowering, 14 DAF and 28 DAF (harvest).

The activity of Succinic dehydrogenase enzyme (SDH) in 100mg fresh plant tissues (grain) was assessed following Sato (1953). The related panicle weight (g) tiller^{-1} was also recorded during ripening stages and at harvest. There was a decline in the activity of Succinic dehydrogenase in grain under both N sources and N-doses. But concomitantly, there was an increase in average panicle weight tiller^{-1} in both early rice varieties during ripening stages with all treatments.

However, the ammoniacal source of nitrogen as against nitrate nitrogen exhibited delayed progressive maturity in panicle with retention of higher Succinic dehydrogenase activity in grain e.g. 347% and above more average panicle weight tiller^{-1} by 15.4%. the higher rate of nitrogen treatment i.e., N_2 dose was more effective in maintaining grater Succinic dehydrogenase activity in grain by 26.1% and increased the related panicle weight tiller^{-1} by 13% in both the early rice varieties during post flowering stages (Table 1).

Table 1. Progressive changes in the activity of Succinic dehydrogenate (SDH) in grain expressed as µg of Triphenyl Formazan (TPF) 100 mg^{-1} fresh weight and panicle weight of two rice varieties

Culture (V)	Stage (s)					
	Flowering		14 DAF		28 DAF	
	SDH in grain	PW tiller^{-1}	SDH in grain	PW tiller^{-1}	SDH in grain	PW tiller^{-1}
Ratna	0.66	0.30	0.52	1.10	0.39	1.48
Rasi	0.49	0.22	0.46	1.04	0.26	1.40
Mean	0.58	0.26	0.49	1.07	0.33	1.44
Ratna	0.59	0.27	0.44	0.94	0.32	1.22
Rasi	0.45	0.20	0.41	0.86	0.30	1.12
Mean	0.52	0.24	0.42	0.90	0.31	1.17
Ratna	0.73	0.33	0.63	1.27	0.43	1.54
Rasi	0.54	0.24	0.56	1.20	0.29	1.46
Mean	0.64	0.29	0.60	1.24	0.36	1.50
Ratna	0.66	0.30	0.49	1.04	0.33	1.27
Rasi	0.50	0.22	0.44	0.95	0.31	1.17
Mean	0.58	0.26	0.47	1.00	0.32	1.22
Ratna	0.91	0.41	0.73	1.46	0.52	1.87
Rasi	0.72	0.30	0.65	1.38	0.36	1.77
Mean	0.82	0.36	0.69	1.42	0.44	1.82
Ratna	0.82	0.37	0.57	1.20	0.40	1.54
Rasi	0.60	0.27	0.52	1.10	0.37	1.42
Mean	0.71	0.32	0.55	1.15	0.38	1.48
	N. Rate	N. Rate	N-Dose			
CD (P=0.05)	0.02	0.02	No=Control			
Variety (V)	0.01	0.02	N1= 20 kg N ha^{-1}			
Stages (S)	0.02	0.04	N2= 40 kg N ha^{-1}			
TXV	0.03	0.03				
SXV	0.03	0.05				

The delayed progressive maturity of panicle in two early rice varieties was evident by retention of higher Succinic dehydrogenaase activity in grains which lead to maintenance of more total N and protein N, more sink activity and better grain filling thus resulting in higher panicle weight with all the N-fertiliser (both source and dose) treatments.

There was a significant correlation between N-source, N-dose and average panicle weight tiller^{-1} at harvest in both rice varieties i.e., Ratna (r-0.916) and Rasi (r=0.702**)

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