New Agriculturist, **28**(2) : 517–528, 2017 http://biovedjournal.org/

Effect of split application of nitrogen and desiccant on yield and quality of rice (*Oryza sativa*)

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Received June 5, 2017 and Accepted August 7, 2017

ABSTRACT : Rice is a vital food crop because half the world's population feeds rice as a main part of their diets. It provides more calories per hectare than any other cereal grain. The yield components of rice are the number of panicles/unit area, number of spikelets/panicle, weight of spikelet and spikelet sterility or filled spikelet. Insufficient nitrogen supply in inappropriate timing is an important constraint to productivity of rice (*Oryza sativa* L.). A field experiment was conducted at Dighwadubauli, Baikunthpur, Gopalganj, Bihar during two consecutive *kharif* seasons of year 2009 and 2010, respectively to know the effect of split application of nitrogen and desiccant on yield and quality of rice. The experiment was conducted in split plot design replicated thrice. Treatments comprising of different ways of nitrogen splitting were put in the main plot and combinations of time of harvest and desiccants in the sub-plots. There were four treatments in the main plot and 12 treatments combination in the sub-plot making a total of 48 sub plots in each replication. The results showed that application of nitrogen at panicle initiation stage in rice enhanced maturity time by 4-5 days without any gain in yield. Nitrogen application at transplanting and active tillering stage in proportion of 50:50 or 25:75 was best for yield in rice cultivation. Application of 0.1% paraquat or 10% common salt solution did not affect yield and quality of rice adversely.

Key Words : Rice (*Oryza sativa*), split application of nitrogen, desiccant, yield, quality.

Table-1: Number of total tillers and effective tillers per meter square as affected by different treatment at harvest.

Treatments/Symbol	No. of total tillers			No. of effective tillers		
	2009	2010	Pooled	2009	2010	Pooled
Main plot : N-Splitting						
N_1 (75%B+25%AT)	312.08	324.03	317.61	283.80	297.66	290.73
N_2 (25%B+33%AT)	357.24	373.74	365.49	312.27	325.91	319.09
N_3 (50%B+50%AT)	351.72	370.93	361.33	316.61	333.49	326.05
N_4 (50%B+25%AT+25%PI)	309.36	316.69	313.02	276.30	290.11	283.20
S.E.	25.39	30.18	27.88	20.17	21.13	20.98
S.E. m±	12.69	15.08	13.94	30.08	10.56	10.48
Sub Plot : Time of Harvest:						
H_1 (25 DAF)	328.83	345.83	337.33	295.38	302.22	303.30
H_2 (30 DAF)	342.12	345.52	341.11	300.24	312.24	306.24
H_3 (35 DAF)	331.97	347.66	339.81	296.83	306.19	305.04
H_4 (40 DAF)	332.91	345.49	339.20	297.47	312.52	304.49
S.E.	5.71	1.03	1.57	2.04	4.75	1.22
S.E. m±	2.85	0.51	0.78	1.01	2.37	0.61
Desiccants:						
M_1 (Paraquat 0.1%)	339.13	345.88	340.61	297.20	312.57	305.26
M_2 (Common salt 10%)	327.97	347.88	339.13	297.78	311.32	302.68
M_3(Control)	331.63	342.72	338.34	298.26	311.49	305.55
S.E.	5.69	2.60	1.15	0.53	0.68	1.58
S.E. m±	3.28	1.50	0.66	0.30	0.39	0.91

B : Basal; AT- Active Tillering; PI : Panicle Initiation; DAF : Days After 50 per cent Flowering.

Table-2: Length of panicle (cm) and 1000-grain weight (g) as affected by different treatments.

Treatments / Symbol	Length of panicle			1000-grain weight		
	2009	2010	Pooled	2009	2010	Pooled
Main Plot : A. N.-Splitting :						
N_1 (75%B+25% AT)	20.66	21.21	20.94	21.49	21.42	21.46
N_2 (25%B+75% AT)	20.04	20.72	20.38	21.48	21.40	21.44
N_3 (50%B+50%AT)	20.18	21.11	20.64	21.47	21.29	21.38
N_4 (50%B+25%AT+25% PI)	20.30	21.37	20.83	21.50	21.37	21.44
S.E.	0.27	0.28	0.25	0.01	0.06	0.03
S.E. M±	0.13	0.14	0.12	0.00	0.02	0.01
Sub-plot : A. Time of harvest:						
H_1 (25 DAF)	20.22	21.13	20.68	20.56	20.52	20.54
H_2 (30 DAF)	20.50	21.08	20.79	21.77	21.60	21.69
H_3 (35 DAF)	20.14	21.05	20.60	21.81	21.69	21.75
H_4 (40 DAF)	20.31	21.37	20.83	21.78	21.66	21.72
S.E.	0.15	0.15	0.10	0.61	0.57	0.59
S.E. M±	0.07	0.07	0.05	0.29	0.28	0.29
Desiccants :						
M_1 (Paraquat 0.1%)	20.24	21.15	20.66	21.50	21.46	21.98
M_2 (Common salt 10%)	21.34	21.10	20.38	21.57	21.45	21.51
M_3 (Control)	20.34	21.06	20.65	21.51	21.45	21.48
S.E.	0.61	0.05	0.16	0.04	0.01	0.28
S.E. M±	0.35	0.02	0.09	0.02	0.00	0.14

B : Basal; AT : Active tillering; PI - Panicle initiation: DAF : Days after 50% flowering.

Table-3: Number of fertile and sterile spikelets per panicle as affect by different treatments.

Treatments / Symbol	No. of fertile spikelets			No. of sterile spikelets		
	2009	2010	Pooled	2009	2010	Pooled
Main Plot :A. N.-Splitting						
N_1 (75%B+25% AT)	76.26	80.07	78.16	6.84	7.41	7.12
N_2 (25%B+75% AT)	80.04	83.85	81.93	6.85	7.30	7.07
N_3(50% B+50% AT)	81.38	84.76	83.07	6.47	6.71	6.59
N_4 (50%B+25%AT+25% PI)	79.50	85.12	82.31	6.47	6.81	6.65
S.E.	2.17	2.32	2.19	0.22	0.35	0.28
S.E. M±	1.08	1.15	1.09	0.10	0.17	0.13
Sub- plot;						
A. Time of harvest						
H_1 (25 DAF)	76.82	80.59	78.70	9.34	9.86	9.60
H_2 (30 DAF)	79.63	83.98	81.81	5.93	6.32	6.13
H_3 (35 DAF)	80.80	84.74	82.77	5.70	6.05	5.88
H4 (40 DAF)	79.91	84.49	82.20	5.68	5.99	5.83
S.E.	1.72	1.93	1.82	1.79	1.88	1.83
S.E. M±	0.86	0.96	0.91	0.89	0.93	0.91
B. Desiccant :						
M1 (Paraquat 0.1%)	79.03	83.52	81.28	6.66	7.06	6.86
M2 (Common salt 10%)	79.48	83.39	81.44	6.66	7.074	6.85
M3 (Control)	79.36	83.44	81.40	6.67	7.07	6.87
S.E.	0.23	0.07	0.08	0.01	0.01	0.01
S.E. M±	0.13	0.03	0.04	0.00	0.00	0.00

B : Basal, AT : Active tillering, PI : Panicle initiation DAF : Days after 50% flowering.

Table-4: Grain yield as affected by different treatments**.**

Treatments/Symbol	Grain yield (q/ha)		
Main Plot : A. N.-Splitting :	**2009**	**2010**	**Pooled**
N1 (75% B+25% AT)	47.83	51.54	49.68
N2 (25% B+75% AT)	50.37	55.61	52.99
N3 (50% B+50% AT)	51.29	56.34	53.81
N4 (50%B+25%AT+25% PI)	48.98	54.74	51.85
S.E.	1.52	2.12	1.79
S.E. M±	0.76	1.05	0.89
Sub-plot			
A. Time of harvest:			
H1 (25 DAF)	46.84	51.04	48.83
H2 (30 DAF)	50.27	55.56	52.91
H3 (35 DAF)	51.07	56.22	53.64
H4 (40 DAF)	50.52	55.39	52.96
S.E.	1.92	2.37	2.20
S.E. M±	0.95	1.18	1.09
B. Desiccant :			
M1 (Paraquat 0.1%)	49.74	54.47	52.08
M2 (Common salt 10%)	49.06	54.77	52.12
M3 (Control)	49.68	54.42	52.05
S.E.	0.38	0.19	0.04
S.E. M±	0.21	0.10	0.02

B : Basal; AT : Active tillering: PI : Panicle initiation; DAF : Days after 50% flowering

Table-5: Straw yield as affected by different treatments.

Treatments Symbol	Straw yield (q/ha)		
Main Plot : A. N.-Splitting :	2009	2010	Pooled
N1 (75% B+25% AT)	52.84	57.15	54.91
N2 (25% B+75% AT)	55.65	60.62	58.15
N3 (50% B+50% AT)	56.61	61.97	59.12
N4 (50%B+25%AT+25% PI)	53.92	60.18	57.06
S.E.	1.69	2.03	1.81
S.E. M±	0.84	1.01	0.90
Sub-plot;			
A. Time of harvest:			
H1 (25 DAF)	53.04	57.80	55.43
H2 (30 DAF)	55.54	60.60	57.80
H3 (35 DAF)	55.58	60.81	58.20
H4 (40 DAF)	54.87	60.72	57.80
S.E.	1.19	1.46	1.27
S.E. M±	0.59	0.72	0.63
B. Desiccant :			
M1 (Paraquat 0.1%)	54.85	60.92	57.11
M2 (Common salt 10%)	54.66	60.59	57.53
M3 (Control)	54.75	60.67	55.30
S.E.	0.10	0.17	1.19
S.E. M±	0.05	0.09	0.68

B : Basal, AT : Active tillering, PI : Panicle initiation and DAF : Days after 50 per cent flowering.

Table-6: Hulling percentage of rough rice as affected by different treatments.

Treatments/Symbol	Original Value			Transformed value		
	2009	2010	Pooled	2009	2010	Pooled
Main Plot: A. N.-Splitting :						
N_1 (75% B+25% AT)	79.78	79.96	79.87	63.64	63.74	63.69
N_2 (25% B+75% AT)	79.99	80.05	79.88	63.72	63.81	63.76
N_3 (50% B+50% AT)	79.85	80.05	79.95	63.69	63.80	63.75
N_4 (50%B+25%AT+25% PI)	79.83	79.98	79.91	63.66	63.76	63.71
S.E.	0.09	0.05	0.04	0.03	0.03	0.03
S.E. M±	0.04	0.02	0.01	0.01	0.01	0.01
Sub-plot;						
A. Time of harvest:						
H_1 (25 DAF)	76.91	77.12	77.01	61.52	61.77	61.70
H_2 (30 DAF)	80.72	80.85	80.78	64.30	64.38	64.24
H_3 (35 DAF)	80.89	81.05	80.97	64.40	64.52	64.46
H_4 (40 DAF)	80.87	80.96	80.92	64.37	64.45	64.41
S.E.	1.96	1.92	1.94	1.42	1.34	1.34
S.E. M±	0.97	0.95	0.97	0.70	0.67	0.66
B. Desiccant :						
M_1 (Paraquat 0.1%)	79.95	80.00	79.98	63.75	63.77	63.76
M_2 (Common salt 10%)	79.82	78.04	79.93	63.64	63.84	63.74
M_3 (Control)	79.79	79.95	79.87	63.64	63.73	63.68
S.E.	0.09	1.12	0.06	0.06	0.06	0.04
S.E. M±	0.04	0.64	0.03	0.03	0.03	0.02

B : Basal, AT : Active tillering, PI : Panicle initiation, DAF : Days after 50% flowering.

Table-7: Milling percentage of rough rice as affected by different treatments.

Treatments/Symbol	Original Value			Transformed value		
	2009	2010	Pooled	2009	2010	Pooled
Main Plot : A. N-Splitting :						
N_1 (75% B+25%AT)	71.55	71.62	71.59	58.18	58.21	58.19
N_2 (25% B+75%AT)	71.41	71.65	71.53	58.08	58.23	58.15
N_3 (50% B+50%AT)	71.63	71.43	71.53	58.21	58.09	58.15
N_4 (50%B+25%AT+25%PI)	71.51	71.58	71.55	58.15	58.18	58.17
S.E.	0.09	0.10	0.03	0.06	0.06	0.02
S.E. M±	0.04	0.04	0.01	0.02	0.03	0.00
Sub-plot;						
A. Time of harvest:						
H_1 (25 DAF)	65.46	69.27	69.37	56.89	56.74	56.82
H_2 (30 DAF)	72.15	72.28	72.22	58.54	58.62	58.58
H_3 (35 DAF)	72.15	72.40	72.32	58.59	58.68	58.63
H_4 (40 DAF)	72.25	72.38	72.32	58.60	58.67	57.65
S.E.	3.36	1.54	1.46	0.84	0.96	0.86
S.E. M±	1.68	0.77	0.72	0.42	0.47	0.43
B. Desiccant :						
M_1 (Paraquat 0.1%)	71.50	71.62	71.56	58.14	58.20	58.17
M_2 (Common salt 10%)	71.50	71.58	71.54	58.14	58.19	58.16
M_3 (Control)	71.57	71.51	71.54	58.18	58.14	58.16
S.E.	0.04	0.06	0.01	0.02	0.03	0.01
S.E. M±	0.02	0.03	0.00	0.01	0.01	0.00

B : Basal, AT : Active tillering, PI : Panicle initiation, DAF : Days after 50% flowering.

Table-8 : Head rice recovery (%) as affected by time of harvest % desiccants interaction.

2009

Desiccants	Time of Harvest				
	H_1	H_2	H_3	H_4	Mean
M_1	68.55	68.35	60.76	53.78	62.86
M_2	67.09	89.49	65.85	61.17	70.90
M_3	67.52	68.85	65.42	58.37	65.04
Mean	67.72	75.56	64.01	57.77	66.27

2010

Desiccants	Time of Harvest				
	H_1	H_2	H_3	H_4	Mean
M_1	70.72	70.47	63.31	59.76	66.07
M_2	70.12	70.32	68.40	62.67	67.88
M_3	69.52	71.19	67.97	60.16	67.21
Mean	70.12	70.66	65.56	60.86	67.05

Pooled

Desiccants	Time of Harvest				
	H_1	H_2	H_3	H_4	Mean
M_1	69.63	69.41	62.03	54.79	63.97
M_2	68.60	69.91	67.13	61.92	66.89
M_3	68.53	70.07	66.70	59.27	66.14
Mean	68.92	69.80	65.29	58.66	65.67