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Study the effect of real time nitrogen management in transplanted rice of Eastern Uttar Pradesh

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Abstract
The experiment was conducted during *kharif* season of 2021-22 with an objective to study the Real time Nitrogen management in rice. The experiment was laid out in Randomized Completely Block Design with four N levels *viz*. nitrogen splits @ 90, 120, 150 and 180 kg N ha^{-1} managed through LCC (LCC scores of 3, 4 and 5), recommended nitrogen level and control replication four. The results of the experiment revealed that the current recommendation of fixed time split N applications at specified growth time is not adequate to synchronize N supply with actual crop N demand due to poorly designed Nitrogen splitting and variations in crop Nitrogen demand. The result of the experiments revealed that the application of 180 kg N ha^{-1} with LCC were significantly superior in terms of growth and yield attributes *viz*. plant height, LAI, Number of tillers m^{-2}, Dry matter accumulation, Days taken to different phenological stages, accumulated heat units, effective panicles m^{-2}, panicle length, panicle weight and fertile grains $panicle^{-1}$ nutrient uptake and returns/rupee invested on account of applied nitrogen fertilizer as compared to other LCC scores and recommended nitrogen level during experimentation. The maximum grain yield was recorded with the treatment 180 kg N ha^{-1} (based on LCC), noted 57.0 q ha^{-1} while minimum grains yield (37.2 q ha^{-1}) was obtained from Control. The maximum net returns (Rs. 60438.70 ha^{-1}) was obtained from the 180 kg N ha^{-1} (based on LCC) and minimum net returns (Rs 26169.60 ha^{-1}) was recorded in the control.

Keywords: LCC, nitrogen, split doses and growth

Introduction
Rice is one of the important crop of the world both in terms of area (163.7 m ha) and production (749.8 m tones). About 90 percent of the world's rice is grown and consumed in Asia and 60 percent of world's population depends on rice for their half of the calorie intake (FAO, Rice Market Monitor, 2020) [17]. Rice is contributed about 45 percent in total cereal production of India and is main food source for more than 60 percent population of the country. In India, the crop is cultivated in about 43.90 million hectares area with an annual production of 135.54 million tones and productivity 25.90 q/ha. (Anonymous, 2023) [1]. It is grown in the temperate range of 4 °C to 45 °C and under annual rainfall of 25mm (Rajasthan) to 1256mm (Assam). It thrives well in sandy loam to heavy black cotton clay soil ranging from normal to saline-alkaline conditions. These diverse agro-ecological situations demand location specific management technology for realization of full yield potential (Vinkateswarly, 1992) [18]. Nitrogen (N) is the most widely used fertilizer nutrient in rice and its consumption has increased substantially in the past decades. The quantity of rice grain produced per unitof applied N fertilizer (partial factor productivity) has continuously decreased to very low values **(**Dobermann *et al*., 2002) [19]. Farmers generally apply nitrogen fertilizer in fixed time recommended N split schedule **(**Pillai and Kundu, 1993) [9] in 2:1:1 ratio at basal, maximum tillering and panicle initiation stages, respectively, without taking into account whether theplant really requires N at the time which may lead to loss or may not be found adequate enough to synchronize nitrogen supply with actual crop nitrogen demand (Ladha *et al*., 2000) [16]. Unbalanced and excessive use of N- fertilizers causes environmental pollution, lodging of plants and increased pest pressure, in addition to increased cost to farmers from excessively applied fertilizers and pesticides. A simple, quick and non destructive method for estimating the plant nitrogen demand is LCC that provides indirect assessment of leaf nitrogen status, which is closely related to photosynthetic rate [3] and biomass production [4]. The use of LCC for scheduling N application may not be uniform to all varieties which differ in inherent leaf color and regions that differ in climate, thereby necessitating individual or group

standardization in different cultivated areas. Hence the present investigation was focused on standardizing the LCC critical value for short duration rice (NDR-2065) under transplanted condition.

Methods and Material

The experiment was conducted at Student Research Farm, Department of Agronomy, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Ayodhya during *kharif* season of 2021. The experiment was laid out in Randomized Completely Block Design with four N levels *viz*. nitrogen splits @ 90, 120, 150 and 180 kg N ha^{-1} managed through LCC (LCC scores of 3, 4 and 5), recommended nitrogen level and control replication four. The soil was high in organic carbon and Phosphorus, medium in Nitrogen and potassium with silty clay loam texture. LCC readings were taken 3-4 times in a week from 30 DAT upto flowering. The minimum temperature ranged from 24.1 to 27.5 °C, maximum temperature from 31.6 to 35.3 °C and the average maximum relative humidity from 86.4 to 95.9%, whereas mean minimum relative humidity ranged from 60.7 to 80.7%. The range of rainfall received during the experimentation period was 1.0 to 206.0 mm during the crop growing season of *Kharif* 2021, respectively. NDR 2065 was the variety selected for the study. All agronomic practices were carried out as per the recommendations.

Result and Discussion

Effect of Nitrogen management on growth of Transplanted Rice

The evaluation of the data showed that the different Nitrogen management through LCC significantly affected the plant growth, yield attributes and economics of transplanted rice.

The maximum plant height was recorded with the treatments Nitrogen @ 180 kg ha^{-1} (based on LCC), representing, 67.5, 102.8, 112.4 and 115.6 cm at 30, 60, 90 DAT and at harvesting stage respectively which is at par with N 180 kg ha^{-1} (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)and N 150 kg ha^{-1} (based on LCC). while significantly higher than rest of the treatment. The results are also in close conformity with Premalatha (2001) [20] and Gaddanakeri *et al.* (2007) [5] Balasubramanian *et al.* (1999) [2] also reported increased plant height with application of 20 kg N ha-1 as basal plus LCC based N. The increased plant height at LCC score of 5 might be attributed due to the increased level of N fertilization as compared to other LCC scores and recommended N (Singh *et al*., 2009) [14]. The higher level of N encouraged the carbohydrate synthesis that resulted in the taller plant in above said LCC value (Gupta *et al*., 2011) [4].

The maximum number of tiller m^2 were recorded with in N 180 kg ha^{-1} (based on LCC), representing, 122.0, 319, 327.6 and 130.9 at 30, 60, 90 DAT and at harvesting stage respectively. . Minimum number of tiller m^2 at were associated with N0- Control which recorded, 115.6, 255.0, 261.0 and 265.0 at 30, 60, 90 DAT and at harvesting stage. The number of tillers m^2 increased upto flowering and there after a decrease was noticed, which could be due to senescence of the secondary tillers and tertiary tillers (Srinivasagam and Stephan, 2013) [13].

The maximum leaf area index was found in N8- N 180 kg ha^{-1} (based on LCC), representing 3.15, 5.16 and 5.36 at 30, 60 and 90 DAT respectively which was at par with N6- N 150 kg ha^{-1} (based on LCC), presented 3.14, 5.11 and 5.28 and N7- N 180 kg ha^{-1} (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage), noted, 3.13, 5.05 and 5.17 at 30, 60 and 90 DAT but significantly better than rest of the treatments. Minimum leaf area index was recorded in N0- Control, representing, 3.00, 3.67 and 3.82 at 30, 60 and 90 DAS, respectively. Similar findings were reported earlier by Sitaramiah *et al*. (1998) [15] and Shukla *et al*. (1995) [21].

Maximum dry weights of plant (g) were recorded with treatment N8- 180 kg N ha^{-1} (based on LCC), representing 209.4, 790.4 and 1129.3 g dry matter at 30, 60 and 90 DAT which was at par with N6- 150 kg N ha^{-1} (based on LCC), and N7- 180 kg N ha^{-1} (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage) but significantly better than rest of the treatments. Minimum dry weight of plant was recorded in N0-Control, representing, 181.0, 530.4 and 758.0 g at 30, 60 and 90 DAT, respectively. Similar were the findings of Premalatha (2001) [20] Dry matter production is dependent upon the plant’s metabolic activities and its corresponding growth. With higher leaf area and chlorophyll content, the plant exhibited higher photosynthetic activities which ultimately led to greater dry matter production (Debtanu *et al*., 2004) [3] thereby resulting in greater biomass production (Kropff *et al*., 1993) [8].

Effect of Nitrogen Management on yield attributes

The highest number of tillers m^2 recorded with 180 kg N ha^{-1} (based on LCC) were 312.0 whereas, the lowest number of tillers m^{-2} were in control. The maximum length of panicles was recorded in 180 kg N ha^{-1} (based on LCC). representing (22.7 cm) whereas in Control recorded minimum length of panicle (18.1 cm). The highest number of grains per panicle was recorded with 180 kg N ha^{-1} (based on LCC), (115.0), whereas lowest number of grains panicle was found in Control (91.2).The highest number of filled grains per panicle were recorded at 180 kg N ha-1 (based on LCC) represented (90). Lowest number of filled grains per panicle was found in Control, representing (67).The highest number of unfilled grains panicle^{-1} were recorded at 180 kg N/ha ha (based on LCC) represented (25.0) while lowest number of unfilled grains per panicle was found in Control, representing (20.2).The maximum test weight (27.4 g) was recorded in 180 kg N ha^{-1} (based on LCC), representing while minimum test weight (21.0 g) was recorded in Control was obtained.The maximum grains weight (2.18 g) per panicle was recorded in 180 kg N ha^{-1} (based on LCC), represented whereas, Control recorded minimum grains weight (1.58 g) per panicle.

Effect of Nitrogen Management on Yield of transplanted Rice

The maximum grain yield (57.0 q/ha) and straw yield (74.73 q/ha) was recorded with the treatment 180 kg N ha^{-1} (based on LCC), while minimum grains yield (37.2 q ha^{-1}) and straw yield (50.95 q ha^{-1}) was obtained from Control. The harvest index was not significantly influenced by the different nitrogen management practices. The higher harvest index (43.40%) was recorded with 180 kg N ha^{-1} (based on LCC), while Lowest harvest index were noted under Control, presented (42.20).

Table 1: Effect of Nitrogen management on growth parameters of transplanted Rice

Treatment	Growth Parameter													
	Plant height (cm)				Number of Tillers/m^{-2}				Leaf Area Index			Dry matter accumulation (g/m^2)		
	30 DAT	60 DAT	90 DAT	At ha.	30 DAT	60 DAT	90 DAT	At ha.	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
N0- Control	55.3	82.6	87.6	88.4	115.6	255.0	261.0	265.0	3.00	3.67	3.82	181.0	530.4	758.0
N1- N-90 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	58.4	88.8	95.0	97.1	117.4	286.4	294.6	297.6	3.04	4.43	4.60	189.1	648.8	926.8
N2- N-90 kg/ha LCC	60.1	91.8	98.2	99.5	118.2	290.4	298.8	301.8	3.06	4.59	4.76	192.4	672.6	960.8
N3- N-120 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	61.0	93.6	101.6	102.9	119.0	295.8	310.6	317.6	3.08	4.78	4.99	195.7	704.2	1006.2
N4- N-120 kg/ha (based on leaf colour chart)	62.5	96.4	103.1	106.3	119.8	304.0	310.3	314.0	3.10	4.98	5.13	198.2	738.8	1055.4
N5- N-150 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	63.2	98.2	106.4	108.8	120.4	300.4	307.2	312.3	3.12	5.00	5.06	201.1	741.5	1059.0
N6- N-150 kg/ha LCC	66.8	101.5	110.8	113.2	121.2	313.6	319.0	322.5	3.14	5.11	5.28	207.4	782.8	1118.0
N7- N-180 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	65.6	100.3	109.2	111.4	120.6	308.3	314.8	317.8	3.13	5.05	5.17	204.8	752.2	1074.57
N8- N-180 kg/ha LCC	67.5	102.8	112.4	115.6	122.0	319.0	327.6	330.9	3.15	5.16	5.36	209.4	790.4	1129.3
SEM	0.61	1.19	1.27	1.61	1.57	4.83	4.58	4.62	0.30	0.05	0.07	1.99	5.00	9.49
CD at 5%	1.79	3.61	3.85	4.88	4.74	14.60	13.84	13.98	NS	0.14	0.21	4.85	14.70	27.86

Table 2: Effect of Nitrogen management on yield and yield attributes parameters of transplanted Rice

Treatments	Yield Parameter										
	No. of eff. tillers m^{-2}	Length of paniclem-2	No. of grain/ panicle	No. of filled grains/panicle	No. of unfilled grains/panicle	Test weight (gm)	Grain weight/panicle (gm)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index
N0- Control	250.0	18.1	91.2	67	20.2	21.0	1.58	37.2	50.95	88.15	42.20
N1- N-90 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	280.6	19.5	97.6	71	22.0	22.2	1.92	45.8	61.97	107.77	42.49
N2- N-90 kg/ha LCC	284.5	20.2	101.9	74	21.7	23.3	1.97	47.5	64.22	11.72	42.52
N3- N-120 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	290.0	21.5	105.1	77	23.8	25.4	2.00	49.9	67.1	117.0	42.64
N4- N-120 kg/ha (based on leaf colour chart)	298.0	22.0	107.2	79	23.5	26.6	2.03	52.4	70.32	122.72	42.69
N5- N-150 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	294.5	21.8	109.8	82	23.8	26.2	2.06	52.6	70.55	123.15	42.71
N6- N-150 kg/ha LCC	307.4	22.5	113.6	87	24.6	27.0	2.14	55.7	73.0	128.7	43.27
N7- N-180 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	303.9	22.3	111.5	85	24.2	26.8	2.11	53.4	71.55	124.95	42.73
N8- N-180 kg/ha LCC	312.0	22.7	115.0	90	25.0	27.4	2.18	57.0	74.32	131.32	43.40
SEM	3.33	0.17	1.64	1.89	0.21	0.22	0.04	0.62	1.55	1.22	1.55
CD at 5%	9.80	0.51	4.95	5.73	0.62	0.65	0.11	1.82	4.74	3.59	NS

Table 3: Effect of Nitrogen management on Economics of transplanted Rice.

Treatment	Cost of cultivation (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B:C Ratio (per rupees invested)
N0- Control	43320.00	69489.60	26169.60	0.60
N1- N-90 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	44628.00	85,554.40	40926.40	0.91
N2- N-90 kg/ha LCC	44728.00	88,730.00	44002	0.98
N3- N-120 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	45064.87	93,213.20	48,148.33	1.06
N4- N-120 kg/ha (based on leaf colour chart)	45164.87	97,883.20	52718.33	1.16
N5- N-150 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	45501.10	98,256.80	52,755.7	1.15
N6- N-150 kg/ha LCC	45601.10	104,047.60	58446.5	1.28
N7- N-180 kg/ha (1/3 at basal + 1/3 at tillering and 1/3 at panicle initiation stage)	45937.30	99,751.20	53,813.9	1.17
N8- N-180 kg/ha LCC	46037.30	106,476.00	60438.7	1.31

Effect of Nitrogen Management on economics of transplanted Rice

It is evident from Table 3 that the different N management practices by using LCC treatments of rice increased the net return. the maximum net returns (Rs. 60438.70 ha^{-1}) was obtained from the -180 kg N^{-1}ha (based on LCC) The higher net returns in treatment LCC ≤ 5 @ 30 kg N ha^{-1} was due to steady supply of nitrogen which synchronized with the peak period of nitrogen requirement that had produced higher yield (Gupta *et al*., 2011) [4]. Similarly, Reddy and Pattar (2005) [12] also reported higher net returns with LCC based nitrogen management (LCC ≤ 5 @ 30 kg N ha-1) as compared to recommended practices.

The maximum B: C ratio (1.31) was obtained from the 180 kg N ha^{-1} (based on LCC) while the minimum B: C ratio (0.60) was recorded in N0 - Control. Similarly, Reddy and Pattar (2006) [12] also reported higher net returns with LCC based nitrogen management (LCC ≤ 5 @ 30 kg N ha^{-1}) as compared to recommended practices.

References

1. Anonymous. Economic Survey, Directorate of Economics and Statistics, New Delhi; c2023.
2. Balasubramanian V, Morales AC, Cruz RT, Abdulrachman S. On farm adaptation of knowledge intensive nitrogen management technologies for rice systems. Nutrient Cycling in Agro Ecosystem. 1999;53:59-69.
3. Debtanu M, Das DK, Tanmoy K, Mahua B. Management of nitrogen through the Use of Leaf Color Chart (LCC) and Soil Plant Analysis Development (SPAD) or Chlorophyll Meter in rice under irrigated ecosystem. The Scientific World Journal. 2004;4:838-846.
4. Gupta RK, Varinderpal S, Yadvinder S, Bijay S, Thind HS, Ajay K, *et al*. Need-based fertilizer nitrogen management using leaf colour chart in hybrid rice (*Oryza sativa*). Ind. J of Agril. Sci. 2011;81(12):1153-1157.
5. Gaddanakeri SA, Biradar DP, Kambar NS, Nyamgouda VB. Productivity and economics of sugarcane as influenced by leaf colour chart based nitrogen management. Karnataka Journal of Agricultural Sciences. 2007;20(3):466-468.
6. Hiremath SM, Patel ZG. Effect of winter green manuring and nitrogen application on summer rice. Indian Journal of Agronomy. 1998;43:71-76.
7. Houshmandfar A, Kimaro A. Calibrating the leaf color chart for rice nitrogen management in Northern Iran. African J of Agril Res. 2011;6:2627-2633.
8. Kropff MJ, Cassman KG, Laar HHV, Peng S. Nitrogen and Yield Potential of Irrigated Rice. Plant and Soil. 1993;155-156:391-394.
9. Pillai KG, Kundu DK. Fertilizer Management in Rice, In: Fertilizer Management in Food Crops. [Ed. H.L.S. Tandon], Fertilizer Development and Consultation Organization, New Delhi; c1993. p. 1-26.
10. Premalatha BR, Angadi VV. Performance of growth and yield components of direct seeded rainfed lowland rice under integrated nitrogen management. Research on Crops. 2006;7(3):633-636.
11. Premalatha PR, Angadi VV. Crop-need-based N management through leaf colour chart (LCC) in direct dry-seeded rainfed lowland rice. Mysore Journal of Agricultural Sciences. 2005;39(1):140-143.
12. Reddy BGM, Pattar PS, Ravishankar G. Evaluation of leaf colour chart (LCC) for efficient nitrogen management in drum seeded rice. Madras Agricultural Journal. 2005;92(10-12):765-767.
13. Srinivasagam K, Stephan H. Integrated nutrient management and LCC based nitrogen management on soil fertility and yield of rice (*Oryza sativa* L.). Scientific Research and Essays. 2013;8(41):2059-2067.
14. Singh DK, Singh JK, Lal S. Real time nitrogen management for higher N-use efficiency in transplanted rice (*Oryza sativa*) under temperate Kashmir conditions. Indian Journal of Agrcultural l Science. 2009;79(10):772-775.
15. Sitaramaiah KV, Madhuri J, Reddy NS. Physiological efficiency of rice hybrids. International Rice Research Notes. 1998;23(2):32-33.
16. Ladha JK, Fischer KS, Hossain M, Hobbs PR, Hardy B. Improving the Productivity and Sus-tainability of Rice-Wheat Systems of the Indo-Gangetic Plains, A Synthesis of NARS-IRRI Partnership Research Discussion Paper 40, IRRI, Los Banos; c2000.
17. FAO. Food Outlook, Biannual Report on Global Food Markets: June 2020. Rome: FAO; c2020. Available at: http://www.fao.org/3/ca9509en/CA9509EN.pdf
18. Venkateswarlu NB, Raju PS. Fast ISODATA clustering algorithms. Pattern Recognition. 1992 Mar 1;25(3):335-342.
19. Dobermann A, Witt C, Dawe D, Abdulrachman S, Gines HC, Nagarajan R, Satawathananont S, *et al*. Site-specific nutrient management for intensive rice cropping systems in Asia. Field Crops Research. 2002 Feb 15;74(1):37-66.
20. Mohan V, Deepa R, Shanthi Rani S, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). Journal of the American College of Cardiology. 2001 Sep;38(3):682-687.
21. Cairns RA, Mamum AA, Bingham R, Boström R, Dendy RO, Nairn CM, Shukla PK. Electrostatic solitary structures in non-thermal plasmas. Geophysical Research Letters. 1995 Oct 15;22(20):2709-2712.