Int.J.Curr.Microbiol.App.Sci (2020) *9*(6): 1651-1656

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 6 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.906.204

Nutrient Management in Different Rice (*Oryza sativa L.*) Establishment Methods under Black Clay Soils of Tungabhadra Command

B. G. Masthana Reddy*, K. Mahantashivayogayya, Sujay Hurali and S. B. Gowdar

All India Co-ordinated Rice Improvement Programme, Agricultural Research Station, Gangavathi-583 227, University of Agricultural Sciences, Raichur, Karnataka (India)

**Corresponding author*

Keywords

Nutrient management, LCC, Dry direct seeded rice

Article Info

Accepted: 18 May 2020
Available Online: 10 June 2020

A B S T R A C T

Field experiment was conducted at Agricultural Research Station, Gangavathi, Karnataka during the rainy season of 2015 and 2016 to evaluate nutrient practices for different rice establishment methods in comparison with puddle transplanting with recommended nutrient practice. Three establishment methods as main treatments and five nutrient practices as sub treatments were tried in split-plot design with three replications. Among establishment methods puddle transplanting recorded higher grain yield and among nutrient practices application of 200:100:100 kg N, P_2O_5 & K_2O/ha, 150%RDF and LCC based N application resulted in higher grain yields. The interaction revealed that a combination of puddle transplanting with either 200:100:100 kg N, P_2O_5 & K_2O/ha or 150%RDF and wet direct seeding with LCC based N management proved superior to puddle transplanting with recommended nutrient practice. However, LCC based N application in addition to maintaining on par yield with location specific practice also resulted in 31.5, 25 and 25% saving in N, P and K respectively and 10% saving in N against recommended practice and can be adopted by the farmers.

Introduction

Rice is an important food crop of India, grown over an area of 43.44 mha with a production of 112.4mt and with a productivity of 2.7t/ha (Anon 2016). In order to feed the growing population India need to produce 130mt of rice by the year 2030 according to projections by Indian Institute of Rice Research, Hyderabad. Rice is grown under different establishment methods under various agro ecological conditions. In irrigated low land system it is traditionally established by manual transplanting with continuous ponding of water in the field. Due to non availability and high cost of labour, urbanization, mechanization and shortage of water availability a shift in the planting methods has been observed in recent years in many farmers fields and farmers are adopting many methods of establishment like mechanical transplanting, dry direct seeding and broadcasting of seeds on unpuddle soils. Though lot of work on nutrient management practices in transplanted rice has been carried out in the past, such work on other methods is very much lacking. Hence in the present investigation an attempt was made to evaluate different nutrient management practices for different establishment methods in comparison with traditional transplanting.

Materials and Methods

Field experiment was conducted on black clay soil during the rainy season of 2015 and 2016 at the Agricultural Research Station, Gangavati, coming under Tungabadra command of Karnataka. The soil of the experimental site was medium deep black clay in texture, neutral to alkaline in reaction (pH 8.1 to 8.3) and low in electrical conductivity(0.50 to 0.75dS/m). The soil was low in alkaline $KMnO_4$-N (210 kg ha^{-1}), high in Olsen's-P_2O_5 (74.5 kg ha^{-1}) and high in NH_4OAc extractable K_2O (410 kg ha^{-1}) in the surface 0-20cm depth. The treatments consisted of three establishment methods viz., M_1: normal manual transplanting, M_2: wet direct seeding on puddle soil through drum seeding and M_3: dry direct seeding on un puddle soil as main plot treatments and five nutrient practices viz., S_1: 100% recommended NPK(150:75:75 kg N, P_2O_5 and K_2O/ha), S_2: 75% inorganic+25%organic on N equivalent basis of recommended NPK,S_3: 150% of recommended NPK, S_4: LCC based N application with recommended P and K and S_5: Location specific NPK (200:100:100 kg N, P_2O_5 and K_2O/ha) were tried in split-plot design with three replications. Gangavathi sona (GGV-05-01) a medium duration rice variety maturing in 135 days was used. Direct seeding was done on 12th August and 4th August during 2015 and 2016 respectively. While transplanting was done on 11th September and 3rd September during 2015 and 2016 respectively. In the case of transplanting 30 days aged seedlings (at a seed rate of 62.5kg/ha) were transplanted at 20x10cm spacing. While sprouted seeds at the rate of 45kg/ha were sown using a drum seeder in wet direct seeding on puddle soil and in the case of dry direct seeding seeds were sown at 22.5cm spacing using a seed rate of 30kg/ha. Recommended herbicides and need based plant protection measures were followed. Observations on grain yield and yield parameters were recorded and economics worked out.

Results and Discussion

Effect on grain yield

Among the establishment methods puddle transplanting recorded significantly higher grain yield during both years and in the mean data (57.58, 44.82 and 50.93 q/ha respectively during 2015, 2016 and in the mean) as compared to wet seeding and dry direct seeding. The treatment recorded 11.1 and 14.2 % higher grain yield respectively over direct wet seeding and direct dry seeding. Among the nutrient practices 150% NPK and location specific NPK (200:100:100 kg N, P_2O_5 and K_2O/ha) recorded significantly higher grain yield of 54.18 and 54.02q/ha respectively than recommended dose of 150:75:75 kg N, P_2O_5 and K_2O/ha (49.29 q/ha) during 2015.However, during 2016 LCC based NPK application and 150%RDF recorded significantly higher grain yield of 46.64 and 45.97q/ha than recommended dose. The two year mean data revealed that application of 200:100:100 kg N, P_2O_5 and K_2O/ha recorded 9.6% higher grain yield than recommended NPK which however remained on par with 150% NPK and LCC based N application. The interaction effect revealed that a combination of puddle transplanting x 200:100:100 kg N, P_2O_5 and K_2O/ha(M_1S_5) recorded significantly higher grain yield of 61.81 and 52.17 q/ha respectively during 2015 and 2016 which however remained on par with puddle transplanting x 150%RDF and puddle transplanting x LCC based N application. Earlier Srinivasagam Krishnakumar and Stefen Haefele (2013), Shantappa Duttarganvi *et al.,* (2014), Ahmad Ali *et al.,* (2015), Ashrabani Moharana *et al.,* (2017), Tauseef A Bhatt *et al.,* (2017) and Yogendra *et al.,* (2017) reported higher grain yield of rice with less N application in the case of LCC based N application as compared to blanket application. The mean interaction was non significant.

Savings in NPK

The different nutrient practices revealed that LCC based NPK application accounted for 135:75:75 kg N, P_2O_5 and K_2O/ha which resulted in 31.5,25 and 25% saving in N, P and K respectively as compared to location specific NPK (200:100:100 kg N, P_2O_5 and K_2O/ha) and 10% saving in N against recommended practice (150:75:75 kg N, P_2O_5 and K_2O/ha) besides remaining on par in grain yield with these treatments. Indranil Das and Narayanachandra sahu (2015) Reported that LCC based applications reduced the excessive N application in rice besides recording higher grain yield in rice.

In rice the grain yield is mainly determined by a combination of the number of panicles per square meter (sqm), panicle weight, number of filled grain per panicle and test weight. In the present study the panicle per square meter were significantly higher in the case of dry direct seeding as compared to other methods. Among the nutrient practices the application of 150%RDF, 200:100:100 kg N,P_2O_5 and K_2O/ha and LCC based N application recorded significantly higher number of panicles than recommended practice and contributed to higher grain yield in these treatments. On the other hand the panicle weight and the number grains per panicle were significantly higher in the case of puddle transplanting than other methods and in turn contributed to higher grain yield. There was no significant difference in panicle weight among nutrient practices. Among the nutrient practices application of 200:100:100 kg N, P_2O_5 and K_2O/ha followed by 150%RDF recorded more grains per panicle and contributed for higher yield. The interaction effect for panicle number and weight was non significant.

Economics

The economics (Table 2) revealed that puddle transplanting recorded 11.43 and 14.93 % higher mean net returns over wet and dry direct seeding respectively. Among the nutrient practices, application of 200:100:100 kg N, P_2O_5 and K_2O/ha recorded higher net returns during 2015. However, LCC based N application proved superior during 2016 and in the mean data representing 24 and 17 % higher net returns than recommended practice. The interaction revealed that a combination of puddle transplanting x 200:100:100 kg N,P_2O_5 and K_2O/ha recorded higher net returns during 2015 which however remained on par with puddle transplanting x 150%RDF and puddle transplanting x LCC based N application. However, during 2016 wet direct seeding x LCC based N application recorded higher net returns than recommended practice and 150% RDF. The mean data revealed that puddle transplanting x 200:100:100 kg N, P_2O_5 and K_2O/ha recorded higher net returns but remained on par with puddle transplanting x 150%RDF and direct wet seeding x LCC based N application. The results are in line with [9] who reported higher additional income due to LCC based N application in rice.

Among the establishment methods the BC ratio was significant only during 2016 with direct wet seeding recording higher BC ratio of 2.11. Among nutrient practices LCC based N application recorded higher BC ratio during both years and in the mean indicating economic profitability of LCC based N application. The interaction revealed that BC ratio was non significant during 2015.

Table.1 Grain yield and yield parameters as influenced by establishment methods and nutrient practices in rice

	Grain yield(q/ha)			Panicles /sqm	Panicle weight(g)	Grains/ panicle
Establishment methods	2015	2016	Mean	Mean	Mean	Mean
M1	57.58	44.28	50.93	393	2.74	165.2
M2	48.68	41.46	45.27	401	2.57	150.3
M3	49.79	40.26	43.70	445	2.32	137.8
SEm	1.25	0.65	1.20	7.50	0.06	3.43
CD(p=0.05)	5.03	2.55	4.70	29.6	0.24	13.48
Nutrient practices						
S1	49.29	40.13	44.71	380	2.48	147.8
S2	49.74	32.36	41.38	410	2.53	145.7
S3	54.18	45.97	48.96	432	2.56	158.3
S4	52.88	46.64	48.65	417	2.51	142.00
S5	54.02	44.91	49.47	422	2.62	161.7
SEm	0.78	1.06	1.04	11.4	0.05	2.85
CD(p=0.05)	2.29	3.09	3.02	33.2	NS	8.73
Interaction						
M1S1	55.67	43.02	49.34	373	2.81	157.3
M1S2	53.10	32.92	43.01	377	2.60	172.7
M1S3	60.84	47.42	54.13	390	2.73	176.3
M1S4	56.70	47.50	52.10	422	2.57	148.7
M1S5	61.81	52.17	56.99	395	2.98	171.0
M2S1	43.48	36.72	40.10	373	2.48	145.0
M2S2	50.67	33.47	42.07	362	2.61	147.0
M2S3	51.57	43.77	47.67	440	2.64	156.3
M2S4	48.80	49.52	49.16	391	2.53	133.3
M2S5	48.87	43.83	46.35	371	2.57	169.7
M3S1	48.71	40.65	44.68	395	2.17	141.3
M3S2	45.43	30.70	38.06	425	2.37	117.3
M3S3	50.12	46.72	48.42	466	2.31	142.3
M3S4	53.33	44.52	48.93	438	2.43	144.0
M3S5	51.39	38.72	45.05	498	2.30	144.3
SEm	1.76	1.76	2.00	19.2	0.09	5.59
CD (p=0.05)	5.15	5.14	NS	NS	NS	16.34

Table.2 Economics of rice as influenced by establishment methods and nutrient practices

	Net returns(Rs/ha)			Benefit-cost ratio		
Establishment methods	2015	2016	Mean	2015	2016	Mean
M1	75276	49806	62541	2.52	2.00	2.26
M2	61969	48816	55392	2.41	2.11	2.26
M3	62149	44257	53203	2.41	1.95	2.15
SEm	2716	1381	1661	0.05	0.03	0.05
CD(p=0.05)	10665	NS	6521	NS	0.11	NS
Nutrient practices						
S1	62068	44731	53400	2.36	1.98	2.17
S2	60705	25414	43060	2.39	1.54	1.91
S3	69197	54807	62002	2.42	2.13	2.27
S4	69903	59277	64590	2.55	2.32	2.44
S5	70449	53901	62175	2.50	2.15	2.32
SEm	1681	2316	1709	0.05	0.05	0.04
CD(p=0.05)	4908	6762	4989	NS	0.15	0.11
Interaction						
M1S1	72845	48735	60790	2.51	2.01	2.26
M1S2	64717	24052	44385	2.28	1.48	1.88
M1S3	80375	54770	67572	2.57	2.06	2.31
M1S4	74564	54729	64647	2.55	2.14	2.34
M1S5	83880	66745	75312	2.69	2.34	2.51
M2S1	52224	39446	45835	2.22	1.92	2.07
M2S2	65380	30250	47815	2.46	1.67	2.06
M2S3	66199	52301	59250	2.44	2.14	2.29
M2S4	64982	67796	66389	2.50	2.60	2.55
M2S5	62296	54286	58291	2.41	2.23	2.32
M3S1	61136	46012	53574	2.36	2.02	2.19
M3S2	52019	21942	36981	2.10	1.46	1.78
M3S3	61016	57353	59184	2.26	2.18	2.22
M3S4	71399	55307	63353	2.59	2.23	2.41
M3S5	65173	40673	52923	2.40	1.87	2.14
SEm	3763	3845	3125	0.10	0.08	0.07
CD (p=0.05)	10985	11224	9123	NS	0.24	2.00

However during 2016 and in the mean data a combination of wet direct seeding x LCC based N application recorded higher BC ratio of 2.6 and 2.55 respectively and proved significantly superior to puddle transplanting x recommended practice and puddle transplanting x 150%RDF.

The two year data indicated that puddle transplanting in combination with either location specific recommendation of 200:100:100 kg N, P_2O_5 and K_2O/ha or

150%RDF or LCC based N application proved superior than puddle transplanting x recommended practice in terms of grain yield. However based on economic analysis of net returns and BC ratio it can be concluded that puddle transplanting in combination with either 200:100:100 kg N,P_2O_5 and K_2O/ha or 150%RDF and direct wet seeding with LCC based N application performed better and can be recommended for farmers adoption.

References

Ali, Ahmad Ali, Harmith singh THIND, Sandeep Sharma and Yadvinder Singh. 2015. Site specific nitrogen management in dry direct seeded rice using chlorophyll meter and Leaf colour chart. *Pedosphere* 25(1):72-81.

Anonymous, *Agricultural statistics at a glance* 2016. GOI, Ministry of Agriculture and farmers welfare, Dept of Agriculture, Co-operation and farmers welfare, Directorate of Economics and Statistics

Ashrabani Moharana, Gulati J M L and Jena S N. 2017. Effect of LCC based nitrogen application on growth and yield of rice varieties during dry season. *Indian Journal of Agriculture Research* 51(1): 49-53.

Indranil Das and Narayana Chandra sahu. 2015. Nitrogen management by using Leaf Colour Chart in *kharif* rice in alluvial soils of West Bengal. *Journal of Krishivigyan*, 3(2):69-72.

Shantappa Duttarganvi, Channabavasanna, A.S, Satyanarayana Rao and Halepyati, A S.2014. Effect of LCC and SPAD based nitrogen management on growth and yield of low land rice. *The Bioscan* 9(2):663-665

Srinivasagam Krishnakumar and Stefen Haefele. 2013. Integrated nutrient management and LCC based Nitrogen management on soil fertility and yield of rice. *Scientific Research and Essays* 8(41):2059-2067.

Tauseef A Bhat, Kotru R, Akhil Verma, Monzoor A Ganai Latie, Latief A, Dar and Nazeer A and Teli. 2017. Leaf colour chart based N management for yield, nutrient uptake and yield of rice genotypes. *International Journal of current microbiology and applied Sciences* 6(9): 3531-3538.

Yogendra N. D, Kumara B.H, Chandrashekar N, Prakash N B, Anantha M. S and Shashidar, H. E. 2017. Real time nitrogen management in aerobic rice by adopting leaf colour chart (LCC) as influenced by Silicon. *Journal of plant nutrition* 40(9): 1277-1286.

How to cite this article:

Masthana Reddy, B. G., K. Mahantashivayogayya, Sujay Hurali and Gowdar, S. B. 2020. Nutrient Management in Different Rice (*Oryza sativa* L.) Establishment Methods under Black Clay Soils of Tungabhadra Command. *Int.J.Curr.Microbiol.App.Sci.* 9(06): 1651-1656.
doi: https://doi.org/10.20546/ijcmas.2020.906.204