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Performance of salinity tolerant rice varieties MCM-100 & MCM-103 in Krishna district, Andhra Pradesh

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Abstract

Rice is the most predominant crop in Krishna district which offers food more than 70 percent of the population. Rice crop is most sensitive to salinity at seedling and reproductive stages which causes highest yield loss. Salt affected soils such as saline soils are present in the coastal belt in and around Machilipatnam division, Koduru, Nagayalanka, mandals and farmers are growing the normal varieties, they were not aware of saline tolerant varieties in terms of yield, acceptability and its adoption potential during *kharif* season. Frontline demonstrations were conducted by Krishi Vigyan Kendra, Ghantasala during *Kharif* 2021, 2022, 2023 and 2024 across 15 villages of Krishna district to demonstrate suitable saline tolerant rice varieties MCM-100 & MCM-103 for saline patches. Pooled data of four years revealed that demo variety MCM-100 (Pandu Ranga), MCM-103 had shown highest average yield (58.8 q ha^{-1}, 53.4 q ha^{-1}) as compared to BPT-5204 (50.8 q ha^{-1}) under saline condition. Hence cultivation of saline tolerant rice varieties (MCM-100 & MCM-103) along with management practices will minimize the yield loss in saline soils.

Keywords: Rice, salinity and yield

Introduction

Rice (*Oryza sativa* L.) is one of the most important crops in the world that offers food for more than 50% of the world's population. A 100 g of rice provides 345.0 k cal, 78.2 g of carbohydrates and 6.8 g of protein. Agricultural land of 8s33 million ha of soils are salt affected (FAO, 2021) globally in more than 100 countries. In India, the available salt affected soil exists in the form of sodic and saline, covering 6.73 million hectares out of which 2.95 million hectares are saline soils. In total saline soils of India, Andhra Pradesh stands at 7th place with a share of 6.2% (Arora and Sharma 2017) [1]. In Andhra Pradesh, Krishna district stands first under saline soils with 42,796 ha. (Mandal *et al*. 2018) [7]. Soil salinity is one the major constraints for rice productivity in coastal areas of Andhra Pradesh. Rice is cultivating in 22 lakh hectares in Andhra Pradesh state with 8.79 million tonnes production (G. P. Sunandini *et al.* 2023) [6]. The average productivity of paddy is 6661 kg ha^{-1}. In Krishna district paddy is cultivating in 1.62 Lakh ha. Rice crop is highly suitable for warm and humid climate. The ideal pH range for paddy is 5.5 to 7.0. The rice crop is salt sensitive crop particularly at seedling and reproductive stages and threshold electrical conductivity of 3 dS m^{-1} considered as the salinity tolerance (Mohammadi *et al*., 2013) [8]. Cultivation of saline tolerant rice varieties along with better management practices (Green manure insitu incorporations or Greenleaf manuring practices) will reduce the yield loss in saline soils. Salt tolerant rice varieties i.e., MCM 100 & MCM 103 were suitable for saline soils of Andhra Pradesh, they were released from Agricultural Research Station, Machilipatnam, ANGRAU with moderate tolerance to BPH & BLB. Farmers are not aware of newly released and improved saline tolerant varieties. KVKs are grass root level organization meant for application of technology through assessment, refinement and demonstration of proven technologies under micro farming situation in a district (Das *et al*., 2010) [2]. Hence, the study was planned with the objective to improve the yield of paddy in saline soils that are comparable with that of normal soils under *kharif* season through Frontline demonstrations in the district.

Materials and Methods

The present experiment was conducted by Krishi Vigyan Kendra, Ghantasala during the *Kharif* season for four consecutive years during 2021, 2022, 2023 and 2024 in the farmers fields of different 15 villages thus a making of total 30 demonstrations. A total of thirty farmers were selected based on their innovativeness, progressive and activeness in adoption of latest technologies with the help of department officials and direct observation while during field visits and other interactive meetings.

The frontline demonstration was conducted in three consecutive years in the farmer fields with a main objective to demonstrate the performance of new saline tolerant rice varieties under saline condition. The saline tolerant rice

variety MCM-100 & MCM-103 was used as a demo and BPT-5204 used as control. Viswanadapalli, Koduru, Chittipalem, Saluru, Salempalem, Nagayalanka, Dhindimeraka, Hamsaladeevi and Modumudi villages of Krishna district were selected as experimental units during *kharif* 2021, 2022, 2023 and 2024. The testing varieties MCM-100 & MCM-103 were provided to the selected farmers and the package of practices for paddy cultivation followed as per ANGRAU recommendations. The data on yield and economics of all the varieties were recorded. The data obtained from experiments were subjected to statistical analysis. Statistical significance was tested by applying T-test at 0.05 level of probability and critical differences were calculated for those parameters, which were found significant ($p< 0.05$) to compare the effects of different varietal treatments.

Results and Discussion

Krishi Vigyan Kendra, Ghantasala has conducted Front line demonstration of paddy crop in 30 locations during four consecutive years. Results of the Pooled years data (Table-1 (a)) MCM-100 & 103 recorded significantly higher plant height (Cm) (107.3 cm and 103.6 cm), productive tillers hill^{-1} (17 and 18), Panicle length (Cm) (24 and 21.2 cm) and number of grains per panicles (258 and 224) over BPT-5204. Similar findings were recorded with Girijarani *et al.* 2024 [5]. Results of the pooled data (Table-2) indicated that saline tolerant varieties MCM-100, MCM-103 recorded higher yield (58.8 q ha^{-1}, 53.4 q ha^{-1}) which was significantly superior over BPT-5204 (50.8 q ha^{-1}) under saline conditions. Datta *et al* (2005) [3] suggested cultivars exhibit different levels of salt resistance and salt sensitivity due to more exclusion of NA and Cl ions by salt tolerant varieties and possible salt injuries which may be due to less effective sequestration or mobility of ions towards some innocuous centers of plant tissue. The overall yield increased was 13.2, 8% under MCM-100 & MCM-103 demo variety compared to BPT-5204. Regarding economics, highest net returns (Rs.42,855.00 ha^{-1}, Rs.53,406.00) noted with MCM-100 & MCM-103 where as in BPT-5204 it was Rs.30,196.00 ha^{-1} and B:C ratio 1.65:1, 1.74:1 was more in treatmental varieties (MCM-100 & MCM-103) where as 1.39: 1 in BPT-5204. Similar findings were recorded with Girijarani *et al*. 2024 [5], Roy *et al.* 2023 [9], B Tejasri and B Aparna, 2022 [10]. The reason for above results due to that the new varieties MCM-100 & MCM-103 was saline tolerant rice varieties during these four consecutive years. Economics of any crop plays a major role in making recommendations for dissemination of a new technology and its adoption to the farmers. The data related to net returns and B:C ratio of Demo and farmer practice were presented in Table 3.

Table 1: Characteristics of paddy variety selected for study

Treatment	Year of release	Duration	Characteristics
MCM-100 (Pandu ranga) & MCM-103 (T_1)	2018, 2022	145 days	Yield - 5-5.5 t ha $^{-1}$ in saline soils for both MCM-100 (Pandu Ranga) & MCM-103 Non-lodging and saline tolerant
BPT-5204 (T_2)	1986	155 days	-

Table 1(a): Biometric observations (Pooled years during *Kharif* 2021, 2022, 2023 and 2024) recorded for MCM-100 & MCM-103 in comparision with BPT-5204

Treatments	MCM-100	BPT-5204	MCM-103	BPT-5204
Plant population - No of hills/m^2	24	2222242324	23	21
Plant height (Cm)	107.3	98.4	103.6	99.8
No of productive panicles per hill	17	13	18	16
Panicle length (Cm)	24	19	21.2	18.4
No of grains per panicles	258	235	224	208
Grain yield (Kg ha^{-1})	5880	5113	5340	5062

Table 2: Yield of Paddy (Year wise)

Year	No. of Demonstrations	Yield (q/ha)			% increase in yield
		MCM-100	MCM-103	BPT-5204	
2021	10	57.8	-	51.5	12.2
2022	10	59.8	-	52.6	14.3
2023	5	-	56.2	50.6	11.1
2024	5	-	50.6	48.7	4
Pooled	30	58.8	53.4	50.8	-

Table 3: Economic parameters (Pooled data) of demo and control varieties of paddy.

Year	Net returns (Rs ha^{-1})			B:C ratio		
	MCM-100	MCM-103	BPT-5204	MCM-100	MCM-103	BPT-5204
2021	44107.00	-	25509.00	1.70:1	-	1.36:1
2022	41603.00	-	25515.00	1.60:1	-	1.31:1
2023	-	71750.00	35055.00	-	1.96:1	1.45:1
2024	-	35055.00	34705.00	-	1.53:1	1.44:1
Pooled	42855.00	53402.5	30196.00	1.65:1	1.74:1	1.39:1

Statistical analysis

Interference: P value is above 4.6 reveals that calculated test statistic value is greater than standard value indicating rejection of null hypothesis and accepting alternate hypothesis. And the result indicated that MCM-100 & MCM-103 recorded higher yield (55.3 q ha^{-1}) which was significantly superior over BPT-5204 (50.6 q ha^{-1}).

Conclusion

From the four years of demonstrations, it could be concluded that the Demonstration of salt tolerant paddy varieties MCM-100 & MCM-103 with management practices along with regular advises, frequent monitoring, timely operations and need based training programmes by KVK, Ghantasala leads to good yields of rice in saline soil condition. It could be considered as a better option for achieving higher productivity and profitability of paddy crop under salinity condition in areas of Viswanadhapalli, Koduru, Nagayalanka, Dhindimeraka, Hamsaladeevi and Machilipatnam areas of Krishna district.

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