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Performance, adoption and spread of salt tolerant paddy varieties in salt affected area at Kaushambi and across the district

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Abstract
The Field demonstrations were conducted to study the performance of salt tolerant paddy varieties in sodic soil in Kaushambi district during Kharif season, 2019-20 and 2020-21 in NICRA village - Umarchha and other adjoining having venerability sodicity. Total Salt affected area under Rice-Wheat Cultivation -18500 ha in the district and a sodic field having pH range 8.9 to 9.2, EC 1.9 dS/m, ESP 39. The traditional/farmer paddy varieties NDR-350 and Pant-12 could not withstand owing to higher salt accumulation in root zone. KVK Kaushambi conducted a farmer field demonstration in 37.5 ha area at 99 farmer fields on salt tolerant paddy varieties *viz*., CSR 36 and Short duration CSR-43 in NICRA village Umarchha during Kharif season -2016-17 and 2017-18. Gypsum was used for reclamation purpose and Dhaincha as a green manure crop was raised in the selected field and incorporated in soil @ 50% flowering stage at before planting. Uniform cultural practices were applied to all the varieties up to maturity. Proper plant protection measures were taken according to the incidence of pest and diseases. Better growth and yield was observed in CSR-36 paddy varieties, maximum yield was recorded from Paddy varieties CSR-36 (48.5 q/ha.), which was followed by NDR -359 (39.2 q/ha) and CSR-43 (38.8 q/ha.), as compared to traditional/farmer varieties Pant -12 (34.40 q/ha.) respectively. Net return was recorded maximum of (Rs. 42999/-) CSR-36 followed by Paddy varieties NDR-359 (Rs. 29288/-), CSR-43 (Rs.28904/-) and least in Pant-12 (Rs. 22673/-). It was concluded In all, CSR-36 salt tolerant paddy varieties was superior in respect of yield and economically viable. CSR-43 short duration variety performed better than Pant-12 and equal to NDR-359 in terms of yield but CSR-43 beneficial due to short duration characteristics. Out of total potential area for upscaling in the NICRA village as well as adjoining villages ----% of the potential area for in village has been covered through this demonstration and -----% of the potential area was covered through convergence with line departments.

Keywords: Paddy varieties, growth and yield parameters, sodic soil, yield, income and area spread and convergence

Introduction
Salt-affected soils, those on which plant growth is limited by an excess of salts. Estimates of the area of salt-affected soils ranging from 6% to 10% of earth's land area and 77 million hectares (Mha) of irrigated lands. Due to lack of availability of water, nutrients, and oxygen in the root zone under sodic condition, reduction in yield is about 30% to 50% in rice. In sodic soil crop yield can be enhanced by nutrient management especially N, water management through irrigation with good quality water and appropriate drainage, use of soil amendments like manures and gypsum, etc., and use of salt-tolerant varieties (Eynard *et al*, 2008) [2]. In Kaushambi District has an area of 18500 ha salt affected are and adopted village Umarchha under NICRA (National Innovation in Climate Resilent Agriculture) projrct by Krishi Vigyan Kendra Kaushambi. The Village Umarchha has approximately 199 ha area affected with salt Rice (*Oryza sativa*) is one of the world's most important food crops, particularly in Asia. Rice and wheat provide approximately 50 percent of the calories consumed by the human population. The projected increase of human population from 6 billion in 2000 to 9 billion in 2050 requires increase in the production of rice. Any further increase in production will come principally from intensification of production in the abiotic stress environments such as salinity, alkalinity, drought, *etc*. Rice is suitable for rehabilitating saline and alkaline soils because of its ability to grow under flooding and its high potential for genetic improvement. To bring the salt-affected soils under cultivation, and the traditional/farmer paddy varieties ould not withstand owing to higher salt accumulation in root zone, the crop scientists are adopting the concept of "adoption and selection of plant cultivars according to soil

environment" through screening of plant cultivars to be cultivated in salt-affected soils (Qureshi *et al*, 2000) [4]. But, Modern high yielding salt tolerant varieties required considerable investment to ameliorate these soils to ensure reasonable yields and this investment is beyond the capabilities of the resource-limited small holder farmers living off these salt affected areas (Singh *et al*., 2016) [6]. Hence. The Field demonstration was conducted to assess the suitability of these salt tolerant paddy varieties under NICRA village and adjoining village in eco climatic conditions and to increase in yield and high economic return to the farmers

Materials and Methods

The Field demonstrations were conducted at farmers field of NICRA village and adjoining village during the year 2019-20 and 2020-21 on two salt tolerant variety *viz*. CSR-36 and CSR-43 on different locations in salt affected soils. The existing varieties NDR-359 and Pant-12was used as local check. The soil of the experimental field is clay loam in texture with low in Organic carbon content, pH value varies from 8.9 to 9.2-9.7, EC is 1.9 -2.3 dS/m, ESP is 39 -44 and, and the fertility level falls under low in N and P and medium in available K. Green manure dhaincha grown and incorporated at 50% flowering stage. Fertilizers were applied as four split doses based on soil testing. Full dose of P and one fourth of N and K applied as basal, remaining three parts of N and K was applied during tillering stage, panicle initiation stage and heading stage of rice. All the cultural practices were followed as per the package of practices. Paddy was harvested at physiological maturity. The data on growth and yield attributes were recorded.

Table 1: Sources and characters of paddy varieties used under investigation

S. No.	Variety	Sources	Duration (In days)	Grain type
1.	CSR 36	Breeder Seed from CSSRI, Karnal and KVK Seed Production programme	135	Long slender
2.	CSR-46	Breeder Seed from CSSRI, Karnal and KVK Seed Production programme	110	Medium slender

Results and Discussion

The performance of salt tolerant paddy varieties and local check (farmers variety) and economic indicators are presented in table 2. It was observed that germination and growth of salt tolerant paddy varieties was better as compared to the local check. The data revealed that the performance in terms of growth and development of cultivar may attributed to salt tolerant paddy variety CSR-36, NDR-359, CSR-43 as camper PANT-12. Datta *et al* (2005) [8] 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

Among the four rice varieties, paddy salt tolerant variety CSR-36 performance better in growth and yield parameters was observed. Maximum yield was recorded in CSR-36 (48.5bq/ha), which was followed by paddy NDR-359 (39.2 q/ha), CSR-43 (38.8 q/ha) and Pant-12 (34.30 q/ha), respectively. However the lowest grain yield was recorded with Pant-12 the difference is yield might be due to the fact that genetic cause or responses of the particular genotype to the soil and climatic condition might be reflected in growth and yield of rice. The results are in line with Hassan *et al*., (2001) [3].

Economic indicator indicated that highest net return was obtained with paddy CSR-36. It might be due to the higher yield in sodic soil, it was followed NDR-359 and CSR-43 in terms of economics both equal but due to short duration characteristics of CSR-43 was most suitable than NDR-359 by Similar views in coriander has reported by Singh and Singh (2013) [5] and Bajad *et al.*, (2017) [1]. Singh *et al*., also reported that the yield advantage, together with tolerance of sodicity, good grain quality and market value contributed to the selection and commercialization of the variety and to its faster adoption in the sodic soils.

Adoption and Spread of the Salt tolerant Paddy Varieties Across the district (2019-20 -2020-21): Out of total potential area for upscaling in the village as well as adjoining villages of the otential area for paddy in the project village has been covered through this technology ----% and % of the potential area was covered through convergence with line departments.

Adoption and Spread of the Salt tolerant Paddy Varieties Across the district (2019-20 -2020-21)

Sr. No.	Crop	Total NICRA Village Area (ha)	Are Covered by Intervention in NICRA Village (ha)	Area Covered by Intervention in Adjoining Villages (ha)	Total area covered through technology (ha)	Area Converted by Intervention
1	Paddy (CSR-36)	199.00	75.67	58.37	134.04	67.35
2-	CSR-43	199.0	55.45	39.0	94.45	47.46

Table 2: Performance and economic indicators of different paddy cultivars in sodic soil

Paddy variety	Plant height (cm) *	Number of Productive tiller/hill*	No. of grains per panicle *	Grain Yield (q/ha)*	Gross expenditure (Rs.)*	Gross Income (Rs.)*	Net income (Rs.)*	CB ratio*
CSR 36	109	16.8	230	48.5	22476	65475	42999	2.9
NDR-359	95.6	13.3	170	39.2	23632	52920	29288	2.23
CSR-43	82.1	12.9	150	38.8	22120	52380	28904	2.23
Pant-12	91.8	12.4	145	34.30	23210	46305	22673	1.95

*mean of five locations

Conclusion

The salt tolerant varieties proved to be beneficial among the existing agro-climatic situations in the village. CSR -36, salt tolerant varieties performed better than NDR-359 and CSR-43 short duration variety performed better than Pant-12 and equal to NDR-359 in terms of yield but CSR-43 beneficial due to

short duration characteristics. The sowing of traditional/farmers varieties was not economically viable. Both the salt tolerant varieties proved to be boon for farmers. Between the two salt tolerant varieties CSR-36 performed more efficiently in terms of yield and economics.

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