Technological Gap in Adoption of Recommended Reclamation Practices in Sodic Soils of Tiruchirappalli District in Tamil Nadu

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ABSTRACT

About 2.5 million ha in India and 0.47 million ha in Tamil Nadu have been affected solely by sodicity which affects productivity of the land directly. An expost-facto research was undertaken with a specific objective to assess the technological gap and constraints faced in adoption of reclamation practices in sodic soil by the farmers of Tiruchirappalli district in Tamil Nadu as the farmers were facing lower productivity. Survey of 100 farmers was conducted in five different villages of Manikandam block where sodicity of soil are higher using interview schedule and direct interview method. The findings revealed that the overall technological gap in adoption of recommended reclamation practices in Sodic Soil is found to be medium (93.00%) and that the highest technological gap was noticed for the practices dosage of spent wash, application of mineral amendments, dosage of application of Zinc sulphate, quantity of additional Nitrogen and number of splits of additional nitrogen. The overall technological gap of the respondents is significantly correlated at 1 per cent for the variables educational status, sodic soil, sources of information, economic motivation, scientific orientation, innovativeness and attitude towards group activity. The major constraints faced by cent percent of the respondents in adopting the recommended reclamation practices in sodic soil are small fragmented land holdings, drainage problem, non-availability of suitable varieties and seeds during sowing, lower market value of TRY (TNAU) 3 variety, labour shortage and erratic monsoon or poor rainfall. The farmers in the study area suggested to encourage for cooperative farming, provide timely input subsidy. Agricultural department officials should boost up the farmers for farming, agricultural information should reach all the farmers and arrange awareness camps in nearby villages around the Institutions/department and provide all the information to the villagers.

Key words : *Sodic soil, reclamation practices, technological gap, constraints and suggestions*

Soil sodicity is characterized by high pH, high water soluble and exchangeable sodium and low biological activity. As a result, these soil exhibit poor physical properties often leading to low water conductivity at the surface and transmission within the profile and deficient in many essential nutrients. As 90 per cent of food requirements come from land based farming, the pressure on agricultural land is heavy. Hence, it is necessary to develop cheap and effective soil technologies for problem soil utilizing the locally available resources without disturbing the ecological balance to feed the burgeoning population of our country.

The basic principle in the reclamation of sodic soil is to replace the sodium ($Na+$) ion from soil exchange sites by cations like hydrogen ($H+$), calcium ($Ca++$) and magnesium ($Mg++$) ions. Extensive research work has been carried out on the reclamation of sodic soil utilizing the many inorganic and organic amendments either alone or in combinations. Application of gypsum in combination with organic manures has been often recommended for the reclamation of sodic soil and has enjoyed the confidence of our farmers for over three to four decades. Other common mineral amendments used are gypsum, phosphogypsum, calcite and other acid-forming salts, e.g., iron and aluminium sulphates, lime-sulphur and pyrites. However, for the complete reclamation of sodic soil, it requires repeated application of gypsum and organic manures for two to three years and this process increases the cost of reclamation. Besides, the availability of organic manures is now – a – days very scarce to the farmers.

Singh and Parshad (1995) conducted a study on ‘farmers response to amendment use for reclaiming alkali soils and use of sodic waters for crop production’ in Harayan, Panjab and Uttar Pradesh and revealed that, only 44 per cent farmers in karnal and 40 per cent in the Kaithal district used it for reclamation or amending sodic waters to be used directly for irrigation purposes. Ajore and Singh (1996) in their results showed that, 89.00 per cent of farmers of the progressive district were in low adoption gap category, 4.00 per cent in the medium and 7.00 per cent in the high adoption gap categories of the reclamation technology of sodic soils. Whereas, 1.00 per cent farmers of the less progressive district were in low adoption gap category, 28.00 per cent in the medium adoption gap category and 71.00 per cent were in the high adoption gap categories.

Hence a research project was undertaken in Tiruchirappalli district of Tamil Nadu to find out the extent of technological gaps prevailing in adoption of recommended reclamation practices in sodic soil which directly affects the productivity. This project also aimed at eliminating the maximum possible constraints and suggest for framing suitable policy options so as to provide assistance to researchers, extension agents and farmers to evolve amicable ways so that reclamation of sodic soil will be carried out in a coordinating/cooperative manner and increase the productivity of soil which ultimately feed the growing population in India.

Objectives of the study

1. To study the profile characteristics of adopters and non-adopters of recommended reclamation practices in sodic soil
2. To find out the technological gap in adoption of reclamation practices among the sodic soil farmers.
3. To enumerate the reasons / constraints for non-adoption of reclamation practices in sodic soil and
4. To evolve suggestions to overcome the constraints for non-adoption of reclamation practices

METHODOLOGY

Tamil Nadu has an area of about 4.7 lakh hectare under problem soil. Due to this, crop yields are affected by about 30.0 to 40.0 per cent. Among the seven agro-climatic regions of Tamil Nadu state, Region-II comprising erstwhile Tiruchirappalli district has about 18.0 per cent of the total area under problem soil. In Region-II erstwhile Tiruchirappalli district alone has the problem of salinity and alkalinity to an extent of 31645 hectare. Of the 31645 hectare under problem soil in the district sub-region 3 has an area of 11468 hectare constituting 36.0 percent of the total problem soil area of the district. Sub-region 3 has seven development blocks. Manikandam block is one of the most problematic blocks in the district with respect to soil health wherein the problem soil constituted about 24.0 percent of the cultivated area. Hence, Manikandam block of Tiruchirappalli district was selected for the study.

The research was conducted during 2011-2012 in five different villages of Manikandam block where sodicity of soil are higher viz., Kallikudi, Inam Kulathur, Adavathoor, Sethurapatti and Piratiyur villages of Tiruchirappalli district by using proportionate and purposive sampling.

From the five selected villages of Manikandam block where sodicity of soil are higher. The 100 farmers comprising small, medium and big farmers were selected by purposive sampling. From each village, a sample size of 20 farmers selected proportionately giving due importance to both categories of adopters and non-adopters of recommended reclamation practices in sodic soil. Farmers were selected using random sampling method. Keeping in view the objectives and the variables selected for the study, a well structured interview schedule was developed and pre-tested in non-sample area for its practicality and relevancy. Based on the discussions with soil science experts, the interview schedule was modified wherever necessary and finalized. An extensive survey of 100 farmers was conducted by using direct interview method. Using the interview schedule, the respondents were interviewed individually and required data were collected.

The difference between the recommended reclamation practices in sodic soil and its actual adoption by the farmers was considered as technological gap in this study. This variable as measured by the 'gap index' for the selected reclamation practices in sodic soil as given below

$$\text{Technological gap} = \frac{\text{Recommended} - \text{Adopted}}{\text{Recommended}} \times 100$$

Recommended : This was conceived as the maximum degree to which a farmer could extend his adoption

Adopted : This was conceived as the degree to which a farmer had actually adopted a practice

RESULTS AND DISCUSSION

The data collected from the 100 farmers was analyzed for their technological gap in adoption of the recommended reclamation practices in sodic soil using statistical procedures like frequency, percentage, mean, standard deviation. Based on mean and standard deviation, the respondents were classified into low, medium and high. The data on constraints and suggestions offered by the farmers were collected and using percentage analysis of each farmers response was carried out. The results of the study are discussed below

Profile characteristics of the farmers

It is evident from the Table1, that the respondents of the study area possessed the following profile characteristics: More than half of the farmers were old aged (55.00 %) followed by middle and young age group. The young age category farmers were very low as these people show more interest in white collar jobs to work in the cities than to look after their ancestral agricultural occupation. More than two third (85.00%) of the farmers were found literate possessing different levels of education. Ninety-four per cent of the farmers were continuing agriculture as their primary occupation. Nearly two –third (63.00%) of the respondents possessed medium level of farming experience. Almost all the farmers (95.00%) in the study area had sodic soil for cultivation.

Only 45.00 per cent of the farmers showed interest in social participation either as member or office bearer in various social institutions. The main sources from where the respondents collected agricultural related information were, by individually contacting their fellow farmers, friends, relatives, neighbours and village leaders. The second priority was given to private dealers and seed agency followed by agricultural department officials and newspapers. The respondents possessed medium economic motivation (62.00%), scientific orientation (73.00%) and innovativeness (91.00). The attitude towards group activity among the respondents was found to be high (61.00%).

Table 1.
Profile characteristics of the farmers (n=100)

S.No.	Characteristics	Per cent	S.No.	Characteristics	Per cent
1.	**Age**		**B.**	**Individual contact**	
	Young (<35)	4.00		Fellow farmers	100.00
	Middle (35-50)	41.00		Friends	100.00
	Old (>50)	55.00		Relatives	100.00
2.	**Educational Status**			Neighbours	100.00
	Illiterate	15.00		Village leaders	100.00
	Functionally literate	2.00	**C.**	**Government officials**	
	Primary	32.00		Research scientists	36.00
	Middle	10.00		Agrl. Dept officials	90.00
	Secondary	27.00	**D.**	**Private sources**	
	Higher secondary	4.00		Dealers	97.00
	Collegiate	10.00		Seed agency	97.00
3.	**Occupational status**			Exhibition	58.00
	Agriculture as Primary	94.00		Adaptive trials	35.00
	Agriculture as Secondary	6.00		Demonstrations	39.00
4.	**Farming experience (years)**			Others	12.00
	Low	20.00	**8.**	**Economic Motivation**	
	Medium	63.00		Low	17.00
	High	17.00		Medium	**62.00**
5.	**Farm size (acre)**			High	21.00
	Normal soil	11.00	**9.**	**Scientific orientation**	
	Sodic soil	95.00		Low	9.00
	saline soil	-		Medium	**73.00**
	others	5.00		High	18.00
6.	**Social participation**		**10.**	**Innovativeness**	
	Membership	36.00		Low	4.00
	Office bearer	9.00		Medium	**91.00**
7.	**Sources of information**			High	5.00
A.	**Mass media**		**11.**	**Attitude towards group activity**	
	Radio	76.00		Low	5.00
	Television	30.00		Medium	34.00
	Newspapers	**85.00**		High	**61.00**
	Magazines	62.00			

Technological gap in adoption of recommended reclamation practices in sodic soil

The overall technological gap in adoption of recommended reclamation practices in Sodic Soil is found to be medium (93.00%). Almost 96.00 per cent of the farmers in the study area showed technological gap in the adoption of reclamation practices they possessed medium level of economic motivation, scientific orientation, and innovativeness and that their overall awareness and knowledge was also medium.

Ashok (2008) projected the overall adoption of saline and waterlogged soil reclamation practices by the respondents. The results indicated that majority (57.78%) of the respondents belonged to low adoption category, followed by 34.07 per cent and 8.15 per cent belonging to medium and high level of adoption categories, respectively.

Table 2
Technological Gap in adoption of recommended reclamation practices in sodic soil (n=100)

S.No.	Category	Technological Gap	
		Frequency	Per cent
1.	Low	4	4.00
2.	Medium	93	***93.00***
3.	High	3	3.00
	Total	100	100.00

Singh et al (2013) indicated that only 34.4%

farmers knew the recommended practices of sodic soil reclamation, whereas only 3.1 per cent farmers used gypsum without knowing gypsum requirement along with application of FYM and formed bunds around the fields for rain water conservation, 4.7 per cent used gypsum without knowing gypsum requirement, 9.4 per cent did bunding of fields for rain water conservation and 14.1 per cent used FYM.

The Table 3 revealed that highest technological gap was noticed for the practices dosage of spent wash, application of mineral amendments, dosage of application of Zinc sulphate, quantity of additional Nitrogen and number of splits of additional nitrogen. The main reason being the respondents lacked proper knowledge on these technologies.

There was no technological gap for the practice duration of retention of water after application of gypsum and subsequent drainage as this practice is very essential for their cultivation of crops in sodic soil.

The practices like stage of cultivation for gypsum application, layout of drainage channels and cultivation of green manure crops recorded low technological gap as the respondents might have been following these practices by experience and from their ancestors.

Table 3
Practice wise technological gap in adoption of recommended reclamation practices in sodic soil (n=100)

S. No.	Recommended Reclamation practices	Technological gap (%)
1.	Dosage of gypsum per hectare	46.50
2.	Stage of cultivation for gypsum application	24.50
3.	Time duration for split application of gypsum	46.75
4.	I year split dosage of gypsum	46.75
5.	II year split dosage of gypsum	46.75
6.	III year split dosage of gypsum	46.75
7.	Duration of retention of water after application of gypsum and subsequent drainage	0.00
8.	Dosage of application of zinc sulphate	**65.25**
9.	Layout of drainage channels	23.75
10.	Cultivation of Green manure crops	23.50
11.	Quantity of green leaf manure crops	43.00
12.	Dosage of farm yard manure	41.50
13.	Dosage of spent wash	**72.50**
14.	Application of mineral amendments	**72.25**
15.	Resistant varieties in rice suited to sodic soil	49.25
16.	Age of rice seedling for transplantation	47.75
17.	Number of seedlings per hill	50.00
18.	Quantity of additional nitrogen	**62.25**
19	Number of splits of additional nitrogen	**62.25**
20	Other crops suitable for sodic soil	54.75

Moderate technological gap was found for the practices like dosage of gypsum per hectare, time duration for split application of gypsum, I year split dosage of gypsum, II year split dosage of gypsum, III year split dosage of gypsum, quantity of green leaf manure crops, dosage of farm yard manure, resistant varieties in rice suited to sodic soil, age of rice seedling for transplantation, number of seedlings per hill and other crops suitable for sodic soil.

The overall technological gap of the respondents on the recommended reclamation practices in sodic soil is significantly correlated at 1 per cent to the variables educational status, sodic soil, sources of information, economic motivation, scientific orientation, and innovativeness, Attitude towards group activity and significantly correlated at 5 per cent to the variable total farm size.

Ashok (2008) indicated that education was found to be significantly associated with adoption of saline and waterlogged soils reclamation practices at 5 per cent level of probability.

The technological gap in adoption of any agricultural practice is correlated with the knowledge level of the respondents in the study area. This research also assessed the awareness, knowledge and adoption of recommended reclamation practices in sodic soil by the respondents. The overall awareness, knowledge level and adoption of recommended reclamation practices in sodic soil were tested for its significance with the technological gap and found that significantly correlated at 1% level with the overall technological gap of the respondents on the recommended reclamation practices in sodic soil.

Table 4
Pearson correlations between independent variables and dependent variables

Variable name	Overall Technological Gap	Variable name	Overall Technological Gap
Age	-0.067	Economic motivation	**0.736****
Educational status	**0.314****	Scientific orientation	**0.755****
Occupation	-0.092	Innovativeness	**0.599****
Farming experience	-0.040	Attitude towards group activity	**0.283****
Sodic soil	**0.341****	Overall awareness	**0.669****
Farm size total	**0.207***	Overall knowledge	**0.525****
Social participation	0.123	Overall adoption	**0.872****
Sources of Information	**0.279****		

***. Correlation is significant at the 0.01 level*
**. Correlation is significant at the 0.05 level*

The farmers of the study area faced lots of problems in reclamation of their sodic soil since past. The major constraints faced by cent percent of the respondents in adopting the recommended reclamation practices in sodic soil are given in Table 5. The respondents encountered with small fragmented land holdings, drainage problem, non-availability of suitable varieties, shortage of seeds during sowing, lower market value of TRY (TNAU) 3 variety, labour shortage and erratic monsoon or poor rainfall. More than three-fourth of the respondents revealed that non availability of gypsum, shortage of bore well facilities, marketing problem, lesser village visits made from institutions, more damage by newer pests and diseases, non-cooperation among farmers, poor response to farmers from institution, exploitation of input dealers /private agencies, non adoption of villages for variety release and no adaptive research trials from the agricultural college/institutes are laid out in this area as constraints.

Table 5
Constraints faced in adopting the recommended reclamation practices in sodic soil

S. No.	Constraints	Per cent
1.	Small fragmented land holdings	100.00
2.	Drainage problem	100.00
3.	Non-availability of suitable varieties	100.00
4.	Shortage of seeds during sowing	100.00
5.	TRY (TNAU)3 variety market value low	100.00
6.	Labour shortage	100.00
7.	Erratic monsoon or poor rainfall	100.00
8.	No timely supply of inputs either from department or institutions	100.00
9.	Non availability of gypsum	97.00
10.	Shortage of bore well facilities	95.00
11.	Marketing problem	94.00
12.	Lesser village visits made from institutions	91.00
13.	More damage by newer pests and diseases	87.00
14.	Non-cooperation among farmers	85.00
15.	Poor response to farmers from Institution	78.00
16.	Exploitation of input dealers /private agencies	78.00
17.	Non adoption of villages for variety release	74.00
18.	No adaptive research trials	62.00

Datta and Dayal (2000) studied the farm level constraints facing farmers in their effort to manage water and soil quality problems in Mathura district of Uttar Pradesh and reported that inadequate and untimely availability of good quality water was the main constraint followed by non-availability of salt tolerant high yielding varieties of crops, non availability of organic manures and non-availability of soil amendments like gypsum.

Kadam et al. (2001) in their study reported that lack of information/guidance in respect of each practice was the main reason for non-adoption. The second important reason for non-adoption of the recommended soil and water conservation practice was non availability of inputs, materials/labours etc. In case of many of the practices, difficulty in crop cultivation, difficulty in maintenance and lack of skill were the reasons for non-adoption.

Ashok (2008) revealed that, high initial cost for undertaking land reclamation practices was major problem in adoption of land reclamation practices as it was expressed by 77.03 per cent of farmers. In adequate

Table 6.
Suggestions given by the farmers to overcome the constraints in adopting the recommended reclamation practices in sodic soil (n=100)

S. No.	Suggestions	Per cent
1.	Encourage for Cooperative farming	100.00
2.	Provide timely input subsidy	100.00
3.	Agricultural department officials should boost up the farmers for farming	100.00
4.	Agricultural information should reach all the farmers	100.00
5.	Arrange awareness camps in nearby villages around the Institutions / department and provide all the information to the villagers	100.00
6.	Provide better drainage facilities in each village	100.00
7.	Need more awareness, exposure visits and training on methods of reclamation practices	100.00
8.	Total el ectricity subsidy to farmers be provided	100.00
9.	Release rice varieties of short duration, slender grain, sodicity tolerant and good yielding with market value	100.00
10.	Encourage farmers clubs/producer companies/commodity groups	95.00
11.	Association to control irrigation sources in the village	88.00
12.	Labour union establishment through government	84.00
13.	Establish direct procurement/purchase centres blockwise	82.00
14.	Progressive farmers be included University Advisory Committee and be invited for all interaction meetings	77.00
15.	Agricultural graduates be placed in the nearby villages during their village stay programme to facilitate exchange of information and views/opinions	75.00
16.	Establish common borewells through government aid	73.00
17.	Diesel rate subsidy be facilitated to encourage mechanization and to overcome labour shortage	63.00

availability of organic manures (72.59%), in adequate technical guidance (70.73%), no common out-let for removing surface drainage water (47.40%) and high rate of interest on bank loans (43.70%) were the other problems in adoption of land reclamation practices.

It was observed from Table 6 that, cent per cent of the farmers in the study area suggested to encourage for cooperative farming, provide timely input subsidy, agricultural department officials should boost up the farmers for farming, agricultural information should reach all the farmers, arrange awareness camps in nearby villages around the Agricultural Institutions/department and provide all the information to the villagers, provide better drainage facilities in each village, more awareness, exposure visits and training on methods of reclamation practices need to given, cent percent electricity subsidy to farmers be provided, research efforts to release rice varieties of short duration, slender grain, sodicity tolerant and good yielding with market value.

CONCLUSION

From the research it could be concluded that to improve the productivity of sodic soils, the technological gap need to be reduced with regard to various reclamation practices released from TNAU, Coimbatore. The factors affecting technological gap in adoption of reclamation technology were examined through Pearson's correlation method. Educational status, sodic soil, sources of information, economic motivation, scientific orientation, innovativeness, attitude towards group activity and farm size of the farmer were significant determinants of adoption of reclamation technology.

As knowledge becomes prerequisite for formation of attitude and ultimate use of the technology, an organized effort is required by Department of Agriculture in association with the Non Government Organization to educate the farmers regarding the land reclamation practices for sustainable production. The NGOs play significant roles in the process of reclamation of sodic soils like to identify and create awareness, educate, mobilize communities, form local institutions, ensure that a sensitive disposition and participatory process pervades all partners, disseminate technology, mobilize women, link men and women with credit institutions, nurture and ensure sustainability. Awareness campaigns needs to be arranged or organized to create in-depth knowledge to farmers on critical technologies like application of spent wash, mineral amendments etc., and trainings on latest technologies to sodicity affected farm owners through the district Krishi Vigyan Kendras. Through the coordinated efforts of the Tamil Nadu Agricultural University and Indian Council of Agricultural Research release rice and other crop varieties tolerant to sodicity with good cooking and/or marketing value.

Further the Department of Agriculture in linkage with other department should encourage and/ motivate farmers for farming through various extension activities and facilitate timely availability of inputs as farmers are changing their tendency and leaving behind agriculture. The KVKs and State Department of Agriculture should encourage the farmers to produce organic manures and supply/circulate among themselves in a group approach. Also research should be undertaken to facilitate farmers to reclaim their sodic soils atleast in subsidized rates using low cost reclamation technologies.

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