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Awareness, Knowledge and Adoption of Reclamation Practices in Sodic Soil of Tiruchirappalli District in Tamil Nadu

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An *ex-post-facto* research was undertaken during 2011-2012 with the objectives to assess the knowledge and extent of adoption of reclamation practices in sodic soil by farmers of Tiruchirappalli district in Tamil Nadu. Survey of 100 farmers was conducted in five villages of Manikandam block where sodicity of soil is higher. The findings revealed that almost three-fourths of the respondents had medium overall awareness and more than three-fourth of them had medium overall knowledge level and adoption level of recommended reclamation practices. More than 90.00 per cent of the farmers did not adopt the practice- application of sugar industrial effluents and application of mineral amendments. The Correlation analysis showed that overall awareness and knowledge of the farmers were the significant determinants of adoption of reclamation technologies.

Key words: Sodic soil, Reclamation practices, Awareness, Knowledge, Adoption

The land degradation of different forms in India reported to be 146.82 million hectares, which includes water erosion 93.68 million ha, wind erosion 9.48 million ha, water logging/flooding 14.30 million ha, salinity/alkalinity 5.94 million ha, soil acidity 16.04 million ha and complex problems 7.38 million ha (NBSS & LUP, 2005). In another estimate, Thanwar and Biswas (2005) reported that nearly 57.10 per cent of the geographical area suffers from one or the other form of degradation of which salinization and severe nutrient depletion account for about 14.8 million hectares and water logging to the extent of 11.80 million hectares.

Soil salinization / sodification are one of the most serious forms of land degradation in India, which largely affects agricultural production. Out of the total degraded lands in India, approximately 6 million hectare are affected by soil salinity/sodicity, which largely distributed in arid and semi arid areas. About 2.5 million hectare in India and 0.47 million hectare in Tamil Nadu have been affected solely by sodicity. Due to climate change/global warming, the frequent occurrence of drought, the area of salinity / sodicity may be expanded.

Soil sodicity is characterized by high pH, high water soluble and exchangeable sodium and low biological activity. As a result, the soils exhibit poor physical properties often leading to low water conductivity at the surface and transmission within the profile and deficient in many essential nutrients. Hence, it is necessary to develop cheap and effective soil management technologies for problem soils utilizing the locally available resources without disturbing the ecological balance to feed the burgeoning population of this country.

The Agricultural College and Research Institute, Tiruchirappalli recommends the soil amelioration measures *viz.,* application of gypsum at the rate of 5 tonnes per hectare, zinc sulphate at the rate of 25 kg per hectare and raising of green manure crop at the rate of 50 kg per hectare or use of green leaf manure or farm yard manure at the rate of 5 tonnes per hectare to reclaim sodic soils of Tiruchirappalli district of Tamil Nadu. As gypsum package for the reclamation of alkaline/sodic soil is found to be costlier, spent wash as an alternative to gypsum was recommended at the rate of 5 lakh litres per hectare.

In the light of the above recommendations, a research was undertaken with the objectives to assess the knowledge and extent of adoption of recommended reclamation practices in sodic soil by farmers.

Methodology

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 31,645 ha. Of the 31,645 ha under problem soil in the district sub-region 3 has an area of 11,468 ha 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

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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 Manikandam block of Tiruchirappalli district. Survey of 100 farmers was conducted @ 20 farmers from each village selected randomly by using interview method.

Results and Discussion

Awareness level of respondents on recommended reclamation practices for sodic soil

Awareness of the respondents about sodic soil reclamation practices is defined as the quantum of information known to the respondents about the reclamation practices. A set of 13 items related to recommended sodic soil reclamation practices were administered to the farmers of the study area. Score of one and zero were given to the responses 'aware' or 'not ware' respectively. The summation of scores of the correct answers for a particular respondent indicated his awareness about land reclamation practices. Based on the total score, the respondents were grouped into three categories using mean and standard deviation. The findings are given in Tables 1 and 2.

Table 1. Distribution of respondents according to their overall awareness on recommended reclamation practices for sodic soil n=100

Category	Awareness
	Per cent
Low	4.00
Medium	73.00
High	23.00
Total	100.00

It is revealed from Table 1, that almost three-fourths (73.00%) of the farmers had medium overall awareness on reclamation practices in sodic soil. The individual reclamation practice in Table 2 revealed that the respondents had cent percent awareness for the practices *viz* ., Application of gypsum, Cultivation of Green manure crops, Application of Green leaf manure crops, Application of Farm yard manure, Cultivation of resistant rice varieties, transplantation of 35-40 days rice seedling of sodic soil resistant varieties, transplantation of 3-5 seedlings per hill, Cultivation of other crops suitable for sodic soils like ragi, cotton, sugarcane, chilli and bhendi and laying of proper field drainage channels to collect leached out water.

Awareness of 91.00 percent and 79.00 per cent were seen for the practices *viz*., Application of Zinc sulphate after last ploughing and Application of additional 25% of Nitrogen in four splits, respectively. Least awareness was observed for the reclamation practices *viz*., Application of other mineral amendments- phosphogypsum, calcite, other acid-forming salts like Iron and Aluminium sulphites, Lime- sulphites and pyrites (51.00%) and Application of sugar industrial effluents *i.e.* spent wash as an alternative to gypsum (27.00%).

Table 2. Practice-wise awareness on recommended reclamation practices for sodic soil n=100

Reclamation practices	Awareness
	Per cent
Application of gypsum	100.00
Application of zinc sulphate after last ploughing	91.00
Cultivation of green manure crops	100.00
Application of green leaf manure crops	100.00
Application of farm yard manure	100.00
Application of sugar industrial effluents *i.e*. spent wash as an alternative to gypsum	***27.00***
Cultivation of resistant rice varieties	100.00
Transplantation of 35-40 days rice seedling of sodic soil resistant varieties	100.00
Transplantation of 3-5 seedlings per hill	100.00
Application of additional 25% of Nitrogen in four splits	79.00
Cultivation of other crops suitable for sodic soil like ragi, cotton, sugarcane, chilli and bhendi	100.00
Application of mineral amendments *viz*., phosphogypsum, calcite, other acid-forming salts like iron and aluminium sulphites, lime- sulphites and pyrites	***51.00***
Laying of proper field drainage channels to collect leached out water	100.00

Knowledge level of respondents on recommended reclamation practices for sodic soil

Knowledge of the respondents about sodic soil reclamation practices was operationalised as the quantum of accurate information known to the respondents about the reclamation practices. A teacher made knowledge test with 18 items was developed and used to measure the knowledge level of the respondents on sodic soil reclamation practices. Score of one and zero were given to the responses 'correct' and 'incorrect' respectively. The summation of scores of the correct answers for a

Table 3. Distribution of respondents according to their overall knowledge of recommended recla mation practices for sodic soil

n=100

Category	Knowledge
	Per cent
Low	14.00
Medium	78.00
High	8.00
Total	100.00

respondent indicated his/her knowledge on land reclamation practices. Based on the total score, the respondents were grouped into three categories *viz.,* low, medium and high using mean and standard deviation. The findings are presented in Tables 3 and 4.

From Table 3, it is found that more than three-fourth (78.00%) farmers in the study area possessed medium level of overall knowledge on recommended reclamation practices. The findings are in line with Ashok (2008) who found that as high as 49.63 per cent of the respondents had low level of knowledge about land reclamation practices, while, 37.78 per cent and 12.59 per cent respondents had medium and high level of knowledge, respectively.

Table 4. Knowledge of respondents on individual reclamation practices for sodic soil

Reclamation practices	Per cent
Dosage of gypsum to be applied per hectare	94.00
Stage of cultivation during which gypsum is to be applied	100.00
Time duration i.e. number of years in which split application of gypsum to be completed	94.00
Split dosage of gypsum to be applied during first year of soil reclamation	66.00
Split dosage of gypsum to be applied during second year of soil reclamation	66.00
Split dosage of gypsum to be applied during third year of soil reclamation	74.00
Duration of retention of water after application of gypsum and subsequent drainage of excess salt dissolved water	100.00
Dosage of application of zinc sulphate after last ploughing	18.00
Cultivation of green manure crops suitable for sodic soil	100.00
Quantity of green leaf manure crops to be applied	100.00
Quantity of farm yard manure to be applied	100.00
Dosage of spent wash to be followed	8.00
Cultivation resistant rice varieties	100.00
Age of rice seedling of sodic soil resistant rice varieties to be transplanted	86.00
Number of seedlings per hill to be transplanted	46.00
Quantity of additional nitrogen to be applied for reclamation of sodic soil	8.00
Number of splits in which the additional quantity of nitrogen is to be applied	8.00
Cultivation of other crops suitable for sodic soil like ragi, cotton, sugarcane, chilli and bhendi	86.00

Table 4 shows that cent per cent knowledge (100.00%) was noticed for practices *viz.*, at what stage of cultivation gypsum is to be applied, duration of retention of water after application of gypsum and subsequent drainage of excess salt dissolved water, cultivation of green manure crops suitable for sodic soil, quantity of Green leaf manure crops to be applied, dosage of application of farm yard manure and cultivation of resistant rice varieties suited to sodic soil. The reason might be that the farmers would have learnt these technologies by experience and by seeing their forefathers, friends and /or fellow farmers. In order to get more yield and more income, organics were added to the problematic soils. Due to these facts considerable number of farmers had knowledge on the above aspects of land reclamation.

Table 5. Distribution of respondents according to their overall adoption of recommended reclamation practices for sodic soil n=100

Category	Adoption
	Per cent
Low	13.00
Medium	76.00
High	11.00
Total	100.00

More than two-thirds of the respondents possessed knowledge on the practices viz., dosage of gypsum to be applied per hectare, time duration *i.e.* number of years in which split application of gypsum is to be completed, age of rice seedling of sodic soil resistant rice varieties to be transplanted,

Table 6. Practice wise adoption of recommended reclamation practices for sodic soil

Reclamation practices	Adoption		
	Fully adopted	Partially adopted	Not dopted
	Per cent	Per cent	Per cent
Application of gypsum	13.00	84.00	3.00
Application of zinc sulphate after last ploughing	5.00	14.00	81.00
Cultivation of green manure crops	**33.00**	67.00	-
Application of green leaf manure crops	**33.00**	67.00	-
Application of farm yard manure	**36.00**	64.00	-
Application of sugar industrial effluents *i.e.* spent wash as an alternative to gypsum	3.00	4.00	93.00
Cultivation resistant rice varieties	5.00	79.00	16.00
Transplantation of 35-40 days rice seedlings of sodic soil resistant rice varieties	6.00	81.00	13.00
Transplantation of 3-5 seedlings per hill	5.00	82.00	13.00
Application of additional 25% of nitrogen in four splits	3.00	45.00	52.00
Cultivation of other crops suitable for sodic soil like ragi, cotton, sugarcane, chilli and bhendi	-	74.00	26.00
Application of mineral amendments- phosphogypsum, calcite, other acid-forming salts like iron and aluminium sulphites, lime-sulphites and pyrites	2.00	7.00	91.00
Laying of proper field drainage channels to collect the leached out water	15.00	85.00	-

cultivation of other crops suitable for sodic soil like ragi, cotton, sugarcane, chilli and bhendi and split dosage of gypsum to be applied in first year of soil reclamation, split dosage of gypsum to be applied in second year of soil reclamation, split dosage of gypsum to be applied in third year of soil reclamation.

Poor knowledge (8 to 18%) was noticed with regard to reclamation practices *viz*., dosage of application of Zinc sulphate after last ploughing, dosage of application of spent wash, quantity of additional Nitrogen to be applied for reclamation of sodic soil and number of splits in which the additional quantity of nitrogen is to be applied. This might be due to the reason that they are not aware of it and showed lesser interest in acquiring knowledge on these technologies. Further, if the farmers are practicing these practices certainly they will be aware of them. It is evident from the study that the adoption level of these practices was also very low.

Adoption level of respondents on recommended reclamation practices for sodic soil

The adoption measurement tool consisted 13 adoption items for sodic soils. The response to the questions was quantified using a three point continuum *viz.,* fully adopted, partially adopted and not adopted with scores of 3, 2 and 1 respectively. The summation of scores for a respondent indicates his/her adoption level. Based on the total scores, the respondents were grouped into three categories *viz.,* low, medium and high using mean and standard deviation. The findings are presented in Tables 5 and 6 .

Table 5 reveals that more than three-fourth (76.00%) of the respondents was found with medium level of overall adoption of reclamation measure s for sodic soils. As adoption of recommendations by an individual depends upon his knowledge level, the results obtained are understandable. High initial cost, inadequate availability of organic manures, inadequate technical guidance and no common outlet for removing surface drainage water from the land were the constraints expressed by the farmers in adoption of land reclamation practices.

Ashok (2008) revealed that majority (57.78%) of the respondents belonged to low adoption category of saline and water logged soil reclamation practices, followed by 34.07 per cent and 8.15 per cent belonging to medium and high level of adoption categories, respectively.

It is evident from the Table 6 that only one-third of the respondents fully adopted the recommended reclamation practices *viz.* , cultivation of green manure crops, application of green leaf manure crops and application of farm yard manure. The main reason is that it is part of their organic way of cultivation followed from their forefathers.

Table 7. Correlation between independent variables and dependent variables

Variables	Overall awareness	Overall knowledge	Overall adoption
Age	0.111	-0.139	-0.055
Educational status	0.385**	0.336**	0.388**
Occupation	-0.140	-0.066	-0.034
Farming experience	0.125	-0.086	0.001
Sodic soil	0.248*	0.214*	0.218*
Farm size total	0.138	0.169	0.081
Social participation	0.262**	0.267**	0.212*
Sources of Information	0.286**	0.263**	0.298**
Economic motivation	0.613**	0.605**	0.750**
Scientific orientation	0.648**	0.629**	0.783**
Innovativeness	0.415**	0.492**	0.632**
Attitude towards group activity	0.372**	0.343**	0.271**
Overall awareness		0.453**	0.721**
Overall knowledge			0.534**

**Correlation is significant at the 0.01 level

*Correlation is significant at the 0.05 level

More than two-thirds of the respondents partially adopted the practices *viz.,* Cultivation of green manure crops, application of green leaf manure crops, application of farm yard manure, cultivation of other crops suitable for sodic soil like ragi, cotton, sugarcane, chilli and bhendi, transplantation of 35-40 days rice seedling of sodic soil resistant rice varieties, transplantation of 3-5 seedlings per hill, application of gypsum and laying of proper field drainage channels to collect the leached out water. This is because the farmers were adopting these practices based on the availability of inputs, rainfall, capital investment and labour availability, which is always fluctuating from time to time. Practically, farmers faced problems in providing common outlet for removal of impounded water as it requires mobilization of farmers at community level. This has become a stumbling block in adoption of this particular practice.

More than 90.00 per cent of the farmers were not adopting the reclamation practice of application of sugar industrial effluents *i.e.* spent wash as an alternative to gypsum and Application of mineral amendments- phosphogypsum, calcite, other acid-forming salts like iron and aluminium sulphites, lime-sulphites and pyrites. This may be due to their lack of awareness and knowledge on these technologies and pessimistic opinion of higher cost of these newer inputs and fear of getting lesser yield due to poor soil productivity as spent wash create black colouration to soil and bad odour.

Ashok (2008) disclosed that surface drainage was adopted by 41.48 per cent farmers and growing of salt resistant crops was practiced by 36.30 per cent farmers. The other practices *viz*., leveling of the land, construction of bunds for impounding the water, and removal of impounded water was practiced by 17.04 per cent, 14.07 per cent and 11.85 per cent, respectively. Bio-drainage and sub-surface drainage practices were not adopted by farmers.

Correlation between independent variables and dependent variables

From Table 7, it is seen that overall awareness and overall knowledge of the respondents on the recommended reclamation practices in sodic soil is significantly correlated at 1% level with the independent variables *viz*., educational status, social participation, sources of information, economic motivation, scientific orientation, innovativeness, attitude towards group activity, and significantly correlated at 5% level with the variable - sodic soil (*i.e* land possessed by the farmers affected by sodicity).

The overall adoption of the respondents is significantly correlated at 1% with the variables *viz*., educational status, sources of information, economic motivation, scientific orientation, innovativeness, attitude towards group activity and significantly correlated at 5% with the variables- sodic soil and social participation. Further, the variable overall awareness is correlated with the variables overall knowledge and overall adoption at 1% level, and the variables overall awareness and overall knowledge are correlated with overall adoption at 1% level. Ashok (2008) in his study had found that the association between knowledge and extent of adoption of land reclamation practices was highly significant association. It is inferred that to improve the awareness, knowledge and adoption level of the recommended reclamation practices in sodic soil, the independent variables *viz.,* educational status, sodic soil, farm size, sources of information, economic motivation, scientific orientation, innovativeness and attitude towards group activity

are very essential to alter their thinking and attitude/ behaviuor. Only when awareness is created, knowledge will be gained and adoption level of recommended reclamation practices will be increased as all these variables are inter correlated.

Conclusion

The variables *viz*., educational status, sources of information, economic motivation, scientific orientation, innovativeness, attitude towards group activity, area under sodic soil and overall awareness and knowledge of the farmers were significant determinants of adoption of reclamation technology. Increasing contact with extension agents and more access to credit are likely to increase the adoption level of sodic soil land reclamation technologies. More number of trainings and awareness campaigns need to be organized to create awareness and knowledge among the farmers which in turn may increase the adoption levels thereby improving the soil productivity and overall production.

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