What is the problem?
Salt-affected soils are increasing in Tanzania thereby decreasing cultivable land and undermining national food security. There are three categories that make up salt-affected soils: saline, sodic, and saline-sodic. Saline soils have high amounts of calcium and magnesium and commonly have visible salt deposits. Sodic soils have high amounts of sodium. Saline-sodic soils are high in both sodium and other salts.

The Extent of the Problem
The FAO (2000) estimates the extent of the saline and sodic soils in Tanzania is 2 million hectares (ha). However, estimates by Tanzanian scientists for saline and sodic soils are 3.6 million ha. The difference in estimations demonstrates that the actual extent of the issue is not well established. Studies throughout Tanzania by Kashenge-Killenga et al. (2012, 2012, 2014 and 2016) report the growing effects of salt affected soils in most rice irrigation schemes in the country as well as the increasing concern from farmers.
While all regions of Tanzania produce rice, the major rice producing areas are within the central and southern corridors. The central corridor produces 34%, and the southern corridor 30%, of the total rice production in Tanzania.

Initial studies on salt affected soils in rice irrigation schemes North Eastern Tanzania indicated that 78% of the surveyed irrigation schemes were salt affected (Kashenge-Killenga et al., 2012). The study was expanded to more irrigation schemes in major rice growing areas. In 2013-2014, a diagnostic survey was carried out in major rice growing areas of the central and southern corridor to establish the extent of salt affected soils. Four regions of the central corridor (Shinyanga, Tabora, Singida, and Dodoma) and five regions of the southern corridor (Katavi, Rukwa, Mbeya, Iringa and Morogoro) were surveyed—for a total of 18 districts and 58 irrigations schemes.

The southern rice-growing corridor has higher prevalence of salt affected soils compared with the central corridor. Laboratory results from soil samples collected confirmed that 67% of surveyed irrigation schemes in southern corridor were salt affected. This same study also indicated the area of land abandoned due to salt affected soils ranged from 5-50%. Additionally, farmers reported yield loss of up to 100% in some areas. A combination of saline-sodic soils (Magadi-Chumvi) is a common problem in the majority of irrigation schemes. Therefore a combination of management for both saline and sodic soils must be promoted throughout Tanzania (Kashenge-Killenga et al., 2016).
What are the solutions?

Studies done with funding from the Innovative Agricultural Research Initiative (iAGRI)—a USAID Feed the Future Project—from 2013-2016 have shown that integrated salt-affected soil management and mitigation approaches have the potential to address the complex problems of salt-induced land degradation. Results from these studies indicate that five different management options can effectively improve production on salt affected soils. These management options include application of gypsum, farmyard manure, sawdust, and rice hulls, as well as the use of salt-tolerant rice varieties.

Gypsum and farmyard manure applications

Prior to sowing, gypsum is broadcast at a rate of 8 t/ha, incorporated in the soil. After three weeks, the soil is flushed four times with irrigation water. After the last flushing, farmyard manure can be incorporated and regular management practices followed. The iAGRI-sponsored study found that the effects of soil treatments were significant:

- The use of gypsum at a rate of 8 t/ha gypsum increased yields by 583%
- The application of 6 t/ha gypsum combined with 2.5 t/ha farmyard manure increased yields by 917%

Sawdust and rice husk applications

Sawdust or rice husks are incorporated in the soil prior to planting. The soil is then flushed with irrigation water three to four times to remove excess salts. After the last flushing, regular planting and management practices are followed.

- The incorporation of 6-12 t/ha of rice husk increased yields by 542%
- The incorporation of 3-4 t/ha of sawdust increased yields by 250%
Development of salt-tolerant rice varieties
There are studies on salt affected soils in Tanzania as well as sub Saharan Africa. The initial work on developing salt tolerant rice varieties in Tanzania began in 2007. The research resulted in the official release of the first salt tolerant rice variety in Tanzania (SATO1) as well as a high yielding moderate salt tolerant variety (SATO9). Both varieties were released in March 2016.

- The use of a salt-tolerant rice variety (Ch-SATO1) without other management practices increased yields by 367% compared with a non-salt-tolerant rice variety.
- Combining a salt-tolerant rice variety and 8 t/ha gypsum applications increased yields 50% above the same gypsum application with a non-salt-tolerant rice variety.
- Combining a salt-tolerant rice variety with 6 t/ha gypsum and 2.5 t/ha farmyard manure application increased yields 76% above the same applications with a non-salt-tolerant variety.

Improved infrastructure
Many irrigation schemes lack proper infrastructure. This can cause water to move from one field to the next instead of using the proper irrigation canals. When this happens, the irrigation water can accumulate salt. Once one field is affected, the flow of water can be transferred to unaffected fields.

Irrigation schemes surveyed for salt affected soils.

50% - 917%
Yield increases achieved through improved technologies
POLICY RECOMMENDATIONS

1. **Planning:** The Ministry of Agriculture, Livestock and Fisheries (MALF) should develop a National Strategic Plan for monitoring and managing salt-affected soils. The plan should integrate the management of salt-affected environments into the overall management for land and water resources in the country.

2. **Data Availability:** There is a need for in-depth data on the extent of salt-affected soils and on the rate of change in areas affected by salinization and sodication at regional and country level. Efforts should be made to integrate satellite remote sensing data on salt affected soils in collaboration with the National Bureau of Statistics (NBS) and international open data initiatives such as the Global Open Data for Agriculture and Nutrition (GODAN).

3. **Training:** Information on salts, their effects, preventive and management practices must be incorporated into training curricula for agricultural and natural resources institutions, institutions of higher education and taught to farmers through agricultural extension agents.

4. **Review of irrigation schemes:** All irrigation scheme master plans should be reviewed by the Ministry of Water and Irrigation. Construction of new schemes should be verified to make sure they follow construction principles.

5. **Participatory rural appraisal (PRA):** NGOs and researchers should involve farmers in the development and evaluation of technologies for restoration of salt-affected soils.

6. **Land tenure:** Accelerate the issuing of title deeds to land owners through the Ministry of Lands, Housing and Human Development to ensure a continued interest in the productivity of land as the accumulation of salt hinders the rehabilitation of abandoned land.

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**References**


The **Innovative Agricultural Research Initiative** (iAGRI), is a Feed the Future project funded by USAID. It aims to prepare the next generation of agricultural leaders in the public and private sectors to strengthen the core institutions of agricultural research and education in Tanzania. Ohio State University (OSU) is the managing entity for a consortium of six U.S. universities including Michigan State University, Virginia Tech, Tuskegee University, University of Florida and Iowa State University. Key partners in Tanzania include Sokoine University of Agriculture (SUA) and the Ministry of Agriculture, Livestock and Fisheries (MALF). The project prepares teachers, researchers, extension practitioners, and students in Tanzania to cooperatively and effectively address the needs of smallholder farmers and the agribusiness sector.