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Varietal assessment of wheat crop in sodic land situation in district Auraiya Uttar Pradesh

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Abstract
Problematic soils in India mainly consist of salt-affected soil and acidic soil with an area extension of 6.73 million ha (Sharma *et al*., 2016) and 15.93 million ha, respectively. However, at the global level, 0.34 billion and 0.56 billion ha of the area have saline and sodic soil, respectively (Shahid *et al*., 2018). Along with this, there are soils that are getting polluted because of untreated industrial effluents, sewage water and waste from landfill areas, and seepage of industrial pollutants. These soils have several problems and need special management practices and input addition along with normal management practices for successful crop production. An on farm trial was conducted in Rabi 2012-13 by KVK, Auraiya to optimize the wheat yield in partially reclaimed sodic soils by the use of sodic salt tolerant variety developed by CSSRI, Karnal. The varieties KRL 210 and KRL 213 was tested against the local variety Lok 1. Both the varieties i.e., KRL 210 (4.98 and 6.39 t/ha) and KRL 213 (4.24 and 5.58 t/ha) showed the higher grain and straw yield as compared to local (3.64 and 5.21 t/ha). In terms of return KRL 210 showed the highest net return of Rs. 46710/- as compared to KRL 213 which showed the net return of Rs. 36898/- and least is in case of local (Rs. 30592/-). This showed that KRL 210 performance was best in sodic soil.
Problem definition: Low yield due to sodicity.

Keywords: Wheat yield, sodic soils, salt tolerant variety

Introduction
Soil is an important natural resource providing water, nutrient, and mechanical support for plant growth. In agroecosystem, continuous manipulation of soil is going on due to addition of input, removal of nutrients, changing water balance, and microbial life. These processes affect soil properties (physical, chemical, and biological), and the deviation of these properties from the normal status is controlled by soil buffering capacity and soil resilience. If these changes are beyond the reach of soil resilience, then soil loses its original state, leading to soil degradation. At present, the extent of the degraded area in the world is 1,036 to 1,470 million ha. This urges the need for maintaining soil health rather than the mere addition of input for crop production. Soil health is an integrative property that reflects the capacity of soil to respond to agricultural intervention, so that it continues to support both agricultural production and the provision of other ecosystem services. Maintaining the physical, chemical, and biological properties of soil is needed to keep it healthy, and this is possible through the adoption of different agronomic approaches. The diversification of nutrient sources with emphasis on organic sources, adoption of principles of conservation agriculture, enhancement of soil microbial diversity, efficient resource recycling through the integrated farming system, and amendment addition for correcting soil reactions are potential options for improving soil health, and are discussed in this review. This article reviewed the concept of soil health and its development, issues related to soil health, and indicators of healthy soil. At the same time, the impact of the ill health of the soil on crop productivity and resource use efficiency reported in different parts of the world in recent years are also reviewed. The agro-techniques such as green and brown manuring in arable land and agroforestry on degraded and marginal land were followed on piece meal basis and for economic gain. The potential of these and several other options for maintaining soil need to be recognized, evaluated, and quantified for their wider application on the front of soil health management avenues. The use of crop residue, agro-industrial waste, and untreated mineral or

industrial waste (basic slag, phosphogypsum, etc.) as soil amendments has a huge potential in maintaining healthy soil along with serving as sources of crop nutrition. The review emphasizes the evaluation and quantification of present-day followed agro-techniques for their contribution to soil health improvement across agro-climatic regions and for wider implications. Furthermore, emphasis is given to innovative approaches for soil health management rather than mere application of manures and fertilizers for crop nutrition. Soil salinity is one of the environmental factors that bound distribution and efficiency of major crops. The excess salt taken up by the plants is stored in older leaves: continued transport of salt into transpiration stream over extended period results in very high concentration of Na+ Cl- which results in the death of leaves. This injury is certainly caused by overloading the vacuolar capacity to catalog toxic salt species. Otherwise, they might accumulate in cell wall and cause dehydration. Wheat is one of the foremost crops that have the chattels of anti-oxidation against the oxidation of important bio-molecules such as membrane lipids, protein and DNA. It stops the human LDL cholesterol per oxidation, per oxide anion (O2-). Free stable radicals like DPPH and ABTS+ are also inhibited by wheat bran extracts as well as phospholipid liposomes hydrogen peroxide. The production of reactive oxygen species (ROS) is restricted or scavenged by an antioxidant system like antioxidant compounds (ascorbate, glutathione, tocopherol's, salicylate, etc.) and antioxidant enzymes such as superoxide dismutase (SOD), ascorbate peroxidase (APX) and catalase (CAT). Hence, the aim of this study was to screen (i) the potential wheat cultivars for better performance under salt stress (ii) pattern of accumulation and growth of glycine betaine, proline, MDA and total phenolic contents in the leaves of different varieties of wheat cultivars under different levels of salinity, and the roles of these phenolics in plant stress tolerance in terms of membrane lipid peroxidation, and the antioxidant capacity against the total production of free radicals.

Problematic soils in India mainly consist of salt-affected soil and acidic soil with an area extension of 6.73 million ha (Sharma *et al*., 2016) and 15.93 million ha, respectively. However, at the global level, 0.34 billion and 0.56 billion ha of the area have saline and sodic soil, respectively. Along with this, there are soils that are getting polluted because of untreated industrial effluents, sewage water and waste from landfill areas, and seepage of industrial pollutants. These soils have several problems and need special management practices and input addition along with normal management practices for successful crop production. These practices are broadly divided as follows. Use of Soil Amendments and Its Effect on Soil Health Soil amendments are mainly added to bring the soil reaction to the desirable range, thereby improving soil health. Considering soil reactions, exchangeable sodium percentage and electrical conductivity of the soil are broadly classified as saline, sodic (alkali), and saline-sodic (alkali) soil. Saline soil is dominated by soluble salts such as sulfate and sodium chloride; while the dominant salt in sodic soil is sodium carbonate. In the case of saline soil, the leaching of soluble salts below the root zone with plenty of fresh water is followed. Along with that, limestone and iron pyrite are chemical soil amendments that can be added. In the case of sodic soil, gypsum, sulfur, iron sulfate, and iron pyrite may be added to improve the soil condition. The improvement for acidic soil is done by liming with calcium oxide, calcium hydrate, dolomite, calcite, or basic slag. The application of soil amendments for the correction of sodic soil has a significant and positive effect on soil health through improvement in soil properties such as aggregation, porosity, and infiltration rate, replacing exchangeable sodium concentration from exchange complexes and bringing the pH in the neutral range. In acidic soil, the application of liming materials leads to a reduction in the toxic concentration of metal elements such as Fe, Mn, and Al, enhancement of the availability of phosphorus, calcium, magnesium, and potassium, and enhancement of the activity and diversity of microbes in the soil. These improvements in soil health make the soil fit for crop cultivation. Cultivation Practices Along with the addition of soil amendments, cultivation practices are also reported to be beneficial for the management of problematic soil. These are as follows: Soil Tillage Deep plowing in order to increase infiltration of rainfall moisture to a considerable depth, compartmental bunding, which increases the opportunity time for infiltration of rainwater and opening of a dead furrow, which acts as a drainage channel during an event of heavy rainfall and stores moisture, are suggested modifications. Land Configuration Land leveling, which reduces depression spots where water gets collected and there may be an accumulation of salts and different land configurations such as ridges and furrows, and sowing of crop ¾ height of ridges are also suggested for efficient crop cultivation in problematic soils. Selection of Crops, Mulching, and Irrigation Crops tolerant of saline soil such as mustard, barley, cotton, and sugar beet (Jehangir *et al*., 2013) [10] are suggested; while for sodic/alkali soil, Karnal grass, para grass, rhodes grass, rice, sugar beet, and green manure crops such as dhaincha (*Sesbania aculeata*) are suggested (Chhabra, 1996) [6]. Other suggested measures are the application of excessive water during pre-sowing irrigation for leaching of salts, frequent and shallow irrigation, use of fresh quality irrigation water, and use of organic mulches to reduce evaporation losses, which will reduce the upward movement of salts. All these cultivation practices improve soil physical properties and promote soil microbial population and diversity, which ultimately contribute to soil health improvement. The addition of organic matters due to the growing of crops, application of mulches, and suitable microclimate provided by irrigation help in increasing microbial population, thereby improving soil biological health. Phytoremediation It is defined as the use of higher plants for the cost effective, environmental-friendly rehabilitation of soil and groundwater contaminated by toxic metals and organic compounds (Aken, 2011) [1]. Phytoremediation plays a role in soil health improvement through its capacity to combat soil pollution. It is achieved by phytoextraction (phytoaccumulation), phytovolatilization, phytostabilization, or phytodegradation (Yan *et al*., 2020) [15]. This strategy is important for heavy metal pollutants, organic pollutants, industrial effluents, sewage water, waste for landfills used as manure, etc. Nowadays, phytoremediation is essential as town compost and waste water from cities is increasingly used in agriculture in peri-urban areas mainly for the growing of vegetables and flowers. Therefore, these areas have polluted soil that needs to be reclaimed in a cost-effective way. At the same time, the use of agrochemicals is now a regular practice and is increasing day by day because of changes in the level of biotic stresses and the need to produce more from limited resources. Therefore, soil pollution is going to be an important reason for soil degradation in times to come. Some of such situations are observed in parts of India where soil ground water is becoming polluted because of the excessive use of agrochemicals (Kaur and Kaur, 2019) [11]. Considering this, it has become essential to incorporate the phytoremediation strategy in agricultural production systems. Besides pollution in agricultural land, areas for dumping of waste are increasing at an alarming rate (Kumar *et al*., 2017; Kiran *et al*., 2020) [13, 12], and they will act as a source of contaminants for agriculturally useful land in the future, and these are areas within the scope of phytoremediation. Another important consideration for the phytoremediation technique is that it does not show any significant effect on crop growth and development in the short term, but it helps in improving soil health by reducing the adverse effect of pollutants on human and animal health.

Materials and Methods

Assessment through the Problem identification: Low yield due to sodicity.

The study shows that salt tolerant wheat variety crop Location of the study: one village were studied namely- Bahadurpur block Bhagyanagar In through Krishi Vigyan Kendra Auraiya, in village 05 farmers were selected for the optimize the wheat yield in Partially reclaimed sodic soils by the use of sodic salt tolerant variety from district Auraiya UP India

Results and Discussion

Table 1: optimize the wheat yield in Partially reclaimed sodic soils by the use of sodic salt tolerant variety

Technology Option	No. of trials	Grain Yield (t/ha)	Straw Yield (t/ha)	Net Returns (Rs. in lakh /ha)
Farmers Practice (Lok 1)	5	3.64	5.21	0.30592
KRL 210		4.98	6.39	0.46710
KRL 213		4.24	5.58	0.36898

The results showed that the control of each variety displayed higher scavenging percentage that was gradually and significantly (p decreased by increasing the salt concentration. Among different varieties. the An On Farm Trial was conducted in Rabi 2012-13 by KVK, Auraiya to optimize the wheat yield in patially reclaimed sodic soils by the use of sodic salt tolerant variety developed by CSSRI, Karnal. The varieties KRL 210 and KRL 213 was tested against the local variety Lok 1. Both the varieties i.e. KRL 210 (4.98 and 6.39 t/ha) and KRL 213 (4.24 and 5.58 t/ha) showed the higher grain and straw yield as compared to local (3.64 and 5.21 t/ha). In terms of return KRL 210 showed the higest net return of Rs. 46710/- as compared to KRL 213 which showed the net return of Rs. 36898/- and least is in case of local (Rs. 30592/-). This showed that KRL 210 performance was best in sodic soil.

Conclusion

In the present day, soil no more remains a medium for plant growth but it turns into a valuable resource for mankind to meet its requirement of provisional services from plants and animals receding in agroecosystems. Considering the present level of land degradation, there is a need to develop and implement novel approaches to maintain soil health with a similar or even higher level of production from agroecosystems. Concepts such as diversification of nutrient sources with emphasis on the use of organic manures and other alternatives to compliment and supplement the chemical fertilizer-based approach will have the potential to contribute significantly to the improvement of soil health. The diversification of production systems through the adoption of conservation agriculture and organic farming is worth considering their role in soil health improvement. The closed system of nutrient cycling achieved through an integrated farming system, will be the self-sustained option of soil health management, along with improvement in resource use efficiency. There is a need to give attention to soil biological health, with the involvement of attempts to enhance soil microbial diversity and curtailment of soil pollution caused by the extensive use of agrochemicals (such as chemical fertilizers).

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