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Development of Microbial Bioinoculant of Soil Isolates for the Reclamation of Salt Affected Soils from Karad Taluka, Maharashtra, India: A Mini Review

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ABSTRACT

The land degradation due to water logging in sugar come track of Lousiness greet Maharashtra. Soil Costales adegrada great diversity of micro- organism belonging to different group of bacteria, fungi, algae etc. among the microbes. Some are now well known for their in hearten ability to tolerate Verifying salt concentration and promote plant growth. These salt tolerant plant beneficial microbes are of great importance in agriculture where to this study we will analyse the effect of some tolerant micro- organism on saline soils. This can be useful in other regions especially in agriculture Sector of western Ghats Maharashtra.

Key words : *Plant growth promoting microorganisms, Phosphate solubilizing bacteria, Nitrogen fixing microorganisms, Amino cyclopropane carboxylate*

Land and Land degradation

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Saline soil salinity and microbes

The salt affected soil is responsible for the decreases in growth and development of plants. As the global population increases day by day is decline in the cultivation of farmland due to salt affected soil which effect on food Scarcity. salt affected soil occurs the all over the world. The total area of global Salts affected Soil is 1 billion ha and in India nearly 674 million ha^{-1} but in is salt affected out of this 2.95 million ha^{-1} are saline soil (including Costal) and 3.78 million ha^{-1} are alkali soil. The management of salt stressed soil specific approaches for sustainable crop production recommend for agriculture purpose: The physic-chemical & biological methods will be using for reclamation of salt affected soil. The sole of microorganism has been working as problematic saline soil, Halophilic bacteria cyanobacteria phosphate solubilizing bacteria, potassium mobilizing bacteria, siderophore producing bacteria, plant growth promoting bacteria etc effective for reclamation saline soil.

Nowadays soil salinity has immerged as a serious issue for the agriculture sector. The salt is deposited

in excess amounts in the cultivated land, which directly affects the crop productivity. In India there is about 2.1 % of geographical area which is salt affected. So, there is an urgent need to remediate the saline soil. Use of Halophilic (salt tolerant) and salt reducing microbes for the remediation and health improvement of salt affected soil has novel application Arora (2016). Some researchers have tried and obtain positive results for the reclamation of saline soil. Many different isolates of *Azotobacter chroococcum* showed increased N2 fixing efficiency in saline and slightly saline environments compared to unsaline environments. Some researchers have tried and obtain positive results for the reclamation of saline soil. In a field experiment at a pH of 9.4, Arora *et al.* (2020) examined the viability of halophilic PGP bacterial isolates in salty soils. When seeds were infected with a consortium of halophilic N-fixers + P solubilizers, the yield of wheat *(Triticum aestivum)* in the fields increased from 3497 kg ha^{-1} to 4129 kg ha^{-1}. Straw yields also rose, from 5.03 to 6.24 t ha^{1}, after the introduction of the halophilic inoculates. Soil production can be improved and the plant's ability to withstand adverse environmental conditions enhanced by employing stress tolerant microbial strains connected with agronomic crop roots Wu *et al.*(2009). Orhan (2016) investigated the impact of halotolerant and halophilic bacteria on growth, enhancing capabilities in both in vitro and hydroponic cultures. The findings revealed that the investigated bacterial strains exhibited a wide range of plant growth-promoting properties in vitro. Root and branch lengths were significantly increased when the bacterial strains were applied to plants growing in salt stress conditions (200 mM NaCl). In addition, there was an increase in the aggregate fresh weight of plants. Plants that were given a bacterial strain saw growth rates between 62.2% and 78.1%.

Global Scenario

According to the United Nations Environment Program, about 20% of agricultural land and 50% of farmland throughout the globe is salt stressed. According to assessments, salinity and related issues, such as solicit, waterlogging, and droughts, cause around 2000 hectares of land to yield reduced agricultural output every day. Salts Ca^{2+}, Salt accumulation in soil is characterized by saline soil, contains high amount of soluble Mg^{2+}, K^{+} and Na^{+} salt of Cl^{-}, NO^{3-}, SO_4^{2-} & CO_3^{3-} etc; Sodic soil, dominated by Na+ salt & saline-sodic soil that has high salt of Ca^{2+}, Mg^{2+} and K^{+} as well as Nat. To reclaim salt affected soils, both physical and chemical methods are not cost-effective. The biotic approach 'plant-microbe interaction' to overcome salt stress has recently received a considerable approach 'plant-microbe interaction' to overcome salt stress has recently received a considerable attention from many workers throughout the world. Plant-microbe interaction is beneficial association between plants and microorganisms and also a more efficient method used for the reclamation of salt affected soils Arora *et al*. (2020).

Soil salinizationsalinity is the numberof dissolved saltsin the soil solution. The process of accumulating soluble Salts in the soil is known as salinization Sault in the so the weathering of primary minerals (which I make up the rocks of the original soil mineral) is the indirect source of salt present in the soil. The aged salt-affected by such natural processes from saline soil, soil could arise, such do not increase so drastically when Microbial Diversity and salt affected soils! the most commonly used microbes in this technique.

Halophilic Microorganism and their role

The saline microorganism also referred to as halophilic bacteria and fungi have the ability to as halophilic bacteria and fungi have the ability topromote growth of the plant in saline environment. Certain bacteria traits like exopolysaccharides production ability, 1- amino cyclopropane, 1-carboxylate (ACC) deaminase, and production of osmolytes, increasing 'nutrient asses and activity of antioxidant enzymes as well as maintain ratio of^{K+Na+} The suitable bacteria for promoting plant under salt affected environment. The capability of these microorganism to fix nitrogen, produce siderophore, solubilizing insoluble nutrients and protection of provision against harmful pathogens more accelerates the beneficial microorganismin agriculture sector. To establish eco-friendly species in reclamation of saline in agriculture. The halophilic bacteria and fungi could be a more effective approaches to reclama the salinity Zahir *et al.* (2019).

The microbial community diversity plays an important role in the nutrients cycling. Environmental stress in the soil affects the microorganism and becomes detrimental to the survival of the microbes, slow rate activities of surviving cells because ofthe metabolic load imposed by the starting and activa-

tion of the salt tolerant mechanisms. Schimel *et al*. (2007). Under a dry and hot environment where low humidity and salt affected soil are the most stressful factors for soil microbial diversity, the activity and metabolism of the microorganisms decrease. The detrimental and adverse effects are more in the rhizosphere of the plant because of the increase in the water absorption by the plants due to transpiration. Life under the stress of salinity has a requirement of high bioenergetics because the microflora need to maintain the osmotic equilibrium between the cytoplasm of the microbes and the surrounding environment. Microbes under salt stress conditions surviveby excluding the sodium ions from the cell inside, so microorganisms require a high energy, which is sufficient for osmoregulation. Oren *et al.* (2002). Cells are separated by the medium using a cell membrane, which is permeable to water. When the concentration of the salt increases Sustainability 2022, 14, 9280 3 of 24 in the surrounding medium of the cells and reaches a point where the solute concentration becomes high, the solute concentration inside the cells loses the water and leads to the risk of the drying out of the cell. Cells can tolerate the salt counter balances that increase in the osmotic pressure. Microbes had to be able to survive at high salt or solute concentration in the medium in order to maintain an equally high concentration of solute in the cell cytoplasm. The rising of the solute concentration in the cell cytoplasm can be achieved by the synthesis and accumulation of the small organic molecules, which are called compatible solutes because of their non-interference with cellular functions. Wood *et al.* (2011).

The accumulation of the potassium ions (K^+) inside the cell cytoplasm is another short-term response strategy to escape in situations where the salt concentration has rapidly increased. The enzymatic process is affected by the high ions' concentration; this is why mostorganisms synthesize the small organic molecules. Compatible solutes are accumulated in the cells, whereas the salt ions are toxic, as they interfere in the enzymatic activities, and sodium (Na^+) and chlorine (Cl–) must be excluded from the cells. The exclusion of the salt ions is possible through the cross-membrane protein pump. The binding of the K^+ ions is responsible for the activation of more than 50 plant enzymes, so an increase in the concentration of salt or Na^+ inter-feres with the binding of the K^+ binding sites, which leads disruption of the metabolic processes.

Soil reclamation: Microbial Bioinoculants

Agriculture is adversely affected due toabiotic stress like salinity, temperature, drought. Because of these major hindrances is seen the sustainable agriculture all around the world Gupta *et al*. (2019). There are some concern which are responsible for abiotic stress which include air, temperature, soil, drought Light, salinity and water pollutants Kapadia *et al.* (2021). During the night high temperatureis concluded to cause a proper reduction in plant growth and hormones metabolites. Antioxidant activities alters by temperature stress Zahrani *et al.*(2022).

To promote the growth of various plant PGPR (Plant growth-promoting rhizobacteria) plays an important role by various mechanism. Which is best alternate for saline soil affected plant and microbes. Many organisms plays an important role by producing Biofilm, Exopolysaccharide, Indole Acetic Acid and Siderophores in to the environment for survival of many plants Kalam *et al.*(2020). PGPR provides vegetative growth, increase in root, stem and shoot length of plant as well as it also increases nutrient content in the plant. Sharma *et al.* (2013). The use of salt tolerant bacteria is for to increase the yield of salt affected land, and this salt tolerating bacteria is used as a bio inoculant instead of using harmful chemical pesticides and fertilizers. Taylor *et al.*(2007)

Salinity of soils affects the plants in many ways which can decreased yield of crop in the farms such as low germination rate, vegetative growth, cell death, low nutritional potential (Ca, N, P, Fe) deficiency, reduces water availability to plants, nitrogen fixing ability, low chlorophyll content Saboor *et al*. (2021).

Conclusion

The challenges will be associated their reclamation and management of saline soil. The microbial consortia and potential bio inoculants will be benefited for reclamation of soil. The development and applications of Halophilic bacteria, Cyanobacteria, Nitrogen fixing bacteria, PSBS, Siderophore producing bacteria will be beneficial to long term production of crop productivity of salt affected soil. Treatment of saline soils with inoculants can become economically affordable for farmers in Karad Taluka.

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References

Arora, N.K., Fatima, T., Mishra, J., Mishra, I., Verma, S., Verma, R. and Bharti, C. 2020. Halo-tolerant plant growth promoting rhizobacteria for improving productivity and remediation of saline soils. *Journal of Advanced Research*. 26: 69-82.

Arora, S. 2016. Microbial approach for remediation and health management of salt affected soil. *Soil conservation society of India*, New Delhi.

Oren, A. 2002. Molecular ecology of extremely halophilic archaea and bacteria. F*EMS Microbiol. Ecol*. 39: 1-7.

Schimel, J.P., Balser, T.C. and Wallenstein, M. 2007. Microbial stress response physiology and its implications for ecosystem function. *Ecology.* 88: 1386-1394.

Wood, J.M. 2011. Bacterial Osmoregulation: A Paradigm for the Study of Cellular Homeostasis. *Annu. Rev. Microbiol*. 65: 215-238.

Wu, C.H., Bernard, S.M., Anderson, G.L. and Chen, W. 2009. Developing microbe-plant interactions for applications in plant-growth promotion and disease control, production of useful compounds, remediation and carbon sequestration. *Microb Biotechnol*. 2: 428-444.