Agricultural Science Horizon (2026) 2(1): 6-10

Noticeable Challenges Facing Agriculture Sector

Muhammad Danish Toor

European University of Lefke, Institute of Graduate Studies and Research, Department of Environmental Science Northern Cyprus TR-10 Mersin, Turkey

K E Y W O R D S

Agricultural assets, Global GDP, Challenges, Land degradation, Drought stress, Biotic stress, Nutrient's deficiency

A B S T R A C T

We are living in an agriculturally based world. Where human development predominantly depends upon agricultural assets. A large number of workforces are surviving due to agriculture. It also contributes as a backbone of global GDP. In short, more than half population of the world directly or indirectly depends upon farming sector. Even though it has important and progressive influences, yet the farming of the world faces several challenges and pressures. The noticeable problems include, land degradation, drought stress in plants, biotic stress in term of reduction in the amount of microbial population, environmental management, nutrients deficiency, influence of industrial waste water, impact of inorganic fertilizers and effects of pollution etc. These noticeable problems of agriculture greatly affect the production as well as fertility of our soils. Moreover, this study will help the researchers to find out the restored solution for the control of these noticeable problems of agriculture which is directly or indirectly damaging the farming sector.

Corresponding Author Email: muhammaddanishtoor@gmail.com

1. Introduction

Agriculture is a key source of employment and plays an important part in foreign exchange earnings. In short, it is a vital sector of economy. The growth in agriculture is very important because it is a main profitable sector, which provides the basic components to the people. It is perceived that the production of agriculture is directly proportional to the economic growth because, when there is an increase in agriculture productivity the growth of economic sectors also rises extensively (Anwer et al., 2015). Conversely, there are several factors which effect the production of agriculture. Likewise, degradation of land because it is an environmental process in which the excellence of land is disturb due to change in physical, chemical, and biotic properties. Degradation of land may be produced by erosion, loss of organic matter, removal of forest, compaction of soil and such additional phenomena that create agrarian land critical for the production of crop (Turner et al., 2016).

About 60 % of land is degraded Worldwide (Pimentel, 2006). Likewise, degradation of land is altering hydrological and biogeochemical cycles (Brevik et al., 2015). Degradation of land is an environmental sensation that distressing the arid lands and influences the natural and economic quality of an agricultural land (Mantel et a, 1997). Secondly, drought stress is also affecting the production of agriculture crop by adversely affects the mechanisms within the plant body such as proteins formation, materialization of nucleic acid and development of carbohydrates which decreases the absolute growth and production of crop (Table 1). not only holds back the growth of plant at several phases but also disturbs the yield and quality of crop (Guo Y et al., 2018) To accomplish the condition of foodstuff, energy and raw material the stress on farming land has been increases due to the fast rise in the amount of human population. Famers apply pesticides and chemical fertilizers to achieve the desires but this damages the health of soil and causes deterioration of biodiversity in soil (Carsten at al., 2014).

Table1 Total land area and population affected by major problems

Major problems of agriculture	Total land area (%)	Affected population (million)
Land Degradation	25	3200
Drought Stress	40	55
Depletion of soil Microbes	20-60	40
Environment and Agriculture	80	930

Submission date: 12-01-2026, Revision date: 20-04-2026, Acceptance date: 10-05-2026, Published online: 15-06-2026

Nutrient Deficiency	33	2000
Heavy metals	12	200
Inorganic Fertilizers	50	7000

Thirdly, change in environmental conditions is also the most severe hazard of environment that negatively affects the agricultural productivity. Because there are various factors like moisture and temperature which are directly linked with environment and influenced the plant system as well as crop yield. These aspects may act both synergistically or antagonistically with more factors in determination of yields (MacDonald at., al 2000). Moreover, agricultural land is polluted with heavy metals which are a worldwide problem at present. Furthermore, accumulation of heavy metals producing decrease in agricultural yield and also hazardous effects on health when it became a part of diet chain. Likewise, in plants many processes are affected by nickel with the most common symptoms such as Chlorosis, inhibited respiration and photosynthesis when it is up taken in toxic level (Fatemeh et al., 2012). Furthermore, nonstop use of fertilizer which are chemical in nature may result in a string of heavy metal at toxic level such as cadmium, arsenic and uranium in the soil. These chemical fertilizers also affect the soil very adversarial and severe (Sonmez et al., 2007).

1.1.Major Problems of Agriculture

1.1.1. Land Degradation

Land is the vital component of agriculture because farming sector is directly connected with land which delivers us basic necessaries of life. But unluckily generation by generation our agricultural land reserve is degraded by many elements like natural, climatic and anthropogenic. These factors causing decline in land quality and despoiled it for farming use. Moreover, speedy variations in climatic circumstances, desertification, and removal of forest, erosion, accumulation of salts in excessive amount, waterlogging, and depletion of organic matter led to the degradation of land. For land restoration, it is essential to reduce and managed the effects of these elements. By ground covers, alternating source of fuels, replantation of timber, making the policies and dams we can manage agricultural land (Toor et al., 2020).

According to UNEP (2007) degradation of land is an ongoing environmental deterioration and decline of production (Bai et al., 2006). Generally annual degradation budget is about 40 billion USD (ELD Initiative, 2013) and it will keep on a key problem for 21st century because of its deleterious effects on environment, agriculture and food security. In short it has become a main environmental problem (Scherr, 1999). Worldwide, land degradation is roughly 18.1 million km^2 in which 92 % is because of poor management and 38 % is due to animals overgrazing (Hamdy and Aly, 2014). Generally, 30 % jungles, 20 % of arable land and 10 % savannas are affected due to degradation of land. It may be because of the outcome of different aspects or mixture of anthropogenic actions like variations in climatic conditions and unsustainable land management (Bai et al., 2008).

1.1.2. Drought stress

The production of crops and animals rearing is simply known as Agriculture although some elements deteriorate the land quality and degraded it for cultivation, drought stress is one of them. Furthermore, drought is a most challenging problem that alarming the farming sector globally (Abolhasani and Saeidi, 2004; Adnan, 2020). Drought stress limiting the crop production by adversely disturbing the plant mechanisms which decreases the final production and growth of crop. There are several ways to control drought stress but the easiest technique is foliar application of zinc because Zn is a dynamic element that plays a significant role in various biological processes and application of Zn considerably reduced the harmful effects of droughts stress on plants by decreasing photo oxidative damages (Toor et al., 2020b). Although, during drought situation, absorption of micronutrients by plant roots is adversely affected (Heidarian et al., 2011). It reduces the ability of transpiration and photosynthesis in plants (Figure 1). It adversely effects the propagation of seed, development and growth of many crops. For adjusting deficiencies and controlling drought stress foliar application of zinc is suggested due to zero residual effect and on each crop new applications must be made.

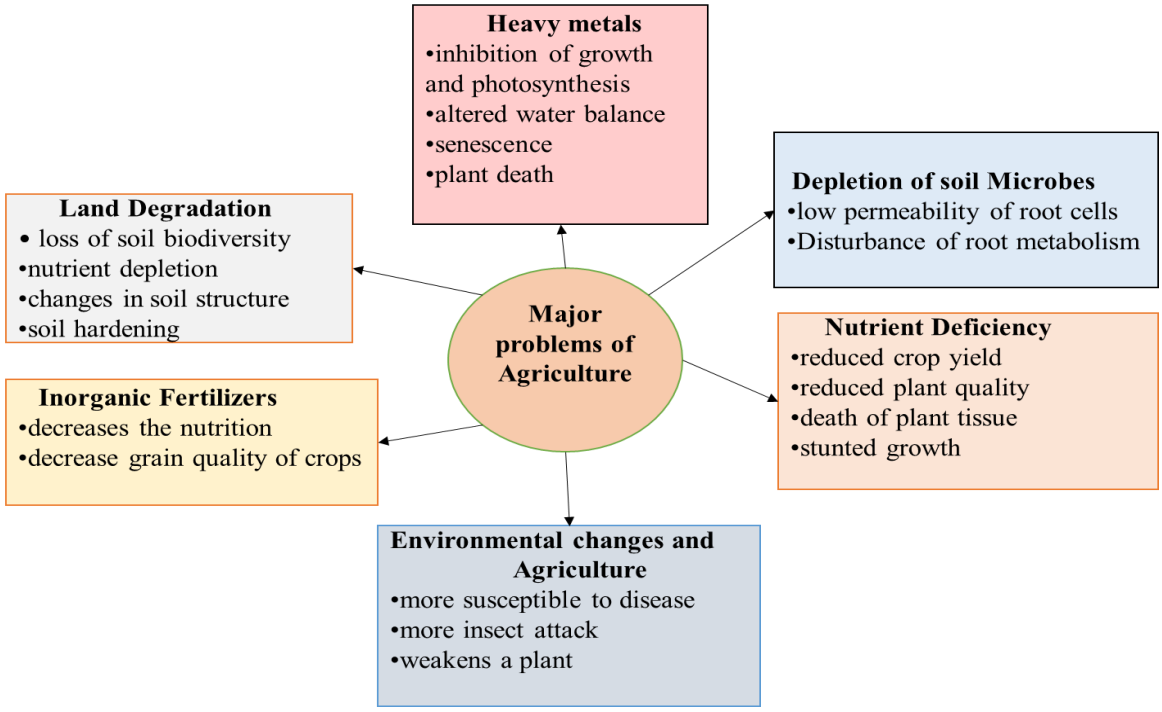

Figure 1 Description of major problems of agriculture

1.1.3. Salinity stress

In the contemporary period, agricultural output has declined due to the negative effects of climate change, increasing global temperatures, and increasing environmental stresses. Therefore, it seems that using suitable solutions and ecologically compatible and friendly techniques to reduce the negative impacts of these stresses on plants is essential for achieving sustainable agricultural development and increasing agricultural products that can feed the world's population. Soil salinity is a worldwide problem that reduces crop yields. The most up-to-date information suggests that crops grown in soils that have been damaged by salt experience osmotic stress, nutrient diseases and toxicity, less physical soil quality, and lower crop yields. Considering the increasing need for food, it is of the utmost importance to reduce crop losses caused by salt stress. New agricultural technology are necessary to enhance food production on soils damaged by salt. There are a number of ways in which beneficial halotolerant rhizospheric bacteria can improve plants' tolerance to salt. These include developing stronger root systems, improving soil structure, increasing water and nutrient uptake, decreasing sodium absorption, mitigating the effects of ethylene stress, and increasing the expression of genes that are involved in salt resistance. Microbial inoculation of plants to reduce stress may be a more cost-effective, environmentally friendly, and time-efficient solution.

Depletion of Soil Microbes

Soil microbes play a significant role in building a compound link among plants and soil. For healthy growth of crop, activity of microbes is very essential to improve the strength of soil because soil delivers a base for the production of agriculture. In the soil system, soil microbes performed several positive functions and act as a dynamic constituent of soil. Microorganisms are involved in a wide variety of biological processes, including the conversion of organic matter (OM) and biological nitrogen fixation (BNF). Additionally, they increased the nutritional availability to the plants. Typically, one gramme of soil contains around 90 million bacteria that assist plants in nutrient absorption by converting inaccessible nutrients to available forms. Due to a lack of information about microorganisms' relevance, people tend to focus on their negative influence, as germs frequently serve as disease-causing agents. However, from an agricultural standpoint, microorganisms are extremely advantageous to plant development. Nowadays, biotic stress is a significant concern for agriculturalists, as the enormous increase in the human population degrades the land and depletes the microbial population, which has a detrimental effect on plant development. By and large, people believe that microorganisms are pathogenic agents. Organic materials will decompose with the assistance of these soil microbes (Schulz et al., 2013). Additionally, it is noted that several bacterial species have been employed to mineralize organic toxins during soil bioremediation (Zaidi et al., 2008).

Environmental changes and Agriculture

There is a wealth of literature on environmental management and the deployment of technology for sustainable agriculture in agriculture. The purpose of this review article is to provide light on the link between environmental changes and their effect on agriculture. This bidirectional relationship between environmental change and agriculture is gaining traction. Agriculture's production is mostly determined by the environment. Agriculture is inextricably linked to the larger environment and consumes around one-third of the world's land surface. Global warming will increase the power and frequency of severe events, such as water scarcity, flooding, and tornadoes, all of which will have a detrimental effect on the water balance and agricultural productivity in the coming years. Agriculture is impacted by climate change through greenhouse gas emissions such as nitrous oxide, methane, and carbon dioxide. The direct sources of these emissions include tillage methods, fossil fuels, livestock manure, and a high fraction of fertilized agricultural soils. Climate change is expected

to have an effect on agricultural productivity via a variety of indirect and direct mechanisms. Water availability and temperature variations, together with higher deviation in meteorological conditions and more frequent weather episodic occurrences, will have a direct effect on agricultural production.

Nutrient's deficiency

According to Saeed et al. (2020), several countries are facing the problem of dietary inadequacies. Micronutrient insufficiency poses a serious threat to the global population, according to statistics from the World Health Organization (WHO, 2007). Minerals like calcium, zinc, and iron are essential for plant development and growth. When it comes to crop management, bio fortification, also known as foliar fertilization, is crucial for getting the most out of your harvest. One way to improve food is by bio fortification, which involves adding beneficial components such as macro- and micronutrients, stimulants, and plant hormones. Plant development and growth are directly impacted by the availability of nutrients. There are two main types of plant nutrients, macronutrients and micronutrients, that are essential to plant growth and development. Among these nutrients are nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), zinc (Zn), iron (Fe), boron (B), sulfur (S), and magnesium (Mg). Many nutrients in plants control biological reactions, increase disease resistance, and eventually lower harvest quality. A combination of factors, including a world population on the rise and a downward spiral in agricultural production, has made food safety an urgent issue. That is why a balanced application of nutrients is so important for increasing food production and crop yields. In addition, mineral amendments greatly improve soil fertility, which in turn fosters better plant growth.

Effect of heavy metal

Heavy metals are primarily responsible for stomatal closure, which results in decreased transpiration. As a result of the decrease in moisture content and stomatal closure, photosynthesis becomes hazardous (Seregin et al., 2003). Nickel often accumulates near the soil surface and distributes evenly throughout the soil profile. Ni is a microelement that is critical for plant growth and metabolism (Fargasova et al., 2008). Excessive application results in the breakdown of food stored in seeds and impair seed germination (Pandey et al., 2002). Baccouch et al. (2001) demonstrated that nickel toxicity resulted in oxidative stress in roots and increased lipid peroxidation, which might be a consequence of the basic effects of nickel stress. Bashmakov et al. (2005) investigated the development of seedlings using physiological and sub lethal dosages of heavy metals lead, copper, nickel, and Zn. Ten to one hundred millimeters While physiological concentrations promoted development in young plants, 1–5 M inhibited growth processes and biomass accumulation in roots, as well as causing leaf area decrease and water imbalance. The concentration of heavy metals and the chemical nature are accountable for their effects.

Impact of Inorganic Fertilizers

Agricultural output is now in high demand due to the need to meet demanding quality requirements while also creating environmentally conscious strategies. The ongoing use of inorganic fertilisers puts a strain on our land and ecology, despite the fact that they are essential for plant growth and output. Therefore, we should use organic fertilizers again, as they plainly work better than synthetic ones. Because of their high nutrient concentration and high organic matter proportion, organic fertilisers can enhance the soil's physical properties, such as aggregate stability and bulk density, as well as its biological and biochemical properties and the structure of its microbial community (Ilahi et al., 2020). In order to achieve high agricultural productivity, chemical fertilisers are essential (Hepperly et al., 2009). Chemical fertilizers increase plant strength and growth, which satisfies worldwide food safety regulations, but this method of growing plants lacks the development of desirable traits like healthy root and shoot structures, nutritional qualities, and enough time to mature (Kumar et al., 2019). According to Thakur et al. (2001), in continuous cropping systems, using inorganic fertilizers to apply excessive amounts of nutrients (N or NP alone) isn't enough to maintain a certain level of crop yield, which eventually hinders the natural functioning of agricultural crops.

Conclusion

In short, more than half of the world's population is directly or indirectly dependent on agriculture. Despite its significant and beneficial impacts, global agriculture confronts a number of problems and constraints. Several notable issues include land degradation, drought stress on plants, and biotic stress in the form of a reduction in the number of microbial populations, environmental management, nutrient deficiency, industrial waste water influence, inorganic fertiliser impact, and pollution effects, among others. This paper outlines the problems and impediments that agriculture faces globally today in order to sustainably enhance agricultural production. It is founded on an examination of current data and references and highlights numerous significant difficulties. In conclusion, global adoption of new technology has the potential to increase production sustainably, protect agricultural enterprises, and perhaps reduce reliance on imports.

Conflict of interest

Authors declared no conflict of interest each other.

Acknowledgments

Authors are highly thankful to Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad, Pakistan for their moral support.

Contributions

All the authors contributed equally in the current manuscript.

References

Anwer M, Farooqi S and Qureshi Y (2015) Agriculture sector performance: An analysis through the role of agriculture sector share in GDP. *J*. Agric. Ext. *Rural* Dev, 3(3): 270-275.

Turner KG, Anderson S, Gonzales-Chang, Costanza M and Courville R, *et al* (2016) A review of methods, data, and models to assess changes in the value of ecosystem services from land degradation and restoration. Ecol. Modell, 319: 19-207.

Pimentel D (2006) Soil erosion: A food and environmental threat. Environ. Dev. Sustain. 8: 119-137.

Brevik EC, Cerda A, Mataix-Solera J, Pereg L and Quinton JN *et al* (2015) The interdisciplinary nature of Soil. Soil. 1: 117-129.

Mantel S and Engelen VWP (1997) The impact of land and degradation on food productivity-case studies of Uruguay. Argentina and Kenya. Vol 1, Main report. Report 97/01, Int Soil Reference and Infernation Center (ISRIC). p. 52. Wageningen.

Guo Y, Tian S, Liu S, Wang W and Sui N (2018) Energy dissipation and antioxidant enzyme system protect photosystem II of sweet sorghum under drought stress. Photosynthetica, 56:861-872.

Carsten SJ and Mathis HH (2014) Agricultural soils pesticides and microbial diversity. Curr Opin Biotechnol, 27: 15-20.

MacDonald D, Crabtree JR, Wiesinger G, Dax T, Stamou N and Fleury P *et al* (2000) Agricultural abandonment in mountain areas of Europe:

environmental consequences and policy response. J. Environ Managment, 59: 47-69.

Fatemeh G, Heidari R, Jameii R and Purakbar L (2012) Effects of Ni^{2+} toxicity on Hill reaction and membran functionality in maize. J. Stress Physiol. Biochem, 8(4):55-6

Sonmez KM and Sonmez S (2007) An investigation of seasonal changes in nitrate contents of soils and irrigation waters in greenhouses located in Antalya-Demre region. Asian J. Chem 19(7), 5639.

Toor MD, Adnan M, Raza A, Ahmed R, Arshad A and Maqsood H *et al* (2020a) Land Degradation and its Management: A Review. Int. J. Environ. Sci. Nat, 25(1):54-57.

Bai ZG and Dent DI (2006) Global assessment of land degradation and improvement: Pilot study in Kenya, Report 2006/01. p. 42. ISRIC-World Soil Information Wageningen.

ELD Initiative (2013) The rewards of investing in sustainable land management. Interim Report for the Economics of Land Degradation Initiative: A global strategy for sustainable land management, The Economics of Land Degradation (ELD) Initiative.

Scherr SJ (1999) Soil degradation: a threat to developing-country food security by 2020? Int. Food Policy Res. Ins, 27: 20- 27.

Hamdy A and Aly A (2014) Land degradation, agriculture productivity and food security. In: Fifth International Scientific Agricultural Symposium, Presented at the Agrosym.

Bai ZG, Dent DL, Olsson L and Schaepman ME (2008) Global assessment of land degradation and improvement. 1. Identification by remote sensing. Report 2008/01, ISRIC – World Soil Information Wageningen.

Abolhasani K and Saeidi G (2004) Relationships between agronomic characteristic of safflower under water stress and control. IR. J. Field Crops Res, 1:127-138.

Adnan M (2020) Application of Selenium; A Useful Way to Mitigate Drought Stress; A Review. J. Biog. Sci. Res, 3(1):1-4.

Toor MD, Adnan M, Javed MS, Habibah UE, Arshad A, Mughees ud din M and Ahmad R (2020b) Foliar application of Zn: Best way to mitigate drought stress in plants; A review. Int. J. Appl. Res, 6 (8): 16-20.

Heidarian AR, Kord H, Mosafavi K, Lak AP, Amini F (2011) Investigation Fe and Zn foliar application on yield and its components of soybean (*Glycine max L.*) at different growth stages. J. Agric. Biotech, 3(9):189-197.

Schulz S, Brankatschk R, Dümig A, Kögel-Knabner, Schloter M (2013) The role of microorganisms at different stages of ecosystem development for soil formation. Biogeosciences, 10: 3983-3996.

Zaidi S, Usmani S, Singh BR and Musarrat J (2008) Significance of Bacillus subtilis strains SJ-101 as a bioinoculant for concurrent plant growth promotion and nickel accumulation in Brassica Juncea. Chemosphere, 64: 991-997.

Saeed MS, Saeed A and Adnan M (2020) Production and Utilization of Single Cell Proteins-An Overview. Curr. Res. Agri. Farm, 1(4): 9-12.

WHO (2007) Micronutrient deficiency: iron deficiency anaemia. Geneva: WHO.

Seregin IV, Kozhevnikova AD, Kazyumina EM and Ivanov VB (2003) Nickel Toxicity and Distribution in Maize Roots. Russ. J. Plant. Physiol, 50(5): 711–717.

Fargasova A (2008) Phytotoxicity of chromium and nickel. Ecol. Chem. Eng. S, 15:355-348.

Pandey N and Sharma CP (2002) Effect of heavy metals Co, Ni and Cd on growth and metabolism of cabbage. J. Plant Sci, 163:753-758.

Baccouch S, Chaoui AE and Ferjani E (2001) Nickel toxicity induces oxidative damage in Zea mays. J. Anim. Vet. Adv, 24:1085-1997.

Bashmakov DL, Lukatkin AS, Reevin VV, Duchovskis P, Brazaityte A and Baranauskis K (2005) Growth of maize seedling affected by different concentration of heavy metals. Ekol, 3:22-27.

Ilahi H, Hidayat K, Adnan M, Rehman Fur, Tahir R, Saeed MS, Shah SWA and Toor MD (2020) Accentuating the Impact of Inorganic and Organic Fertilizers on Agriculture Crop Production. A Review, Ind. J. Pure App. Biosci, 9(1): 36-45

Hepperly YP, Lotter D, Ulsh CZ, Siedel R and Reider C (2009) Compost Sci. Util, 17: 117–126.

Kumar CR, Kumar R and Prakash O (2019) The impact of chemical fertilizers on our environment and ecosystem. Res. Trends Environ Sci, 5: 69-86.

Thakur R, Sawarkar SD, Vaishya UK and Muneshwar S (2001) Impact of continuous use of inorganic fertilizers and organic manure on soil properties and productivity under soybean-wheat intensive cropping of a vertisol. J. Indian Soc. Soil Sci, 59(1): 74-81.