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Improvement of Gypsum Soil Properties by Adding Organic and Mineral Fertilizers and Its Productivity for Oil Crops(Review Article).

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ABSTRACT
These studies were carried out with the purpose of boosting the efficiency of oil crop production. The purpose of this study was to gain a better understanding of how the use of organic and mineral fertilizers can influence the physical and chemical features of gypsum soils. Compost, manure, and biochar are examples of organic soil additions that may provide an increase in soil porosity, water-holding capacity, soil microbial population, root penetration, and nutrient utilization. These improvements can be accomplished by the application of organic soil amendments. On the other hand, there is the availability of concentrated inorganic fertilizers, which provide a substantial amount of elements such as minerals and vitamins. These fertilizers are composed of nitrogen, phosphorus, and potassium, and their purpose is to improve the quality of crops as well as the vitality of plants. By combining a number of different methods of fertilization, it is possible to successfully lessen the quantity of soil that is compacted and to optimize the efficiency with which nutrients, root conditions, and water regimes are cycled through the plant. Research conducted in the field has shown that the implementation of the strategy leads to an increase in the amount of oil crops that are produced. An increase in oil quality and quantity, as well as an increase in the plant's resistance to abiotic stresses like salt and drought, are the means by which this objective may be attained. According to the findings of this research, the management of gypsum soils should make use of methods that are both effective and environmentally friendly. It also established that the most effective method to attain these aims is to combine organic and mineral fertilisers as the acceptable and practical techniques to promote sustainable agriculture and realise the oil crop production potential on gypsum soils. This was determined by the findings of the study.

***Keywords*:** Gypsum soils, organic fertilizers, mineral fertilizers, soil fertility, oil crops, sustainable agriculture, soil improvement.

INTRODUCTION
The irrigated lands where agriculture, especially the cultivation of oil crops, has been developed experience severe desertification, water and wind erosion, and salinization. Changes in soil structure and properties have led to decreased soil fertility. Gypsum soils are particularly vulnerable to degradation if cultivated carelessly, resulting in increased soil density, reduced water permeability and infiltration, and thinning of the active topsoil layer, while deeper layers cease functioning effectively. The detrimental effects of increased gypsum content can hinder root system development, worsen soil fertility, and reduce plant growth, development, yield, and the content of useful substances in plant biomass [1].

To counter these effects, using organic and mineral fertilizers and cultivating crops like lupine and amaranth is suggested. Scientific investigations aimed at increasing the productivity of gypsum soil for oilseed crops through fertilization are essential. Applying these fertilizers has shown nearly a 100% yield increase in oilseed crops like soybeans compared to untreated soils. Additionally, humus and nutrient content in the topsoil improved, and soil pH shifted toward the alkaline range. These findings highlight the potential for ecological restoration through fertilization [2].

Gypsum Soil Properties
In some areas, soils suffer from gypsum contamination, leading to degraded soil properties such as disrupted water regimes, poor plant nutrition, and reduced crop productivity. This study aimed to evaluate the effectiveness of humates and mineral fertilisers in modifying gypsum-contaminated soil properties (Figure 1) and boosting sunflower and rapeseed yields [3].

The researched soils were classified as chromatophosols, differing in bioactive element content. The highest gypsum content was found in the soil horizon, with similar levels in the primary and subsoil layers (Figure.2). High calcium saturation was observed in the soil adsorption complex, with $Ca^{2+}/\Sigma(Ca+Mg)$ ratios ranging from 0.75-0.97 in the primary soil layer and 0.99-1.00 in the subsoil. Conversely, cation exchange capacity (CEC) was relatively low. Soil pH values ranged from 4.61 to 4.87, decreasing significantly in subsoil layers due to gypsum and free aluminium content [4].

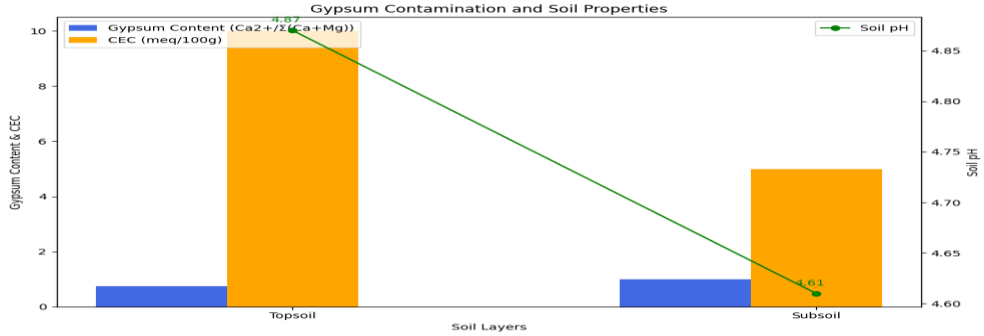

Figure.1 “A comparative analysis of the effect of gypsum contamination on the chemical properties of the top-soil and sub-soil horizons. The above graph shows fluctuation between gypsum content $Ca^{2+}/\Sigma(Ca+Mg)$, CEC, and soil pH. Gypsum content and calcium saturation increase downwards while CEC values decrease downwards, showing poor nutrient holding capacity for deeper layers of subsoils.”

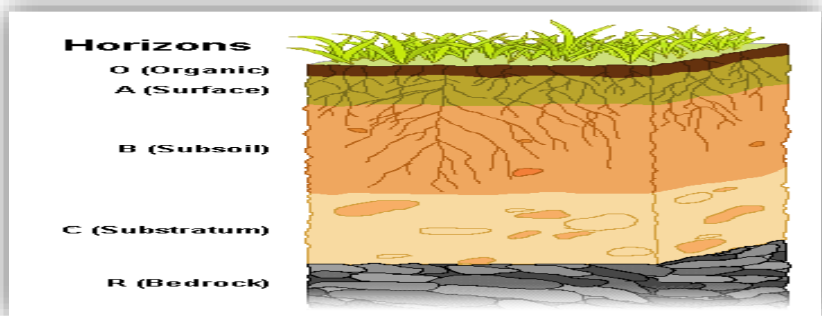

Figure.2 Soil Layers

Characteristics of Gypsum Soil

The main soil-forming rocks in the North Caucasus are carbonaceous and low-mountain gypsum, characterized by low humus content, limited mineral nutrients, especially nitrogen, less mobile phosphorus forms, and heavy metal accumulation. Soil reclamation in this region requires high doses of organic and mineral fertilizers. Reclamation efforts have improved gypsum soil properties, boosted crop yields, and enhanced nutrient absorption due to extended snow retention periods [5].
Research indicated that control soils of carbonaceous gypsum contained 0.3% humus, 185 mg/kg soluble nitrogen, and minimal hydrolyzable phosphorus. Sunflowers absorbed inorganic phosphorus from endospheres primarily during early growth stages. Root exudation of carboxylate ions promotes phosphorus availability, which is essential for plant nutrition. Due to low exchangeable cations, plants relied on rhizospheric microorganisms for magnesium, potassium, and sodium, while heavy metals were immobilized due to high clay content and cation exchange capacity (Figure.3) [6].

A

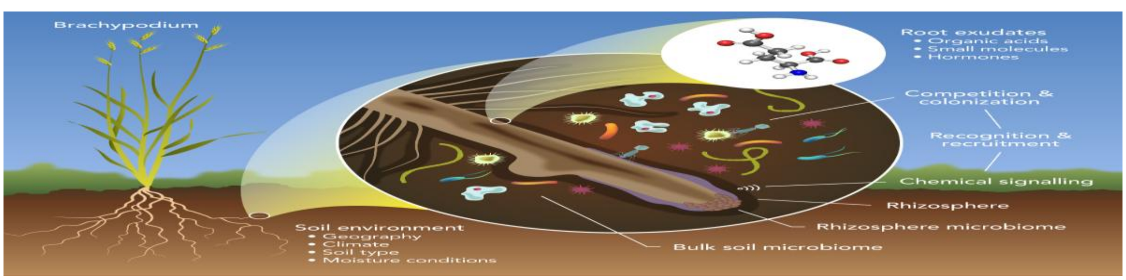

Figure.3

visualization of rhizospheric microorganisms interacting with plant roots in soil.

Importance of Gypsum Soil in Agriculture

Gypsum soils are very important in agriculture especially in areas that are characterized with water rationing or areas which soils are degrading due to water stress or poor quality water. Each of these soils is cemented with high gypsum content giving them specific physical and chemical properties suitable for agriculture with some complications. As a type of soil, intensive management should be employed so as to realize their potential in the support of agricultural activities [7].

One of the main benefits of using gypsum soil is the fact that it enhances the soil structure. Being a soil conditioner, it facilitates aggregate stability of gypsum, improves water infiltration, and provides better drainage. It is especially important in areas where water is scarce since it reduces forming of pus on the ground; at the same time, it makes moisture available to the root systems in plentiful amounts. In addition, it is established that intensive recalcitrant gypsum soils do not impart the detrimental consequences of salinization-a noteworthy nuisance in arid climates. Gypsum removes sodium ions from the soil and also has a role in changing the physic chemical condition of the soil to support crop production [8].

But again, gypsum soils have limitation that need to be managed to enhance production and yields. Such soils often have a low organic matter content, available micronutrients, and easily compactible particles. Efficient fertilizer technologies, such as the incorporation of organic matter and the fundamental nutrients, that will help in the improvement of the fertility of the gypsum soils, must be applied in an appropriate way for the fertilization of the gypsum soils. Also, crop choices which are not sensitive to the conditions of the gypsum soils would enhance agricultural performance [9].

With regard to the discourse of sustainable agriculture, gypsum soil is a pool of opportunities that can support soil conservation, increased land yield and food security even under unfavorable conditions of the physical environment. Such 'droughty' soils, if properly managed, can offer a lasting resource, enhancing the sustainability of our agricultural system and the viability of agri-production systems in the arid and semi-arid areas [10].

Several studies indicate that gypsum soils suffer from a deficiency in the available quantities of most nutrients. [24] found 18.2 mg kg^{-1} soil available nitrogen in the soils of the College of Agriculture fields at Tikrit University. With regard to the discourse of sustainable agriculture, gypsum soil is a pool of opportunities that can support soil conservation, increased land yield and food security even under unfavourable conditions of the physical environment. Such 'droughty' soils, if properly managed, can offer a lasting resource, enhancing the sustainability of our agricultural system and the viability of agri-production systems in the arid and semi-arid areas [11].

Organic and Mineral Fertilizers

Types of Organic Fertilizers

Another type of fertilizer is the organic fertilizer and this is those fertilizers that are from natural products Table.1. The most common types are compost, manure, and biochar, all of which add different values to most agricultural settings. Organic manure, prepared from decomposing matters, plant products, and kitchen wastes is a rich source of nutrients in addition to contributing to the improvement of the soil structure. It helps, in creating pore spaces between the particles, which aid in aeration, improves water retention, and stimulates microbial organisms whose main habitat is in the soil [7].

Another organic fertilizer is manure coming from any living cattle and other livestock. It gives nitrogen phosphorus and potassium needs of plants and at the same time contributes to the content of the organic matter in the soil. It also assists in soil development for fertility, water retention and is a constraining factor from soil erosion. This helps reduce contamination with pathogen and makes manure suitable for use in crops production Properly aged or processed manure is safe for crops when applied [11].

Biomass pyrolysis produces biochar, which has been widely considered to have the potential to enhance the physical status of the soil. This activity helps in improving water recruitment and nutrient utilization, alleviation of soil acidity and improvement of soil health through the support of beneficial microbial population. There is substantial literature on how biochar helps in storage of carbon in the soil for long term, so it has a potential for mitigating climate change [12].

Also, organic manures release nutrients slowly in the soil rather than releasing them at once, as is the case with mineral fertilisers, and this greatly reduces leaching and constantly avails nutrients to the crops. They also help in maintaining long term health of the soils by augmenting the organic content of the soil as well as encouraging suitable microbial actions [13].

The inclusion of organic fertilizers in agriculture has a positive impact on sustainable farming systems since quantity of soil fertility can be enhanced, water retention ability and environmental conservation can be enhanced. Their application is most important in combating soil degradation and sustaining agriculture systems in various production environments [14].

Table.1 organic fertilizer and their benefits:

Type of Organic Fertilizer	Source	Key Benefits
Compost	Decomposed organic matter (e.g., plant residues, food waste)	Improves soil structure, enhances aeration, increases water retention, and boosts microbial activity. [13,14,15].
Manure	Animal waste (e.g., cattle, poultry, or sheep manure)	Provides essential nutrients (nitrogen, phosphorus, potassium), increases organic matter, and retains moisture. [13,14,15].
Biochar	Biomass (e.g., wood, crop residues) processed via pyrolysis	Improves water retention, enhances nutrient availability, reduces soil acidity, and sequesters carbon. [4].
Green Manure	Cover crops (e.g., clover, alfalfa) plowed into the soil	Enriches soil with nitrogen, suppresses weeds, and improves soil structure. [17].
Bone Meal	Finely ground animal bones	Provides a slow-release source of phosphorus and calcium, improving root development and plant strength. [12].

Fish Emulsion	Byproducts of fish processing	Offers quick-release nutrients, especially nitrogen, and boosts plant growth.[13 , 14].
Vermicompost	Decomposed organic material processed by earthworms	Enhances nutrient availability, increases microbial activity, and improves soil structure. [19].
Peat Moss	Decomposed sphagnum moss or other organic material	Enhances water retention, improves soil aeration, and reduces soil compaction. [15].
Seaweed Fertilizer	Extracted from marine algae (e.g., kelp)	Supplies trace minerals, boosts plant health, and enhances resistance to stress. [14].

Types of Mineral Fertilizers

Mineral fertilizers have become notable input in contemporary farming because they supply the plants with nutrients that are in one way or another easily accessible to enhance the plant density's production output Table.2. These fertilizers, which contain nitrogen (N), phosphorus (P) and potassium (K) are essential in supplements for wants in the soil and production needs in intensively farmed ground [15].

Organic nitrogen fertilizers like urea and ammonium nitrate are important in encouraging growing of vegetations. Nitrogen makes up chlorophyll, which is the pigment in plants needed for photosynthesis as well as aminos, which are the acids that make for proteins. Nitrogen availability forms one of the best ways through which farmers can improve on plant growth and the possible yields [16].

Phosphorus fertilizer which includes super phosphate and DAP are crucial as root formation, transport of energy to the plant tissues and flowering. Phosphorus is most important for initial stage of plant growth and enhances the quality of the crop by increasing the structural characteristics [17].

Potassium bearing fertilizers including potassium chloride and potassium sulfate improve the plant stress tolerance, drought susceptibility, and other constraints including pest and diseases. Potassium affects water absorption, stimulates enzymes, builds up strong cell membranes which enhance crop quality and shelf life [18].

The nutrient depletion is more rampant in intensively farmed systems because crops are grown frequently. Mineral fertilizers replace these nutrients and sustain soil fertility hence enhancing sustainable crop production. When properly applied, incorporation of these fertilizers will help farmers to avoid degradation in their soils, produce yields for longer periods, and most importantly use resources appropriately [19].

Nonetheless, if used inappropriately and or in large proportions, these mineral fertilizers may cause the following environmental problems: Water pollution and soil salinization. As a result, it was concluded that an ISFM, which is the use of chemical fertilizers along with organic inputs, is effective in accomplishing the goals of sustainable agriculture with concern to the environmental effects. These mineral fertilizers are still critical input in the current day farming as the population continues to increase around the world [15].

Table.2 Types of Mineral Fertilizers:

Fertilizer Type	Key Nutrients	Benefits
Nitrogen (N)	Promotes leaf and stem growth	Enhances vegetative development
Phosphorus (P)	Supports root and flower development	Increases blooming and fruiting
Potassium (K)	Boosts disease resistance and water regulation	Improves crop quality and stress tolerance

Effects of Organic and Mineral Fertilizers on Gypsum Soil Properties

The use of organic and mineral fertilizers is a feasible approach to overcome the problem of low production potential of gypsum soils that dominate the arid and semi-arid zone. Halolimnic and alluvial soils have some constraints, such as low levels of organic matter, poor soil structure, and poor nutrient status. The application of organic and mineral fertilizers together eliminates these drawbacks making the soil healthy as well as the agricultural production [7].

Compost, manure and biochar as type of organic fertilizers are known to be essential in enhancing the physical characteristics of gypsum soil. They also contribute organic top dressing to the gypsiferous soils, which are normally poor in this form of soil improver. Organic matter increases the ability of soil formation of aggregates, hence, reduces the compactability of the soil. This in turn improves on the degree of aeration and water infiltration to a plant root system so that the latter can get sufficient supplies of both oxygen and water. Besides the availability of nutrients, organic manure increases water holding capacity, and this is a vital factor for irrigation, which is limited in arid areas [1].

Posts include onion sets and mineral fertilizers that supply nutrients readily available to the plants. Nitrogen enhances greening and leafing, phosphorus stimulates root formation and flowering, while potassium enhances the plant's ability to endure drought and diseases. Many gypsum soils are low in these nutrients, hence their replenishment through mineral fertilizers enables crops to have an access to the elements required for their growth [20].

Thus, the application of the organic, and comparatively to a lesser extent, the mineral fertilizers stimulate microbial action in gypsum soils. Certain small living organisms break down complex organic compounds and liberate nutrients in soluble form that plants can take up. It results in a better nutrient cycling increasing the fertility of the soil, making it suitable for plant

growth. In the same process, the ability to increase crop yields outweighs the other methods used in the long-run sustainability factor in farming [5].
Among the reported advantages of interdependent fertilization, a great deal is made of enhancing the root production. Improved structure and nutrient supply in the soil lets roots go deeper and become stronger, at the same time the plant has greater capacity to obtain water and nutrients. This is more helpful in gypsum soil because plant growth is always limited by root penetrate ability on this type of soil. A deeper root structure will also enhance crop resistance to various conditions harbingers of poor yields such as drought and salinity [21].
Also, the use of organic and mineral fertilizers enhances the rates of water infiltration in the gypsum soil type. Organic matter prevents the formation of hard crusts on the surface while enhanced structure promotes water infiltration down the layers of soil profile. This is done because runoff is reduced; therefore, the most available water is used to the optimum. I find that increase water infiltration has an added advantage of minimizing the instances of soil erosion, a vice common in areas with gypsum soils [22]
Application of organic and mineral fertilizers is a form of sustainable farming thus, appropriate to practice. It improves crop yields and at the same time solves the problems of land depletion, thus enabling subsequent generations to find arable land to cultivate. This way of improving gypsum soil properties OKs the growth of many crops, food security and protection of the environment [21].

Productivity of Oil Crops in Gypsum Soil

For edible oil, it means sunflower, rapeseed, and soybean crops are important, as they are used in the food chain, as well as for oil needed for people and animals. These crops can be grown on gypsum soils with high levels of calcium sulfate, but soil productivity constraints include low fertility, soil compaction, and poor water holding capacity. Use of organic and mineral inputs has been found to enhance the productivity of oil crops in gypsum substrate and enhance agricultural practices [1].
Gypsum soils can be improved through the physical and chemical changes made to them through organic fertilizers such as compost, manure and biochar. Such an amendment raises organic matter in the soil making the structure of the soil and the ability to penetrate the soil by roots better. Better aeration implies that roots are well supplied with oxygen (Figure.4), whereas better watering enhances soil water supply during critical developmental stages. These factors are more relevant, especially to the oil-bearing crops such as the sunflower and the rapeseed crops, which prefer a soil type that should be well drained while at the same time possessing the ability to retain moisture [7].

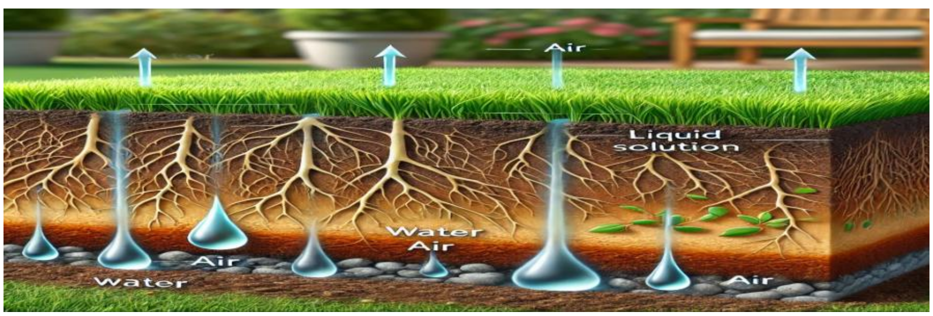

Figure.4 Air penetration in healthy Soils

Organic fertilizers as they improve soil tilth, induce microbial activity that induces nutrient cycling. Microbes decompose organic matter to release nutrient elements, including nitrogen, phosphorus, and potassium, that the plants readily absorb. The slow release and steady supply of these nutrient elements reinforce the healthy growth of plants and make crops more tolerant to the environment, such as drought or salinity. For example, improved microbial activity benefits legumes like soybeans that fix nitrogen: they are an asset to the microorganism by improving the symbiotic relationship between them and nitrogen-fixing bacteria [11].
Mineral fertilizers enhance the supplementation strategy by delivering required micro and macronutrients instantly and directly. Nitrogen fertilizers enhance development of a large canopy of leaves necessary for photosynthesis and energy source in oil crops crops. Phosphorus fertilizers enhance root growth and improve flowering as well as seed set leading to a desirable level of oil quality and quantity. Potassium-bearing fertilizers build up plant immunities to various biotic and abiotic threats, thus raising crop quality and production stability. In the gypsum soils, which are poor in nutrients inter alia, these organic and inorganic mineral fertilizers are said to have a vital role to play for satisfying the nutrient requirement of a high yielding crops [3].
The interactions between organic and mineral fertilisers show a multiplier impact, resulting in an increase in the productivity of oil crops in the gypsum soils. Favourable soil conditions include conducive conditions for the penetration of roots deeper into the soil for access to nutrients and water. This is especially advantageous to sunflowers as they develop a much striking

root system which enables them to access deeper water sources when needed. That is why establishing a root system is important; crops can then endure less water or any other stressful factors to continue yielding fruits [23].

In addition, increased viscosity and positively changed fertilization readiness optimise the health of oil crops, enhancing the quality of the obtained yields. For instance, theconventional rapeseed when subjected to the right fertilizers procreates seeds with more oil content, satisfying the market and, thereby, improving the farmers' income levels. In the same way, the enhanced soil conditions enhance qualitative and quantitative production of soybeans in terms of protein content and oil yield, which boosts food production and its efficient systems.

Therefore, we can conclude that, the use of organic and mineral fertilizer improves the yields of the oil crops in the gypsum soils. Adopting these practices enhance viability in order to enhance sustainable agriculture development and optimize the gypsum potential for oil crop production in related lands. Rather than applying individual nutrients separately which maybe had a negative impact on the soil, this integrated manner of fertilization not only enhance plant yield but also has beneficial effects to the soil and the environment in the long run [7].

Conclusion

Poor structure, fertility, and water-holding make gypsum soils unsuitable for agriculture, although they have promise. This study demonstrated that organic and mineral fertilisers offer a unique way to improve the physical, chemical, and bio-physical aspects of gypsum soils to boost sunflower, rape seed, and soybean yields. Organic fertilisers, including compost, manure, and charcoal, boosted soil nutrients. Aggregation from organic matter reduces density and increases space and water permeability, improving soil structure. These additives promote microbial nutrient cycle and nitrogen, phosphate, and potassium release. Organic fertilisers improve root penetration and soil water retention, encouraging plant development and drought and salinity tolerance. Nutrient leaching is limited by slow organic manure solubility and root nourishment mineral availability. Mineral fertilisers replace nutrients quickly and locally, improving organic manure. Nitrogen fertilisers increase chlorophyll and photosynthetic tissue. Phosphorus fertilisers help roots and blossoming, whereas potassium fertilisers help plants resist pests and illnesses. In low-nutrient gypsum soils, regulated mineral fertiliser use boosts crop yield and quality. Due to synergy, organic and mineral fertilisers function better. This complete soil fertility management method supports sustainable agriculture by improving soil structure and fertility. Double dirtying improves oil crop root systems to absorb more water and nutrients from deep sources and endure water stress. They increase the oil content and quality of other important crops like rapeseed and soybeans, which provide food and income.

This study recommends integrated fertilisation of gypsum soils to preserve soil chemical and physical qualities for long-term sustainability and agricultural production without diminishing land yield. Green soil management for dry and semi-arid areas offers several benefits: Biochar increases carbon sequestration and reduces soil salinity, reducing nutrient loss in Integral Soil Management.

References:

[1]. Rashmi, I., Meena, B. P., Rajendiran, S., Jayaraman, S., Joshy, C. G., Ali, S., ... & Kala, S. (2024). Can gypsum and organic amendments achieve sustainability, productivity and maintain soil health under soybean-mustard cropping in sodic soils of western India. Soil and Tillage Research, 240, 106075. DOI:10.1016/j.still.2024.106075

[2]. Alsajri FA, Farhan M, Hilai N. Evaluating the Efficiency of Potassium Fertilizer Sources and Levels on Sesame Growth and Yield in Two Different Gypsum Soils. Tikrit Journal for Agricultural Sciences. 2024;24:156-169. DOI:10.25130/tjas.24.1.13

[3]. Jyothsna K, Jayadeva HM, Sahana G, Nagangoudar MB. Influence of Soil Additives (Gypsum and Dolomite) on Peanuts Productivity and Soil Properties: A Review. Asian Journal of Soil Science and Plant Nutrition. 2024;10:460-467. DOI:10.9734/ajsspn/2024/v10i2303

[4]. Hamoud YA, Saleem T, Zia-ur-Rehman M, Shaghaleh H, Usman M, Rizwan M, Alabdallah NM. Synergistic effect of biochar with gypsum, lime, and farm manure on the growth and tolerance in rice plants under different salt-affected soils. Chemosphere. 2024;142357. DOI:10.1016/j.chemosphere.2024.142357

[5]. Du Plessis M. The effect of gypsum form and source on soil amelioration (Doctoral dissertation, Stellenbosch University). 2024.

[6]. Rashmi I, Ali S, Mina BL, Kumar K, Kumar A, Kala S, Kumawat A. Effect of gypsum integrated with organic amendments on hydrologic attributes, crop productivity and soil health of table land in Chambal river basin. Indian Journal of Soil Conservation. 2024;52,26-33. DOI:10.1080/01904167.2023.2211625

[7]. Shruthi, Prakash NB, Dhumgond P, Goiba PK, Laxmanarayanan M. The benefits of gypsum for sustainable management and utilization of acid soils. Plant and Soil. 2024;1-24. DOI:10.1007/s11104-024-06907-0

[8]. Khajiev M, Atadjanova M, Dusiyoro J. Development of combined aggregate for improvement of meliorative condition of saline gypsum soils. In BIO Web of Conferences (Vol. 105, p. 01006). EDP Sciences. 2024. DOI:10.1051/bioconf/202410501006

[9]. Ekholm P, Ollikainen M, Punttila E, Ala-Harja V, Riihimäki J, Kiirikki M, Begum K. Gypsum amendment of agricultural fields to decrease phosphorus losses–Evidence on a catchment scale. Journal of Environmental Management. 2024;357:120706. DOI:10.1016/j.jenvman.2024.120706

[10].Abdolvand Y, Sadeghiamirshahidi M. Soil stabilization with gypsum: A review. Journal of Rock Mechanics and

Geotechnical Engineering. 2024. DOI:10.1016/j.jrmge.2024.02.007
[11].Hadid ML, El-Mageed TA, Ramadan KMA, El-Beltagi HS, Alwutayd KM, Hemida KA, Al-Elwany OAA I. Pyridoxine-HCl plus gypsum and humic acid reinforce salinity tolerance of coriander plants with boosting yield and modifying oil fractionations. Russian Journal of Plant Physiology. 2024;71:64. DOI:10.1134/S1021443724603975
[12].Chen L, Ma J, Xiang S, Jiang L, Wang Y, Li Z, Xiao Y. Promotion of rice seedlings growth and enhancement of cadmium immobilization under cadmium stress with two types of organic fertilizer. Environmental Pollution. 2024;346:123619. DOI:10.1016/j.envpol.2024.123619
[13].Panday D, Bhusal N, Das S, Ghalehgolabbehbahani A. Rooted in nature: The rise, challenges, and potential of organic farming and fertilizers in agroecosystems. Sustainability. 2024;16:1530. DOI:10.3390/su16041530
[14].Yu Y, Zhang Q, Kang J, Xu N, Zhang Z, Deng Y, Qian H. Effects of organic fertilizers on plant growth and the rhizosphere microbiome. Applied and Environmental Microbiology. 2024;90:e01719-23. DOI:10.1128/aem.01719-23
[15].Chojnacka K, Mikula K, Skrzypczak D, Izydorczyk G, Gorazda K, Kulczycka J, Witek-Krowiak A. Practical aspects of biowastes conversion to fertilizers. Biomass Conversion and Biorefinery. 2024;14:1515-1533. DOI:10.1007/s13399-022-02477-2
[16].Djurayev B, Fayziyeva S, Samiyeva G, Sultanov B. Improvement of the modeling system of mineral fertilizer use efficiency in agriculture. In BIO Web of Conferences (Vol. 95, p. 01002). EDP Sciences. 2024. DOI:10.1051/bioconf/20249501002
[17].Fontaine D, Rasmussen J, Eriksen J. Marginal increase in nitrate leaching under grass–clover leys by slurry and mineral fertilizer. Nutrient Cycling in Agroecosystems. 2024; 28:1-12. DOI:10.1007/s10705-023-10327-4
[18].Marchezan C, Abdala DB, Boitt G, Ferreira PAA, Ceretta CA, da Silva ICB, Brunetto G. Consecutive Applications of Mineral Fertilizer or Animal Wastes and Effects on soil Phosphorus after Thirteen Years of no-tillage. Journal of Soil Science and Plant Nutrition. 2024;1-12. DOI:10.1007/s42729-024-01683-3
[19].de Lavôr WKB, da Silva EF, de Almeida Ferreira E, Gondim JEF, Portela JC, de Sousa Antunes LF, Fernandes BCC. Vermicompost and millicompost as a resource in sustainable agriculture in semiarid: decomposition, nutrient release, and microstructure under the action of nitrogen and organic-mineral fertilizers. Environmental Science and Pollution Research. 2024;1-18. DOI:10.1007/s11356-024-33446-z
[20].Elsonbaty A. Improving the yield and quality of faba bean grown in alkaline soils using agricultural gypsum, organic fertilizers and cobalt. Egyptian Journal of Soil Science. 2024;64. DOI:10.21608/ejss.2024.292907.1778
[21].Hamada AA, Khalifa AM. Effect of the type of organic fertilizer and spraying with boron on the growth and yield of BRASSICA OLERACEA in gypsum soil. Dijlah Journal of Agricultural Sciences. 2024;2:278-292.
[22].El-Sharkawy M, Alotaibi MO, Li J, Mahmoud E, Ghoneim AM, Ramadan MS, Shabana M. Effect of Nano-Zinc Oxide, Rice Straw Compost, and Gypsum on Wheat (Triticum aestivum L.) Yield and Soil Quality in Saline–Sodic Soil. Nanomaterials. 2024;14:1450. DOI:10.3390/nano14171450
[23].Gopinath KA, Rajanna GA, Visha Kumari V, Singh VK, Ajay BC, Awasthi NK, Rajkumar B. Exploring the use of POLY4 for the improvement of productivity, peanut quality, and soil properties in Southern India. Frontiers in Plant Science. 2024;15:1448909. DOI:10.3389/fpls.2024.1448909.
[24].Al-Kafaje, R. K. K. 2012. Effect of Adding Phosphate Rock and Organic Matter on Available Phosphorus for Wheat Planted in Gypsiferous Soil. M.Sc. Thesis, college of agriculture, Tikrit University.

تحسين خواص الأرض الجبسية بإضافة الأسمدة العضوية والمعدنية وانتاجيتها للمحاصيل الزيتية(مقالة مراجعة)..

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[1,2,3]مركز دراسات الصحراء, جامعة الانبار, الانبار, العراق.

الخلاصة

لقد أجريت هذه الدراسات بهدف تعزيز كفاءة إنتاج المحاصيل الزيتية. كان الغرض من هذه الدراسة هو الحصول على معرفة أفضل بكيفية تأثير استخدام الأسمدة العضوية والمعدنية على السمات الفيزيائية والكيميائية للتربة الجبسية. السماد العضوي، السماد الطبيعي والفحم الحيوي هي أمثلة على إضافات التربة العضوية التي قد توفر زيادة في مسامية التربة، والقدرة على الاحتفاظ بالمياه، والسكان الميكروبيين للتربة، واختراق الجذور، واستخدام المغذيات. يمكن تحقيق هذه التحسينات من خلال اضافة محسنات التربة العضوية. من ناحية أخرى، هناك توافر الأسمدة غير العضوية المركزة، والتي توفر كمية كبيرة من العناصر مثل المعادن والفيتامينات. تتكون هذه الأسمدة من النيتروجين والفوسفور والبوتاسيوم، والغرض منها هو تحسين جودة المحاصيل وكذلك حيوية النباتات. من خلال الجمع بين عدد من طرق التسميد المختلفة، من الممكن تقليل كمية التربة المضغوطة بنجاح وتحسين الكفاءة التي يتم بها تدوير العناصر الغذائية وظروف الجذر وأنظمة المياه من خلال النبات. أظهرت الأبحاث التي أجريت في هذا المجال أن تنفيذ الاستراتيجية يؤدي إلى زيادة كمية المحاصيل الزيتية التي يتم إنتاجها وزيادة جودة الزيت وكميته كذلك زيادة مقاومة النبات للضغوط اللاأحيائي مثل الملح والجفاف، هذه الوسائل التي يمكن من خلالها تحقيق هذا الهدف. وفقا لنتائج هذا البحث، يجب أن تستخدم إدارة تربة الجبس طرقا فعالة وصديقة للبيئة. كما أثبتت أن الطريقة الأكثر فعالية لتحقيق هذه الأهداف هي الجمع بين الأسمدة العضوية والمعدنية كتقنيات مقبولة وعملية لتعزيز الزراعة المستدامة وتحقيق إمكانات إنتاج المحاصيل الزيتية في تربة الجبس. تم تحديد ذلك من خلال نتائج الدراسة.

الكلمات المفتاحية: تربة الجبس,الأسمدة العضوية,الأسمدة المعدنية,خصوبة التربة,المحاصيل الزيتية,الزراعة مستدامة,تحسين التربة.