Summary

Gypsum formation is one of the common features in many soils of arid and semi-arid regions such as the Middle East and North Africa. It is found that soils containing gypsum either as geological or pedological formations are wide spread in Egypt and the area was estimated to be 382.2 km^2 **(FAO, 1990).** These gypsic soils were recognized in different geomorphic and geographic units. They cover considerable areas in the Nile Delta and Valley, Fayoum, Sinai, Eastern and Western Desert. Gypsum formation is influenced by many climatological factors as temperature, precipitation, pressure and freezing. Other local conditions in the soil as type of minerals, salt concentration, fluctuation of water table, organic acids, evaporation and oxidation-reduction processes are important factors of gypsum formation in most soils.

The main objectives of this research work was to study the most important areas in Egypt which have gypsum accumulation and the environmental conditions which affect their productivity, particularly from the following aspects:

- Assess mind of the effect of different levels
- Evaluation of the various methods used to determine gypsum in soils and forms of gypsum content and its

effect on the main chemical and physical characteristics of the soil.

- Defining the hazard of gypsum level on plant growth

Accordingly, sixteen profiles were selected to represent the gypsiferous soils in various regions in Egypt as follows:

1- Profile no. 1 : Qasr El Basel, Itsa, El Fayoum

2- Profiles no. 2 and 3 : Beni Mazar, El Minya

3- Profile no. 4 : Wadi El Farigh, Cairo-Alex. Desert Road

4- Profile no.5 : Wadi El Natrun, Cairo-Alex. Desert Road

5- Profiles no. 6 and 7 : Hurghada, Red Sea

6- Profiles no. 8,9 and 10 : Dhibbah, Abo Shrouf and Gabal El- Dakrour, Siwa Oasis

7- Profiles no. 11 – 14 : From Ismailia region

8- Profile no 15 : Girza, Giza

9- Profile no 16 Beni Suef

The obtained results can be summarized in the following points:

1-Gypsum content of the soils was determined according to the different methods (acetone, resin, increase of soluble calcium and magnesium, gravimetric). It can be concluded that the strong acid resin method is more reliable than the acetone one.

2- The accumulation of gypsum as a general characteristic of these profiles takes different forms and its content fluctuates between 2.10 to 81.7 %. The powdery form, needle crystals and platy gypsic layers are common in most of the hard, cemented, subsurface gypsic layers are found in the profiles at Hurghada, Siwa and Ismailia, while at Girza (profile no. 15) gypsum forms a hard surface layer (0-15 cm).

Classification of gypsic soils:

The most significant diagnostic horizons in these soils are :

The salic horizon is a common pedogenic feature which occurs as surface or subsurface layer in various concentration and thickness.

The gypsic horizon (> 15% and > 10 cm thickness) which is dominant in the studied profiles has a high concentration of gypsum (> 15 %) content over the whole solum except profiles no. 4 and 5 which have a limited depth with high gypsum accumulation.

The calcic horizon is found in profiles no. (6,7,8,9,10 and 16) while profile no.2 has a surface layer (0-20 cm) and profile no 11 has a deep layer (40-60 cm).

According to the field description and analytical data and the Soil Taxonomy (USDA 1999), the investigated soils have been classified up to sub great group levels as follows:

- Gypsic Haplosalids: includes profiles no. 1 (El Fayoum), 3 (El Minya), 5 (Wadi El Natrun) and 15 (Girza).
- Calcic and Gypsic Haplosalids are proposed for profiles no. 6 and 7 (Hurghada), 8,9 and 10 (Siwa Oasis), 11 (Ismailia) and 16 (Beni Suef).
- Petro gypsic Haplosalids as in profiles no.12 and 13 in Ismailia area.
- Typic Haplosalids : Profile no 4 in Wadi El Farigh
- Gypsic Aquisalids : profile no. 14 in Ismaila

Micromorphological contribution to the gypsic soils:

The gypsic features in thin sections:

- Systematic description of thin sections (23 slides) from the studied profiles including these parameters:

Microstructure, coarse and fine materials, types of voids, the related distribution of these components and the pedofeatures with particular stress on the ferrous of gypsum in thin section. The complete description and the illustrated micro photo graphs are included in the appendix.

The forms of gypsum can be summarized in the following :

-Microcrystallites of granular gypsum scatterd in the groundmass are observed in the soil of Wadi El Farigh (profile no. 4) with gypsum content (8.30 %).

Columnar and granular of relatively large size infillings partly or completely in the large vughs and chambers as in profile no. 1 (El Fayoum).

- Granular isolated enhedral or subhedral prismatic grins scattered in the groundmass are observed in profiles of El Minya (profiles no.2 and 3).
- Micro grains of intergrowth of irregular mostly cemented and form petrogypsic hard layers as in profile no. 6 with gypsum content of 47.30 %.
- Void gypsum as dense complete microcrystalline infilling of channels or large plane occur as a result of accumulation of salts rising from saline water table in the deep layers (70-150 cm) soil of Beni Suef in the profile no 16.
- Abundant gypsum crystals as coarse grains dominating the groundmass in lenticular, granular and prismatic macro crystals as in Ismailia soil profile no. 13.

Towards this aim several pot experiments have been conducted on selected samples from the studied soil

profiles where wheat and barley seedlings were used as indicator plants. However, a preliminary experiment was carried out (for two years) to identify and assess the influence of pure gypsum content on the growth of wheat and barley plants.

Similar greenhouse experiments were conducted on represented samples from the soils that have various natural gypsum contents and forms.

The measurements of growth parameters including: Germination %, dry matter, macro and micronutrients uptake supported by statistical analysis lead to the following conclusions:

- the moderate accumulation of gypsum up to 10% has a beneficial influence on germination dry weight, N,P and K uptake of wheat seedlings. While a negative effect on the micronutrient uptake as Fe and Zn have been observed with the increase of gypsum more than 10%. Also, the results prove that a good suitability of barley to gypsum content more than wheat.