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Calcium Level in Agricultural Soil from Gwalior City after Harvesting of Wheat (*Triticum aestivum*)

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Abstract: The presence of calcium in the agriculture soils is very important for the proper growth of the crop plants. However, due to various factors the calcium in the soil is leaching out and causes various types of diseases to plants and its yield gets reduced. In the present study calcium in the soil of Gwalior city has been assessed by following the standard methods. It was observed that the calcium content in the soils of Gwalior is very low that may affect the yield of the crops in the region.

Key words: Calcium · Agriculture · Crop yield · Gwalior

INTRODUCTION

The concentration of certain elements in soils is determined by the element content of the bedrock or other deposits from which the materials originated, effects of climatic and biological factors and by influences of agricultural and industrial operations that have acted on the materials for various periods of time. The diversity of these factors in a large area is expected to result in a corresponding diversity in the element contents of the surficial materials[1]

Calcium is readily evident in alkaline soil and is very scarce in very acidic silicon soil. Weathering and rainfall in the area has a large impact on the chemical composition and calcium levels in the surrounding soil. In soil from arid or semiarid zones, high calcium concentrations have been found [2,3,4] Lower levels of acidity, less rainfall and therefore, less erosion, enhance the stability of minerals like the calcium in the soil's clay. As a result, the high calcium content will tend to flocculate in the upper profile of the soil's clay [5]. Phillips and Chiy [6] observed an enhancement of calcium concentrations in leachate. Similarly, an increase in calcium, magnesium and pH values was observed in tropical agricultural soil after applying compost [7,8]. When the acidity of soil's increases, a diminishment of available magnesium is observed due to the fact that hydrogen ions occupy a high number of the exchange sites [9]. This study was initiated to assess the total calcium content in agricultural soil after harvesting of wheat. The field capacity of the samples was also measured in order to evaluate their influence on magnesium content.

Methodology: Soil samples were collected from the wheat (*Triticum aestivum*) fields after farmers have harvested the crop following standard procedure. Soil samples were air dried and ground to pass through a 2-mm sieve. Soil texture and field capacity of samples was determined by following the standard methods of Gupta [10]. The Calcium in the soil was determined by following the standard methods of Department of Agriculture and Cooperation Ministry of Agriculture Government of India New Delhi [11]. Five grams of air dried soil sample was taken in 150 ml conical flask and 25 ml of neutral normal ammonium acetate was added to the sample. The sample was shaken for 5 minutes and filtered through Whatman filter paper No.1. 2-3 crystals of carbamate and 5 ml of 16% NaOH solution was added to the aliquot (5 or 10 ml). Ammonium purpurate was added as an indicator and it was titrated with 0.01N EDTA solution till the colour gradually changed from orange red to reddish violet (purple) and the concurrent readings were recorded for each sample analyzed.

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Table 1: Soil texture, percentage of calcium and field capacity of Agriculture soil

Parameter	I	II	III	IV	V
Texture	Sandy silty loam	Sandy silty loam	Sandy silty loam	Sandy silty loam	Sandy silty loam
Calcium (%)	2±0.2	2.4±0	2.4±0.4	3.2±0	2.8±0.5
Field capacity (%)	24.5±3	22.4±3.2	25.7±2.1	24.9±2	25.7±1.3

RESULTS AND DISCUSSIONS

The present study revealed that the soil is sandy silty and its calcium content is very low and it has been found that the field capacity of the soil is not good for production of wheat in the area.

A high amount of calcium present in the plant is a result of high element levels existing in the soil more than the plant's uptake efficiency, the velocity of the plant's transpiration [12,13,14], or the addition of liming materials to soil [15]. Calcium deficiency symptoms can be rather vague in soils of Gwalior since the situation often is accompanied by a low soil pH. Visible deficiency symptoms are seldom seen in agronomic crops but will typically include a failure of the new growth to develop properly. The wheat plants may get deformity in number of ways due to the deficiency in the calcium. The first definite symptom in wheat plants is a necrotic spotting about the middle of the leaf in the new growth which gradually expands and collapses midway before unrolling. [16]. Extremely acid soils can introduce an entirely new set of symptoms, often from different toxicity's and deficiencies as it is evident from many fruits and vegetables that demonstrate dramatic symptoms such as Black heart in celery and broccoli, Tip burn in lettuce and cabbage, white heart or hollow heart in cucurbits, blossom end rot in tomatoes and peppers and pops in peanuts. Tree fruit with low calcium will exhibit increased storage problems such as bitter-pit in apples, cork-spot in apples and pears, cracking in cherries and other degradation of the fruit while in storage. Deficiency in all crops often also impairs root growth and lead to additional symptoms as a secondary effect. Most of the problems caused by excess soil Ca are the result of secondary effects of high soil pH. Calcium is essential for the formation of cell-walls in the wheat plants, as calcium pectate forms part of the middle layer of the cell-wall. The middle lamella regulates the entry of only those nutrients which are not toxic to the plant. In root-tips of wheat, calcium is very essential for the meristematic activity or formation of new tissues. Besides its direct nutrient value, calcium when applied to acid soils increases the availability of other nutrients, like phosphorus, nitrogen and molybdenum. Excess of calcium in the calcareous soils depresses the uptake of potassium and magnesium.

The human influence and the analysis were carried out after harvesting the crop may have decreased the calcium content in the agricultural soils. The present investigation revealed that the soils of the sampled agricultural fields are sandy slit loam that are dry quickly, need watering frequently and in the process some of the nutrients gets washed away, however, the soils many be productive if proper strategy is sorted out for their management. We do not find any relation between the calcium deficiency and the field capacity in our study. However, the limitation of our study may be the titration method by which the analysis of the calcium has been carried out.

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