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FROM THE DUSTY CLASSROOMS TO THE FLOWER GARDEN: CALCITE AS PLANT GROWTH ENHANCER

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Abstract: *This paper looked into the practical waste management of left pieces of board chalk (calcite) in the classrooms. Specifically, this study covers the preparation and application of board chalk (calcite) as plant growth enhancer. Observations on its effect on the growth of plants highlighted the findings of the study. It aimed to give educational information on the practical waste management of left pieces of board chalk in the classrooms. Experimentation was used with three treatments of varied ratio and proportion of soil and powdered chalk in order to validate the effect of powdered chalk on the growth of plants. The study concludes that powdered chalk is an effective growth enhancer for plants. It was found out that moderate proportion of soil and powdered chalk is more effective for the plant to grow faster, taller, healthier, and have stronger stem. It is recommended that teachers and students should dispose and collect pieces of chalk properly so that it will be readily available for the school gardener to use it as fertilizer for flowers and selected plants. It is also recommended for farmers to use powdered chalk (calcite) as growth enhancer for their farm plants.*

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BACKGROUND OF THE STUDY

Waste management topped the list of environmental issues. Waste is not something that should be discarded or disposed of with no regard for future use. It can be a valuable resource if addressed correctly, through policy and practice. With rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include: 1.Economic - Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and materials resulting in valuable materials being recovered for reuse. 2. Social - By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities. 3. Environmental - Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction ofgreenhouse emissions; and; 4.Inter-generational Equity - Following effective waste management practices can provide subsequent generations a more robust economy, a fairer and more inclusive society and a cleaner environment.

The school is one of the identified institutions that generate volume of solid wastes. But, every time we talk of school based solid waste management, we only consider the ones that are very evident, like, papers, wrappers, and the like. We forget to see what's in our classrooms, or how our classrooms look like whether it is clean, dirty, or dusty with the daily use of chalk board. This chalk board is one of the indispensable materials in the classroom. Teaching and learning process will not be effective without the use of chalk board, especially in places where technology is somewhat behind. That's why, pieces of left chalk are scattered in this classrooms, and these are considered as solid waste. But, most of the time if not always, this generated wastes are not considered in school waste management, they are just left there and seen as insignificant and no importance at all.

Considering the hazardous health and environmental effect of the dust generated from using chalk board and the problem created by the pieces of chalk left in the classrooms, the

researcher thought of a simple and practical way in managing the waste pieces of chalk. Thus, this humble and simple experimental research was developed.

CONCEPTUAL FRAMEWORK

Chalk is a finely grained, easy pulverized and porous sedimentary rock that is used in a variety of products such as putty, plaster, cement, quicklime, mortar and rubber goods, in addition to blackboard chalk. The chemical formula for chalk is CaCO3, calcium carbonate, and it has a calcite crystal structure. http:// www.britanica.com

A calcium carbonate is classified as a mineral group that contains one or more metallic elements plus the carbonate compound of CO3. Chalk has the same chemical composition as limestone, marble and precipitated calcium carbonate. Additionally, since chalk is a carbonate, it is also lightly colored and transparent when pure. Because all calcium carbonates have the same crystal form of calcite, it is hard to distinguish between them. However, chalk is different because it contains microscopic fossilized seashells from coccolith organisms called foraminiferans. http:// www.mineral.net/calcite

Calcium carbonate has several applications in various fields spanning from diet to pharmaceuticals, and from agriculture to construction. Calcium carbonate is a primary component of garden lime, also known as agricultural lime, which is used for neutralizing acidic soil and to enhance soil quality. Garden lime when added to soil, acts as a rich source of calcium for plants and increase the pH and water-retaining capacity of acidic soils. It is a rich source of calcium, and is beneficial for the crops. Also, it enhances the consumption of essential plant nutrients like Nitrogen, phosphorus, and potassium in acidic soils. www.certified.ph/Product-list

Calcium is found in many minerals in soil, but is relatively insoluble in this state. Calcium is not considered a leachable nutrient. Many soils will contain high levels of insoluble calcium such as calcium carbonate, but crops grown in these soils will often show a calcium deficiency. High levels of other cations such as magnesium, ammonium, iron, aluminum and especially potassium, will reduce the calcium uptake in some crops. A common misconception is that if the pH is high, adequate calcium is present. This is not always true.http:// www.mineral.net/calcite

As stated by Dr. William Albrecht, former head of the University of Missouri, Calcium perhaps plays more roles in the overall health of both the plants and the soil than any other nutrients.

The role of calcium in plants must not be overlooked.Calcium is considered a secondary plant nutrient. Only nitrogen and potassium are required in larger amounts by plants.Calcium plays a very important role in plant growth and nutrition, as well as in cell wall deposition. Every plant needs calcium to grow.Once fixed, calcium is not mobile in the plant. It is an important constituent of cell walls and can only be supplied in the xylem sap. Thus, if the plant runs out of a supply of calcium, it cannot remobilize calcium from older tissues.If transpiration is reduced for any reason, the calcium supply to growing tissues will rapidly become inadequate.

Plants react to the calcium ions in the concentrations found in soils. Calcium as a plant nutrient is characterized by its relatively high content in the plant coupled with a requirement not much higher than that of a micro nutrient element and an exceedingly uneven occurrence in soils. The difficulties in defining its actions are accentuated by a weak biochemical activity. In ecological conditions the secondary consequences of variations in calcium content may be more striking than the direct ones. Electron-microscopical studies have revealed that calcium is required for formation and maintenance of lamellary systems in cell organellae, a fact which might suffice to explain its indispensability for meristematic growth. Calcium is required for cell elongation in both shoots and roots; the common experience that it inhibits shoot elongation is certainly due to calcium additions far above actual requirement. It must be assumed for a rational interpretation of cell elongation that the fundamental mechanism is the same in shoots and roots. The one action which can be ascribed with certainty to calcium is a stabilizing of the cell wall with an increase in rigidity, an effect which, with over-optimal supply, may lead to growth inhibitions. The function is, however, necessary for the normal organization of cell walls. Calcium has, on the contrary, no significant effect on the synthesis of cell wall compounds but appears to act on their proper incorporation into the cell wall.

Without adequate amounts of calcium, plants experience a variety of problems. Calcium deficiency symptoms in crops are often called physiological disorders. Symptoms of calcium deficiency include: Necrosis at the tips and margins of young leaves; Bulb and fruit

abnormalities; Deformation of affected leaves; Highly branched, short, brown root systems; Severe, stunted growth; and; General chlorosis.It must be remembered that these problems are caused by an inadequate supply of calcium to the affected tissues. These deficiencies can occur even when the soil appears to have an adequate presence of calcium.

For all practical purposes, calcium is not considered to be toxic to plants. Although rare, excess calcium levels in the soil can reduce a plant's uptake of other nutrients such as phosphorus, potassium, magnesium, boron, copper, iron, or zinc, resulting in deficiencies of these nutrients.

When calcium is needed, it is not necessary to apply a material such as limestone that will affect the pH level in the soil. Hi-Cal fertilizer can supply 100 percent of the recommended soluble calcium and will not affect soil pH levels. In today's crop production, this effect is most desirable because the soluble calcium can be applied through an irrigation system when needed and in the amounts that are needed. Because calcium does not relocate in the plant, a soluble source of calcium applied throughout the growing season is preferred, especially in vegetables and other fast growing crops.http://www.tetrachemical.com/product/agriculture

OBJECTIVES

It is the objective of this study to (1) provide useful information on the simple and practical way in managing waste pieces of board chalk (calcite) in the classrooms; (2) perform the proper preparation and application of powdered board chalk (calcite) as growth enhancer for flowers and vegetables; and (3) observe and validate the beneficial effect of powdered board chalk (calcite) on the growth of plants.

PROCEDURES/ METHODOLOGY

Research Design

The experimental research was used to have careful observations on the effect of powdered board chalk (calcite) on the growth of flowers and crops. The study was conducted from June to December 2013.

Data Resources and Analysis

The collection of pieces of chalk from the classrooms was done from June to October. Some students and teachers were instructed to help in gathering pieces of chalk. The pieces of

chalk were collected in one box. The collected material was pulverized before it is being weighed.

The garden soil used was taken from one area to avoid other factors that may affect the growth of plants. The pH level of the soil was taken making use of a pH paper. The powdered chalk was applied or mixed to the soil 3 weeks before planting. The application was done twice in 3 weeks.

Mongo seeds and Vietnam rose were used in the experiment. The mongo seeds are used in the experiment because they have a very short span of time to sprout and grow. Vietnam rose also grow easily.

The experiment made use of three treatments:

Set A: Mongo Seeds

Treatment 0 (T_0) - 1 Kg garden soil/ No powdered chalk/ 10 mongo seeds

Treatment 1 (T_1) - 1 Kg garden soil/ 100 g powdered chalk/ 10 mongo seeds

Treatment 2 (T_2) - 1 Kg garden soil/ 300 g powdered chalk/ 10 mongo seeds

Treatment 3 (T_3) - 1 Kg garden soil/ 500 g powdered chalk/ 10 mongo seeds

Set B: Vietnam Rose

Treatment 0 (T_0)- 1 Kg garden soil/ No powdered chalk/ a pot of Kamantigue

Treatment 1 (T_1)- 1 Kg garden soil/ 100 g powdered chalk/ a pot of Kamantigue

Treatment 2 (T_2)- 1 Kg garden soil/ 300 g powdered chalk/ a pot of Kamantigue

Treatment 3 (T_3)- 1 Kg garden soil/ 500 g powdered chalk/ a pot of Kamantigue

Significance of the Study

This research will provide useful information on the simple and practical way in managing waste pieces of board chalk (calcite) in the classrooms. The use of potential plant growth enhancer that is readily available plays an essential role in our environment, to human, and to plants. Powdered chalk is helpful alternative growth enhancer for plants because of its economic value, at the same time pieces of waste chalk will be managed properly.

Results and Discussion

A. Mongo Seeds

Table1. Treatments and observations for 25 days (Mongo Seeds)

Treatment	Height of Stem (cm)			
	Day 10	Day 15	Day 20	Day 25
T_0	108.1	123.7	127.2	130.1
T_1	116.2	131.1	133.2	141.3
T_2	128.3	144.3	160.1	175.2
T_3	133.4	143.1	166.8	176.3

From the table, it is shown that there is an increasing height of the stem of the mongo seeds with increase ratio and proportion of soil and powdered chalk.

Figure 1. Pictures of the treated Mongo plants

As observed from the result of the experiment, there is a difference on the rate of growth of the mongo plants. The mongo plants with no powdered chalk grew slower and not that tall. The plants with moderate amount of powdered chalk grew faster, taller, healthier, and have stronger stem. The plants with higher amount of powdered chalk grew a little bit slower.

To support to the findings, Calcium is required for cell elongation in both shoots and roots; the common experience that it inhibits shoot elongation is certainly due to calcium additions far above actual requirement. It must be assumed for a rational interpretation of cell elongation that the fundamental mechanism is the same in shoots and roots. The one action which can be ascribed with certainty to calcium is a stabilizing of the cell wall with an increase in rigidity, an effect which, with over-optimal supply, may lead to growth inhibitions.http://www.tetrachemical.com/product/agriculture

B.Kamantigue Flower

Table 2: Length of stem (25 Days observation)

Treatment	Lenght of Stem (cm)			
	Day 10	Day 15	Day 20	Day 25
T_0	333 30.1.1	61	72.2	86.3
T_1	39.3.3.3	76.1	83.5	89.7
T_2	50.2	88.3	96.8	101.7
T_3	51.4	85.2	93.4	99.8

Basing from the table, there is an increasing length of stem with increasing amount of powdered chalk added to the soil. But, in Treatment 3, there is a little bit slower rate of growth as evidenced by the shorter length of stem as compared to Treatment 2.

Figure 2. Pictures of treated Kamantigue

CONCLUSIONS

Using powdered chalk as plant growth enhancer is an effective and practical way to manage properly waste pieces of chalk left in the classrooms.

The study concludes that powdered chalk is an effective growth enhancer for plants. It was found out that moderate proportion of soil and powdered chalk is more effective for the plant to grow faster, taller, healthier, and have stronger stem.Calcium plays a very important role in plant growth and nutrition, as well as in cell wall deposition. Every plant needs calcium to grow.

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RECOMMENDATIONS

It is recommended that teachers and students should dispose and collect pieces of chalk properly so that it will be readily available for the school gardener to use it as growth enhancer for flowers and selected plants.

It is also recommended for farmers to use powdered chalk (calcite) as growth enhancer for the following farm plants so that they will grow stronger and healthier: Cabbage, carrots, pepper, peanuts, potatoes, tobacco and other legumes.

Powdered chalk can also be used as first aid to solve problems on their plants like PH Imbalance.

IMPACT OF THE STUDY

In such circumstances, we as responsible public servants need to put in some efforts to do our bit at the grass root level. This can be easily done by inculcating some simple ways to help the environment in our day-to-day life. Though the efforts might look insignificant when seen individually, together they can have a strong impact on the environment. Let us do our own bit, for, in the well-being of the environment lies the key to our survival.

SHARING THE RESULTS OF THE RESEARCH

THE ILA, KASC SCHOOL GARDEN

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