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Effect of Dolomite Powder on Amelioration the Soil Fertility and Growth of Tomato Plant

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Abstract

Dolomite powder is a rich source of Ca and Mg, which are secondary plant nutrients. The XRF analysis of dolomite powder showed the presence of many micro and ultra micro plant nutrients in it. Therefore, it can be very useful for increasing the fertility of soil. Tomato is a Ca and Mg deficient plant and dolomite application can fulfil the nutritional needs of tomato. In this paper, two types of experiments: control (simple soil) and control with dolomite powder in different concentrations (x, 2x, 3x, 4x, and 5x, x = 3%) were performed on the growth and yield of tomato plants. It was found that among all the treatments, 2x showed the highest vegetative growth and crop yield with increased biomass.

***Key words*: Calcium, Dolomite, Magnesium, Plant nutrients, Soil productivity, Tomato

One of the sectors of the Indian economy that is now expanding the fastest is the stone industry [1]. Dolomite is a well-known stone industry in Rajasthan, Gujarat and South region of India [2]. Dolomite is a bicarbonate of Calcium and Magnesium {$Ca(CO_3)_2$. $Mg(CO_3)_2$} with a specific gravity of 2.8 to 2.9 [3]. It is a nonmetallic catalyst that is frequently utilized in biomass gasification to convert tar. Dolomite is a crucial raw material for the iron and refractory industries because it contains significant levels of MgO. In the dolomite industry, during mining, cutting, shaping, and polishing, a lot of stone is wasted due to lack of technological advancements [4]. Inappropriate quarrying techniques result in massive waste production and inadequate mineral recovery [5-6]. During mechanical processing, between 30 to 40 percent of the stone is wasted, leaving the stone as a slurry or powder [7]. Additional waste is produced by broken blocks, sawing and polishing processes, and rejecting damaged or broken slabs [8]. This significant amount of dolomite powder which is produced in the dolomite industry in various processes contains large amounts of Ca and Mg, which are secondary nutrients for plants [9]. Dolomite powder is useful as an acidic soil amendment and calcium-magnesium fertilizer in certain proportions [10]. Both slurry and powder of dolomite can be used as calcium and magnesium fertilizer due to their composition. By adding the right amount to the soil, the available essential nutrient content can be increase in soil and this will increase the fertility of the soil [11].

The dolomite industry in India presents both opportunities and challenges. On one hand, dolomite is a valuable raw material for various industries such as iron and refractory, and its extraction contributes to economic growth. On the other hand, inefficient quarrying and processing methods lead to significant waste production, which has environmental implications and hampers the efficiency of the industry. Promoting the use of dolomite powder as a soil amendment and fertilizer requires collaboration between the dolomite industry, agricultural stakeholders, and policymakers. Encouraging the adoption of dolomite-based fertilizers through awareness campaigns and providing incentives for farmers can stimulate demand for this product. Dolomite powder contains significant amounts of calcium and magnesium, making it suitable for agricultural applications as a soil amendment and fertilizer. By utilizing dolomite powder in the field of agriculture, not only can the industry reduce waste, but it can also contribute to enhancing soil fertility and productivity of crops.

Due to Ca and Mg availability, many researches have been done their research on the use of dolomite powder on different plants. Soeparjono *et al*. [12] studied the effect of lime of dolomite and NPK fertilizers on the response of growth, yield and protein content on black soybean in acid soils. Damrongrak *et al*. [13] reported the research of the effect of fertilizer and dolomite application on growth and yield of tapping rubber trees. Cao *et al*. [14] studied the immobilization of trace elements and lettuce growth in soil amended with activated dolomite phosphate rock fertilizers. Suntoro *et al*. [15] studied the effect of cow manure and dolomite on nutrient uptake and growth of corn. Perdanalika [16] studied the effect of rice husk ash and dolomite on soybean yield at Latosol soil. Cahyono *et al*. [17] studied on the influence of liming on soil properties and plant growth of pineapple (*Ananas comusus* L. Merr.) on red acid soil. Nufus *et al*. [18] studied the role of dolomite and vermicompost in nutrient uptake and production of sweet potato on acid soil. Dewisambi *et al*. [19] studied the effect of dolomite and pig manure on growth and production of carrots (*Daucus carota*). Ilyas *et al*. [20] investigated the interactive effect of calcium and magnesium on the growth and yield of tomato (*Lycopersicon esculentum* L.).

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Exploring the potential of dolomite powder to enhance the growth and productivity of tomato plants can be a valuable area of research and application. Given that dolomite powder contains not only calcium and magnesium but also various micro- and ultra-micronutrients, it has the potential to provide a comprehensive nutrient source for plants, including tomatoes. Along with Ca and Mg, there are many micro- and ultra-micronutrients also present in dolomite powder, and these can be utilized to boost plant growth and soil productivity. Tomato is one of the most important vegetables in the world, ranking second to potato in many countries, and it is consumed as a vegetable and fruit. It is a calcium and magnesium deficient plant; therefore, the effect of dolomite powder was performed on the tomato plant.

Conducting controlled experiments to assess the effects of dolomite powder on tomato plants under different growing conditions, soil types, and application methods would provide valuable insights into its efficacy as a soil amendment and fertilizer. Additionally, studying the long-term effects on soil productivity and plant health can help optimize the application of dolomite powder for sustainable agricultural practices.

MATERIALS AND METHODS

Materials

Soil: Soil of Jaipur district of Rajasthan was selected for the study. The chemical analysis of soil is: organic matter = 4.47%, Electric conductivity = 0.810 dSm^{-1}, Moisture = 1.8%, alkalinity = 20.2 mg/kg, pH = 7.82, Phosphorous = 14.3 kg/ha, Nitrogen = 223.2 kg/ha, Potassium = 228 kg/ha, bulk density = 1.36 gm/cm^3, Calcium = 8.32 mg/ kg, Magnesium = 3.65 mg/kg.

Dolomite powder: It was collected from Rajgarh tehsil of Alwar district of Rajasthan, India. The chemical analysis of Dolomite powder is: CaO = 36.68%, SiO_2 = 8.45%, MgO = 11.80%, Al_2O_3 = 0.13%, Fe_2O_3 = 0.73%, LOI = 41.80%, Whiteness = 92.60%, Brightness = 89.20%, $CaCO_3$ = 65.50%, $MgCO_3$ = 24.78%, Ret. on 300 Mesh = 1.52%.

Tomato: Local variety seeds of tomato (*Lycopersicon esculentum*) were used in the experiment.

Methods

Preparation of soil: Sufficient quantity of soil was collected and allowed to air dry for three days. It was first ground using a wooden mortar and pestle, and then it was sieved using a 2 mm mesh.

XRF analysis: Using an X-ray fluorescence spectroscopic technique, the components in dolomite powder, soil, and soil with dolomite powder were analyzed. The WD XRF results are listed in (Table 2-3).

Experimental set up: The pot culture method used for this investigation is displayed in (Table 1). The effects on soil productivity and tomato plant development were investigated using soil [control (C)] and soil containing different percentages of dolomite powder (SD). Research has been done on seed germination, number of leaves, plant height, crop yield, and biomass. Before the soil was added, the pots were numbered to keep them from becoming mixed up. According to the plan of the study, five dosages of dolomite powder (x, 2x, 3x, 4x, and 5x, where X = 3%) were applied to soil. Nine replicates of each dosage of control and different quantities of powdered dolomite mixed with soil were considered for the experiment.

Table 1 Schematic presentation of the experiment

Control (C)	Control + different % of dolomite powder (SD)				
	x	2x	3x	4x	5x
⌂	⌂	⌂	⌂	⌂	⌂

x = 3%; ⌂ = Nine pots

RESULTS AND DISCUSSION

X-Ray Fluorescence (XRF) results

The effect of dolomite powder on soil fertility can be analyzed by X Ray Fluorescence technique**.** The XRF analysis of dolomite powder is presented in (Table 2).

Table 2 XRF analysis of dolomite powder

Elements	Concentration (%)
Mg	16.531
Na	0.681
Ca	72.214
Si	7.115
Al	1.278
P	0.104
S	0.04
Cl	0.115
K	0.273
Fe	1.443
Mn	0.156
Sr	0.05

XRF analysis results of soil and soil with dolomite powder is presented in (Table 3).

Table 3 XRF analysis of soil and soil with dolomite powder

Parameters	Concentration %	
	Soil	Soil with dolomite powder
MgO	1.498	2.397
Na_2O	4.051	3.567
CaO	1.434	3.719
SiO_2	73.21	70.79
P_2O_5	0.559	0.593
SO_3	0.323	0.46
K_2O	1.429	1.643
Al_2O_3	12.677	12.717
Fe_2O_3	3.686	3.704
Cr_2O_3	0.101	0.075
MnO	0.078	0.073
TiO_2	0.456	0.464
NiO	0.287	0.017
ZnO	0.015	0.018
Rb_2O	0.015	0.017
SrO	0.036	0.036
ZrO_2	0.061	0.054
BaO	0.074	0.059

Effect on tomato plant: The effects of C and various SD dosages on tomato plant growth have been investigated by monitoring the different parameters across different periods of time. The effects of carbon (C) and various soil drench (SD) dosages on tomato plant growth involves assessing multiple parameters over different periods of time to comprehensively understand their impact. Results of seed germination, plant height, Number of flowers, crop yield and biomass are shown in (Fig 1-6, Table 4), respectively.

Seed germination results: Results of seed germination are represented in (Fig 1).

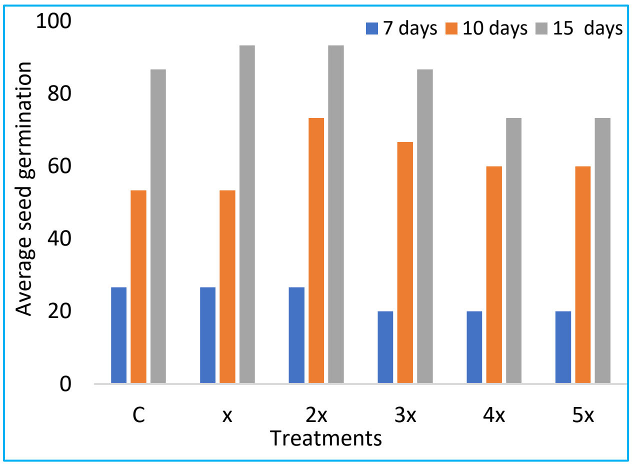

Fig 1 Average no. of seed germination after 7, 10 and 15 days in C and different types of SD treatments

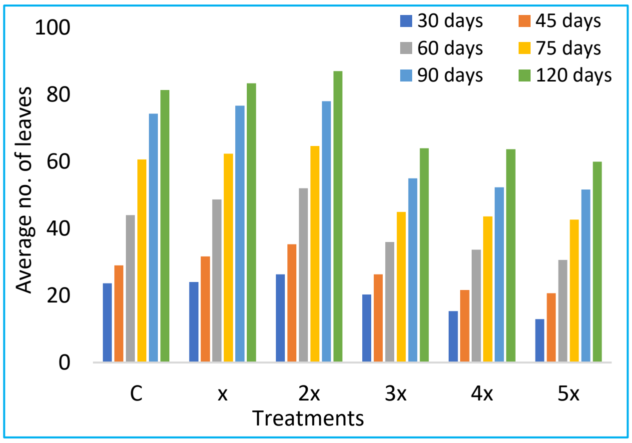

Fig 3 Average number of leaves of C and different types of SD after 30, 45, 60, 75, 90 and 120 days

Plant height results: Average plant height results are shown in (Fig 2).

No. of leaves: Results related to average number of leaves are shown in (Fig 3).

Number of flowers: Results related to average number of flowers are summarized in (Fig 4).

Number of fruits: Results of average number of fruits are shown in (Fig 5).

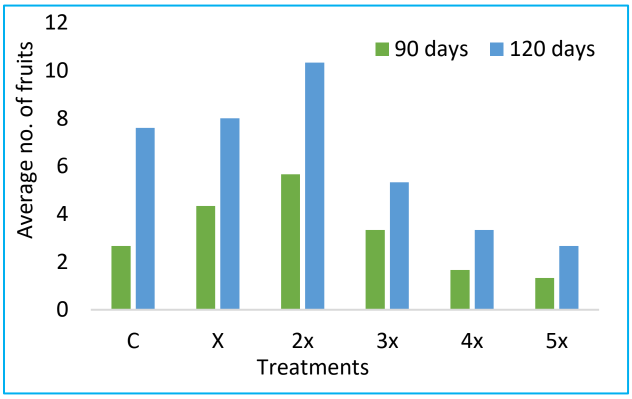

Fig 5 Average number of fruits of C and different types of SD after 90 and 120 days

Crop yield: Average crop yield results are presented in (Table 4).

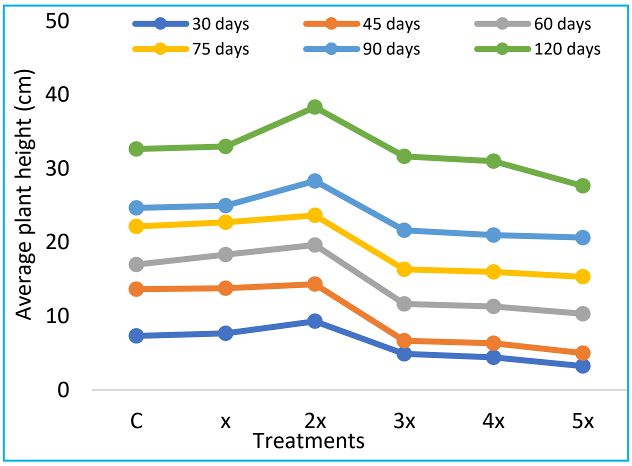

Fig 2 Average plant height data of C and different types of SD after 30, 45, 60, 75, 90 and 120 days

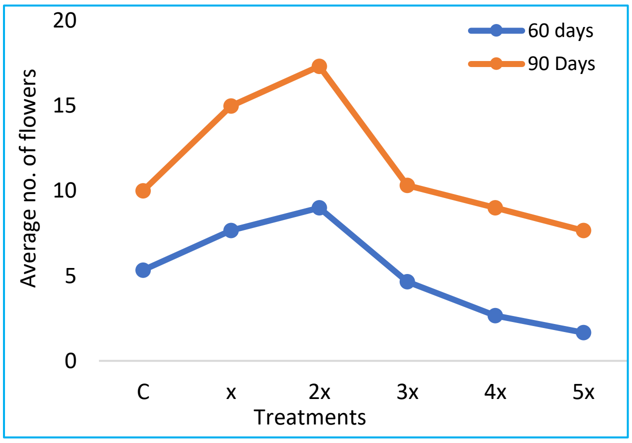

Fig 4 Average number of flowers of C and different types of SD after 60 and 90 days

Table 4 Crop yield data of C and different types of SD

Treatments	Average number of fruits	Average weight of fruit	Crop yield
C	7.60	60.1	456.76
X	8	62.12	496.96
2x	10.33	65.15	672.99
3x	5.33	62.01	330.51
4x	3.33	61.54	204.92
5x	2.66	60.22	160.18

Biomass: Biomass related results are shown in (Fig 6).

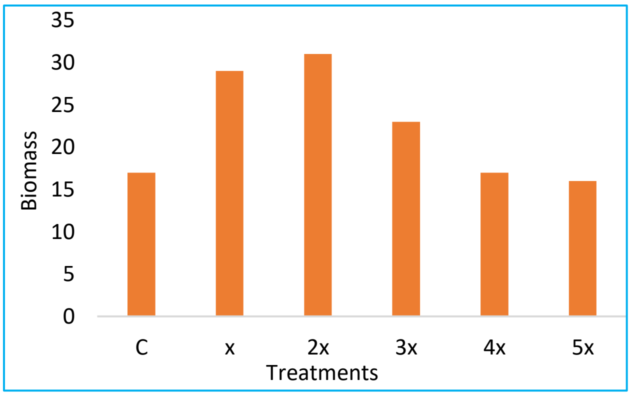

Fig 6 Biomass data of C and different types of SD

Growths of plants of C and different types of SD at different time intervals are shown in (Fig 7-12).

Fig 7 Plant growth after 30 days in C (a) and SD (b)

Fig 8 Plant growth after 45 days in C (a) and SD (b)

Fig 9 Plant growth after 60 days in C (a) and SD (b)

Fig 10 Plant growth after 75 days in C (a) and SD (b)

Fig 11 Plant growth after 90 days in C (a) and SD (b)

Fig 12 Plant growth after 120 days in C (a) and SD (b)

XRF analysis of dolomite powder: Data depicted in (Table 2) displays the results of the XRF examination of the dolomite powder. This study indicates that there is a tremendous opportunity for using dolomite powder as a source of nutrients for plants and soil. This powder contains secondary plant nutrients (Ca, Mg, S), micronutrients (Fe, Mn, Cl), ultra micronutrients (Al, Sr), and beneficial plant nutrients (Na, Si). As a result, it may be extremely important for improving plant growth and soil productivity.

XRF analysis of simple soil (control) and soil with dolomite powder: The nutrient composition of simple soil (Control, C) and soil with dolomite powder (SD) are represented in (Table 3). The concentration of P increases to 0.034% in SD than C. The concentration of K in SD is 0.214% greater than C. The concentration of Ca is 2.285% greater in soil with dolomite powder than simple soil. In dolomite treated soil Mg is 2.397% which is 0.899% more than control. The availability of S in SD is 0.137% greater than control. Fe, Zn, Cu, Mn, B, Cl and Ni are micro nutrients and require less than 1000 ppm for plants. In SD Fe is 0.018% and Mn is 0.005% greater than C. Na, Cu, V and Si are considered as beneficial plant nutrients. In SD Sodium is 0.484% less than control. Si is 70.79% in SD which is 2.42% less than C. Mo, Se, Al, Rb, Sr, Ni, and Cr are considered as ultra micronutrient for plant. Presence of Al in SD is 0.04% more while Cr is 0.026% less than C. Significant amount of Rb, Sr, and Ni also present in SD. From the above analysis, it can be concluded that SD is more nutritious for plants than C.

Effect on tomato plant: Effect of C and different doses of SD on growth of tomato plant have been analyzed by monitoring the following parameters at different time intervals.

Seed germination: Prior to planting, tomato seeds were immersed in water for the entire day. The variations in the percentage germination of the seeds in C and the various doses of SD were examined in the pot culture experiment, and the results are shown in (Fig 1). The results were recorded after 7, 10 and 15 days after sowing. According to reports, the germination percentage rises from C to 2x of SD composition and then decreases. It was also evident that the rate of germination rises with time. The highest germination percentage was reported for x and 2x of SD. The overall germination percentage for 2x of SD is highest among all the experiments.

It can be explained by the easy availability and accessibility of the many required elements of plants in SD. The early germination, root formation, and early growth in 2x are primarily caused by a high P content, which was reinforced by Ca, Mg, and an increase in the concentration of other plant nutrients in 2x of SD. The development of cell membranes depends on calcium. Early germination is further supported by the high concentration of calcium in 2x of SD because during root formation, fast cell division and development result in an increased need for Ca.

The minimum germination percentage was found for 4x and 5x of SD. This is due to that high concentration of dolomite powder creates unfavorable conditions for germination of tomato plant. Dolomite is the mixture of Calcium and Magnesium carbonate. In the soil dolomite powder react with water as follows:

$$CaCO_3.MgCO_3 + H_2O \rightarrow Ca(OH)_2 + Mg(OH)_2 + 2\ CO_2\uparrow$$
$$Ca(OH)_2 \rightarrow Ca^{2+} + 2\ OH^-$$
$$Mg(OH)_2 \rightarrow Mg^{2+} + 2\ OH^-$$

Ca $(OH)_2$ and Mg $(OH)_2$ are highly basic in nature. These produces OH^- ions in excess amount and responsible for increase in pH of soil. For germination of tomato plant the soil pH should be slightly acidic (6.0 to 6.5). In x and 2x of SD the concentration of dolomite powder is small, hence there's not such a big change in pH, but from 3x to 4x of SD, this increased pH slows down the process of germination.

Plant height: Plant height is determined by measuring the height from the soil's surface at the base of the stem to the plant's tallest point. (Fig 2) shows the tomato plant's plant height data for C and SD. The addition of dolomite powder to the soil increased plant growth in contrast to the control. It may be attributed to the increase in nutrient elements in soil by adding dolomite powder and plant growth thus facilitating the transfer of nutrients to plants.

The exchangeable calcium, magnesium, and potassium present in SD contribute in increased electrical conductivity of soil. Additionally, the maximum plant height was noted in 2x treatment, which might be caused by higher levels of macronutrients such calcium, magnesium, phosphorus, and potassium as well as with various micronutrients. These nutrients enhance the production of certain plant hormones that are responsible for fast growth of plant.

Ca is a part of the cell wall and affects the permeability and structure of membranes. K is important in photosynthesis, the translocation of carbohydrates, and synthesis of proteins. Mg is an enzyme activator and a crucial part of chlorophyll. An essential part of plant proteins is S. Rapid change in plant height was observed during initial days due to readily availability of nutrients to plants. After that no such big difference was observed due to a lot of nutrients already absorbed by the plants.

As discussed earlier, small amounts of dolomite powder in soil (x and 2x) positively affect the growth of plants as they increase the concentration of beneficial plant nutrients in the soil and increase the productivity of the soil, but for high concentrations of dolomite powder in soil (3x to 5x), the basicity of the soil increases, which is an unfavorable condition for the growth of tomato plants. Besides this, the dolomite powder used in this experiment is of 300 mesh size, which is very fine and easily fits in the pores of the soil. This is responsible for the chocking of the pores of the soil, and as a result, water does not penetrate the bulk of the soil, causing a deficiency of water in the plant. For a small amount of dolomite powder (x and 2x), this effect is very small or negligible, but as the concentration of dolomite powder in soil increases (3x to 5x), this effect increases and causes drought to the roots of the tomato plant, combined with increased basicity of the soil. These two effects (3x to 5x) are responsible for the decrease in growth of the tomato plant.

Number of leaves: The average number of leaves recorded at 30, 45, 60, 75, 90, and 120 days after sowing of the plants treated with different doses of SD along with C is presented in (Fig 3). There is an increase in the number of leaves after the application of SD as compared to the control. It is due to the high concentration of nutrients and their availability to plants in SD. In all treatments, 2x of SD shows the maximum number of leaves. The number of leaves rapidly increases up to 60 days; after that, not so big change was observed. This was attributable to the lack of availability of nutrients in the soil because plants have already absorbed a large amount of nutrients for their growth, and the remaining nutrients are responsible for the flowering and fruiting stages of the plant. SD is rich in Ca and Mg. SD contains Mg at 2.397%, which is 0.899% more than C.

Healthy leaves are the result of magnesium. Moreover, magnesium is involved in energy metabolism, transfer of sucrose, the utilization of nitrogen, interactions between plants and soil microbes, and many other biological processes [21-26]. It also helps in the synthesis of calcium pectinate and ATP, which serves as a glue between the cell walls. The synthesis of chlorophyll (Chl) pigments in chloroplasts, which aids in the uptake of CO_2 during photosynthetic activities, depends on magnesium [27-28]. Only around 15–35% of the magnesium that plants absorb is fixed in Chl pigments the remaining 65–85% is utilized for protein synthesis and other pertinent biological processes [29-30]. Magnesium is a cofactor for about 300 enzymes, including those involved in the synthesis of chl and photosynthetic CO_2 fixation [31-34].

Mg is required for the activation of a large number of other enzymes, including phosphatases, carboxylases, RNA polymerases, glutathione synthase, and adenosine triphosphatases (ATPases) [35-37]. Because magnesium is involved in the nitrogen metabolism of plants, higher levels of protein are found in the roots or upper parts of plants where magnesium absorption is higher. Magnesium acts as an activator of various enzymes related to the metabolism of proteins and carbohydrates [38]. Mg and K function as chlorophyll composers and activators of diverse enzymes in photosynthetic and respiratory reactions, as well as in RNA and DNA formation [39-40].

Ca rises to 2.285% in SD compared to C. A high calcium content in SD is essential for healthy leaf development and growth. Ca takes involvement in the metabolism of the intake of other nutrients. In SD, calcium is important for activities that maintain the membrane's structural and functional integrity by stabilizing cell wall structures, which strengthens the plant tissues [41].

Since calcium is an element that is immobile in plants, it should be applied to them in their early stages of growth. This is because the root system absorbs calcium in these early stages of development quickly and linearly, which helps to maintain the integrity of the membrane and stabilize the cell wall. Prior to harvest, these characteristics exhibit a notable decrease [42-43]. For the formation of a new middle lamella, calcium is required. As a result, the meristematic zones of roots, stems, and leaves are highly vulnerable to the limited supply or absorption of calcium in the soil due to the constant cell division present there.

Ca is crucial for plant disease resistance because it shields the pathogen-secreted enzyme that breaks down plant cell walls. Because of the high amounts of calcium in the soil treated with value-added fertilizers, plants grew with better leaf growth. In order to locate the phosphate group and carboxylic acid in phospholipids and proteins, preferably near the membrane's surface, calcium stabilizes cell membranes. P encourages tissue growth and cell division. It is connected to intricate energy changes that occur within the plant. Fe enters cytochromes, which are essential for transpiration in plants. It aids in the synthesis of chlorophyll. Mn regulates photosynthesis and a number of oxidation-reduction processes. The enhanced level of nutrients in SD increases no. of leaves. Additionally, S promotes the production of leaves. It is a crucial part of proteins found in plants. Plants use it to produce amino acids. It is required for the production of chlorophyll, the stability of N, and the activation of vitamins and enzymes. K regulates stomatal activity to control water consumption.

Crop yield: The amount of agricultural production that is harvested is commonly measured in terms of crop yield. The data related to crop yield are shown in (Table 4). It is related to flowering and fruiting of plant. (Fig 4) shows the average number of flowers produced by each plant at various doses of SD and control during the plant's flowering stage. The mean number of flowers per plant that were turned into fruits was compared at various dosages of SD and C in (Fig 5). In order to evaluate the yield, weight of the fruits was also taken and compared in different treatments and with control.

According to the data, there were more flowers in 2x treatment, and the majority of these flowers turned into fruits in that same treatment. The use of SD increased the weight of the fruit, and this further improved crop production even more. It has an impact on fruit quality as well. The increase in yield may be explained by the betterment of plant nutrition. Presence of macro and micronutrients in the dolomite powder improved the nutrients status of SD which may be responsible for increase in crop yield by the application of different doses of mineral based fertilizer.

For better production and quality, the role of macronutrients and micronutrients in nutrition is essential [44]. Improving the yield quality of a crop greatly depends on applying macronutrients and micronutrients in a balanced amount. The early transition of plant parts from the vegetative to the reproductive phase, which results in early flowering, may be caused by the simple intake of nutrients and the concurrent transportation of growth-promoting chemicals like cytokinins to axillary buds, breaking apical dominance. Applying mineral fertilizers enhances crop output in addition to the physical condition of the soil.

To produce fruits and flowers, plants require a balanced diet that includes N, P, K, Ca, Mg, and S. Plant flowering and fruiting are influenced by the pH of the soil as well as imbalances or deficits in nutrients. The enhancement of soil physiochemical properties and the achievement of a balanced nutrient level are responsible for the induction of blooming in plants treated with SD. The production of fruit and flowers is also aided by micronutrients. Mg is responsible for stress tolerance, male fertility, and pollen production. Fertilization and fruit production require potassium. Moreover, it confers resistance to illness. It regulates the uptake of water by the roots and its release through the leaves. A high P content promotes earlier and more uniform crop maturation. Florigen hormone is a consistently mobile signal that is produced in leaves and sent to the shoot apical meristem by the phloem, where it triggers flowering [45-46]. The Ca ions attach to calmodulin in the florigen hormone's functioning mechanism, and the Ca^{2+}/CaM signaling system then causes the expression of G1 mRNA, also known as FT and CO mRNA. The plant flowers as a result of the daytime buildup of G1 mRNA or GI-CO-FT m-RNA [47]. Therefore, high Ca concentration in SD promotes early flowering than C and highest number of flowers produced in 2x SD due to issue of pH and dryness of soil in 3x to 5x of SD.

Biomass: The sum of the net average plant weight and crop output is known as biomass. To calculate biomass, a clipping and weighing approach was employed. In order to record the biomass, tomato plants were carefully taken from the soil system after they had reached full size, taking care not to damage any parts of the plant. The weight difference between the freshly clipped plant and after 48-hour weights was used to compute biomass. The plants were dried after being softly cleaned with a trickle of water. Following that, the weight of the recently clipped plants was determined. Following a 48-hour air drying period, they are weighed. (Fig 6) shows the biomass data of tomato plants under various treatments.

When the percentage of plant biomass was compared, there was a noticeable difference between the plants grown in untreated soil and those treated with dolomite powder. The rise in the levels of macronutrients, micronutrients, and growth hormone necessary for the plant's optimal growth is responsible for the increase in biomass of the plants treated with mineral waste.

The variations in tomato growth, yield, and fruit quality could be attributed to variations in their genetic structure. Biofertilizers, on the other hand, can provide a variety of nutrients and enhance the physical and biological characteristics of the soil, increasing the uptake of vital nutrients and decreasing nutrient losses. This, in turn, improves fertilizer use efficiency and raises soil nutrient availability.

Plants treated with dolomite powder had significantly more fruits overall, both in terms of quantity and mass (x and 2x). The health and biomass of the crop are in fact influenced by several nutrient elements that are present in dolomite powder. The plants take up these available nutrients from the soil, which stimulates vegetative growth and productivity.

The main factor for an increase in biomass is the presence of primary, secondary, essential, and ultra micronutrients in dolomite powder. An increase in P has an impact on a number of plant functions, including photosynthesis, respiration, energy transmission and storage, cell division, and expansion. K is necessary for the absorption of water and the synthesis of plant sugar for human consumption. In this way, it encourages the growth of plants, roots, fruits, seeds, etc.

Ca is essential for maintaining cell integrity and membrane stability. Magnesium activates a number of enzymes that are involved in the synthesis of nucleic acids found in chlorophyll molecules and the metabolism of carbohydrates. A phosphatic carrier is Mg^{2+}. Micronutrients are involved in many aspects of plant metabolism, including the growth of cell walls, respiration, photosynthesis, the production of chlorophyll, enzyme activity, nitrogen fixation and reduction, and photosynthesis. The crop yield's quality and quantity were enhanced by the dolomite powder's inclusion of micronutrients such as Mn, Fe, and others. The higher biomass in 2x SD compared to C and other SD treatments is caused by all of these reasons.

CONCLUSION

Excess amount of dolomite powder is produced in dolomite stone industry, which contains Mg and Ca in large amount. The XRF analysis also showed that in comparison to simple soil, soil with dolomite powder contains several plant nutrition elements. Tomato is Ca & Mg deficient plant and SD is rich in Ca and Mg, and its application of tomato plant showed that seed germination, plant height, no. of leaves, crop yield and biomass are better for SD than C. In all SD treatments, 2X showed maximum vegetative growth, crop yield and biomass due to sufficient level of nutrients present in 2X treatment. The excess application of dolomite powder (3x -5x treatment of SD), responsible for chocking of soil pores, causing dryness of roots, and increases alkalinity of soil, therefore these concentrations are not favorable for growth of tomato plant. Therefore, it can be concluded that recycling of dolomite powder from the dolomite industry into soil fertilizer and using it to increase crop yield can be a very effective way of providing the tomato plant's nutritional needs and soil fertility.

Conflicts of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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