



Tomato Farming by using Organic Fertilizer

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A. Introduction

General Initiation of the crop:

Tomato is contemplated as a crop grown during warm season. It stipulates a climate of warm and cool nature. The plants are not subjected to high humidity and frost. Another fact that explicates is that the intensity of light is an influencing factor for color of fruit, set of fruit and its pigmentation (Poudel, Horwath, Mitchell, & Temple, 2001). Thus, Tomato crops can be sensitive and vulnerable in diverse climatic conditions. There are segregated climatic ranges for the germination of the seed, growth of the seedling, fruit and flower set and lastly the quality of the fruit. Any temperature estimated to be above 38 degrees and below 10 degrees may affect the plant adversely due to the influence on the plant tissues and a de-accelerated growth of the physiological activities (Bogdanovic, Ilin, Cabilovski, Marijanusic, & Adamovic, 2014). The temperature range suitable for its growth is between 10 and 30 degrees with an ideal range of 21 to 24 degrees of temperature. The temperatures at mean above 27 degrees and 16 degrees is inappropriate (Rossi et al., 2009). There cannot be a withstanding of the level of frost and demands a rainfall till medium range and is unsuitable for a highly moist conditions. However again a prolonged period of dryness and water stressing may cause fruits cracking. The sunshine of a considerable level during the fruit set time can facilitate to have the fruits turned to a dark red and the desired fruit color.

Importance of the Tomato Crop:

The Tomato is a significant vegetable crop which has accomplished considerable significance as a part of a daily diet in the last century. It has grown substantially in the global front, be it in the net-houses, out-door fields or the green houses (Dorais & Pepin, 2011). The crop can be segregated into two segments tomatoes that are of fresh market which dominates in processing and that is grown in the outdoors and also which is harvested mechanically. As a significant source of Vitamin C and Vitamin A, Tomato crops has been significant in growth of bones, augmenting cell division, differentiation also facilitating in the immune system regulation. It has as well ensured maintenance of the respiratory, intestinal tracts and urinary system (Poudel, Horwath, Mitchell, & Temple, 2001). Vitamin C is significant in the collagen formation, protein structuring to bones, blood vessels, muscle and cartilage. Alongside, it as well helps for growing bones and teeth. A substantial anti-oxidant –Lycopene as a constituent of tomato can intercept growth of any carcinogen in body.

Farming Methods of Tomato:

Tomato Crops can be grown organically in green houses and inorganically in outdoor fields. The semi-determinate and determinate tomatoes along with the tomatoes of fresh market are grown in the outdoor fields with the bush tomatoes varieties of determinate (growing on ground excluding the method of staking and varieties of semi-determinate with the utilization of string and stake method. A semi-determinate method encompasses the utilization of the stakes of wood positioned inside the plants rows and has a number of string's parallel places run to amidst stakes and new plant growth trapping amidst strings. The plants kept in the position upright intercepts the fruit from the ground touch (Zoebel, 2002).

Determinate tomatoes necessitate very scarce care of the plant and has a predetermined cluster strength, that is not so augmented (Duuml rdane, Naif, Yusuf, Mine, & Perihan, 2011). Their growth is not of an elevated level and may have inputs that are as well low. Such crop kinds are commonly found in the countries that are developing with lower prices and where quality may not always be a deciding factor.

For the growth of tomato crops organically, the soil texture, quality, nutrients levels like nitrogen, potassium, Magnesium, sodium and others like calcium can be critical factors. Pruning is a significant method adopted, while crop rotation is a predominant technique for soil maintenance in the growth of organic tomato crops.

Aims and Scope:

The Report shall thus elucidate the growth of tomato crops using the organic farming methodology and importance of organic farming for the same.

Overall Ideas of the Report:

Organic fertilizers, its contribution in tomato crops and farming. Its impact in plant parts, production, maintenance, harvesting, soil quality and nutrients supply.

B. Discussion: Organic Fertilizers

Definition:

Organic Fertilizers are retrieved from the human excreta, animal matter/ vegetable matter. The organic fertilizers derived naturally encompass the wastes from animals like the peat (Garg, 2014), meat processing, guano, slurry and manure.

Contrarily most fertilizers are utilized in the commercial farming and derived from minerals or industrially.

In contrast to the chemical fertilizers which are manufactured commercially, the organic fertilizers is usually composed of a single kind of ingredients and may be suitable to the needs of a garden's specific nutrition (Döring, 2013). The kinds of organic fertilizers may be from animal/plant/ mineral resources, based on the kind of chemicals that a garden entails. However for qualifying as an organic based fertilizer, the constituents must be natural in nature.

Types

There are varied number of organic fertilizers to use. They consists of:

1. Plant based fertilizers: It breaks down faster than other kinds of organic fertilizers. However, they mostly ensure more to condition the soil than the other nutrients. Such materials include compost and alfalfa meal etc. (Zoebli, 2002). which gives drainage and power of moisture retention to the soils of poor quality with no water holding power. There are several kinds of plant based fertilizers like Legume cover crops, Molasses, Compost tea etc.
2. Animal based Organic fertilizers: It encompasses the blood meal, bone meal, manure that puts more nitrogen in soil. It is highly beneficial to the leafy plants and ensure strength in growth in the preliminary gardening weeks (Duuml rdane, Naif, Yusuf, Mine, & Perihan,

2011). Some animal based fertilizers additionally used includes the Fish emulsion, urea. Milk and also the Manure tea.

3. Mineral-based fertilizers: These ensure adding nutrients to the composition of soil along with the lowering or raising of pH level if required for the growth of healthy plant. Types of Mineral based fertilizers include Calcium and Magnesium.

Advantages and Disadvantages:

Advantages of Organic Fertilizers:

1. Organic Fertilizers encompass other than phosphor and nitrogen other minerals that also ensure advantageous for the growth of Plankton (Forman & Silverstein, 2012).
2. Organic Fertilizers is advantageous on the pond bottom. The quality of adsorption is leveraged or is made greater than the capacity of the potential buffer, thus enhancing the microflora. Yet, an augment in bacteria is helpful of the ration of C:N is lesser than 30. However if the case is not as such, nitrogen components may be used by the bacteria from the column of water for the growth to persist (Garg, 2014).
3. There is a considerable level of fat, fiber and protein in organic fertilizers. The particles of fertilizer used along with bacteria may be utilized straightly as food by the species.
4. As organic fertilizers float the, phosphor loss is diminished.
5. With the help of organic fertilizers, a waste product can be re-cycled that would have otherwise not been used.

Disadvantages:

1. As Organic fertilizers are composed of myriad constituents, the fertilizers procedures and their standardization becomes tough (Glaser, Wiedner, Seelig, Schmidt, & Gerber, 2014). It is because they also accompany with substantial levels of phosphor and constraints like arrival of blue green algae and benthic
2. There should be a decomposition of organic fertilizers whose action can be considerably lesser which may further augment the risk losses
3. Organic fertilizers often trigger the growth of bacteria especially with the high level of oxygen demand. An excessive level of fertilizer consumption may lead to depletion of oxygen and increase the mortality rate of the crops.
4. It may as well elevate the chances of infections in plants
5. The quantity of organic fertilizers may leverage the high cost of labour and the cost of transportation (Gagnon & Berrouard, 1994).

c. Critique Analysis

Reason of Organic Fertilizers in Tomato Farming

The primary reason that makes organic fertilizers apt for tomato farming is because the crop thrives in soils made up of a prodigious amount of organic matter along with a deep root zone. The micro-organisms of the soil breaks down the fertilizers that are organic into myriad rates. With the help of an amendment of in a fast release of organic soil for an instance the alfalfa meal with an amendment of slow release along with feather meal, there can be a provision of all the needs of the plant fertilizer at the season beginning (Thakur, Kumar, & Singh, 2016). A good compost ensures a good level of phosphorous, potassium and nitrogen

that amalgamates as the entailing nutrients for the right soil for tomato growth. The phosphorus and potassium levels must be considered while growing tomatoes.

Importance of Organic Fertilizers in the growth of Tomato. Relation of good tomato and organic fertilizer use

A secret behind luscious, fresh and highly nutrient content tomatoes is due to the use of organic fertilizers. Tomatoes need a considerable level of NPK which consists of Nitrogen, Phosphorus and Potassium in soil along with these essentials there are various kinds of other organic fertilizers that may provide extraordinary level of nutrients in contrast to a normal level of fertilizers.

Animal organic fertilizers from vegetarian animals like horses and cattle can be highly useful. Faeces from dogs and cats should not be used as they are highly toxic with a considerable level of Pathogens in the content. The Manure must be aged/ composted prior to use or else it might be too sensitive for tomatoes for burning/ incinerating them. A good level of composted cow manure can be highly beneficial as an organic fertilizer for tomato. Alongside, bone meal can be highly useful as outstanding nitrogen/ phosphorus source for purchase in feed or garden centres (Gagnon & Berrouard, 1994).

Fish Emulsion: Fish emulsion can be highly useful with the mixture of the fish parts with the carbon like the sawdust and have it decomposed.

Grass clippings and weeds: Any plants with high amount of chlorophyll is rich in nitrogen and can resemble as a good fertilizer. For destroying the weed seeds, compost must be preliminarily used.

Alfalfa meal: It might be used as rabbit food or hay bales. Alfalfa can ensure an ideal NPK fertilizer and is rich in high amount of micronutrients as well as hormones. The cow manure enabled soil have tomatoes which is alfalfa dressed (Hobson, 1992).

Hence Organic fertilizers can be highly important for the growth of highly rich content of nutrients content in tomatoes as against the commercially viable inorganic fertilizers in market.

Organic Fertilizers and

Impact on Plant Parts:

Pruning Tomatoes is highly significant step to contribute a health growth of a tomato crop. This shall encompass branch removal, suckering along with bottom clearing.

Suckering: The time of growth of a tomato, it generates several side shoots and side branches.

The distinct element between the two is that the side branches are ordinary branches which augment and extend from the growth of the tip, also known as the lateral growth. A sucker is contemplated as a new plant which has its formation from crotch amidst the pivotal stem and the side branch. It may develop into a fruit or even a flower similarly like its mother plant (Glaser, Wiedner, Seelig, Schmidt, & Gerber, 2014).

Tip: For ensuring proper flow of air, tomatoes must be pruned of all the suckers. It not only augments the stem but as well the outcome is a bigger fruit and an obvious enhanced circulation of air (Kolota, Beresniewicz, Krezel, & Nowosielski, 1993).

Branch removal: At times a branch which is diseased can disseminate and spread in the rest of the plant parts if overlooked. A technique to de-accelerate the infection growth is the removal of the branches that are infected at the stem.

One must note that the removal of the infected branches shall not render any use as because the virus lies in the branch's veins. The complete branch might go.

A very different reason for the removal of the branches is for increasing the flow of air. There are many a times branches are produced from healthy plants. This may diminish the flow of air which may in turn lead to moisture for persisting on leaves for a longer time period that may further result in mildews as well as blights.

Bottom clearing: Bottom clearing is denoted as the technique of having all the leaves taken within 1 foot of the line of the soil. This shall intercept from leaves splashing which is the primordial reason of blight along with other plants diseases that are soil borne. It can be taken as a measure for prevention as well as for an enhanced flow of air amidst the canopy for intercepting moisture from persisting on leaves.

Impact in soil characters:

Ensuring the appropriate soil for tomatoes can be a critical factor for their growth.

Soil structure:

The soil suitable for the growth of tomatoes must be well-drained and loose. Moist soil does not suit well for the growth of tomatoes (Wang, Klassen, Li, & Codallo, 2009). If the soil is not drained properly, several diseases can in the club root from the root rot to the fusarium wilt. The soil must entail considerable amount of organic matter with a make-up of 20%, sand as 40% and the rest

40% clay. This shall ensure that the aeration is proper in optimal root (Döring, 2013), with a high level of penetration of water and a complete good growth of the root.

Nutrients of soil: Despite the composition of the soil being myriad from silica to carbon, there is a distinct benefit received from the composition of the kit of NPK to enhance the fertility of soil with suitably aged compost / manure mixture. The three primordial macro-nutrients of tomato for its proper growth include Nitrogen, Phosphorus and Potassium. However there is as well Magnesium and calcium which are substantially significant for the growth of tomatoes.

Nitrogen: Nitrogen is highly critical for the growth of tomato and it ensures contribution to the green color of the plant's leaves and make the plant stronger as well as sturdier. However an elevated level of nitrogen may persuade the plant to not produce fruit (Wang, Klassen, Li, & Codallo, 2009). Plants that lack in substantial level of nitrogen can be seen with the color of the leaves that may be yellow in color. A proper source of nitrogen is the blood meal which is 100% natural and generally OMRI certified.

It is useful for the tomato plant to be given nitrogen based organic fertilizers at initial spring.

Phosphorus: Phosphorus is highly significant for the flowers to set in and to enhance the health of the root. A grower of tomato must emphasize on Phosphorus higher than any other nutrients. At times, as it is considered to be an all-rounder as an organic fertilizer. If a tomato does not have a suitable amount of phosphorus nutrient, it can be identified clearly with a deep color under the leaf and the stunted main stem. A bloom buster is considered as a good bloom buster wherein many good agricultural firms produce. A great organic substitute is Bone meal which has a substantial amount of Phosphorus and shall render the outcome one is looking for. Giving

substantial amounts of Phosphorus at the growing time of Tomato shall augment the production of the fruit.

Potassium: The most fundamental element in the complete health of the plant is high strength and vigour. A higher growth of plant is essential for having higher quantity of fruit prior to the approach of the cold winters. It as well intercepts the leaves from the mildew that is powdery in texture and viruses like the spot of septoria leaf, late blight/ initial blight and Fusarium Wilt (Thakur, Kumar, & Singh, 2016). A potassium deficient leaf is often noticeable as a yellow color lamina with the veins as green color. In serious cases the leaf edges may as well start curling.

Calcium: It is one of the most neglected soil nutrients to be considered for tomato growth. The nutrient is essential to ensure the plant has a robust structure. Along with Potassium, the combined effect shall render a rigid structure of leaf and as well protect it from molds, insects, viruses as well as mildews. For the fruit set, calcium is a significant element and its deficiency may cause cracking with excessive cracking of water as the tomato's skin becomes thinner. The secondary problem shall be a Blossom End Rot or called BER (Taiwo, Adediran, & Sonubi, 2007).

Due to the formation of a tomato, a Blossom end rot may cause water lack that results the plant from taking in the calcium.

Magnesium: Magnesium plays a primordial role in the chlorophyll formation and also to initiate the process of Photosynthesis. An amalgamated effect of nitrogen along with magnesium shall see an expected outcome of as the nitrogen shall ensure the plant growth with the energy necessary to enhance the growth. It can impact with a high content of sugar and fruit's sweetness (Tavakoli & Khoshkam, 2013). A plant which is deficient in Magnesium may bend down or curl up.

A convenient way to use Magnesium for the growth of the tomato plant is giving a high level of Epsom Salt.

Impact on Production and Harvest:

The primary factors for Production and harvesting includes:

Soil pH: The pH appropriate for the soil to grow tomatoes must be between 5.5 to 6.0 (Sánchez de Cima, Luik, & Reintam, 2015). It is due to the fact that tomatoes grow properly in acidic soil. A pH which may deviate from the above mentioned range may render deficiencies in the soil. The reason being that pH has a complete effect on the manner the nutrients can be utilized by the roots.

Soil Temperature: The temperature apt for the growth of tomatoes can be in between 55 to 85 degrees for the optimal health. The soil temperature can be probable for ensuring the plant growth to be healthy. A cool or a cold weather may give a higher probability of the diseases that are soil borne. The temperature of the soil can also speak about the soil activities. Mulching can be considered as a measure to maintain a suitable temperature and moisture content of the soil and also ensure protection from evaporation.

With an appropriate level of pH and soil temperature, the tomatoes can be adaptable to a broad range of growth conditions. However a low temperature and short growth seasons may diminish the growth (Prasad, Simmons, & Maher, 2004).

Soil Preparation: An incorporation of organic matter and cover crops is highly entailing. Once the cover crop comes in place, it must be utilized in a minimum of 3 weeks prior to

transplantation. If wind protection is entailed, a cover crop may be strip tilled to ensure strips of cover crops to have the wind buffered.

Field design: There are myriad cultural systems to be utilized in tomatoes commercial producing. The seeding methods, shaped beds and the spacing of the plants are of the criterions (Tavakoli & Khoshkam, 2013).

Direct seeding: It requires a considerable numbers of seeds to be used in every acre that also leverages the cost of the seed.

Bed Systems: Beds ensure a proper drainage of the soil and can enhance the production level for soils that are poorly drained. Yet during dry periods, an increased irrigation is entailing for raised beds.

Plant spacing: Plants of densities between 3200 to 5700/ acre is unstaked can be appropriate and about 2400-3200 per acre. The row spacing may depend on the cultivator vigor and how shall it be pruned.

Irrigation: The activities at the time of production include irrigation management. Organic fertilizers in harvesting shall diminish the likelihood of the soil mixture fluxes and leverage the water retention capacity with Mulches enhancing the water relations with water conservation and fluctuation reduction which causes plant stresses, cropping and reduced tillage (Prasad, Simmons, & Maher, 2004).

Harvesting:

The stages of ripeness of tomatoes can be identified as:

1. Immature green

2. Mature green
3. Breaker
4. Pink
5. Full-Tipe
6. Over-Ripe

Harvesting organically may render the best results if the harvesting operations are initiated at the light red to the stage where the tomato becomes red. Wash water is utilized with the organically authorized sanitizer like ozone, chlorine and Peroxyacetic acid (Karabcová, Pospíšilová, Fiala, Škarpa, & Bjelková, 2016).

Impact in resistance of diseases:

For the protection against diseases like Tomato Hornworm, organic methods like plucking parasitic wasps, plucking by hand and parasitic wasps are useful. Hornworms are basically found in leaves undersides for the new and tender leaves. A bird feeder next to tomato plants can be useful to eat tomato horn worms. A hornworm may cause brownish green droppings and also loss of foliage.

Pest Aphid

A pest like Aphid in a tomato plant can be mitigated by the spray of high pressure water, larva of ladybug and along with neem oil. An Aphid may result in sticky water drops called Honey dew, leaves downward curling, a growth which is stunted as well as excessive presence of ants.

Pest: Cutworms:

Applying about 7 tooth picks around the plant base can be highly useful.

Impact in environmental benefits

Organic fertilizers are bio degradable in nature that defines its long term sustainability. Organic fertilizers ensures medium as well as long term effects in the agro eco system. It helps to develop the plant as well as ensure an ecological balance that also intercepts pest issues (Prasad, Simmons, & Maher, 2004).

In tomatoes, crop rotation as well as soil conditioning in organic farming can be highly useful environmentally.

Crop Rotation can be considered as the practice involved in the growth of a set of different as well as dissimilar crop types in the same spot for sequential seasons (Oliveira et al., 2013). There are various benefits given by the soil. Crop Rotation ensures preventing the growth of Pathogens and the pests that frequently occur if a species is grown with continuation. It thus improves the structure of the soil and helps to leverage the fertility level with the alternation of shallow as well as deep rooted plants.

As Tomatoes have several varieties that are disease tolerant, it is easier to have the growing locations modified every year (Rossi et al., 2009).

Soil Conditioning: The action of a product addition to the soil for the improvement of the physical qualities along with the usefulness to ensure the necessary nutrition to the plants in future may enhance the level of fertility and the water retention capacity along with the complete looseness or tilth.

Changes in air and climate: Organic agriculture may diminish the non-renewable energy by diminishing the needs of the agro-chemicals. Organic culture ensures contributing to the mitigation of the effect of green-house as well as global warming to have the soil sequestered

with carbon (Miller, 1972). The carbon contents in a soil higher can dictate more potential of mitigation against then climate change.

Impact on Human Health:

Organic Fertilizers restore the pure nutrients of the Tomato. With additional anti-oxidants (Graham-Rowe, 2007) it enhances the nutritional value of the plants. In tomatoes, inorganic fertilizers often give a coating of a chemical leveraged layer that can be harmful to health if consumed. There has been reports that often the chemicals used in inorganic fertilizers can be carcinogenic and also may add persistent level of toxicities that may show its harmful effects later in life. The natural constituents in an organic fertilizers like Manure, animal waste, plant waste or others re-instate the nutritive value of the plant and does not degrade it or make it chemical based.

Organic fertilizers used on Tomatoes is considered to be safer than inorganic ones with assurance to health care and security. It ensures the pure freshness of the fruit and does not degrade its quality.

Impact in Quality of crop:

The organic fertilizer use in soil helps to improve the quality of soil by leveraging the retention of water and drainage capacities. In contrast to the synthetic fertilizers (Kolota, Beresniewicz, Krezel, & Nowosielski, 1993), the organic fertilizers like plant wastes and manures add considerable humus to the soil which ensures a persistent and an equilibrium state of nutrients supply for the root growth improvement (Oliveira et al., 2013). Additionally, the organic fertilizers ensures feeding and sustaining the micro-organisms that are beneficial which can live in the soil for a considerable time ("Size isn't everything when it comes to organic tomatoes", 2012). Unlikely

where the chemical constituents in an inorganic soil destroys the chemical products by having the acid levels in the soil leveraged.

Unlike the inorganic fertilizers that ensure considerably a higher level of nutrients and in turn destroy the young plants with adverse effects like root burning and damaging. Aged and composted fertilizers are easily absorbed by the plants. This makes it a considerably slow process of burning or over-feeding the plant roots. Thus re-instating the required quality of the soil.



D. Conclusion:

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Recommendations:

1. In the course of the study, it is thus recommended that the ideal soil for the growth of Tomato consists of considerable level of Nitrogen, Potassium and Phosphorus along with elements like Magnesium and calcium.
2. The organic fertilizers used must be plant waste, minerals and waste of herbivorous animals eating plants.
3. The manure must be aged and composted before application to the soil.
4. For soil maintenance of the organic tomato farming, crop rotation and soil conditioning can be pre-requisite.

5. The soil pH must be acidic and the temperatures must be between 55 to 85 degrees for retaining the required nutrients of the soil.

Abstract of all points:

Tomatoes grow in ideal temperatures of a warm and a cool climate with less humidity conditions. A highly humid weather content can make the soil's water drainage process difficult and may further adversely affect the growth of the plant. Given that, a considerable supply of the NPK nutrients, proper plant placing, density and harvesting (Kolota, Beresniewicz, Krezel, & Nowosielski, 1993), protection from pests and maintenance of the growth is highly entailing for the growth of tomatoes. As organic farming is a slow process, the intervention towards proper care and handling must as well be precise and not over done. For highly frost conditions the tomato plants can be guarded with a plastic sheet to protect the plant from destroying due to the extreme conditions in temperature.

Summary Critique:

The findings of the report suggests that the growth of tomatoes is organically ensure high anti-oxidant rich production by retaining the nutritive value of the fruit unlike the inorganic fertilizers. Hence, it must be significant that the best organic fertilizers are used for the purpose with suitable soil characters, harvesting, production, maintenance and quality of the growth.

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