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Application and Response Two Different Calcium Nutrient Treatment on Sweet Corn Growth (*Zea mays saccharata* Strutt.) in Ultisol

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ABSTRACT

Sweet corn is a crop that has a very good nutrients and tastes sweet. Ultisol is one of the soil that spread vastly in Indonesia, up to 25% of the Indonesian total terrestrial area. Ultisol is acidic soil, hence calcification can be applied to deal with it. The purpose of this research was to determine the growth response of sweet corn in two sources of calcium nutrients applied to ultisol soil. This research was conducted in the gauze of the Faculty of Agriculture, the University of Sumatera Utara with an altitude of ± 32 m above sea level starting from October 2017 to December 2017. This research used a Non Factorial Completely Randomized Design with 7 treatments and 4 repetition, the treatment of which was calcium nutrient, shell egg (9.22 g / 15 kg soil), eggshell (13.84 g / 15 kg soil), eggshell (18.45 g / 15 kg soil), dolomite 1 x Al dd (equivalent to 9.22 g / 15 kg of soil), dolomite 1.5 x Al dd (equivalent to 13.84 g / 15 kg of soil), dolomite 2 x Al dd (equivalent to 18.45 g / 15 kg of soil). The results showed that the two sources of calcium nutrients (eggshell or dolomite) applications had no significant effect on plant height, leaf number, stem diameter, canopy, and root wet weight, and canopy and root dry weight.

Keywords: sweet corn, ultisol, egg shell, dolomit.

INTRODUCTION

Sweet corn is often preferred because of its taste, carbohydrates, proteins, vitamins and relatively high sugar content but low in fat. In addition to vegetables, sweet corn is consumed boiled or grilled. Sweet corn has a sweet taste because the sugar content is 5-6% which is more than the taste of ordinary corn with 2-3% sugar content (Sirajuddin, 2010).

Currently the demand of sweet corn is increasing, encourages farmers to make improvements in the cultivation system to increase production. In 2014, Corn production in North Sumatra amounted to 1,159,795 tons with a harvested area of 200,603 ha. The production decreased compared to 2012 which reached 1,347,124 tons with a harvested area of 243,098 ha (Badan Pusat Statistik, 2017).

One of the important factors in increasing sweet corn productivity is fertilization. Fertilization is an effort to provide fertilizer to increase nutrients needed by plants in order to increase the growth, production and quality of crop yields. In an effort to develop more competitive sweet corn, efforts are needed to improve farming, both economic, quality and productivity through the application of technology ranging from location determination, use of varieties, quality seeds, proper planting, fertilization, maintenance, to proper harvest and post-harvest handling. (BPPP, 2008).

Ultisol is one type of soil that vastly spread in Indonesia, reaching 45,794,000 ha or about 25% of the total terrestrial area of Indonesia, which has great potential for expanding and increasing agricultural productivity in Indonesia.

The main problem of Ultisol being used as agricultural land is being poisoned with alumunium (Al) and its acid nature. The high content of Al saturation and acidity are reported as the main causes of poor growth and low

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productivity. Al's high saturation in acid soils caused hampered root growth to reduce nutrient and water uptake. In addition, the problem of water shortages and low nutrient also caused the low productivity or failed to produce on Ultisol soil (Hakim, et al. 2009).

Adding calx to acidic soil give a good effect to the nature of the soil in a good way. Mg level of the soil increased, N level, P in the leaf also increased. With clacification, the soil's pH will increase, where ion Mg and Ca that can replace the position of H^+ on coloid's surface neutralized the soil's packaging. Clacification also used to reduce the risk of being poisoned with the alumunium, increase the availability of soil's P element from the bond od Al-P and Fe-P. (Kuswandi, 2003).

To increase the productivity, fertilization is needed. The additional fertilizer can be an organic fertilizer or inorganic fertilizer. The facat is, most of the farmer in Indonesia still using inorganic fertilizer. This is because of the inorganic fertilizer is easy to use and the satisfying yields. (Simamora dan Salundik, 2006).

The availability of inorganic fertilizer in the market, is a common problem for the farmers. One of the causes is not on time distribution. The price of staples which are relatively expensive also made the price of inorganic fertilizer relatively expensive. One of the solutions is to use the organic fertilizer. (Simamora dan Salundik, 2006).

Organic fertilizer has some advantages such as: increasing the organic substances in the soil, fixing the soil structure, increasing the land cation exchange capacity, increasing the biologic life of soil and increasing the nutrient of the soil. Organic fertilizer has acidic humous that can help to release the bounded elements, so, it will be easy to be absorbed by the plants. Organic fertilizer consists of manure, green manure, guano, night soil, bone meal, fish flour and blood flour (Hasibuan, 2006).

Plant's growth needs calcium, phosphor and other nutrients, hence, adding organic or chemical fertilizer is so important for its growth. The aim of this research was to determine the response of the sweet corn (*Zea mays saccharata***Sturt**) by egg shell flour application as the calcium nutrient resource. According to Nursiam (2011) the nutrient substance of the egg shell which as good as the egg itself, do not get enough attention right now.

The utilization of egg shell flour as a Ca organic flour is one good alternative to solve the problem of Pemanfaatan tepung kulit telur unggas sebagai sumber pupuk organik Ca merupakan salah satu alternatif yang sangat tepat untuk mengatasi Ca deficiency when filling corn grains. A lot of poultry egg shell around us have not been utilized and usually just get thrown right away. Egg shell is a household waste, small industry waste, and some others where the egg shell just wasted. Egg shell contains a very high Ca that can be used as a substitute for Ca. Eventhough Ca's ion provided at the first stage of planting Meskipun ion Ca tersedia pada awal tanam with a sufficient pH of the plant at the time of vegetative growth, however Ca deficiency during seed filling can reduce yield. The reduction can occur up to 60% (Goldsworthy dan Fisher, 1992).

Dry eggshells contain about 95% calcium carbonate weighing 5.5 grams. Eggshells consist of 97% calcium carbonate. Besides that the average of eggshells contains 40% of the elemental calcium every 5.5 grams of eggshell or the equivalent of an eggshell. The calcium content in eggshells has great potential as a source of nutrients for plants and also as an impacting agent for resistance to disease, controlling pests such as molusca, ants and so on (Jamila, 2014).

Calcium nutrients application is one way to increase the pH of ultisol soil. The function of calcium also stimulates the formation of fine roots, thickens the fruit cell walls, and stimulates the growth of seeds for corn (Jamroji, 2015).

MATERIAL AND METHODS

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This research was conducted in the gauze of Faculty of Agriculture, University of Sumatera Utara with a height of ± 32 m above sea level starting from October 2017 to December 2017.

The material used in this research is sweet corn variety of Bonanza F1 which is used as an indicator of observed plants, chicken egg shell flour as a source of organic calcium nutrients, dolomite sebagai sumber hara kalsium inorganic, NPK fertilizer as a base fertilizer for corn plants, ultisol soil as a planting medium, polybag size 30 cm x 35 cm for containers of planting media, fungicides and insecticides to control plant disturbing pests, labels to mark the planting media container.

The tools used in this research were blenders to process eggshells into eggshell flour, hoes to cultivate the soil, plastic rope to measure the planting area, brood to water the plants, analytic scales to weigh the roots and canopy weights, the oven to dry the roots and canopy plant, meter to measure plant growth, stationery and books to record plant and camera growth data as a documentation tool during the research.

This research used a Non Factorial Completely Randomized Design (CRD) with 7 treatments, namely C0: Non-Calcium, C1: Eggshell (9.22 g / 15 kg soil), C2: Eggshell (13.84 g / 15 kg soil) , C3: Eggshell (18.45 g / 15 kg of soil), D1: dolomite 1 x Aldd (equivalent to 9.22 g / 15 kg of soil), D2: dolomite 1.5 x Aldd (equivalent to 13.84 g / 15 kg of soil), D3: dolomite 2 x Aldd (equivalent to 18.45 g / 15 kg of soil) with 4 reworks to obtain 28 experimental units.

RESULTS AND DISCUSSION

Based on observational data and analysis of variance in Table 1, it was found that two types application of calcium nutrient sources, namely eggshell or dolomite on ultisol soil had no significant effect on plant height, number of leaves and stem diameter. This is presumably because plants lack nutrients due to acidic soil pH and this is evident from plants that grow small and plants that attacked by downy mildew. According to Novriani (2010) soil acidity can affect the growth of corn plants because soil acidity is closely related to the availability of nutrients in the soil. The pH of the soil that is suitable for the growth of corn plants ranges from 5.5 to 7.0. According to Haris (2013) that downy mildew is a major disease in sweet corn plants, so the release requirements for a variety of corn are the candidate varieties must have resistant properties to downy mildew. The main cause of the high attack is downy mildew because it is generally planting corn at any time so that it is not simultaneously planted. The result is found corn crop in sharing age level (young age to harvest age), which results in the availability of a source of downy mildew inoculum, so that the next sweet corn crop is potentially attacked by downy mildew, which in turn affects the growth of sweet corn.

According to Sembiring and Anidarfi (2010) states bivalent calcium Ca2 +. Ca is the least moving essential ingredient compared to other ions, there is little or no transport in the phloem. Nutrients for plants are one of the limiting factors in the growth and production of sweet corn crops. To achieve maximum sweet corn yield, sweet corn plants cannot be deficient in nutrients. Improvement of nutrient-poor soils does not only deal with soil acidity, but also must pay attention to the nutrient content in it with the addition of organic matter to provide nutrients for the soil and plants.

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Table 1. Application of calcium nutrient sources on plant height in ultisol

Treatment	Plant Height (cm)		
	2 WAP	4 WAP	6 WAP
C0	30.41	56.16	89.7
C1	33.91	62.21	90.7
C2	33.51	64.81	96.69
C3	34.36	64.75	91.85
D1	34.00	62.55	92.29
D2	34.09	64.03	92.08
D3	33.88	63.01	92.81

According to Marsono and Sigit (2001) the more carbohydrates formed and stored in the body of the plant will increase the dry weight of the plant. Basically the amount of nutrients given to all plants is the same, the difference is the source of these nutrients, namely organic and inorganic nutrients. The condition of organic nutrients is more complete than inorganic nutrients, both from macro nutrients and micro nutrients.

Tabel 2. Application of calcium nutrient sources on wet weight,Canopy and root plant

Treatment	Plant parameter		
	wet weight	Canopy	root
C0	29,83	12,90	10,50
C1	34,23	16,38	4,79
C2	42,72	19,41	16,38
C3	22,07	11,36	5,39
D1	27,70	11,46	11,66
D2	27,71	11,38	8,65
D3	20,33	11,18	6,79

Based on observational data and analysis of variance in Table 2, it was found that two types of calcium nutrient sources application, namely egg shells or dolomite to the growth of sweet corn on ultisol soil had no significant effect on wet weight and canopy and roots. This is presumably because the number of leaves that can grow on sweet corn is too little so that the plant is unable to carry out photositesis perfectly. so that when harvested many are left in the soil. In the development of roots and headlines the availability of nutrients and the rate of net assimilation play an important role. According to Setiawan (2003), growth and production and quality of sweet corn results are influenced by two factors, namely genetic factors and environmental factors such as soil fertility and sufficient sunlight. Corn plants require nutrients that are fulfilled, so if a little nutrients in the soil and plants give unfavorable results such as thin and weak stems. So that the nutrient needs of sweet corn plants for canopy and root development can be fulfilled.

Based on Table 2 it is known that two types of calcium nutrient sources application, namely eggshell flour or dolomite has no significant effect on root weight because root growth is inhibited due to the pH of the soil that is still acidic on ultisol soil as well as a lot of clay texture. contained in the land of tearebut can affect the growth of corn root. According to Wawan (2002) acidic soil conditions can inhibit the growth of plants grown on this soil. This

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happens because of disruption of plant root development. The roots of the plant become shorter, their size is larger than usual, stiff like a wire, easily broken, and the root tips swell. So that the roots of plants cannot absorb water and nutrients perfectly which will cause plants to experience water stress and nutrient deficiency.

According to Lingga (2008) that providing organic fertilizer can improve soil structure, increase soil absorption material to water, increase living conditions in the soil, and as a source of food substances for plants. Whereas inorganic fertilizer can stimulate overall growth, especially branches, stems, leaves, and play an important role in the formation of leaf green. Complete and balanced nutrient availability that can be absorbed by plants is a factor that determines the growth and production of plants.

Eggshell fertilizer application can also affect crop yield components such as canopy weight and root weight. Increasing or decreasing plant yield components due to organic fertilizer or having something to do with the production of other plant organs when photosynthesis plants are translocated to parts of plants that need them, including dry roots and canopy dry weight. This is consistent with the statement of Salisbury et al. (1995) that increasing crop production is inseparable from the influence of the role of nutrients N, P, K on growth. The element N plays a role in chlorophyll, so in P and K even though these two elements are not included in the chlorophyll composition, of course all are very helpful in the photosynthesis process which then produces photosynthesis into various plant organs.

According to Widyawati et al. (2008) that eggshells contain elements of calcium found in mineral sulfur in the form of Calcium Carbonate (CaCo3) or lime. In soil, calcium is not only derived from lime and added fertilizer is also derived from the rocks and minerals that form the soil. Calcium is one of the main cations in the exchange complex, so it is commonly associated with soil acidity and liming problems, because it is the most suitable cation to reduce acidity or increase soil pH. The addition of eggshell fertilizer gives the same effect at various doses given. Besides that, eggshell fertilizer is suspected to increase soil acidity, improve soil damage due to chemicals caused by insecticides and manufacturing fertilizers and play a role in plant growth. According to Dartius (1991) that the availability of elements needed by plants that are in sufficient condition, the metabolic results will form proteins, enzymes, hormones and carbohydrates, so that enlargement, extension and cell division will take place quickly.

CONCLUSION

The addition of eggshells or dolomite as a source of calcium nutrients had no significant effect on all variables of growth growth of sweet corn (Zea mays sacchrata Sturt.) On ultisol soil.

REFFERENCES

BPPP. 2008. Teknologi budidaya jagung. Badan Penelitian dan Pengembangan Pertanian. Bogor.

BPS. 2017. Produksi Jagung Sumatera Utara.

Dartius. 1991. Dasar – dasar Fisiologi Tumbuhan. USU Press. Medan.

Goldsworthy, P.R dan Fisher. N.M. 1992. Fisiologi Tanaman Budidaya Tropik. Gajah Mada University Press. Jogjakarta.

Hakim,N., Agustian dan Syafrimen,Y. 2009. Pengapuran Pemupukan dan Penggunaan Sisa Tanaman untuk Tumpang Sari Padi Gogo,Jagung dan Kedelai pada Podzolik Dalam Jurnal Penelitian dan Pengabdian Masyarakat,Fakultas Pertanian Universitas Andalas, Padang.

Haris Talanca, A. 2013. Status Penyakit Bulai pada Tanaman Jagung dan Pengendaliannya. Litbang Pertanian. Kalimantan Selatan.

Hasibuan, B. E. 2006. Pupuk dan Pemupukan. Fakultas Pertanian USU. Medan

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Jamila. 2014. Pemanfaatan Limbah Cangkang Telur. Program Studi Peternakan. Universitas Hasanuddin. Makassar.

Jamroji M. 2015. Aplikasi Pemupukan Tanaman Jagung. Bp4k Blitarkab. Blitar.

Kuswandi. 2003. Pengapuran Tanah Pertanian. Kanisius. Yogyakarta

Lingga, P., dan Marsono. 2008. Petunjuk Penggunaan Pupuk. Penebar Swadaya. Jakarta.

Marsono dan P. Sigit. 2001. Pupuk Akar, jenis dan Aplikasi. Penebar Swadaya, Jakarta.

Novriani, 2010. Alternatif pengolahan unsur hara P (Fosfor) pada budidaya jagung. Agronobis., 2(3) : 42-49

Nursiam, Intan. (2011). Uji Kualitas Telur. Diakses dari http://intannursiam.wordpress.com pada tanggal 15 Desember 2016.

Salisbury, Frank B dan Cleon W Ross. 1995. Fisiologi Tumbuhan Jilid 1. ITB. Bandung

Sembiring, N dan Anidarfi. 2010. Kajian Beberapa Sumber Ca untuk Meningkatkan Kebernasan Polong pada Berbagai Varietas Kavang Tanah (*Arachis hypogea* L.). Jurnal Penelitian Lumbung, Volume 9 No.1.

Setiawan, K., 2003. Pertumbuhan, produksi dan kadar sukrosa tiga varietas jagung manis akibat pemberian berbagai dosis urea. Jurnal Hortikultura Vol.3 No. 12, Jakarta.

Simamora, Ir. S dan Salundik.2006. Meningkatkan Kualitas Kompos. AgroMedia Pustaka, Jakarta.

Sirajuddin, M. 2010. Komponen Hasil dan Kadar Gula Jagung Manis (*Zea mays saccharata*) Terhadap pemberian Nitrogen dan Zat Tumbuh Hidrasil. Penelitian Mandiri. Fakultas Pertanian. UNTAD. Palu.

Wawan, 2002. Pengelolaan Subsoil Masam Untuk Peningkatan Produksi Tanaman Pangan. Makalah Falsafah Sains. PPS-IPB, Bogor

Widyawati, W., W.Q. Mugnishah, dan A. Dhalimi. (2008). Pengaruh Pemupukan Kalsium dan Magnesium terhadap Pertumbuhan dan Kesehatan Tanaman Panili (*Vanilla planifolia* Andrews.) di Pembibitan. Jurnal Pertanian. Universitas Sriwijaya. Palembang.