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THE EFFECT OF $Mg(CO_3)_2$ COMPOUND FERTILIZER AND N,P,K FERTILIZER ON THE Mg-EC, PLANT Mg-UPTAKE, AND YIELD OF TOMATO (*Solanum lycopersicum* L.) ON INCEPTISOLS OF JATINANGOR

Emma Trinurani Sofyan[1)], Rina Devnita[1)], Rheida Fayza Islasorna Aurell[2]
1) Lecture at the Department of Soil Science and Land Resources, Faculty of Agriculture, University of Padjadjaran
2) Agrotechnology Study Program, Faculty of Agriculture, University of Padjadjaran
Jl. Raya Bandung Sumedang Km 21 Jatinangor

Corresponding author: emma.trinurani@unpad.ac.id

Abstract

Inceptisols is a soil order that has an area of about 70.5 million hectares in Indonesia. The commodity that can be cultivated on Inceptisols is tomatoes. The nutrient content of Inceptisols is classified as low, resulting in decreasing in tomato yield. One of the efforts that can be made to increase the yield of tomatoes is by applying $Mg(NO_3)_2$ compound fertilizer. The experiment was conducted to determine the effect of $Mg(NO_3)_2$ compound fertilizer on soil exchangeable Mg (Mg-EC), plant Mg-Uptake, and yield of tomato. The experiment was conducted at the Experimental Field of the Laboratory of Soil Chemistry and Plant Nutrition, Faculty of Agriculture, Universitas Padjadjaran, Jatinanor, from October to December 2023. The experimental design used was a Completely Randomized Block Design (RCBD) with six treatments: one treatment without fertilizer, one treatment of the recommended dose of N, P, K fertilizer, four treatments of various doses of $Mg(NO_3)_2$ compound fertilizer combined with N, P, K fertilizer with four replications each. The results of the experiment showed that $Mg(NO_3)_2$ compound fertilizer had the effect of increasing soil exchangeable Mg (Mg-EC), plant Mg-Uptake, and yield of tomato. The treatment of 1 dose of $Mg(NO_3)_2$ compound fertilizer and $^3/_4$ dose of N, P, K fertilizer showed the best results on soil Mg-EC(3,82 cmol kg^{-1}), plant Mg-Uptake content (1.23%), number of fruits (268 fruits), fruit diameter (38.15 cm, weight per fruit (36.75 g), and fruit weight per plot (6.13 kg) on Inceptisols Jatinangor.

Keywords

$Mg(CO_3)_2$Compound Fertilizer, Mg-EC, Plant Mg-Uptake, Tomato, Inceptisols

1. INTRODUCTION

Tomatoes are a horticultural plant that is rich in vitamins and minerals, not only used as a fruit vegetable but also as a complement to cooking spices, fresh drinks (juice), and natural coloring agents. Even tomatoes can also be used as a basic ingredient for cosmetics or medicines (Purwati and Khairunisa, 2007). Tomatoes have a delicious taste and contain high levels of vitamins and substances that are rarely found in other plants that function for health, namely lycopene (Sunarnami, 2008).

The Gustavi variety tomato plant is one of the hybrid tomatoes developed in Indonesia. This variety has good resistance to Geminivirus and bacterial wilt, high productivity, and is well adapted to low, medium to high altitudes. The Gustavi variety tomato tree can produce 38 to 46 fruits per plant with a total weight of up to 4 kg (Wahyurini & Suryawati, 2021).

Tomato production in Indonesia has decreased from 1.11 million tonnes in 2021 to 793 thousand tonnes in 2022. The availability of tomatoes has also decreased from 4.03 kg per capita per year to 2.85 kg per capita per year in 2022 (Central Statistics Agency, 2022). To improve the production of crops in general and tomatoes in particular, this can be done through several efforts, namely increasing crop production per unit area of land (intensification) and expanding the planting area (extensification). Extensification efforts are faced with the problem of limited fertile land, so agricultural development is directed at dry land.

In Indonesia, Inceptisol has a fairly wide distribution, namely around 70.52 million ha (37.5%), so it has great potential to be used as agricultural land (Bogor Soil and Agroclimate Research Center, 2006). The use of Inceptisol as agricultural land has several problems in the field, as stated by Abdurachman et al. (2008) generally dry land such as Inceptisol has low levels of soil fertility (low N, P, K), relatively acidic pH, and also low organic matter. Wales et al., (2023) stated that a lack of macronutrients in plants can affect the rate of growth, cell multiplication, and enlargement, as well as inhibiting the flowering process which affects the weight and volume of tomatoes. Efforts that can be made to increase tomato production are by fertilizing so that soil fertility can increase. Fertilization is one of the efforts that can be made to increase the availability of nutrients needed by plants so that plant yields can increase (Kiswondo, 2011).

One of the nutrients needed by plants, especially during the growth phase, is magnesium (Damanhuri et al., 2022). The nutrient magnesium plays a role as an activator of various enzymes in the processes of photosynthesis, respiration, and the formation of RNA and DNA (Noza et al, 2014). Magnesium acts as a constituent of chlorophyll which influences the photosynthesis process. Lack of these elements can result in stunted and disrupted growth of cultivated plants (Panggabean, 2001).

Providing fertilizer to plants can stimulate overall growth, especially in branches, stems, and leaves (Dewanto et al., 2013). The application of magnesium nitrate (Mg(NO3)2) compound fertilizer in granular form combined with single N, P, K fertilizer is expected to increase the nutrient content in Jatinangor Inceptisols.

It is better to apply granular fertilizer using a retail technique compared to direct sowing. The dilution technique is carried out by diluting the fertilizer first using water.This is done so that the elements contained in fertilizer are more easily absorbed by plants (Lingga and Marsono, 2008). Based on research by Hamdani et al. (2021), the application of fertilizer diluted first has been proven to provide the nutrients that plants need more quickly.

The combination of Mg(NO_{32} compound fertilizer and single N, P, K fertilizer can stimulate overall growth, especially branches, stems, and leaves. The availability of macronutrients affects plant growth, so the addition of macro inorganic fertilizer is needed so that plant growth can run optimally (Lingga and Marsono, 2008).

The experiment aimed to determine the effect of the combination of Mg(NO_{32} and N, P, K compound fertilizer on soil exchangeable Mg content (Mg-EC), plant Mg-uptake, and tomato plant

yields on Jatinangor Inceptisols; and to obtain a suitable combined dose of $Mg(NO_3)_2$ and N, P, K compound fertilizer for tomato plants on Inceptisols Jatinangor.

2. MATERIALS AND METHODS

2.1. Time and Place

This experiment was carried out from October to December 2023 at the Soil Chemistry and Plant Nutrition Experimental Field, Faculty of Agriculture, Padjadjaran University, Jatinangor Campus, Sumedang Regency, which has an altitude of around 832 m above sea level. Soil and plant chemical analysis will be carried out at the Soil Chemistry and Plant Nutrition Laboratory, Faculty of Agriculture, Padjadjaran University, Jatinangor, Sumedang Regency.

2.2. Materials and Tools

The materials used are planting media from Inceptisols Jatinangor, tomato seeds of the Gustavi F1 variety, Mg(NO3)2 compound fertilizer, single N, P, K fertilizer (Urea, SP-36, and KCl), insecticide containing the active ingredient profenofos, and chemicals used for analysis in Mg-dd and plant Mg levels in the laboratory.

The equipment used is laboratory tools for analyzing soil and plants, treatment signs, rulers, meters, writing tools, analytical scales, calipers, hoes, black and silver plastic mulch, plastic samples, and buckets.

2.3. Experimental Design

The experiment used a Completely Randomized Block Design (CRBD), consisting of 6 treatments; Each treatment was repeated four times so that the total number of experimental plots was 24 plots. The treatment design is as follows: A = as control; B = N, P, K dose recommended (200 kg ha^{-1} Urea, 250 kg ha^{-1} SP-36, and 100 kg ha^{-1} KCl); C = 1 dose of $Mg(NO_3)_2$compound fertilizer; D = ¾ dose of $Mg(NO_3)_2$compound fertilizer + ¾ recommended dose of N, P, K; E = 1 dose of $Mg(NO_3)_2$compound fertilizer + ¾ recommended dose of N, P, K; and F = 1 ½ doses of $Mg(NO_3)_2$ compound fertilizer + ¾ recommended doses of N, P, K.

2.4. Experimental Activities

The stages of experimental activities are as follows: (1) land preparation; (2) nursery; (3) planting; (4) applying fertilizer according to treatment; (5) maintenance: watering, replanting, weeding, weeding and controlling pests and diseases; (6) harvest; (7) soil and plant analysis in the laboratory; (8) data collection and analysis; and (9) reporting.

2.5. Data Collection

The data collected consists of: (1) main data, namely: soil Mg-EC content; plant Mg-uptake, tomato plant yield (number of fruit per plant, fruit diameter, weight per fruit, and fruit weight per plot); and supporting data, namely the results of the initial analysis before treatment.

2.6. Data Analysis

Analysis was carried out using analysis of variance and continued with Duncan's Multiple Range Test at a 5% level (Gomez and Gomez, 1995). For data analysis using SPSS software..To determine the status category for soil chemical properties, an assessment was carried out based on criteria from the Bogor Soil Research Center.

3. RESULTS AND DISCUSSION

3.1 Initial Soil Analysis

The results of the initial soil analysis are presented in Table 1

Table 1. **Initial Soil Analysis Results**

No	Parameters	Unit	Value	Criteria*)
1	pH H_2O	-	6,52	slightly acidic
2	pH KCl 1 N	-	5,49	-
3	C-Organic	%	1,57	Low
4	N Total	%	0,16	Low
5	C/N	-	10	Low
6	P_2O_5 HCl 25%	mg.100g^{-1}	26,65	Medium
7	P_2O_5 (Bray I)	ppm P	11,1	Medium
8	K_2O HCl 25%	mg.100g^{-1}	32,20	Medium
9	Base Exchangeable Cations:			
	K-EC	cmol.kg^{-1}	0,49	Medium
	Na-EC	cmol.kg^{-1}	0,47	Medium
	Ca-EC	cmol.kg^{-1}	9,84	Medium
	Mg-EC	cmol.kg^{-1}	2,05	Medium
10	CEC	cmol.kg^{-1}	25,35	High
11	Saturation of Base	%	50,69	Medium
12	Al-EC	cmol.kg^{-1}	0,06	-
13	H-EC	cmol.kg^{-1}	0,73	-
14	Saturation of Al	%	0,59	Very Low
15	Texture :			
	Sand	%	4	
	Silt	%	50	*Silty Clay*
	Clay	%	46	

Information :

1) Results of Soil Fertility and Plant Nutrition Laboratory Analysis, Department of Soil Science and Land Resources, Faculty of Agriculture, Padjadjaran University (2023).
2) Criteria based on the Soil Science Book, Sarwono Hardjowigeno (2010).

Based on the data in Table 1, shows that the soil has a dusty clay texture. The C-organic content and C/N ratio are included in the low criteria. The soil reaction is slightly acidic, the total N content is low, the P_2O_5 HCl 25% content is moderate, the K_2O HCl 25% is moderate, and the Mg-EC content is moderate. Based on the description of soil characteristics above, there are obstacles to soil fertility such as low to moderate availability of N, P, K, and Mg elements, so it requires a combination of

$Mg(NO_3)_2$ compound fertilizer and single N, P, K fertilizer to provide nutrient availability, as well as other soil properties for plants.

3.2. Content of Soil Exchangeable Mg(Mg-EC)

Based on the results of statistical tests, show that the combination of $Mg(NO_3)_2$ compound fertilizer and single N, P, K fertilizer has a significant effect on the content of exchangeable Mg in the soil. The results of research on the effect of giving a combination of $Mg(NO_3)_2$ compound fertilizer and single N, P, K fertilizer have a significant effect on the exchangeable Mg content of the soil are presented in Table 2.

Table 2. **Effect of $Mg(NO_3)_2$ and N, P, K Compound Fertilizer on Content of Exchangeable Mg In Jatinangor Inceptisols**

	Treatments	Mg-EC ($cmol.kg^{-1}$)
A	Control	1,78 a
B	1N, P, K dose recommended	1,84 a
C	1dose of $Mg(NO_3)_2$ compound fertilizer	4,99 b
D	$^3/_4$dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	5,36 bc
E	1 dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	5,87 c
F	$1^1/_2$dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	5,02 b

Note: Numbers followed by the same letter are not significantly different according to the DMRT test at the 5% significance level

Based on the results of the statistical analysis presented in Table 2, shows that the exchangeable Mg (Mg-EC) content of Jatinangor Inceptisols in treatments C, D, E, and F is significantly different from treatments A and B. In general, treatments C, D, E, and F (combination of N,P,K fertilizers with Mg(No3)2 compound fertilizer produced a higher Mg-EC content compared to treatment A (control) and treatment B (recommended of N.P,K fertilizer dose recommended). Treatments D and E produced a higher Mg-EC content) higher compared to other treatments, namely 5.36cmol.$kg^{-1}$and 5.86cmol.kg^{-1} (including the high category). This is due to the $Mg(NO_3)_2$ compound fertilizer given decomposes in the soil solution and releases Mg^{++} cations, so that the Mg-EC content of the soil increases. According to the results of the research reported by Wibowo (2013) MgO fertilizer treatment significantly increases the exchangeable Mg in the soil and the exchangeable Ca is no different.

Treatment A (control) showed the lowest soil Mg-EC value compared to other treatments, namely only 1.78 cmol kg^{-1} (included in the medium category). The Mg-EC content of the soil is lower than the Mg-EC content of the initial soil, namely 2.05 cmol kg^{-1}. This is because there is no addition of N, P, K fertilizer and $Mg(NO_3)_2$ compound fertilizer and also some of the Mg nutrients have been absorbed by the tomato plants. It was stated by Fageria, (2009) that a decrease in Mg concentration in the soil can occur through absorption by plants and the leaching process.

3.3. Content of Plant Mg-Uptake

The results of statistical tests show that the combination of $Mg(NO_3)_2$ compound fertilizer and N, P, K fertilizer has a significant effect on plant Mg-uptake. The results of research on the effect of giving a combination of $Mg(NO_3)_2$ compound fertilizer and single N, P, K fertilizer have a significant effect on the plant Mg-uptake are presented in Table 3.

***Table 3.*Effect of $Mg(NO_3)_2$ and N, P, K Compound Fertilizer on Plant Mg-Uptake in Jatinangor nInceptisols**

	Treatments	Plant Mg-Uptake (%)
A	Control	0,72 a
B	1N, P, K dose recommended	0,75 a
C	1dose of $Mg(NO_3)_2$ compound fertilizer	1,11 b
D	$^3/_4$dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	1,19 b
E	1 dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	1,23 b
F	$1^1/_2$dose of $Mg(NO_3)_2$ compound fertilizer+ $^3/_4$N, P, K dose recommended	1,13 b

Note: Numbers followed by the same letter are not significantly different according to the DMRT test at the 5% significance level

Based on the results of the statistical analysis presented in Table 3, it shows that the content of plants Mg-Uptake in treatments C, D, E, and F was significantly different from treatments A and B, but the difference between the four treatments was not significant. Treatment B was not significantly different compared to treatment A (control). The experimental results showed that treatments C, D, E, and F produced plant Mg-uptake ranging from 1.11 – 1.23%, the plant Mg-uptake was higher compared to treatment B, namely 0.75% and the lowest was in treatment A, namely 0.72%.

Increasing the Mg-uptake of plants in treatments C, D, E, and F was due to the application of compound Mg compound fertilizer $Mg(NO_3)_2$. In line with the research results of Arios et al (2005) that the application of Mg fertilizer and soil type had a significant effect on plant Mg-uptake in the upper part of peanut plants; and increasing the level of Mg fertilizer tends to increase plant Mg-uptake in the upper part of peanut plants. Furthermore, it was reported by Wibowo (2013) that the application of MgO fertilizer tended to reduce the Mg content and Mg-uptake in plant leaves, but tended to increase the K-uptake and Ca-uptake in green bean leaves.

3.4. Tomato Yield

Based on the results of statistical tests, it shows that the application of a combination of Mg(NO3)2 compound fertilizer and N, P, K fertilizer a significant effect the number of fruit, fruit diameter, fruit weight per plot, weight per fruit, and fruit diameter. The results of research on the effect of giving a combination of $Mg(NO_3)_2$ compound fertilizer and single N, P, K fertilizer on tomato plant yields are presented in Table 4.

***Table 4*. Effect of $Mg(NO_3)_2$ and N, P, K Compound Fertilizer on Tomato Yield in Jatinangor Inceptisols**

Treatments		Number of Fruit	Fruit Diameter (cm)	Weight per fruit (g)	Fruit Weight per plot (kg)
A	Control	137,25 a	26,72 a	12,90 a	1,40 a
B	1 N, P, K dose recommended	243,75 bc	35,65 b	19,55 b	5,02 bc
C	1 dose of $Mg(NO_3)_2$ compound fertilizer	195,00 ab	35,97 b	29,80 c	4,22 b
D	$^3/_4$dose of $Mg(NO_3)_2$ compound fertilizer + $^3/_4$N, P, K dose recommended	255,50 bc	38,25 b	37,45 d	5,16 bc
E	1 dose of $Mg(NO_3)_2$ compound fertilizer + $^3/_4$N, P, K dose recommended	268,00 c	38,15 b	36,75 d	6,13 c
F	$1^1/_2$dose of $Mg(NO_3)_2$ compound fertilizer + $^3/_4$N, P, K dose recommended	239,75 bc	36,08 b	35,45 cd	4,82 bc

Note: Numbers followed by the same letter are not significantly different according to the DMRT test at the 5% significance level

Based on Table 4, shows that the yield components (number of fruit, fruit diameter, weight per fruit) and fruit weight per plot produced by treatments B, C, D, E, and F were significantly different compared to treatment A (control). Fertilizer treatments (B, C, D, E, and F) produced a greater number of fruit per plant, larger fruit diameter, heavier weight per fruit, and higher fruit weight per plot compared to treatment A (control). Treatments D and E (3/4 dose and 1 dose of N, P, K fertilizer) combined with ¾ dose of $Mg(NO_3)_2$ compound fertilizer produced better fruit yield components and fruit weight per plot compared to treatment A (control), B, C, and F. The highest fruit weight per plot was produced in treatment E (6.13 kg $plot^{-1}$) followed by treatments D (5.16 kg $plot^{-1}$), B (5.02 kg $plot^{-1}$), F (4.82 kg $plot^{-1}$), C (4.22 kg $plot^{-1}$), and the lowest was in treatment A (1.40 kg $plot^{-1}$). This is because apart from the macronutrients N, P, K, and the nutrient Mg, plants are very necessary. After all, they are one of the essential nutrients (Damanhuri et al., 2022). Furthermore, it was stated by Hutagalung et al., (2019) that the Mg element is needed in the process of chlorophyll formation and as a co-factor for enzymes in plant metabolism such as photosynthesis, protein formation, cell formation, starch formation, carbohydrate distribution, and energy transfer. The research results reported by Hakim (2005) stated that a balanced application of fertilizer between N, P, K, and Mg could increase yields in corn production. Surbakti et al. (2013) reported that the combination of Mg and N, P, K fertilizer had a significant effect on plant height, harvest time, flowering time, and corn crop yields. The results of other research reported by Wibowo (2013) stated that the application of N, P, and K fertilizer by adding the element Mg could increase the height growth and yield of green bean plants.

The research results also showed that treatment F (increasing the dose of $Mg(NO_3)_2$ compound fertilizer from 1 dose to 1⅟2 dose tended to reduce the yield components and fruit weight per plot. This was caused by an imbalance of nutrients in the soil and nutrient uptake. by plants. As stated by Dwijoseputro (1998) plants will grow well if nutrients are available in sufficient and balanced

quantities. In line with the research results of Qu, et al (2023) with increasing Mg levels, plant biomass, root growth, and the accumulation of nutrients in vegetable plants all increased until they reached maximum values in the Mg2 treatment and then experienced a significant decrease in the Mg3 treatment.

Treatment A (control) produced the lowest fruit components and fruit weight per plot of tomato plants. This is because tomato plants are not given fertilizer, resulting in a deficiency of nutrients such as Mg. Hortidayli (2023) stated that Mg in tomato plants plays an important role in photosynthesis (the process by which plants produce energy to encourage growth), protein synthesis (required in cell formation), activation of plant enzymes (required for many cellular functions, and growth), and chlorophyll synthesis. . (a green pigment in plants that is important for optimal plant growth). Mg deficiency can reduce overall plant health and ultimately reduce plant quality and yield.

4. CONCLUSION

1. Providing $Mg(NO_3)_2$ compound fertilizer combined with N, P, K fertilizer has a significant effect on soil Mg-EC, plant Mg-uptake, fruit number, fruit diameter, weight per fruit, and fruit weight per plot of the tomato Gustavi F1 variety on Inceptisols Jatinangor.
2. The combination of 1 dose of Mg(NO3)2 compound fertilizer and ¾ doses of N, P, K fertilizer can increase soil Mg-EC, plant Mg-uptake, number of fruit, diameter of fruit, weight per fruit, andfruit weight per plot of tomato.

BIBLIOGRAPHY

Abdurachman, A. A., Dariah, and A. Mulyani. 2008. Dry Land Management Strategy and Technology to Support National Food Procurement. Journal of Agricultural Research and Development. 27 (2) : 43-49

Arios, J., R,, H.B. Pulunggono, and S. Djuniwati. 2005. The Effect of Applying Magnesium (Mg) Fertilizer on Total Leaf Chlorophyll Content and Mg Nutrient Uptake in Peanut Plants (*Arachis hypogaea* L.) in Jasinga podzolic and Darmaga latosol. Scientific Repository. IPB, Bogor.

Central Bureau of Statistics. 2022. Food Consumption Statistics in 2022. Center for Agricultural Data and Information Systems, Ministry of Agriculture of the Republic of Indonesia, 1–132.

Damanhuri, Widodo, T. W., & Fauzi, A. 2022. Regulation of Nitrogen and Magnesium Balance to Increase Corn Growth and Production (*Zea mays* L.). Innovation Scientific Journal, 22(1), 10–15. https://doi.org/10.25047/jii.v22i1.2842

Dewanto, F. G., Londok, J. J. M. R., Tuturoong, R. A. V., & Kaunang, W. B. 2013. The Effect of Inorganic and Organic Fertilization on the Production of Corn Plants as a Feed Source. Zootek, 32(5), 1–8.

Dwijoseputro, D. 1998. Introduction to Plant Physiology. Gramedia, Jakarta.

Fageria, N. K. 2009. The Use of Nutrients in Crop Plants. In Jurnal Penelitian Pendidikan Guru Sekolah Dasar (Vol. 6, Issue August).

Gomez, C.A. and K.A. Gomez. 2007. Statistical Procedures for Agricultural Research. UI Press. Jakarta.

Judge, N. (2005). Integrated Liming Technology for Dry Land. Journal of Land and Water. Vol. 1 of 2005. Director General of Land and Water Management. Jakarta

Hamdani, J. S., Sumadi, S., Kusumiyati, K., Mubarok, S., & Harisy, M. P. 2021. Effect of Method of Applying NPK Fertilizer and Frequency of Giving Paclobutrazol on Growth and Yield of Go Potato Seeds in Medium Plains. Cultivation, 20(3), 222–229.

Hortidayli. 2023. Magnesium deficiency in tomatoes. https://www.hortidaily.com/article/9536745/magnesium-deficiency-in-tomatoes/. Accessed June, 13, 2023

Hutagalung, R. H., Zulkifli, T. B. H., Putra, I. A., & Kurniawan, D.2019. Utilization of Chicken Manure, Potassium and Magnesium Fertilizer for the Growth of Sweet Corn (*Zea mays* saccharata Strut). Agrinula: Journal of Agrotechnology and Plantation, 2(2), 39–47.

Kiswondo, S. 2011. Use of Husk Ash and ZA Fertilizer on the Growth and Yield of Tomato Plants (*Lycopersicum esculentum* Mill.). Embryo, 8(1), 9–17.

Lingga, P and Marsono. 2008. Instructions for Using Fertilizer. Penebar Swadaya, Jakarta.

Noza, L. A., Yetti, H., & Khoiri, M. 2014. Effect of Dolomite and N, P, K Fertilizers on the Growth and Production of Sweet Corn (*Zea mays* saccharata Sturt) in Peatlands. Jom Faperta, 1(2), 1–11.

Panggabean, E. 2001. Calcium, Magnesium and Their Role in Plant Growth and Development. Medan Area University, 1–12.

Purwati, E. and Khairunisa, 2007, Lowland Tomato Cultivation, Penebar. Swadaya, Depok

Qu, S.; Li, H.; Zhang, X. Gao, J.; Ma, R.; Ma, L.; Ma, J. 2023. Effects of Magnesium Imbalance on RootGrowth and Nutrient Absorption in Different Genotypes of Vegetable Crops. Plants 2023, 12, 3518. https://doi.org/10.3390/plants12203518.

Soil & Agroclimate Research Center. 2006. Acid Soils in Indonesia, Inceptisol. Bogor.

Sunarmani, K.T.D, D., 2008, Lycopene Parameters in Standardization of Tomato Fruit Concentrate, Proceedings of PPI Standardization, Jakarta.

Surbakti, M. F., Ginting, S., & Ginting, J. 2013. Growth and Production of Corn (*Zea mays* L.) Pioneer-12 Variety by Pruning Leaves and Providing NPKMg Fertilizer. Online Journal of Agroecotechnology, 1(3), 523–534.

Wahyurini, E., & Suryawati, A. 2021. Tomato Cultivation and Genetic Diversity.

Wales, S., M. T, S. T., & Mamarimbing, R. 2023. Growth and Production of Tomato Plants (*Solanum lycopersicum* L.) on Several Types of Planting Media. Applied Agroecotechnology, 4(1), 84–93.

Wibowo, A. S. (2013). The Effect of Magnesium (Mg) Fertilizer on the Production and Uptake of N, P, K, Ca, Mg Nutrients from Green Bean Plants in Latosol Darmaga. Bogor Agricultural Institute.