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The effect of liquid inorganic fertilizer on the growth of seven sugarcane (*Saccharum officinarum* L.) clones for sugar factory in Indonesia

Pengaruh pupuk cair anorganik terhadap pertumbuhan tujuh klon tebu (*Saccharum officinarum* L.) untuk pabrik gula di Indonesia

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ABSTRACT

Sugarcane (*Saccharum officinarum* L.) is a type of plantation crop that has high economic value as the main ingredient for sugar production. Indonesia's sugar demand increases every year, but it is not accompanied by an increase in sugar production. Problems that cause low sugar production include seed quality, fertilizer availability, water availability, slash-and-carry management, and inadequate soil conditions. Increasing sugarcane productivity and production is related to the level of yield production. The availability of new superior varieties (VUB) is one way that can be done to produce high sugar production. The continuous use of excessive inorganic fertilizers can cause problems in agriculture. The purpose of this study was to analyze the effect of inorganic liquid fertilizer on the growth of seven sugarcane clones (*Saccharum officinarum* L.) in Sidoarjo Regency, Indonesia. This research was conducted in the Sugarcane Research and Development Center (P3T) garden and in collaboration with PG Krembung PT Perkebunan Nusantara X (PTPN X) in October-January 2021. This study used a one-factor Randomized Group Design (RAK) with 9 treatments and 3 replications. Parameters observed in this study were stem diameter, stem length, and number of stems. The results showed that the growth of the K4 sugarcane clone (SB 11 clone) was higher than the K5 (PS 881 clone). Petrovita fertilizer application resulted in more optimal growth in sugarcane clone.

ABSTRAK

Tebu (*Saccharum officinarum* L.) merupakan jenis tanaman perkebunan yang memiliki nilai ekonomis tinggi karena digunakan sebagai bahan utama pembuatan gula. Kebutuhan gula masyrakat Indonesia selalu meningkat setiap tahunnya, namun tidak diiringi dengan peningkatan produksi gula. Penyebab rendahnya produksi gula antara lain kualitas benih, ketersediaan pupuk, ketersediaan air, pengelolaan tebang angkut, dan kondisi tanah yang tidak memadai. Peningkatan produktivitas dan produksi tebu berkaitan dengan tingkat rendemen yang dihasilkan. Tersedianya varietas unggul baru (VUB) merupakan salah satu cara yang dapat dilakukan untuk menghasilkan produksi gula yang tinggi. Penggunaan pupuk anorganik yang berlebihan secara terus-menerus dapat menimbulkan masalah dalam pertanian. Tujuan penelitian ini untuk menganalisis pengaruh pupuk cair anorganik terhadap pertumbuhan 7 klon tebu (*Saccharum officinarum* L.) di Kabupaten Sidoarjo, Indonesia. Penelitian ini dilaksanakan di kebun Pusat Penelitian dan Pengembangan (P3T) Tebu dan bekerja sama dengan PG Krembung PT Perkebunan Nusantara X (PTPN X) pada bulan Oktober-Januari 2021. Penelitian ini menggunakan Rancangan Acak Kelompok (RAK) satu faktor dengan 9 perlakuan dan 3 ulangan. Parameter yang diamati pada penelitian ini yaitu diameter batang, panjang batang, dan jumlah batang. Hasil penelitian menunjukkan bahwa pertumbuhan tebu 7 klon K4 (Klon SB 11) lebih tinggi dibandingkan klon K5 (Klon PS 881). Pemberian pupuk Petrovita menghasilkan pertumbuhan yang lebih optimal pada tanaman tebu.

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INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) as the main ingredient of sugar is a plant with high economic value. Basically, the dignity of the Indonesian nation has triumphed in its time and has become a world history that has excelled in the sugarcane-based sugar industry. Most of the sugarcane farmers are currently still planting the BL variety which has experienced a decrease in productivity Budi et al. (2014). According to Central Statistics Agency (2021) Indonesia's population in 2021 will be 271 million people and will continue to increase every year, and economic growth will grow up to 5-7% annually, which is a large market for sugar cane commodities that produce sugar. Meanwhile, the demand for sugar in Indonesia continues to increase in line with population growth. Sugar has been imported to Indonesia since 1997, which 2016 fluctuated in 2016 with an increasing trend. This condition is caused by sugarcane production in Indonesia which is still relatively low, while domestic sugar demand and prices continue to increase (Safrida et al., 2020).

The high demand for nutrients occurred due to the low productivity of sugarcane. To meet the needs of these nutrients, it is necessary to add fertilizers that can increase the growth and productivity of sugarcane plants. Fertilization can be in the form of organic fertilizers and inorganic fertilizers. Organic Fertilizers can improve soil health by encouraging microbial activity, improving soil structure, and reducing erosion. They also tend to have a lower environmental impact, as they come from natural and renewable sources. While inorganic fertilizers can provide rapid nutrient uptake for plants, they have negative impacts on soil health and the environment such as disrupting soil microbial populations, causing soil acidification, and contributing to water pollution through runoff (Wahyudi, 2022). Effective fertilization involves both quantitative and qualitative requirements. The quantitative requirement is the dose of fertilizer, while the qualitative requirement includes the nutrients provided in the fertilization relevant to the existing nutritional problems, the timing of fertilization and the proper placement of fertilizer. Plants can use the absorbed nutrients to increase growth.

Inorganic liquid fertilizer is a complete liquid fertilizer that has a higher concentration of specific nutrients such as nitrogen, phosphorus, and potassium, supporting the growth process of plants because it contains nutrients that support the metabolic processes of plants (Susilo et al., 2013). Petrovita is indeed one of the most popular liquid inorganic fertilizer brands and is often used in agriculture. Liquid inorganic fertilizers such as Petrovita contain essential nutrients that are easily absorbed by plants, helping to increase plant growth and productivity. The macro and micro nutrient content of Petrovita liquid fertilizer is relatively high including 8.82% N; 6.21% P_2O_5; 6.47% K_2O; 1.89% S and 0.03% Mg which can be used to increase plant growth (Petrokimia Kayaku, 2020). In recent years, the use of inorganic fertilizers in agricultural production has become increasingly popular. The use of inorganic fertilizers has been shown to have a significant effect on the growth and productivity of sugarcane plants. Inorganic fertilizers consist of simple compounds of nitrogen, phosphorus, and potassium, which are essential for plant growth and development. These nutrients are readily available to plants, so they can absorb and utilize them faster than organic fertilizers. Therefore, inorganic fertilizer is the best way to increase sugarcane production quickly and efficiently. Febrianto et al. (2020) has shown that inorganic fertilizers can increase the growth rate of sugarcane plants and improving their overall health. For example, inorganic fertilizers can increase sugarcane yields by up to 30%, and improve the crop quality and sugar content.

The availability of complete macro and micro nutrients is a support for the growth and development of sugarcane plants, thus resulting in a better productivity. By paying attention to these factors, it can meet the needs of nutrients in the soil that have been reduced or lost. The application of inorganic foliar fertilizers that contain complete macro and micro nutrients can be used as an alternative to meet the nutrients needed by sugarcane plants to increase their productivity. According to Istiqomah (2016) the timely application of inorganic foliar fertilizers can affect plant growth. This is because the nutrients from inorganic liquid fertilizer can be optimally absorbed by plants during the growth period. This nitrogen-containing inorganic liquid fertilizer can stimulate the growth of apical meristems in plants so that it can affect the vegetative growth of a plant. In addition, the application of inorganic liquid fertilizer can also be used as an effort to increase vegetative growth and productivity in sugarcane plants. According to Ritonga et al (2020), inorganic fertilizers as complete liquid fertilizers with macro, micro, buffer and wetting substances in their contents are needed by plants, both food and plantation. The use of liquid inorganic fertilizers such as Petrovita has great potential to increase crop productivity, including sugarcane. By providing the right nutrients directly to the plant through a solution, liquid inorganic fertilizers can help accelerate growth, increase yields, and improve production quality. Thus, the use of liquid inorganic fertilizers can be one of the solutions to increase sugar production by improving the growth and productivity of sugarcane plants. In this study the authors conducted a study to analyse the effect of applying liquid petrovita fertilizer on the growth of clone plants (*Saccharum officinarum* L.) at PG Krembung PT Perkebunan Nusantara X (PTPN X) Sidoarjo.

MATERIALS & METHODS

Research site

The research was conducted at the Sugarcane Research and Development Center (P3T) plantation in collaboration with PG Krembung PT Perkebunan Nusantara X (PTPN X). The experimental site is located at an altitude of approximately 62 meters above sea level.

Materials

The materials used included inorganic liquid fertilizer (Petrovita) applied at a dosage of 2 mL/plant, determined based on previous studies indicating its efficacy in enhancing sugarcane growth (Pramono et al., 2023). The sugarcane clones used in the study were SB01, SB03, SB04, SB11, SB12, SB19, and SB20, as well as the Bululawang and PS881 varieties. The clones were developed using Hawaiian and Pedigree models and planted using the mule planting method in the P3T Jatisari garden.

Experimental design

The experiment was designed following a Randomized Complete Block Design (RCBD) with nine treatments and three replications to ensure statistical rigor. The treatments included seven sugarcane clones (SB01, SB03, SB04, SB11, SB12, SB19, and SB20) and two additional varieties, Bululawang (PS881) and MOJO. Each treatment was randomly assigned within the blocks to minimize environmental variability.

Observed variables

The study measured key growth parameters to evaluate the effect of liquid inorganic fertilizer. Plant height was determined by measuring from the base of the shoot to the tip of the highest leaf using a measuring tape (Billi et al., 2016). Stem diameter was measured at the base of the shoot using a vernier caliper (Putra et al., 2017). The number of leaves was counted manually, and the average was calculated across plant samples (Nurazizah, 2022). The number of stems in each clump was recorded manually by counting all visible stems (Putra, 2019).

Data analysis

The data were analyzed using Analysis of Variance (ANOVA) at a 5% significance level. When significant differences were observed, the results were further analyzed using the Least Significant Difference (LSD) test at the same significance level.

RESULTS & DISCUSSIONS

Plant height and stem diameter

Based on the results of the analysis, there were significant differences ($p<0.05$) in the height and diameter of the sugarcane stalks at 15 WAP, 17 WAP, 19 WAP and 21 WAP. The average stem height and diameter for each treatment is shown in Table 1. A significant difference is presented in the treatment K4 (SB 11) on plant height parameter. The significant response of clone SB 11 to Petrovita fertilizer is likely due to its compatibility with the soil's microbial community, which enhances nutrient absorption and plant growth. Increased stem plant height was occurred in plants due to cell division and elongation, dominated at the tip of the shoot. According to Gana (2021) the nitrogen and phosphorus content in inorganic fertilizers is able to divide and elongate sugarcane plant cells. With the addition of nutrients, plants will grow well if the nutrients needed are sufficiently available that can be absorbed by plants and are supported by loose soil texture conditions. Inorganic liquid fertilizer that contains macro and micro nutrients in quite a lot, if the complete foliar fertilizer is easily absorbed by plants then it is used by plants in metabolic processes thereby accelerating plant growth and development (Syahputra et al., 2014). One of the important nutrients for sugar cane is potassium. Syavitri (2018) potassium has a function, namely to determine the length of the stem that can be milled and the number of tiller stems. Potassium has another important role, namely playing a role in the translocation process of sucrose from the leaves to the surose storage tissue in sugarcane stems. This is in line with research by Ritonga et al. (2020) that inorganic liquid fertilizers can increase plant growth and yields, because inorganic liquid fertilizers contain complete nutrients such as nitrogen, phosphorus, and potassium in high amounts.

Table 1. Average height and stem diameter

Treatment	Plant height (cm)				Stem diameter			
	Weeks after planting (WAP)							
	15	17	19	21	15	17	19	21
K1	119.56 a	146.78 a	173.56 ab	196.67 ab	32.87 c	34.97 c	37.27 c	39.58 c
K2	123.78 a	151.56 ab	174.11 ab	200.00 ab	24.62 a	27.39 a	29.52 a	31.74 a
K3	128.00 ab	152.78 ab	204.78 c	202.00 ab	29.49 bc	32.16 b	34.01 b	36.41 b
K4	149.11 b	174.78 b	204.78 c	226.67 b	24.46 a	26.64 a	29.00 a	31.33 a
K5	114.67 a	135.56 a	160.78 a	187.33 a	27.91 b	30.42 b	32.72 b	35.10 b
K6	121.00 a	140.11 a	166.00 a	191.11 a	30.18 bc	32.77 bc	34.74 b	36.90 b
K7	121.11 a	148.56 ab	169.22 a	193.89 a	30.73 c	33.03 bc	34.84 b	37.12 b
K8	122.67 a	145.22 a	165.11 a	190.11 a	25.14 a	27.66 a	29.64 a	31.63 a
K9	142.22 b	165.56 b	188.00 b	212.56 b	23.01 a	25.31 bc	27.37 a	29.68 a
LSD 5%	**27.56**	**30.00**	**27.22**	**25.22**	**2.82**	**4.54**	**4.54**	**4.48**

Note: In the same column followed by different letters, it indicates a significant difference based on the 5% LSD test.

The better response of certain clones, such as SB 11, to treatments can be attributed to several factors, including genetic traits, interactions with beneficial soil microbes, and overall environmental adaptability. Clones like SB 11 may possess specific genetic characteristics that enhance their ability to absorb nutrients and withstand stress, leading to improved growth under certain conditions (Bassi et al., 2018). Additionally, beneficial soil microbes, such as mycorrhizal fungi and nitrogen-fixing bacteria, play a crucial role in enhancing nutrient uptake, which can contribute to better treatment responses (Arat et al., 2021). Furthermore, the root structure of SB 11 may facilitate more efficient water and nutrient absorption, allowing for a more robust response to treatments like organic and inorganic fertilization (Budi et al., 2014). Finally, environmental factors such as rainfall and soil composition may influence how different clones interact with treatments, with some clones like SB 11 being better suited to the specific growing conditions (Cahyani et al., 2016). These interactions underscore the importance of considering both genetic and environmental factors when evaluating plant responses to treatments.

Diameter growth increased in treatment K1 (SB 01) due to the effect of inorganic liquid fertilizer. According to Zhang et al. (2020) the increase in diameter increased in response to the application of fertilizers, and was greatest in the nitrogen, phosphorus, and potassium treatment. This high growth rate is caused by an increase in the rate of photosynthesis and total leaves due to the application of nitrogen, phosphorus, and potassium fertilizer. Genetic factors from sugarcane clones can provide differences that affect the growth of sugarcane plants. These factors result in genetically different sugarcane plants not being able to respond well to any content that is outside them (Martono, 2020). According to Rahmad et al. (2019) the availability of adequate and balanced nutrients, the process of cell division and enlargement takes place quickly which results in the rapid growth of plant organs thereby increasing the rate of plant growth.

The existence of genetic factors in sugarcane plants can affect absorption. Bassi et al. (2018) stated that providing a supply of nitrogen can increase the photosynthetic apparatus by increasing the chlorophyll content, the amount of activity and carboxylation enzymes, the content of sugars and metabolites related to photosynthesis. In addition, the addition of organic matter can improve the physical, chemical and biological properties of the soil, so that the soil can increase the holding capacity of water used by plants for photosynthesis. According to Cahyani et al. (2016), lack of water will affect all aspects of growth in plants, including leaf stomata will close thereby inhibiting CO_2 entry and photosynthetic activity as well as inhibiting protein synthesis and cell walls.

Number of stem and number of leaves

Based on the results of the analysis there was a significant difference ($p < 0.05$) in the number of stems and the number of leaves at 15 WAP, 17 WAP, 19 WAP and 21 WAP, while the number of leaves at 21 WAP was not significantly different. The average number of stems and number of leaves of each treatment is shown in Table 2.

Table 2. Average number of stems and number of leaves

Treatment	Number of stems				Number of leaves			
	Weeks after planting (WAP)							
	15	**17**	**19**	**21**	**15**	**17**	**19**	**21**
K1	6.00 a	6.00 a	6.00 a	6.00 a	10.44 b	10.78 c	10.33 ab	11.00
K2	7.33 ab	7.33 ab	7.33 a	7.33 ab	9.89 ab	9.56 bc	10.44 ab	10.56
K3	6.44 a	6.44 a	6.44 a	6.44 a	10.11 b	10.33 bc	11.11 b	10.67
K4	9.67 b	9.67 b	9.67 b	9.67 b	9.44 ab	10.33 bc	10.22 ab	10.33
K5	6.67 a	6.67 a	6.67 a	6.67 a	9.44 ab	9.44 b	10.44 ab	10.56
K6	5.78 a	5.89 a	5.78 a	5.78 a	10.78 b	10.67 bc	11.11 b	10.44
K7	7.78 ab	7.78 ab	7.78 ab	7.78 ab	10.33 b	10.33 bc	10.56 ab	9.56
K8	8.00 ab	7.44 ab	7.22 a	7.22 a	9.00 a	8.00 a	9.56 a	10.00
K9	7.89 ab	7.89 ab	9.67 b	7.89 ab	10.22 b	10.00 bc	9.67 a	10.44
LSD 5%	**3.89**	**3.78**	**3.89**	**3.89**	**1.11**	**1.33**	**1.56**	**tn**

Note: In the same column followed by different letters, it indicates a significant difference based on the 5% LSD test.

Based on the table above, there is a significant difference in the K9 treatment (SB 12) on the number of stems due to inorganic liquid fertilization with the same concentration in all clone treatments cloud increase and maintain the number of sugarcane stems. Leaves experience differences in curvature angles that affect the amount of light that can be received by each plant leaf. This is in accordance with the results of Ubaidillah's (2018) that the condition of the narrow leaves allows shading, so that the absorption of sunlight is minimized and the process of photosynthesis is hampered. Shaded leaves result in the chlorophyll unable to fully capture sunlight. The existence of genetic factors can cause growth to be not optimal, because the responsiveness of each sugarcane plant that experiences genetic differences can also be different (Mayangsari et al., 2018). Previous study by Zeng et al. (2020) indicated that chlorophyll content in leaves is closely related to the growth and yield of the plant.

There is a significant difference in the variable number of leaves in treatment K1 (SB 01) which has increased after applying inorganic liquid fertilizer with high nutrients and can later be absorbed by the roots of sugarcane plants. Inorganic liquid fertilization can increase plant growth and production, because the presence of N elements can affect the process of photosynthesis, plant transformation and transportation. The use of inorganic liquid fertilizer can increase plant growth and production, as well as increasing yields and can provide a balance of nitrogen, phosphorus and potassium elements for plant growth. According to Zaini et al. (2017) the ability of plants to produce assimilation is not only related to photosynthetic activity but also to the size of the photosynthetic area including leaves, stems and other green organs of plants. The number of leaves of the plant depends on leaves position and environmental conditions during leaf development. Susanto et al. (2014) argues that if the number of leaves is large, the ability to photosynthesize is higher than those with fewer leaves. There are also factors that cause no significant difference in the variable number of leaves because nutrient uptake in 40 plant leaves is very limited by the outer epidermal cell wall. The cell wall is covered with a cuticle which contains waxes, pectin, hemicellulose and cellulose. Therefore, the outer cell is hydrophobic even though the inside is hydrophilic. Cuticle permeability also depends on leaf development. The cuticle on young leaves is still hydrophilic, besides that on old leaves it is already hydrophobic (Arat et al., 2016). In addition, the existence of genetic factors resulted in plants not being able to respond properly. Because each plant has different genetic factors and cannot experience an optimal growth process, quite the opposite.

CONCLUSION

Based on these results, it shows that the application of Petrovita fertilizer at a dose of 2 mL/plant has a significant impact on the growth of sugarcane plants, especially on the SB 11 clone (K4) compared to the PS 881 clone (K5). The significant difference in stem height and number of stems indicates that Petrovita fertilizer specifically supports the growth of sugarcane plants, especially in clone SB 11. The use of Petrovita fertilizer can be a good option to improve the productivity and quality of sugarcane plants, especially if optimal growth is required. This study highlights the potential of using specific fertilizer doses to enhance sugarcane productivity. Further research could explore genetic markers for breeding high-yield sugarcane clones.

REFERENCES

Arat, I. G. N., Wiraatmaja, I. W., & Kartini, N. (2021). Pengaruh konsentrasi zat pengatur tumbuh naa dan jenis pupuk organik terhadap hasil tanaman serai wangi (Cymbopogon nardus L.). *Jurnal Agroekoteknologi Tropika, 11(4)*, https://ojs.unud.ac/index.php/JAT

Bassi, D., Menossi, M., & Mattiello, L. (2018). Nitrogen supply influences photosynthesis establishment along the sugarcane leaf. *Scientific Reports, 8(1)*. https://doi.org/10.1038/s41598-018-20653-1

Bili, A., Syafriandi, S., & Mustaqimah, M. (2016). Pengaruh kedalaman keprasan tebu dengan menggunakan mesin kepras traktor roda dua terhadap kualitas keprasan dan pertumbuhan tunas. *Jurnal Ilmiah Mahasiswa Pertanian, 1(1)*, 995-1001. https://doi.org/10.17969/jimfp.v1i1.1361

Budi, S., Laily, N. A., Prihatiningrum, K., Sutaryianto, A. E., & Widyaningsih, T. (2014). Peningkatan produktivitas tanaman tebu melalui model integrasi kultur teknik optimal berbasis bibit single bud (budchips) di provinsi jawa timur. Laporan Penelitian. Penelitian Unggulan Strategi Nasional. Fakultas Pertanian Universitas Muhammadiyah Gresik, 65.

Cahyani, S., Sudirman, A., Azis, A. (2016). Respons pertumbuhan vegetatif tanaman tebu (*Saccharum officinarum* L.) ratoon 1 terhadap pemberian kombinasi pupuk organik dan pupuk anorganik. in respons pertumbuhan vegetatif tanaman tebu. *Jurnal Agro Industri Perkebunan, 4(2)*. https://doi.org/https://doi.org/10.25181/aip.v4i2.45

Febrianto, A. D., Budi, S., & Lailiyah, W. N. (2022). Uji Pemberian Dosis Pupuk Daun terhadap Pertumbuhan dan Hasil Tanaman Tebu (*Saccharum officinarum* L.) Terbakar. *Jurnal Ilmiah Pertanian Nasional, 2(2)*, 103-115. http://ojs.unik-kediri.ac.id/index.php/jintan

Gana, A. K. (2021). Effects of organic and inorganic fertilizers on sugarcane production. African *journal of general agriculture, 4(1)*. http://ojs.klobexjournals.com/index.php/ajga/article/view/697

Hartatie, D., Taufika, R., & Achmad, P. B. (2021). Pengaruh curah hujan dan pemupukan terhadap produksi tebu (*Saccharum officinarum* L.) di pabrik gula asembagus kabupaten situbondo. *Jurnal Ilmiah Inovasi, 21(2)*, 66–72.

Kusuma, Y. P. (2019). Aplikasi Pupuk Hayati Mikoriza Dan Pupuk KCL Terhadap Pertumbuhan Serta Produksi Bawang Merah (Allium Ascalonicum L) (Doctoral dissertation, Universitas Islam Riau).

Martono, B. (2020). Keragaman genetik, heritabilitas dan korelasi antar karakter kuantitatif nilam (Pogostemon sp.) hasil fusi protoplas. *Jurnal Penelitian Tanaman Industri, 15(1)*, https://doi.org/10.21082/jlittri.v15n1.2009.9-15

Mastur, M., Syafaruddin, S., & Syakir, M. (2015). Peran dan pengelolaan hara nitrogen pada tanaman tebu untuk peningkatan produktivitas tebu. *Review Penelitian Tanaman Industri, 14(2)*, 73-86. https://10.21082/p.v14n2.2015.73-

86

Mayangsari, & Andina. (2018). Faktor-faktor yang mempengaruhi produksi gula pg. wringin anom kabupaten situbondo. conferance on innovation and aplication of science and technology. https://publishing-widyagama.ac.id/ejournal-v2/index.php/ciastech/article/view/648

Nurazizah, S., Budi, S., & Lailiyah, W. N. (2022). Pertumbuhan berbagai klon tanaman tebu (*Saccharum officinarum* L.) di kebun juwet dukuhdimoro, mojoagung–jombang. *Jurnal Ilmiah Terapan Budidaya dan Pengelolaan Tanaman Pertanian dan Perkebunan, 11(2),* 87-100. https://doi.org/10.51978/agro.v11i2.463.

Nurlaeny, N. (2015). Bahan organik tanah dan dinamika ketersediaan unsur hara tanaman. Universitas Padjajaran. Bandung.

Pramono, D., Natawijaya, D., & Suhardjadinata, S. (2023). Pengaruh Jenis Pupuk Organik dan Pupuk NPK Terhadap Pertumbuhan dan Hasil Kedelai Edamame (Glycine max L. Merril). *Media Pertanian*, *8(2),* 59-71. https://doi.org/10.37058/mp.v8i2.8353

Pratiwi, I., Gustomo, D., & Kusuma, Z. (2018). Aplikasi kompos vinasse dan bakteri endofit untuk memperbaiki serapan nitrogen dan pertumbuhan tanaman tebu (*Saccharum officinarum* L.). *Jurnal Tanah dan Sumberdaya Lahan, 5(2),* 949-957.

Putra, N. A. E. (2019). Klasifikasi kematangan tebu berdasarkan tekstur batang menggunakan metode naïve bayes (Doctoral dissertation, Universitas Muhammadiyah Gresik). http://eprints.umg.ac.id/id/eprint/2611

Putra, S. M., Susanti, P., Amanah, D. M., Umahati, B. K., Pardal, S. J., & Santoso, D. (2017). Pengaruh biostimulan terhadap pertumbuhan vegetatif tanaman tebu varietas PSJT-941. *Menara Perkebunan, 85(1),* 37-43. http://dx.doi.org/10.22302/iribb.jur.mp.v85i1.241

Rahmad, L. A., Kuswinanti, T., & Musa, Y. (2019). The Effect of Sugarcane Bagasse and Filter Mud Compost Fertilizer and Manure Application on the Growth and Production of Sugarcane. *Int. J Sci. Res. & Tech, 6(6),* 338-345. https://doi.org/10.32628/IJSRST196668

Rifimaro, S., Budi, S., & Lailiyah, W. N. (2022). Pertumbuhan vegetatif 9 klon tanaman tebu (*Saccharum officinarum* L.) keprasan satu dengan pemberian pupuk organik cair di gresik. *Jurnal Ilmiah Terapan Budidaya Dan Pengelolaan Tanaman Pertanian Dan Perkebunan, 11(2),* 101–116. https://doi.org/10.51978/agro.v11i2.464

Ritonga, E. N., & Siregar, E. S. (2020). Respon pertumbuhan vegetatif tanaman karet (havea brasiliensis) terhadap pemberian pupuk cair lengkap petrovita dan pupuk npk 15-7-8 bintang kuda laut. *Jurnal Agroteknologi Fakultas Pertanian Universitas Muhammadiyah Tapanuli Selatan, 5(1),* 1-5. https://doi.org/10.32734/jpt.v9i2.9010

Safrida, Sofyan, & Taufani, A. (2020). Dampak impor gula terhadap produksi tebu dan harga gula domestik di indonesia. *Jurnal Agricore, 5(1).* https://10.24198/agricore.v5i1.24850

Statistik, Badan Pusat. 2021. Statistik tebu indonesia 2021. https://www.bps.go.id/id/publication/2022/11/30/6392bf8e4265949485d85e72/statistik-tebu-indonesia-2021

Susanto, E., Herlina, N., & Suminarti, N. E. (2014). Respon pertumbuhan dan hasil tanaman ubi jalar (Ipomoea batatas L.) pada beberapa macam dan waktu aplikasi bahan organik. *Jurnal produksi tanaman, 2(5),* 412-418. https://core.ac.uk/download/pdf/295409583.pdf

Susilowati, S. H., Tinaprilla, N., Departemen Agribisnis, F. E. M., & Kamper, K. I. D. J. R. (2012). Analisis efisiensi usaha tani tebu di Jawa Timur. https://repository.pertanian.go.id/handle/123456789/1564

Syahfari, H., Oktaviani, S. R., & Sutejo, H. (2021). Uji efikasi ekstrak bandotan (Ageratum conyzoides L.) terhadap frekuensi dan intensitas serangan hama ulat Plutella xylostella L. pada tanaman lobak (Rhapanus sativus L.). *ziraa'ah majalah ilmiah pertanian, 46(1),* 70-77.

Syavitri, D. A., Prayogo, C., & Gunawan, S. (2019). Pengaruh pupuk hayati terhadap pertumbuhan tanaman, dan populasi bakteri pelarut kalium pada tanaman tebu (*Saccharum officinarum* L.). Jurnal Tanah dan Sumberdaya Lahan, 6(2), 1341-1352.

Ubaidillah, U. (2018). Variasi fenetik aksesi tebu (*Saccharum officinarum* L.) dibeberapa wilayah Indonesia berdasarkan karakter batang dan daun (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).

Wahyudi, A. H., Budi, S., & Redjeki, E. S. (2022). Perbedaan dosis pupuk organik cair dan jenis klon ratoon 1 terhadap pertumbuhan tanaman tebu (*Saccharum officinarum* (L)) di Kecamatan Kebomas-Gresik. *Jurnal Ilmiah Terapan*

Budidaya dan Pengelolaan Tanaman Pertanian dan Perkebunan, 11(2), 117-132. https://doi.org/10.51978/agro.v11i2.465

Zaini, Akbar H., et al. "Uji Pertumbuhan berbagai jumlah mata tunas tebu (*Saccharum officinarum* L.) Varietas Vmc 76-16 Dan Psjt 941." *Jurnal Produksi Tanaman, 5(2),* 182-190.

Zeng X-P, Zhu K, Lu JM, Jiang Y, Yang LT, Xing YX & Li YR. 2020. Long-term effects of different nitrogen levels on growth, yield, and quality in sugarcane*. agronomy 10(3),* 353. https://doi.org/10.3390/agronomy10030353

Zhang, M., Sun, D., Niu, Z., Yan, J., Zhou, X., & Kang, X. (2020). Effects of combined organic/inorganic fertilizer application on growth, photosynthetic characteristics, yield and fruit quality of Actinidia chinesis cv 'Hongyang'. *Global Ecology and Conservation*, https://doi.org/10.1016/j.gecco.2020.e00997