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Growth and Yield Responses of Three Soybean (*Glycine max* L.) Varieties to Different Dolomite Dosages on Saturated Soil Culture

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ABSTRACT

The need for soybean commodities is increasing in line with increasing changes in population and public awareness of the importance of food nutrition. One of the efforts to increase soybean production is to improve crop cultivation by selecting superior varieties. The purpose of this study was to obtain soybean varieties that had the best growth response and yields by adding dolomite to a saturated soil culture (SSC). This research was carried out from November 2020 to February 2021 in the experimental land of the Department of Agricultural Cultivation, Faculty of Agriculture, University of Bengkulu. The design used was a randomized completely block design (RCBD) factorial pattern consisting of two factors. The first factor was the dolomite dose which consisted of 4 levels, namely 0 x Al-dd, 0.5 x Al-dd, 1 x Al-dd, and 1.5 x Al-dd. The second factor was soybean varieties consisting of Gepak Kuning, Dering 1, and Derap 1 varieties. The results showed that Gepak Kuning produced the best growth response and yield by adding dolomite to SSC.

Keywords : soybean, dolomite, saturated soil culture

INTRODUCTION

Soybean (*Glycine max* L.) is one of the third priority national food commodities after rice and corn which is needed as cheap and nutritious food. Soybean is also used as a raw material for the agro-industry of tofu, tempeh, tauco, soybean oil, and soy sauce as well as for animal feed purposes (Krisnawati, 2017). The need for soybean commodities is increasing in line with increasing changes in population and public awareness of the importance of food nutrition.

Saturated soil culture (SSC) can encourage the growth and production of soybeans in tidal swamps because it can reduce pyrite levels and reduce the salt content that enters the soil. Soybeans can be cultivated in swamps, by adjusting the depth of the water table so that the soil conditions are more reductive (Sagala *et al*., 2013). According to Purwaningrahayu *et al*. (2004), SSC is carried out by keeping the water demand in the ditch stable and at a certain height so that the root layer can become saturated but not inundated. Soybean plants in water-saturated soil can form adventitious roots because plants can adapt to a root environment that lacks oxygen by forming lateral roots and adventitious roots (Stefia, 2017). Soybeans grown in this SSC have a fairly large seed size. This shows that during the formation of pods, plants experience a critical phase of environmental stress, especially in water-saturated conditions (Adisarwanto, 2001). Water-saturated land has conditions that are more reductive so that it can suppress the solubility of iron (Fe) (Bachtiar *et al*., 2016).

Dolomite is a natural mineral that contains the nutrients Mg and Ca in the form of flour which is used both for agricultural land, plantations, and industrial needs. In addition to increasing the pH of dolomite soil, it can also function as a nutrient. The results of Asmi's research (2013) showed that giving dolomite doses of 4.5 tons ha^{-1} could increase soybean crop production. Giving dolomite lime at a dose of 300 kg ha^{-1} combined with applying biological fertilizers, phonska, and manure can increase the highest soybean yields by up to 1.89 tons ha^{-1} (Jumakir *et al*., 2016). The results of research by Taufiq *et al*. (2015) showed that in tidal lands

applying 750 kg ha^{-1} of dolomite could improve soil acidity to increase soybean crop production. In addition to improving the physical, chemical, and biological properties of the soil, varieties that are suitable for water saturation conditions are needed to increase production yields.

The use of different soybean varieties will result in different growth and yields. Therefore it is necessary to make efforts to get the best soybean varieties on SSC. Soils that have a low pH need to be calcified so that soil acidity can lead to conditions suitable for plant growth.

MATERIALS AND METHODS

This research was carried out from November 2020 to February 2021 in the experimental land of the Department of Agricultural Cultivation, Faculty of Agriculture, University of Bengkulu. The materials used in this study were Gepak Kuning, Dering 1, and Derap 1 soybean seeds. dolomite, Furadan, and inorganic fertilizers (Urea, SP-36, and KCl). The tools used in this study included land preparation equipment, calipers, scissors, nails, markers, and scales.

This study used a complete randomized block design (RCBD) factorial pattern consisting of 2 factors. The first factor is the dolomite dose which consists of 4 levels, namely: B_0 = 0 x Al-dd; B_1 = 0.5 x Al-dd; B_2 = 1 x Al-dd; and B_3 = 1.5 x Al-dd The second factor is three soybean varieties, namely: A_1 = Gepak Kuning, A_2 = Dering 1, and A_3 = Derap 1. Based on the treatment used, 12 treatment combinations were obtained, and each treatment was carried out with 3 replications, 36 were obtained experimental unit.

The stages of the research included land clearing and preparation, planting media preparation, soil analysis, labeling, planting plants, fertilizing plants, plant maintenance (watering plants, planting plants, thinning plants, weeding, controlling pests and plant diseases), and harvesting. Observational variables consist of growth variables and outcome variables.

The data obtained were analyzed statistically using an Analysis of Variance (ANOVA) level of 5% if there was a significant effect on the dolomite dose followed by the Orthogonal Polynomial method. As for interactions and varieties, if they give a real effect, then continue with a DMRT level of 5%.

RESULTS AND DISCUSSION

The research area is an acid soil with a soil pH of 4.25, an N content of 0.23% (low), a P content of 3.69 (high), a K content of 0.25% (low), and an Al-dd content of 1.75 m 100^{-1}. The land used is categorized as acid soil so it still needs to add dolomite to increase the soil pH so that the soybean plant grows.

In general, soybean plants at the time of the study showed good growth. Every week the plant height has increased. Based on the results of observations, the treatment with the highest plant height was the treatment with dolomite at a dose of 0.5 x Al-dd. When the soybean plants are 20 DAP old, pests such as caterpillars, ladybugs, and green grasshopper (*Atractomorpha crenulata*) occur. This is because the environmental conditions around the weed plants are quite lot, thus inviting these pests to look for food around the plants. Increased humidity around the plants causes pests to be comfortable and reproduce quickly. According to Christia *et al*. (2017), types and densities can reduce yields on soybean plants. According to Hasanuddin *et al*. (2012), weed density affected the fresh weight of root nodules and the seed weight of soybean plants. Pest attack control was carried out by spraying insecticides with the active ingredient Deltamethrin 25g L^{-1} and insecticides with the active ingredient Profenofos 50 g L^{-1}. Spraying was carried out when the plants were 25 DAP in stages once a week with a concentration of 2 mL L^{-1} using a knapsack sprayer. Apart from that, there are also broad-leaf weeds, and narrow-leaf weeds. When the plants are in the vegetative phase, the rainfall is categorized as high enough to cause the soybean plant environment to be flooded. Climate affects the growth and yield of soybean plants. Soybean plants require rainfall of 23 ^{o}C-26 ^{o}C, optimal humidity during growth is 75-90%, while during the pod filling phase, it is 60-75%, and sunlight is 50-60% (Sumarno & Mansuri, 2007).

The dose of dolomite given to soybean plants was able to affect the number of nodules, fresh nodule weight, nodule dry weight, shoot fresh weight, and shoot dry weight. Soybean variety independently showed a significant effect on variable plant height, number of mature pods, number of immature pods, number of seeds, shoot fresh weight, shoot dry weight, and number of pods per plant. While the interaction between the two treatments was significant in the shoot fresh weight and dry weight variables (Table 1).

Effect of dolomite dosage on the number of root nodules

The effect of dolomite dose on the number of root nodules forms a second-order line with the equation $y = 0.3189x^2 - 1.4828x + 1.7044$ and the value of the coefficient of determination (R^2) = 0.7112. The regression equation formed was able to describe the relationship between dolomite dosage and the number of root nodules of 71.12%, while the other 28.88% was influenced by other factors (Figure 1). Dolomite is a sedimentary rock consisting of the mineral dolomite, which is usually used as an additive in agriculture to increase soil pH. Dolomite is used as a source of

magnesium and calcium required by plants for healthy growth.

Tabel 1. Summary of the F value of analysis variance

Variable	F value			CV (%)
	Dolomite	Varieties	Interaction	
Plant height	1.83^{ns}	12.49*	1.30^{ns}	15.3
Number of leaves	2.62^{ns}	2.09^{ns}	1.32^{ns}	27.61
Number of branches	1.79^{ns}	3.68^{ns}	1.52^{ns}	25.66
Number of root nodules	4.54*	2.90^{ns}	1.70^{ns}	27.84
Fresh weight root nodules	3.70*	0.22^{ns}	0.62^{ns}	26.97
Dry weight of root nodules	5.80*	1.30^{ns}	1.74^{ns}	10.67
Number of mature pods	1.59 ^{ns}	38.38*	0.54^{ns}	17.42
Number of immature pods	1.18^{ns}	29.45*	0.48^{ns}	18.04
Number of seeds	1.65^{ns}	39.79*	0.43 ^{ns}	17.32
Shoot fresh weight	7.24*	6.24*	5.44*	27.79
Shoot dry weight	6.51*	5.47*	4.77*	28.81
Number of pods per plant	1.52^{ns}	41.66*	0.30^{ns}	17.24
Fresh Weight of Roots	1.92^{ns}	0.62^{ns}	0.43^{ns}	14.92
Dry weight of Roots	1.91^{ns}	0.54^{ns}	0.43^{ns}	10.61

Note : * = significant ; ns = non-significant

The number of soybean root nodules is the number of nodules formed on the roots of soybean plants. These root nodules contain *Rhizobium* bacteria which can bind nitrogen from the air and convert it into a form that can be used by plants. The relationship between dolomite and the number of nodules in soybean is indirect because dolomite does not directly affect nodule formation. However, the use of dolomite can increase soil pH, which can help improve plant growth and development, including the formation of root nodules in soybean plants. When the soil pH is too low (acidic), soybean plants can have difficulty absorbing nutrients from the soil, including nitrogen which is needed for the formation of root nodules. Under these conditions, the use of dolomite can help increase soil pH and facilitate the absorption of nutrients by soybean plants, including nitrogen used by *Rhizobium* bacteria in the formation of root nodules. Therefore, the use of dolomite can indirectly affect the number of soybean root nodules by increasing the availability of nutrients needed for plant growth and development. The results of Jumakir *et al*. (2016) showed that giving dolomite at a dose of 300 kg ha^{-1} could increase the number of root nodules by 43.24% when compared to only giving Urea and Phonska.

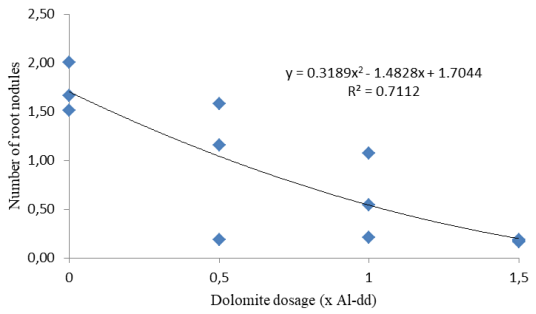

Figure 1. The relationship between dolomite dosage and the number of root nodules

Effect of dolomite dosage on the fresh weight root nodules

Dolomite dose and fresh weight root nodules form a quadratic relationship with the equation y = -0.5472x^2 + 1.0429x + 0.1465 and the coefficient of determination R² = 0.1363. The determination value (R²) = 0.3534 indicates that the regression equation formed can describe the relationship between dolomite dose and root nodule weight of 13.63%, while the other 86.37% is influenced by other variables (Figure 2).

The fresh weight of root nodules is generally measured as an indicator of the amount of nitrogen produced by leguminous plants. The relationship between dolomite and fresh-weight root nodules is indirect because dolomite does not directly affect root nodule production in leguminous plants. However, using dolomite can help increase soil pH, which can help promote plant growth and development, including root nodule formation in leguminous plants.

When the soil pH is too low (acidic), leguminous plants can have difficulty absorbing nutrients from the soil, including nitrogen which is necessary for root nodule production. Under these conditions, the use of dolomite can help increase soil pH and facilitate the uptake of nutrients by leguminous plants, including nitrogen used by Rhizobium bacteria in the production of root nodules (Nathanson, 1984). The use of compost enriched with dolomite can increase the growth ability and yield of soybean plants in SSC on tidal land (Haitami, 2022).

Thus, the use of dolomite can indirectly affect the fresh weight of root nodules by increasing the availability of nutrients needed for root nodule formation and nitrogen production in leguminous

plants. However, the fresh weight of root nodules is also influenced by other factors such as the type of leguminous plant, plant genetics, and environmental conditions, so the effect of dolomite may vary depending on the growing conditions of the leguminous plant. The results of research by Santi *et al.* (2019) showed that the improvement in soil conditions due to the application of 15 tons ha^{-1} of empty palm fruit bunch compost resulted in the largest root nodule weight when compared to other treatments.

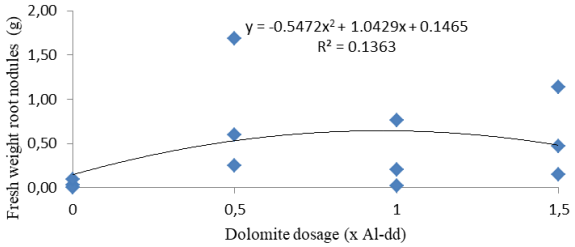

Figure 2. The relationship between dolomite dosage and fresh weight root nodules

Effect of dolomite dosage on the dry weight of root nodules

Dolomite dosage and dry weight of root nodules form a quadratic relationship with the equation y = -0.0865x2 + 0.2942x + 0.0367 and the value of the coefficient of determination (R^2) = 0.3284. The determination value (R^2) = 0.3284 indicates that the regression equation formed can describe the relationship between dolomite dose and root nodule weight of 32.84%, while the other 67.16% is influenced by other factors (Figure 3). Based on the curve, the optimum dose of dolomite to the dry weight of the nodule was obtained, namely at a dose of 0.85 x Al-dd which produced the largest dry weight of the nodule, namely 0.227 g.

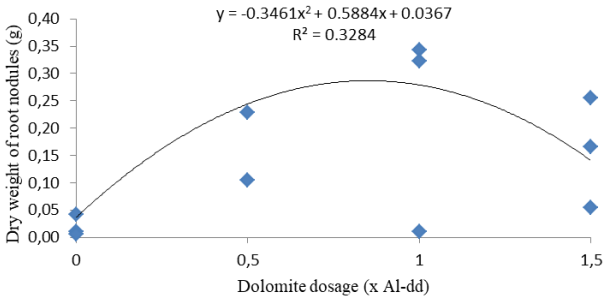

Figure 3. The relationship between dolomite dosage and dry weight of root nodules

The dose of dolomite can affect the number of nodules, fresh nodule weight, and dry nodule weight. This is caused by an improvement in soil pH and the availability of nutrients needed by plants and rhizobium. According to (Anitasari, 2015) that calcification in soybean plants encourages the formation of root nodules to fix nitrogen. In this case, what must be considered is the initial condition of the soil pH, the dose of liming is also regulated in this activity so that the soil pH is suitable for soybean growth. Rukmana & Yuyun (1996) stated that liming can increase soil pH, increase the elements of Ca, Mg, and the availability of P and Mo elements. The poisoning potential of Fe, Mn, and Al elements can be reduced. The life of microorganisms in natural soils becomes better so that they can activate the formation of root nodules. The element Ca is important for root growth, which plays a role in stimulating the growth of root hairs so that the more root hairs that grow, the more root nodules will grow so that the dry weight of the lower shoots becomes high (Sutedjo, 2008). Likewise, Hasibuan (2018) states that the addition of ¼ Al-dd dolomite can increase the pH even though it is still relatively acidic, but reduce Al-dd and Al saturation by up to six times so that the available P content also increases. The application of 50 kg ha^{-1} dolomite significantly increased the dry biomass weight of soybean stems, leaves, and total plants in the R5 phase when compared to the control (Cherunisa *et al.,* 2021).

Effect of soybean varieties on plant height

Soybean plant height can differ between varieties, depending on genetic factors and the growing environment. Some soybean varieties have short plant heights, while others are taller. The Derap variety used in this study had an average plant height of 26.56 cm which was significantly lower when compared to the Gepak Kuning and Dering 1 varieties. Meanwhile, the Gepak Kuning and Dering 1 variety showed results that were not significantly different (Table 2).

Gepak Kuning is a variety that has an average plant height of 35.46 cm which is higher than the other two varieties. This result is in line with Silaban's research (2022) which showed that the Gepak Kuning variety was the best soybean variety compared to other varieties.

Effect of soybean varieties on number of mature pods

The Gepak Kuning variety produced an average number of mature pods of 101 pods which were significantly different when compared to the Dering 1 variety, which was 50 pods and the lowest was the

Derap 1 variety with an average of 30 pods (Table 2). These results are to the results of Andayanie & Adinurani's research (2014) which stated that the Gepak Kuning soybean variety gave the best yields (high yielding) and was resistant to SMV (Soybean Mosaic Virus), so it was feasible to develop. The three soybean varieties showed different growth rates, depending on the adaptability of the varieties to environmental conditions. The decrease or increase in growth rate is strongly influenced by genetic and environmental factors such as water, temperature, and nutrients. The components of these environmental factors can have a direct or indirect effect on plant growth (Zainuddin *et al*., 2022).

*Effect of soybean varieties on **n**umber of immature pods*

The highest number of immature pods was produced by the Gepak Kuning variety, namely 50 pods, which was significantly different when compared to the other two varieties, Dering 1 (25 pods) and Derap 1 variety (14 pods) (Table 2). Superior varieties play an important role in soybean production because achieving high yields is largely determined by their genetic potential. Yield potential in the field is influenced by the interaction between genetic factors and environmental conditions. If the growing environmental conditions are not suitable, then the high yield potential of these superior varieties cannot be achieved (Adisarwanto, 2006). The genetic composition is one of the factors causing the diversity of plant appearance. Genetic programs that will be expressed in various plant traits include plant forms and functions that produce different growth variations and plant yields.

*Effect of soybean varieties on **n**umber of seeds*

The Gepak Kuning variety produced the highest number of seeds, with an average of 202 soybeans, which was significantly different from the other varieties, namely Dering 1 which produced 100 soybeans, and Derap 1 produced 59 seeds (Table 2). The differences resulting from the three varieties are thought to be due to the genetic differences of each plant and the suitability of the plants in a water-saturated environment so that each type of variety will have a different response. According to Tanjung & Juanda (2022) that each variety has a different response to the environment so the growth and potential results obtained are also different. Wagiana et al. (2011) also stated that in the physiological processes of soybean plants, what supports growth is the genetic factor of each variety and in the end, also supports the seed-filling process thereby increasing the yield of soybean seeds.

*Effect of soybean varieties on **n**umber of pods per plant*

The Gepak Kuning variety produced the highest number of pods per plant with an average of 151 pods. These results were significantly different when compared to the other two varieties, namely the Dering 1 variety which produced 75 pods, and Derap 1 which produced 44 pods (Table 2). Research by Yusran *et al*. (2021) and Wijaya *et al*., (2022) showed the same thing, the use of the Gepak kuning cultivar at a spacing of 40 cm x 20 cm showed the best results compared to other varieties. Genetic traits are the main factor for differences in soybean growth and yield (Nabilah *et al*., 2022). The significant effect on the number of pods per plant is thought to be due to the genetic characteristics and adaptability of each variety.

Table 2. DMRT result for growth and yield of soybean

Varieties	Plant height (cm)	Number of mature pods	Number of immature pods	Number of seeds	Number of pods per plant
Gepak Kuning	35.46 a	101.00 a	50.00 a	202 a	151.00 a
Dering 1	35.20 a	50.00 b	25.00 b	100 b	75.00 b
Derap 1	26.56 b	30.00 c	14.00 c	59 c	44.00 c

Note : numbers in the same column followed by the same letter are not significantly different at the 5% test level

Effect of interaction dolomite dosage with varieties on shoot fresh weight

The combination of dolomite varieties and doses showed a significant interaction on the Shoot fresh weight variable. Dering 1 variety that obtained a dolomite dose of 0.5 x Al-dd produced the heaviest

crown fresh weight of 78.26 g (Table 3). According to Suriadikarta (2006), high acidity and Al saturation can be neutralized by liming. Liming is one of the efforts to increase soil pH from very acidic or sour to slightly neutral or neutral pH, as well as reduce Al levels. To increase the levels of Ca and Mg dolomitic lime can be given, in addition to increasing the soil pH of dolomitic lime it can also increase Ca levels and base saturation. This result is also directly related to the resulting root nodules. Rhizobium in soybean plants helps the formation of root nodules.

Table 3. Average shoot fresh weight of soybean varieties at dolomite doses

Varieties	Dolomite			
	0 x Al-dd	0.5 x Al-dd	1 x Al-dd	1.5 x Al-dd
Gepak Kuning	31.42 d	52.02 b	48.44 b	62.29 ab
Dering 1	37.93 cd	78.26 a	31.01 d	28.91 d
Derap 1	28.07 d	38.82 cd	42.80 c	19.78 e

Note : numbers followed by the same letter are not significantly different at the 5% test level

The more root nodules, the more it helps the provision of N nutrients for plants in the process of growing roots, stems, and leaves (Kumalasari *et al*., 2013). So that it can affect the resulting fresh weight shoot. The response of plants to environmental conditions varies depending on the type and cultivar of the plant. Plants can respond positively or negatively to changes in the growing environment (Taufiq & Sundari, 2012).

Effect of interaction dolomite dosage with varieties on shoot dry weight

The interaction of dolomite doses and varieties was able to increase the shoot dry weight of soybean plants. The dolomite dose of 0.5 x Al-dd in the Dering 1 variety resulted in an average shoot dry weight of 42.77 g (Table 4). Water-saturated environmental conditions are suitable for increasing the shoot dry weight. This result is also related to the fresh weight of the shoot, the higher the fresh weight of a plant's crown, the higher the shoot dry weight produced. The appropriate soil pH can affect the absorption of nutrients from the soil to plants. According to Syahputra *et al*. (2015) that adding dolomite to the soil can increase soil pH. This increase occurs due to the presence of groups of hydroxyl ions that bind acidic cations (H and Al) in soil colloids to become inactive so that the pH increases. Dolomitic lime reduces soil acidity (pH) as it increases by converting some of the H^+ into water. According to Amir (2015), soybean varieties that have low root nodule weights are thought to be because plants only utilize N available in the soil and only a small portion is obtained from air N_2 fixation. So that it will affect the biomass produced by each plant variety. Plants require certain adaptive properties to be able to grow and produce well. Therefore it is necessary to look for varieties that can adapt and produce high in water-saturated conditions.

Table 4. Average shoot dry weight of soybean varieties at dolomite doses

Varieties	Dolomite			
	0 x Al-dd	0.5 x Al-dd	1 x Al-dd	1.5 x Al-dd
Gepak Kuning	18.74 cd	31.19 b	28.96 b	37.55 ab
Dering 1	20.29 cd	42.77 a	17.16 d	15.73 d
Derap 1	17.00 d	23.69 c	25.94 bc	12.09 e

Note : numbers followed by the same letter are not significantly different at the 5% test level

CONCLUSION

There was an interaction between dolomite dose and soybean plant varieties on the variables of crown fresh weight and shoot dry weight. The best combination on the fresh weight shoot variable was the Dering 1 variety with a dose of dolomite 0.5 x Al -dd with a yield of 78.26 g and on the shoot dry weight the combination of dolomite dose 0.5 x Al-dd with the Ring 1 variety with a yield of 42.77 g. The best variety in SSC was the Gepak Kuning variety seen in variable plant height (35.46 cm), number of mature pods (101.00 pods), number of immature pods (50.00 pods), number of pods per plant (151.00 pods), number of seeds (202.00), shoot fresh weight (49.00 g) and shoot dry weight (29.00 g).

References

Adisarwanto. (2001). Opsi inovatif pengolahan air untuk kedelai di lahan sawah irigasi. *Buletin Palawija*, 1, 24–32.

Adisarwanto, T. (2006). Budidaya Dengan Pemupukan yang Efektif dan Pengoptimalan Peran Bintil Akar Kedelai. Penebar Swadaya, Jakarta.

Amir, B. (2015). Hubungan bintil akar dan aktivitas nitrat reduktase dengan serapan N pada beberapa kultivar kedelai (*Glycine max* L,). Conference: Seminar Nasional Masyarakat Biodiversitas Indonesia. DOI: *10.13057/psnmbi/m010528*.

Andayanie, W. R. & Adinurani, P.G. (2014). Seleksi galur dari populasi F4 kedelai yang tahan terhadap penyakit mosaik (*Soybean Mosaic Virus*) dan berdaya hasil tinggi. *J HPT Tropika*, 14(2), 152–159. DOI: *https://doi.org/10.23960/j.hptt.214152-159*.

Anitasari, F., Sarwitri, R. & Suprapto, A. (2015). Pengaruh Pupuk Organik Dan Dolomit Pada Lahan Pantai Terhadap Pertumbuhan dan Hasil Kedelai. *The 2nd University Research Coloquium*, 315–324.

Asmi R. 2013. Pengaruh Dosis Dolomit Dan Pupuk Kandang Terhadap Pertumbuhan Dan Hasil Tanaman Kedelai (*Glycine max* (L.) Merill) Pada Lahan Gambut. *Skripsi*. Fakultas Pertanian Universitas Teuku Umar, Meulaboh, Aceh

Badan Pusat Statistik (BPS). (2018).

Cherunisa, S.R., Ghulamahdi, M. & Lubis, I. (2021). Ameliorasi rizosfer kedelai menggunakan Jerami, abu sekam, dan dolomit. *J. Agron. Indonesia*, 29(2), 154-161. DOI: *https://dx.doi.org/10.24831/jai.v49i2.34964*.

Chiristia, A., Sembodo, D.R.J & Hidayat, K.F. (2017). Pengaruh jenis dan tingkat kerapatan gulma terhadap pertumbuhan dan produksi kedelai (*Glycine max* (L). Merr) Agatha. *Jurnal Penelitian Pertanian Terapan*, *16*(1), 22–28. DOI: *https://doi.org/10.25181/Jppt.V16i1.71*.

Haitami, A., Wahyudi & Ezward, C. (2022). Kompos jerami padi yang diperkaya dengan kotoran sapi + dolomit bereaksi terhadap pertumbuhan dan produksi kedelai pada budidaya jenuh air di lahan pasang surut. *BIO-Lectura : Jurnal Pendidikan Biologi*, 9(2), 271-276. DOI: *https://doi.org/10.31849/bl.v9i2.11684*.

Hasibuan, H.S., Sopandie, D., Rrikoesoemaningtyas & Wirnas, D. (2018). Pemupukan N, P, K, Dolomit, dan Pupuk Kandang pada Budidaya Kedelai di lahan kering masam. *J. Agron. Indonesia*, 46(2), 175-181. DOI: *https://dx.doi.org/10.24831/jai.v46i2.17268*.

Hasanuddin, H., Erida, G. & Safmaneli, S. (2012). Pengaruh persaingan gulma *Synedrella nodiflora* L. Gaertn. pada berbagai densitas terhadap pertumbuhan dan hasil kedelai. *Jurnal Agrista Unsyiah*, 16(3), 146–152.

Jumakir, Endrizal & Suyamto. (2016). Uji beberapa paket pemupukan dan dolomit terhadap hasil kedelai di lahan rawa pasang surut Provinsi Jambi. *Jurnal Lahan Suboptimal*, 5(1), 86–94. DOI : *https://doi.org/10.33230/JLSO.5.1.2016.236*.

Krisnawati, A. (2017). Kedelai sebagai sumber pangan fungsional (Soybean as source of functional food). *Iptek Tanaman Pangan*, 12 (1), 57-65.

Kumalasari, I.D., Astuti, E.D. & Prihastanti, E. (2013). Pembentukan bintil akar tanaman kedelai (*Glycine max* (L) Merrill) dengan perlakuan jerami pada masa inkubasi yang berbeda. *Jurnal Sains dan Matematika*, 21(4), 103-107.

Nabilah, H., Satyana, K.A. & Islami, T. (2022). Respon 6 varietas kedelai (*Glycine max* (L.) Merr.) terhadap perbedaan interval penyiraman. *Plantropica: Journal of Agricultural Science*, *7*(2), 52–57. DOI: *https://doi.org/10.21776/ub.jpt.2022.007.2.7*.

Nathanson, K., Lawn, R..L., De Fabrun, P.L.M. & Byth, D.E. (1984). Growth, nodulation and nitrogen accumulation by soybean in saturated soil culture. *Field Crops Res*. 8, 73-92.

Purwaningrahayu, R. D., Indradewa, D. & Sunarminto, B.H. (2004). Peningkatan hasil beberapa varietas kedelai dengan penerapan teknologi basah. *Penelitian Pertanian Tanaman Pangan*. 23(1), 49-58.

Rukmana, R. & Yuyun, Y. (1996). Kedelai Budidaya dan Pasca Panen. Penerbit Kanisius, Yogyakarta

Sagala, D., Suzanna, E., Prihanani, P. & Nero, J. (2013). Uji adaptasi beberapa varietas kedelai di lahan salin dengan teknologi budidaya jenuh air. *Jurnal Agroqua: Media Informasi Agronomi dan Budidaya Perairan*, 11(1), 52–55. DOI: *https://doi.org/10.32663/JA. V11I1.43*.

Santi, R., Nurul, A.S. & Alfajri. (2019). Efektivitas bintil akar kedelai edamame dengan pemberian TKKS di tailing pasir pasca tambang timah. *Jurnal AGRO,* 6(2), 153-167. DOI: *https://doi.org/10.15575/5524*.

Silaban, H. T. 2022. Respon pertumbuhan dan hasil beberapa varietas tanaman kedelai (*Glycine max* (L.) Merrill) akibat penggunaan konsentrasi pupuk hayati. *Skripsi*. Universitas Negeri 'VETERAN', Surabaya, Jawa Timur.

Stefia, E. 2017. Struktur Anatomi Tanaman Kedelai (*Glycine max* L.). Departemen Biologi, Fakultas Matematika aan Ilmu Pengetahuan Alam, Institut Teknologi Sepuluh November, 11–12.

Sumarno & Mansuri. (2007). Persyaratan Tumbuh dan Wilayah Produksi Kedelai di Indonesia. Balai Penelitian Tanaman Kacang-Kacangan dan Umbi-Umbian, Malang

Suriadikarta. 2016. Karakteristik potensi dan teknologi pengelolaan tanah Ultisol untuk pengembangan pertanian lahan kering di Indonesia. *Litbang Pertanian*, *25*(2), 39–47.

Sutedjo, M. M. (2008). Pupuk dan Cara Pemupukan. Penerbit Rineka Cipta, Jakarta.

Syahputra,D., Rusli, M. & Alibasyah, T.A, (2015). Pengaruh kompos dan dolomit terhadap beberapa sifat kimia Ultisol dan hasil kedelai (*Glycine max* L. Merril) pada lahan Berteras.

Jurnal Manajemen Sumberdaya Lahan, 4, 535 –542.

Tanjung, B.R. & Juanda, D.S.S. (2022). Potensi hasil lima varietas kedelai (*Glycine max* L.) pada lahan kering masam. *Jurnal Agroqua*, 17(2), 115–125. DOI: *https://doi.org/10.32663/ja.v*.

Taufiq, A. & Sundari, T. (2012). Respon tanaman kedelai terhadap lingkungan tumbuh. *Buletin Palawija*, 26(23), 13–26.

Taufiq, A., Wijanarko, A. & Suyamto. (2015). Takaran optimal pupuk NPKS, dolomit, dan pupuk kandang pada hasil kedelai di lahan pasang surut. *Jurnal Penelitian Pertanian Tanaman Pangan*, 30(1), 52–57.

Wagiana, W., Apriani, A. & Farida, N. (2011). Respon berbagai varietas kedelai (*Glycine max* (L.) Merril) terhadap sterilisasi tanah dan inokulasi dengan Mikoriza Arbuskular. Fakultas Pertanian Universitas Mataram, Mataram.

Wijaya, A. A. & Sukmasari, M.D. (2022). Penampilan enam kultivar unggul kedelai pada berbagai jarak tanam yang berbeda untuk penanaman di musim hujan. *Agrivet: Jurnal Ilmu-Ilmu Pertanian dan Peternakan (Journal of Agricultural Sciences and Veteriner)*, 10 (1), 90-96. DOI:*10.31949/agrivet.v10i1.2662*.

Yusran, Sukmawati, St., Izma, S. & Nurlina, R.R. (2021). Pemberian inokulasi *Rhizobium sp* pada berbagai varietas kedelai terhadap peningkatan hasil dan kualitas benih. *AGRO-LAND : Jurnal Ilmu-Ilmu Pertanian*, 28(1), 52-63. DOI: *https://doi.org/10.22487/agrolandnasional.v0i0.705*.

Zainuddin, R., Yusuf, M.N., Usnawiyah, U., Ismadi, I. & Nazaruddin, M. (2022). Uji adaptasi morfo -fisiologis beberapa varietas kedelai (*Glycine max.* L*). Jurnal Ilmiah Mahasiswa Agroekoteknologi*, 1(2), 28–33. DOI: *https://doi.org/10.29103/jimatek.v1i2.8462*.