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Effect of dolomite and pig manure on growth and production of carrots (*Daucus carota*)

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Abstract. *Sambi ND, Limbongan Y, Pata'dungan AM. 2023. Effect of dolomite and pig manure on growth and production of carrots (*Daucus carota*). Nusantara Bioscience 14: 22-29.* This study aims to see how dolomite and pig manure affect carrot (*Daucus carota* L.) plant development and taproot production. The research was conducted from May to August 2021 in the Padangiring Village, Rantetayo Sub-district, Tana Toraja District, South Sulawesi, Indonesia. Three levels of dolomite in combination with four levels of pig manure were used: control (no treatment), and dolomite at 3 tons/ha, 6 tons/ha, and pig manure at control (no treatment), and 20 tons/ha, 30 tons/ha, and 40 tons/ha. The optimal dolomite level of 3 tons/ha significantly influenced plant height, the number of leaves, taproot length, and taproot diameter but had no significant effect on individual taproot weight, plot taproot weight, or taproot weight per hectare. The optimal pig manure dose of 4 kg/plot (40 tons/ha) showed a substantial influence on all investigated variables. The interaction between dolomite and pig manure substantially influenced taproot length but had no effect on the other observable variables. The optimum treatment combination was 3 tons/ha of dolomite with 40 tons/ha of pig manure, yielding 38.67 tons/ha of carrot taproots. Thus, commercial carrot growth and production may be boosted by a combination of dolomite and pig manure.

Keywords: Carrot, dolomite, pig manure

INTRODUCTION

Carrot (*Daucus carota* L.) is an agricultural product in great demand by the people in Indonesia because it has beneficial vitamin and mineral contents (Stefl et al. 2017) and a delicious taste. Carrot plants are classified as seasonal plants and are bush-shaped and can grow in the rainy and dry seasons (Gadomska et al. 2018). The market demand for carrots is quite high. According to data from the Central Statistics Agency (2020), the production of carrot vegetable commodities reached 674,634 metric tons in 2019. In addition to meeting domestic needs, carrots are one of the vegetables in demand abroad, so the prospect of carrot exports is very promising. The prospect of developing carrot plants in Indonesia is very bright because market demand continues to increase along with the increasing rate of population growth, especially in Tana Toraja.

The success of carrot cultivation is highly dependent on several factors, one of which is the nutrient content in the soil. The lack of nutrients in the soil can be overcome by providing additional nutrients to the soil, namely by fertilization. One type of fertilizer that farmers often use is inorganic fertilizer because the response of plants to inorganic fertilizers is quite fast. However, the tendency of some farmers to use inorganic fertilizers continuously causes residues that can damage the environment and result in poor-quality production. The use of organic fertilizers can overcome the problem of inorganic fertilization. Organic fertilizers have benefits, including preparing organic material in the soil or media, providing essential micronutrients needed by plants, and having a significant role in improving soil properties, both physical, chemical, and biological properties of the soil (Hayanti et al. 2012; Mokaya et al. 2018; Valšíková-Frey 2021; Satriawan et al. 2022).

Organic fertilizer is one type of fertilizer whose ingredients come from agricultural waste. Applying organic matter to agricultural land increases land fertility, improving the soil's chemical, physical, biological, and environmental properties. Organic fertilizers applied to the land will undergo several phases of an overhaul by degrading bacteria to become humus or organic matter (Lee et al. 2012). Pig manure is one of the wastes that can be used as organic fertilizer. Based on data from the Livestock Service Office of North Toraja District, the total population of pigs in North Toraja is 298,895 heads. The production of feces in pigs is 7 kg per day (Rahim et al. 2019). So that, pig manure production reaches 2.092 million tons per day.

Soil acidity is one of the important factors besides fertility that needs to be considered, especially for carrot plants. The soil acidity level can affect the nutrient absorption from the soil by plants. Carrot plants can grow well at a neutral pH with an acidity degree of 5.5-6.5. One way to overcome low acidity is to use minerals that can contain calcium oxide and magnesium oxide such as dolomite (Schultz et al. 2014)

Dolomite is one of the minerals containing calcium oxide with high magnesium oxide levels, which can neutralize soil pH. Lack of calcium and magnesium nutrients in the soil will cause plants to produce less than optimal production. Therefore, the use of dolomite plays a

very important role in plant growth and production. Dolomite is a mineral that contains several nutrients, such as calcium (CaO) and magnesium (Mga0) which are high enough to neutralize pH that is too acidic. Soil that lacks calcium and magnesium nutrients can cause plants to not produce well (Noviana 2021).

Based on the need for information on soil amendments to improve carrot production, we conducted a study to determine the effects of different levels of pig manure and dolomite on the growth and production of carrot plants.

MATERIALS AND METHODS

The study was conducted in the Padangiring Village, Rantetayo Sub-district, Tana Toraja District, South Sulawesi, Indonesia, from May to August 2021. Altitude 900 m above sea level, humidity 85-97%, temperature 15-27^{o}C with type of soil Ultisol and pH=4,0.

Experimental design

The study was carried out in the form of a field experiment with a Two-Factoral Randomized Block Design (RBD). The treatments consisted of 3 levels of dolomite and 4 levels of pig manure. The treatment doses to be tested were: Factor I, the amount of dolomite which consists of treatment levels: D0 = Control, D1 = 300 g/plot (3 tons/ha), D2 = 600 g/plot (6 tons /Ha). Factor II, the amount of pig manure which consists of 4 levels of treatment: B0 = Control B1 = 2 kg/plot (20 tons/ha) B2 = 3 kg/plot (30 tons/ha), and B3 = 4 kg/plot (40 tons/ha). Therefore, there were 12 treatment combinations.

Land preparation

The land is plowed and processed twice so that the soil is completely loose, so that the physical, chemical and biological conditions of the soil become better. Furthermore, the beds are made with a height of 30 cm, a width of 100 cm and a bed length of 100 cm. Making beds is done so that air and water circulation is good. Between the beds made a trench with a width of 30 cm.

Liming

Liming was carried out 1 week before planting with the use of dolomite at a dose according to the experimental dose D0 without treatment D1 300 g/plot and D2 600 g/plot

Carrot planting

Before planting, the first thing to do is to make a planting hole with a depth of 3-5 cm with a distance of 10 x 10 cm then the seeds are mixed with sand to make it easier to plant because the size of the carrot seeds are very small and then sown on top of the array and covered with soil.

Fertilization

Fertilization is done by giving pig manure according to the treatment given to carrot plants one week before planting. Then follow-up fertilization was carried out at 14 and 28 days after fertilization according to the dose before fertilization was carried out.

Watering and weeding

Watering carrot plants is done in the morning and evening every day depending on the weather. Weeding was done by removing weeds that grew in the research plot. While embroidery is done after weeding by replacing plants that do not grow or die.

Carrot plant pest control

Control of plant-disturbing organisms is carried out manually by pulling weeds that grow and catching or making pest traps, while for diseases using natural pesticides or removing infected plants so they don't spread.

Harvest and postharvest

Harvesting is done when the carrot plant is 100 days after planting and already has the characteristics of being ready to harvest, including 75% of the upper leaves falling or drying out. Harvesting is done by pulling the plant carefully.

Observation variables

Plant height

Observation of plant height was carried out by measuring the height of the carrot plant from the base of the stem or soil surface to the tip of the highest leaf and carried out at the age of 2 weeks after planting and repeated until the plants were 6 weeks old with an interval of 2 weeks.

Number of leaves

The number of leaf branches was counted by counting the number of leaf branches in the plant and was carried out at the age of 2 weeks after planting and repeated until the plants were 6 weeks old with an interval of 2 weeks.

Taproot length

The length of the tubers was measured using a ruler and measured from the base to the tip and was carried out after harvesting. The tubers measured were plant taproots that were used as samples.

Taproot diameter

The tuber diameter was measured using a roll meter. The tubers measured were plant taproots that were used as samples.

The weight of the taproot

The weight of the plots was calculated by weighing the tubers from the plots that had been cleaned of dirt.

Weight of taproots per hectare

The weight per hectare is calculated by converting the weight of the plots to hectares with the equation of area per hectare / area of research plot x yield of plots.

Data analysis

The results of the observations were analyzed using analysis of variance (ANOVA), and if the treatment had a significant effect, a further test was carried out using the Tukey's Honestly Significant Difference Test (HSD). (Stigler 1986).

RESULTS AND DISCUSSION

Based on the results of the analysis using the variable variance test for carrot plant height at the age of 2, 4 and 6 weeks after sowing in Table 1 and Figure 1, it was shown that the dose of dolomite lime and pig manure had a very significant effect on plant height. However, the interaction of dolomite lime dose and pig manure had no significant effect on carrot plant height.

Table 1 shows the HSD test for plant height at a level of $p < 0.05$ of 2 weeks after planting. The treatment of the dolomite at 300 g/plot (D1) resulted in the highest average plant height (18.03 cm) after sowing which was significantly different from the dolomite level D2, and different from the lowest average plant height (12.83) cm) at level D0. Pig manure with a dose of 40 ton/ha (B3) gave the highest average carrot plant height (19.80 cm) at the age of 2 weeks after planting, which was not significantly different from the B2 level (15.81 cm) but was very significantly different from the B1 and B0 levels. The lowest plant height was found in treatment B0 with an average plant height of 12.21 cm.

Dolomite treatment of 3 ton/ha (D1) resulted in the highest average carrot plant height (32.63 cm) at the age of 4 weeks after sowing which was not significantly different from the dolomite level D2 but was very significantly different from the D0 level with average plant height 12.83 cm (lowest). Pig manure at a dose of 4 kg/plot (B3) gave the highest average carrot plant height (34.41 cm) at the age of 4 weeks after planting which was not significantly different from the B2 level (30.41cm) but very significantly different from the B1 and B0 levels, while The lowest plant height was found in treatment B0 with an average plant height of 26.81 cm.

Dolomite treatment of 3 ton/ha (D1) resulted in the highest average carrot plant height (47.15 cm) at the age of 6 weeks after sowing which was not significantly different from the dolomite level D2 but was very significantly different from the D0 level with average plant height 41.99 cm (lowest). Pig manure at a dose of 4 kg/plot (B3) gave the highest average carrot plant height (48.90 cm) at the age of 6 weeks which was significantly different from other levels of manure treatment, while the lowest plant height was in treatment B0 with an average plant height 41.51 cm.

The combination of treatments with the best plant height growth was achieved at a dose of 3 tons/ha (D1) of dolomite and 40 tons/ha (B3) of pig manure at 2 weeks, 4 weeks and 6 weeks after sowing.

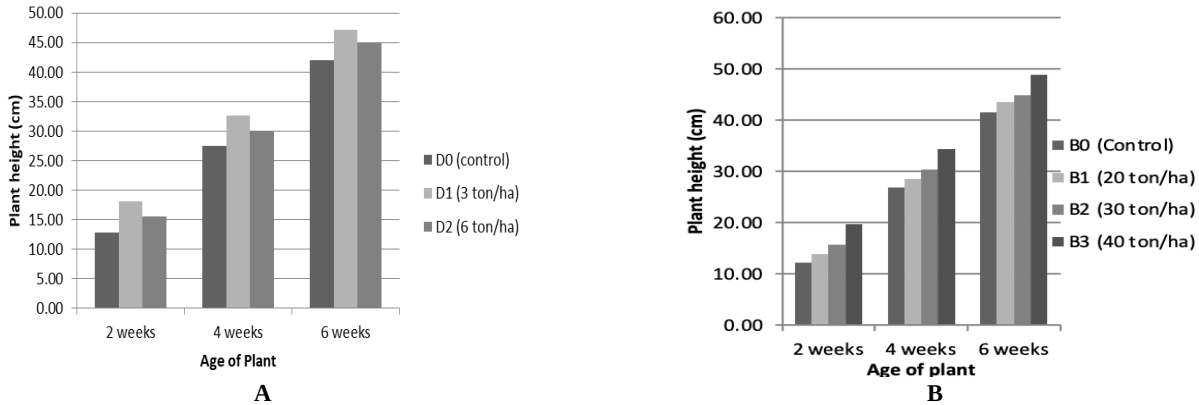
Number of leaves

Based on the results of the analysis using the test of variance of the variable number of carrot leaves at the age of 2, 4 and 6 weeks after sowing in Table 2 and Figure 2, it was shown that the dose of dolomite and pig manure had a very significant effect on the number of carrot leaves. Meanwhile, the interaction of dolomite lime and pig manure did not significantly affect the number of carrot leaves.

Table 1. Average of plant height 2, 4, and 6 weeks after planting

Treatments	Plant height					
	2 weeks		4 weeks		6 weeks	
Dolomite						
D0 (control)	12.83	v	27.43	v	41.99	v
D1 (3 ton/ha)	18.03	w	32.63	w	47.15	x
D2 (6 ton/ha)	15.48	v	30.08	w	45.03	wx
Pig manure						
B0 (control)	12.21	p	26.81	p	41.51	p
B1 (20 ton/ha)	13.96	p	28.56	p	43.55	pq
B2 (30 ton/ha)	15.81	pq	30.41	pq	44.93	q
B3 (40 ton/ha)	19.80	q	34.40	q	48.90	r

Note: The average value followed by the different letter in the column for averages across dolomite treatments (v, w, x) and for averages across pig manure treatments (p, q, r, s), is significantly different at level of HSD $p<0.05$



A B

Figure 1. The effect of dolomite (A) and pig manure (B) on plant height

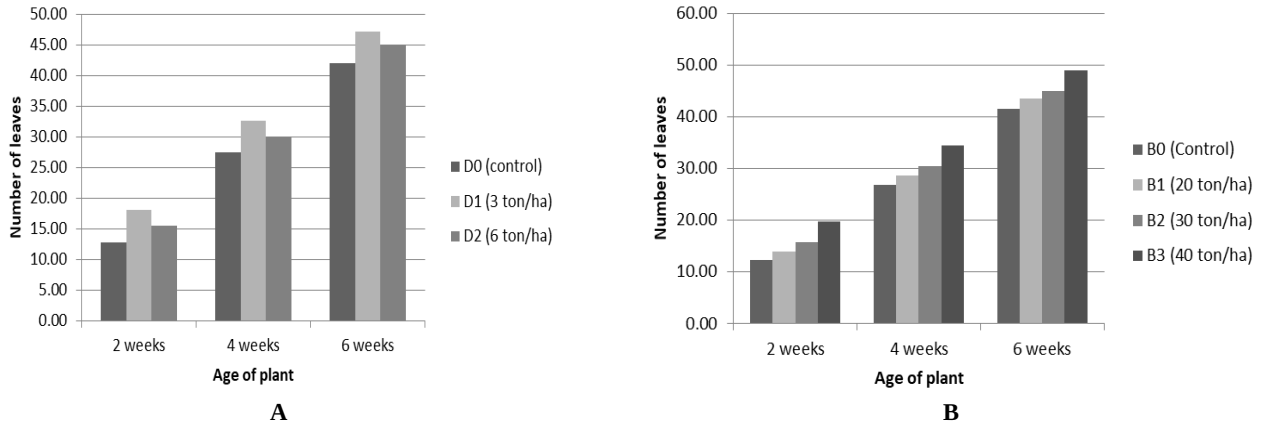


Figure 2. The effect of dolomite (A) and pig manure (B) on number of leaves

Table 2. Average number of leaves 2, 4 and 6 weeks after planting

Treatments	Plant height					
	2 weeks		4 weeks		6 weeks	
Dolomite						
D0 (control)	3.40	v	4.70	v	3.40	v
D1 (3 ton/ha)	5.04	w	6.34	w	5.04	x
D2 (6 ton/ha)	4.04	v	5.34	vw	4.04	vx
Pig manure						
B0 (Control)	2.77	p	4.07	p	2.77	p
B1 (20 ton/ha)	3.14	p	4.44	p	3.14	pq
B2 (30 ton/ha)	4.59	q	5.89	q	4.59	q
B3 (40 ton/ha)	6.13	r	7.43	r	6.13	r

Note: The average value followed by the different letter in the column for averages across dolomite treatments (v, w, x) and for averages across pig manure treatments (p, q, r, s), is significantly different at level of HSD p>0.05

Dolomite treatment of 300 g/plot (D1) resulted in the highest average number of carrot leaves (5.04 strands) at the age of 2 weeks after sowing, which was significantly different from the other dolomite levels, while the lowest average number of leaves was found in DO level (3.40 pieces). Pig manure with a dose of 4 kg/plot (B3) gave the highest average number of carrot leaves (6.3 pieces) at the age of 2 weeks which was significantly different from other levels of manure treatment, while the lowest number of leaves was in treatment B0 with an average the number of leaves 2.77 pieces. Treatment B2 is also significantly different from B1 and B0.

Dolomite treatment of 3 ton/ha (D1) resulted in the highest average number of carrot leaves (6.43 pieces) at the age of 4 weeks after sowing, which was not significantly different from the dolomite level D2 but was very significantly different from the dolomite level B0, with an average of 4.70 leaves (lowest). Pig manure with a dose of 40 ton/ha (B3) gave the highest average number of carrot leaves (7.43 strands) at the age of 4 weeks which was significantly different from other levels of pig manure treatment, while the lowest number of leaves was found in treatment B0 with an average the average number of leaves 4.19 pieces. Treatment B2 is also significantly different from B1.

Dolomite treatment of 3 ton/ha (D1) resulted in the highest average number of carrot leaves (8.64 pieces) at the age of 6 weeks after planting, which was not significantly different from the dolomite level D2 but very significantly different from the dolomite level B0, with an average number of leaves 7.00 pieces (lowest). Pig manure with a dose of 40 ton/ha (B3) gave the highest average number of carrot leaves (9.72 strands) at the age of 6 weeks which was significantly different from other levels of pig manure treatment, while the lowest number of leaves was found in treatment B0 with an average of the average number of leaves 6.37 leaves. Treatment 30 ton/ha pig manure B2 is also significantly different from 20 ton/ha (B1). The combination of treatments with the best number of leaf growth was achieved at a dose of 3 tons/ha (D1) of dolomite and 40 tons/ha (B3) of pig manure at 2 weeks, 4 weeks and 6 weeks after sowing.

Taproot length

Based on the results of the analysis using the variable variance test of carrot length in Table 3, it was shown that the dose of dolomite lime, pig manure, and the interaction of the two treatments had a very significant effect on carrot taproot length.

The dolomite treatment of 3 ton/ha (D1) resulted in the highest average carrot taproot length (16.81cm), which was not significantly different from the dolomite level D2 (15.18 cm) but very significantly different from the dolomite level B0, with an average taproot length of 14.49 cm (lowest). Pig manure at a dose of 40 tons/ha (B3) gave the highest average length of carrot s taproots (17.58 cm) which was significantly different from other levels of pig manure treatment, while the lowest taproot length was found at the level of pig manure B0 with an average taproot length 14.04 cm. Mention B2 also different from B1 and B0. The interaction of the D1B3 treatment gave the highest taproot length (20.60 cm), which was not significantly

different from the D1B2 (17.43 cm) treatment but was very significantly different from other treatment combinations. While the lowest taproot length was found in the interaction combination treatment D0B0 (13.93 cm).

Taproot diameter

Based on the results of the analysis using the variance test Based on the results of the analysis using the variance test for the variable diameter of the carrot taproot in Table 3, it was shown that the dose of dolomite lime and pig manure had a very significant effect on the diameter of the carrot taproots. Meanwhile, the interaction of dolomite lime and pig manure did not significantly affect the diameter of the carrot taproot.

Dolomite treatment of 3 tons/ha (D1) resulted in the highest average diameter of carrot taproots (3.29 cm), significantly different from other levels of dolomite. In contrast, the lowest average taproot diameter was at the D0 dolomite level (2.44 cm). Pig manure with a dose of 40 tons/ha (B3) gave the highest average carrot taproot diameter (3.69 cm), which was not significantly different from the B2 level (2.82 cm) but was very significantly different from the B1 and B0 levels. In contrast, the lowest taproot diameter was found in treatment B0 with an average taproot diameter of 2.21 cm. Treatment B2 is also significantly different from B1 and B0.

Taproot weight

Based on the analysis results using the test of variance of the variable weight of taproot weights (Table 3), it was shown that the treatment of pig manure had a very significant effect on the weight of carrot taproots. Meanwhile, the dose of dolomite lime and the interaction of dolomite lime and pig manure did not significantly affect the taproot weight of carrot planting.

Treatment of pig manure at a dose of 40 tons/ha (B3) gave the highest average carrot taproot weight (137.10 g) which was significantly different from the other levels of manure treatment, while the lowest taproot weight was found at the level of pig manure B0 with an average taproot weight of 71.03 g. Treatment B2 is also significantly different from B1 and B0.

Taproot weight per hectare

Based on the results for taproot weight per plot of the analysis using the test of variance of the taproot weight variable per hectare of carrots, it shows that the treatment of pig manure has a very significant effect on the weight of taproots per hectare of carrot plants. Meanwhile, the dose of dolomite lime and the interaction of the dose of dolomite lime and pig manure did not significantly affect the weight of taproots per hectare of carrot plants.

There was no difference among dolomite treatments for taproot weight per hectare. However, the treatment of pig manure at a dose of 40 ton/ha (B3) gave the highest average taproot weight per hectare of carrot plants (38.39 tons) which was significantly different from other levels of pig manure treatment, while taproot weight per hectare. The lowest level was found at the level of pig manure B0, with an average taproot weight of 19.89 tons per hectare. Treatment B2 is also significantly different from B1 and B0.

Table 3. Average taproot length and taproot diameter (cm)

Treatments	Variable							
	Length of taproot		Diameter of taproot		Weight of taproot per plant		Weight of taproot per ha	
Dolomite								
D0 (control)	14.49	v	2.44	v	87.20	v	24.42	v
D1 (3 ton/ha)	16.81	w	3.29	x	106.10	v	29.71	v
D2 (6 ton/ha)	15.18	vw	2.65	v	99.85	v	27.90	v
Pig manure								
B0 (Control)	14.04	p	2.21	p	71.03	p	19.89	v
B1 (20 ton/ha)	14.56	p	2.45	p	79.96	p	22.39	v
B2 (30 ton/ha)	15.79	q	2.82	pq	102.78	q	28.70	x
B3 (40 ton/ha)	17.58	r	3.69	q	137.10	r	38.39	wx
Interaction								
D0B0	13.93	A	1.79		63.10		17.67	
D0B1	14.27	A	2.12		73.21		20.50	
D0B2	14.60	A	2.57		86.31		24.17	
D0B3	15.15	AB	3.27		126.19		35.33	
D1B0	14.13	A	2.80		80.36		22.50	
D1B1	15.07	AB	3.00		83.93		23.50	
D1B2	17.43	BC	3.30		113.10		31.67	
D1B3	20.60	C	4.06		147.02		41.17	
D2B0	14.07	A	2.03		69.64		19.50	
D2B1	14.33	A	2.23		82.74		23.17	
D2B2	15.33	AB	2.60		108.93		30.27	
D2B3	17.00	B	3.73		138.10		38.67	

Discussion

The results of the analysis of all observational variables showed that the dolomite treatment had a significant and beneficial effect on carrot plants, namely the variables of plant height, number of leaves, taproot length, and taproot diameter, but had no significant effect on plant taproot weight either on an individual taproot or hectare basis. In contrast, pig manure treatment significantly affected all observed variables. However, the dolomite and pig manure interaction was only significant for the taproot length.

Pig manure contains essential nutrients needed by plants in the vegetative phase, especially elements of N, P, and K, which stimulate the photosynthesis process to produce photosynthate, which is translocated to all parts of the carrot plant for cell formation and cell enlargements such as leaves, stems, and roots so that it has an impact to increased production (Duan et al. 2012).

Dolomite had few effects on taproot weights, likely due to environmental conditions, namely high rainfall at the beginning of the study, so most of the dolomite given was washed away by rainwater. In addition, rainwater also has a fairly wet pH, so the absorption of nutrients in the soil by carrot plants is not optimal (Gadomska et al. 2018) so the impact on the interaction that occurs between pig manure and dolomite is not optimal in affecting the growth and production of carrot plants.

Dolomite lime influence

Based on the results of the variance analysis, it was shown that the dolomite treatment had a significant effect on the variables of plant height, number of leaves, taproot length, and taproot diameter but had no significant effect on plant taproot weight, plot taproot weight and taproot weight per hectare of carrot plants (Figure 4). Meanwhile, the HSD test at 0.05 level showed that the best dose of dolomite was 300 g/plot (3 tons/ha).

Using dolomite at a dose of 300 g/plot (3 tons/ha) increased plant height, number of leaves, and taproot length and diameter. Furthermore, the results of observations of soil pH before and after dolomite administration showed an increase from an average pH of 5.4 to 6.0 to provide both macro and micro nutrients needed by carrot plants. This result is to the opinion of Ilham et al. (2019), who said that dolomite can provide nutrients in the soil and contains other micronutrients to support plant growth and development. Amri et al. (2016) and Krismawati et al. (2021) further stated that the application of dolomite fertilizer can significantly influence plant height, stem circle, number of leaves, and leaf chlorophyll content.

Giving lime CaMg(CO3)2 can provide nutrients, Ca and Mg will stimulate cell turgor and the formation of chlorophyll so that the photosynthesis process increases and the product of photosynthesis also increase (Sirait et al. 2018). Magnesium plays a very important role in forming leaf green matter (chlorophyll) and helps plant metabolic processes such as photosynthesis, cell formation, protein formation, starch formation and carbohydrate distribution throughout plant tissues (Thana and Haryati 2021).

Giving dolomite can also provide P nutrients needed in plants in cell development that can increase plant growth, such as the number of leaves and plant height. Syahputra et al. (2015) stated that the application of dolomite lime in a certain range increased the soil's available P. Furthermore, La Habi et al. (2018) state that the availability of element P is strongly influenced by soil acidity. P cannot be dissolved in acidic soil conditions, so plants cannot absorb and use it (Sirait et al. 2018). Dolomite at a dose of 3 tons/ha improved the pH of acidic soil (pH 4.0) to neutral (pH 6.0) so that P nutrients were available for carrot plants used for growth.

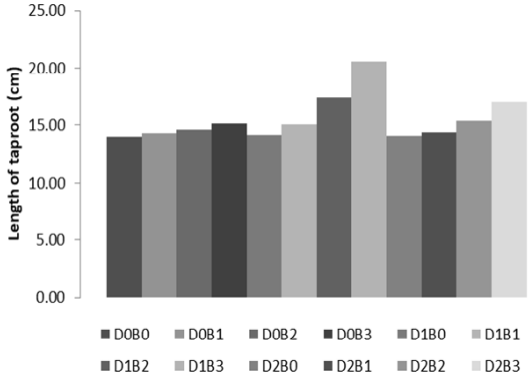
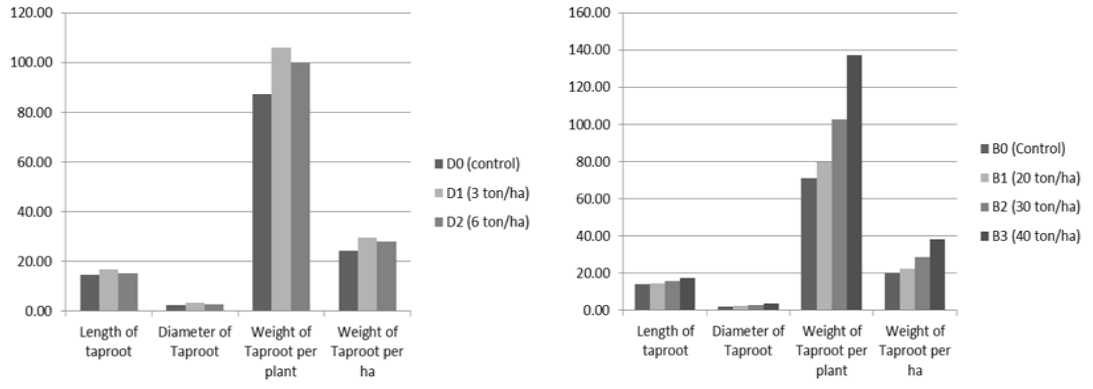


Figure 3. Interaction of dolomite and pig manure on length of taproot



A **B**

Figure 4. The effect of dolomite (A) and pig manure (B) on length of taproot, diameter of taproot, weight of taproot and weight of taproot per ha

Giving dolomite lime can increase the nutrients available to plants, increase the decomposition process by microorganisms in the soil and increase the availability of nutrients in the soil in the form of ions that plants can take up (Widodo et al. 2017; Rosalyne 2020). Sirait et al. (2018) stated that besides providing elements of Ca and Mgdolomite, it could affect the availability of nitrogen and other nutrients bound by heavy metal content such as Al, Fe, and Mn. So that gives a dose of 3 tons/ ha of nutrients that can be absorbed by plants that will be used to increase growth and production.

A dolomite dose of 3 tons/ha gave the highest taproot weight, but it was not significantly different from the control treatment (without dolomite). This was thought to be caused by washing some of the dolomite from rainwater because the study was carried out in the rainy season.

Effect of pig manure

The results of the variance test of pig manure showed a significant effect on all observed variables. Based on the results of the HSD test at 0.05 level, the best level was treatment with pig manure at 4 kg/plot (40 tons/ha).

The highest dose of pig manure, 4 kg/plot, resulted in the greatest response for all observed variables. It is suspected that the high nutrient content influenced this result in pig manure (Pujiastuti et al. 2021; Vamvuka and Raftogianni 2021) stated that the nutrient content of pig manure includes 3.75% nitrogen, 3.13% phosphorus, and 2.50% potassium with 68% humidity. The element N is the highest nutrient element in pig manure which functions as a form of plant vegetative organs such as plant height and several leaves. Plants containing sufficient N elements will form wider leaves and higher chlorophyll content, if this happens, it will affect the process of forming assimilate/ carbohydrates that are sufficient for plants to use in forming vegetative organs (Duan et al. 2012; Bhato 2015; Marlina et al. 2015). In line with that, Nokas et al. (2015) and Thana (2019) stated that nitrogen plays a role in increasing plant growth, such as the formation of green leaves, increasing protein levels, and the proliferation of microorganisms in the soil.

The level of pig manure also plays a role in increasing the activity of microorganisms, especially in the process of decomposition of organic matter to produce nutrients that are available and can be absorbed by plants. Galla and Naman (2021) and Chinyaeva et al. (2022) suggested that adding manure to the soil will stimulate microorganisms to increase their activity. This is because the number of sources of energy needed by microorganisms for activities increases, impacting plants' absorption of nitrogen and phosphorus.

The high macronutrient content in manure likely had a beneficial effect on the growth of carrot plants, such as several leaves increasing, while their chlorophyll content also increased, resulting in a high photosynthetic rate. Limbongan (2019a) and Yasa et al. (2019) stated that a high number of leaves indicates a higher photosynthetic efficiency of plants so that photosynthesis assimilation for growth and development of taproots is relatively fast. Therefore, giving high doses of pig manure can provide high carrot production so that the right dose of pig manure is used to get maximum carrot production above 40 tons/ha (Figure 4).

Interaction of dolomite and pig manure

Based on the interaction variance test results between dolomite and pig manure, the best treatment combination was 3 tons/ha of dolomite with 40 tons/ha of pig manure resulting in 38.67 tons/ha of carrot taproot production. The interaction of dolomite and pig manure is linear where at a pig manure dose of 30 tons/ha, it shows an increase in taproot length with an increase in dolomite dose (Figure 3).

The interaction of dolomite and pig manure with a combination of 3 tons/ha of dolomite and 40 tons/ha of pig manure gave the highest yield on length variables. This is because in the initial phase of taproots, dolomite and pig manure together supply the nutrient needs of carrot plants in the growth phase, especially in taproot formation. In addition, the high content of P and K elements in pig manure is able to produce high photosynthate which is then translocated to all parts of the plant and the rest is channeled to the s. In line with that, Limbongan (2019b) stated that P and K elements greatly affect fruit weight because they form storage networks. The formation of better fruit flesh is strongly supported by the presence of microelements, especially Fe.

The combination of treatments that produced the highest taproot weight was 3 tons/ha of dolomite and 40 tons/ha of pig manure with a taproot weight of 38.67 tons per hectare. However, this result has not yet reached optimal production. This is because the dose of manure given has not been maximum, so growth and production with these interactions are not significantly different. In addition, dolomite and pig manure have not been able to act together to increase carrot plants' growth and production. In line with that, Steel and Torrie in Safei et al. (2014) state that there is no significant difference in an interaction caused by each treatment factor acting independently or the influence is independent.

In addition, it is suspected that part of the dolomite treatment given was washed away by rainwater because of the sloping experimental land and high rainfall, so the nutrient content was also partially washed off by rainwater which plant roots had not absorbed. So that the highest dose combination 3 tons/ha of dolomite and 40 tons/ha of pig manure has not been able to show a significant difference with the low dose combination.

In conclusion, dolomite lime influenced carrot plant height, the number of leaves, and taproot length and taproot diameter but had no significant effect on taproot weight, taproot weight per plot, and taproot weight per hectare. The optimal dose of dolomite was 300 g/plot (3 tons/ha) for a significant influence on the growth and production of carrots Pig manure influenced all investigated variables. The optimal dose of pig manure was 4 kg/plot (40 tons/ha), which substantially influenced all investigated variables. The interaction between dolomite and pig manure substantially influenced taproot length but did not affect the other observable variables; the optimum treatment combination was 3 tons/ha of dolomite with 40 tons/ha pig

manure, yielding 38.67 tons/ha of carrot taproots. To get maximum results, it is advisable to cultivate carrots on rainfed land with a combination was 3 tons/ha of dolomite with 40 tons/ha of pig manure.

REFERENCES

Amri AI, Armaini A, Purba MRA. 2016. Application of compost of oil palm empty fruit bunches and dolomite on subsoil inceptisol medium for oil palm (*Elaeis guineensis* Jacq.) nurseries in primary nurseries. J Agroteknologi 8 (2): 1-8. DOI: 10.24014/ja.v8i2.3349.

Bhato MA. 2015. Growth response and yield of corn (*Zea mays* L.) pioneer varieties against various doses of pig manure and planting distance. Sandalwood Savana 1 (2): 85-89. DOI: 10.32938/sc.v1i02.18.

Chinyaeva UZ, Kalganov AA, Kramarenko MV, Minaev EA. 2022. The effect of different doses of pig manure on soil microbiological activity and spring wheat yield. IOP Conf Ser: Earth Environ 949: 012147. DOI: 10 1755-1315/949/1/012147.

Duan Y, Xu M, He X, Li S, Sun X. 2012. Long-term pig manure application reduces the requirement of chemical phosphorus and potassium in two rice-wheat sites in subtropical China. Soil Use Manag 27: 427-436. DOI: 10.1111/j.1475-2743.2011.00364.

Gadomska JM, Dobrowolski A, Micolewicz E. 2018. Morphological characteristics and nutritional value of purple-coloured storage roots of carrots protected with a biofungicide. Acta Agrophisica 25 (2): 175-183. DOI: 10.31545/aagr/92546.

Galla E, Naman N. 2021. Effect of Various types of manure on arabica coffee seeds (*Coffea arabica*). AgroSainT 9 (2): 72-76.

Hayanti IP, Amiputri RB, Praswanto. 2012. The effect of liquid organic fertilizer and pearl grass extract on shoot growth of gotu kola (*Centella asiatica*) in vitro. Biofarmasi 10: 54-60. DOI: 10.13057/biofar/f100204.

Ilham F, Prasetyo TB, Prima S. 2019. The effect of dolomite provision on some chemical properties of peat soil and growth and yield of shallots (*Allium ascalonicum* L.). J Solum 16 (1): 29-39. DOI: 10.25077/jsolum.16.1.29-39.2019.

Krismawati A, Latifah E, Sugiono. 2021. Effectiveness of dolomite on growth and yield of maize (*Zea mays* L.) in dry land. International Conference on Tropical Agrifood, Feed and Fuel (ICTAFF). Adv Biol Res 2021: 5-20. DOI: 10.2991/absr.k.220102.002.

La Habi M, Ivone JN, Marasabessy D, Martin AK. 2018. Availability of phosphate, phosphate absorption and yield of corn (*Zea mays* L.) plants due to provision of sago granule compost with phosphate fertilizer in inceptisols. J Agrologia 7 (1): 42-52. DOI: 10.30598/a.v7i1.356.

Lee J, Kim H, Lee S, Ro C. 2012. Evaluation of composted pig manure and organic fertilizer for organic onion production in paddy soil. Kor J Hort Sci Technol 30 (2): 123-128. DOI: 10.7235/hort.2012.11086.

Limbongan YL. 2019a. Cultivation of verticulture of shallots (*Allium ascalonicum* L) Bima variety using chicken manure liquid organic fertilizer. AgroSainT 7 (2): 82-89.

Limbongan YL. 2019b. Effect of various doses of bokashi straw (Bio-Triba-1) decomposer on growth and production of large chili (*Capsicum* sp.) local varieties. AgroSainT 8 (2): 77-84.

Marlina. 2015. Application of chicken manure manure on peanut plants (*Arachis hypogeae* L.). J Biosci 7 (2): 136 -141.

Mokaya BN, Chemining'wa GN, Ambuko JL, Nyankanga RO. 2018. Effect of organic and inorganic fertilizers on growth yield and nutrient use efficiency of clonal tea (*Camellia sinensis*). Cell Biol Dev 2: 15-26. DOI: 10.13057/cellbioldev/v020103.

Nokas Y, Taolin RICO, Maria AL. 2015. Effect of application time and dosage of pig manure on growth and yield of soybean (*Glycine max* (L.) Merr.). Savana Cendana 1 (02): 31-37. DOI: 10.32938/sc.v1i01.6.

Noviana H. 2021. Pengaruh Bakteri Pelarut Fosfat (BPF) dan Bokashi Paitan (*Tithonia diversifolia*) terhadap Produktivitas Tanaman Jagung Manis (*Zea mays* Saccharata L.) Varietas Sweet Boy pada Tanah Pasca Galian C. [Thesis]. UIN Sunan Gunung Djati Bandung. [Indonesia]

Pujiastuti SE, Siahaan FR, Tampubolon YR, Tarigan JR, Sumihar STT. 2021. Response of soil and peanut (*Arachis hypogaea* L.) on the application of several local microorganism and manures. J Agroteknologi Perkebunan 4 (1): 1-12. DOI: 10.36490/agri.v4i1. [Indonesian]

Rahim IR, Selintung M, Saputra R. 2019. Study of the potential of pig waste as biogas energy in North Toraja Regency a case study of Salusopai Village. Intl J Innov Technol Explor Eng (IJITEE) 8 (4): 68-72.

Rosalyne I. 2020. Effect of dolomite dosage and potassium fertilizer dosage on growth and production of corn (*Zea mays* L.) Bisi-2 ybride. Rhizobia: J Agrotechnol 2 (2): 10-21.

Safei M, Rahmi A, Jannah N. 2014. Pengaruh Jenis dan Dosis Pupuk Organik Terhadap Pertumbuhan dan Hasil Tanaman Terung (*Solanum Melongena* L.) Varietas Mustang F1. Universitas 17 Agustus 1945 Samarinda, Samarinda. [Indonesia]

Satriawan H, Nazirah L, Fitri R, Ernawita. 2022. Evaluation of growth and yield ofupland rice varieties undervarious shading levels and organic fertilizer concentrations. Biodiversitas 23: 2655-2662. DOI: 10.13057/biodiv/d230549.

Schultz AK, Barrett DM, Dungan SR. 2014. Effect of acidification on carrot (*Daucus carota*) juice cloud stability. J Agric Food Chem 62: 11528-1153. DOI: 10.1021/jf5042855.

Sirait IL, Zulia C, Ch RM. 2018. The effect of dolomite fertilizer and sp-36 fertilizer on growth and production of soybean plants (*Glycine max* (L) Merr). Agric Res J 14 (1): 13-25.

Stefl HH. 2017. Exploring the Nutritional Value of Carrots and Determining Attributes that are Favored by Consumers. [Honors Thesis]. Honors College, University of Maine, Maine. [US]

Stigler SM. 1986. The History of Statistics: the Measurement of Uncertainty Before 1900. Belknap Press of Harvard University Press, Cambridge, Mass.

Syahputra D, Alibasyah MR, Arabia T. 2015. Effects of compost and dolomite on some chemical properties of ultisol and soybean (*Glycine max* L. Merril) yield on rice terraces. J Land Resour Manag 4 (1): 535-542.

Thana DP, Haryati BZ. 2021. The effect of giving Bokashi calliandra leaves and dolomite dosage on purple eggplant (*Solanum melongena* L.) laguna F1 varieties. AgroSainT 12 (1): 1-13.

Thana DP. 2019. Growth and production response of carrots (*Daucus carota* L.) towards application of liquid organic fertilizer. AgroSainT 9 (1): 16-24.

Valšíková-Frey M, Kačániová M, Ailer S. 2021. Influence of organic fertilizers on carrot yield and quality. Intl J Recent Sci Res 12 (07): 42195-42200. DOI: 10.24327/IJRSR.

Vamvuka D. Raftogianni A. 2021. Evaluation of pig manure for environmental or agricultural applications through gasification and soil leaching experiments. Appl Sci 11: 12011. DOI: 10.3390/app112412011.

Widodo, Turmudi E, Naibaho V. 2017. Growth and yield responses of peanuts on dolomite and cow manure doses. Intl J Agric Technol 13 (7.1): 1505-1516.

Yasa PAS, Kartini L, Mahardika IBK. 2019. Effects of pig manure and cow biourine dosage on growth and yield of tomato plants (*Solanum Lycopercium* L.). Sustain Environ Agric Sci 3 (1): 42-47.