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The Effect of Plant Spacing and Type of Manure on the Growth and Yield of Green Beans (*Vigna Radiata* L) Cultivar Vima I

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Abstract. The objectives of this study are: (1) To determine the effect of the combination of planting distance and type of manure on the growth and yield of green bean plants (Vigna radiata L) *cultivar VIMA-1, (2) To determine the combination of planting distance and type of manure that can have the best influence on the growth and yield of mung bean plants (*Vigna radiata L) VIMA-1 cultivar. The research was conducted in Wirakanan Village, Kandanghour District, Indramayu Regency, from December 2020 to January 2021. The research method used is the Group Random Design (RAK) method. The treatment consists of three levels of planting distance (20x25 cm, 20x30 cm, and 20x35 cm) and three types of manure (chicken, goat, and cow) with a dose of 6 tons/ha for each manure and without manure. The combination is repeated three times so that there are 36 tiles. Variables observed include Plant height, number of leaves, number of pods, weight of 100 grains, weight of dry seeds per plant, and dry weight per plot. The results showed that: (1) the combination of planting distance and type of cow manure significantly affected plant height aged 15, 22, and 29 HST, number of leaves aged 15, 22, and 29 HST, total number of pods, and seed weight per plot. (2) the combination treatment of planting distance and type of manure produces plant height higher is produced by combination D (20x25 cm and cow manure) at the age of 15, 22, and 29 HST, the combination of planting distance and type of manure produces the number of leaves, the higher is produced by the combination of D (20x25 cm and cow manure) at the age of 15, 22 and 29 HST, the combination of planting spacing and type of manure produces the number of pods, the higher one is produced by the combination of D (20x25 cm and cow manure), the combination of planting spacing and type of manure produces the weight of seeds per plot, the higher one is produced by the combination of D (20x25 cm and cow manure). The combination of spacing treatment (20 x 25 cm) and manure (chicken, goat, or cow) at a dose of 6 tons/ha has the best effect on the weight of dry beans per plot, which is 0.64 kg or equivalent to 15.23 quintals/ha (80% effective land).

Keywords: Plant Spacing, Green Beans, Manure

INTRODUCTION

Green beans include food crops that have long been cultivated in Indonesia. It is thought to have originated in India in the early seventh century, along with trade and religious relations between India and Indonesia (Amirudin, 2012). In Indonesia, green beans are a food crop. Green

beans have the advantage of being genjah aged (55-65 days), tolerant of drought, and can be planted in less fertile areas, so that the potential to be developed in sub-optimal lands (Trustinah *et al.*, 2014). According to Cahyono (2007), Green beans are annuals that are easy to cultivate. Green beans can grow in all types of well-drained soil. This plant can be planted at 0-500 meters above sea level. To grow and develop properly, green beans require optimal rainfall of 50-200 mm/month, with temperatures of 20- 35o C, air humidity of 50-80%, and enough sunlight.

Green beans, as a source of vegetable protein, are a strategic commodity because the demand for food, feed, and industry is large yearly (Alfandi, 2015). Compared to other types of bean crops, green beans have advantages in agronomy and economy, such as more drought resistance, fewer pest and disease attacks, being harvested at full age, less fertile land, and easy to cultivate (Wan Barus *et al.*, 2014). Green beans are a significant food crop because they provide various sources of food protein that are easily digested. The seeds contain 24.7% protein, 0.6% fat, and 0.9% fiber (Astawan, 2009). According to Syofia et al. (2014) that the content of green beans contains nutritious substances, including amylum, manganese, magnesium, niacin, and vitamins (B1, A, and E). Green bean production is still relatively low, based on data from the Ministry of Agriculture in 2013-2017 mung bean production in West Java for the last five years (2013-2017) can be seen in Table 1.

Table 1. Area of Harvest, Production and Productivity of Mung Bean Plants in West Java Province

Num	Year	Harvest Area (Ha)	Production (Ton)	Productivity (Ton/Ha)
1.	2013	9.121	11.002	1,206
2.	2014	10.228	12.749	1,246
3.	2015	7.607	9.691	1,274
4.	2016	7.744	9.699	1,253
5.	2017	8.543	10.715	1,252
Rata-rata		8.648	10.771	1,246

Source: Agricultural Statistics, Ministry of Agriculture (2017)

Based on the Ministry of Agriculture in 2013-2017, the area of mung bean harvest in West Java in 2013 was 9,121 ha. In 2017, it showed that the harvest area of mung beans was 8,543 ha, with a production of 10,715 tons and productivity of 1,252 tons/ha. The area of harvest, production, and productivity of mung bean plants in West Java fluctuates because mung bean plants are side crops, not the main crop, and usually, mung bean plants are planted after rice plants are harvested. In addition, the average productivity of green beans in West Java is 1,246

tons/ha, which is still below the potential yield that can be achieved at 2.4 tons/ha (Baliktabi, 2016). Low productivity of mung bean plants due to suboptimal cultivation techniques, especially in maintenance such as fertilization that is not by recommendations and the level of soil fertility is getting lower.

One of the efforts to increase production is to regulate the number of plants per hectare or planting distance, which is essential for getting high yields. Like tillage, corn yield is also influenced by the number of plants per unit area. Proper spacing for plant types is aimed at avoiding competition between plants in water absorption, nutrients, use of sunlight, and competition with nuisance plants. Proper planting spacing is essential for the maximum utilization of sunlight for photosynthesis (Kartika, 2018).

In addition to spacing planting, using inorganic fertilizers and pesticides containing chemical compounds causes soil fertility to be reduced, which can reduce plant productivity. The alternative effort to improve the physical properties of the soil or increase the fertility of agricultural soil sustainably is by providing organic matter; organic matter is one of the soil improvers that has felt the benefits in improving soil properties, both physical, chemical, and biological properties of the soil. Physically improve soil structure, determine the level of development of soil structure, and play a role in forming soil aggregates (Ega Ginanjar, 2020). Organic fertilizers increase the soil's physical, chemical, and biological fertility and streamline the use of inorganic fertilizers.

The quality and composition of organic fertilizers vary depending on the primary material of compost and the manufacturing process. The use of legumes, both in the form of alley cropping and cover crops, as well as in situ organic matter, needs to be intensified to support non-commercial organic fertilizers and restore soil fertility. (Hartatik 2015). Manure treatment needs to be done to reduce environmental pollution. Manure processing can be done by using manure as manure. Livestock manure is used as manure because of its nutrient content, such as nitrogen (N), phosphorus (P), and potassium (K), as well as micronutrients, including calcium, magnesium, sulfur, sodium, iron, and copper needed by plants and soil fertility (Hapsari, 2013).

In their research, Lingga and Marsono (2006) concluded that using organic fertilizers such as manure (manure) is one alternative to maintain soil fertility. Manure can also reduce the use of artificial fertilizers that are relatively expensive and difficult to obtain. The benefits of organic fertilizers are not only determined by the content of nitrogen, phosphoric acid, and calcium alone but also contain almost all macro and micronutrients needed by plants and play a role in maintaining nutrient balance in the soil. In his research, Atman (2020) concluded that the dose

and type of manure play a vital role in increasing soil fertility, significantly improving the soil's physical, chemical, and biological properties.

The more manure is applied, the more soil fertility increases, which can increase plant productivity because of increased nutrient uptake. Surya et al. (2013) state that goat manure can be used as organic matter in making manure because the nutrient content is relatively high, where goat manure mixes with urine (urine), which also contains nutrients that improve the soil. Based on the problems described above, it is necessary to research to determine the effect of planting distance and type of manure on the growth and yield of green beans (*Vigna radiata* L) cultivar vima I.

METHOD

This research has been carried out in the rice field area of Wirakanan Village, Kandanghaur District, Indramayu Regency, which is located at an altitude of 5 meters above sea level, the air temperature in the area ranges from 27o C – to 33o C. Air humidity between 75% – 80%, clay texture and has a degree of soil acidity. Based on rainfall over the past ten years, the average rainfall in the area is 0.842 mm/year and belongs to the moderate type of rainfall (D). This experiment was conducted during the third planting season or from December 2019 to January 2020. The material used in this study is green beans, namely the cultivar Vima 1. This cultivar has a potential yield of 1.96 tons/ha. Harvest age 60-67 days, plant height 53-60 cm, fertilizer used in this study is manure (chicken manure 6 tons/ha, goat manure 6 tons/ha, and cow manure used as much as 6 tons/ha).

The tools used in this study were machetes, hoes, calipers, analytical scales, hand sprayers, drills, meters, and stationery. This study's experimental design is group randomized (RAK), which consists of 12 treatment combinations. The first factor that is careful is the planting distance, which is 20 cm x 25 cm, 20 cm x 30 cm, 20 cm x 35 cm, and the second factor is manure, including chicken manure 6 tons/ha, goat manure 6 tons/ha, and cow manure at a dose of 6 tons/ha. The combination of treatments is as follows:

A = Plant distance 20 cm x 25 cm, without fertilizing the barn

B = Plant spacing 20 cm x 25 cm, chicken manure

C = Plant distance 20 cm x 25 cm, feed the goat

D = Planting distance 20 cm x 25 cm, cow manure

E = About 20 cm by 30 cm, without a rifle

F = Plant spacing 20 cm x 30 cm, chicken manure

G = Plant distance 20 cm x 30 cm, feed the goat

H = Planting distance 20 cm x 30 cm, cow manure

I = Planting distance 20 cm x 35 cm, without manure

J = Plant spacing 20 cm x 35 cm, chicken manure

K = Plant distance 20 cm x 35 cm, feed the goat

L = Planting distance 20 cm x 35 cm, cow manure

Of the 12 treatment combinations, each was repeated three times, resulting in 36 trial plots. Population per plot; 67, 56, and 48 plants and were sampled 5 plants/experimental plots so that there were a total of 180 plants in observation units

The main observations processed using the linear model proposed by Ali Hanafiah (2001) are as follows:

$Xij = \mu + ri + tj + \varepsilon ij$

Where:

Xij = Observation result on the i-th replay, j-th treatment

μ = General average value

ri = Effect of i-th test.

tj = Influence of the jth repeat.

εij = Random influence of the i-th replay and the j-th treatment.

Based on the following linear model, a list of various fingerprints can be compiled as shown in Table 2 below:

Table 2. Variety Fingerprint List (Anova)

Sources of Diversity	DB	JK	KT	F_{Count}	$F_{0.05}$
Deuteronomy (r)	2	Σ Yi...2/t – Y...2/rt	JK(r)/DB(r)	KT(r)/KTG	4,543
Treatment (t)	9	Σ Yj...2/t – Y...2/rt	JK(t)/DB(t)	KT(t)/KTG	2,403
Error (G)	12	JK(T)-JK(r)-JK(t)	JK(G)/DB(G)		
Total (T)	35	Σ Yi ... 2 – Y... 2/rt			

Source: Hanafiah (2001)

Information:

Yi = Total j-th repeat

Yj = Total I-like hold

Y... = General Total

Yij = The number of observations of the j-type in the i-th group

From the results of data processing or variety analysis, if there is a noticeable difference from the treatment or Fcalculate is greater than the F_{table} at a real level of 5%, then the test is continued using the Scott-Knott group test. The steps of the Scott-Knott Cluster Test are as follows:

1. The average value of treatment is arranged in order from smallest to largest.
2. Determine the comparison value λ (lambda) using the formula:

$$\lambda = \frac{\pi B0-Max}{2S_0^2(\pi-2)} = 1.376\frac{B_{0-Max}}{S_0^2}$$

$$S_0^2 = \frac{\sum(Yi - Y \ldots.)2 + a\,S_y^2}{a+t}$$

Information:

P = 22/7 = 3.14285

Bo-max = Number of squares of the largest pair of value groups

Yi = The average value of the i-th treatment

Y ..... = General average value

Sy2 = S_e^2 / r = ragam galat rata-rata

Se2 = Variety of error attempts

R = Number of repetitions

A = Degree error-free experiment

t = The average value of the treatment compared

1. The spread of λ (lambda) is approached by the spread of Chi-Kuadrat (X2) with the following free degrees: a0 = t / (Π – 2)= 0.875t
2. Test rules if λ (lambda) is smaller than Chi-Squared (X2), then the average group of treatment tested is uniform. If λ (lambda) is greater than Chi-Squared (X2), then the group average value of the tested treatment is not uniform. Testing is continued on each cluster fraction, until the average value of uniform treatment is obtained.

DISCUSSION

The results of soil analysis showed that the soil used for the experiment belonged to clay-textured soil types and had a pH content of H2O 6.6 (Neutral), C-organic 1.19% (low), N-total 0.12 (very low), C/N ratio 10 (medium), P2O5 116.1 ppm (very high), K 155.4 ppm (very high). From the results of soil analysis, it can be seen that the C-organic content in the criteria is low. Therefore, applying chicken, goat, and cow manure with planting distances of 20 cm x 25 cm, 20

cm x 30 cm, and 20 cm x 35 cm is expected to increase C-organic so that manure can work optimally. The results of manure analysis show that chicken, goat, and cow manure has several nutrient contents, as in Table 3.

Table 3. Nutrient Content In Chicken, Goat And Cow Manure

Num	Parameter	Chicken (%)	Goat (%)	Cow (%)
1	pH	7,77	9,05	-
2	Up Air	18,75	-	17,42
3	Organic Materials	48,13	-	-
4	N-Total	2,10	-	1,68
5	P_2O	5,03	0,70	2,08
6	K_2O	1,48	1,73	1,96
7	C/N Ratio	13,28	15,10	22
8	C-Organik	-	10,72	35,04

Observations supporting rainfall data obtained from the Department of Agriculture can be seen that the type of rainfall according to Schmidt-Ferguson (1951) includes type D rainfall (0.600 < Q < 1,000) that shows moderate criteria. So that green bean plants can grow optimally.

Key Observations

Main observations observed

includes plant height, number of leaves, total pod count and hollow pods per plantation, weight of 100 dry grains, and weight of dry seeds per plant and plot.

Plant Height (cm)

The results of data analysis of green bean plant height as listed in table 4.

Table 4. The Effect of Plant Spacing and Manure on the Height of Green Bean Plants

Treatment		Plant Height (cm)					
		15 HST		22 HST		29 HST	
A	(20x25)cm without manure	14,07	a	27,73	b	30,20	d
B	(20x25)cm chicken manure	16,80	b	24,20	a	27,60	c
C	(20x25)cm goat manure	17,20	c	24,00	a	27,03	c
D	(20x25)cm cow manure	18,07	c	27,07	b	32,00	d
E	(20x30)cm without manure	13,80	a	21,80	a	27,33	c
F	(20x30)cm chicken manure	15,20	a	23,20	a	27,93	c
G	(20x30)cm goat manure	16,07	b	22,07	a	27,20	c
H	(20x30)cm cow manure	16,33	b	23,33	a	27,60	c
I	(20x35)cm without manure	16,13	b	17,93	a	22,60	a

J	(20x35)cm chicken manure	17,40	c	22,27	a	25,60	b
K	(20x35)cm goat manure	16,13	b	20,73	a	24,20	a
L	(20x35)cm cow manure	17,73	c	20,73	a	23,53	a

Description: Numbers followed by unequal letters in the same column differ markedly according to (Scoot-Knoot Test)

Based on Table 4, the combination of planting distance and manure application significantly affects the variable height of mung bean plants at the age of 15 HST. Treatments C, D, J, and L differ markedly from treatments A, B, E, F, G, H, I, and K. The average height of plants is highest in treatment D. This is thought to be due to efforts to increase plant productivity by several factors, one of which is planting spacing. Planting with the proper planting distance and by the environment determines success. The effect of various planting distances and the application of various doses of manure is assumed to increase the availability of mineral and essential nutrients and support plant height growth.

It can be seen that the combination of planting spacing and manure application significantly affects the variable height of mung bean plants at the age of 22 HST. Treatment A and D significantly differed from treatment B, C, E, F, G, H, I, J, K, and L. The highest average plant height was in treatments A and D. A planting distance of 20 x 25 cm was considered appropriate in supporting the height growth of mung bean plants. In addition, the N content in chicken manure is very high; according to (Jumin, 2002), nitrogen elements enhance vegetative growth, especially leaves and roots, spurring budding and increasing man height.

It can be seen that the combination of planting spacing and manure application significantly affects the variable height of mung bean plants at the age of 29 HST. Treatment A, B, C, D, E, F, G, and H showed a marked difference from treatment I, J, K, and L. The highest average in plant height aged 29 HST is in treatment D; this is to Hardjadi's opinion (2002), setting planting distances that are too wide will cause the presence and growth of weeds higher so that there will be competition between plants and weeds in the utilization of existing resources such as nutrients, water, and sunlight to reduce the effectiveness of land use.

Another research relevant to the results of this study is research conducted by Rohmah and Mustofa (2018). Planting distance treatment of 30x25cm has a natural effect on the development of plant height, with an average yield of 27.54 cm at the age of 21 HST. Applying solid fertilizer to cows will improve soil structure, affecting plant growth through the development of plant roots and plant root physiological processes. Plant root physiology processes that are influenced by soil structure include nutrient absorption, water absorption, and respiration, which can affect

the development of plant height. The treatment shows the development of plant height reaches a height of up to 33.61cm (Firmansyah et al., 2021).

Number of leaves

The statistical analysis results show that the combination of planting distance and manure really influences the variable number of green bean leaves at the age of 15, 22, and 29 HST. The results of data analysis of the number of green bean leaves are listed in Tables 5, 6, and 7. Based on Table 5, the influence of planting spacing and manure application significantly affects the parameter of the number of green bean trifoliate leaves at the age of 15 HST. Treatment L significantly influences treatments A, B, C, D, E, F, G, H, I, J, and K. The highest average value in the variable number of trifoliate leaves 15 HST shows in treatment L.

This is the opinion of Sutedjo (2002), who states that the element Nitrogen (N) is the primary nutrient for plant growth, which is generally necessary for forming vegetative parts of plants such as leaves, stems, and roots. The process of photosynthesis will be more active so that it will make plants grow well. Solid fertilizer, in addition to improving the physical properties of the soil, can provide nutrients for plants, where the nutrient Nitrogen (N) in cow manure plays a role in the growth rate of plant height, which is in line with the opinion of Sutedjo (2002), stating nitrogen is the primary nutrient for plant growth, which is generally very necessary for the formation of vegetative parts of plants can be seen in Table 5.

Table 5. The Effect of Plant Spacing and Manure on the Number of Green Bean Leaves

Treatment		Number of leaves					
		15 HST		22 HST		29 HST	
A	(20x25)cm without manure	8,40	b	11,80	b	38,13	c
B	(20x25)cm chicken manure	8,20	b	13,00	b	39,40	d
C	(20x25)cm goat manure	8,20	b	12,00	b	41,73	e
D	(20x25)cm cow manure	7,80	b	12,80	b	47,20	f
E	(20x30)cm without manure	6,60	a	10,80	a	37,00	b
F	(20x30)cm chicken manure	6,80	a	12,20	b	38,40	c
G	(20x30)cm goat manure	7,00	a	11,80	b	39,20	d
H	(20x30)cm cow manure	7,80	b	12,20	b	43,40	e
I	(20x35)cm without manure	6,40	a	10,00	a	32,60	a
J	(20x35)cm chicken manure	7,40	a	11,00	a	36,20	b
K	(20x35)cm goat manure	7,00	a	10,00	a	38,73	c
L	(20x35)cm cow manure	9,40	c	11,00	a	41,40	e

Description: Numbers followed by unequal letters in the same column differ markedly according to (Scoot-Knoot Test)

The combination of planting spacing and manure application significantly affects the variable number of green bean trifoliate leaves at the age of 22 HST. Treatments A, B, C, D, F, G, and H showed a significantly different effect from treatments E, I, J, K, and L. In the variable number of trifoliate leaves at 22, HST treatment B showed the average value of the number of trifoliate leaves. The results of this study are in line with research conducted by Wijaya (2008), which concluded that element N in plants would encourage the growth of organs related to photosynthesis, namely leaves; nitrogen deficiency causes disrupted plant growth and development and decreased yields caused by disruption of the formation of chlorophyll which is very important in the process of photosynthesis.

It can be seen that the combination of the influence of planting spacing and manure application has a significant effect on the parameter of the number of green bean trifoliate leaves at the age of 29 HST. Treatment D showed a marked difference from treatment A, B, C, E, F, G, H, I, J, K, and L. The best effect of the variable number of trifoliate leaves in general 29 HST was seen in treatment D. This affects photosynthesis and, consequently, will also affect the formation of buds and leaves so that the number of leaves in plants will increase with the lower population (Basuki, 2000). Another research relevant to the results of this study is a study conducted by Sarianti et al. (2017), which stated that at the age of 2 weeks of mung bean plants, the measurement of the number of leaves showed that the treatment with cow manure was 8.38 strands. At the age of 3 weeks, the measurement of the number of leaves showed that the treatment with cow manure was 18.63 strands.

Number of Total Pods and Hollow Pods

The statistical analysis results show that the combination of planting distance and manure really influences the variable number of total pods. The variable number of hollow pods showed no markedly different effect. The results of data analysis of mung bean plant height are listed in Table 6.

Table 6. Effect of Plant Spacing and Manure on Total Pod and Vacuum Pod Count

Treatment		Number of pods Total		Number of Hollow Pods	
A	(20x25)cm without manure	58,20	a	15,13	a
B	(20x25)cm chicken manure	65,53	b	17,60	a
C	(20x25)cm goat manure	77,33	c	18,07	a
D	(20x25)cm cow manure	81,47	c	18,07	a
E	(20x30)cm without manure	54,47	a	18,13	a
F	(20x30)cm chicken manure	59,20	a	18,13	a
G	(20x30)cm goat manure	74,07	c	18,27	a
H	(20x30)cm cow manure	77,87	c	18,33	a
I	(20x35)cm without manure	66,47	b	18,67	a
J	(20x35)cm chicken manure	66,13	b	19,93	a
K	(20x35)cm goat manure	79,67	c	20,33	a
L	(20x35)cm cow manure	81,73	c	23,53	a

Description: Numbers followed by unequal letters in the same column differ markedly according to (Scoot-Knoot Test)

Based on Table 9, the spacing treatment and manure combination show a significantly different effect on the variable number of total pods. The C, D, G, H, K, and L treatments showed markedly different effects on A, B, E, F, I, and J treatments. This states that the planting distance will affect the effectiveness of plants' nutrient absorption and light intensity, so the more comprehensive the planting distance, the more opportunities for water absorption and nutrients the plant population will have per unit area. Jumin (2002) stated that plant density or planting distance is inseparable from the amount of yield obtained from a piece of land. Plant production results from reproductive factors and vegetative growth; planting distance will be closely related to competition between plants in obtaining sunlight and nutrients needed for plant growth and yield.

Bustami et al. (2012) stated that plant growth and production will reach optimal if the supporting factors of growth are in optimal conditions, balanced elements, the correct dose of fertilizer, and the nutrients needed are available for plants. Applying fertilizers on the dose and needs can increase yields, while excessive application will reduce plant yields. In line with the opinion of Ardisarwanto (2005), the amount of nitrogen absorbed by plants through the soil will initially accumulate on the stems and leaves. However, most of the nitrogen will be distributed into the seeds after forming pods. So, vegetative growth affects the generative development of plants. Increasing the number of pods to the optimum point is related to the function of nutrients (P), which play a role in encouraging root growth, which then optimizes the absorption of water

and nutrients. Alfandi (2015) Phosphorus elements help in the cultivation of green beans, especially in soils where the availability of P is deficient due to low pH in the soil; phosphate absorption will be maximized when inoculated with *Arbuscular Mycorrhizal Fungi (CMA).*

Weight 100 Dry Grains (grams)

The statistical analysis results show that planting spacing and manure do not really influence the variable weight of 100 dry grains.

Table 7. The Effect of Spacing And Manure on The Weight of 100 Dry Grains

Treatment		Weight 100 dry grains (gram)	
A	(20x25)cm without manure	9,27	a
B	(20x25)cm chicken manure	9,50	a
C	(20x25)cm goat manure	9,73	a
D	(20x25)cm cow manure	9,97	a
E	(20x30)cm without manure	9,43	a
F	(20x30)cm chicken manure	9,67	a
G	(20x30)cm goat manure	9,97	a
H	(20x30)cm cow manure	10,20	a
I	(20x35)cm without manure	9,87	a
J	(20x35)cm chicken manure	10,10	a
K	(20x35)cm goat manure	10,47	a
L	(20x35)cm cow manure	10,70	a

Remarks: Numbers followed by unequal letters in the same column differ markedly according to (Scoot Knoot Test).

Table 10 shows that the spacing and manure application combination similarly affect the variable weight of 100 dry grains. This is related to the influence of genetic factors on the number of pods formed and the number of hollow pods in the planting unit. In Santria Marpaung's opinion (2020), planting distance has an intangible effect on plant height, productive branches, number of pods, seed weight per plant, and weight of 100 seeds. According to Hastuti et al. (2015), the number of green bean seeds depends on the number of pods produced, but not all pods produce whole seeds due to environmental factors such as water and light, resulting in a decrease in the number of seeds.

Dry Seed Weight Per plant and Per Plot (grams)

The results of the statistical analysis show that the combination of planting spacing and manure has a real influence on the parameters of dry seed weight per plant and dry weight per plot. The results of the analysis of dry bean weight data per plot are listed in Table 8.

Table 8. Effect of Plant Spacing and Manure on Dry Seed Weight Per Plant and Per Plot (g)

Treatment		Dry seed weight per plant (g)		Dry seed weight per tile (g)	
A	(20x25)cm without manure	46,00	a	620.00	d
B	(20x25)cm chicken manure	47,00	a	635.67	d
C	(20x25)cm goat manure	48,33	a	644.67	d
D	(20x25)cm cow manure	49,33	a	667.33	d
E	(20x30)cm without manure	46,67	a	569.67	c
F	(20x30)cm chicken manure	48,33	a	558.67	c
G	(20x30)cm goat manure	49,67	a	578.67	c
H	(20x30)cm cow manure	51,00	a	570.67	c
I	(20x35)cm without manure	49,67	a	473.00	a
J	(20x35)cm chicken manure	51,00	a	484.00	a
K	(20x35)cm goat manure	52,67	a	501.67	b
L	(20x35)cm cow manure	54,00	a	513.27	b

Remarks: Numbers followed by unequal letters in the same column differ markedly according to (Scoot Knoot Test).

Based on Table 11, it can be seen that the combination of spacing treatment and manure application shows a significantly different effect on the variable weight of dry beans per plot (grams). Treatments A, B, C, and D showed different influences on dry weight variables per plot, with the best results in treatment D. Plants need nutrients and sunlight to carry out the photosynthesis process, nutrients that are sufficiently available and can be used by plants properly, and the ability of plants to absorb more light can launch the photosynthesis process. According to Hardjadi (2005), setting a planting distance that is too wide will cause the presence and growth of weeds to be higher so that there will be competition between plants and weeds, in line with the opinion of Jumin (2005) states that plant density or planting distance has an inseparable relationship with the amount of yield obtained from a piece of land. Reproductive factors, vegetative growth yields, and planting distance will be closely related to competition between plants in obtaining sunlight and nutrients needed for plant growth and yield. The right plant population will determine the level of mung bean production to be achieved.

Based on Table 11, the spacing treatment and manure application combination does not show a natural effect on the variable dry seed weight per plant (grams). This was conveyed by Susilowati (2002). Regulation of plant density in one planting area is necessary; this is done to reduce competition among plants and obtain increased yields from cultivated plants, namely by increasing plant density or plant population.

They were added by Nurtika (2007), who said that a plant will grow and reach a high production level if the nutrients needed by plants are sufficient and balanced in the soil. Another study relevant to the results of this study is research conducted by Firmansyah et al. (2021), which concluded that the application of solid fertilizer to cow dung has a natural effect on the number of pods per mung bean plant with 13 pods, dry seed weight of 9.65 grams / per plant equivalent to 1.6 tons/hectare with the best treatment using cow manure. The relevant research results are research conducted by Irna (2014), which states that the application of solid organic fertilizer has a natural effect on plant height parameters, pod weight per plant, and weight of 100 seeds. The best application dose was 50.63 g/plot (225 kg/ha).

CONCLUSION

Based on the results of the study can be concluded:

1. The combination of 20x25 cm spacing treatment and cow manure type had a significant effect on variable plant height aged 15, 22 and 29 HST, number of leaves aged 15, 22 and 29 HST, total pods and seed weight per plot.
2. The combination of spacing treatment (20 x 25 cm) and manure (chicken, goat or cow) at a dose of 6 tons / ha has the best effect on the weight of dry beans per plot, which is 0.64 kg or equivalent to 15.23 quintals / ha.

Based on the conclusions above, the author can suggest the following:

1. To increase the growth and yield of mung bean plants (Vigna radiata L) Vima-1 cultivar, *20x25 cm planting distance treatment and application of cow or chicken manure can be recommended for the cultivation of mung bean plants (*Vigna radiata *L) Vima-1 cultivar*.
2. To get recommendations for planting spacing treatment and applying manure to green bean plants (*Vigna radiata* L) Vima-1 cultivars that are more appropriate, it is necessary to conduct further research in different places and seasons.

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