

## Research Article

# Effect of legowo planting system and doses of cow manure on growth and yield of maize (*Zea mays* L.)

## *Pengaruh sistem tanam jarak legowo (2 : 1) dan berbagai dosis pupuk kandang sapi terhadap pertumbuhan dan hasil tanaman jagung (Zea mays L.)*

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**Abstract:** Increasing of maize productivity can be reached through using of superior varieties BISI 18, application of organic fertilizer, and regulation of crop populations. This study was aimed to know the influence of jarak legowo planting system (2:1) and cow manure on growth and yield of maize. This research was conducted in Bualemo B, Bualemo, Banggai from July up to October 2020. The experiment was arranged in Randomized Block Design with 2 factors, the first factor is the spacing of planting in legowo planting system (2:1), which consists of 3 levels namely 70 x 25 x 25 cm (J1), 70 x 30 x 30 cm (J2), 70 x 35 x 35 cm (J3), the second factor is the dose of manure which consists of 3 levels namely 8 tons/ha (K1), 9 tons/ha (K2), and 10 tons/ha (K3). Each treatment had 3 replications so there were 27 treatment plots. The results showed that the combination of jarak legowo planting system and cow manure has no effect on the height of plants at 2, 4, and 6 weeks after planting, as well as the number of leaves, but giving the effect on the height of plants at 8 weeks after planting. The combination of jarak legowo planting system and cow manure has a real effect on the average weight of cob and has a very real effect on dry weight per plot. The weight average in corn cobs about 239.67 grams in the spacing of planting 70 x 35 x 35 cm with 8 tons/ha dose of manure. While the grain dry weight average is highest in the spacing of planting 70 x 35 x 35 cm with 10 tons/ha dose of manure and it is about 212.56 ounces.

**Keywords:** Jajar legowo, cow manure, maize

**Abstrak:** Peningkatan produktivitas jagung dapat dilakukan melalui penggunaan varietas unggul BISI 18, pemberian pupuk organik dan pengaturan populasi tanaman. Penelitian ini bertujuan untuk mengetahui pengaruh jarak tanam dengan sistem tanam jarak legowo (2:1) serta pemberian pupuk kandang sapi terhadap pertumbuhan dan hasil tanaman jagung hibrida. Penelitian ini dilaksanakan di Desa Bualemo B, Kecamatan Bualemo, Kabupaten Banggai pada bulan Juli hingga Oktober 2020. Percobaan menggunakan Rancangan Acak Kelompok (RAK) pola faktorial dua faktor, faktor pertama adalah jarak tanam pada sistem tanam legowo 2:1 yang terdiri dari 3 taraf yaitu 70 x 25 x 25 cm (J1), 70 x 30 x 30 cm (J2), 70 x 35 x 35 cm (J3), faktor kedua adalah dosis pupuk kandang sapi yang terdiri atas 3 taraf yaitu 8 ton/ha (K1), 9 ton/ha (K2), dan 10 ton/ha (K3). Masing-masing kombinasi perlakuan terdiri dari 3 ulangan, sehingga terdapat 27 unit perlakuan. Hasil penelitian menunjukkan kombinasi perlakuan sistem tanam jarak legowo dan pupuk kandang sapi tidak berpengaruh nyata terhadap tinggi tanaman pada umur 2, 4, dan 6 mst serta jumlah daun tanaman, namun berpengaruh sangat nyata terhadap tinggi tanaman umur 8 mst. Kombinasi perlakuan sistem tanam jarak legowo dan pupuk kandang sapi berpengaruh nyata terhadap berat tongkol dan berpengaruh sangat nyata terhadap berat kering pipilan per petak. Rata-rata berat tongkol jagung hibrida tertinggi pada perlakuan jarak tanam 70 x 35 x 35 cm dengan dosis pupuk kandang 8 ton/ha sebesar 239,67 g. Adapun rata-rata berat pipilan kering per petak tertinggi pada perlakuan jarak tanam 70 x 35 x 35 cm dengan dosis pupuk kandang 10 ton/ha sebesar 212,56 ons.

**Kata kunci:** Jajar legowo, pupuk kandang sapi, jagung

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## INTRODUCTION

The prospect of developing corn farming is very bright to increase farmers' income and welfare. Corn plants in Indonesia also have economic value but have fluctuating production levels every year and a relatively low increase in production each year ([Wahyudin et al., 2017a](#)). The presentation of data from the [Central Statistics Agency \(BPS\) \(2020\)](#) of Banggai Regency shows that there has been no actual increase in corn crop productivity for the last five years. Data for Bualemo District shows that in 2015 productivity was 5.7 tons/ha; from 2016 to 2018, productivity data was stagnant at 4.68 tons/ha, then in 2019, it was only 5.7 tons/ha.

Efforts to increase crop productivity can be made by introducing cultivation technology, such as using superior varieties, regulating plant populations, and applying organic manure. According to [Erawati and Hipi \(2016\)](#), hybrid corn varieties have many advantages compared to ordinary corn seeds, among others, faster harvesting period, more resistance to pests and diseases, and higher productivity. Setting the plant population can adopt the *jajar legowo* system, which is usually used in the rice cropping system.

The principle of the *row legowo* planting system is that it can increase the plant population by adjusting the spacing so that the planting will have rows of plants interspersed with empty rows where the spacing on the edge rows is half the spacing between rows ([Silangit et al., 2018](#)). *Jajar legowo* is a planting method designed to increase plant productivity through growing plant populations and utilizing the effects of marginal plants, where planting is done by closing the distance between plants in rows and stretching the space between *legowo* plants ([Balitbangtan, 2016](#)).

The use of organic fertilizers, green manure and animal manure compost can be used to cultivate corn plants; according to the research results of [Khair et al. \(2013\)](#), the application of chicken manure can increase the growth and production of maize. Organic fertilizers can reduce Phonska's NPK dose by half from the recommended dose ([Tumewu et al. 2017](#)). Organic fertilizers are fertilizers that can be in the form of solid or liquid originating from plants and animals ([Rosadi et al. 2019](#)), which can improve the health of agroecosystems including biodiversity, biological cycles and soil biological activities by emphasizing the use of inputs from within and using natural methods mechanical, biological and cultural methods ([Ariyanto, 2011](#)). Therefore, the provision of cow manure and increasing the availability of nutrients can also improve the physical properties of the soil ([Asbur et al. 2019](#)). Based on this description, it is necessary to research the growth and yield of maize grown using the *jajar legowo* (2:1) cropping system and the application of cow manure at various doses.

## MATERIALS AND METHODS

This research was conducted in Bualemo B Village, Bualemo District, Banggai Regency. The study was conducted from July to October 2020. The experiment used a two-factor factorial randomized block design (RAK); the first factor was the spacing on the 2:1 *legowo* planting system, which consisted of 3 levels, namely 70 x 25 x 25 cm (J1), 70 x 30 x 30 cm (J2), 70 x 35 x 35 cm (J3), the second factor is the dose of cow manure consisting of 3 levels, namely 8 tons/ha (K1), 9 tons/ha (K2), and 10 tons/ha (K3). Each treatment combination consisted of 3 replications, so there were 27 treatment units. Variables observed were plant height, number of leaves, the weight of cob, and weight of dry shells per plot. The data obtained were analyzed by analysis of variance (Anova). If there is an effect, it will be tested further using the Tukey test.

## RESULTS AND DISCUSSION

The analysis of variance showed that the combination of treatment with the jajar legowo planting system and cow manure had no significant effect on plant height at the age of 4 and 6 weeks ([Table 1](#)). Based on the results of the Tukey test, the average plant height at the age of 4 weeks showed that treatments J2 (71.15 cm) and J3 (74.11 cm) were very significantly different from J1 (61.22 cm). In contrast, the K2 (70.26 cm) and K3 (70.04 cm) treatments were significantly other from the K1 treatment (66.19 cm). The average plant height at the age of 6 weeks showed that treatment J3 (121.96 cm) was very significantly different from J1 (99.26 cm) and J2 (113.15 cm). While the K3 (114.15 cm) treatment was very significantly different from the K1 (108.93 cm) and K2 (111.30 cm) treatments.

**Table 1.** The average height of corn plants aged 4 and 6 MST

Plant age	Treatments	K1	K2	K3	Treatment J	<i>p-value</i>
4 MST	J1	57,67	64,11	61,89	61,22 <sup>b</sup>	0,015
	J2	69,22	71,78	72,44	71,15 <sup>a</sup>	
	J3	71,67	74,89	75,78	74,11 <sup>a</sup>	
	Treatment K	66,19 <sup>b</sup>	70,26 <sup>a</sup>	70,04 <sup>a</sup>		
	<i>p-value</i>	0,000				
6 MST	J1	97,22	98,89	101,67	99,26 <sup>c</sup>	0,000
	J2	109,11	113,78	116,56	113,15 <sup>b</sup>	
	J3	120,44	121,22	124,22	121,96 <sup>a</sup>	
	Treatment K	108,93 <sup>b</sup>	111,30 <sup>b</sup>	114,15 <sup>a</sup>		
	<i>p-value</i>	0,001				

**Note:** Numbers followed by different letters in the same row or column are significantly different based on the Tukey test ( $p$ -value < 0.01).

The treatment of the jajar legowo planting system independently affected considerably plant height at 4 and 6 weeks of age. In contrast, the cow manure treatment alone had a significant effect on plant height at 4 mst and a significant impact on plant height at 6 mst. The results of [Bilman's \(2001\)](#) research show that wide plant spacing with a smaller population has a higher net assimilation rate than denser spacing. Corn growth and productivity are significantly influenced by plant spacing and variety ([Yulisma, 2011](#)). According to [Prananda et al. \(2014\)](#), the use of organic materials such as compost as an additive or substitute for topsoil increases the availability of nutrients in the soil.

The results of the analysis of variance showed that the combination of the Jajar Legowo planting system and cow manure had a very significant effect on the growth of corn plant height 8 mst ([Table 2](#)). The highest average hybrid maize plant height in the J3K3 treatment (planting distance of 70 x 35 x 35 cm + cow manure 10 tons/ha) was 209.67 cm, while the lowest was in the J1K1 treatment (planting distance of 70 x 25 x 25 cm + cow manure 8 tons/ha) which is 172.78 cm. This is by the research results of [Asbur et al. \(2019\)](#) that the interaction of treatment between cow manure and the spacing system had a significant effect on corn plant height.

**Table 2.** The average height of corn plants aged 8 mst

Treatments	Average	<i>p-value</i>
J1K1	172,78 <sup>d</sup>	0,000
J1K2	177,67 <sup>cd</sup>	

Treatments	Average	<i>p-value</i>
J1K3	181,89 <sup>c</sup>	
J2K1	181,89 <sup>c</sup>	
J2K2	193,56 <sup>b</sup>	
J2K3	203,78 <sup>a</sup>	
J3K1	208,89 <sup>a</sup>	
J3K2	208,22 <sup>a</sup>	
J3K3	209,67 <sup>a</sup>	

**Note:** The numbers followed by different letters mean that they are very significantly different based on the Tukey test ( $p$ -value < 0.01)

The treatment of the rowing legowo planting system had a significant effect on the number of plant leaves at the age of 6 mst. Meanwhile, at the age of 8 weeks after the observation, the treatment of the jajar legowo planting system had a significant effect on the number of plant leaves. The application of manure does not affect the number of leaves of corn plants ([Table 3](#)).

**Table 3.** The average number of leaves aged 6 and 8 MST

Plant age	Treatments	Average	<i>p-value</i>
6 MST	J1	12,78 <sup>b</sup>	0,001
	J2	12,67 <sup>b</sup>	
	J3	13,44 <sup>a</sup>	
8 MST	J1	15,04 <sup>b</sup>	0,011
	J2	15,59 <sup>ab</sup>	
	J3	15,85 <sup>a</sup>	

**Note:** The numbers followed by different letters mean that they are very significantly different based on the Tukey test ( $p$ -value < 0.01).

The treatment of J3 was effected on the number of leaves. This treatment is better than other treatments. This is by the research results of [Silangit et al. \(2018\)](#) that the jajar legowo planting system affects the number of leaves on corn plants at 56 days after planting. The analysis of variance showed that the combination of the Jajar Legowo planting system and cow manure had a significant effect on the average cob weight ([Table 4](#)).

**Table 4.** The average weight of corn cobs (grams)

Treatments	Average	<i>p-value</i>
J1K1	177,67 <sup>e</sup>	0,028
J1K2	183,00 <sup>de</sup>	
J1K3	184,00 <sup>de</sup>	
J2K1	200,67 <sup>cd</sup>	
J2K2	206,78 <sup>c</sup>	
J2K3	216,11 <sup>bc</sup>	
J3K1	239,67 <sup>a</sup>	
J3K2	231,22 <sup>ab</sup>	
J3K3	227,67 <sup>ab</sup>	

**Note:** The numbers followed by different letters mean that they are significantly different based on the Tukey test ( $p$ -value < 0.05).

The spacing treatment of the jajar legowo system added with cow manure gave better results on the average weight of the cobs. The average weight of the highest hybrid corn cobs in the J3K1 treatment was 239.67 grams. According to [Afandi et al. \(2015\)](#), the application of organic materials in the form of chicken manure, cow manure, and compost has a significant effect on the chemical properties of Entisol. In addition, it also affects the increase in soil organic C, soil pH, total soil N, soil available K and soil available P. According to [Wahyudin et al. \(2017\)](#), the absorption of P elements causes more photosynthate allocated to the cobs. The analysis of variance showed that the combination of the jajar legowo planting system and cow manure had a very significant effect on the dry shell weight per plot ([Table 5](#)).

**Table 5.** The weight of dry shelled maize per plot (ounces).

Treatments	average	<i>p-value</i>
J1K1	174,67 <sup>e</sup>	0,001
J1K2	182,67 <sup>d</sup>	
J1K3	189,89 <sup>cd</sup>	
J2K1	190,22 <sup>c</sup>	
J2K2	193,33 <sup>c</sup>	
J2K3	203,56 <sup>b</sup>	
J3K1	212,22 <sup>a</sup>	
J3K2	211,78 <sup>a</sup>	
J3K3	212,56 <sup>a</sup>	

**Note:** The numbers followed by different letters mean that they are very significantly different based on the Tukey test (*p-value* < 0.01).

The spacing treatment of the jajar legowo system added with cow manure (J3K3) gave a better average dry shell weight per plot of 212.56 ounces. As revealed by the [Food Crops Research Agency \(2011\)](#), the application of cow manure can increase crop production by up to 30%. [Suratmini \(2009\)](#) also put forward another supporting statement with the application of cow manure can increase the dry weight of corn seeds.

## CONCLUSIONS

The combination of treatment with the row legowo planting system and cow manure did not significantly affect plant height at 2, 4, and 6 mst, and the number of plant leaves, but had a very significant effect on plant height at 8 mst. The combination of treatment with the row planting system and cow manure had a significant effect on the weight of the cobs and a very significant effect on the dry weight of shells per plot. The average weight of the highest hybrid corn cobs in the J3K1 treatment was 239.67 grams. In contrast, the average dry shell weight per plot was the highest in the J3K3 treatment of 212.56 ounces.

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