

Response of Several Types of Manure And Dosages on Cabbage (*Brassica Oleracea* L.) Growth and Yield

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ABSTRACT

This research was conducted in Tiga Runggu, Simalungun Regency, Indonesia. This research was conducted using a factorial randomized block design consisting of two factors, i.e. application of manure types consisting of 3 treatments, namely J1: chicken manure, J2: cow manure and J3: buffalo manure. The second factor consisted of three treatments, namely: D1: 75g/plant, D2: 100g/plant, and D3: 125g/plant. The parameters observed in this study were: (a) rate of crop formation, (b) gross crop weight per sample plant, (c) net crop weight per sample plant, (d) gross crop weight per plot, and (e) net crop weight per plot. The results of the study showed that the type of manure treatment had a significant effect on the rate of crop formation, gross crop weight per sample plant, net crop weight per sample plant, gross crop weight per plot and net crop weight per plot.

Keyword: organic fertilizer, plant development, yield

INTRODUCTION

Cabbage is a soft-stemmed vegetable known since ancient times (2500-2000 BC) and was revered and venerated by the Ancient Greeks. Cabbage, with its Latin name (*Brassica oleracea*), was originally a wild plant in subtropical regions. This plant originates from Europe, first discovered in Cyprus, Italy, and the Mediterranean. Cabbage is a seasonal or short-lived vegetable. It can only produce once after which they will die. Cabbage is harvested when the cabbage reaches 60-80 days after planting (Cahyono, 2003). Cabbage is one of the commodities widely cultivated in Indonesia, especially in highland areas. Cabbage has significant potential for development, as it not only meets domestic demand but also serves as an export commodity. Indonesia is the fifth-largest vegetable supplier to Singapore, after Malaysia, China, Australia, and India. In 2009, cabbage exports reached 44,904 tons, the largest compared to other vegetables such as mushrooms, shallots, and potatoes. Central Java is the largest cabbage-producing region in Indonesia compared to other provinces.

Fertilizer is a material added to the soil to provide essential elements for plant growth. Fertilizers are generally classified based on the source of the material used, the application method, the form, and the nutrient content (Hadiuwito, 2007). Fertilization plays a crucial role in increasing cabbage production because it contains high levels of nutrients. However, the high cost of artificial fertilizer becomes a crucial obstacle for most farmers in Indonesia. Thus, the application of animal manure is an alternative fertilizer for sustainable agriculture.

Manure is a fertilizer derived from livestock, either in the form of solid waste (feces) mixed with food scraps or urine. Manure comes in two types: solid and liquid (Lingga and Marsono, 2013). Animal manure is an exceptional source of organic fertilizer which contains high percentage of nitrogen, phosphorus, potassium and other important nutrients readily available for plant uptake as compared to other organic sources. The present study is carried out to investigate the response of cabbage yield with the application of several types of animal manures.

RESEARCH METHODOLOGY

This research was conducted in Purba Dolok, Purba District, Simalungun Regency with an altitude of $\pm 1,200$ m above sea level. This research was conducted for three months, starting from November to January 2020. The materials used were: NPK fertilizer, chicken manure, cow, buffalo, insecticide with active ingredient Deltamethrin, and fungicide with active ingredient Propinep 70%, cabbage seeds Erna F1 Green Nova variety, water. The tools used were: Hoe, watering can, meter, pruning shears, scales, and stationery and other tools that support the research. This research used a 2-factor Randomized Block Design (RBD). The first factor is the type of manure (J) which consists of 3 treatment levels, namely: J1 = chicken manure, J2 = cow manure, J3 = buffalo manure. The second factor is the dosage of manure application (D) which consists of 3 treatment methods, namely: D1 = 75 grams/ plant, D2 = 100 grams/ plant and D3 = 125 grams/ plant.

The parameters observed include rate of crop formation (days), gross weight per sample plant (kg), net weight per sample plant (kg), gross weight per plot (kg) and net crop weight per plot (kg).

RESULTS AND DISCUSSIONS

The results of the study showed that the treatment of manure type and manure dosage significantly affected the rate of crop formation, gross crop weight per sample plant, net crop weight per sample planting, gross weight per plot and net weight per plot. The interaction of manure type and manure dosage treatment did not significantly affect the speed of crop formation, gross weight per sample plant, net weight per sample planting, gross weight per plot and net weight per plot. Further test was carried out with a 5% least significant difference (LSD) test to examine the differences between each type of manure treatment on the rate of crop formation, gross weight per sample plant, net weight per sample plant, gross weight per plot and net weight per plot. The results can be seen in table 1.

Table 1. Average difference test of the effect of manure type and manure dosage treatment on rate of crop formation, gross weight per sample plant, net weight of sample plant, gross weight per plot and net weight per plot.

Treatment	Rate of crop formation (Days)	Gross weight per sample plant (Kg)	Net weight per sample plant (Kg)	Gross weight per plot (Kg)	Net weight per plot (Kg)
J1	48.33 c	2.93a	1,97a	2.73a	1.94a
J2	51.78 b	2.56b	1,55b	2.52b	1.61b
J3	56.33 a	1.90c	1,24c	2.13c	1.23c
D1	54.44 a	1.93c	1,18c	1.79c	1.10c
D2	52.22 b	2.36b	1,51b	2.44b	1.43b
D3	49.78 c	3.11a	2,08a	3.17a	2.25a
J1D1	50.67	2.29g	1.44e	1.83g	1.19e
J1D2	48.67	2.97c	2.01b	2.91d	1.91c
J1D3	45.67	3.55a	2.47a	3.46a	2.72a
J2D1	54.00	2.18h	1.19f	2.06f	1.13e

J2D2	51.33	2.53f	1.51d	2.54e	1.53d
J2D3	50.00	2.98b	1.97b	2.98c	2.18b
J3D1	58.67	1.32i	0.91h	1.48i	0.98f
J3D2	56.67	1.57e	1.02g	1.86h	0.87g
J3D3	53.67	2.81d	1.79c	3.07b	1.86c

Note: Numbers followed by different notations in the same column are not significantly different at the 5% LSD level

Table 1 shows that the fastest crop formation was in treatment J1 (48.33 days), which was significantly different from J2 (51.78 days) and J3 (56.33 days). In addition, the treatment of manure dosage resulted in the fastest growth rate in treatment D3 (49.78 days) which was significantly different from D1 (54.44 days) and D2 (52.22 days). The results inferred that chicken manure has higher nutrient content compared to cow and buffalo manure. According to Afriyie et al. (2013), chicken manure contains higher macro nutrients (N, P, K) compared to cow manure. Furthermore, Duyar et al. (2009) reported a significant increase in the lettuce plant by applying chicken manure. The application of manure with a high dosage will affect not only plant growth but also produce high nutrient elements. According to Khalid et al. (2014), the addition of manure can create better soil conditions for plant growth, because manure can increase soil organic matter content and nutrient availability, thereby supporting plant growth speed.

The interaction between manure type and manure dosage resulted in the fastest rate of crop formation in treatment J1D3 (45.67 days) and the slowest in treatment J3D1 (58.67 days). This is likely because applying manure at a dosage of 125g per plant provides more nutrients. Increasing the dosage of manure will further improve plant growth. Manure can also improve the physical, chemical, and biological properties of the soil. Manure application maintains soil microorganisms and is able to provide water content in the soil. As plant growth improves, crop formation will also accelerate. To see the differences in each rate of crop formation, see Figure 1.

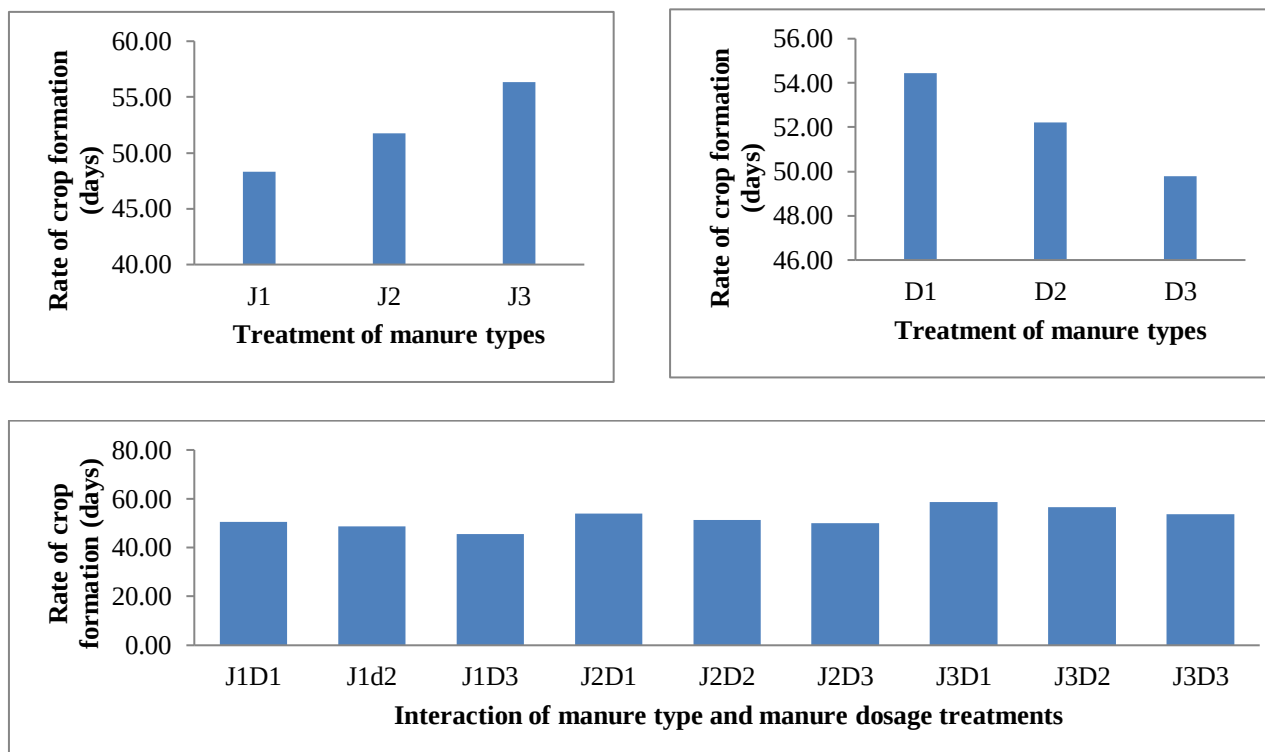


Figure 1. Histogram of the effect of treatment manure type, manure dosage and interaction of treatment manure type and manure dosage on rate of crop formation (days)

The highest gross and net crop weight per sample plant was found in treatment J1 (chicken manure) which was significantly different from treatments J2 (cow manure) and J3 (buffalo manure). In addition, the higher the dosages of manure applied (D3), the higher gross crop weight per sample plant, compared to the application of D2 and D1. These results are in accordance to the combination of manure type and manure dosage application, resulting in the highest both gross and net crop weight per plant in J1D3 and the lowest in J3D1 (Fig. 2 and Fig. 3).

Chicken manure contains three times more nitrogen than other manures (Damanik et al. (2011)). The N provided by chicken manure is very close the chemical fertilizer application. This substance can increase soil fertility (Widowati, 2004), so that roots can more easily absorb nutrients contained in the soil. Optimal application of manure to the soil has a positive effect on the physical, chemical and biological properties of the soil by increasing the development of microorganisms and the availability of nutrients needed by plants. Nutrients absorbed by the roots will be used by plants to increase plant growth. The provision of manure as a source of organic fertilizer can increase nutrient content, neutralize soil pH, and be able to bind water well in the soil to provide nutrients for plants during plant growth. Plant will grow and develop well if the required nutrients are present and available sufficiently and are in a form suitable for absorption by the root hairs.

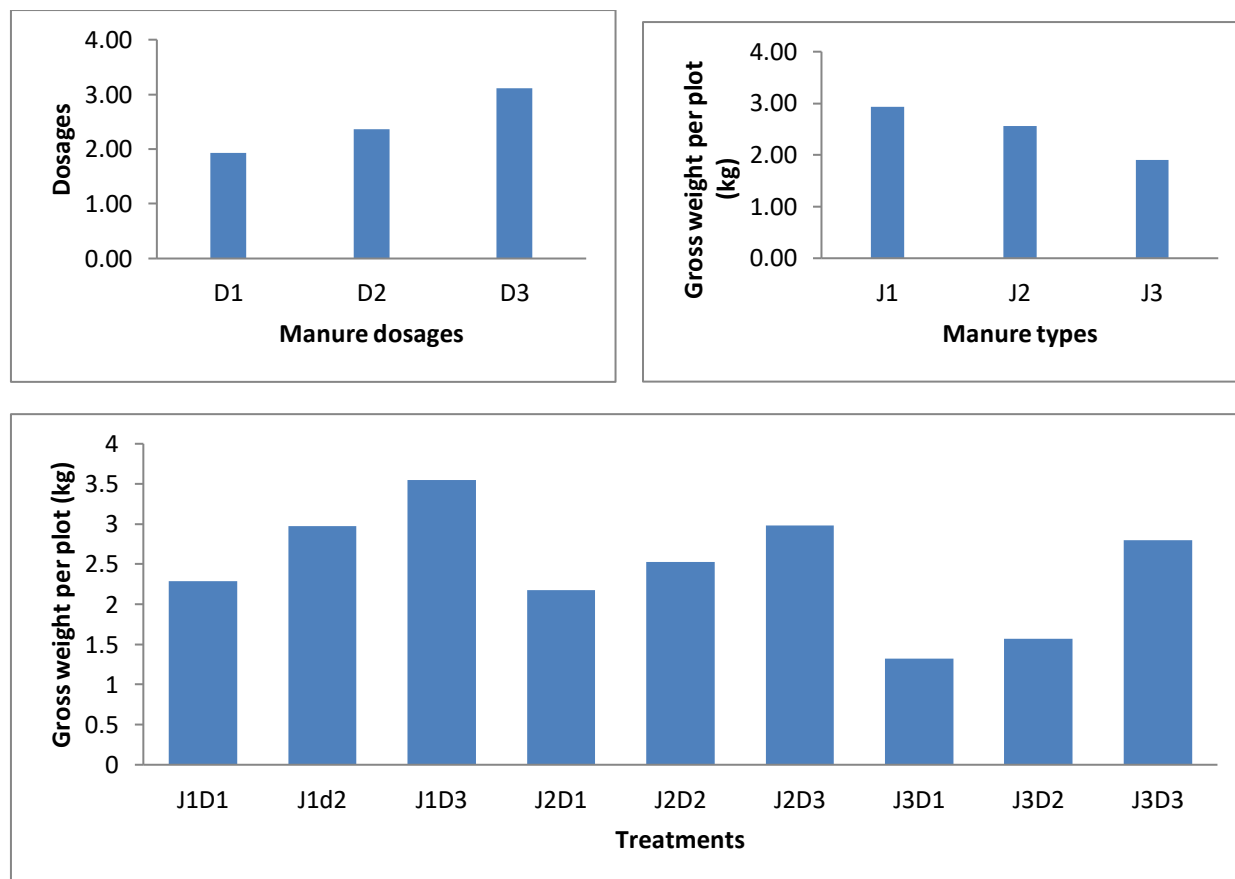


Figure 2. Histogram of the effect of manure type and manure dosage and the interaction of manure type and manure dosage treatment on gross crop weight per sample plant (kg)

The gross weight of manure per plot in treatment J1 (2.73 kg) was significantly different from treatment J2 (2.52 kg) and J3 (2.13 kg). This is thought to be due to chicken manure containing higher levels of N, P, and K, thus providing greater nutrient requirements for the plants. Chicken manure also decomposes more quickly in the soil compared to cow and buffalo manure, making the nutrients more readily available to plants. This is consistent with Sutejo's (2002) statement that the high N nutrient content in chicken manure is more adequate than other manures. If the nitrogen nutrient requirements of plants are met, it will improve plant growth. Better plant growth can improve the production of the plants.

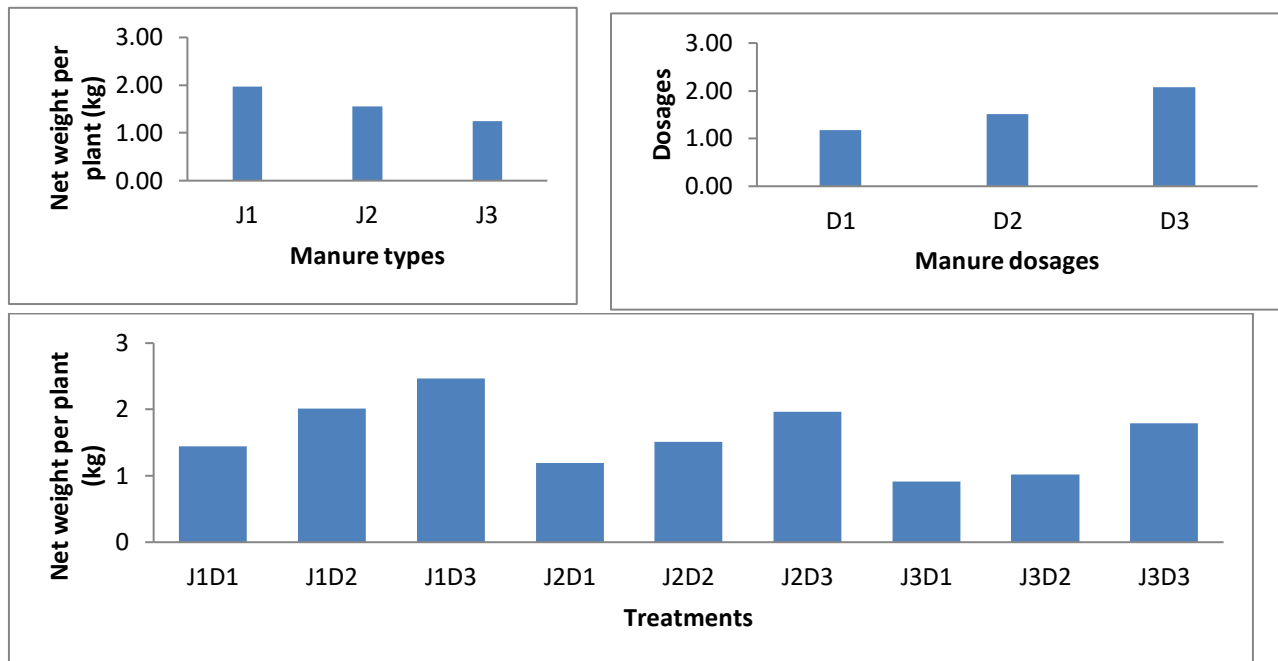


Figure 3. Histogram of the effect of manure type and manure dosage and the interaction of manure type and manure dosage treatment on net crop weight per sample plant (kg)

Similar trend was also observed when comparing the yield per plot values obtained, due to the effects of fertilizers and the dosage level on cabbage studied, it is inferred that the highest production yield, both in gross and net weight per plot were obtained by the combination of J1D3 applications (Fig. 4 and Fig. 5).

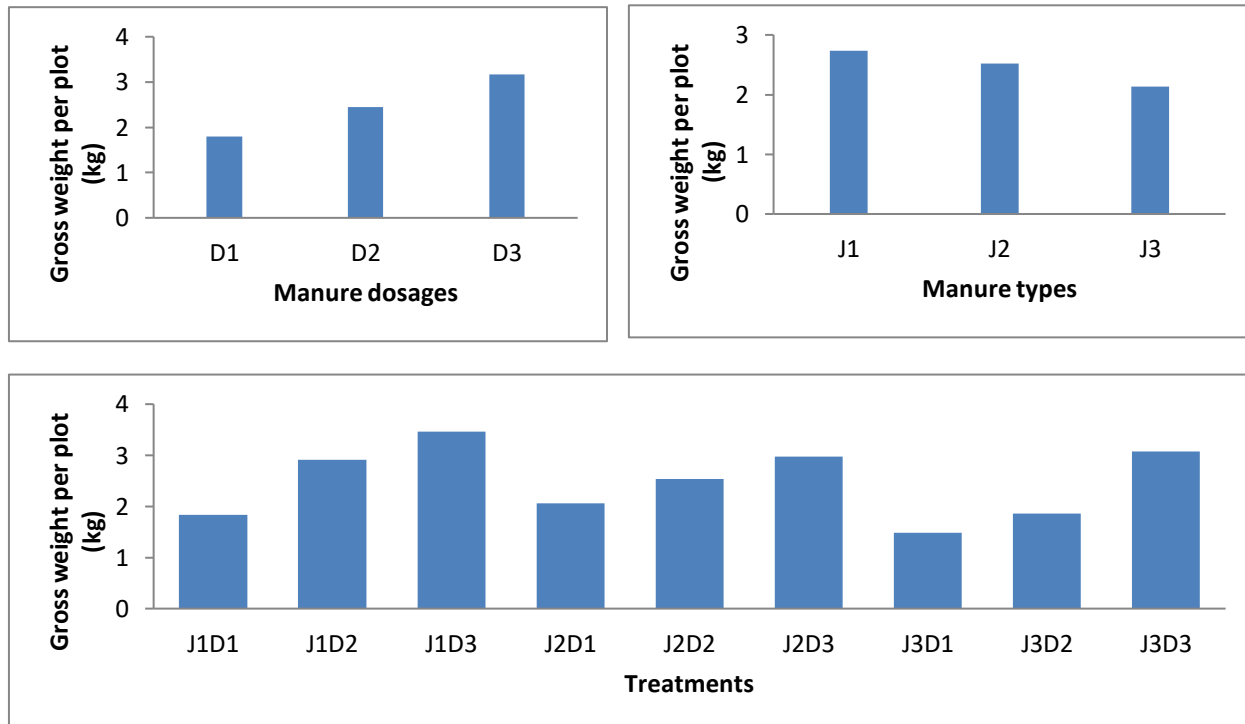


Figure 4. Histogram of the effect of manure type and manure dosage and the interaction of manure type and manure dosage treatment on gross crop weight per plot (kg)

The higher dosage of manure applied, the higher the nutrient intake for the plants. This is consistent with Kusuma's (2012) statement that applying high dosages of manure will affect plant growth and production.

Poultry manure made available nutrients, especially N, P and K that are essential for plant growth, which eventually led to increased grain yield (Agbede and Ojeniyi, 2009). According to Marinari et al. (2000), manure fertilizer enriches soil organic matter and improves soil aeration, thereby supporting plant growth speed. Manure application will maintain microorganisms in the soil and can provide water content in the soil. If plant growth improves, crop formation will also be faster. Several reports indicate increasing yield growth rate due to application of chicken manure on crops, i.e. on lettuce (*Lactuca sativa* L.) (Polat et al. 2001; Masarirambi et al. 2012), on tomato (*Lycopersicon esculentum* Mill) (Adekiya and Ojeniyi, 2002), on sorghum (*Sorghum* sp.) (Agbede and Ojeniyi, 2009), on Maize (*Zea mays*) (Adeyemo et al.2019).

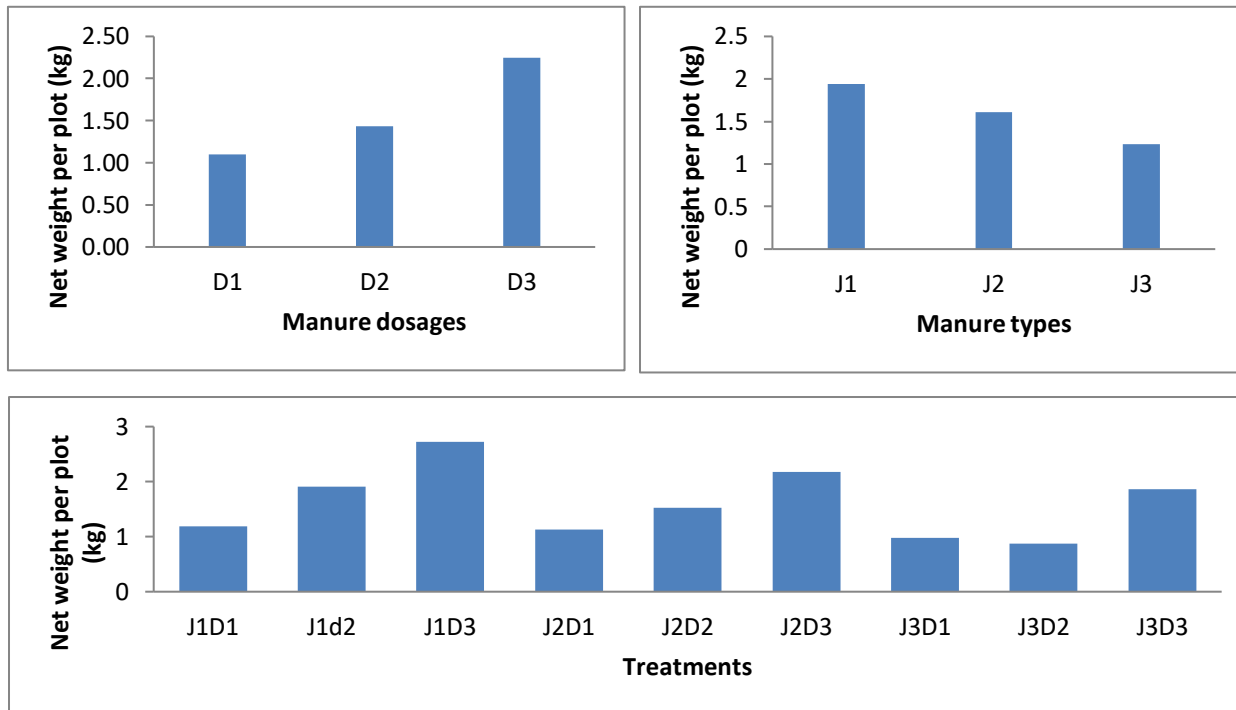


Figure 5. Histogram of the effect of manure type and dosage treatment and the interaction of manure type and dosage treatment on net crop weight per plot (kg)

CONCLUSION AND SUGGESTION

The treatment of manure dosage level significantly affected the rate of crop formation, gross crop weight per sample plant, net crop weight per sample plant, gross crop weight per plot and net crop weight per plot. The treatment of manure dosage level with a dosage of 125 g/plant resulted in the fastest crop formation (49.78 days) the highest gross crop weight per sample plant (3.11 kg), the highest net crop weight per sample plant (2.08 kg) gross crop weight per plot (3.17 kg) and net crop weight per plot (2.25 kg).

The interaction of manure type and manure dosage treatment had no significant effect on the speed of crop formation, but was significantly different on the gross crop weight per sample plant, net crop weight per sample plant, gross crop weight per plot and net crop weight per plot. The treatment of chicken manure with a dosage of 125g/plant resulted in the fastest rate crop formation (45.67 days), the highest gross crop weight per sample plant (3.55 kg), the highest net crop weight per sample plant (2.47 kg), gross crop weight per plot (3.46 kg) and net crop weight per plot (2.72 kg).

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