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Growth and Yield of Red Chili at various Doses of Chicken Manure Using Conventional and Floating Cultivation Techniques

Pertumbuhan dan Hasil Cabai Merah pada berbagai Dosis Pupuk Kotoran Ayam Dengan Teknik Budidaya Konvensional dan Terapung

Susilawati Susilawati[*)], Irmawati Irmawati, Sri Sukarmi, Muhammad Ammar

Department of Agronomy, Faculty of Agriculture, Universitas Sriwijaya, Indralaya 30662, South Sumatra, Indonesia
[*)] Corresponding author: susilawati@fp.unsri.ac.id

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ABSTRAK

Penelitian bertujuan mengetahui pengaruh pupuk kotoran ayam pada tanaman cabai merah dengan teknik budidaya konvensional dan terapung. Penelitian dilaksanakan pada Lahan percobaan untuk teknik budidaya konvensional dan di Embung untuk budidaya terapung yang berlokasi di lingkungan Fakultas Pertanian Universitas Sriwijaya Kecamatan Indralaya Kabupaten Ogan Ilir Provinsi Sumatera Selatan dengan ketinggian tempat 10 m dpl, pelaksanaannya bulan Juli-November 2022. Percobaan menggunakan rancangan acak kelompok satu faktor, yaitu pupuk kotoran ayam (0, 10, 20 dan 30 ton/ha) dengan tiga ulangan. Percobaan terapung menggunakan rakit bambu ukuran 200 cm x 100 cm, satu rakit merupakan ulangan. Parameter yang diamati meliputi tinggi tanaman, jumlah daun, diameter tajuk, panjang buah, diameter buah, berat buah per buah, dan total berat buah per tanaman. Data dianalisis menggunakan Analisys of Variance (ANOVA) pada taraf 5%. Hasil yang diperoleh menunjukkan bahwa peningkatan dosis pupuk kotoran ayam hingga 30 ton/ ha pada kedua teknik budidaya meningkatkan tinggi tanaman dan jumlah daun. Demikian juga untuk jumlah dan berat buah, diperoleh pada dosis yang sama pada teknik konvensional, yaitu 30 ton /ha. Akan tetapi untuk parameter panjang dan diameter lebih tinggi pada budidaya terapung pada semua dosis perlakuan pupuk kotoran ayam. Hasil penelitian dapat disimpulkan bahwa penggunaan pupuk kotoran ayam dapat meningkatkan pertumbuhan cabai pada kedua teknik budidaya, namun ukuran polibag yang digunakan tidak mendukung akibatnya pertumbuhan dan hasil tidak optimal.

Kata kunci: konvensional, terapung, kotoran ayam, cabai merah

ABSTRACT

The aimed of this study was to determine the effect of chicken manure application on red chili plants using conventional and floating cultivation techniques. The research was carried out on the experimental farm for conventional cultivation techniques and in research pond for floating cultivation located in the Faculty of Agriculture, Sriwijaya University, Indralaya Campus, Ogan Ilir, South Sumatra with an altitude of 10 m above sea level from July to November 2022. The experiment used a randomized block design with one factor, namely chicken manure (0, 10, 20 and 30 tons/ha) with three replications.

While the floating experiment used 200 cm x 100 cm of bamboo rafts. Parameters observed included plant height, number of leaves, crown diameter, fruit length, fruit diameter, fruit weight per fruit, and total fruit weight per plant. Data were analyzed using Analysis of Variance (ANOVA) at the 5% level. The results showed that increasing the dose of chicken manure up to 30 tons/ha in both cultivation techniques increased plant height and number of leaves. Likewise for the number and weight of fruit, obtained at the same dose in conventional techniques, namely 30 tons/ha. However, fruit length and diameter parameters were higher in floating cultivation at all doses of chicken manure treatments. Therefore, it was concluded that the use of chicken manure could increase the growth of chili plants in both cultivation techniques, although the size of the polybags used could not support the growth and yields optimally.

Keywords: chicken manure, conventional, floating, red chili

INTRODUCTION

The ecology of the chili plant, which is able to adapt in lowlands and highlands at the end of the rainy season is crucial for off-season cultivation as well as for the establishment of new chili production centers outside Java Island as proposed by the government. The chili plant is a very significant crop in Indonesia and cannot be substituted by any other commodities (Sumarni et al., 2012; Nauly, 2016; Malahayati & Ambarita, 2019). The chili harvest area in Indonesia was about 133,729 ha in 2021 at a productivity of 10.17 tons/ha, according to data from the Central Statistics Agency and the Directorate General of Horticulture (2022), while only 4203 ha of chilies were harvested in South Sumatra Province at a productivity of 5.60 tons/ha. In comparison to the potential for chili, which could reach 17 to 21 tons/ha, this production is still low (Central Statistics Agency, 2022). The wetland-like state of the terrain in South Sumatra severely restricts the development of chili in this lowland region. *Lebak* swamp or inland swamp is one of the wetlands.

Lebak swamp have floods and drought issues and in order to prepare for drought circumstances, farmers typically will build mounds that range in height from 40 to 50 cm to 15 to 120 cm. When the soil water begins to dry up, the low mounds allow water to still be accessible to plant roots. Susilawati and Lakitan's (2019) investigation on the height of mounds on lebak swampland using broad bean plants revealed that the highest plant production was on mounds with a height of 15 cm and were comparable to those with a height of 20 cm. While employing floating cultivation has been anticipated as a solution for dealing with long term flooded or inundated swamp area (Lakitan, 2014; Hasbi, 2017; Lakitan, 2021). There are red chili cultivars that are tolerant to inundation, according to the findings of study on red chili with inundation treatment (Susilawati et al., 2012a & 2012b). An agricultural practice that could be utilized to increase crop productivity is fertilization. Both organic and inorganic fertilizers could be used for fertilization. Manure and other organic fertilizers are considered to be able to enhance the biological and physical properties of soil by, for example, boosting the activity of microorganisms that aid in the decomposition of organic materials. There are undoubtedly differences in the nutrients that each form of manure carries. Based on this context, the research's objective was to compare conventional and floating farming methods to ascertain the impact of chicken manure on red chili plants.

MATERIALS AND METHODS

The research was conducted from July to November 2022 in the Faculty of Agriculture, Indralaya, Ogan Ilir, South Sumatra Province, on an experimental plot

for conventional procedures and in a pond for floating experiment. The experiment used a one-factor randomized group design with three replicates with chicken manure dosages of 0, 10, 20, and 30 tons/ha. A bamboo raft measuring 200 cm by 100 cm was utilized for the floating experiment, with one raft considered as a replicate.

The chili seeds were first soaked in water for ± 24 hours, then sown in 34 cm x 25.5 cm x 7 cm seedling trays. The seedlings were transferred after one week and kept in 14.5 cm × 6 cm baby bags for three weeks. The planting medium was a 2:1 (v:v) mixture of soil and chicken manure, with a media height of about 23 cm, and was placed in polybags of 35 cm x 35 cm in size. One week prior to planting, fertilization of chicken manure with the proper dosage of treatment is carried out. Additionally, 50 kg/ha of urea, 300 kg/ha of ZA, 150 kg/ha of KCl were also used. Three doses of fertilization were administered: the first 1/3 dosage at planting, the second 1/3 dose at the age of the plant one month after planting (MAP), and the third 1/3 dose at the age of the 2 MAP. Plant height, number of leaves, shoot canopy diameter, fruit length, fruit diameter, fruit weight per fruit, fruit weight per harvest, and total fruit weight per plant were among the parameters measured. Analysis of variance (ANOVA) at the 5% level was used to examine the findings of observational data proceed with the Least Significant Difference (LSD) test at the 5% level if the findings are noticeably different.

RESULTS

It was determined that the floating cultivation method resulted in less growth and yield when compared to conventional and floating cultivation of the Laris chili cultivar. The height of the chili plants increased with higher treatment of chicken manure in both cultivation methods, although the height of the plants in floating cultivation was lower than that of the conventional (non-floating) method. In the conventional method, the highest valupe plant height was 73.72 cm, while in floating cultivation, it was only 42.78 cm (Figure 1A). In the conventional method, the peak plant height at the eighth week after planting (WAP) was 58.10 cm, while in the floating culture method, it was 36.95 cm (Figure 1 B).

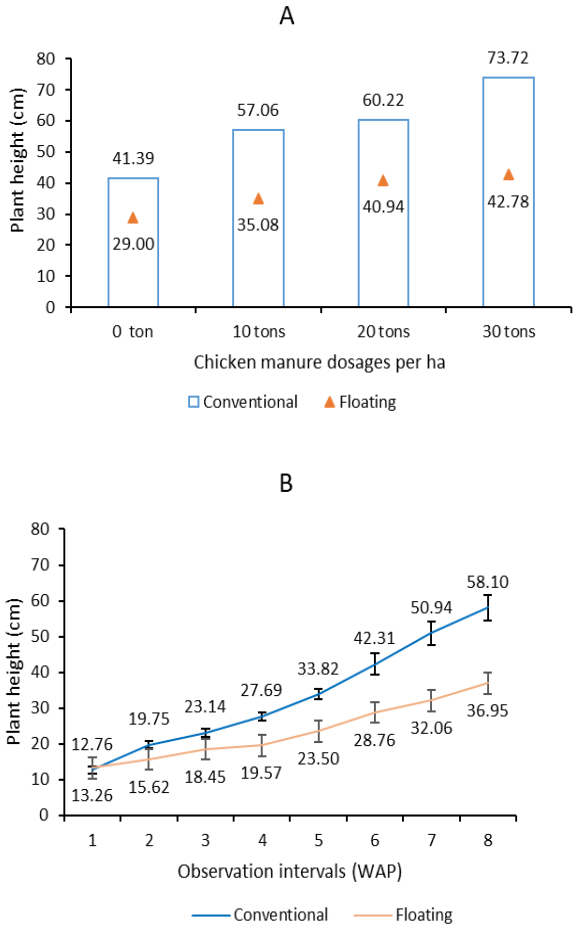

Figure 1. Chili plant height in chicken manure treatment (0, 10, 20 & 30 tons/ ha) for 8 WAP with conventional and floating methods

The number of leaves in both cultivation methods increased when the amount of chicken manure was raised up to 30 tons/ha In the conventional method, there were 97.22 leaves, whereas in floating method, there were 54.89 leaves. However, compared to the conventional method, more leaves were resulted in the floating method in the treatment without chicken manure (Figure 2A).

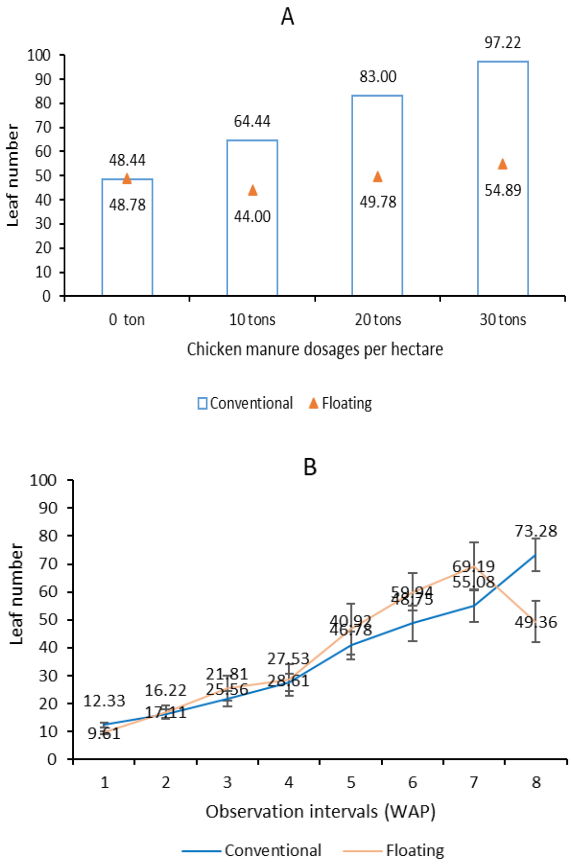

Figure 2. Chili plant leaf number in chicken manure treatment (0, 10, 20 & 30 tons/ ha) for 8 WAP with conventional and floating methods

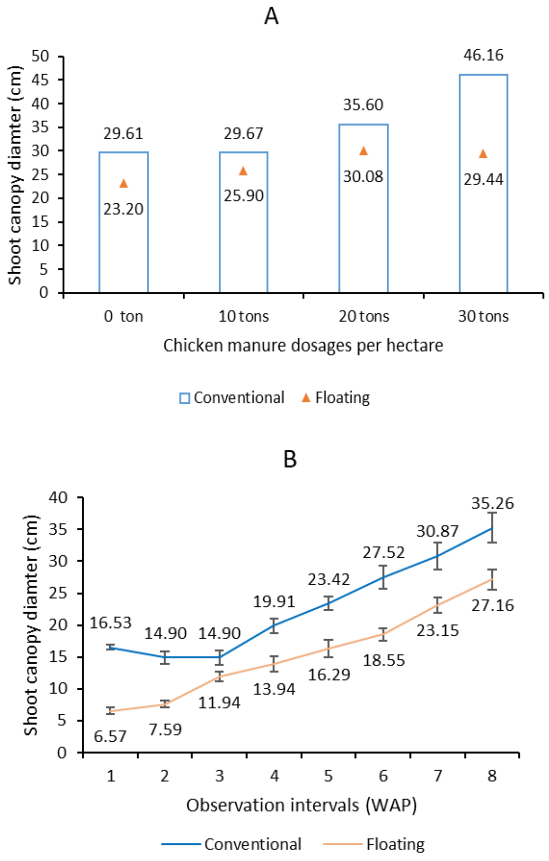

Figure 3. Chili plant shoot canopy diameter in chicken manure treatment (0, 10, 20 & 30 tons/ ha) for 8 WAP with conventional and floating methods

The conventional method produced the most leaves at 73.28 by the eighth week after planting, meanwhile the floating culture produced only 49.36 leaves (Figure 2B). The parameter of shoot canopy diameter closely coincided with plant height and leaf number. The diameter was 46.16 cm at its peak when 30 tons of chicken manure per hectare were treated using the conventional method, but it was only 29.44 cm in diameter under floating cultivation, a decrease of 36.22 percent (Figure 3A). Eight weeks after planting, the plants' canopy diameter in conventional method was 35.26 cm, while in the floating method was just 27.16 cm, a drop of 22.97 percent (Figure 3B).

In both cultivation methods, increasing the chicken manure dosage resulted in more fruits. With a dose of 30 tons/ha, the conventional technique produced the most fruits, 10.89 fruits (Figure 4).

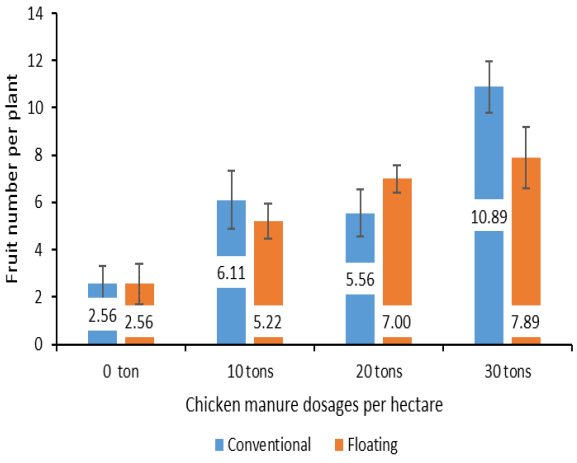

Figure 4. Chili plant fruit number in chicken manure treatment (0, 10, 20 & 30 tons/ha) at 8 WAP with conventional and floating methods

The average length of the fruit is longer in floating cultivation than in conventional method, ranging from 9.16 0.15 cm to

10.35 0.20 cm as opposed to only 6.41 0.19 cm to 7.69 0.57 cm in conventional method. The longest fruit length was achieved under the treatment of 0 tons of chicken manure, indicating that the application of chicken manure did not increase fruit length in floating cultivation. In contrast, the conventional method lengthened the fruit by the addition of 30 tons of chicken manure per/ha (Figure 5). In line with fruit length, the average of longest fruit diameter in floating cultivation ranged from 7.57 ± 0.10 mm to 8.05 ± 0.32 mm. Increased manure application in both cultivation methods could result in larger fruits (Figure 6).

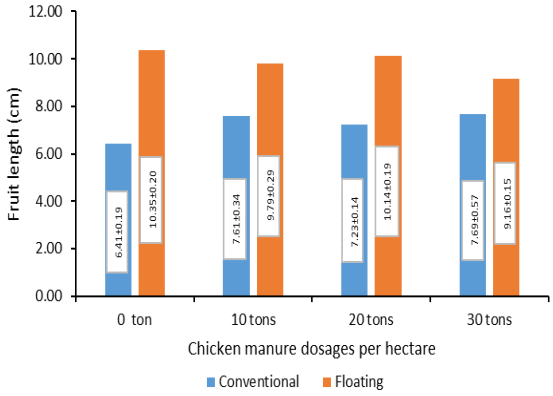

Figure 5. Chili plant fruit length in chicken manure treatment (0, 10, 20 & 30 tons/ha) at 8 WAP with conventional and floating methods

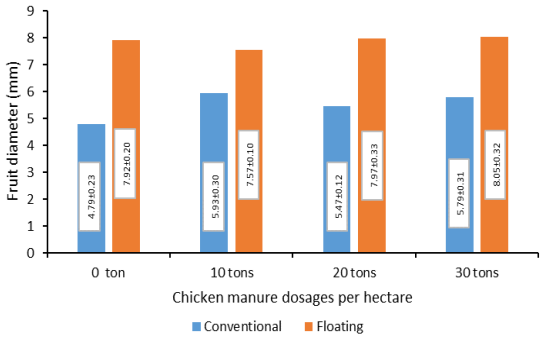

Figure 6. Chili plant fruit diameter in chicken manure treatment (0, 10, 20 & 30 tons/ ha) at 8 WAP with conventional and floating methods

In conventional method, increasing the amount of chicken manure to 30 tons/ha increased fruit weight. The lowest fruit weight was 4.72 g with a treatment of 0 tons/ha, while the highest fruit weight was 24.69 g at a dose of 30 tons of chicken manure (Figure 7).

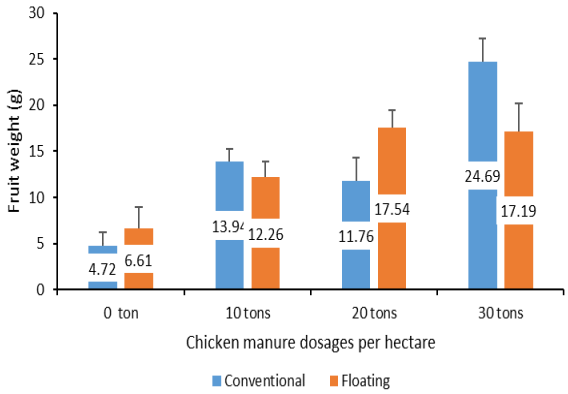

Figure 7. Chili plant fruit weight in chicken manure treatment (0, 10, 20 & 30 tons/ha) at 8 WAP with conventional and floating methods

DISCUSSION

Red chili plant growth was accelerated by using conventional and floating cultivation methods with a dose of 30 tons of chicken manure per hectare. Plant height in the conventional method was around 41.39 cm to 73.72 higher than in the floating method, varied between 29.00 cm and 42.78 cm (Figure 1 A). Since chicken manure is an organic fertilizer with a higher N, P, and K content compared to other animal manures and can improve soil properties (physical, biological, and chemical), the increase in plant height was consistent with the increasing dose applied (Naim and Abker, 2016; Ernest, 2018; Silalahi et al., 2018). Red chili plant height in the conventional method was 58.18 cm while in the floating method, it was 36.95 cm, or a reduction of 36.40 percent. The predominant soil pores were filled with water during floating cultivation, resulting in relatively damp growing media conditions and a slight constrained oxygen supply which could impact the root respiration, restrict nutrient uptake by roots and alter the transfer of nutrients to shoots, causing the slower shoot growth (Susilawati et al., 2012b; Herzog et al., 2016; Steffens & Rasmussen, 2016). In comparison to the

control, both cultivation methods had more leaves and a larger canopy diameter after the application of chicken manure. At a dose of 30 tons/ha, the most number of leaves and the largest shoot canopy diameter were obtained, averaging 97.22 leaves and 46.16 cm for the conventional method, and 54.89 leaves and 29.44 cm for the floating method, respectively (Figures 2A & 3A) (Pujiastuti et al., 2018).

Plant growth is a major determinant of plant development. The Laris variety of chili plants that were grown conventionally or floatingly in polybags with a volume of 5 kg with chicken manure treatment revealed non-optimal growth, which was represented in the yield data consisting of very low number, length, diameter, and fruit weight. Application of chicken manure of just 20 kg per ton in floating cultivation would increase the yield, while increasing the dosage up to 30 tons/ha however would lower crop yields, while in contrast, increasing the dose of chicken manure up to 30 tons/haenhanced crop yields in the conventional cultivation.

This was related to how chicken manure affected the soil physical features. Chicken manure-enriched soil is relatively loose. Depending on the amount applied, electrical conductivity (EC), phosphorus, and nitrate (NO^{3-}) content significantly increased in the soil treated with manure or straw compared to the control soil (without manure) (Aboutayeb et al., 2014; Cayci et al., 2017). As a result, a lower dose was needed for floating cultivation than for conventional farming. Additionally, water was continuously available in the media during floating cultivation since it was capillarially supplied from below the media (Susilawati et al., 2019).

The bottom of the substrate must remain in direct contact with the surface of the water. The substrate's bottom must continue to be in direct touch with the water's surface. Due to the constant supply of water, water predominated in the soil pores, leaving limited space for oxygen. Due to this, the root respiration was slower at floating cultivation than at conventional cultivation due to the higher humid soil conditions of the rooting medium. Both growing methods produced very low yields; as a result of the planting media polybags size could not fully accommodate the growth.

CONCLUSSION

Based on the study's findings, it can be concluded that utilizing chicken manure could promote chili plant growth in both conventional and floating cultivation methods, albeit the results were not optimum due to the use of polybags that could not fully accommodate chili plant growth.

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