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Onion (*Allium Ascalonicum* L) Production Technology Optimization Using Plastic Cover And Organic Fertilizer Dose

Wiwit Widiarti
Faculty Of Agriculture
University Of Muhammadiyah Jember,
Indonesia
wiwit.widiarti@unmuhjember.ac.id

Iskandar Umarie
Faculty Of Agriculture
University Of Muhammadiyah Jember
Indonesia
iskandarumarie@unmuhjember.ac.id

Hudaini Hasbi
Faculty Of Agriculture
University Of Muhammadiyah Jember
Indonesia
hudaini@unmuhjember.ac.id

Insan Wijaya
Faculty Of Agriculture
University Of Muhammadiyah Jember
Indonesia
insan.wijaya@unmuhjember.ac.id

Abstract*—Abstract *The technology was implemented through use of plastic cover and organic fertilizer dose. Experiment was conducted by using split plot design. The main plot consist of colors plastic cover, i.e. W1= Red color plastic, W2=colorless plastic, and W3= blue color plastic. Subplot was dose of organic fertilizer......, i.e. P1:15 ton/ha, P2:20 ton/ha, P3:25 ton/ha, and P4:30 ton/ha). Observation of agronomic characters such as plant height, number of leaves, number of tillers, diameter of bulbs, weight of 100 bulbs and weight of bulbs was done to assess the effect of the implemented technology. Result of the observations confirmed that the use of plastic cover has significant effect on number of leaves, number of tillers, tuber diameter, and tuber weight. The effect of organic fertilizer dose was only significant on the height of onion plant. Treatment with 15 tons of organic fertilizer/ha showed the best results on plant height. The interaction between the two treatments showed a blue cover with a 15 ton/ha fertilizer dose and a red lid with a 25 ton/ha fertilizer dose gave the best effect on plant height and number of leavs. Implementation the interaction between two treatments showed a blue cover with a 15 ton/ha fertilizer dose.*

***Keywords*—hood color, onion, and organic fertilizer**

I. INTRODUCTION

Red onion (*Allium ascalonicum* L.) is a vegetable commodity that has been intensively cultivated for a long time by farmers because of its high selling value. Although farmers are interested in shallots , but the cultivation process is still problem in both technical and economic aspects [1]. Based on its botanical description, shallot has a productivity potential up to 20 tons per ha. Indonesia's shallot production in 2014 has increased by 1,234 million tons, compared to 2013's production of 1,011 million tons. Red onion consumption of Indonesian population is 4.56 kg/capita per year or 0.38 kg/capita per month, so that national consumption reaches 1,608,000 tons per year [2]. This proves that the availability of domestic shallots is not sufficient to fulfill the needs of nationwide consumption. Therefore, increasing the productivity of shallots is an urgent agenda.

Efforts to increase shallot production can be achieved by three approaches i.e. 1) increasing the production per unit area (intensification), 2) increasing the cropping intensity, and 3) extension of planting area. The cultivation process of shallots, soil is an important factor functioning as a growing medium [3]. The productivity of plants is influenced by climate, genetic factors and the level of soil fertility. Climate and genetic traits are difficult to control, while soil fertility is easier to repair by improving the physical, biological and chemical properties of the soil. Efforts to achieve optimal growth, nutrient status must be in a balanced state, meaning that no nutrient should be a limiting factor [4].

Organic fertilizer is the final product from the decomposition of parts and remnants (litter) of plants and animals, such as manure, green manure, compost, and cake. Organic fertilizer improves soil microorganisms, increases absorption and water retention, so that soil fertility is intensified [5]. Organic fertilizer has a low nutrient content and is used primarily for making soil to be loose i.e. having a good structure. The average nutrient composition for manure is about 0.5% N, 0.25% P_2O_5 and 0.5% K_2O or in 1 ton of manure there is 5 kg N, 2½ kg P_2O_5 and 5 kg K_2O [6].

In addition to soil nutrients, sunlight has an important role in the process of plant physiology e.g. photosynthesis, respiration, growth and development, closing and opening stomata, and germination of plants, metabolism of green plants Therefore, the availability of sunlight determines the level of crop production [7]. transparent plastic shade from the beginning of growth to the harvest may provide better microclimate environmental conditions for shallot's growth and development from the seeds without shade [8]. Transparent plastic shade does not reduce the intensity of sunlight that reaches the plants, as impact of the temperature around the plants increases. Increased air temperature around the plant, resulting in the rate of photosynthesis and the rate of plant growth also increases. Accordingly, this study aims to provide the best production technology package for onion plants by using various transfers and doses of organic fertilizer.

II. METHODS

Field experiment with altitude of ± 89 meters above sea level, starting on 12 February 2018 until 24 June 2018. The study was carried out in factorial with a completely randomized design split plot with 2 factors and 3 replications. The main plot was various colors of plastic cover (W1= red color plastic, W2= colorless plastic, and W3= blue color plastic). While sub plot is organic fertilizer, N1 = 15 tons/ha cow manure, N2 = 20 tons/ha cow manure, N3 = 25 tons/ha cow manure, N4 = 30 tons/ha cow manure.

Fertilization consists of basic fertilizer and supplementary fertilizer. Basic fertilizer in the form of cow manure 15 tons/ha (3 kg/m^2), 20 tons / ha (4 kg/m^2), 25 tons/ha (5 kg/m^2) and 30 tons/ha (6 kg/m^2). Basic fertilizer is given by spreading and stirring evenly with the soil before planting, and first supplementary fertilizer in the form of NPK (250 kg/ha) equals 50 g/m^2 (per 2x1 m plot). Whereas secondary fertilizer II is Urea 150 kg / ha (30 g/m^2), ZA 150 kg/ha (30 g/m^2). Subsequent First fertilization was carried out at the age of 15 days after planting and second aftershock at the age of 35 days after planting.

The seeds that will be planted are vernalized first by soaking the water with a temperature of 10ºC, by putting the shallot seeds into the refrigerator for 2 weeks. Before the seedlings are planted in a patch, the experiment is first soaked with a GA3 solution with a concentration of 50 ppm for 10 minutes. Next to avoid the seedlings being attacked by fungus, just before planting the seeds are soaked back into a 5 gram fungicide solution of Dithane M-45 which is dissolved in 7.5 ml of water, for 5 minutes. Onion seeds are planted with a spacing of 5 x 5 cm and each hole is planted with 2 tubers.

Agronomic parameter was observed to determine the quality of the results are : Plant Height (cm), sum of Leaves (strands), sum of Tillers, Diameter of Bulbs, Weight of 100 Grain Bulbs and Weight of Bulbs (gram).

III. RESULT & DISCUSSION

A. Plant height

The results of the variance analysis showed that the height of the shallot plant at the age of 28 day and 48 day after the treatment of color plastic cover (W) was very significant, whereas the treatment of manure (N) was not significantly different. Further test results Duncan Multiple Range Test of red-colored hoods showed the highest plant height both at 24 hst (40,288 cm) and 48 hst (45,957 cm), the results were significantly different from the white lid (W2) (Table 1). It is suspected that plants absorb more blue light, cryptochrome because of its special important role in cryptograms (non-flowering plants) with wavelengths between 440-470 nm and red light between 640-660 nm [7].

The results of this study are in line with the results of Sulistyaningsih [10] the containment of masks increases the highest plant and plant height obtained in the treatment of red hoods. Plant height is affected by light intensity. High light intensity causes short plants. This is because auxin which affects cell elongation works more actively in dark conditions. Plant height is an effort to obtain light. Transparent plastic conditions from the beginning of growth to harvest can provide better microclimate environmental conditions for the growth and development of shallots from seeds than without shade [8]. Transparent plastic shade does not reduce the intensity of sunlight that reaches the plants, but it seems that the air temperature around the plants increases. With increasing air temperature around the plants, the rate of photosynthesis and plant growth rates also increases, resulting in an increase in plant height.

Table 1. Results of Duncan Multiple Analysis on the Treatment of Several Colors of Plastic Shade on Plant Height in the Age of 24 days and 48 days.

Treatment	Plant Height (cm) 24 Day after planting	Treatment	Plant Height (cm) 48 day after planting
W1 (Red color plastic)	40,28^a	W2 (colorless plastic)	45,95^a
W3 (Blue color plastic)	38,29^b	W1 (Red color plastic)	45,81^a
W2 (colorless plastic)	36,73^c	W3 (Blue color plastic)	43,180^b

Note: Means in the same column/row with different superscript significantly different at 95% confident level

The treatment of manure (N) on shallot plants was significantly different from the height of the plants at the age of 48 days, while at the age of 24 days it was not significantly different. Table 2 shows that giving 15 tons/ha of manure (N1) is significantly different from the provision of 20 tons/ha of manure (N2), 25 tons/ha of manure (N3) and 30 tons/ha of manure (N4). It is suspected that the provision of 15 tons/ha of manure, has fulfilled the nutrient sufficiency needed by the shallots, especially nitrogen (N). Nitrogen onion is sufficiently needed to provide Nitrogen fertilizer to stimulate vegetative growth and tuber growth. If the supply of nitrogen is sufficient then most photosynthetic products are converted into proteins and nucleic acids which are important for the growth of production organs (including tubers). This result is different from the results of Sutrapadja [9], revealing that good plant height is obtained from the administration of a dose of 45 kg N/ha, equivalent to 4.5 kg N/m^2 **.**

Table 2. Results of Duncan Multiple analysis of cows in manure treatment for plant height at 48 day.

Treatment	Plant Height (cm)
N1 15 tons/ha cow manure	36.45^a
N4 30 tons/ha cow manure	34.56^b
N3 25 tons/ha cow manure	34.28^c
N2 20 tons/ha cow manure	33.31^d

Note Means in the same column/row with different superscript significantly different at 95% confident level

The results of the analysis of the variety of interactions between the color of the containment and the application of manure to the height of plants aged 24 days showed a significant difference, while the height of the 48 hst age plant showed that the plant height was not significantly different. The results of the Duncan Distance test continued to be 5%, the interaction between the blue hood and 15 tons / ha of manure (W3N1) showed the highest plant height (31,228 cm). This result was significantly different from all other treatment combinations (Table 3). It is suspected that plants absorb more blue light, namely cryptochrome because of its special important role in cryptograms (non-flowering plants), as well as the fulfillment of nutrients and hormones that plants need. Treatment of onion plants requires special attention and must measure water content. Plant growth is not only influenced by internal factors (hormones and nutrients) but also influenced by external factors such as water, air temperature, weather and light intensity [11].

Table 3. Results of Duncan Multiple Analysis on Interactions of Several Colors of Plastic Cover with Manure Fertilizer on Plant Height at 24 day

Interaction (W x N)	Plant Height (cm)
W3N1 (blue color plastic + 15 tons/ha cow manure)	31.23[a]
W1N3 (red color plastic + 25 tons/ha cow manure)	30.80[b]
W1N1 (red color plastic + 15 tons/ha cow manure)	30.43[c]
W3N4 (red color plastic + 30 tons/ha cow manure)	30.06[d]
W1N4 (red color plastic + 30 tons/ha cow manure)	30.04[d]
W1N2 (red color plastic + 20 tons/ha cow manure)	29.60[e]
W2N1 (colorless plastic + 15 tons/ha cow manure)	28.32[e]
W2N2 (colorless plastic + 20 tons/ha cow manure)	28,10[ef]
W3N2 (blue color plastic + 20 tons/ha cow manure)	28,02[f]
W3N3 (blue color plastic + 25 tons/ha cow manure)	27.53[g]

Note: Means in the same column/row with different superscript significantly different at 95% confident level.

B. Number of Leaves

The results of variance analysis showed that the number of onion leaves at the age of 24 days and 48 days with transparent plastic shade treatment (W) was very different. The treatment of manure (N) was not significantly different both at the age of 24 days and 48 days, while the interaction of the two treatments above with the number of red leaves showed significantly different results at the age of 48 days. The results of further tests Duncan distance treatment of red-colored hoods showed that the highest number of leaves at the age of 24 days and the age of 48 were significantly different from other hoods (Table 4). It is suspected that the red hoods channel more light needed by plants for photosynthesis. Leaves are the main organ where photosynthesis takes place. Therefore, the optimum number of leaves allows more even distribution (distribution) of light between leaves. A more even distribution of light between leaves reduces the incidence of shade between leaves so that each leaf can work properly. Increased light intensity (up to the optimum level) increases the rate of total net assimilation of plants so that the photosynthate formed increases. High photosynthate formation encourages the speed of the formation of plant organs such as leaves [10].

Table 4. Results of Duncan Multiple Analysis on Interactions of Several Colors of Plastic Cover on the Number of Leaves in the Age of 24 day and 48 day.

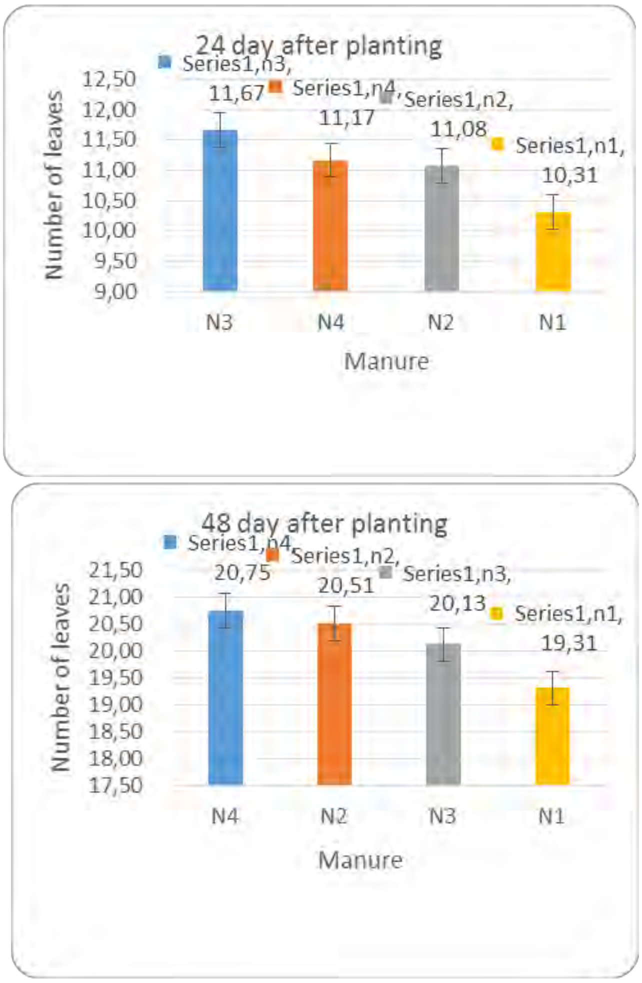
Number of Leave			
Treatment	24 day after planting	Treatment	48 day after planting
W1 (red color plastic)	22[a]	W1 (red color plastic)	38[a]
W3 (blue color plastic)	19[b]	W2 (colorless plastic)	35[b]
W2 (colorless plastic)	18[c]	W3 (blue color plastic)	35[b]

Note: Means in the same column/row with different superscript significantly different at 95% confident level

The results of the analysis of variance, giving various doses of manure did not show a significant difference both 24 days and 48 days, but the provision of manure that was high 25 tons / ha (N3), and 30 tons / ha had the most likely number of leaves. Things like this often occur due to several external factors such as wind, animals, and rain that can cause the leaves to develop not optimally. Observation of the number of leaves carried out at 48 days, showed that the administration of organic matter in various compositions had no significant effect on all the same comparisons of the number of red onion parameters at all ages of observation (Figure 1) [8].

Figure 1. Graph of Effect of Manure on the Number of Leaves of Shallots on the Age of 24 day and 48 day.

Duncan's Multiple analysis results on the interaction between plastic cover and manure (WN), treatment with a combination of red plastic with 25 tons / ha of manure (W1N3) (Table 5) shows the highest number of leaves (30



strands), the results are significantly different from all combinations other treatment. It is assumed that the red plastic is more funneling the light needed by plants to photosynthesize, and is recommended by optimal nutrient adequacy, causing plants to perform maximum metabolic processes. Photosynthesis and other photochemical reactions do not depend on the total energy of light, but on the number of photons or quanta absorbed. High-energy photons in the blue spectrum have nearly 2 times the energy compared to photons in the red spectrum, but both photons have exactly the same effect in photosynthesis [7].

Table 5. Results of Duncan Multiple Analysis on the Interaction of Several Colors of Plastic Cover with Manure Fertilizer on the Number of Leaves in the age of 48 day.

Interaction (W x N)	Sum of leaves
W1N3 (red color plastic + 25 tons/ha cow manure)	30[a]
W1N4 (red color plastic + 30 tons/ha cow manure)	28[b]
W1N2 (red color plastic + 20 tons/ha cow manure)	27[c]
W3N4 (blue color plastic + 30 tons/ha cow manure)	27[c]
W1N1 (red color plastic + 15 tons/ha cow manure)	27 [c]
W2N2 (colorless plastic + 20 tons/ha cow manure)	27 [c]
W2N4 (colorless plastic + 30 tons/ha cow manure)	27 [c]
W2N1 (colorless plastic + 15 tons/ha cow manure)	26[d]
W3N2 (blue color plastic + 20 tons/ha cow manure)	26[d]
W3N3 (blue color plastic + 25 tons/ha cow manure)	25[e]

Note: Means in the same column/row with different superscript significantly different at 95% confident level

C. Number of tillers

The results of variance analysis on the number of tillers showed no significant differences both in the treatment of plastic shade (W), and the treatment of manure (N), as well as the second interaction (WN). It is suspected that the rays needed by plants to stimulate the formation of tillers are all distributed by the three types of plastic shade. Besides that, the chicks on the onion plant have actually been found on the onion bulb itself, so that the application of manure only functions to stimulate the growth of the seedlings in the tubers. The increased production of a variety is due to the variety that has adapted to its growing environment [13]. Genotypically, varieties have the same production potential and quality in one variety, so external factors only function to stimulate their genetic potential.

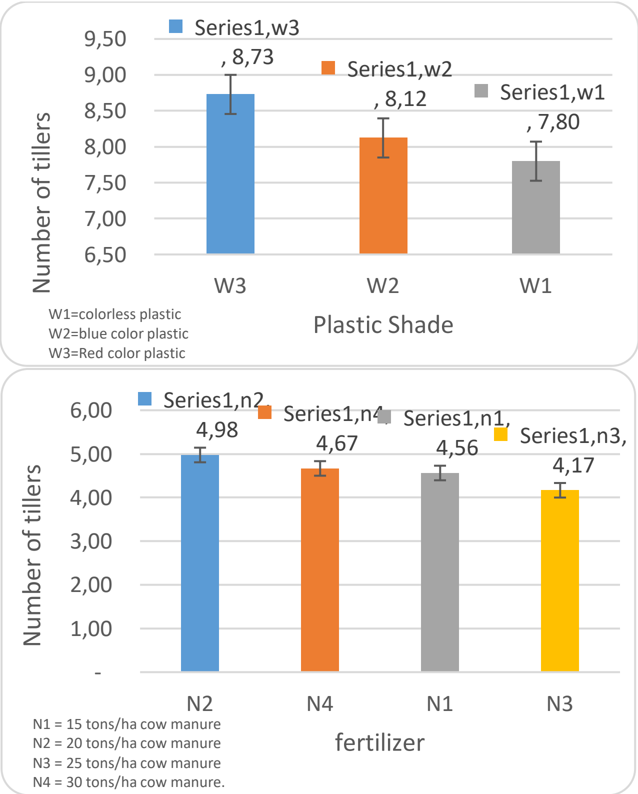


Figure 2. Graph of the Number of Tillers for Treatment (N) and (W)

Figure 2 shows that the blue shade treatment (W3) and manure with a dose of 20 tons/ha has the highest tendency for the number of shallots. A good crop fertilization strategy must refer to the concept of maximum effectiveness and efficiency including: type of fertilizer, time and frequency of fertilization and how to place fertilizer. This type of fertilizer will provide information on the main content of nutrients, additional nutrient content, chemical reactions of fertilizers in the soil and fertilizer sensitivity to the climate [4].

D. Weight of 100 Bulbs

The results of the analysis of a variety of weight of 100 tubers showed that the treatment of plastic shade (W) showed a very significant difference in the weight of 100 tubers. The results of the further test Ducan distance treatment of blue-colored hoods showed the heaviest weight of 100 tubers (Table 7). It is suspected that the blue lid is more channeling the light needed by the plant to metabolize processes related to tuber formation. The lowest growth of hanging pepper cuttings occurred in the color of the blue hood [14]. The best seedling growth occurs in the treatment of red caps. Plant growth is affected by wavelength, duration (duration of irradiation), intensity, and direction of light rays [15]. Physiologically, light affects both directly and indirectly for the plant body. Its effect on metabolism directly through photosynthesis. While the indirect effect is through the growth and development of plants which are metabolic and more complex responses [16].

Table 7. Results of Duncan Multiple Analysis on the Treatment of Several Colors of Plastic Cover on the Weight of 100 Bulbs.

Treatment	Weight 100 Bulbs (g)
W3 (blue color plastic)	848,50[a]
W2 (colorless plastic)	746,60[b]
W1 (red color plastic)	577,80[c]

Note: Means in the same column/row with different superscript significantly different at 95% confident level.

The results of the analysis of the various weight of 100 tubers against manure (N) treatment were not significantly different. The provision of 15 tons / ha of manure (N1) gives optimal results for the weight of 100 tubers which is 410.63 grams (Figure 3). The right dose will increase plant growth, so the plant metabolism increases so that the formation of protein, starch and carbohydrates is not inhibited. This results in increased growth and production [17].

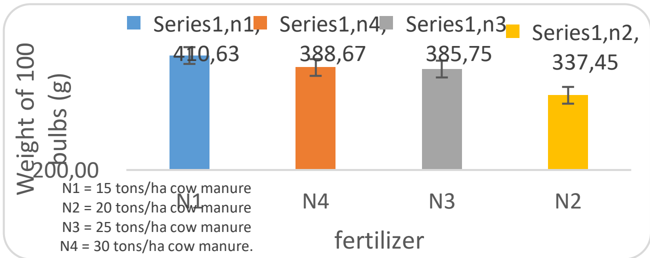


Figure 3. Graph of the Weight of 100 Bulbs on Treatment of Cow Manure.

The results of variance analysis on the weight of 100 tubers against the interaction between plastic cover (W) and manure (N) gave results that were not significantly different.

Figure 4, shows the optimal weight of 100 bulbs obtained from the interaction between blue plastic shade (W3) with 15 tons / ha of manure (N1). Apart from a balanced fertilizer system, environmental factors also affect plant growth and development. Red onions cannot stand drought because of their short roots. During the growth and development of tubers, considerable water is needed. Red onion plants cannot stand the waterlogged place [18].

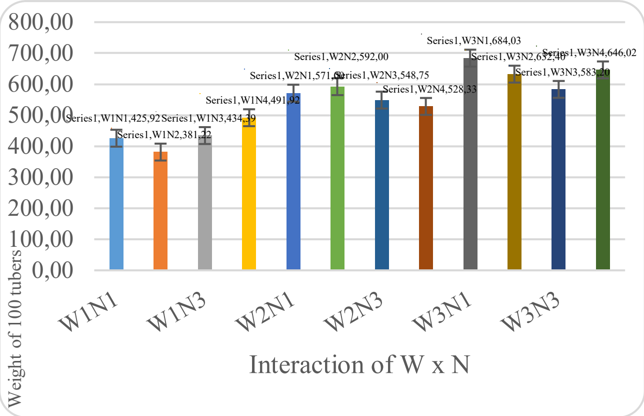


Figure 4. Graph of Weight of 100 Shallots on the Interaction of W x N

One of the attempts to manipulate the plant is by giving mulch. Mulching is a way to improve soil air conditioning and also the availability of water for plants (can be repaired) [3]. In addition, mulch can accelerate the growth of newly planted plants. The advantage of using plastic mulch in agriculture, especially vegetable crops is because it can improve and improve the quality of results, allowing off-season planting and improvement of cultivation techniques [19]. The quality of light does not only affect growth, but also morphology (shape) of plants. Transparent plastic is one of the ingredients that can function as a light filter. Sunlight through certain colored transparent plastics can filter some of the wavelength according to the color of the plastic used [20].

E. Bulbs Weight

The results of the analysis of a variety of Bulbs Weight showed that the treatment of plastic cover (W) showed a very significant difference in Bulbs Weight. Based on the results of Duncan's multiple analysis, the blue plastic shade treatment (W3) showed the heaviest results of 48,54 g / plant. This result is significantly different from other plastic cover (Table 8). This shows that the growth of dry weight of plants other than determined by genetic factors of each plant variety, is also influenced by environmental factors, especially moisture and temperature. Leaf cell water content is one of the factors that have an important role in the metabolic process of plants [21]. Increasing the results of shallot tubers from seeds by providing transparent plastic roof shade due to the transparent plastic shade can reduce disease attacks due to high rainfall during the experiment. The role of light is very large in physiological processes, especially photosynthesis, respiration, plant growth and development, and the opening and closing of stomata. Sunlight as a whole affects the growth, reproduction and yield of plants [22].

Table 8. Results of Duncan Multiple Analysis on the Treatment of Several Colors of Plastic Cover on the Weight of Bulbs.

Treatment	Bulbs Weight (g)
W3 (blue color plastic)	48,50^{a}
W2 (colorless plastic)	42,70^{b}
W1 (red color plastic)	32,90^{c}

Note: Means in the same column/row with different superscript significantly different at 95% confident level

The treatment of giving manure to Bulbs Weight was not significantly different, but the treatment with a fertilizer dose of 30 tons/ha showed the heaviest tuber tendency (Figure 10). The results are in line with the results of Mayun's study [23] of the use of compost of cow dung at a dose of 30 tons ha-1 can increase the weight of tubers in shallots. The high organic matter can maintain the physical quality of the soil so that it helps the development of plant roots and the smoothness of the groundwater cycle, among others through the formation of soil pores and soil aggregate stability [24].

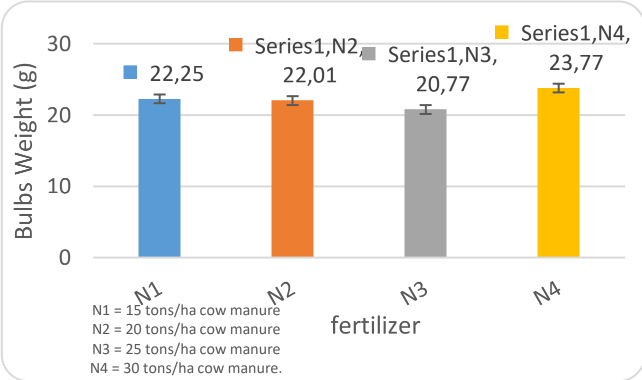


Figure 5. Graph of Weight of Shallots Bulbs on Cow Manure

The results of variance analysis on the interaction between plastic cover (W) and manure (N) were not significantly different from Bulbs Weight. This is allegedly due to biotic environmental factors such as weeds, the quality of the weight of the onion bulbs can go down. At high levels of attack the quantity of harvest will be affected. Figure 11. shows the highest weight of tuber which is the interaction between blue plastic (W3) and 30 tons/ha of manure (N4).

IV. CONCLUSION

The treatment with a plastic cover showed the best results on plant height and number of leaves, while the treatment with a blue color provided the best results at weight of 100 bulbs and bulbs weight. Treatment with 15 tons of organic fertilizer/ha showed the best results on plant height. The interaction between the two treatments showed a blue color with a 15 ton/ha fertilizer dose and a red color with a 25 ton/ha fertilizer dose gave the best effect on plant height and number of leaves

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