Effect of shade covers and foliar fertilizer on the growth of pepper seeds

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Abstract. The main problems with pepper plants in West Kalimantan are the availability of superior seeds for pepper, low productivity, and disease attacks. In contrast, the application of pepper cultivation techniques is still simple, the application of fertilizers is not under the recommended dosage, and the attack of pests and diseases. The purpose of this study was to examine the use of cover types and foliar fertilizers on pepper seeds in nurseries. The treatment to be examined is the type of cover and foliar fertilizer. The types of hoods are: white plastic cover (S1), black parnet cover (S2); cover from coconut midrib (S3) and the foliar fertilizers used are without foliar fertilizer (D0) and foliar fertilizer (D1), the number of repetitions is 4 times, with the treatment combination consisted of S1D0, S1D1, S2D0, S2D1, S3D0, and S3D1 the number of plants per plot of 16 plants so that the total number of plants was 384 plants. The results show the combination of treatment between providing coconut leaf midrib cover with fertilization through leaves gives the best results on the growth percentage of live pepper seeds, plant height, leaves number, branches number, and segment number that grow on pepper seeds in a nursery. Therefore, it is recommended that in the seedbed for pepper, it is to use a cover from coconut leaf midrib and fertilized through the leaves.

1. Introduction
Pepper in West Kalimantan is one of the plantation crop commodities that can support the economy and the people's lives in this area. This is very reasonable because most of the population of West Kalimantan still relies on a source of income from pepper [3]. In 2017, area of pepper plants in West Kalimantan reached 10,307 hectares with a production of 5,499 tonnes, and in 2018 was 10,550 ha with a production of 5,446 tonnes [2]. Pepper plants in West Kalimantan are scattered in Sambas, Bengkayang, Sintang, Sanggau Regencies, Kubu raya, Sekadau, Mempawah and Ketapang.

West Kalimantan is one of the central production of pepper, which ranks sixth after oil palm, rubber, coconut, coffee, and cocoa [4]. The area of pepper plantations in West Kalimantan has increased, but its productivity has decreased. The productivity of pepper in West Kalimantan is still low compared to the national one. The average productivity of West Kalimantan pepper is below 0.85 tonnes ha\(^{-1}\) compared to the national 2 tonnes ha\(^{-1}\) [2].

The main problems with pepper plants in West Kalimantan are the availability of superior seeds of pepper, low productivity, and disease attacks. The low productivity of the pepper plant in this area is due to the simple application of pepper cultivation techniques, including the absence of fertilizer application according to the recommended dosage, the presence of pests and diseases.
Fertilization is the provision of material to the soil to improve or increase soil fertility. Fertilization in a special sense is the provision of materials intended to add plant nutrients to the soil to improve the soil atmosphere, whether physical, chemical, or biological [10]. Fertilizer can be given through leaves and soil. The fertilizer application through the soil that is not right can cause the fertilizer to evaporate quickly, absorption of nutrients by the roots is ineffective [11]. Limited absorption of nutrients by roots causes the nutrients needed by plants in the process of growth and development to be inhibited [18]. Therefore, fertilization through leaves is considered more effective because plants more easily absorb nutrients.

Foliar fertilizers are materials or elements given through the leaves by spraying or watering the plant leaves to be absorbed directly to meet the needs for growth and development [17]. The most striking advantage of foliar fertilizers is that the absorption of nutrients runs faster than fertilizers given through the roots. As a result, the plants will grow shoots faster, and the soil will not be damaged [8]. The purpose of this study was to examine the use of cover types and foliar fertilizers on pepper seeds in nurseries.

2. Materials and methods
This research was conducted at the Simpang Monterado Experimental Garden, West Kalimantan Agricultural Technology Research Institute in Bengkayang Regency from April to December 2019. In this research, several types of cover and foliar fertilizers were tried in the pepper nursery.

2.1. Material
The materials used in this study included pepper seed cuttings, plastic covers, cover from coconut midrib, foliar fertilizers, and other equipment related to pepper seedling. Writing instruments are also needed to record observational data.

2.2. Methods
This experiment used a randomized block design with two factorials, namely the type of cover and the application of foliar fertilizers. The first factor of the type of cover consists of 3 treatments, namely 1) a white plastic cover (S1) (figure 1), 2) a black paranet cover (S2) (figure 2), and 3) a cap from coconut midrib (S3) (figure 3). Meanwhile, the second factor of leaf fertilization consisted of 2 treatments, namely, 1) the pepper seed cuttings were fertilized through the leaves with Gandasil dose 2 g l⁻¹ (D1), and 2) not fertilized (D0). The treatment combination consisted of S1D0, S1D1, S2D0, S2D1, S3D0, and S3D1; the number of plants per plot of 16 plants increased the total number of was 384 plants. The variables observed included the percentage of seed grown, height of the plant, number of leaves, number of branches, and number of internodes of pepper plants.

The effect of treatment on the observed parameters carried out by analyzing variance (ANOVA) using the F test at the confidence level of 5%. If the F test shows a significant or very significant effect, then to determine whether there are significant differences between treatments, the DMRT (Duncan Multiple Range Test) mid-range tests is carried out at the 5% confidence level.

![Figure 1. White plastic cover.](image1)

![Figure 2. Black paranet cover.](image2)

![Figure 3. Coconut midrib cover.](image3)
3. Results and discussion

3.1. Percentage of seed grown

The cover treatment using coconut leaf midrib and leaf fertilization showed the highest percentage of pepper seed growth, which was 88.60%, and significantly different from other treatments. The treatment with closing coconut leaf fronds was not given leaf fertilizer, and the treatment with giving black plastic cover gives leaf fertilizer (table 1).

### Table 1. Effect of combination treatments on the growth of pepper seeds.

| Treatment | Seeds grow (%) | Height of plant (cm) | Number of leaves | Number of branches | Number of internodes |
|-----------|----------------|----------------------|------------------|--------------------|----------------------|
| S1D0      | 59.93 a        | 42.44 a              | 22.67 a          | 10.44 a            | 4.11 a              |
| S1D1      | 69.36 b        | 47.89 a              | 29.22 b          | 12.00 b            | 4.78 b              |
| S2D0      | 75.14 b        | 45.89 a              | 24.67 a          | 10.78 a            | 4.33 a              |
| S2D1      | 79.31 bc       | 46.78 a              | 25.44 ab         | 11.22 b            | 4.89 a              |
| S3D0      | 84.58 c        | 40.67 a              | 27.78 b          | 9.56 a             | 5.11 ab             |
| S3D1      | 88.60 c        | 54.22 b              | 30.44 b          | 13.11 b            | 5.89 b              |

Noted: numbers followed by the same letter are not significantly different.

This shows that providing cover for pepper seeds in the form of an organic cover with coconut leaf sheath and a black paranet covering provides a more humid microenvironment and absorbs nutrients faster, thereby stimulating shoot growth in pepper plants. The use of significant hood affects the growth power of pepper seeds, and the organic cover treatment of coconut leaf midrib has the best growth power. It is assumed that shade can regulate soil temperature and humidity to create a microclimate beneficial for the growth of pepper seeds. Pepper seed germination is also determined by the humidity caused by the shade treatment; therefore, humidity and temperature are important elements in pepper seed germination [7].

The average humidity of the hood with 75% shade has a humidity of 80.25% with a temperature of 24.80°C. While the shade of 25% humidity only reaches 70.6% with a temperature of 26.13°C. Furthermore, it was stated that one of the shading functions of the seedlings from childhood was to regulate sunlight entering the nursery and create an ideal microclimate for early seed growth [12]. Temperature is very important in determining seed germination [7].

3.2. Height of plant

The results showed that the treatment of pepper seed cover with coconut leaf midrib and foliar fertilizer gave the best plant height yield and was significantly different from other treatments, namely 54.22 cm. If we look at the data in Table 1, it shows that fertilization treatment tends to give a better plant height than pepper seeds that are not fertilized even though it is not significantly different.

This is due to the relatively little light intensity and leaf fertilizer applied to pepper seeds tends to spur high growth to get sunlight for plant physiological processes and is supported by the addition of plant nutrients through leaf fertilization. Environmental factors that are less than optimal will affect plant height growth [6], [9]. It stated that plants tend to spur their high growth with relatively little light intensity to obtain the light needed for physiological processes. Height growth is faster in the shade than in the open space.

3.3. Number of leaves

The results showed that the leaf number parameter positively affected the pepper seeds that were fertilized through the leaves, while the pepper seeds that were not fertilized showed fewer leaves. Meanwhile, the application of plant cover to pepper seedlings did not affect the formation of leaf buds (table 1). This shows that the application of fertilizers through the leaves can stimulate the formation
of new shoots. Fertilizing through leaves means adding the nutrients needed for pepper seed plants to form leaf buds [6]. Giving the foliar fertilizer can stimulate seed growth such as shoots and new roots [1].

The rate of nutrient uptake in leaves is influenced by the status of nutrients available in the soil. If the nutrient content in the soil is low, the absorption of nutrients through the leaves is relatively faster [14]. The advantages of using foliar fertilizers are that it can increase photosynthetic activities, transport nutrients from the soil into the tissues, reduce nitrogen loss from leaf tissue, increase the formation of carbohydrates, fats, and proteins, and increase the potential for plant yields [16]. The use of the liquid fertilizer, both synthetic and natural, can accelerate the emergence of shoots to increase the number of new shoots, which will increase the number of leaves [5].

Providing hoods on pepper seed plants does not affect the formation of new shoots. This is due to giving a hood can reduce the daytime temperature so that the transpiration rate is lower; this is better for supporting the early growth of cuttings when they do not have roots to absorb water [14].

3.4. Number of branches

The results showed that the treatment of fertilizing through leaves combined with coconut leaf midrib cover, and black paranet cover, and white plastic cover gave more branches than the pepper seedlings that were not given foliar fertilizer (table 1). This shows that the application of fertilizers through the leaves can stimulate the formation of new branch shoots. Fertilizing through leaves means adding the nutrients needed for pepper seed plants to form branch shoots [9]. Giving the foliar fertilizer can stimulate new branch shoots growth [1]. The use of liquid fertilizer can accelerate the emergence of branch shoots. Giving the foliar fertilizer can stimulate new branch shoots growth [1] to increase new branch shoots [5].

Providing covers on pepper seed plants does not affect the formation of new branch shoots. This is due to giving a cover that can reduce the daytime temperature so that the transpiration rate is lower; this is better for supporting the early growth of cuttings and does not support the growth of new branch shoots [15].

3.5. Number of internodes

The results showed that the treatment of cover application using coconut leaf midrib and leaf fertilization on pepper plant seeds gave the largest number of internodes that grew and were significant but not significantly different from the untreated treatment on the coconut midrib cover (table 1). It shows that the organic cover treatment of coconut leaf midrib tends to give a better number of internodes than pepper seeds that are plastic covered. This is because the relatively little light intensity at cover treatment of coconut leaf midrib and fertilizer applied to pepper seeds tends to spur high number of internode growth. Moreover, it is supported by the addition of plant nutrients through leaf fertilization [6]. The availability of nutrients is sufficient and balanced during plant growth; it will play a role in stem formation, leaf widening so that in the end, it will increase the number of sections of pepper [13].

4. Conclusions

The combination of treatment between providing coconut leaf midrib cover with fertilization through the leaves gives the best results on the percentage of growth of live pepper seeds, the height of pepper seeds, number of leaves, number of branches, and number of segments that grow on pepper seeds in the nursery. Therefore, it is recommended that in the seedbed for pepper, it is recommended to use a cover from coconut leaf midrib and fertilized through the leaves.

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