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# Vernalization and benzylamino purine treatments on the generative growth of shallots (allium cepa var. ascalonicum l.) bauji variety in the lowlands

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**Abstract.** True shallot seeds (*Allium cepa* var. ascalonicum L.) or True Shallot Seed (TSS) has begun to be used widely as planting material. However, not all types of shallot plants can flower and produce true seeds perfectly because the majority of shallot plants in Indonesia are grown in the lowlands with temperatures of more than 30℃. Although there are some local varieties, which naturally flower, they have not been tested until producing true seeds. This study aims to determine the effect of vernalization and benzyl amino purine (BAP) on the Bauji variety onion plants' generative growth. The research was conducted from July to November 2020 in Jember Regency at an altitude of 89 asl. The research design using a factorial randomized block design. The first factor is vernalization, while the second factor is BAP concentration at 50, 100, and 150 ppm. The results showed an interaction between vernalization factors and the use of BAP, and single-use of BAP did not significantly affect the generative growth of Bauji variety shallot. The vernalization treatment separately actually gave an increasing effect on the percentage of flowering plants, the number of umbels per planting, the number of flowers per umbel, the number of capsules per umbel, the number of seeds per umbel, the TSS weight per umbel, and the weight per 100 seeds

## 1. Introduction

Shallot (*Allium cepa* var. ascalonicum) is one of the essential vegetables in Indonesia. Shallots have long been cultivated in the lowlands using seed tubers. Technological innovation to increase yield is by using true shallot seeds or TSS (True Shallot seeds). The supply of TSS as a planting material is still constrained due to the lack of quality seed-producing cultivars. Therefore, good quality TSS procurement in sufficient quantities is still to be done [1]. The main obstacle to flowering shallots in the tropical lowlands is less than ideal temperature in the lowlands for flowering, 30℃. Ideally, onion flowering is at a temperature of 18℃. Therefore, we need efforts to improve flowering and seeding in the lowlands. Bauji variety is one type of variety that is widely grown in shallot centers in East Java, which expects to improve the quality of its TSS by using physiological manipulation, namely by using cold temperature treatment or vernalization and the use of benzyl amino purine to encourage flowering and formation of shallot seeds in the lowlands [2], [3]. The purpose of this study was to determine the effect of vernalization of seed tubers and BAP administration on the generative growth of Bauji varieties in the lowlands.

## 2. Methods

This research was conducted in Antirogo Village, Jember Regency, at an altitude of 89 m above sea level from July to October 2019. This research was conducted using a randomized block design consisting of two factors. Factor I is Vernalization (V), which consists of two levels, namely V0 (without vernalization) and V1 (vernalization). Vernalization was carried out at a temperature of 5-10℃ in for one month. Factor II is the concentration of benzyl amino purine (BAP) with four levels, namely B0 (0 ppm), B1 (50 ppm), B2 (100 ppm), and B3 (150 ppm) and repeated five times with each research unit of eight polybags consisting of than three plants per poly bag. BAP is given by leaking at the growth point of 100 ml per polybag. The parameters observed included the percentage of flowering plants, the number of umbels per plant, the number of flowers per umbel, the number of capsules per umbel, the number of seeds per umbel, the weight of TSS per umbel, and the weight of seeds per 100 TSS. The data obtained were analyzed using variance analysis and continued with the LSD test analysis at the 5% significance level.

## 3. Results and discussion

The study results showed an interaction between vernalization treatment and BAP treatment on the increase in the percentage of flowering plants, as shown in Table 1 below.

**Table 1** Average treatment combination vernalization and BAP treatment parameter of the percentage of flowering plant (%)

| Treatments | Percentage of Flowering Plants (%) |
|---|---|
| ***Vernalization + BAP ( V x B)*** | |
| $V_0B_0$ (non vernalization + BAP 0 ppm) | 0 bc |
| $V_0B_1$ (non vernalization + BAP 50 ppm) | 33 b |
| $V_0B_2$ (non vernalization + BAP 100 ppm | 33 b |
| $V_0B_3$ (non vernalization + BAP 150ppm) | 0 c |
| $V_1B_0$ (vernalization+ BAP 0 ppm) | 91.5 a |
| $V_1B_1$ (vernalization + BAP 50 ppm) | 83 a |
| $V_1B_2$ (vernalization + BAP 100 ppm) | 100 a |
| $V_1B_3$ (vernalisasi + BAP 150 ppm) | 100 a |
| BNT 5% | 18.32 |

*Number followed by same letters within the same column were not significantly different using LSD at a 0.05.*
*Ns =not significantly*

Based on Table 1, it proves that by using the 5% LSD test, all combinations of vernalization treatments with BAP, starting from the V0B0 combination to the V0B3 treatment combination, have a significant effect on the increase in the percentage of flowering plants when compared to all combinations of vernalization treatments with BAP treatment, both starting from the combination treatment V1B0 to treatment combination V1B3. This result can also be seen in Figure 1. In this figure, it further proves that in Figure 1e, 1f, 1g, and 1h is a combination of treatment images between vernalization treatment with BAP concentrations ranging from 50 ppm to 150 ppm, which indicates an increase in the percentage of flowering between 83% to 100% when compared with the combination treatment without vernalization with BAP treatment from a concentration of 0 ppm to a concentration of 150 ppm as shown in Figures 1a, 1b, 1c, and 1d. This seems to be the same as that achieved by Manik et al. [4], [5]. This can be understood because vernalization treatment has an effect on the breakdown of flowering dormancy, as manipulation of winter conditions through the activation mechanism of the enzymes superoxidase dismutase (SOD) and peroxidase (POD) [6] and continued with the work of BAP effect through a mechanism to increase flower production, namely the occurrence of Cytokinin activity in meristematic tissue to increase meristem size or expand the meristematic zone, ie, increase the apical meristem of shallots [7]. With the mechanism of increasing the onion apical meristem, which has been changed from leaf bud meristem to flower bud, it will have an impact on increasing the number of umbel per plant, the number of flowers per umbel, and the number of capsules per umbel as shown in Table 2.

**Table 2**. Number of umbel per plant, number of flower per umbel, number of capsule per umbel

| Treatments | Number of umbel per plant | Number flower per umbel | Number capsule per umbel |
|---|---|---|---|
| **VxB** | ns | ns | ns |
| **Vernalization** | | | |
| V0 | 1 b | 132 a | 0 b |
| V1 | 8 a | 119 a | 64 a |
| **Concentration of BAP** | | | |
| B0 | ns | ns | ns |
| B1 | ns | ns | ns |
| B2 | ns | ns | ns |
| B3 | ns | ns | ns |

*The numbers followed by the same letters within the same column were not significantly using DMRT at a 0,05. Ns= not significantly*

The mechanism of the effect of increasing the percentage of flowering plants seems to have continued implications in the parameters of the increase in the number of seeds per umbel, the weight of seeds per umbel, and the increase in the weight of 100 seeds produced, as listed in Table 3. Although it seems that the test results are more indicated that the increase is more due to the effect of vernalization (V1) when compared to the effect without vernalization (V0). Meanwhile, separately, BAP treatment's effect did not significantly affect the parameters of the number of seeds per umbel, the weight of seeds per umbel, and the weight of 100 seeds. This study's results seem to be the same as those obtained by [8].

**Table 3.** Number of seed per umbel, the weight of TSS per umbel, and weight of 100 seeds

| Treatments | Number of seed per umbel | weight of TSS per umbel | weight of 100 seed |
|---|---|---|---|
| **VxB** | ns | ns | ns |
| **Vernalization** | | | |
| V0 | 0 b | 0 b | 0 b |
| V1 | 118.8 a | 0.45 a | 3.06 a |
| **Concentration of BAP** | | | |
| B0 | ns | ns | ns |
| B1 | ns | ns | ns |
| B2 | ns | ns | ns |
| B3 | ns | ns | ns |

*The numbers followed by the same letters within the same column were not significantly using DMRT at a 0.05. Ns= not significantly*

Compared with the previous research results by Siswadi et al. (2019), namely the effect of vernalization with GA3, there is no interaction between vernalization treatment and GA3. This means that separately the vernalization treatment has a significant effect on all observation parameters. This is because the GA3 mechanism is different from the BAP mechanism. GA3 is ZPT with a mechanism as a substitute for cold temperatures, while (10) BAP is ZPT of the cytokinin group with a mechanism to help the development of increased meristematic tissue so that its impact, when combined with vernalization treatment, can cause synergy to increase the percentage of flowering. This further proves that GA3 and BAP have a different effect on the mechanism of flower formation and TSS, even though they both have a positive effect on TSS production in the lowlands.

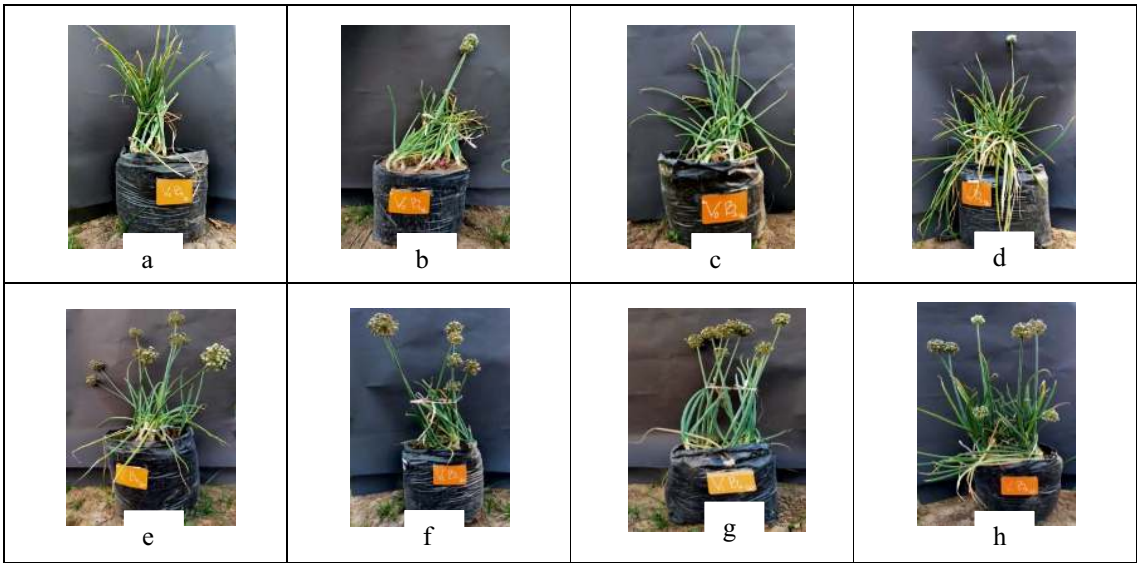


**Figure 1.** Number of umbels as respond to vernalization and BAP in the lowland of Jember. a (non vernalization + BAP 0 ppm), b (non vernalization + BAP 50 ppm), c(non vernalization + BAP 100 ppm), d (non vernalization + BAP 150ppm), e(vernalization+ BAP 0 ppm), f (vernalization + BAP 50 ppm), g (vernalization + BAP 100 ppm), h(vernalisasi + BAP 150 ppm).

## 4. Conclusion

The results showed there were interaction between vernalization factors and the use of BAP, and single-use of BAP did not significantly effect the generative growth of Bauji variety shallot. The vernalization treatment separately actually gave an increasing effect on the percentage of flowering plants, the number of umbels per planting, the number of flowers per umbel, the number of capsules per umbel, the number of seeds per umbel, the TSS weight per umbel, and the weight per 100 seeds.

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