

Growth Performance of Three Ginger (*Zingiber officinale* Rosc.) Varieties in Crate System

Ridwansyah¹, Y. Hasanah¹, E. Yusraini¹, N. Rahmawati¹, M. S. M. Harahap¹

¹Faculty of Agriculture, Universitas Sumatera Utara, Jl. Prof. A. Sofyan No. 3 Kampus USU, Padang Bulan Medan 20155, Indonesia

Keywords : Ginger, Variety, Crate System.

Abstract : Ginger growth is an important factor that must be considered to produce ginger rhizome which is very beneficial for health. The health-promoting perspective of ginger is attributed to its rich phytochemistry. Ginger cultivation in baskets is one way to cultivate ginger production. The study aimed to identify performance of three ginger varieties growth in crate system. Experimental design was a randomized block design non factorial with 5 replications. The treatment were ginger varieties (Emprit, Gajah, and Merah). The result showed that the variety of Gajah ginger and Emprit ginger had higher plant height 2-12 WAP (week after planting) and also number of leaf 2-12 MST compare than Merah ginger.

1 INTRODUCTION

Ginger is one species belongs to the family Zingiberaceae family that is used as raw material in the manufacture of modern and traditional medicines. The health-promoting perspective of ginger is attributed to its rich phytochemistry. The content of secondary metabolites in ginger plants is mainly flavonoids, phenols, terpenoids and essential oils. Secondary metabolite compounds produced by Zingiberaceae plants generally can inhibit the growth of pathogens that harm human life (Kartika, 2013 ; Nafiseh., 2013 ; Shukla and Singh, 2007).

Recent studies on health related effects of ginger which have also stimulated farmers concern on the growth of the plant have shown the efficacy of the plant in some life challenging ailments such as entero toxin induced diarrhea, diabetic nephropathy, nausea, plasma antioxidant, vomiting, high cholesterol, high blood pressure and inflammation (Chen., 2007 ; Ernest and Pittler, 2008 ; Kim., 2008).

Ginger propagation is usually performed with rhizome but has a lot of obstacles. The obstacle among other is the availability of good quality rhizome. Rhizome age, filled out, no wrinkles, bright shiny skin color, and free of pests attacks is characteristic of high-quality seed (Hasanah., 2004)

Based on the size, shape and color of the rhizome, there are 3 types of ginger, namely "jahe gajah" (*Zingiber officinale* var. *officinale*), jahe emprit (*Zingiber officinale* var. *amarum*) and 'jahe merah' (*Zingiber officinale* var. *rubrum*) (Hapsoh., 2008)

Based on the above background, one method of ginger cultivation which is aimed at increasing the growth of ginger is the cultivation of ginger in crate systems. Previous study by Hapsoh. (2008) state that the three ginger types have different characteristics in their secondary metabolites, essential oil, starch content, ash content (Hapsoh., 2008). Therefore, the study aimed to identify performance of three ginger growth in crate system as material for analysis the as material for the characteristic analysis of tuber starch and essential oil from the three types of ginger.

2 MATERIALS AND METHODS

2.1 Study Area

The experiments were conducted at the Research Field Faculty of Agriculture, Universitas Sumatera Utara on March to July 2018.

2.2 Procedures

Treatments were arranged in Non Factorial Randomized Block Design with five replications. The treatment is variety J1 = Jahe gajah, J2 = Jahe emprit, V3 = Jahe merah. Parameters observed was plant height at 2-4 week after planting (WAP).

The planting area to be used is cleaned from weeds, then made drainage beds and ditches, and crate are arranged on beds. The planting medium used is top soil: manure: husks (3: 1: 1). The media is mixed evenly and loosened using a hoe, then put into a basket that has been arranged on the bed. Ginger seeds are prepared which are ready for sowing. The seeds are soaked in Dithane M-45 solution about 1 hour to control the fungus, then drained and the seeds are cut into pieces according to the segment and the seeds are ready to be sown. Seedlings are planted at the nursery. Nursery media are compost and sand in a ratio of 3: 1. The media is distributed evenly, then the prepared seeds are arranged on a stretch of the planting medium with the buds going above.

Seedlings that have been sown and old enough are moved into the crate. Each crate is planted with 5 seeds. After the seeds are planted, the crate is sheltered with paranet to avoid direct sunlight. Watering is done every morning and evening according to weather conditions, while the change of damaged plant is done no later than 2 weeks after planting (WAP). Sprouting is done so that the plant does not fall easily, by making a mound of soil around the plant, started at 2 WAP when the clump has formed with 4-5 tillers.

2.3 Data Collection and Data Analysis

The growth parameters were determined at 4, 6, 8, 10 and 12 weeks after planting (WAP). The parameters essentially determined were; plant height which was measured from the base of the plant to the apex using measuring tape. Number of leaves was measured by counting manually. Number of tillers was taken at the middle of each bed by counting at 12 WAP. Data were subjected to analysis of variance (ANOVA) for comparison of means. Means were separated using Duncan's Multiple Range Test at the 0.05 probability level.

3 RESULT AND DISCUSSION

3.1 Plant Height

The ginger of jahe emprit and jahe gajah, generally has the higher of plant height 2-12 WAP than jahe merah. Increasing the plant height of jahe gajah and jahe emprit 2-12 WAP is almost similar, while the growth of plant height of jahe merah is lower. The plant height increase of jahe emprit and jahe gajah at 4-10 WAP increased sharply, but the plant height of jahe merah at 4-12 WAP increased (Table 1).

The growth phase of ginger is divided into 4 phases, i.e. (1) the budding phase, (2) the seedling phase, (3) the growth and development phase, and (4) the sleep rhizome phase. The phase of growth and development in the ginger plant is divided into two phases, namely the rapid growth phase (active phase) and the phase of the development of the rhizome (the stage of rhizome expansion). Phase growth and development needs 70-80 days after the seedling phase. Lijiu who mentions the fast growth phase is the price of 110-130 day after planting (DAP), while the development phase of the rhizome is 130-160 DAP. (Hapsoh., 2008 ; Li., 2010)

3.2 Number of Leaves

Based on Table 2 it can be seen that generally the ginger of jahe emprit and jahe gajah has the higher of number of leaves 2-12 WAP than jahe merah. Increasing the number of leaves of jahe gajah and jahe emprit at 8-10 WAP is almost similar, while the growth of number of leaves of jahe merah is lower. The plant height increase of jahe emprit and jahe gajah at 4-10 WAP increased sharply, but the number of leaves of jahe merah at 4-12 WAP increased slowly.

Variety	Week after transplanting (WAP)					
	2	4	6	8	10	12
leaf					
Jahe emprit	9.40	11.36	11.80	11.80	17.40	18.08a
Jahe gajah	9.92	10.92	10.92	10.92	17.04	17.60a
Jahe merah	7.72	8.72	8.72	8.72	14.48	14.48b

Note : Different letter represent significant differences as Duncan’s Multiple Range Test (p=0.05)

Table 1. Plant height 2-12week after planting of ginger varieties in crate system cultivation

Variety	Week after transplanting (WAP)					
	2	4	6	8	10	12
cm					
Jahe emprit	43.28	59.06a	65.61a	72.51a	82.04a	84.95a
Jahe gajah	39.72	57.52a	65.65a	74.61a	85.14a	89.34a
Jahe merah	32.24	44.54b	50.92b	57.42b	61.97b	66.99b

Note : Different letter represent significant differences as Duncan’s Multiple Range Test (p=0.05)

Table 3. Number of tillers 2-12 WAP of ginger varieties in crate system cultivation

Variety	Week after transplanting (WAP)					
	2	4	6	8	10	12
tiller					
Jahe emprit	2.3a	2.5a	2.6a	3.4a	3.9a	4.2a
Jahe gajah	1.9a	2.0a	2.2a	2.9a	3.2a	4.0a
Jahe merah	1.1b	1.2b	1.6b	1.7b	2.0b	2.3b

Note :Different letter represent significant differences as Duncan’s Multiple Range Test (p=0.05)

3.3 Number of Tillers

Based on Table 3 and Figure 3 it can be seen that generally the ginger of jahe emprit and jahe gajah has the higher of number of tillers 2-12 WAP than jahe merah. Increasing the number of tillers of jahe gajah and jahe emprit at 8-10 WAP is almost similar, while the growth of number of tillers of jahe merah is lower. The number of tillers of jaheemprit and jahe gajah at 4-10 WAP increased sharply, but the number of tillers of jahe merah at 4-12 WAP increased. This might be due to genetic constitution of the varieties and genotypic potential and availability of nutrients in the soil, which were influenced by low light intensity and

high relative humidity condition under shade net situation (Surendra, 2017 ; Laksmi., 2014).

4 CONCLUSIONS

Each variety has a different growth pattern. Jahe gajah and jahe emprit have a similar growth pattern for plant height, number of tillers and number of leaves. Jahe merah grows more slowly than jahe gajah and jahe emprit. The growth of a variety is dependent on vigour of the plant and other plant characters.

ACKNOWLEDGEMENTS

The authors would like to thank Directorate of Research and Community Services, Ministry of Research Technology and Higher Education that have funded this Research in accordance with Research Contract with Rector Universitas Sumatera Utara, Fiscal Year 2018 Number : 1140/UN5.1.R/PPM/2018, dated 5 February 2018.

REFERENCES

- Chen, J.C. Huang, L., Shibli, W. Hsiang, C. 2007. *Ginger and its bioactive component in entero toxigenic Escherichia coli-heat-labile*. J. Agric. Food Chem. 55(21):8390-8397.
- Ernest, E., Pittler, M.H. 2008. *Efficacy of ginger for nausea and vomiting: A systematic review of randomized clinical trial*. Br. J. Anesth. 84(3):367-371.
- Hapsah, Y. Hasanah, E Julianti 2008 *Budidaya dan teknologi pascapanen jahe* USU Press 112p
- P.N. Ravindran and K.N. Babu. 2005. *Ginger: The genus Zingiber*. CRC Press, Boca Raton 576 p.
- Shukla, Y., Singh, M. 2007. *Cancer preventive properties of ginger* : A brief review. Food Chem. Toxicol. 45:683-690.
- Surendra B, MB Prasanna Kumar, DV Swami, KUma Krishna and Emmanuel, N 2017. Performance of Ginger (*Zingib erofficinale*Rosc) Varieties under Shade Net Condition of Costal Andhra Pradesh. Int. J. Curr. Microbiol. App. Sci. 6(7):494-498. Doi:<https://doi.org/10.20546/ijmas.2017.607.059>
- Vastrad, NV, Hegde, RV, and Girtammanavar, VA 2006 Effect of light intensity and vermicompost and yield of gingerKarnataka J. Agric. Sci., 19: 941-945.