

# Growth and production of Katokkon (*Capsicum chinense* Jacq) chili plants in lowland applied with gibberellins and liquid organic fertilizer

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**Growth and production of Katokkon (*Capsicum chinense* Jacq) chili plants in lowland applied with gibberellins and liquid organic fertilizer**

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**Abstract.** This study aimed to determine the growth and production of katokkon chili plants (*Capsicum chinense* Jacq.) in the application of gibberellins and liquid organic fertilizer. This research was conducted at the Experimental Farm of the Faculty of Agriculture, Universitas Hasanuddin, Makassar from May to October 2017. The research was conducted in the form of a two-factors factorial experiment. The first factor was gibberellins consisted of four levels namely 0 ppm, 25 ppm, 50 ppm and 75 ppm, and the second factor was liquid organic fertilizer consisted of three levels of 25 ml L<sup>-1</sup>, 50 ml L<sup>-1</sup> and 75 ml L<sup>-1</sup> with three replications. Results of the study show that application of gibberellins on the local chili plant of katokkon interacted with liquid organic fertilizer improved the vegetative growth of the plant. Gibberellin also significantly affected the production parameters of the local chili plant. The fruit weight per plant and per hectare decreased with the increased of gibberellin dosages. No significant effect of the use of liquid organic fertilizer found, however, the treatment of 75 ml L<sup>-1</sup> showed better results in several research parameters.

### 1. Introduction

Katokkon chili is one of the red chili cultivars from North Toraja Regency, South Sulawesi [1]. This chili has good potential to be developed because of its spicy, unique shape such as small paprika and has been registered at the Center for Plant Variety Protection and Agricultural Licensing. Chili plant group in North Toraja Regency is dominated 80% by Katokkon chili varieties. Yield of chili obtained in the last two years have still not met the target of the North Toraja Regency government. In 2013, the production target was 107.3 tons but the realization was only 94 tons. Likewise in 2014, the production target was 110.2 tons but the realization could only reach 102 tons [2]. Katokkon chili weighs about 65-90 grams per fruit with 6-7mm thickness of meat. This chili has content per 100 grams of fruit consisting of 16.84 mg of vitamin C, 85.4% water and 9.2% sugar.

One effort to preserve the katokkon chili is to maintain germplasm. By maintaining the germplasm it is expected that the katokkon chili can survive and will not become extinct. Katokkon chili plants are also attempted to be planted in the lowlands because so far the katokkon chili is only famous for growing in the highlands. Despite this, plants grown in the lowlands not often show lower productivity



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due to fail to formed fruit or experiencing flower and fruit fall. Efforts to overcome this problem is necessary such as use of gibberellins that has been known can improve the fruit set of the horticulture plants [3].

Gibberellins (GA3) are growth regulators that have a physiological role in elongating stems, preventing flower fall, preserving fruit and suppressing the aging process and cutting of plant organs [4]. One effort that can be done to prevent the fall of flowers and fruit, improve fruit quality, and increase fruit yields can be done by providing growth regulators (PGR), so that it is expected that chili production can increase. The administration of GA3 can increase the auxin content in flowers so as to prevent absences in flowers [5]. Application of 50 ppm of this hormone to curly chili plants can increase the weight of fruit on curly chili plants [6]. However, the response of plants to growth regulators is influenced by several factors including: types of growth regulators used, season when administration, plant varieties, growth stages and concentrations of growth regulators. In the other previous study on curly chili as response to the application of GA3 at concentration of 40 ppm can reduce the fall of flowers by 42.69% so that the number of planted flowers increases 33.98% resulting in the number of planted fruits increasing 36.64% [7].

Chaudary et al. [8] showed that the administration of 10 ppm GA3 in tomato plants could increase fruit production by 2.30% higher than the control. While higher concentration of 100 ppm GA3 applied to red chili plants was reported can increase plant height and leaf width [9]. Other study reported that the administration of the hormone gibberellin with a concentration of 50 ppm to cherry tomato plants showed the highest crop production and the highest number of fruit harvested [10]. Ouzounidou et al. [11] suggested that application of 25 ppm gibberellin on chilli plants showed the best results in flowering age, height of main branch length, and weight of fruit plantations. These studies show that the gibberellins used in the trials affect flowering and fruiting.

Liquid organic fertilizer is very influential on soil biological properties such as the activity of soil organisms, the number and development of microorganisms [12]. The activity of these microorganisms is very important in the repair of organic matter, the deposition of proteins into amino acids, the nitrification process which ultimately frees nutrients such as N, P, and S, as well as the micro elements. The use of raw materials for making liquid organic fertilizer such as *Gliricidia sepium* leaves, banana weevil, bael fruit (*Aegle marmelos*), rice washing water and coconut water has enormous benefits in providing macro nutrients and micro nutrients as well as containing microorganisms that have the potential to remodel organic matter, growth stimulants, and agents pest and plant disease control so that both are used as decomposers and organic pesticides [12,13]. Based on the previous description, this study was carried out to determine the growth and production of katokkon chili as response to the application of gibberellin and liquid organic fertilizers.

## 2. Methodology

### 2.1. Methods

This research was conducted at the Experimental Farm of the Faculty of Agriculture, Universitas Hasanudin, Makassar from May to October 2017. The trial was set based on randomized Group Design. The first factor was gibberellins consisted of four levels namely 0 ppm, 25 ppm, 50 ppm and 75 ppm, and the second factor was liquid organic fertilizer consisted of three levels of 25 ml L<sup>-1</sup>, 50 ml L<sup>-1</sup> and 75 ml L<sup>-1</sup> with three replications, hence there were 36 experimental units.

### 2.2. Preparation of experimental plots

The plots was made by measuring 6 m x 3 meters with a distance between plots of 30 cm and a distance between replications of 50 cm, with a plant spacing of 50 x 80 cm. Prior to planting, 2.5 kg per plot of compost and NPK (15:15:15) as much as 300 g per plot were added to the plot as the basic fertilizer. The application of the compost was carried out by spreading compost on the top of the bed then mixing it with the soil. While the NPK fertilizer was applied by placing it at 20 cm from the planting hole. The plots were then covered with black silver plastic mulch to cover to suppress the growth of

weeds and maintain soil moisture. Following the installation of the silver black plastic mulch, planting holes were made using used milk cans that previously heated. Seedlings are inserted into holes 5-7 cm in diameter.

2.3. Preparation of gibberellin treatment.

Gibberellins treatment was prepared by weighing the gibberellins according to the required concentration (25 ppm, 50 ppm and 75 ppm) then diluted in alcohol until completely dissolved, after which distilled water was added.

2.4. Application of treatments.

The liquid organic fertilizer was applied 8 times during the experiment started at 1 week after planting (WAP) by spraying fertilizer to all parts of the plant in the morning. The gibberellin hormone treatments were applied three times during planting at 6, 8, and 10 WAP.

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2.5. Data analysis.

The data collected was analyzed statistically using analysis of variance according to the design used. If the effect of treatments resulted significant ( $p < 0.05$ ) on the observed variables, then a further test was conducted using a Least Significance Differences (LSD) test at the 5% level.

3. Results

5  
3.1. Effect of gibberellins and liquid organic fertilizer on growth of Katokkon (*Capsicum chinense* Jacq.) chili plants

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The variance analysis shows that the treatment of gibberellins and liquid organic fertilizer had a significant interaction in affecting plant height and number of productive branches and did not significantly affect the age of flowering and harvest. Average values of some vegetative parameters of the katokkon chili plants are shown in Table 1.

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**Table 1.** Effect of gibberellins and liquid organic fertilizer on growth of Katokkon (*Capsicum chinense* Jacq.) chili plants.

Gibberellin Concentration	Liquid organic fertilizer dose	Plant height (cm)	Number of productive branches (stems)	Time of flowering (days)	Time of harvest (days)
0 ppm	25 ml L <sup>-1</sup>	49.62 ab	18.1 bc	65.67	96.85
	50 ml L <sup>-1</sup>	43.76 abc	18.5 abc	67.33	94.35
	75 ml L <sup>-1</sup>	39.20 b	18.3 abc	65.33	97.92
25 ppm	25 ml L <sup>-1</sup>	44.99 abc	26.5 a	69.33	94.33
	50 ml L <sup>-1</sup>	49.13 ab	16.8 c	67.00	95.42
	75 ml L <sup>-1</sup>	44.47 abc	23.8 abc	68.33	96.25
50 ppm	25 ml L <sup>-1</sup>	42.03 abc	18.1 bc	67.00	97.10
	50 ml L <sup>-1</sup>	34.77 c	25.5 ab	68.00	96.00
	75 ml L <sup>-1</sup>	47.98 ab	20.8 abc	69.67	97.10
75 ppm	25 ml L <sup>-1</sup>	40.91 abc	20 abc	69.00	97.33
	50 ml L <sup>-1</sup>	51.79 a	17.3 bc	64.33	99.00
	75 ml L <sup>-1</sup>	40.83 abc	20 abc	68.00	94.08

6 Tukey's HSD<sub>0.05</sub> 12.13 7 8.3 ns ns  
Numbers followed by same letter in a column (a, b, c) are not significantly different based on Tukey's test at  $\alpha = 0.05$ . ns = not significant.

Table 1 shows that the combination of 75 ppm gibberellin and 50 ml L<sup>-1</sup> liquid liquid fertilizer produced the highest average plant height (51.79 cm) which was significantly different from the other treatments. Whereas 50 ppm gibberellins and 50 ml L<sup>-1</sup> liquid organic fertilizer produced the lowest average plant height (34.77 cm). The combination of 75 ppm gibberellins treatment and 25 ml L<sup>-1</sup> liquid organic fertilizer produced an average number of productive branches (26.5 stems) that was significantly different from other treatments, whereas gibberellins control treatment (0 ppm) and 50 ml L<sup>-1</sup> of liquid org. fertilizer produced the lowest average number of productive braches (16.8 stems).

The analysis of variance showed that the treatment of gibberellins, liquid organic fertilizer and their interactions did not significantly affect the parameters of age of flowering and age of harvest. The treatment of 75 ppm gibberellins and 50 ml L<sup>-1</sup> liquid organic fertilizer resulted in the earliest flowering age (64.33 days), while the 50 ppm gibberellins and 75 ml L<sup>-1</sup> liquid liquid fertilizer had the longest flowering age (69.67 days). Application of 75 ppm of gibberellins and 75 ml L<sup>-1</sup> liquid organic fertilizer treatments resulted in the fastest harvest age (94.08 days), while 75 ppm of gibberellins and 50 ml L<sup>-1</sup> liquid liquid fertilizer showed the longest harvest age (99.00 days).

### 3.2. Effect of gibberellins and liquid organic fertilizer on production of Katokkon (*Capsicum chinense* Jacq) chili plants.

The analysis of variance showed that the treatment of gibberellins had a very significant effect, while liquid organic fertilizer treatment and the interaction between the two factors did not significantly affect the weight of fruit per plant and weight of fruit per hectare. Table 2 shows that the gibberellin control treatment of 0 ppm gibberellins had the highest average fruit weight (70.15) compared to other concentration applied. The concentration of 75 ppm of gibberellin had the lowest average fruit weight per plant (49.37 g). Similarly, the treatment of gibberellins 0 ppm (control) had the highest average fruit weight per hectare (2.61 ton ha<sup>-1</sup>) and significantly different from the other gibberellin treatments. The highest concentration of gibberellin (75 ppm) showed the lowest average fruit weight per hectare (2.07 ton ha<sup>-1</sup>).

2 Table 2. Effect of gibberellins and liquid organic fertilizer on the production of Katokkon (*Capsicum chinense* Jacq) chili plants.

Gibberellin concentration	Fruit weight per plant (g plant <sup>-1</sup> )	Fruit weight per hectare (ton ha <sup>-1</sup> )
0 ppm	70.15 a	2.61 a
25 ppm	59.44 ab	2.39 ab
50 ppm	57.15 ab	2.37 ab
75 ppm	49.37 b	2.07 b

6 Tukey's HSD<sub>0.05</sub> 25.56 7 0.5

Numbers followed by same letter in a column (a, b, c) are not significantly different based on Tukey's test at  $\alpha = 0.05$ . ns = not significant.

## 4. Discussion

The local chilli of Tana Toraja, the katokkon, when planted in lowland and applied with gibberellin and liquid organic fertilizer can produce fruits, even though the production was not as much as the production of katokkon chili planted in its original region of Tana Toraja.

The results showed that at a concentration of 0 ppm gave a good response to several observational parameters. According to Yennita [6], gibberellins growth regulators can function synergistically with auxin. Gibberellins will stimulate the formation of the amylase enzyme [14]. These enzymes can play a role in breaking the starch compounds found in endosperm (food reserves) into glucose compounds, where glucose is a source of growth energy. Rosliani et al. [15] added that application of gibberellins can help the process of seed formation, which stimulates the formation of pollen (pollen), enlarges the size of the fruit, stimulates the formation of flowers, and ends the seed dormancy period.

Concentration of liquid organic fertilizer with a concentration of 75 ml L<sup>-1</sup> resulted in best results on several parameters compared to the use of this organic compound at lower dose. These results show that the greater the dose of the liquid organic fertilizer the higher the production of the katokkon chili plant. Research conducted by Rahmi et al. [16] observed similar results where application of liquid organic fertilizer is able to increase growth and accelerate flowering and fruiting of red chili. This is due to the ability of the organic fertilizer to provide macro nutrients such as, N, P, and K and is thought to react quicker because organic fertilizer is applied to the leaves so that it can be absorbed by plants. From the results of this study have not been able to achieve maximum productivity potential because of environmental factors which during the study prior to the generative phase, the katokkon plants were attacked by pests and disease that cause the leaves to curled. According to Syukur et al. [17], curly leaf disease caused by the presence of the Cucumber Mosaic Virus (CMV), which has an effect on shrinking the chili leaves and disrupting the production of chili plants. This disease is actually carried by insects, therefore spraying chemical poisons is needed to reduce losses and eradicate insects, other than that good fertilization is carried out right and right at the time of fertilization, and destroy plants that have been infected so that it does not spread to other plants.

#### 4 Conclusions

Based on the results of research that has been done, it can be concluded as follows:

- a) Interaction of treatments that give the best results is indicated by the concentration of gibberellins concentration of 75 ppm and liquid organic fertilizer of 75 ml L<sup>-1</sup>.
- b) Gibberellins do not have a significant influence on the growth and production of katokkon chili

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