[Triharyanto* 4(2): February, 2017] ISSN 2349-4506
Impact Factor: 2.785

Global Journal of Engineering Science and Research Management

STUDY OF PLANTING SEASON TO FLOWERING POTENCY, FRUITS AND SEED YIELD

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Corresponding author material used in the cultivation of shallots is consumption bulbs. The use of the consumption bulbs as plant material is faced

DOI: 10.5281/zenodo.344632

KEYWORDS: seasons, flowering, seed yield, shallot.

ABSTRACT
The purpose of this study was to determine the effect of climate elements to flowering, fruit yield, and shallot seeds. The study was conducted on Vertisol soil types at an altitude of 98 meters above sea level. The experimental design used was a Randomize Complete Block Design (RCBD) with one treatment factor placed as block treatment, which is the planting season. The treatment planting season consists of four seasons: early rainy season, early dry season, dry season and rainy season. Analysis of data used analysis of variance followed by Duncan's Multiple Range Test 5%. Correlation analyzes were conducted between elements of climate with the percentage of flowering plants, fruit weight and seed weight. The analysis showed that the dry season is the most suitable time to initiate shallot flowering. In this season, plants able to flowering as much as 76.1%. While in other seasons, shallot able to flowering also, despite in the low percentage. Temperature and photoperiodism positively correlated, with a correlation value of 0.9. While the rainfall and humidity have a negative correlation with a correlation value of -0.6 and -0.9.

INTRODUCTION
Shallot is a plant of two seasons (biannual), that is able to produce flowers and seeds to survive in the winter time (Brewster, 1994). Shallot in Indonesia is difficult to produce flowers and seeds both. This is due to the absence of winter season in Indonesia. In tropical regions like Indonesia, shallot flowering and forming seeds when planted in the dry season. Sun fully shines all day long in this season. Long exposures can reach more than 12 hours. The length of this radiation will affect the initiation of flowering. Besides, while irradiation, the average daily temperature in dry season is relatively lower than the rainy season. The cooler average temperatures will increase the number of flowering plants.

The phenomenon of climate change caused by global warming have an impact to flowering of shallot during the rainy season. Observations in the farmers' fields of shallot crop area, it was found shallot crop planted during the rainy season which is able to produce flowers. As explained in a previous article that the shallot crop is a two seasons crop. The first season is used for the formation of the vegetative growth of leaves and tubers. Second season is for the initiation to flowering, and finally able to produce fruit and seeds. This condition occurs when shallot is planted in subtropical regions. In tropical regions such as in Indonesia, shallot crop is able to flowering while planted in dry season.

Shallots can flowering because of the influence of two factors synergy, ie, genetic factors and environmental factors. Genetic factors have been demonstrated through molecular testing (Figure 1.1), the result makes it clear that all the seeds that come from bulbs have the potential to bloom. While environmental factors that play a role in onion flowering is temperature. In the area of origin of these plants, flowering can occur because stimulated by cold temperature (Brewster, 1994). The results showed that GA3 role in replacing the cold temperatures. In addition, the cold temperature treatment on seeds (vernalization) were able to increase flowering onion (Sumarni and Sumiati, 2001).

The time of transition from vegetative to generative growth is very important in agriculture because it is the first step in sexual reproduction (Bernier et al., 1993). The majority of plants use environmental cues to regulate flowering transition, because all the individuals of the species of plants require the simultaneous flowering to occur crossbreds in favorable conditions (Bernier et al., 1993).

Time (season) planting will affect the flowering of shallots. This is because different planting time will lead to differences in climate elements. Climate elements include long-irradiation, temperature and humidity. Shallot will flower when supported by environmental factors. The role of the elements of the climate to the flowering and seed yield botany still need to be studied further. The purpose of this study was to determine the effect of planting season on flowering of shallot crop.

MATERIALS AND METHODS

The research was conducted in four seasons, in the Vertisol soil types with an altitudes 98 meters above sea level. The study was designed using Randomize Complete Block Design (RCBD). The planting season is placed as a treatment, namely: M1: early rainy season (October-December 2012); M2: early dry season (March-May 2013) Case; M3: dry season (July - September 2013) and M4: rainy season (November 2013 - January 2014). The treatment of each planting season repeated seven times.

Analysis of data used is season analysis. Besides, the degree of relationship (correlation) between the elements of the climate with the percentage of flowering plants, fruit weight and seed weight are also analyzed.
Variable observations include: the percentage of flowering plants; fruit weight per plot; seed weight per plot and observational climate elements data (temperature, precipitation, humidity, and duration of irradiation).

RESULTS

Results of analysis of variance showed that the planting season affect to percentage of flowering, fruit weight per plot and seed weight per plot. Results of Duncan's multiple Range Test showed that the percentage of flowering, fruit weight and the weight of seeds, significantly different between M3 with M1, M2, and M4. Between M1 and M2 were not significantly different to each other but both were significantly different from the M4 (Table 1.1). M3 indicates the highest percentage value of flowering (76%). This is understandable because the season is the dry season. In the dry season the sun shines full with the lower average temperature. This is what makes shallot capable to flowering more.

The treatment of the planting season provides information that every season is different, shallot even in the rainy season is still capable to flowering amounted to 23.71%. The fact provides information that shallot able to flowering throughout the year. This phenomenon may be due to climate change (climate change) that is able to provide support for the flowering of shallot.

The positive correlation is shown by the elements of the climate temperature and photoperiodism. While humidity and rainfall negatively correlated (Table 1.2). Temperature and photoperiodism have correlation values 0.942 and 0.957. This means that the temperature and photoperiodism very supportive to flowering process of shallots. Rainfall and humidity have a negative correlation with a correlation value -0691 and -0.98, means that rainfall and humidity inhibit flowering process. The same correlation was also shown between temperature, rainfall intensity, humidity and photoperiodism with the weight of the fruit and seed weight.

The dry season is the ideal time for planting shallots in order of flowering plants. While in early rainy season, early dry season and in rainy season known as the planting out of season (off season). In general, Plant is unable to produce flowers during off-season. However, in this study it all turns out, plants can produce flowers even though the percentage is smaller than in planting season (on season).

An average temperature in the dry season is at 29^{o} C, early rainy season and early dry season the temperature is stable at 31^{o}C. However, during the rainy season, high fluctuations of temperature occurs between 29-31^{o}C (Figure 1.1). The temperature fluctuations affect the ability of shallot to flowering. Average photoperiodism in the dry season is higher than the other seasons. In the rainy season there are many days who have a high photoperiodism. This of course will affect the flowering of shallots (Figure 1.4)

DISCUSSIONS

Most plants use environmental cues to regulate flowering transition, because each individual plant must regenerate to the sustainability of its life. For those reasons, each individual plant must conduct simultaneous flowering for pollination purposes (Bernier et al., 1993). The main environmental factors that influence flowering is photoperiodism, temperature, and water availability (Bernier et al., 1993; Kamenetsky et al., 2004); Brewster, 1982).

The results showed that the planting season gives a different effect on the percentage of flowering. The dry season is the most suitable season for shallot cultivation. In the season shallot is able to produce flower at 76.1%. In this season, the temperature and photoperiodism provide favorable conditions to flowering. The average daily temperature is lower and have a longer photoperiodism.

Shallot is able to flowering at the low temperature range with a long photoperiodism (Rabinowitch, 1990 cit. Khokhar et al., 2007c; Brewster, 1982). Temperature that supports the initiation of flowering in shallot is 17ºC (Thompson and Smith, 1938 cit. Khokhar et al., 2007c). Bertaud 1988 cit. Khokhar et al., 2007c, also reported that the fastest initiation of shallots flowering is in the temperature range of 20ºC. In Khokhar's research et al., (2007c) reported that shallot capable to flowering at a temperature of 11.4 to 24,3ºC. Shallot is also capable to flowering in the temperature range of 20 to 30ºC (Brewster, 1982). In this study, the average temperature that lower than of 30 ° C range, showed the highest percentage of flowering.

Long exposures that provide favorable conditions to flowering initiation of shallots are 15 hours (Woodbury, 1950 cit. Khokhar et al., 2007). Bertaud 1988 cit. Khokhar et al., 2007c, reported that the length of days 14-hour speed up the initiation of flowering. It is also reported by Khokhar et al., (2007c) that the length of days 14-hour speed up the initiation of flowering. In this study indicate that the plants that get a 12 hour duration of irradiation is able to produces a higher flowering rate than the plants that grow upon irradiation of less than 12 hours.

Results of correlation analysis (Table 1.2) show, that the factors of temperature and photoperiodism have a positive relation and very close to the percentage of flowering, fruit weight and seed weight. Correlation value between temperature and photoperiodism to flowering percentage are 0.94 and 0.96. It has been widely demonstrated that a temperature and photoperiodism climate is a factor that is closely related to flowering. Meanwhile, rainfall intensity and humidity factors have a negative correlation. The higher rainfall and humidity, plants will not capable to flowering.

Data showed that the time of planting out of season prove that plants are also able to produce flower, fruits and seeds although the amount of flower produced were lower. The phenomenon needs to be studied further.

CONCLUSIONS

1. In tropic area, shallot is able to flowering throughout season.
2. Shallots capable to produce the highest flower number in the dry season (76.1%), while in early rainy season (27.7%), at early dry season (26.4%), and the rainy season (23.7%)
3. Shallot flowering is affected by temperature, photoperiodism, rainfall intensity and humidity. Factors temperature and photoperiodism inscreasing flowering, while rainfall intenisty and humidity inhibit flowering

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TABLES

Table 1.1 Flowering percentage, fruit weight per plot, and the seeds weight per plot

Planting Season	Flowering Percentage	Fruit Weight per m^2 (g)	Seed Weight per m^2 (g)
1 (early rainy season)	27,7b	179,4b	18,91b
2 (early dry season)	26,4b	224,3b	19,34b
3 (dry season)	76,1a	679,3c	64,42c
4 (rainy season)	23,7c	155,0a	14,57a

Description: number followed by different letters in the same column indicate significant difference at DMRT level 5%.

Table 1.2 Correlation of Climate Elements and Results

Climate Elements	Result		
	Flowering Percentage	Seed Weight	Fruit Weight
Temperatures	0,942	0,754	0,996
Rainfall Intensity	-0,691	-0,674	-0,604
Humidity	-0,98	-0,713	-0,979
Photoperiodism	0,957	0,76	0,994

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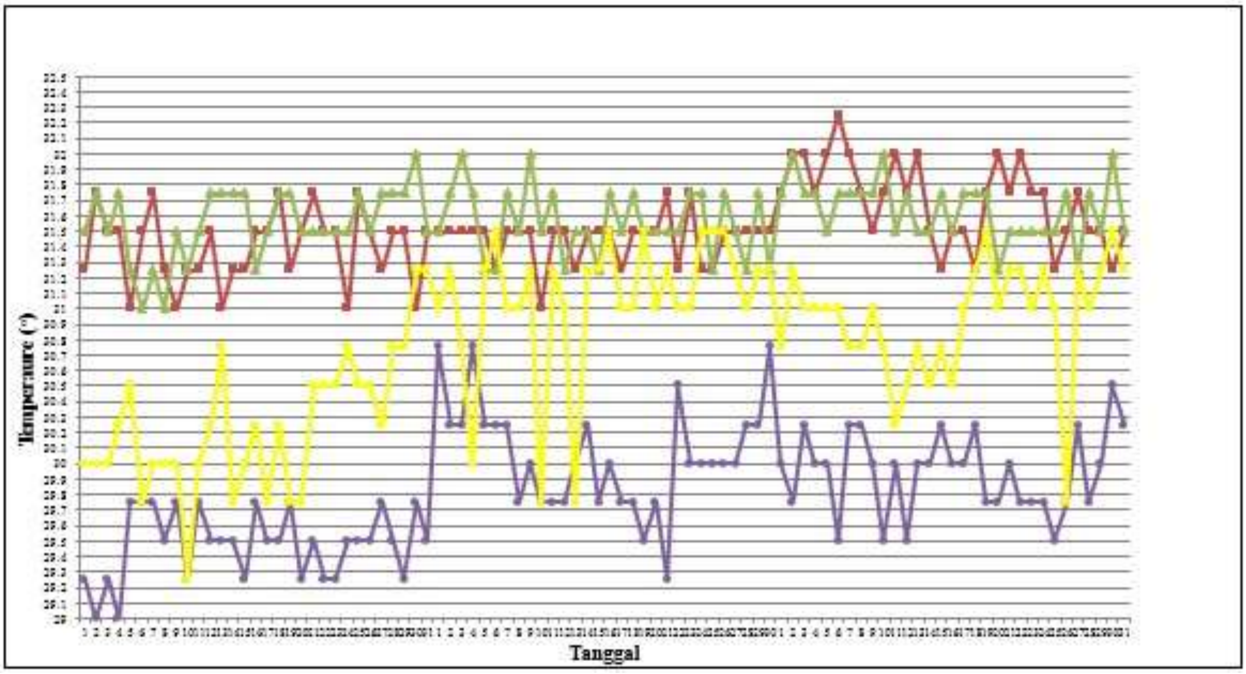

Figure 1.1 Daily Temperature Graph During Plant Growth

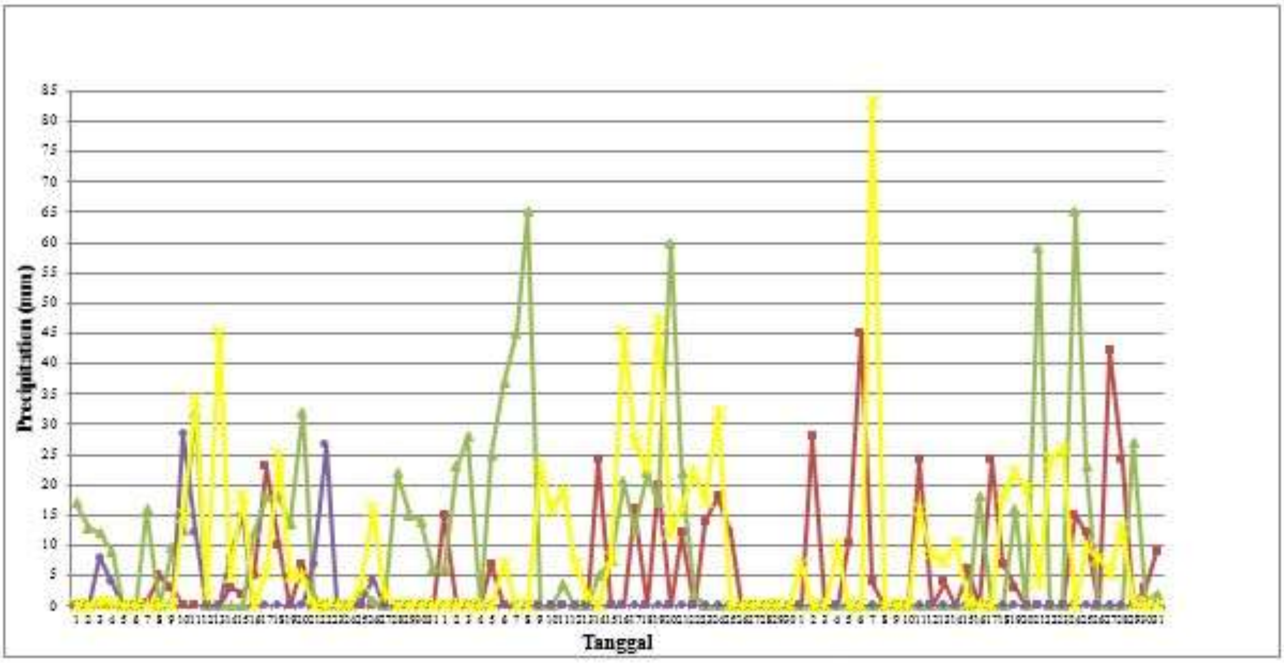

Figure 1.2 Precipitation Graph During Plant Growth

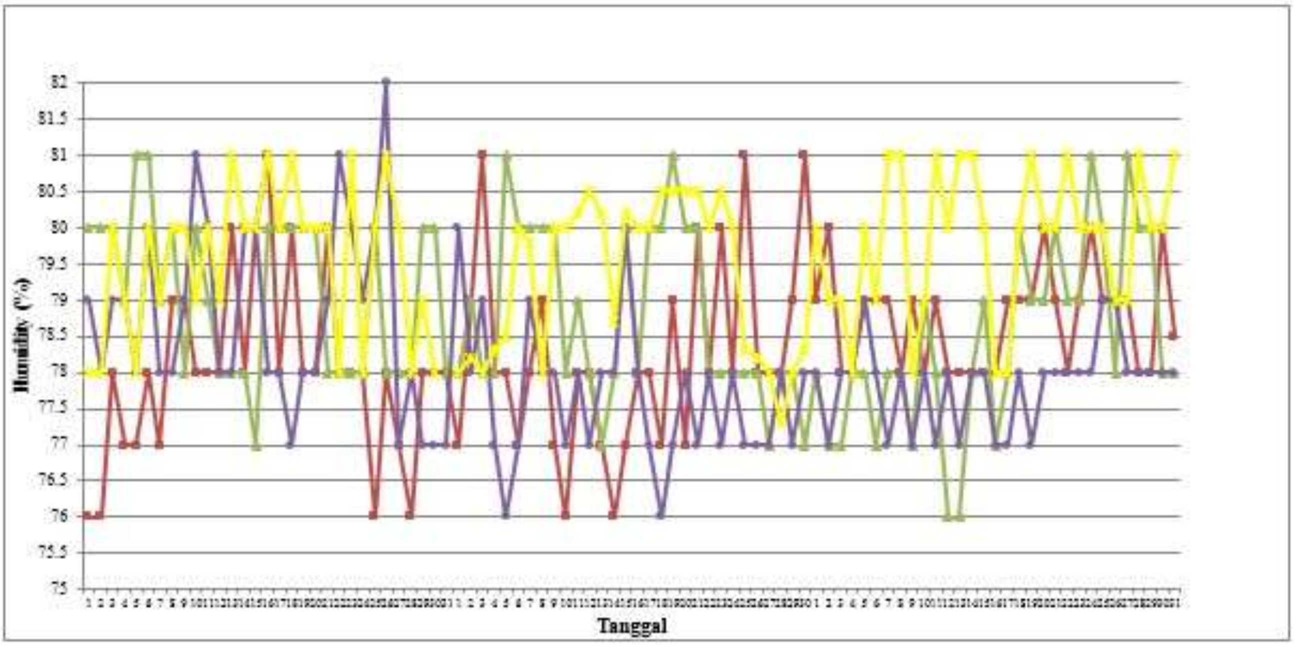

Figure 1.3 Daily Humidity Graph During Plant Growth

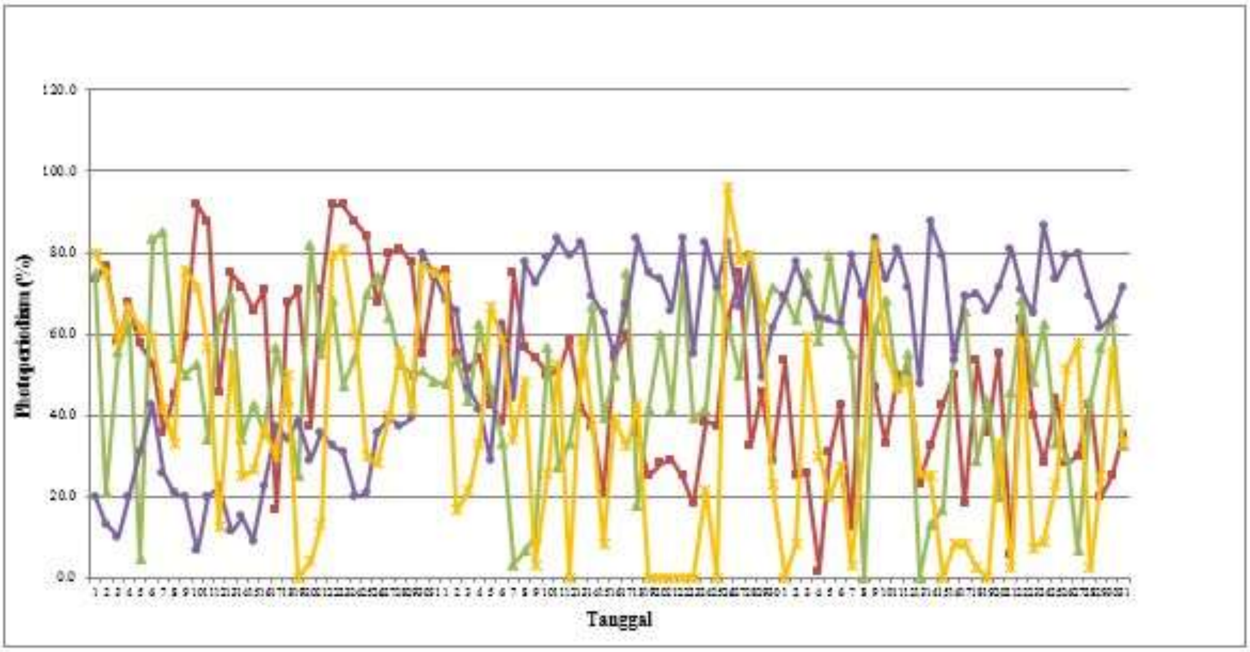

Figure 1.4 Photoperiodism Graph During Plant Growth