

Original Research Article

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Effect of Methyl Jasmonate on Growth and Flowering Behavior of Strawberry cv. Nabila

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ABSTRACT

The experiment was laid out in the year 2019-2020 at Bihar Agricultural University, Sabour to show the application of different doses of methyl jasmonate on growth and flowering behavior of strawberry cv. Nabila. The plant under treatment T₃ (0.6 mM) was found the tallest (21.25 cm), highest leaf area (33.59 cm²), The relative water content in the leaves (55.62%), maximum number of leaves (28.33 per plant) while the all above parameters recorded minimum value under control. Similarly, the highest no. of flowers per plant (37.65 flowers) was found under treatment T₃ whereas lowest number under T₁ (25.67 flowers). The least no. of days (56.24 days) were found for first flowering under treatment T₃ while the plants under T₁ required the most days (57.27 days). The plants under T₁ took the longest (64.50 days) for their first fruit setting while the T₃ took the shortest (60.21 days). Longest harvesting period was found under plants of T₃ (80.50 days) while the shortest duration under T₁ (60.30 days).

Keywords

Methyl jasmonate,
Growth and
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Introduction

Strawberry (*Fragaria x ananassa* Duch) is a man-made hybrid developed by crossing *Fragaria chiloensis* and *Fragaria virginiana*, which then become one of the most important soft fruits in the world. The fruit is consumed fresh and processed in many different products, making it to be in highly demand

due to its rich flavour and aroma, excellent visual and quality. The fruits are not only rich in its taste, but also rich in vitamins and minerals to which many people around the globe include it in their daily diet. For better growth and flowering behaviour of strawberry plants, it require special treatments of different chemicals. The use of different plant growth regulators is a common practice in

different crops in order to get better growth and yield from the crop. The exogenous application of PGRs has been found to stimulate the growth, flowering and fruiting of different fruit crops (Al-Duljaili *et al.*, 1987; Randhawa *et al.*, 1959) which resulted from the improvement of endogenous level of phytohormone and mineral nutrients (Bist, 1990). Among different PGRs, Methyl Jasmonate, a methyl ester of Jasmonic Acid is a phytohormone with ubiquitous distribution among plants and generally considered to modulate many physiological events in higher plants, such as defense responses, flowering and senescence (Cheong and Choi, 2003). Some reports also suggest that methyl jasmonate plays an important role in defense mechanism of plants and diverse developmental pathways such as seed germination, root growth, etc. However, literatures on the exact response of methyl jasmonate on strawberry plants and fruits to improve the yield and quality is still exiguous as the use of this compound is still uncommon for the improvement of crops in experiments or cultivation practices, particularly on the shelf life of the fruits. Therefore, more experiments are required on this field to study its function on various parameters of the plant, especially under sub-tropical condition.

Materials and Methods

The experiment was conducted in Horticulture Garden, Bihar Agricultural College, Sabour, Bhagalpur, Bihar during the year 2019-2020 in Randomized Block Design with four treatments and five replications for the investigation of growth and flowering behavior of strawberry plants cultivar Nabila. The four treatments of methyl jasmonate were T₁ (Control), T₂ (0.3 mM), T₃ (0.6 mM) and T₄ (0.9 mM). The plants were sprayed in two stages during their growth, viz., prior to flowering and 15 days after the first spray. Meteorological observation during cropping season 2019-20 given in Table 1.

Growth parameters

Plant height

The plant height was measured by erecting the measuring scale from the bottom to the maximum height of the plant for three different tagged plants under each replication and the average plant height for each replication was calculated.

Number of leaves per plant

The number of leaves in a plant was measured by counting the total number of leaves produced per plant for three different tagged plants under each replication and average number of leaves per plant for each replication was calculated.

Leaf relative water content (RWC %)

The relative water content of the mature leaves was measured following the method suggested by Weatherley (1950). According to this method, fresh leaf samples were collected and 1 cm² size were cut off from the leaf samples. Fresh weight of these cutoff samples was then taken and was imbibed by floating them in distilled water inside a petri dish overnight.

After imbibing for overnight, the samples were then surface dried with filter paper and were re-weighed before being oven-dried. After that, the samples were dried in an oven dryer at 70°C for 24 hrs. The weight of the dried samples was then taken. The relative water content (RWC) is calculated by using the formula:

RWC (%) =

$$\frac{\text{Fresh weight} - \text{Dry weight}}{\text{Turgid weight} - \text{Dry weight}} \times 100$$

Leaf area (cm²)

The area of leaves was measured with the help of graph paper during their growing period just prior to second spray of the solution, i.e., 14 days after first spray.

Reproductive growth

Days of first flowering

It was measured by counting the total number of days taken by the plant for anthesis of first flower from the date of planting.

Total number of flowers per plant

It was measured by counting the total number of flowers produced by the plants during the entire flowering period.

Days to first fruit setting

It was measured by counting the days taken by the plants to set fruits from the date of planting.

Duration of harvesting

It was recorded by counting the total number of days taken by the plant in each replication under each treatment from harvesting of first fruit to last fruit and expressed in days.

Statistical analysis

The experimental data were subjected to statistical analysis in order to find out which of the treatments showed significant variation in different parameters studied under investigation.

The technique of analysis of variance (ANOVA) for randomized block design (RBD) was adopted as suggested by Panse and Sukhatme (1967).

Results and Discussion

Growth parameters

The plant height of different MeJA treated strawberry fruits has been found non-significant but in respect of leaf area it was significant differences among the treatments (Table 2). It was found highest (33.59 cm²) under plants treated with 0.6 mM MeJA (T₃) and lowest (27.66 cm²) under control (T₁). The relative water content of plants treated with different doses of MeJA was found statistically significant among the treatments and it was showed highest (75.27%) with 0.6 mM (T₃) while the untreated plants (T₁) have the least (55.62%). The data for no. of leaves per plant under MeJA treatment was recorded non-significant. Vegetative growth was not much more affected by MeJA treatments. The value of two parameters i.e. plant height and number of leaves per plant were showed no any effect till higher concentration but in other two parameters i.e leaf area and RCW the value increases upto the concentration of 0.6 mM MeJA and decreases in higher concentration (0.9 mM). This might be due to higher concentration adversely affected the vegetative growth in strawberry plants. These results are in conformity with the findings of Lolaei *et al.*, (2013) in strawberry. Rahimi *et al.*, (2013) were also found better result in growth attributes with lower concentration in *Cuminum cyminum* L. and Cui Li *et al.*, (2018) on sunflower, tomato and soybean.

Flowering behaviours

The plants treated with MeJA have not responded positively in respect of number of days for initiation of first flowering. The number of flowers per plant in strawberry cv. Nabila under different doses of MeJA treatment was significant in nature. Plants treated with 0.6 mM MeJA (T₃) had 37.65 flowers which was followed by T₄ (31.00)

and T₂ (29.70) while the minimum (25.67) in control (T₁). The data in respect of number of days for the first fruiting in strawberry cv. Nabila was found to be non-significant. The data for duration of harvest was found significant among the treatments. The

maximum duration of harvest (80.50 days) was recorded with the 0.6 mM MeJA (T₃) treated plants which was statistically differed from other treatments. The minimum duration of harvest (60.30 days) was under control (Table 3).

Table.1 Meteorological observation during cropping season 2019-20

Month	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Wind speed (km/hr)	Sunshine (hrs)	EP (mm)
	Max.	Min.	7:00 AM	2:00 PM				
Nov. 2019	28.9	16.2	87.6	76.1	0.0	2.1	3.3	1.1
Dec. 2019	21.2	9.3	91.4	75.9	2.5	3.9	3.5	0.6
Jan. 2020	21.9	8.8	93.0	71.0	6.0	4.2	4.5	1.0
Feb. 2020	24.1	9.7	88.4	66.7	38.4	3.6	6.5	1.6
Mar. 2020	30.5	16.8	86.6	59.1	48.0	4.6	6.7	3.5

Table.2 Effect of MeJA on growth parameters

Sl. No.	Treatments	Plant height (cm)	Leaf area (cm ²)	Leaf RWC (%)	No. of leaves per plant
T ₁	Control	19.00	27.66	55.62	24.26
T ₂	0.3 mM MeJA	19.67	31.21	69.46	26.67
T ₃	0.6 mM MeJA	21.25	33.59	75.27	28.33
T ₄	0.9 mM MeJA	20.42	30.32	68.76	25.00
	SE ±(m)	0.073	0.112	0.172	0.097
	CD (P = 0.05)	NS	0.350	0.535	NS

Table.3 Effect of MeJA on flowering behaviours

Sl. No.	Treatments	First flowering (days)	No. of flowers per plant	First fruiting (days)	Duration of harvest (days)
T ₁	Control	57.27	25.67	64.50	60.30
T ₂	0.3 mM MeJA	56.76	29.70	63.40	72.28
T ₃	0.6 mM MeJA	56.24	37.65	60.21	80.50
T ₄	0.9 mM MeJA	56.46	31.00	62.52	66.14
	SE ±(m)	0.170	0.145	0.162	0.205
	CD (P = 0.05)	NS	0.451	NS	0.638

According to Toby *et al.*, 2010 MeJA affects growth of the plant and many flowering behaviours depending on the mycorrhizal or

nonmycorrhizal association in the plants. It was also found that MeJA had no significant effect on floral traits in nonmycorrhizal

plants. Above results suggested that jasmonate group response on presence of mycorrhiza and nutrient status in the plant. In fact, the benefits of mycorrhization for floral traits and pollination behaviour documented in various greenhouse studies (Gange and Smith 2005; Wolfe, Husband and Klironomos 2005) and in the field (Cahill *et al.*, 2008) were lost in our experiment after MeJA application. Mycorrhizal plants treated with MeJA had floral traits comparable to nonmycorrhizal plants. The mechanism of this result is unknown and requires further study; MeJA could have direct effects on the AMF in terms of reduced growth and allocation to reproductive structures (Schmidt and Baldwin 2006).

Hence concluded, in case of growth parameters of strawberry, MeJA treatments had influence positively upto the concentration of 0.6 mM MeJA then after decline. Flowering behaviors also influenced positively upto 0.6 mM MeJA and then adversely affected. So, on the basis of above results it may be concluded that the MeJA treatment with 0.6 mM concentrations was found to be the best result.

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