INFLUENCE OF GROWING CONDITIONS AND SALICYLIC ACID ON THE FLOWER AND SEED PRODUCTION OF LOCAL DAHLIA

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Abstract- A study on "influence of growing conditions and salicylic acid on the flower and seeds production of local dahlia" was conducted at ornamental Horticultural nursery, The University of Agriculture Peshawar, during the year 2021 and 2022. The experiment was carried out in randomized complete block design with spilt plot arrangement having two factors. Treatments were replicated four times. Salicylic acid were applied at the rate of 0 (distilled water), 100, 150, 200 and 250 mg L^{-1}. The seedlings were transplanted into two different growing conditions i.e., partial shade and open field. The results showed that growth and production of dahlia was significantly affected by growing condition and various concentrations of salicylic acid, while their interaction was non-significant. The plants grown in open field produced maximum number of branches, number of leaves, chlorophyll content, leaf area, stem diameter, flower diameter, number of flowers $plant^{-1}$ and number of seeds $plant^{-1}$. Furthermore, open field grown plants height was minimum and flowers early as compared to partial shade. The plants sprayed with 250 mg L^{-1} of salicylic acid resulted in maximum plant height, number of branches, number of leaves, chlorophyll content, leaf area, stem diameter, flower diameter, number of flowers $plant^{-1}$ and number of seeds $plant^{-1}$ that was statistically similar to the effect of salicylic acid at 200,150,100 mg L^{-1}. Moreover, plants sprayed with 250 mg L^{-1} salicylic acid showed early flowering. It is recommended from the significant results that dahlia should be grown in open field for better growth and production. Foliar application of Salicylic acid @ 100 mg L^{-1} is recommended for production better vegetative and flowering attributes of dahlia.

Index Terms- Growing condition, Salicylic Acid, Dahlia, Partial shade, Open field,

I. INTRODUCTION

Dahlia (*Dahlia pinnata* L.) is a popular winter flowering plant in the Compositae family, with 35 species and over 1000 distinct varieties worldwide (Younis *et al*., 2014). Dahlia was named "Plant of the Year" by the National Garden Bureau in 2019, highlighting public concern about this species. Dahlia is herbaceous a semi-hardy perennial with tuberous roots. It requires sandy loam or loamy soils with average soil fertility, better water holding capacity, and a pH range it's on 7.0 to 8.0. (Kiran *et al*., 2007). Dahlia can also be grown from cuttings, and young plants require a shady location during the summer months (Tariq *et al*., 2012). Dahlia can also be beneficial to the environment and the quality of our lives (Cameron *et al*., 2004). Ornamental plants help to beautify landscape, control erosion and improve the aesthetic value of landscapes (Toscano *et al*., 2019). Quality flowers can be produced by observing and controlling environmental conditions such as (photoperiod, relative humidity, and light intensity) etc. (Nazari *et al*., 2009). Temperature is critical for flower growth and morphological characteristics (Shin *et al*., 2001). A significant requirement for greenhouses in order to ensure crop growth and development is an efficient temperature control achieved through the use of active modifiers (heating and cooling devices) and the use of supplemental light in winter (De Pascale *et al*., 2005). Protected cultivation allows for the control of environmental parameters, which improves cut flower yield and quality (Food and Agriculture Organization, 2013). As a result, it is critical to assess the impact of climate variability and variation on greenhouse cultivation, as well as the energy requirements for heating and cooling during cultivation, on a regional scale (Gray, 2004). Protected cultivations are critical for maintaining a steady supply of winter cut flowers on the market. Abscisic acid, zeatin gibberellic acid and salicylic acid are effective plant hormones that play an important role in recent agriculture (Ashraf *et al*., 2011).Salicylic acid is best known for preventing endogenous ethylene biosynthesis, and it suppresses ethylene biosynthesis either by inhibiting the action of ethylene (Hayat *et al*., 2005) and by increasing polyamine content (Freschi, 2013). Salicylic acid works as a plant growth regulator as well as an inhibitor of ethylene biosynthesis (Rivas-San-Vicente and Plasencia, 2011). Exogenous salicylic acid affects a variety of processes in plants, including seed germination (Korkmaz, 2005), stomatal closure, ion uptake and transport (Gunes *et al*., 2005), membrane permeability, photosynthesis, and growth rate (Khan *et al*., 2003). The application of salicylic acid to a variety of plants has resulted in significant improvement of flower production (Ann and Mou, 2011). Salicylic acid application on leaves was observed to enhance chlorophyll content, improve water use efficiency, transpiration rate, and internal CO_2 cycle in organic compound composition (Hayat *et al*., 2005). Keeping in view the importance of growing condition and salicylic acid for flowering and seed production of local dahlia species. To evaluate the effect of different growing conditions (open field vs shed) on the growth and production of local dahlia. To find the optimum level of salicylic acid for best flowering and seed production of local dahlia. To check the interaction between of growing conditions and salicylic acid on the growth and seed production of local dahlia

I. .IDENTIFY, RESEARCH AND COLLECT IDEA

Experimental Design and Plant Material

The research work on "influence of growing conditions and salicylic acid on the flower and seeds production of local dahlia" was performed at the Ornamental Horticultural Nursery, Department of Horticulture, The University of Agriculture Peshawar, Pakistan. The trial was conducted in Randomized Complete Block Design (RCBD) with two factors in split-plot arrangement. There were a total of 12 treatments, each repeated four times. Seeds were sown on 14th October and their seedlings were transplanted in field on 28th October 2021. Factors was two different growing conditions i.e., partial shade and open field. Light intensity, temperature and humidity were recorded daily with the help of LUX meter, digital thermometer and hygrometer respectively. Crop management practices such as weeding, fertilizer application and pest management etc. were kept similar for all treatments throughout experiment. Different concentration of salicylic acid and distilled water were sprayed on dahlia plants after two weeks of transplantation.

Environmental Data Collection

Light intensity, temperature and humidity recorded weekly during the trial are given in figure 1, 2, and 3 respectively.

Studied Parameters:

Plant height (The height of the plant was measured using a measuring tape), Number of branches plant^{-1}, Number of leaves plant^{-1}, Leaf area (leaf area was recorded with a leaf area meter (CI-201), Leaf chlorophyll content (chlorophyll content was measured by SPAD meter (Konica Minolta Spad-502 plus), Stem diameter and Flower diameter (With the use of a Venire calliper), Days to flowering, Number of flowers plant^{-1} and Number of seeds plant^{-1}

Statistical Analysis

The collected data were analyzed with the help of STATISTIX 8.1 (statistical software) using the analysis of variance (ANOVA) technique (Steel and Torrie, 1980). In case of significant differences the means were separated further using the least significant difference (LSD) test (Williams and Abdi, 2010).

II. WRITE DOWN YOUR STUDIES AND FINDINGS

RESULTS AND DISCUSSION

Mean data regarding plant height, No. of leaves, No. of branches, chlorophyll content and leaf area are presented in Table 1, and stem diameter, days to flower, flower diameter, No. of flower per plant, No. of seed per plant are present in table 2. Analysis of variance (ANOVA) showed that the growing conditions and salicylic acid concentrations had significant effect on plant height, while the interaction between the growing conditions and salicylic acid concentrations was non- significant.

Plant height (cm)

In growing conditions the dahlia plant grown in partial shade attained maximum height (153.1 cm), while plants grown in an open field attained minimum height (115.6 cm). Among the concentrations of salicylic acid, maximum plant height (137.9 cm) was attained by plants sprayed with 250 mg L^{-1} that was statistically similar to plant height recorded in plants spray with 200 and 150 mg L^{-1}. Minimum plant height of 129.6 cm was recorded in plants sprayed with tap water (control).

The plant height of dahlia increased in the partial shade, which might be due to the low light intensity as compared to the open field, where the light intensity was higher. The taller plants in partial shade are due to etiolating conditions (Soy *et al*., 2012). Light affects the growth and metabolism processes in plants (Zoratti *et al*., 2014). The current results confirm the findings of Richard *et al*., (2015), who reported that an increase in the height of plants occurred when plants were grown in shade as compared to full light (open field). Dahlia plants that were sprayed with salicylic acid attained maximum height as compared to those plants that were sprayed with distilled water. Salicylic acid increases a plant's ability to withstand various stresses (Hara *et al*., 2012). Defense inducing substances like betaine, glycine, and praline are enhanced by salicylic acid (Zamaninejad *et al*., 2013). By altering the actions of gibberellic acid, cytokinins, and abscisic acid; salicylic acid adopt the crop against stresses (Fahad *et al*., 2015). The increase in the height of dahlia plant may be due to the salicylic acid which play important role in plant growth and defence mechanisms against stresses. Our results are in line with those of Zamaninejad *et al*., (2013), they reported that application of salicylic acid significantly increased the plant height as compared to distilled water sprayed plants.

Number of Branches

Growing conditions revealed that maximum number of branches (14.7) was recorded in open field plants. While minimum number of branches (11.3) was recorded in partial shade grown plants. The results of salicylic acid concentration showed that maximum number of branches (13.36) was noted in plant treated with 250 mg L^{-1} that was statistically not different from number of branches (13.70,13.10 and 12.88) observed in plants treated with 200, 150 and 100mg L^{-1} respectively. While the minimum number of branches (12.5) was recorded in plants sprayed with distilled water (control).

The dahlia plants produced more number of branches in the open field in contrast to plants in the partial shade. It might be due to the fact open field had more favourable temperatures than those in the shade, which might be the reason for the rise in the number of branches in the open field-grown plants. A plant's anatomy, physiology, and morphology alter as a result of temperature variations, which ultimately affect plant growth and development (Shao *et al*., 2008). Unfavourable temperature affects the biochemical reactions in the plants, which leads to the plants' poor growth and yield (Wahid *et al.,* 2007). These results are in agreement with Gowtham and Mohanalakshmi (2018); they found that plants grown in open field produced more branches as compared to shade. The significant findings showed that more branches were produced in plants sprayed with salicylic acid. It might be due to the role of salicylic acid, as a natural plant hormone, as an internal regulator of phenolic nature, which regulates different physiological processes in crops and modulates plant reactions to stresses such as drought, salt, chilling, heat, pathogens and diseases (Bastias *et al*., 2018; Hasanuzzaman *et al*., 2017). The present findings are in line with

the findings of Mady (2009), who observed that salicylic acid sprayed plants produced more branches as compared to control.

Number of Leaves

Growing conditions revealed that maximum number of leaves (73.7) was recorded in open field plants. While minimum number of leaves (56.4) was recorded in partial shade grown plants. The results of salicylic acid concentration showed that maximum number of leaves (66.7) was noted in plant treated with 250 mg L^{-1} that was statistically not different from number of leaves (65.8, and 65.4) observed in plants treated with 200, and 150mg L^{-1} respectively. While the minimum number of leaves (63.2) was recorded in plants sprayed with distilled water.

The dahlia plants grown in the open field produced maximum number of leaves as compared to open field. This increase might be due to the favourable temperatures in the open field than shade. The low temperature alters protein synthesis and metabolism, which results in a number of changes in biochemistry and physiology in the plant that have an influence on growth and development (Zobayed *et al*., 2005). Additionally, unfavourable temperature alters the molecular structure, physiology and morphology of plants, resultantly affect growth and yield (Li *et al*., 2011). The current results are in confirmation with Uzun (2006), who revealed that plants leaves deceased when temperature decrease from the optimum temperature (shade). The results showed that plants of dahlia produced maximum number of leaves when sprayed with salicylic acid. Plant responses to biotic and abiotic stressors are controlled by salicylic acid, which finally enhance plant growth (Ramirez *et al*., 2009). Through the modification of antioxidant enzyme activity, Salicylic acid produces a direct physiological effect (Ananieva *et al*., 2004). It enhances abscisic acid's growth-inhibitory impact, enzyme activities, glycolysis, ethylene synthesis, ion uptake & transport, seed germination, fruit yield, stomatal regulation and water relations (Khan *et al*., 2003). The current results are in line with the results of Hesami *et al*., (2012), who revealed that maximum leaves were observed in plants sprayed with salicylic acid as compared to distilled water.

Chlorophyll content (SPAD)

Growing conditions show that the highest value for chlorophyll content (61.4 SPAD) was observed in open field while the lowest (47.0 SPAD) was observed in the plants in the partial shade. The salicylic acid concentrations showed that the highest value for chlorophyll content (55.6SPAD) was noted in plants sprayed with 250 mg L^{-1}, followed by those sprayed with 200, 150 and 100 mg L^{-1} concentration. The lowest chlorophyll content (52.4 SPAD) was noted in plants sprayed with distilled water (control).

The maximum chlorophyll content in the leaf was observed in dahlia plants grown in the field as compared to the partial shade. The increase in the leaf chlorophyll content could be due to more favourable temperatures and light intensity in the outside field as compared to inside the shade. Temperature is a crucial factor that can greatly restrict the morphological, biochemical and physiological characteristics of plants (Shakeel *et al*., 2011). This can greatly inhibit plant growth and development and drastically lower production of crop (Hatfield and Prueger, 2015). Temperature conditions that are below or above a plant's ideal range have a major impact on and possibly even disrupt metabolic activities including photosynthesis, respiration, and growth, which might also eventually alter the yield (Dusenge *et al*., 2019). A chlorosis condition occurs in the plants due to a lack of sufficient light (Cakmak and Yazici, 2010). Similar findings were reported by Ilic *et al*., (2018), who found that chlorophyll content was found maximum in the open field plants in contrast to shade grown plants. The results showed that plants sprayed with salicylic acid had maximum chlorophyll content as compared to distilled water sprayed plants. Salicylic acid helps in stomatal function, transpiration rate, and improves chlorophyll content (Aliniaeifard *et al*., 2016). It also plays an important role in physiological function, most probably involved in the regulation of some photosynthetic reactions (Popova *et al*., 1997). Similar findings were reported by Yildirim *et al*., (2008), who found that chlorophyll content was maximum in plants sprayed with salicylic acid as compared to control plants (sprayed with distilled water).

Leaf Area (cm^2)

The growing conditions showed that maximum leaf area (1110.8 cm^2) was observed in plant of open field while minimum (847.2 cm^2) was observed in the plants grown in partial shade. The salicylic acid concentrations showed that maximum leaf area (1002.9 cm^2) was recorded in plants sprayed with 250 mg L^{-1}, followed by those sprayed with 200, 150 and 100 mg L^{-1} concentration that showed 987.4, 981.8 and 973.9 cm^2 leaf area. The minimum leaf area (949.1 cm^2) was noted in plants sprayed with distilled water (control).

The increase in area of leaves was observed in the plants that were grown in the open field. This increase might be because of the favourable environmental conditions such as temperature, light and humidity in the open field. Low temperatures significantly reduce plant growth and development (Ahuja *et al*., 2010). Temperature lower than optimum reduce the process of photosynthesis, and resultantly reduce the biomass of the plant (Timlin *et al*., 2006). For optimal photosynthesis, respiration, and physiological and biochemical function, the ideal temperature and light are crucial (Ras *et al*., 2013). Ademilua and Eyemi (2013) also reported that open-field grown plants had a greater leaf area than shade-grown plants. Plants sprayed with salicylic acid showed maximum leaf area in contrast to distilled water sprayed plants. This increase in the total leaf area might be due the crucial role of salicylic acid in defence mechanisms. Salicylic acid plays an important role in physiological function, most probably involved in the regulation of some photosynthetic reactions (Popova *et al*., 1997). Defense-enhancing substances like betaine, glycine, and praline are enhanced by salicylic acid (Zamaninejad *et al*., 2013). The present findings are in line with the findings of Vazquez-Cruz *et al*., (2012), who noted that salicylic acid significantly increase the leaf area of plant as compared to control.

Stem diameter (cm)

In growing conditions dahlia plant grown in open field showed maximum stem diameter (1.5 cm), while plants grown in an partial shade had minimum stem diameter (1.1 cm). Among the concentrations of salicylic acid, maximum stem diameter (1.43 cm) were noted in plants sprayed with 250 mg L^{-1}, that was statistically similar to stem diameter recorded in plants sprayed with 200 and 150 mg L^{-1}. Minimum stem diameter (1.32 cm) was recorded in plants sprayed with tap water (control).

The dahlia plant grown in the open field showed an increase in stem diameter as compared to shade grown plants. It might be

due to ideal environmental condition in the open field for dahlia plants. Temperature is considered one of the most important factors and it affects the growth and development of plants (Yeh, 1996). High or low light intensities affect the morphology, photosynthesis, and secondary metabolism of plants (Ma, 2015). Light greatly affects the growth and metabolism processes in plants (Zoratti *et al*., 2014). Current results are in line with the results of Heikal (2017), who found that maximum stem diameter was observed in plants grown in the open field. Dahlia plants sprayed with salicylic acid showed maximum stem diameter in contrast to distilled water sprayed plants. This maximum stem diameter might be due the crucial role of salicylic acid (SA) in regulating various physiological attributes. The plants sprayed with SA produced maximum number of leaves, chlorophyll content, leaf area with efficient photosynthesis and hence produced maximum diameter (Shi *et al*., 2009; Wang *et al*., 2011). Our current results are in line with the findings of Hussein *et al*., (2007) reported that stem diameter significantly increased when salicylic acid was applied.

Days to flowering:

In growing conditions dahlia plant grown in open field took minimum days to flowering (104.3 days), while plants grown in an partial shade resulted in maximum days to flowering (111.1 days). Among the concentrations of salicylic acid, minimum days to flowering (104.4 days) were noted in plants sprayed with 250 mg L^{-1}, that was statistically similar to days to flowering recorded in plants spray with 200 mg L^{-1}. Maximum days to flowering (110.2 days) were recorded in plants sprayed with tap water (control).

Early flowering was observed in the plants that were grown in the open field as compared to plants grown in partial shade. This early flowering is because of ideal environment in the open field as compare to shade. Low temperature delay the plants flowering, while relatively high temperature brings early flowering in the plants (Kumar *et al*., 2012). Mostly all physiological reactions in plants are controlled by light, which is a crucial factor. Plants' shift from the vegetative to the reproductive stage is strongly influenced by light (Kumar *et al*., 2012). Our results are in agreement with the results of Rezazadeh *et al*., (2018), who reported that early flowering was noted in plants grown in the open field. Early flowering was observed in the plants that were sprayed with salicylic acid as compare to control. Numerous physiological and biochemical processes, including thermogenesis, plants defence, plant signalling and reaction to biotic and abiotic stress, are regulated by salicylic acid (Chen *et al*., 2009; Wani *et al*., 2017). Salicylic acid reduce stresses, including toxicity of heavy metals reducing the accumulation of reactive oxygen species by scavenging reactive oxygen species, or boosting the antioxidant defence system, protecting stability of membrane, it interacts with plant hormones, and enhances the efficiency of the photosynthesis (Dalvi and Bhalerao, 2013; Shi *et al*., 2009; Wang *et al*., 2011; Wei *et al*., 2018; Yin *et al*., 2018; Cui *et al*., 2012) . Current results are in line with the results of Jin *et al*., (2008), who found that early flowering were observed in plants sprayed with salicylic acid.

Flower diameter

In growing conditions dahlia plant grown in open field produced flower with diameter (10.6 cm), while plants grown in a partial shade showed minimum flower diameter (8.2 cm). Among the concentrations of salicylic acid, maximum flower diameter (9.8 cm) were noted in plants sprayed with 250 mg L^{-1}, that was statistically similar to flower diameter recorded in plants spray with 200 and 150 mg L^{-1}. Minimum flower diameter (9.1 cm) was recorded in plants sprayed with tap water (control).

The dahlia plant grown in the open field showed an increase in flower diameter as compared to shade grown plants. This maximum flower diameter might be due to ideal environmental condition in the open field for dahlia plants. Plant grown in open field was exposed by the optimum temperature and light and resulted in better growth. Hence produced larger size flowers (Kumar *et al*., 2012). High or low light intensities affect the morphology, photosynthesis, and secondary metabolism of plants (Ma, 2015). Light greatly affects the growth and metabolism processes in plants (Zoratti *et al*., 2014). The present findings are in contrast to the Yazici and Gunes (2018); they found that plant grown in shade had minimum flower diameter as compared to open field. Dahlia plants sprayed with salicylic acid showed maximum flower diameter in contrast to distilled water sprayed plants. This maximum flower diameter might be due the crucial role of salicylic acid (SA) in defence mechanisms by reducing stresses. When plants are under stress, salicylic acid interacts with other plant hormones (such as auxins, gibberellin and abscisic acid) and encourages the stimulation of antioxidant compounds and enzymes (Shi *et al*., 2009; Wang *et al*., 2011). Many physiological and biochemical processes, including thermogenesis, plants defence, plant signalling and reaction to biotic and abiotic stress, are regulated by salicylic acid (Chen *et al*., 2009; Wani *et al*., 2017). These results are confirm the findings of Bayat *et al*., (2012), who observed that plants treated with salicylic acid significantly increased the diameter of flower in contrast to control.

Number of flower Plant^{-1}

Growing conditions revealed that maximum number of flowers (11.2) was recorded in open field plants. While minimum number of flowers (8.6) was recorded in partial shade grown plants. The results of salicylic acid concentration showed that maximum number of flowers (10.2) was noted in plant treated with 250 mg L^{-1} that was statistically not different from number of flowers (10.0, and 9.9) observed in plants treated with 200, and150 mg L^{-1} respectively. While the minimum number of flowers (9.6) was recorded in plants sprayed with distilled water.

The dahlia plants grown in the partial shade produced maximum number of flowers as compared to open field. This increase in flowers number might be due to the favorable temperatures in the open field than those in the shade. The plants grown in open field were healthy with more leaf area and chlorophyll content therefore produced maximum number of flowers (Zobayed *et al*., 2005). Singh *et al*., (2012) also reported that maximum number of flower per plant was produced in plants grown in the open field. The results showed that plants of dahlia produced maximum number of flowers when sprayed with salicylic acid. SA has role in cell division and enhances growth and development of plants (Ramirez *et al*, 2009). It improves the physiological of plant (Ananieva *et al*., 2004). SA improves the function of other hormones such as auxin and gibberellin. It also improves antioxidant activities (Wang *et al*., 2011). The current results are in line with the results of Bayat *et al*., (2012), who

revealed that more flowers in the plant were produced when sprayed with salicylic acid as compared to distilled water.

Number of seeds plant^{-1}

Growing conditions revealed that maximum number of seeds plant^{-1} (1126.1) was recorded in open field plants. While minimum number of seeds plant^{-1} (868.3) was recorded in partial shade grown plants. The results of salicylic acid concentration showed that maximum number of seeds plant^{-1} (1031.4) was noted in plant treated with 250 mg L^{-1} that was statistically not different from number of seeds plant^{-1} (1006.2 and 996.6) observed in plants treated with 200, and150 mg L^{-1} respectively. While the minimum number of seeds plant^{-1} (965.7) was recorded in plants sprayed with distilled water.

The dahlia plants produced more seeds plant^{-1} in the open field in contrast to plants in the partial shade. Plants in open field were exposed to full sun (fig. 2.1) and optimum light (fig. 2.2) as compared to partial shade that might result in more number of seed in dahlia. The plants grown in open field performed better with improved yield (Shao *et al*., 2008). Including seed production. Our results are in agreement with Kantolic *et al*., (2013), they found that plants grown in open field produced more branches as compared to shade. The significant findings showed that more seeds were produced in the plants sprayed with salicylic acid. It might be due to the role of salicylic acid, as a natural plant hormone, as an internal regulator of phenolic nature, which regulates different physiological processes in crops and modulates plant reactions to stresses such as drought, salt, chilling, heat, ultraviolet, SA resulted in increased number of flower plant^{-1} with more number of branches and hence produced maximum number of seeds. Ultimately increases the yield of a crop (Bastias *et al*., 2018; Hasanuzzaman *et al*., 2017). The present findings are in line with the findings of Zamaninejad *et al*., (2009), who observed that salicylic acid sprayed plants produced maximum yield as compared to control.

Table 1 Plant height, No. of branches, No. of leaves, Chlorophyll content and Leaf area of dahlia plant as affected by growing conditions and salicylic acid concentrations.

Treatment	Attributes				
Salicylic Acid concentration	Plant Height (cm)	No. of Branches	No. of Leaves	Chlorophyll Content (SPAD)	Leaf Area (cm^2)
Control	129.6	12.56	63.2	52.4	949.1
100 (mg L^{-1})	133.4	12.88	64.3	53.6	973.9
150 (mg L^{-1})	134.9	13.10	65.4	54.5	981.8
200 (mg L^{-1})	136.0	13.17	65.8	54.8	987.4
250 (mg L^{-1})	137.9	13.3	66.7	55.6	1002.9
LSD P ≤ 0.05	13.2	0.47	2.34	2.03	34.1
Growing Conditions					
Open Field	115.6	14.7	73.7	61.4	1110.8
Partial Shade	153.1	11.3	56.4	47.0	847.2
LSD P ≤ 0.01	4.86	1.82	9.64	7.57	134.1
Interactions Salicylic acid × growing conditions	NS	NS	NS	NS	NS

Table 2 stem diameter, days to flower, flower diameter, No. of flower plant^{-1}, and No. of seed plant^{-1} of dahlia plant as affected by growing conditions and salicylic acid concentrations.

Treatment	Attributes				
Salicylic Acid concentration	Stem diameter	Days to flower	Flower diameter	No. of flower plant^{-1}	No. of seed Plant^{-1}
Control	1.32	110.2	9.1	9.6	965.7
100 (mg L^{-1})	1.35	108.9	9.3	9.8	986.0
150 (mg L^{-1})	1.36	108.3	9.4	9.9	996.6
200 (mg L^{-1})	1.38	106.6	9.5	10.0	1006.2
250 (mg L^{-1})	1.43	104.4	9.8	10.2	1031.4
LSD P ≤ 0.05	0.066	3.57	0.37	0.37	38.03
Growing Conditions					
Open Field	1.5	104.3	10.6	11.2	1126.1
Partial Shade	1.1	111.1	8.2	8.6	868.3
LSD P ≤ 0.01	0.187	6.7	1.04	1.45	140.8
Interactions Salicylic acid × growing conditions	NS	NS	NS	NS	NS

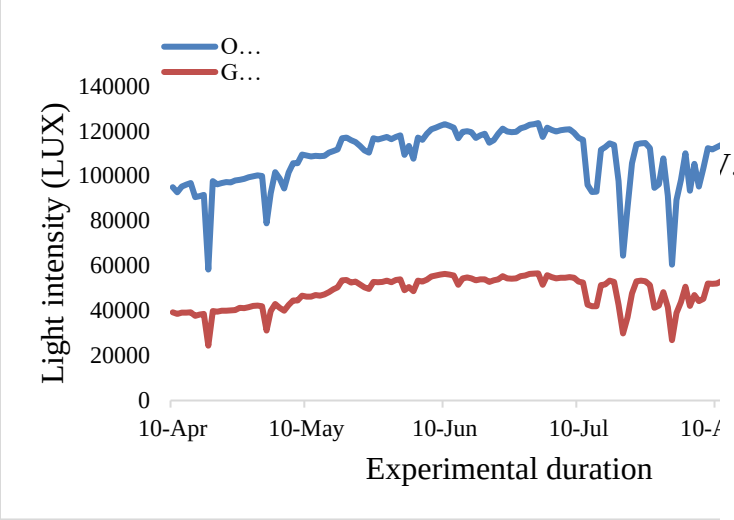

Figure 1. Light intensity measured weekly at 1:00pm during the experiment.

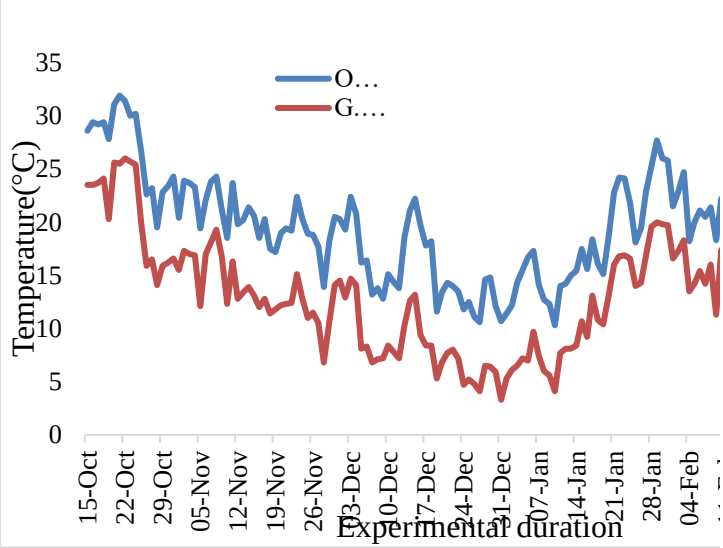

Figure 2. Temperature measured weekly at 1:00pm during the experiment.

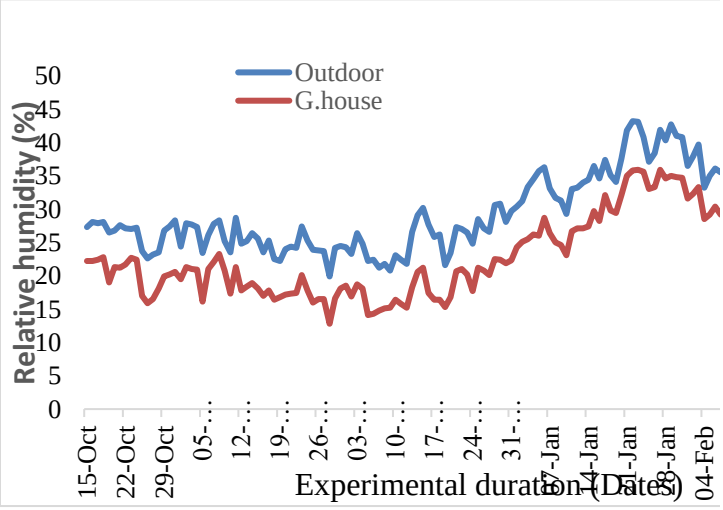

Figure 3. Relative humidity measured weekly at 1:00pm during the experiment.

III. CONCLUSION

The experiment confirmed that both the growing conditions and salicylic acid showed better result for all the growth and production of dahlia as compared to control. The plants grown in open field produced maximum number of branches, leaves, chlorophyll content, leaf area, stem diameter, flower diameter, number of flowers plant^{-1} and number of seeds plant^{-1}. The plants sprayed with 250 mg L^{-1} of salicylic acid resulted in maximum plant height, number of branches, leaves, chlorophyll content, leaf area, stem diameter, flower diameter, number of flowers plant^{-1} and number of seeds plant^{-1} that was statistically similar to the effect of salicylic acid at 200,150,100 mg L^{-1}. Dahlia should be grown in open field for better growth and production. Foliar application of Salicylic acid @ 100 mg l^{-1} is recommended for production better vegetative and flowering attributes of dahlia.

APPENDIX

Appendixes, if needed, appear before the acknowledgment..

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