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Usha Kumari

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

KK Jha

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

S Sengupta

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

S Misra

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

AK Tiwary

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

HC Lal

Department of Plant Pathology,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

Kaushal Kumar

College of Forestry, Birsa
Agricultural University, Kanke,
Ranchi, Jharkhand, India

Corresponding Author:**Usha Kumari**

Department of Horticulture,
Birsa Agricultural University,
Kanke, Ranchi, Jharkhand,
India

Studies on different growth regulators and stage of application on inflorescence induction and development of pineapple (*Ananas comosus* L. Merr.) Var. Queen

Usha Kumari, KK Jha, S Sengupta, S Misra, AK Tiwary, HC Lal and Kaushal Kumar

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Abstract

The experimentation entitled, “Studies on different growth regulators and stage of application on inflorescence induction and development of pineapple (*Ananas comosus* L. Merr.) Var. Queen” was carried out at the Agri-technology Park, Birsa Agricultural University, Kanke, Ranchi during 2017-2020. The experiment was laid out in factorial randomized block design with two factors i.e. factor A- growth regulators (G) and factor B- stage of application (S). These factors consist of twelve and three levels respectively, thirty six treatment combinations with three replications. The experiment was conducted on pineapple plants of Queen Variety. The growth regulators i.e. NAA 10ppm (G₁), NAA 20ppm (G₂), Ethrel 10ppm (G₃), Ethrel 30ppm (G₄), Ethrel 50ppm (G₅), NAA 10ppm + Ethrel 10ppm (G₆), NAA 10ppm + Ethrel 30ppm (G₇), NAA 10ppm + Ethrel 50ppm (G₈), NAA 20ppm + Ethrel 10ppm (G₉), NAA 20ppm + Ethrel 30ppm (G₁₀), NAA 20ppm + Ethrel 50ppm (G₁₁) and Control (G₁₂) by foliar application were applied at 30,35 and 40 leaves stage. Among the different treatment combination the treatment G₄S₃ (Ethrel 30ppm at 40 leaves stage) noted the minimum days taken for completion of flowering and days required for fruit maturity.

Keywords: Pineapple, *Ananas comosus*, Queen

Introduction

Pineapple [*Ananas comosus* (L.) Merrill] is a perennial herbaceous plant that belongs to the family Bromeliaceae and is one of the most commonly known and widely cultivated tropical fruit species. Pineapple is mainly grown for its fresh fruit, which is eaten as a dessert, or exported fresh or as a canned product. Pineapple is also used as an ingredient in a wide range of foods, as a meat tenderizing agent, for medicinal purposes and as an alcoholic beverage. Natural flowering of pineapple (*Ananas comosus* (L.) Merrill) can reduce yields and disrupt crop scheduling. Pineapple plants are induced to flower early especially for commercial production to synchronize harvest and save labor costs (Vences, 2018) [14]. However, pineapples have erratic response to flower induction treatments resulting in irregular and staggered harvesting. This may be due to foliar application timings, rates of flower inducers applied and other factors. Hence, the study aimed to determine the stage of application and rates of growth regulator best for flower induction in pineapple.

The experiment was laid out in Factorial Randomized Block Design with three replication comprising three level of stage of application (30, 35 and 40 leaves stage) and twelve growth regulator levels [NAA 10ppm (G₁), NAA 20ppm (G₂), Ethrel 10ppm (G₃), Ethrel 30ppm (G₄), Ethrel 50ppm (G₅), NAA 10ppm + Ethrel 10ppm (G₆), NAA 10ppm + Ethrel 30ppm (G₇), NAA 10ppm + Ethrel 50ppm (G₈), NAA 20ppm + Ethrel 10ppm (G₉), NAA 20ppm + Ethrel 30ppm (G₁₀), NAA 20ppm + Ethrel 50ppm (G₁₁) and Control (G₁₂)] thereby involving thirty six treatment combinations. Each treatment was replicated three times. All plants used in the experiment were induced at the same time to prevent variation in weather conditions, which can influence the flower induction treatment. Flower induction treatments were applied at 7-8 am using a knapsack applicator.

Results and Discussion

Flowering period (Days)

It is conspicuous from the Table (1) that the different growth regulators and stage of application substantially changed the flowering period.

The lowest flowering period was observed in Ethrel 30 ppm (38.17 days). Which was at par with Ethrel 50 ppm (39.61 days), Ethrel 10 ppm (40.39 Days), NAA 10 ppm (40.83 days), NAA 20 ppm (40.89 days), NAA 20 ppm + Ethrel 30 ppm (42.22 days), NAA 10 ppm + Ethrel 50 ppm (42.39 days), NAA 10 ppm + Ethrel 30 ppm (42.72 days), NAA 20 ppm + Ethrel 10 ppm (42.89 days), NAA 20 ppm + Ethrel 50

ppm (42.89 days) and NAA 10 ppm + Ethrel 10 ppm (43.06 days). Significant maximum flowering period (56.56 days) was recorded from the plants under control (G_{12}).

Lowest flowering period (39.35 days) was recorded in plants of 40 leaves stage. While, highest flowering period (45.67 days) was recorded with plants of 30 leaves stage (S_1).

In interaction levels, growth regulators and stage of application showed non-significant effect on flowering period. While, lowest flowering period (35.50 Days) was displayed when the plants were supplied with Ethrel 30 ppm at 40 leaves stage and highest flowering period (57.83 days) was noticed with water application in 40 leaves stage plants.

Table 1: Flowering period (Days) of pineapple as influenced by various treatments

Growth regulators	2017- 2019				2018-2020				Pooled				
	Stage of application (S)				Stage of application (S)				Stage of application (S)				
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	
	(30 LS)	(35 LS)	(40 LS)		(30 LS)	(35 LS)	(40 LS)		(30 LS)	(35 LS)	(40 LS)		
G ₁	NAA 10ppm	46.33	41.67	35.67	41.22	42.67	41.33	37.33	40.44	44.50	41.50	36.50	40.83
G ₂	NAA 20ppm	49.67	36.67	37.00	41.11	43.00	41.67	37.33	40.67	46.33	39.17	37.17	40.89
G ₃	Ethrel 10ppm	44.33	43.33	35.00	40.89	45.00	37.67	37.00	39.89	44.67	40.50	36.00	40.39
G ₄	Ethrel 30ppm	39.00	39.33	35.00	37.78	41.67	38.00	36.00	38.56	40.33	38.67	35.50	38.17
G ₅	Ethrel 50ppm	44.67	40.67	36.00	40.44	40.33	37.67	38.33	38.78	42.50	39.17	37.17	39.61
G ₆	NAA 10ppm + Ethrel 10ppm	42.33	47.00	38.00	42.44	47.33	46.33	37.33	43.67	44.83	46.67	37.67	43.06
G ₇	NAA 10ppm + Ethrel 30ppm	46.67	39.67	38.67	41.67	47.00	44.67	39.67	43.78	46.83	42.17	39.17	42.72
G ₈	NAA 10ppm + Ethrel 50ppm	44.00	43.33	38.00	41.78	45.00	45.00	39.00	43.00	44.50	44.17	38.50	42.39
G ₉	NAA 20ppm + Ethrel 10ppm	48.67	44.33	39.00	44.00	47.00	40.67	37.67	41.78	47.83	42.50	38.33	42.89
G ₁₀	NAA 20ppm + Ethrel 30ppm	44.00	44.00	39.67	42.56	42.67	44.33	38.67	41.89	43.33	44.17	39.17	42.22
G ₁₁	NAA 20ppm + Ethrel 50ppm	48.00	45.00	41.00	44.67	42.67	43.33	37.33	41.11	45.33	44.17	39.17	42.89
G ₁₂	Control (water application)	58.00	54.67	57.33	56.67	56.00	55.00	58.33	56.44	57.00	54.83	57.83	56.56
Mean		46.31	43.31	39.19		45.03	42.97	39.50		45.67	43.14	39.35	
		SEm ±	CD at 5%	CV (%)		SEm ±	CD at 5%	CV (%)		SEm ±	CD at 5%	CV (%)	
G		2.85	8.04	6.64		2.98	8.39	7.00		2.62	7.40	6.14	
S		1.42	4.02			1.49	4.20			1.31	3.70		
G X S		4.94	NS			5.16	NS			4.54	NS		

30 LS – 30 leaves stage

35 LS – 35 leaves stage

40 LS – 40 leaves stage

NS-Non-significant

Days to fruit maturity

The perusal of data presented in Table 2 shows that both growth regulators and stages had pronounced influence in days to fruit maturity.

Growth regulators had exerted moderate influence on number of days to fruit maturity from flower initiation, irrespective of the treatment compositions. Treatment Ethrel 30 ppm recorded significantly minimum number of days to fruit maturity from flower initiation (141.06 days). Which was at par with NAA 20 ppm + Ethrel 50 ppm (144.56 days), NAA 10 ppm + Ethrel 10 ppm (144.72 days), NAA 10 ppm + Ethrel 30 ppm (145.28 days), NAA 10 ppm (145.33 days), NAA 20 ppm + Ethrel 10 ppm (146.33 days), NAA 10 ppm + Ethrel 50 ppm (146.39 days), NAA 20 ppm + Ethrel 30 ppm (146.83 days), Ethrel 10 ppm (147.72 days) and Ethrel 50 ppm (147.83 days).

Plants grown under S_3 (40 Leaves stage) recorded comparatively early fruit maturity in (138.58 days) from flower initiation followed by plants of 35 leaves stage (147.01 Days).

The interaction between growth regulators and stage of application on days to fruit maturity was found to be significant. Minimum number of days to fruit maturity from flower initiation (131.50 days) was observed with combined effect of Ethrel 30 ppm and 40 leaves stage. Which was closely followed by Ethrel 50 ppm and 40 leaves stage

(131.67 days), Ethrel 30 ppm and 40 leaves stage (132 days), NAA 10 ppm and 40 leaves stage (132.17 days) and NAA 20 ppm and 40 leaves stage (133days).

The pooled minimum days of flowering period (38.17 days) was recorded for the treatment Ethrel 30 ppm, While maximum (65.11 days, 56.56 days and 181.06 days, respectively) in control. Decrease in the duration for flowering by application of Ethrel was reported by several workers (Hussain *et al.* 2015; Lin *et al.* 2009; Subbiyan *et al.* 2009; Butrat *et al.* 2004; Liu *et al.* 2011; Borang *et al.* 2015) [6, 9, 12, 2, 10, 3].

Early fruit maturity (141.06 days) was noted on application of Ethrel 30 ppm. This might be due to Ethrel inducing early ripening, as it is the key plant hormone responsible for fruit ripening and the results were supported with those found by Butrat *et al.* (2004) [2], Norman *et al.* (2016) [11] in pineapple, Hussain *et al.* (2015) [6] in Date palm and Kumar *et al.* (2017) [8] in litchi.

It is evident from the results obtained that, stage of application had significantly influenced on various floral character like days of flowering period. In the present investigation, it was observed that 40 leaves stage significantly affected the floral character of pineapple fruit. The analysis of pooled data showed that 40 leaves stage had minimum days of flowering period (39.35 days) and minimum days to fruit maturity (138.58 days). If the plants

are too small they cannot be induced to flower successfully even if treated with ethephon (Van de Poel *et al.* 2009)^[13]. Forced flower induction of pineapple is done with chemicals once some minimum plant size (35- 40 leaves stage) has been attained. If forcing of fully developed plants is delayed, they are highly susceptible to natural induction. Natural induction

during that time would reduce the number of fruits. (Bartholomew *et al.* 2003; Kuan *et al.* 2005; Hussain *et al.* 2008)^[1, 7, 5]. Das *et al.* (1965)^[4] also reported that effect of the PGRs is influenced by the age and the number of leaves of pineapple.

Table 2: Days to fruit maturity of pineapple as influenced by various treatments

Growth regulators	2017- 2019				2018-2020				Pooled				
	Stage of application (S)				Stage of application (S)				Stage of application (S)				
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean	
	(30 LS)	(35 LS)	(40 LS)		(30 LS)	(35 LS)	(40 LS)		(30 LS)	(35 LS)	(40 LS)		
G ₁	NAA 10ppm	164.00	132.00	130.33	142.11	161.67	150.00	134.00	148.56	162.83	141.00	132.17	145.33
G ₂	NAA 20ppm	165.00	159.67	131.33	152.00	162.00	150.33	134.67	149.00	163.50	155.00	133.00	150.50
G ₃	Ethrel 10ppm	167.00	156.00	130.00	151.00	161.00	138.33	134.00	144.44	164.00	147.17	132.00	147.72
G ₄	Ethrel 30ppm	161.00	132.00	130.33	141.11	155.00	135.33	132.67	141.00	158.00	133.67	131.50	141.06
G ₅	Ethrel 50ppm	157.67	164.67	130.33	150.89	165.67	135.67	133.00	144.78	161.67	150.17	131.67	147.83
G ₆	NAA 10ppm + Ethrel 10ppm	166.00	132.00	131.67	143.22	160.67	140.33	137.67	146.22	163.33	136.17	134.67	144.72
G ₇	NAA 10ppm + Ethrel 30ppm	168.67	135.33	133.33	145.78	162.00	136.33	136.00	144.78	165.33	135.83	134.67	145.28
G ₈	NAA 10ppm + Ethrel 50ppm	162.00	138.00	136.00	145.33	161.00	143.33	138.00	147.44	161.50	140.67	137.00	146.39
G ₉	NAA 20ppm + Ethrel 10ppm	142.00	154.00	137.33	144.44	154.00	149.67	141.00	148.22	148.00	151.83	139.17	146.33
G ₁₀	NAA 20ppm + Ethrel 30ppm	143.00	148.33	140.00	143.78	163.00	145.00	141.67	149.89	153.00	146.67	140.83	146.83
G ₁₁	NAA 20ppm + Ethrel 50ppm	143.67	134.00	138.00	138.56	160.33	160.00	131.33	150.56	152.00	147.00	134.67	144.56
G ₁₂	Control (water application)	188.00	180.33	183.33	183.89	177.00	177.67	180.00	178.22	182.50	179.00	181.67	181.06
	Mean	160.67	147.19	137.67		161.94	146.83	139.50		161.31	147.01	138.58	
		SEm ±	CD at 5%	CV (%)		SEm ±	CD at 5%	CV (%)		SEm ±	CD at 5%	CV (%)	
	G	4.62	13.02			2.92	8.23			2.76	7.79		
	S	2.31	6.51	3.11		1.46	4.12	1.95		1.38	3.89	1.85	
	G X S	8.00	22.56			5.06	14.26			4.78	13.48		

Conclusion

Effect of growth regulators had a pronounced effect on floral characters of pineapple. Minimum duration of flowering (38.17 days) were recorded for the treatment G₄ (Ethrel 30 ppm). Pooled data showed minimum days taken for fruit maturity (141.06 days) with G₄ (Ethrel 30 ppm).

The effect of stage of application was found to be significant on floral characters of pineapple. The minimum duration of flowering (39.35 days) were found for the treatment 40 leaves stage. The pooled data showed the minimum days for fruit maturity (138.58 days) with the treatment 40 leaves stage.

References

- Bartholomew D, Paull RE, Rohrbach KG. The pineapple: botany, production and uses. CABI Publishing, Wallingford, UK 2003, 1-301.
- Butrat P, Wangmuang A. Effects of flowering chemicals application on flowering and fruit quality of pineapple [*Ananas comosus* (L.) Merr. cv. *Phuket*]. Songklanakarin Journal of Science and Technology 2004;26(3):339-345.
- Borang Siyang. Forced flowering of pineapple (*Ananas comosus* cv. Kew) in response to cold stress, ethephon, calcium carbide and activated charcoal. College of Horticulture and Forestry, Central Agricultural University, Pasighat 2015.
- Das N, Baruah SN, Baruah A. Induction of flowering and fruit formation of pineapple with the acid of acetylene and calcium carbide. Indian Agriculture 1965;9:15-23.
- Hussain MJ, Ulla MA, Salim MMR, Rahman MM, Sarker MMR. Effect of different application time of Ethrel on off-season pineapple production at srimongal, Sylhet. International Journal of Sustainable Crop Production 2008;3(6):68-71.
- Hussain I, Ahmad S, Amjad M, Ahmed R. Ethephon application at kimri stage accelerates the fruit maturation period and improves phytonutrients status (Hillawi and Khadrawi cv.) of date palm fruit. Pakistan Journal of Agricultural Sciences 2015;52(2):413-42.
- Kuan CS, Yu CW, Lin ML, Hsu HT. Foliar application of aviglycine reduces natural flowering in pineapple. Hortscience 2005;40:123-126.
- Kumar A, Nath V. Effect of Foliar Application of Chemicals on Flowering and Fruiting in Litchi. International Journal of Current Microbiology and Applied Sciences 2017;6(5):1337-1343.
- Lin CH, Maruthasalam S, Shiu LY, Lien WC, Loganathan M, Yu CW, *et al.* Physical and chemical manipulation of flowering in pineapple. Acta Horticulturae 2009;822:117-124.
- Liu Sheng-hui L, Xiao-ping Z, Guang-ming S. Changes in endogenous hormone concentrations during inflorescence induction and development in pineapple (*Ananas comosus* cv. Smooth Cayenne) by ethephon. Academic Journals 2011;11:124.
- Norman K, Joseph M, Paul K, Karatininis K, Namuwoza C. Tracing Uganda's global primary organic pineapple value chain. African Crop Science Journal. 2016;24(2):15.
- Subbiyan M, Shiu LY, Loganathan M, Lien WC, Liu YL, Sun CM, *et al.* Forced flowering of pineapple (*Ananas comosus* cv. Tainon 17) in response to cold stress, ethephon and calcium carbide with or without activated charcoal. Plant Growth Regulation 2009;60:83-90.
- Van de Poel B, Johan C, Maurice DP. Determination of pineapple (*Ananas comosus*, MD2 hybrid cultivar), plant maturity, the efficiency of flowering induction agents and the use of activated carbon. Scientia Horticulturae 2009;120:58-63.
- Vences CV. Plant Age and Rate of Flower Inducer Affects Flower Initiation of 'MD2' Pineapple (*Ananas comosus* L.). International Journal of Research & Review 2018;5(4):27.