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Study on Effects of Ethephon, Iced Cold Water and Calcium carbide with/without Activated Charcoal on Early Flower Initiation and Shelf Life of Pineapple (Ananas Comosus cv. Kew)

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Abstract—*The study on effects of ethephon, iced cold water and calcium carbide with/without activated charcoal on early flower initiation and shelf life of pineapple (Ananas comosus cv. Kew) was carried out at Fruit Research Farm, Department of Fruit Science, College of Horticulture & Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh in the year 2013-14. The experiment was laid out in Completely Randomized Block Design with 8 treatments and 3 replications. The treatments were T_1= Control, T_2= Iced cold water, T_3= NAA @ 0.002%, T_4= 1% CaC_2, T_5= 1% CaC_2 + 0.5% Activated Charcoal, T_6= 0.025% ethephon + 0.04% CaC_2+ 2% Urea, T_7= 0.24% ethephon + 2% Urea, T_8= 4% CaC_2. Here, treatments for number of days required for initiation of flowering was found to be highly significant. Treatment T6 (0.025% ethephon + 0.04% Calcium Carbide + 2% Urea) recorded least number of days required (57.66 days) for flower initiation after complete application of all treatments. It was shortly followed by treatment no. T5 (1% CaC_2 + 0.5% Activated Charcoal) with 61.33 days required. The treatment no. T1 (Control) took around 78.66 days for its first flower initiation. Highly significant differences have also been observed among all the treatment with respect to shelf life of fruits. Treatment T2 (Iced cold water) recorded the highest shelf life with 7.03 days followed by T3 (NAA@0.002%) with 6.63 days and lowest in treatment T8 (4% Calcium Carbide) with only 3.3 days. Therefore, it is being inferred that the use of chemicals specially calcium carbide or other plant growth hormones reduces the shelf life of Pineapple (var. Kew).*

1. INTRODUCTION

The transition from the vegetative phase to flowering is very important for pineapple, since flowering is the first step of the sexual reproduction resulting in fruit production, which is the main objective for economic exploration of the plants. In general, natural flowering is stimulated by regular seasonal changes of climatic conditions, such as photoperiodism, thermoperiodism and water balance (Bernier *et al*., 1993) [4]. However, the floral differentiation of pineapple plants has another singularity; it can be triggered artificially, by chemical substances that are also related to natural flowering (Cunha, 2005) [9]. The treatment for floral induction (TFI) of pineapple using appropriate chemical substances-growth regulators or phytohormones is known for a long time, because this crop fits quite well for this practice (Rodriguez, 1932) [19]. Increase in pineapple production for both local and foreign industries involves early flower induction, which is necessary for uniform fruiting and maturity. This is achieved through treating the pineapple with chemicals such as ethephon, acetylene and calcium carbide.

As per Norman (1972) [18], research by several workers has demonstrated that by the use of certain compounds, flowering is induced and consequently an early crop is obtained. However, no work has been done on early induction of flowering in Pineapples using such compounds under Pasighat condition; therefore, keeping in view the vital need of such a study, the present research was planned.

2. MATERIALS AND METHODS

The present experiment entitled “Study on effects of ethephon, iced cold water and calcium carbide with/without activated charcoal on early flower initiation and shelf life of pineapple (*Ananas comosus* cv. Kew)’’ was conducted at the Fruit Research Farm, Department of Fruit Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, East Siang, Arunachal Pradesh, India, which is situated between 28°04`N latitude and $95^0$22`E longitude having an elevation of 153 meters above the mean sea level. The climatic condition of the region is characterized by humid sub-tropical and maximum rainfall receives between June-September months. The soil type is sandy loam with pH value of 6.7.

The experimental materials for the present investigation were comprised of eight treatments. All the treatments were applied at the core of the plants using a 50ml syringe (without the needle). The strength of chemicals and their combinations was prepared as per similar trials done by Chang *et al.* (2011) [7], Cunha (2006) [9], Hazarika and Mohan (1998) [16] and Malip (2011) [17]. The list of the treatment with their dose/concentration is tabulated as below:

Table 1: List of treatments with their dose and concentration:

Sl. No	Treatments	Dose/plant	References
T1	**Control**	**-**	
T2	**Ice cold water**	**50ml**	**Chang *et al.* (2011)** [7] **& Cunha (2005)** [17]
T3	**NAA @ 0.002%**	**50ml**	**Chadha (2006)** [6]
T4	**1% Calcium carbide**	**50ml**	**Chang *et al.* (2011)** [7] **& Cunha (2005)** [17]
T5	**1% Calcium carbide + 0.5% Activated Charcoal**	**50ml**	**Chang *et al.* (2011)** [7] **& Cunha (2005)** [17]
T6	**0.025% Ethephon+ 0.04% Calcium Carbide+ 2% Urea**	**50ml**	**Hazarika and Mohan (1998)** [16]
T7	**0.24% Ethephone + 2% Urea**	**50ml**	**Malip (2011)** [17]
T8	**4% Calcium Carbide**	**50ml**	**Cunha *et al.* (2005)** [17]

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications and eight treatments. In the trial, number of days taken for initiation of flowering of 3840 numbers of Kew variety of pineapple plants (after complete application of treatments) at the rate of 160 numbers of plants per replication were observed and recorded.

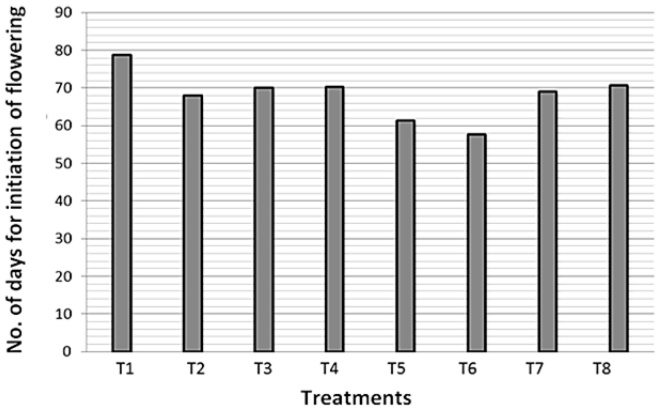
Meanwhile for fulfillment of the other objective of the experiment i.e. Shelf life of pineapple, a set of 10 pineapple fruits from each treatment were randomly selected during harvest period and stored under laboratory condition to assess daily the state of the fruits with regards to change in color, smell and overall condition of the fruit to examine the effects of each treatment on shelf life of pineapple.

3. RESULTS

The data with regards to the effect of different treatments revealed that they had a significant effect on early initiation of flower in pineapple (cv. Kew) under Pasighat condition. Number of days for initiation of flowering was found to be significant among different treatments applied. Here, T6 (0.025% ethephon + 0.04% Calcium Carbide + 2% Urea) showed least number of days required for flower initiation (57.66 days) followed by T5 (1% CaC2 + 0.5% Activated Charcoal) with 61.33 days. Treatment T1 (Control) exhibited highest number of days required for flower initiation (78.66 days) which was not a desirable trait for the present investigation. The critical difference (CD) was found to be 7.15 at 5% level of significant. Standard error of differences (S.E.D) was found to be 3.33.

Regarding the outcome in data for shelf life of pineapple, highly significant differences have also been observed among all the treatments. Treatment T2 (Iced cold water) recorded the highest shelf life with 7.03 days where the condition of the fruits were almost fine and was still in edible condition. Treatment T2 was shortly followed by T3 (NAA@0.002%) with 6.63 days of stable fruit condition. The lowest shelf life was found in treatment no.T8 (4% Calcium Carbide) with only 3.3 days after which the fruits started showing some deterioration. In a similar experiment, Aboles (1992) [1] and Dzogbefia *et al*. (2001) [11] stated that people have been complaining that the use of Calcium carbide for induction, which is a common practice in Ghana, affects the quality of fruits and reduces their shelf lives. Therefore, it is inferred by the findings of this study that the use of chemicals like calcium carbide or plant growth hormones indeed reduces the shelf life of Pineapple (var. Kew).

Table 2: Graphical representation for No. of Days for initiation of flowering against treatments:



Where, T_1= Control, T_2= Iced cold water, T_3= NAA@0.002%, T_4= 1% CaC_2, T5= 1% CaC_2 + 0.5% Activated Charcoal, T6= 0.025% ethephon + 0.04% CaC2+ 2% Urea, T_7= 0.24% ethephon+ 2% Urea, T_8= 4% CaC_2

4. DISCUSSION AND CONCLUSION

When pineapple crops are left as it is for natural flowering, serious scheduling problems for the growers may occur due to their delayed and non-uniform flowering behavior which can cause economic losses. Induction of reproductive development in pineapple under natural condition is favoured by shortened day length and cool night temperatures (Van overbeek and Cruzado 1948 [21]; Gowing 1961[15]; Friend and Lydon 1979 [12]; and Friend 1981 [12]) however, other stresses can also

induce flowering. Pineapple is considered to be one of the important fruit crop to be grown in Arunachal Pradesh, however, due to absence of any standard floral induction methodology, expected yield has not been accomplished yet. The present investigation was therefore aimed at assessing the effects of different treatments for speeding up the flower induction artificially in Pineapple under Pasighat condition. In the present exploration, however, it must be mentioned that the interval between the dates of application of the compounds and flowering could be greatly influenced by other environmental factors such as temperature, relative humidity and light.

However, from the overall assessment of the results of the present investigation "Study on effects of ethephon, iced cold water and calcium carbide with/without activated charcoal on early flower initiation and shelf life of pineapple (*Ananas comosus* cv. Kew)'', it can be concluded that use of 0.025% ethephon + 0.04% Calcium Carbide + 2% Urea (50ml/plant) showed earliest flower initiation of pineapple (*Ananas comosus* cv. Kew) under Pasighat condition. Yet, the treatment although showing good performance in inducing early flowering in pineapple, it can't be abruptly recommended to the farmers. The reason being that the component of treatment no.T6 i.e. Calcium carbide is a known carcinogenic compound. It can be harmful to farmer's health if used without proper supervision, dose or care during long term use of the chemical. However, in absence of other acetylene generating compounds in market, the farmers can opt for Calcium carbide for short term use as it is available at cheaper cost in compare to other brands of laboratory ethylene chemical.

Also, highly significant differences have been observed among all the treatment with respect to shelf life of fruits under ambient condition. Treatment T2 (Iced cold water) recorded the highest shelf life with 7.03 days followed by T3 (NAA@0.002%) with 6.63 days and lowest shelf life was demonstrated in treatment T8 (4% Calcium Carbide) with only 3.3 days after which the fruits started showing signs of deterioration. Finally, therefore, It can be concluded based on the outcome of the investigation conducted, that the use of chemicals like calcium carbide or other plant growth hormones do have a negative effects on the quality of the fruits and thus, reduces the shelf life of Pineapple (var. Kew). The present result is in consistent with the report of similar works by Collins (1960) [8].

Fig. 1: Glimpse of the field & the flower initiations

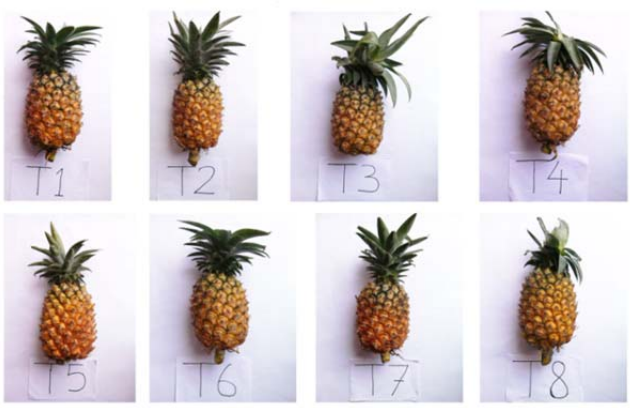


Fig. 2: Glimpse of fruits, one from each treatment

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