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## Influence of varied growth and pollination temperature on different seed setting mechanism

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### Abstract

The experiment was conducted during the winter of 2022-23 at the Indian Agricultural Research Institute in New Delhi, this experiment employed a randomized block design with three replications, focusing on the broccoli cultivar DPB 1. The research aimed to analyze the impact of temperature variations at different growth stages by manipulating transplanting times, observing their effects on the seed setting of broccoli. This study investigated how temperature fluctuations, regulated through transplanting times, affected the seed setting mechanisms in the selected broccoli cultivar. By scrutinizing the outcomes at different growth stages, the research aimed to offer insights into optimizing temperature conditions to enhance the seed setting process in broccoli cultivation.

**Keywords:** Broccoli, climate, pollination, seed set, temperature

### Introduction

Broccoli (*Brassica oleracea* var. *italica* Plenck) is a Cruciferous vegetable believed to have originated in the eastern Mediterranean and later introduced from Italy. Its cultivation in India commenced during the late 20<sup>th</sup> century, gaining prominence owing to the dense inflorescence exhibiting variations in colour, presenting in green, purple, or yellow hues (Das and Ghosh, 2021) [5]. Among the various cultivars, DPB 1 has garnered attention due to its unique characteristics and potential benefits. However, optimizing cultivation practices, especially concerning temperature regulation during growth stages, remains crucial for enhancing the seed setting process and ensuring optimal yields in broccoli.

The influence of temperature on plant growth and development, particularly in relation to seed setting mechanisms, has been widely studied across various plant species (Schouten, 2009) [9]. Temperature variations during different growth stages have shown significant impacts on reproductive processes *viz.* pollination under bagging, pollination under hand pollination and pollination under open condition on seed formation.

Understanding the nuanced relationship between temperature fluctuations and seed setting processes is imperative for devising optimized cultivation strategies. This study seeks to contribute valuable insights into tailoring temperature conditions during specific growth stages to enhance the seed setting process in broccoli, ultimately aiming to bolster yields and quality in broccoli cultivation.

### Materials and Methods

Observational procedures encompassed three distinct pollination methods are pollination under bagging, hand pollination, and open pollination, with a primary focus on monitoring seed development. Transplanting dates (T) were the primary experimental factors investigated. It comprised three distinct levels denoting various transplanting dates: T<sub>1</sub> (October 10<sup>th</sup>), T<sub>2</sub> (November 10<sup>th</sup>), and T<sub>3</sub> (December 10<sup>th</sup>). These transplanting times significantly influenced the environmental conditions, encompassing temperature and photoperiod variations, crucial for the crop's developmental phases. The diverse transplanting dates played a pivotal role in subjecting the crop to distinct environmental circumstances, potentially impacting its growth and subsequent stages (Bjorkman and Pearson, 1995) [2]. To prevent unintended cross-pollination, individual flower buds were enveloped with butter paper bags the night before flower anthesis, subsequent to the removal of male flowers, ensuring a controlled pollination environment. The following morning, within the enclosed female flowers, pollination was conducted utilizing male flowers stored separately within bags exclusively designated for this purpose (Agrawal, 2018) [1].

The evaluation of seed setting percentage involved a systematic count of seed-producing flowers amidst the total observed flowers (Chandra and Shukla 2013) [4]. This calculation method derived the seed setting percentage by dividing the count of seed-producing flowers by the total number of observed flowers, multiplied by 100 (El-Kassaby, 2008) [6]. This meticulous approach facilitated a quantitative assessment of seed setting efficiency under varied pollination conditions, providing insights into the impact of different pollination methods on broccoli seed formation.

**Results and Discussion**

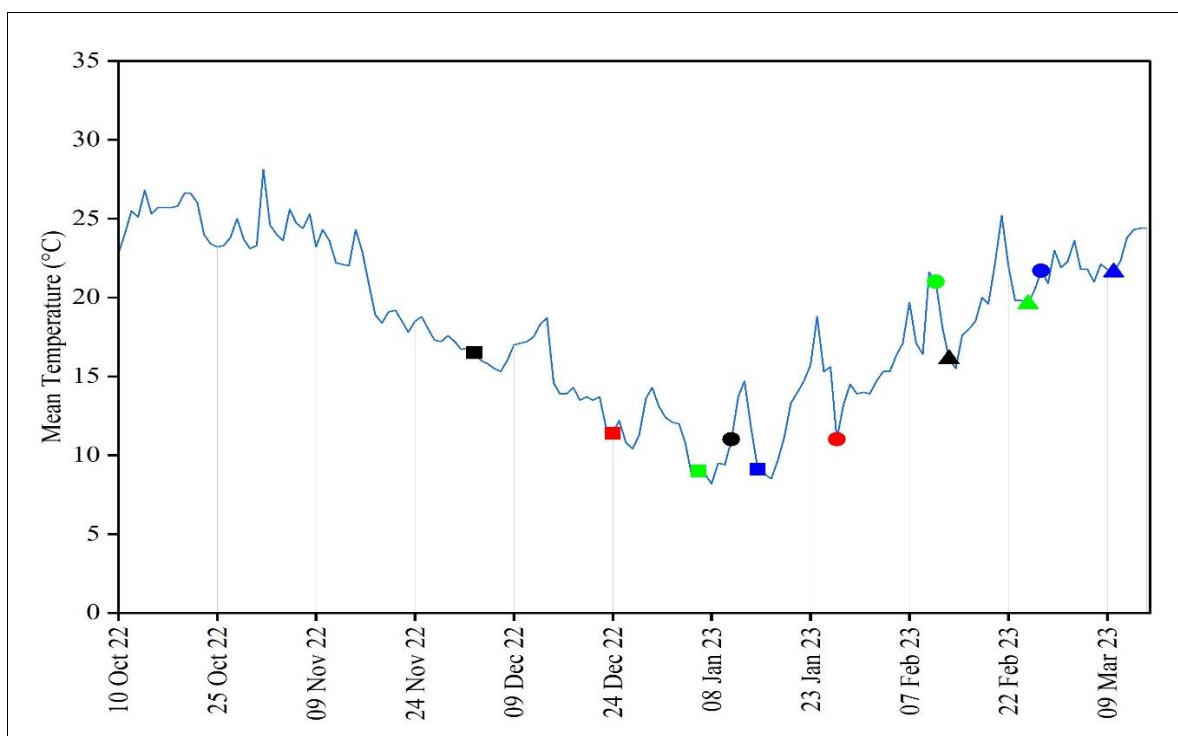
The correlation analysis between treatments and pollination mechanism viz. pollination by bagging, hand pollination and open pollination revealed significant outcomes. The data, detailed in the table, pollination under bagging resulted significant influence of temperature was noticed highest seed set in T<sub>1</sub> (4.08 and hand pollination also showed significant effects concerning T<sub>1</sub> was the highest seed setting (52.33%). Conversely, noteworthy influence of treatment combinations on open pollination, particularly in the case of T<sub>1</sub>, exhibiting a substantially higher seed setting percentage of 80.98% ( $p>0.005$ ).

**Table 1:** Effect different transplanting time concise with change in temperature and its effect on seed setting by various pollination mechanism

Treatments	Seed set by bagging (%)	Seed set by hand pollination (%)	Seed set by open pollination (%)
T <sub>1</sub>	4.08	52.33	80.98
T <sub>2</sub>	4.05	43.96	63.97
T <sub>3</sub>	2.98	36.25	56.27
CV	12.56	10.03	2.85
CD	0.81	7.66	3.31

In T<sub>1</sub>, flower initiation and pollination were observed within a temperature range of approximately 10 °C (Lin *et al.*, 2019) [8], while seed setting temperatures varied between 10 °C and 23 °C. Conversely, T<sub>2</sub> exhibited higher temperatures ranging from 23 °C to 26 °C during flower initiation and pollination, continuing into the seed setting phase. This indicated a comparatively warmer growth environment compared to T<sub>1</sub>. In T<sub>3</sub>, curd initiation commenced at approximately 17 °C; however, curd maturation was hindered as temperatures

exceeded 25 °C, leading to direct bolting into flower stalks (Carey and Nair, 2021) [3]. Pollination occurred around 24 °C, but during seed maturation, temperatures surpassed 28 °C, adversely impacting the seed setting process. These temperature fluctuations across different transplanting dates denote varied environmental conditions, potentially influencing crucial pollination and fertilization ultimate on seed setting (Jagdish *et al.*, 2021) [7].



**Fig 1:** Varied temperature noticed during the different stages of the plant cycle; CI: Cued initiation, CM: Curd maturity, FI: Flower initiation, SS: Seed setting.

**Conclusion**

The research validates that temperature variations throughout broccoli growth stages, ideally within the range of 10-20 °C, markedly influence pollination mechanism. In the subtropical conditions of the Indian plains, transplanting by October 10<sup>th</sup> is recommended to attain a superior seed yield, particularly

under open pollination conditions.

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