



Polythene cover: Locally available low cost polythene can be used. But one should ensure to remove these covers after 2-3 days to avoid heat generation and humidity. Hence a few number of very small holes can be made.



Muslin cloth: These are costly but durable and can be reused for 3-4 years. These are suitable for light to moderate rainfall conditions but not effective for heavy rainfall areas/condition.



Butter paper cover: For covering pollinated stigma of the flowers (if pollination done during evening). No need of remove these covers as they automatically fall out with stigma. But these are not suitable for heavy rainfall regions

Benefits

This technology prevent the yield loss due to flower and immature fruit drop and also improves the fruit quality. Thus, this technology helps in enhancing farmers income if adopted appropriately even under aberrant rains during flowering or anthesis period.

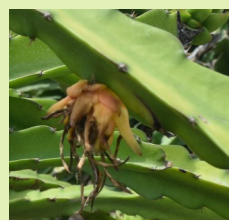
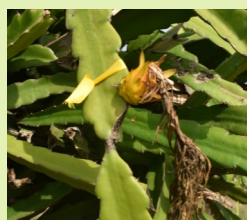
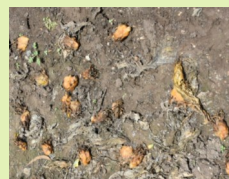
Benefit cost ratio: B: C ratios are in comparison with unprotected/rain affected condition

- ♦ Bagging: 1: 2.00
- ♦ Sheltering: 1: 2.20
- ♦ Supplementary hand pollination: 1: 2.50

Precaution Before Adopting Technology

- Cover the flowers before anthesis.
- Ensure removal bags (if using polythene bags) next day for noon and also make few small pin holes for aeration to avoid heat and excess humidity formation.
- Sheltering the plants only during blooming period (generally 2-4 days in a month) and ensure proper height so that heat should not generate (avoid sun scorching effect).
- For better results of pollination methods farmers should know the following points:

- ♦ Phenological stages of flowering and fruiting, timing of anthesis, duration of pollen viability and stigma receptivity.
- ♦ Identification of viable pollen and stigma receptivity, collection and storage of pollen, pollination, bagging etc. (Needs hands on training/demonstration)
- ♦ Ensure best pollen source and quality (Male clone)



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Technical Folder No. 51

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Prevention of Flower Drop in Dragon Fruit through Bagging, Sheltering and Supplementary Pollination



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Introduction

Dragon fruit was introduced in India during the late 1990s. Due to its adaptation to diverse agro-ecologies, resilience to abiotic stresses, high nutritive value, less water requirement and maintenance the crop is becoming popular and now being cultivated in almost all states of India. But the productivity in India is too low compared to Vietnam, Malaysia and other South East Asian countries. This is mainly due to limited availability of quality planting materials and lack of region specific crop management practices. Further, in recent past years flower drop and immature fruit drop has been reported across the country. In this context, a series of experiments were conducted at ICAR-NIASM during fruiting seasons of two years 2020 and 2021 to develop and validate technologies to prevent yield losses caused by flower drop due to rains.

Flowering and fruiting behaviour

The flowering in dragon fruit is mainly affected by the photo period, which requires 10–13 h of light. The phenology of reproductive stages such as floral bud initiation, anthesis and fruit development is varies from species to species. We observed that in *Hylocereus undatus* (white flesh type) the blooming period stars from April and ends in October with 5-6 major cycles and 2-3 blooms with few sparse flowers, whereas in red type blooming starts from May ends in September. In both the species it takes 14-15 days for anthesis from floral bud stage and fruit matures 30-35 days after anthesis (DAA). The anthesis starts at 6.30 PM in the evening, completely blooms between 9.00 PM-12.00 AM, starts closing 7.00 AM onwards, partially closes at 9.00 AM and starts withering 10.30 AM as sunshine increases (Fig. 1).



Fig 1. Flowering and fruiting phenological stages.

An experiment to identify causes and remedies for flower drop in dragon fruit

In order to find the exact cause of flower drop, we have monitored the fruit set across fruiting seasons in each flowering cycles and compared with rainfall data. It is found that the flowering cycles whose anthesis coincides with precipitation recorded low fruit set. Rainfall during anthesis period causes drastic pollen wash out and thus it effects the pollination and consequently the fruit set and development. Reported up to 70 % yield loss

due to flower and immature fruit drop and even a small amount of rainfall of 1-2 mm during anthesis period causes reduction in fruit size due to insufficient pollination.

Thus we assumed that preventing the pollen wash from rain splash can be solution for flower/immature fruit drop. To prove this assertion we have imposed seven different pollination treatments (Table 1) evening time based on weather forecasting expecting rainfall. The rainfall started as drizzling at 6.30 PM onwards and slowly increased intensity. Precipitation occurs throughout night with intermittent drizzling till early morning hours (5 PM) with total amount of rainfall 4.00 mm.

Table 1. Fruit set upon different methods of covering and pollination

Pollination treatment	Fruit set (%)
Bagging with muslin/ cotton cloth	90
Bagging with polythene cover	100
Hand pollination and open	50
Hand pollination + covered with butter paper	97
Hand pollination and covered with poly-ene cover	100
Nocturnal pollination (open during night)	27
Diurnal pollination (closed during night and opened during daytime)	83
Natural pollination	30
Hand pollination in the morning	100

Interestingly we have observed less fruit set in the flowers exposed to rainfall during evening and night period coincide with anthesis and active pollination period (Table 1). On the other hand flowers protected with polythene cover, muslin cloth and butter paper cover were recorded good fruit set. The flowers covered with muslin cloth during night protected flowers from pollen washout and recorded 83 % of fruit set, whereas the flowers kept open during night and protected during daytime recorded least fruit (27%) which is almost on par with natural pollination (30%). Based on these observations a technology has been developed to prevent flower/immature drop in dragon fruit.

Technology: Prevention of flower and immature fruit drop in Dragon Fruit through Bagging, sheltering and supplementary pollination

The technology comprises three methods such as bagging/ covering the flowers, sheltering plants and supplementary pollination to prevent flower and immature fruit drop. This technology prevents the yield losses occur due to flower and immature fruit drop. But farmers should know method, time and duration of bagging, covering and sheltering and practical aspects of pollination process. Therefore, the technology briefly described in the following section for better understanding.

A. Bagging or covering: Covering unopened pre-anthesis flower buds with a suitable size water proof bags or polythene bag or butte paper cover before anthesis to protect the flowers from direct pollen wash out by rains. Procedure and materials to be used for this method depends on availability and affordability of materials and climatic/weather conditions.

B. Sheltering: Covering whole plant rows with 2 m wider polythene sheet or thin tarpaulin to avoid direct fall of rain water on plant canopy which protects flowers from pollen wash out thus prevents dropping of flowers due failure of pollination. Cover only during anthesis time of blooming period (2-3 days) of every flower cycle. It should be transparent sheet preferably and kept covered at above one meter of canopy to avoid heating effect on flowers. This method is costly but very effective and suitable for big size orchards where availability labours is major limitation.

C. Supplementary hand pollination: Rainfall during anthesis period (evening/night hours) causes pollen washout and partial or failure of pollination. Hence, immediately pollinating the such rain splashed flowers during next day early morning hours to supplement the insufficient pollination and subsequently enhances the good fruit set. For this purpose at least few flowers (20:1) should be protected from rainfall for pollen source by sheltering the plants in the evening hours before anthesis.



Sheltering the plants

Hand pollination