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Application of different plant growth regulators (PGRs) on yield and quality of bitter gourd: A review

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Abstract
One of the major cucurbits that are widely grown for commercial purposes in India is the bitter gourd. After fertilizers and pesticides, the next generation of agrochemicals are called plant growth regulators, or PGRs. They improve the connection between the source and sink and quicken the transfer of photosynthates, which leads to improved fruiting. Standard mode PGRs work by altering the way plants grow and develop by interfering with their typical homeostasis, specifically hormonal control. It is a cucurbitaceous crop and monoecious in nature. Plants with an unbalanced male-to-female flower sex ratio yield less fruit due to a low fruit set. In this review paper, different studies to evaluate the impact of plant growth regulators (PGRs) at various stages of growth on bitter gourd sex expression, fruit output, and seed yield have been shown. Application of Ethrel in different treatments was found most effective in improving femaleness with increased fruit yield of Bitter Gourd.

Keywords: PGRs, homeostasis, cucurbitaceous, ethrel, fruit set, yield

Introduction
One of the most significant commercially important and very nutritious vegetables, bitter gourd (*Momordica charantia* L.) is grown widely all throughout Tripura from the plains to an altitude of 1500 meters. It is regarded as a favoured vegetable among *Cucurbitaceous* vegetables due to its high nutritional value, particularly its ascorbic acid and iron concentrations.

In North and East India, it is better known as "Karela," in West India, "Karli," in South India, and "Paval" and "Kakara." Bitter melon is another name for bitter gourd in several regions of the world. It is a significant vegetable crop that is cultivated for its immature tuberculate fruits, which have an exceptional bitter flavour. Fruits are regarded as a nutrient-dense source because they contain 88 mg of vitamin C per 100 grams after stuffing and frying, fruits are employed, and delectable concoctions are produced. Fruits are cut into slices, partially cooked with salt during market gluts, and then sun-dried for several months. After frying, this is used. Fruits from bitter gourds have therapeutic potential and are used to treat rheumatism, blood disorders, diabetes, and asthma. Naturopaths advise drinking fresh bitter gourd juice. Several ayurvedic treatments use the roots and stems of wild bitter gourds.

The maleness of the bitter gourd, like that of other cucurbits, is one of the main challenges that lowers fruit and seed yields. When administered in modest quantities, the new generation of agrochemicals known as plant growth regulators (GA3, NAA, and Ethrel) alter the natural growth of crop plants from seed germination to senescence. The cultivar, the climate, and cultural techniques all affect flowering behavior (Deshpande *et al*., 1979) [3].

Although the PGRs have a great potential to influence plant growth morphogenesis, it is important to carefully plan their application and accrual assessments in terms of the best concentrations, application stages, species specificity, and seasons, which are the main barriers to the PGRs' applicability. Due to their sensitivity, different plant stages are the main factors taken into account while applying PGR. Applying plant growth regulators at the 2-leaf and fower initiation stage significantly improves early flowering, harvesting, and maximum fruit setting (Sarkar *et al*. 2019) [10].

Some plant growth regulators (PGRs) mimic or block the actions of natural plant hormones, while others are actual hormones that occur in plants. They are regarded as the fourth generation of agricultural chemicals, following fertilizers, insecticides, and herbicides, and are well recognised for improving source-sink relationships and promoting the translocation of photoassimilates, which improves fruit development. Similar to this, the yield level of bitter gourd can be raised by boosting the fruit set percentage by the use of various growth

regulators. Using PGRs could be beneficial and a different way to boost crop productivity. Recently, the significance of PGRs in raising crop output has come to the attention of the entire world. Gibberellic acid is a crucial growth regulator that can be used in a variety of ways to alter plant growth, yield, and yield-contributing traits (Rafeekher *et al*., 2002) [7].
Gibberellic acid applied exogenously has a significant impact on a variety of plants' physiological processes, such as cell division, elongation, and expansion, all of which promote plant development (Sprangers *et al*. 2020) [11].
In order to improve growth habits, fruiting, and yield in bitter gourd, it is imperative to produce exact information for the local agricultural community to measure the impact of PGRs at various growth phases.
Increasing bitter gourd seed output and productivity while simultaneously inducing femaleness through the application of various PGRs is the present need of the hours.

Methodology
The bitter gourd is a naturally monoecious plant that produces more male flowers than female blossoms. Its flowering behaviour is unfavourable and uneconomical since it affects fruit set and yield. Low yield due to less flowering and fruit set in Bitter gourd. The male-to-female flower ratio must be lowered and synced for a higher yield. Typically, environmental factors including temperature, photoperiod, nutrition, and the use of growth regulators can change a person's gender. Many variables, including the insecticide's toxicity, the technique and timing of application, the number of sprays, the percentage of foragers visiting the treated field, the crop and its floral structure, and pollinators' feeding habits, among others, all affect the damage to bee colonies. Hormonal influences can alter cucurbit sex expression and blooming behaviour, and cultivar differences may also affect these characteristics (Moniruzzaman *et al*. 2019; Reddy *et al*., 2020; Shailendra kumar *et al*. 2017) [5, 8, 9].
There are several technologies have been developed and standardized by different research Institutes, SAUs, and other private agencies to increase the productivity of cucurbitaceous crops as well as Bitter Gourd.
Application of ethrel technology developed by KAU, 2014. Application of Ethrel @ 100 ppm (1 ml in 10 liters). Spray four times starting from 15 DAS & followed by weekly intervals. Planting time – December under Tripura conditions.
The crop is sown on hills between April and May. States like Rajasthan and Bihar sow bitter gourd between January and March on the plains where the growing season is early. Sowing takes place in February and March in states with lengthy and late winters. In regions with moderate winters, the crop is sown all year long. When the bitter gourd is produced intensively in Kerala, the summer crop is sown in January and February, the kharif crop is sown in May and June, and the rabi crop is sown in September. On humus-rich, fertile soil, kakrol and sweet gourd are typically grown during the rainy season. Performance improves when there is some shade.
According to a number of reports from the USA, Japan, Israel, and India, plant growth regulators can decrease male blooms in cucumber plants while boosting the number of female flowers (Bhandary *et al*., 1974) [2].
According to Pandey *et al*. (2021) [6], the Ethrel 200 ppm treatment was the most successful in enhancing femaleness and increasing the yield of fruit in cucumbers (cv. Kalyanpur Green). The application of plant growth regulators dramatically enhanced growth, according to the results. In terms of yield characteristics, GA3 (100 ppm) is crucial, followed by NAA (100 ppm). Ethrel (300 ppm) can be used to reduce the ratio of male to female flowers. Fruit set and fruit retention percentage were increased by applying GA3 (150 ppm) and then GA3 (200 ppm).
Medium black soils rich in organic matter and sandy to sandy loam soils with good drainage are suitable for growing bitter gourd. Bitter gourds can be grown well in alluvial soil found near riverbeds. An ideal pH range is thought to be between 6.0 and 7.0. With 1-2 crosswise ploughings, the field is ploughed, levelled, and brought to a beautiful tilth. Depending on the support system to be used, furrows are opened at a distance of 1.5 to 2.5 m. Pits are dug with a 60 cm diameter and a 30-45 cm depth at a spacing of 2.0-2.5 x 2.0-2.5 m on finely tilled ground. Applying well-rotted farmyard manure at a rate of 20 to 25 t/ha, filling the pits with top soil to a height of 3/4 of the height, and sowing 4-5 seeds at a rate of 5.0 to 6.0 kg/ha in each pit. The summer crop is sown in the plains between January and February, whilst the rainy crop is sown in May. Four to five kilogrammes of seed are needed to grow one hectare of land. Thiram (3 g/kg of seed) is applied to the seed prior to sowing.
Bitter gourd seeds should be soaked in cold water for an entire night since they have a tough seed coat. After that, seeds are kept in wet cloth for one or two days to allow germination. Immediately following germination, seeds are spread in pits. Early after harvest, mechanical scarification is useful for seed germination.
Kerala Agricultural University advises applying a fertiliser dose of 70 kg N, 25 kg P2O5, and 25 kg K_2O/ha in addition to 20–25 t/ha of farmyard manure. Farmyard manure is initially applied in pits and mixed with topsoil. Administer a basal dose of 1/3 N, full P and half K either right before sowing or 10-15 days after sowing. 45 days after sowing, 1/2 K can be applied. The remaining fertilisers can be administered in a number of split doses (5–6) spaced out over a two-week period. Bitter gourd should be fertilised in numerous split applications because it is regularly harvested.
Bitter gourd cannot stand dry conditions or stagnant water. For a high production, frequent irrigation at intervals of 2 to 5 days, especially during the fruiting stage, is required. In Tripura, the crop is irrigated every 3–4 days during the early stages and every other day when it is fruiting. 20 t/ha of FYM should be applied each pit. As a basal fertiliser, use 100 g of NPK 6:12:12 per pit, and add 10 g of nitrogen 30 days later.
Growth regulators have tremendous effects on sex expression and flowering in cucumber crop leading to either suppression of male flowers or an increase in the number of female flowers (Al-Masoum and Al-Masri, 1999) [1]. Plant growth regulators are also used to control the vegetative growth of cucumber plants, thereby increasing the plant population per unit area with regard to yield (Latimer, 1991) [4].
Use of Plant growth regulators that is ethrel 100 ppm having benefits in fruit set and crop yield. The female flowers and yield of bitter gourd increase at the 2-leaf and 4-leaf stages.
About 55 to 60 days following sowing, harvesting begins. Fruits are picked when they are completely developed but still young and fragile. When harvested, seeds shouldn't be too hard. 15-20 harvests are possible from a healthy crop, and harvesting is done twice weekly. Fruits that are left to ripen on vines have a negative impact on subsequent bearing. Fruits are marketed after being harvested and packaged in tempo bags or thin gunny bags. Fruits should be sold as soon as

possible to adjacent marketplaces on the same day since maintaining quality is poor. Otherwise, fruits' freshness and beauty will suffer, and tubercles may drop off. Yield increases 10-15%.

Asian type of bitter gourd at farmers' field of Dhalai district, Tripura

(Bitter gourd plots of farmers under Dhalai District) Assessment on ethrel application in Bitter Gourd by KVK Dhalai

Parameters on Technology	Results/observation on selected parameters	Net return (Rs/ha)	B:C Ratio (GR/GC)	Farmers feedback
Application of Ethrel @ 1 ml/10 litres of water	Yield: 23 t/ha	208000	3.6	Better yield due low rate of flower drop
Farmer Practice (No PGR use)	Yield:17.5t/ha	128000	2.6	Flower drop occurred more

Bitter gourd plot with mulch at Tripura

Farmers' average yield and returns after adopting the technology through demonstration

Demonstration Yield (Qt/Ha)			Yield of local Check	% increase	Gross Cost (Rs/Ha)	Gross Return (Rs/Ha)	Net Return (Rs/Ha)	B: C Ratio (GR/GC)
H	L	A	(Qt/Ha)	%				
112.44	84.50	100.62	88.00	14.34	1,46,000	5,13,920	3,67,920	3.52:1

Conclusion

Using PGRs increased the proportion of fruit retention and increased the fruit set. It is possible to reduce the ratio of male to female flowers by applying ethrel. The use of PGRs plays an important role in the overall crop yield and also quality of the crop. Every PGR treatment showed a substantial difference in every feature when compared to the control plants at various stages. PGRs offer a tremendous deal of promise to increase the development and yield of various vegetables, but there isn't enough study to determine the best application time and dose for a certain vegetable.

References

1. Al-Masoum AA, Al-Masri AA. Effect of ethephon on flowering and yield of monoecious cucumber. Egyptian J Horti. 1999;26:229-236.
2. Bhandary KR, Shetty KPV, Sulkier GS. Effect of ethrel (2-chloroethyl phosphonic acid) on the sex expression and yield of cucumber. Progressive Horticulture. 1974;6:2-3.
3. Deshpande AA, Venkatasubbaiah K, Bankapur VM, Nalawadi UG. Studies on floral biology of bitter gourd (*Momordica charantia* L.). Mysore Journal of Agriculture Science. 1979;13:156-159.
4. Latimer JG. Growth retardants affect landscape performance of Zinnia, Impatiens and Marigold. Hort Sci. 1991;26:557-560.
5. Moniruzzaman M, Khatoon R, Moniruzzaman M, Qamruzzaman A. Influence of plant growth regulators on vegetative growth, sex expression and yield of summer bottle gourd. Bangladesh J Agric Res. 2019;44:577-590.
6. Pandey P, IN Shukla IN, Upadhyay A. Effect of different plant growth regulators on growth, yield and quality parameters of cucumber (*Cucumis sativus* L.) cv. Kalyanpur green. Journal of Pharmacognosy and Phytochemistry. 2021;10(1):2681-2684.
7. Rafeekher M, Nair SA, Sorte PN, Hatwal GP, Chandhan PM. Effect of growth regulators on growth and yield of summer cucumber. Journal of Soils and Crops. 2002;12:108-110.
8. Reddy AM, Saravanan DS, Bahadur DV. Effects of different plant growth regulators on plant growth, yield and fruit quality of Bitter gourd (*Momordica charantia* L.) cv. Kashi Mayuri. Int J Chem Stud. 2020;8:1573-1575.
9. Shailendrakumar VM, Valia RZ, Sitapara HH. Effect of plant growth regulators on growth, sex expression and yield of sponge gourd (*Lufa cylindrica* L.) Cv. Pusa Chikni. Ann Hortic. 2017;10:243.
10. Sarkar MD, Moniruzzaman M, Alam S, Rahman J, Quamruzzaman, Rojoni RN, *et al*. Growth, sex expression and nutrient composition of cucumber (Cucumis sativus) as influenced by maleic hydrazide. Pakistan J Bot. 2019;51:117-123.
11. Sprangers K, Thys S, van Dusschoten D, Beemster GTS. Gibberellin enhances the anisotropy of cell expansion in the growth zone of the maize leaf. Front Plant Sci. 2020, 11.