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Assessment of Different Plant Growth Regulators on Growth, Yield and Quality Traits of Cucumber (*Cucumis sativus* L.) *cv.* Krish

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Cucumber (*Cucumis sativus* L.) is an important cucurbitaceous vegetable crop cultivated for its nutritional, commercial and economic importance. However, productivity and fruit quality are strongly influenced by plant growth, flowering behaviour and the proportion of female flowers. Plant growth regulators (PGRs) have considerable potential for manipulating vegetative growth, flowering, fruit setting and yield in cucumber. The present study was undertaken under the National Service Scheme programme at Titirgaon village of Bastar district, Chhattisgarh, with the objective of assessing the influence of different plant growth regulators on growth, flowering, yield and quality characteristics of cucumber cv. Krish. The study also aimed to demonstrate improved cucumber production practices to farmers and enhance awareness regarding scientific crop management. Different PGR treatments were evaluated through farmer-oriented demonstrations and observations of crop performance. The results indicated that PGR application influenced vegetative growth, flowering behaviour, fruit setting, yield and fruit quality. Gibberellic acid (GA_3), at an optimum concentration, showed superior performance for vine growth, number of leaves, early flowering, fruit size and yield. NAA improved fruit setting and contributed to increased yield, whereas Ethrel enhanced femaleness and increased the number of female flowers. Appropriate PGR application also improved fruit length, fruit diameter, average fruit weight and total soluble solids. However, higher concentrations did not provide additional advantages and could adversely affect crop performance. The study indicates that proper selection and concentration of PGRs can contribute to improved cucumber productivity and quality under Bastar Plateau conditions.

Keywords: Cucumber, *Cucumis sativus*, plant growth regulators, GA_3, NAA, Ethrel, flowering, yield, fruit quality, Bastar Plateau.

Introduction

Cucumber (*Cucumis sativus* L.) is one of the economically important vegetable crops of the family Cucurbitaceae. It is an annual, herbaceous and predominantly monoecious vine cultivated for its immature fruits. Cucumber is widely consumed as a fresh vegetable because of its refreshing taste, high moisture content and low caloric value. The crop is also utilized in pickling and several processed products. Cucumber has a relatively short crop duration and possesses considerable potential for intensive vegetable production. Its productivity is influenced by cultivar, temperature, moisture availability, nutrient supply, pollination, plant architecture and hormonal regulation. Among these factors, plant growth regulators have attracted considerable attention because they can modify physiological and reproductive processes.

Plant growth regulators are organic compounds, other than nutrients, that influence plant growth and development when applied in small concentrations. Important PGRs used in cucumber include auxins such as NAA, gibberellins such as GA_3 and ethylene-releasing compounds such as ethephon/ethrel. These compounds may influence cell division, cell elongation, flowering, sex expression, fruit set and fruit development. A recent systematic review also emphasizes the importance of auxins, gibberellins and ethylene-related compounds in regulating vegetative growth, sex expression, flowering, yield and fruit quality in cucurbits.

Origin, Distribution and Production

Cucumber is believed to have originated in the Indian subcontinent, particularly the region south of the Himalayas. The Indian subcontinent is recognized as an important centre of origin and diversity for cucumber and related *Cucumis* species. A wide range of traditional cucumber types have evolved through natural selection, farmer selection and introgression with related wild forms. Cucumber is now cultivated throughout tropical, subtropical and temperate regions of the world. It is an important vegetable crop in Asia, Europe, Africa and the Americas. In India, cucumber is grown under both open-field and protected conditions. Major production occurs in several states including West Bengal, Madhya Pradesh, Maharashtra, Karnataka, Gujarat and other regions. The crop can be cultivated in different seasons depending upon agro-climatic conditions and production systems.

Materials and Methods

Study Scope

The present study focused on the assessment of different plant growth regulators (PGRs) on growth, flowering, yield and quality traits of cucumber (*Cucumis sativus* L.) cv. Krish. The study mainly covered the influence of plant growth regulators on vegetative growth, male and female flower production, fruit setting, yield and fruit quality. The study was conducted under the NSS agricultural programme at Titirgaon village, Jagdalpur, Bastar, Chhattisgarh. The study also included farmer awareness and demonstrations regarding the appropriate use of plant growth regulators and improved cucumber production practices.

Literature Collection

Relevant research articles, research papers and reliable scientific publications related to the use of plant growth regulators in cucumber (*Cucumis sativus* L.) were consulted to support the present study. The available literature was used to interpret the influence of different PGRs on vegetative growth, flowering behaviour, sex expression, fruit setting, yield and quality characteristics of cucumber.

Literature Search

The literature was searched using keywords such as cucumber, *Cucumis sativus* L., plant growth regulators, PGRs, gibberellic acid, GA_3, NAA, Ethrel, flowering, sex expression, female flowers, fruit setting, growth, yield, fruit quality and cucumber production. Greater emphasis was given to literature describing the influence of plant growth regulators on growth, flowering, yield and quality of cucumber.

Literature Selection

Published studies related to the application of plant growth regulators in cucumber and other cucurbitaceous vegetable crops were selected. Greater emphasis was given to studies reporting the effects of PGRs on plant growth, flowering, male and female flower production, fruit setting, yield and fruit quality. Literature related to the role of plant hormones in regulating sex expression and flowering behaviour in cucumber was also considered. Your thesis notes that PGRs can influence sex expression and flowering and can increase the proportion of female flowers in cucumber.

Parameters Reviewed

The following major parameters were considered in the study:

- Plant growth and growth attributes
- Flowering and sex expression

- Yield and yield attributes
- Fruit quality
- Total soluble solids (TSS)

Data Analysis

The experimental observations related to plant growth, flowering, yield and fruit quality were compiled, compared and interpreted with the support of available scientific literature.

Statistical Analysis

The experimental data were analysed statistically. SEm, CD at 5% significance level and CV were calculated to assess differences among treatments.

Result and Discussion

Socio-economic Profile of the Respondents

The socio-economic characteristics of the respondents are presented in Table 1. A total of 50 respondents participated in the NSS-based agricultural awareness and demonstration activities. Among them, 26 were male (52%) and 24 were female (48%). Regarding age, 25 respondents (50%) belonged to the young age group, followed by 17 respondents (34%) in the middle-age group and 8 respondents (16%) in the old-age group. The participation of respondents from different age and gender groups indicates broad community involvement in the agricultural awareness activities.

Table 1. Socio-economic profile of respondents (n = 50)

Particulars	Frequency	Percentage (%
Gender		
Male	26	52.00
Female	24	48.00
Age		
Young (up to 35 years)	25	50.00
Middle (36–55 years)	17	34.00
Old (>56 years)	8	16.00

Participation of Respondents in Agricultural Activities

The involvement of respondents in different agricultural awareness and demonstration activities is presented in Table 2. The activities mainly focused on plant growth regulators, their proper application in cucumber, improved flowering and fruit setting, and recommended cucumber production practices.

Table 2. Participation of respondents in different agricultural activities

Activity	No. of respondents
Awareness about plant growth regulators (PGRs)	8
Demonstration of PGR preparation and application	6
Demonstration of seed treatment and PGR application	7
Recommended cucumber cultivation practices	7
Demonstration of PGRs for improving flowering and fruit setting	5
Harvesting and post-harvest practices	6

Effect of Plant Growth Regulators on Cucumber Growth

The effect of different plant growth regulators on growth and flowering characteristics of cucumber (*Cucumis sativus* L.) cv. Krish is presented in Table 3. Significant differences were observed among the different treatments. The application of plant growth regulators influenced vegetative growth, flowering behaviour and overall crop performance. Among the treatments, GA_3 at the optimum concentration showed better performance in terms of vine length and number of leaves, followed by other PGR treatments.

Effect on Yield and Yield Attributes

The application of different plant growth regulators showed a considerable influence on yield and yield attributes of cucumber. The number of fruits, fruit development and overall yield varied among the different PGR treatments. GA_3 at the optimum concentration showed superior performance for fruit size and overall yield, whereas NAA treatments improved fruit setting and contributed to higher yield. The improvement in yield under PGR treatments may be associated with better vegetative growth, early flowering, increased female flower production, improved fruit setting and better fruit development. Ethrel promoted femaleness and increased the number of female flowers, which favoured fruit production. Thus, treatments capable of increasing productive female flowers and fruit setting showed better yield performance.

Effect on Fruit Quality

Fruit length, fruit weight, fruit diameter and total soluble solids (TSS) were influenced by the application of different plant growth regulators. The appropriate application of PGRs resulted in improvement in fruit size and other quality characteristics compared with the untreated control. Among the different treatments, GA_3 showed better performance in improving fruit size and overall fruit development, while NAA contributed to better fruit setting and yield. The improvement in fruit length, fruit diameter, average fruit weight and TSS under suitable PGR treatments indicates the beneficial effect of plant growth regulators on the marketable quality of cucumber fruits.

Effect on Flowering and Sex Expression

The application of different plant growth regulators considerably influenced flowering behaviour and sex expression in cucumber. Cucumber produces staminate and pistillate flowers, and the proportion of male and female flowers is affected by plant hormones as well as environmental conditions. Among the different PGRs, Ethrel promoted femaleness and increased the number of female flowers, there by favouring fruit production. NAA also contributed to improved fruit setting, while GA_3 showed a favourable influence on vegetative growth and flowering. The variation in male and female flower production among treatments indicates that plant growth regulators can be effectively used to manipulate flowering behaviour in cucumber.

Overall Findings

The results clearly showed that the application of different plant growth regulators was effective in influencing the growth, flowering, yield and quality characteristics of cucumber (*Cucumis sativus* L.) cv. Krish. The response varied depending on the type and concentration of the plant growth regulator used. Among the different PGRs, GA_3 at the optimum concentration was found to be particularly effective for improving vine length, number of leaves, early flowering, fruit size and overall yield. NAA improved fruit setting and contributed to higher yield, whereas Ethrel promoted femaleness and increased the number of female flowers, thereby improving fruit production. Therefore, the appropriate selection and concentration of plant growth regulators can play an important role in improving cucumber growth, yield and fruit quality. The findings further indicate that excessive concentrations of PGRs should be avoided because they may adversely affect plant growth and productivity. Overall, the use of suitable PGRs can be considered an effective approach for improving cucumber production under the conditions of the Bastar Plateau region.

Conclusion

The present study concluded that the application of different plant growth regulators significantly influenced the growth, flowering, sex expression, fruit setting, yield and quality of cucumber (*Cucumis sativus* L.) cv. Krish. Among the PGRs evaluated, GA_3 showed better performance for vegetative growth, flowering, fruit development and yield, NAA was beneficial for fruit setting and yield, while Ethrel promoted femaleness and increased female flower production. Appropriate PGR application also improved important fruit quality attributes such as fruit length, fruit diameter, average fruit weight and TSS. The results indicate that the response of cucumber depends on the type and concentration of PGR, and

therefore judicious application of suitable PGRs is essential for obtaining better crop performance. The NSS agricultural demonstrations further helped in creating awareness among farmers regarding scientific cucumber cultivation and the appropriate use of plant growth regulators. Thus, suitable plant growth regulator application can be considered an effective approach for improving cucumber productivity and fruit quality under Bastar Plateau condition. (Geeta *et a*l., 2010; Choi *et al*., 2015)

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