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Effect of Plant Growth Regulators on Growth and Flower Yield of Calendula (*Calendula officinalis* L.) cv. Calypso

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ABSTRACT

The present experiment was conducted to determine "Effect of Plant Growth Regulators on Growth and Flower Yield of Calendula (Calendula officinalis L.) cv.Calypso" under Allahabad agro-climatic conditions in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Science, Allahabad, (U.P.) during the year 2017-2017. The laboratory experiment was conducted in Completely Randomized Design with three replications and used different plant growth regulators [(GA3 @ 100 ppm, @ 200 ppm, @ 300 ppm), (NAA@ 50 ppm, @ 100 ppm, @ 150 ppm, @ 200 ppm) and (cycocel@250ppm, @500 ppm, @750 ppm, @1000 ppm)], with 12 different treatments. The result reveals that T3-GA3 @ 300 ppm was effective in improving pre and post harvest parameters of calendula. Treatments influenced significantly plant height (cm), Plant spread (cm), Number of primary branches per plant, Number of leaves. The data revealed that significantly influenced the different post-harvest attributes in phalsa viz., Diameter of flower Weight of flowers, Flower yield per plant, No of flower per plant, Yield of flowers per plot and Shelf life of flower. Similarly, maximum T3-GA3 @ 300 ppm and minimum was recorded with T0-control.

Key words: *Calendula, Plant Growth Regulators (GA3, NAA and cycocel)*

INTRODUCTION

Flowers are also the symbol of beauty, love, purity and passion. They form the soul of a garden and convey the message of nature to the man. Floriculture is of great antiquity. Eloquent references to the aesthetic value of flower are available in the ancient literature and scripture. The important of flowers has been realized throughout the world and today flower cultivation has developed into an intensive form of agriculture. In India, floriculture has been associated with culture and heritage since very ancient time and has a long tradition of growing of flowers due to their diversity in beauty, form, texture, colour and fragrance. These quality attributes of flowers have always touched the heart of human beings.

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Uses of flowers have been practiced in our country for many centuries (Rig-Veda, 3000-2000 B.C. and Ramayana, 1200-1000 B.C) but commercial cultivation of flowers and development of floriculture as an industry is of recent origin. Our country is bestowed with diverse agro-climatic conditions, ranging from temperate to humid tropics and from sea level to snowline, which provide opportunities for production of all major flowers throughout the year. The estimated area under flower crops growing in the country is about 161 thousand hectare with 870 M tones production of loose flowers and 4342 million numbers of cut flowers.

Calendula (*Calendula officinalis L.*) is one of the most commonly cultivated seasonal flowers. It is also known as English marigold or pot marigold. The word calendula has been derived from Latin word kaendge, meaning first day of the month. It is a free blooming annual with beautiful crowns, grown for garden decoration and cut flower purpose. The flower is found in diverse colors and used in making bouquets, garland and vase arrangements. It has a long flowering period bearing large yellow or orange single or double flowers with many petals. It is around 60 cm tall with branches leafy stems

Application of GA3 induces the majority of the long day and cold requiring plants to form flowers; it also induces flower formation in certain long-short-day plants when in substituted for the long day requirement. Gibberellins usually enhances flowering in short-day plant growing under inductive condition .The flower formation of long day or long short day plant can be controlled by regulating the endogenous level of gibberellins-like substances though the use of such growth retardant.

Use of naphthalene acetic acid in calendula industry successfully induced more concentrated flowering thereby, facilitating, harvesting. Initially it was thought that this success was due to the role of natural auxins in flowering but now it is known that the NAA had effect through the stimulation of ethylene production.

Cycocel is very diverse group of compound and therefore have different biological effects on plants. they generally retarded stem elongation by preventing cell division in the sub apical meristem usually without similarly affecting the apical meristem.

These substances modify plant character like height, number and size of leaves and flowers, branching habits, internodes lenth, fresh and dry weight and root growth etc.by influencing the physiological process within the plant ,which ultimately affects the yield and quality of flowers.

MATERIAL AND METHODS

The present study entitled "Effect of Plant Growth Regulators On Growth and Flower Yield Of Calendula (*Calendula officinalis* L.) cv.Calypso" comprise of a field experiment laid out at the Horticulture Research Farm, SHUATS. Allahabad during ravi season 2017-18. The detail of the experiment site, soil, climate is described in this chapter together with the experimental design, plan layout, culture practice and techniques employed for growth studies.

LOCATION

The experiment will be conducted at the Horticulture Research Farm of SHUATS, Allahabad, U.P.

EXPERIMENTAL SITE

The experiment will be conducted at the Horticulture Research Farm of SHUATS, Allahabad, U.P., which is located at $25^{0}27^{1}$N latitutde, $81^{0}51^{1}$E longitude and 98m above the mean sea level.

Details of Treatment

Plant growth regulator

GA3 (@ 100 ppm, @ 200 ppm, @ 300 ppm)

NAA (@ 50 ppm, @ 100 ppm, @ 150 ppm, @ 200 ppm) Cycocel (@250ppm, @500 ppm, @750 ppm, @1000 ppm)

RESULTS AND DISCUSSION

From the (Table 1 & fig 1) it is observed that, the mean of growth characters. A critical analysis of appendix ANOVA table shows that floral characters was significantly affected by

different plant growth regulator over control. Maximum plant height (38.86) was recorded in treatment T3-GA3 @ 300 ppm, followed by T2-GA3 @ 200 ppm. Minimum plant height (24.66) was recorded in treatment T0-Control. While maximum plant spread (46.16) was recorded in treatment T3-GA3 @ 300 ppm, followed by T2- GA3 @ 200 ppm (39.86). Maximum number of branches (34.66) was recorded in treatment T3-GA3 @ 300 ppm. Maximum Number of leaves at successive stage 90 days (240.96) was recorded in treatments T3-GA3 @ 300 ppm, followed by T2-GA3 @ 200 ppm (225.36) and minimum T0-Control was (205.06) respectively.

Table 1: Effect of plant growth regulators on growth parameters of Calendula (*Calendula officinalis* L.) cv. Calypso

Treatments	Plant height (cm)	Plant spread (cm)	No. of Branches / plant	No. of Leaves Per Plant
T0	24.66	28.86	20.96	205.06
T1	32.06	34.86	27.16	225.16
T2	34.66	39.86	32.56	225.36
T3	38.86	46.16	34.66	240.96
T4	27.66	32.96	24.46	217.66
T5	28.66	33.96	28.36	218.26
T6	30.26	35.86	30.46	221.36
T7	32.56	36.86	30.46	227.16
T8	27.46	30.06	28.66	211.86
T9	28.86	32.96	25.66	214.56
T10	23.76	27.86	23.76	209.66
T11	26.86	31.96	26.56	210.16
Result	S	S	S	S
S. Ed. (±)	1.059	1.414	1.414	1.229
C.D. at 5%	2.186	2.919	2.919	2.536

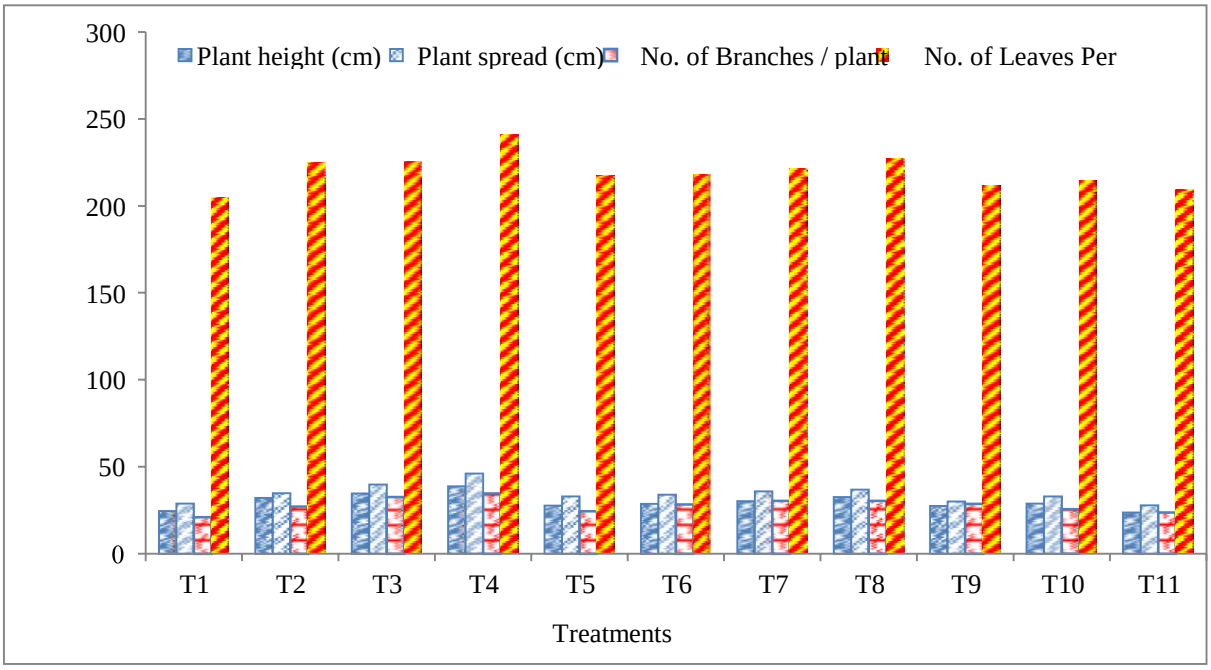

Fig. 1: Effect of plant growth regulators on vegetative parameters of Calendula (*Calendula officinalis* L.) cv. Calypso

From the (Table 2 & fig 2) it is observed that, the mean floral and yield parameters. A critical analysis of appendix ANOVA table shows that floral and yield parameters was significantly affected by different plant growth regulator over control. The maximum diameter of flower (7.06) was recorded with the treatment T3-GA3 @ 300 ppm respectively. In incase of weight of flowers maximum (4.36) was recorded in treatments T4-NAA@ 50 ppm, followed by T5-NAA@ 100 ppm (4.16). The maximum Total number of flowers per plant (42.43) was recorded with the treatment T3-GA3 @ 300 ppm. Maximum Flower yield per plant (211.76) was recorded in treatment T3-GA3 @ 300 ppm, followed by T2-GA3 @ 200 ppm (177.76). The Number of flower per plant maximum was (10.26) recorded with T3-GA3 @ 300 ppm and minimum was T0 (Control) (50.53) and Yield of flowers per plot (1056.46) was significantly increased in treatment T3-GA3 @ 300 ppm, followed by T2-GA3 @ 200 ppm (886.56). The maximum Flower yield per hectare (12.16) was recorded with the treatment T3-GA3 @ 300 ppm, The maximum Shelf life of flower (11.19) was recorded with the treatment T11-cycocel@1000 ppm respectively.

Table 2: Effect of plant growth regulators on floral and yield parameters of Calendula (*Calendula officinalis* L.) cv. Calypso

Treatments	Diameter of flower (cm)	Weight of Flower (gms)	No of flowers per plant	Yield of flower per plant	Yield of flower per plot(g)	Yield of flower per hectare (t)	Vase life (days) of cut flowers
T0	4.36	3.16	20.53	84.66	421.26	5.06	8.90
T1	6.76	3.86	28.73	123.96	610.56	7.26	10.78
T2	6.46	3.66	39.73	177.76	886.56	10.26	10.89
T3	7.06	3.76	42.43	211.76	1056.46	12.16	11.00
T4	5.56	4.36	25.73	106.56	530.86	6.36	11.17
T5	5.56	4.16	35.63	191.06	952.46	11.06	10.13
T6	5.66	4.06	33.63	164.66	821.26	9.56	9.94
T7	5.86	4.96	30.93	136.46	680.86	8.06	9.81
T8	4.36	3.96	29.53	130.96	652.96	7.66	9.69
T9	4.66	3.46	24.03	98.76	491.16	5.96	10.29
T10	4.26	4.46	21.73	89.86	447.26	5.46	11.00
T11	4.76	3.36	24.73	101.76	507.26	6.06	11.19
Result	S	S	S	S	S	S	S
S. Ed. (±)	0.556	0.434	2.675	1.192	4.052	0.356	0.660
C.D. at 5%	1.148	0.895	5.522	2.460	0.735	8.364	1.362

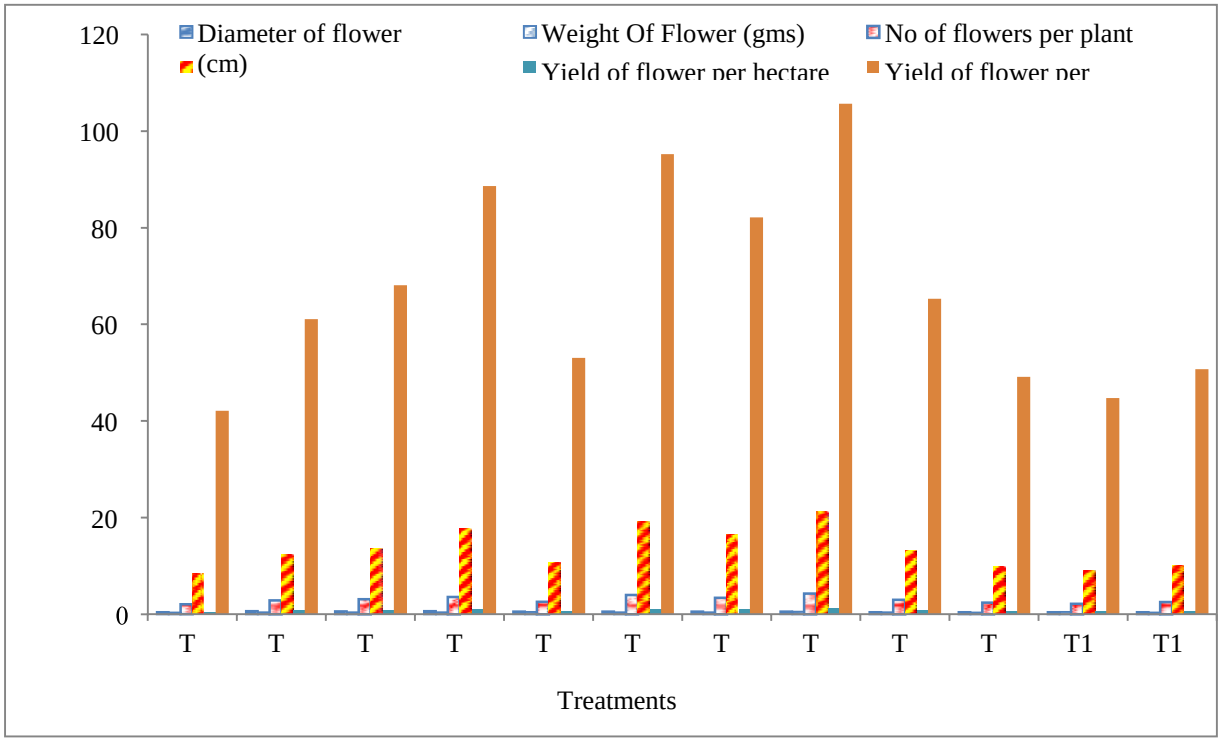

Fig. 2 2 Effect of plant growth regulators on floral and yield parameters of Calendula (*Calendula officinalis* L.) cv. Calypso

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