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Studies on the Effect of Pinching and Cycocel on Growth and Flowering of Gaillardia (*Gaillardia pulchella.* L)

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ABSTRACT

A field experiment was carried out in college of agriculture, Nagpur, Dr. PDKV Akola, on the effect of pinching and cycocel on growth and flowering of gaillardia (*Gaillardia pulchella.* L) during the year 2012 - 2013 (September-March).The experiment was laid out in Factorial Randomized Block Design with four pinching levels (No pinching, 30 DAT, 45 DAT and 30 and 45 DAT) and four levels of cycocel (water spray, 500 ppm, 1000 ppm and 1500 ppm) with sixteen treatment combinations replicated thrice. The vegetative growth parameters in terms of plant height was recorded minimum under the treatment double pinching at 30 and 45 days after transplanting as well as cycocel 1500 ppm. However, number of primary branches per plant and spread of plant were found significantly maximum under single pinching at 30 days after transplanting as well as cycocel 1000 ppm. The flowering parameters in terms of days to first flower bud initiation, opening of flower from bud initiation, days to 50 % flowering and days to first harvesting from transplanting were found earlier in no pinching as well as water spray (C_0). Flowering was delayed by 5 to 10 days in pinching treatment as well as application of cycocel. Whereas, significantly maximum duration of flowering was found in double pinching at 30 as well as 45 days after transplanting as well as cycocel 1500 ppm. The interaction effect of pinching and cycocel for all growth and flowering parameters was found non significant.

Key words *Gaillardia, Pinching, Cycocel, Growth and Flowering*

The flowers are one of the nature's most beautiful boons to mankind that bring joy and happiness to one and all. Flowers are real symbols of joy, peace, passion, beauty and love. Flowers are given as gifts brighten people's spirits and bring a big smile to their face and make their eyes light up. Flowers can express and convey many feelings, especially compassion and at times a token of forgiveness and motivate us in positive way. Flowers have always been a part of the many special events in a person's life. It's pretty colors and aromatic fragrances add a special touch to any occasion.

Indian Floriculture industry more or less was established itself in the national and international market after initial struggle. The quantum jump is a witness in production and trade of horticultural produce due to sound research system which focused attention of the government coupled with innovative entrepreneurs. The traditional flowers have been given a mainly in the country, but, the production of flowers under greenhouse with international quality standard is only an ancient development. In today's life flower is found at all occasion i.e. birth, death, marriage, festival, inauguration programmes and also used for the purpose of garlands, veni, bouquets etc. Due to that demand for loose flowers and cut flowers in domestic market, export has been increasing tremendously. The floriculture trade is one of the most rapidly expanding and dynamic global enterprise in today's world. It has far a greater annual growth potential of 25 to 30 percent, which is 25 to 30 times more than that of any other agriculture produce.

Among the wide range of commercial flower crops, Gaillardia occupies a selective position because of its prettiness, elegance, diverse forms and varied attractive colour ranges. It has gained considerable importance in flower trade because of their short life, less input requirement and can obtain early returns. Its flowers are used as loose flowers for garlands, decoration and also used for bedding and potting purposes. It has got very beautiful effect when it is grown in large masses in beds and are valuable for filling gaps in mixed herbacious borders. Their long life tends them beautifully to different floral arrangement for interior decoration.

Gaillardia (*Gaillardia pulchella*) belongs to Asteraceae family, native to North and South America. It was named after Mr. Gaillard de Charentonneau, an 18th century French botanist. Gaillardia is commonly known as "blanket flower" or "fire wheel". The common name refers to the inflorescence's resemblance to brightly patterned blankets made by native American. There are more than two dozen known species of Gaillardia grown to tall, with bright daisy like single color and bicolor blooms in shades from buff to red brown.

Gaillardia is a drought tolerant and perennial herbaceous plant. These plants form wiry, branched stems of hairy and upright , growing to 60 cm tall with lanceolate to linear basal leaves are alternate, mostly basal ,4-8 cm long, with edges smooth to coarsely toothed or lobed. The pinwheel, daisy like inflorescences are 4-6 cm diameter, vividely colored with red, orange and yellow. The central disc florets of the flower head tend to be more red-violet, with the outer ray florets being yellow.

All gaillardia species have an erect habit and are conspicuous for their hairy foliage. In Maharashtra it is grown in Pune, Nashik and Solapur districts on large scale. It is also grown in Kolhapur, Thane and districts of Vidharbha regions. It grows on light to medium black soil, though sandy and well-drained are best. It has a high drought tolerance and does best with a dry colored flowers can be seen carpenting fields and the sides of highways for miles in the summer to late fall. In the garden, the flowers can be removed to promote further blooming.

In Gaillardia, an inflorescence of florets is born on a

head. It means terminal types of flowering were observed in it. After transplanting the growth of plant is mostly upward with very little branching. To arrest such tall growth and to promote axillary branching pinching is used. Pinching refers to the removal of the growing tips of the plants to induce the growth of vegetative laterals, manipulate the plant physiology, plant architect which may eventually lead to enhance number of flower bearing branches, leaves, flower and alter source and sink relationship leading to higher yield. Cycocel is a important growth retardant useful in most of the plant. Growth retardant is also useful to arrest vertical growth as it is act as antagonistically to auxin and thus counteracts apical dominance and hence it may be also useful in increasing number of branches per plant.

In Vidarbha region of Maharashtra state, Gaillardia is cultivated throughout the year but the productivity is low and there are no proper recommendations based on latest technology to increase the yield potential. Farmers are unable to regulate the supply of flowers to market so as to assure better price for their produce. Looking to these facts, the present investigation, "Effect of pinching and cycocel on growth, yield and quality of Gaillardia" was undertaken at Horticulture Section, College of Agriculture, Nagpur.

MATERIAL AND METHODS

The field experiment was carried out during the year 2012 - 2013 at the department of Horticulture, College of Agriculture, Nagpur. Nagpur is situated at 20^0 10' North latitude and 79^0 19' East latitude at the elevation of 321.26 meter above mean sea level (MSL) and lies under subtropical zone. Nagpur is characterized by hot, dry summer and fairly cool winter. The area shows wide diurnal fluctuation in temperature. Meteorological data in respect of rainfall, humidity, maximum and minimum temperature was recorded at Agro Meteorology laboratory, Agronomy section, College of Agriculture, Nagpur.

The experiment was laid out in Factorial Randomized Block Design with four pinching levels (No pinching, 30 DAT, 45 DAT and 30 and 45 DAT) and four levels of cycocel (water spray, 500 ppm, 1000 ppm and 1500 ppm) with sixteen treatment combinations replicated thrice.

Seeds of Gaillardia var. *Local* was collected from Plot No.16, Ravinagar, Horticulture Section, College of Agriculture, Nagpur.The seeds were sown on raised bed on 25th September 2012. The seeds were treated with thirum @ of 3 g per kg of seed weight and sown on raised beds. A regular watering, weeding and plant protection measures were carried out as and when required. The land was prepared. The uniform and healthy seedlings were selected for transplanting and one day prior to transplanting irrigation was given to the plot. The seedlings were transplanted in field on 27th October, 2012 by keeping 45 cm distance between plant to plant and 60 cm between rows. Immediately after planting watering was given.

A standard dose of NPK at the rate of 100 kg N, 50 kg P and 50 kg K per hectare was applied through urea, Single super phosphate and murate of potash. The basal dose of 50 kg N and full dose of P and K was applied at the time of transplanting, remaining 50 kg of N was applied as top dressing after 30 days of transplanting.

Five plants were selected randomly from each plot for recording data on various growth and flowering attributes. The data on growth, flowering, flower quality and flower yield were recorded during the course of investigation and subjected to statistical analysis as per Panse and Sukhatme (1967). The appropriate standard error of mean S.E. (m) and the critical difference (C.D.) were calculated at 5% level of probability.

RESULTS AND DISCUSSION

Vegetative Parameters

Effect of Pinching

The results presented in Table 1 indicated that, The vegetative growth parameters in terms of plant height was recorded minimum under the treatment double pinching at 30 and 45 days after transplanting (60.68 cm), which was at par with pinching at 45 days after transplanting (62.03 cm). Whereas, significantly maximum plant height was recorded in no pinching (68.36 cm). In pinching, removal of the apical growth or top most of the shoots from plant which arrested the vertical growth of plant therefore, pinching reduced plant height. Obvious that maximum plant height was produced by control treatment (no pinching) and reduction in plant height was found due to pinching treatments. These results are in close agreement with the findings of Chavan *et al.* (2004) in carnation.

However, number of primary branches per plant were found significantly maximum under single pinching at 30 days after transplanting (30.45) followed by single pinching at 45 days after transplanting (27.11). However, significantly minimum number of primary branches per plant was recorded in no pinching (20.99). In pinching, the apical portion of main stem was pinched and therefore, more side branches were formed below pinched portion. This is due to diversion of carbohydrates or food material towards the auxiliary vegetative buds below pinched portion. These results are in close agreement with the finding of (Pawar 2001 and Rakesh *et al.* 2003) in chrysanthemum and Sehrawat *et al.* (2003) in marigold.

Whereas, spread of plant was maximum under single pinching at 30 days after transplanting (61.21cm) which was at par with pinching at 45 days after transplanting (58.32 cm) and pinching at 30 and 45 days after transplanting (57.92 cm). Whereas, significantly minimum spread of the plant was recorded in control treatment i.e. no pinching (53.22 cm). Increase in the spread of plant might be due to pinching and removal of the apical growth or top most shoots from plant which arrested the vertical growth and auxiliary buds below pinched portion may gives rise to primary branches of plant. Therefore, there was enhance spread. As the number of pinching increased the spread of plant was reduced. Similar results were reported by Pawar (2001) in chrysanthemum, Benival *et al.* (2003) revealed that, plant spread was highest at early pinching i.e. pinching at 25 Days after transplanting. Shinde *et al.* (2010) in carnation.

Effect of Cycocel

Significantly minimum plant height was noticed in cycocel 1500 ppm (61.50 cm) followed by the treatments cycocel 1000 ppm (62.62 cm) and cycocel 500 ppm (65.10

cm). However, significantly maximum plant height was recorded in control treatment (67.19 cm). From above results it is indicated that, plant height was reduced as concentration of cycocel was increased. This might be due to the fact that cycocel act as a growth retarding substance. In cycocel treated plant, it might have reacted with gibberelic acid or IAA oxidase to lower down the level of diffusible auxin thereby suppressing the vegetative growth. The results are in close agreement with the findings of Naik *et al*. (2004) in African marigold**.**

With respect to number of primary branches per plant maximum results were obtained in cycocel 1000 ppm (27.76) which was followed by cycocel 1500 ppm (26.46) and cycocel 500 ppm (25.77). C_1 and C_3 were statistically at par with each other. However, significantly minimum number of primary branches per plant were recorded in control treatment (23.42). This might be due to the fact that, cycocel act as a growth retarding substance. Cycocel arrest the vertical growth as it is act as antagonistically to auxin and thus counteracts apical dominance resulted into increased number of primary branches. In cycocel treated plant, suppression of apical dominance may be attributed to increase the number of primary branches per plant. The results are in close agreement with the findings of Pawar *et al.* (2005) in gaillardia.

Significantly maximum spread of the plant was noticed in cycocel 1000 ppm (62.40cm) and it was followed by cycocel 1500 ppm (56.44 cm) and cycocel 500 ppm (55.90 cm). Whereas, significantly minimum spread of the plant was recorded in control treatment (54.43 cm). This might be due to that cycocel decreases the auxin content and act antagonistically to auxin and thus counteracts apical dominance. Cycocel increases the number of leaves and primary branches per plant.Similar results were found by in Saiyad *et al*. (2010). in gaillardia.

The interaction effect due to the pinching and cycocel on all the growth parameters was found non significant.

Flowering Parameters

Significantly early flower bud initiation was noticed in control treatment i.e. no pinching (59.94 days) followed by single pinching at 30 days after transplanting (66.68 days) and pinching at 45 days after transplanting (68.75 days). Whereas, significantly late flower bud initiation was recorded in treatment double pinching at 30 and 45 days after transplanting (72.77 days). The delay in flowering by pinching was due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flowers than non pinched plants.These results are in close agreement with the findings of Khandelwal *et al*. (2003) and Sehrawat *et al.* (2003) in marigold.

Minimum days were required to opening of flower from bud initiation in control treatment i.e. no pinching (6.56 days) followed by pinching at 30 days after transplanting (8.19 days) and pinching at 45 days after transplanting (10.07 days). Whereas, significantly maximum days were required for opening of flower from bud initiation in pinching at 30 and 45 days after transplanting (11.80 days). The delayed in flowering by pinching due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flower than non pinched plant. These results are in close agreement with findings of Pawar (2001) in chrysanthemum, Bhat and Shephered (2007) who reported that single pinching at 35 days after transplanting gave earliest number of days to first flowering (47.85) in African marigold.

Significantly minimum days were required for 50% flowering in control treatment i.e. no pinching (75.16 days) which was followed by pinching at 30 days after transplanting (87.12 days) Whereas, significantly maximum days were required for 50% flowering in pinching at 30 and 45 days after transplanting (98.61 days) which was at par with pinching at 45 days after transplanting (95.15 days).The delayed in flowering by pinching due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flower than non pinched plant. These results are in close agreement with the finding of Pawar (2001) in chrysanthemum, and Sehrawat *et al.* (2003) in marigold.

Minimum days were required to first harvesting in control treatment i.e. no pinching (98.10 days) which was at par with single pinching at 30 days after transplanting (104.97 days) and pinching at 45 days after transplanting (106.97 days). P_1, P_2 and P_3 were at par with each other.The delayed in flowering by pinching might due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flowers than non pinched plants. These results are in close agreement with the findings of Pawar (2001) in chrysanthemum and Sehrawat *et al.* (2003) in marigold.

Effect of Cycocel

Significantly mean minimum days to first flower bud initiation were noticed in control treatment (63.88 days) which was at par with the treatments cycocel 500 ppm (66.50 days) and cycocel 1000 ppm (68.59 days). Whereas, significantly mean maximum days to first flower bud initiation were observed in cycocel 1500 ppm (69.59 days). Cycocel being a growth retardant have inhibited the endogenous synthesis of gibberellins responsible for flower bud initiation and hence delayed flowering. Similar results were found by Khandelwal *et al*. (2003) in marigold.

With respect to days to opening of flower from bud initiations minimum results were obtained in control treatment (7.84 days), It was followed by the treatments cycocel 500 ppm (8.84 days) and cycocel 1000 ppm (9.36 days). Whereas, significantly maximum days required to opening of flower from bud initiation were observed in cycocel 1500 ppm (10.34 days) this might be due to their growth retarding action might have inhibited the endogenous synthesis of gibberellins resulted in delayed opening of flower bud. Similar results were found by Parmar and Singh (1983) who observed that cycocel delayed initiation of first flower bud in marigold.

Significantly minimum days were required to 50 % flowering in control treatment (83.48 days). It was followed by the treatments cycocel 500 ppm (88.06 days) and cycocel 1000 ppm (91.15 days). Whereas, significantly maximum days

Table. Effect of pinching and cycocel on growth and flowering parameters of *Gaillardia pulchella*. L

Treatments	Height of Plant (cm)	Number of primary branches per plant	Spread of plant at 50% flowering	Days to first flower bud initiation from transplanting	Days to opening of flower from bud emergence	Days to 50% flowering from transplanting	Days to first harvesting from transplanting	Flowering span (Days)
Pinching								
No pinching (P_0)	68.36	20.99	53.22	59.94	6.56	75.16	98.10	60.51
Pinching at 30 DAT (P_1)	65.35	30.45	61.21	66.68	8.19	87.12	104.79	68.91
Pinching at 45 DAT (P_2)	62.03	27.11	58.32	68.75	10.07	95.15	106.97	73.02
Pinching at 30 and 45 DAT (P_3)	60.68	24.85	57.92	72.77	11.80	98.61	113.48	75.10
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(m)	0.46	0.30	1.71	1.06	0.21	1.29	3.36	0.67
CD at 5%	1.35	0.88	3.42	3.08	0.62	3.72	9.69	1.93
Cycocel levels								
Control (C_0)	67.19	23.42	54.43	63.68	7.84	83.48	98.58	65.47
CCC 500 ppm (C_1)	65.10	25.11	55.90	66.50	8.84	88.06	104.65	67.61
CCC 1000 ppm (C_2)	62.62	27.76	62.40	68.59	9.36	91.15	107.85	70.96
CCC 1500 ppm (C_3)	61.50	26.46	56.44	69.59	10.34	93.35	112.26	73.50
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(m)	0.46	0.30	1.71	1.06	0.21	1.29	3.36	0.67
CD at 5%	1.35	0.88	3.42	3.08	0.62	3.72	9.69	1.93
Interaction effect (PxC)								
'F' test	N.S	N.S.	N.S.	N.S	N.S	N.S	N.S	N.S
SE(m)	0.93	0.61	4.93	2.13	0.43	2.58	6.72	1.34
CD at 5%	-	--	-	-	-	-	-	-

were required to 50 % flowering in cycocel 1500 ppm (93.35 days).which was at par with cycocel 1000 ppm castration. This might be due to growth retardation rather than direct effect on flowering stimulus. These results are in close agreement with the finding of Dutta *et al.* (1993) in chrysanthemum.

Significantly minimum days were required to first harvesting in control treatment (98.58 days) which was at par with cycocel 500 ppm (104.65 days) and cycocel 1000 ppm (106.97 days).C1,C2 and C3 were at par with each other. Significantly maximum days were required to first harvesting in cycocel 1500 ppm (113.48 days). This might be due to growth retardation rather than direct effect on flowering stimulus. These results are in close agreement with the finding of Dutta *et al.* (1993) in chrysanthemum.

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