TO STUDY INDUCTION OF FLOWERING IN GLADIOLUS CORMELS BYCHEMICALS

Abstract

An experiment was conducted at Shobhit university using the cormels of gladiolus cvs. Shobhit Snow White and Shobhit Red in an attempt to induce flowering in the plants raised from cormels during 2021 and 2022. Two foliar sprays of chemicals viz, gibberellic acid (25 ppm), benzyl adenine (50 ppm), salicylic acid (100 ppm), potassium dihydrogen phosphate (1%), potassium nitrate (1%) and calcium nitrate (1%) were given twice at monthly interval. Salicylic acid and calcium nitrate recorded less number of days for flowering and highest flowering percentage. Spike length, number of florets per spike, size of second floret, number of corms and cormels per plot were maximum with salicylic acid. Gibberellic acid treatment significantly delayed flowering and also resulted in minimum flowering percentage. Flowering percentage was significantly high in cv. Phule Ganesh over cv. Phule Prerna. Cultivar Phule Ganesh was also found superior in respect of number of corms produced per plot but cv. Phule Prerna recorded maximum number of big and small cormels per plot.

Keywords: Corm, Cormel, Benzyl Adenine, , Gibberellic Acid, Gladiolus, Potassium Dihydrogen, Salicylic Acid, Potassium Dihydrogen Ortho Phosphate.

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I. INTRODUCTION

Gladiolus is one of the commercially important flower crops belonging to the family Iridaceae. Based on the size, gladiolus corms can be grouped into two categories: flowering stock (2.5 to 5.0 cm or more) and planting stock (1.0 to 2.5 cm). Flowering stock (large and medium sized corms) is used for production of cut spikes, whereas planting stock (small sized corms) production of flower grade corms for the subsequent planting season. Cormels are incapable of producing spikes and are used for the production of flower grade corms only. Thus, it will be most economical to the flower growers, if cormels can be induced to produce spikes along with flower grade corms. But there is no documented information available on flower induction, hence attempts were made to induce flowering in the plants raised from cormels.

II. MATERIALS AND METHODS

The present investigation was carried out at the College Farm, College of Agriculture, Shobhit University Meerut during 2020 and 2021. The cormels (16 each) of two cultivars namely, Shobhit Snow white and Shobhit Red procured from Research Station floriculture unit Jammu weighting 1.10 g and 1.00 g and measuring 1.1+ 0.2 cm and 1.0+ 0.2 cm, respectively, were planted at a spacing of 30 x 20 cm and depth of 2 cm, during October 2021 Seven treatments viz., gibberellic acid (GA3) at 25 ppm; benzyl adenine (BA) at 50 ppm; salicylic acid (SA) at 100 ppm; calcium nitrate (Ca (NO3)2) at 15%; potassium nitrate. (KNO3) at 1%; potassium dihydrogen ortho. Phosphate (KH2PO4) at 1% and control (water spray) were imposed as foliar spray twice at monthly interval, the first being given one month after planting. Corms and cormels were lifted in the month of April 2005. The data recorded on various observations were subjected to analysis of variance as applicable to split plot design.

III. RESULTS AND DISCUSSION

The plant height measured up to the tip of the flower spike was significantly high in the cv. Shobhit snow white (87.43) (Table 1) than in the cv. Shobhit Red (82.19). It was lowest in GA3 treatment as it could not produce significant flowering. All the treatments viz., SA, KNO3, Ca(NO3)2, BA and KH2PO4 significantly increased the plant height and this may be correlated with flower inducing ability of respective chemicals due to which the final plant height after spike emergence increased significantly. Cultivar shobhit snow white, however, was found to be significantly early in flowering (77.81 day) than cv. Shobhit Red (85.91 day). Salicylic acid, Ca(NO3)2 and KH2PO4, significantly reduced the number of days for flowering over GA3, Flowering percentage was significantly high in the cv. Shobhit Red (57.69) than in cv. Shobhit snow white (35.27). All the treatments except GA3, and KH2PO4significantly increased flowering percentage over control. Salicylic acid recorded highest flowering percentage (83.12) and minimum flowering percentage was recorded in GA, (13.86).

The interaction between the cultivars and treatments was found to be significant in respect of flowering percentage. Cultivar Shobhit Snow Red, BA, Ca(NO3)2 , KNO3, and control. In case of cv. Shobhit snow white, SA recorded maximum flowering percentage (75.00) which was significantly superior over other treatments. This was followed by Ca

(NO3)2 (47.62) which was at par with KH2PO4 (39.52), and BA (36.80). In cv. Phule Ganesh also, SA recorded maximum flowering percentage (91.25) but was at par with Ca (NO3)2 (82.50) and KNO, (78.27).

Cultivars Shobhit Snow white and shobhit Red did not show significant difference in respect of spike length and number of florets per spike (Table 2). Among the treatments, SA increased the spike length (61.50) and number of florets per spike (12.17) significantly. The two cultivars, however, differed significantly in respect of size of second floret. Cultivar Shobhit Red produced significantly big florets (10.62) cm) than Cultivar Shobhit Red (8.12 cm). Among the treatments, SA (10.25 cm) and BA (10.08 cm) significantly increased the size of second floret and were at par.

In gladiolus, SA was found to be highly effective in promoting early flowering as well as in increasing the flowering percentage. The mechanism by which SA induces flowering in plants is not known. One hypothesis suggests that SA induces flowering by acting as chelating agent (Oota, 1975), because the free 0-hydroxyl group confers metal chelating activity on benzoic acids. This view is supported by the fact that chelating agents can induce flowering in Lemnaceae (Seth et al., 1978) and that this induction resembled the flower inducing effects of SA (Pieterse and Muller, 1977).

Salicylic acid induced improvement in flowering performance of the cultivars in respect of days to flowering, spike length, number of florets per spike and size of second floret, may possibly be due to stimulation of alternate respiration by salicylic acid as it stimulates alternate oxidase (AOX) and in turn promotes alternate respiration (Chen and Klersig, 1991).

The cultivars Shobhit snow white and Shobhit Red have potential to produce 16- 18 and 14-16 florets per spike, respectively in the plants raised from corms. In this experiment, however, the maximum number of florets per spike does not exceed 13.33 in Cultivar Shobhit Snow white (SA treatment) and 11.33 in Cultivar Shobhit Red (BA treatment). KH2PO4, treatment was found to be the next best in respect of spike length, number of florets per spike and Ca(NO3)2 , in respect of earliness.

From the results, it can be concluded that Ca (NO3)2 and KNO3, are the next best treatments to salicylic acid for flower induction in the gladiolus plants raised from cormels. The nitrates either calcium or potassium were effective in induction of flowering in many plant species by sensitizing the buds to floral stimulus (Bueno and Valmayor, 1974). Further, calcium acts as secondary messenger in signaling of various physiological processes including flower induction. Calcium binds with calmodulin, activates it, such an activated calmodulin-Ca complex is held responsible for phytochrome mediated responses which includes flower induction (Krishnamoorthy, 1993).

Flower inducing ability of benzyl adenine was also reported by several workers under in vitro as well as in vivo conditions. Induction of flowering may be due to its ability to alter the assimilate distribution i.e. the theory of nutrient diversion (Sachs et al., 1979). In gladiolus also, Tawar et al. (2003) reported improvement in the flowering performance of different gladiolus cultivars when the corms are used as planting material.

Gibberellins strongly inhibited flowering in the plants raised from gladiolus cormels. Gibberellins, a component of the florigen as proposed by Chailakhyan (1936), however, promotes flowering in long day plants (Chen et al., 2003.

Table 1: Effect of Foliar Spray of Different Chemical Solutions on Plant Height, Days to Flowering and Percent Flowering in Gladiolus Cvs. Shobhit Snow White and Shobhit Red Raised from Cormels

Treatment	Plant Height (Cm)			Days to Flowering			Percent Flowering		
	SSW (C1)	SR (C2)	Mean	SSW (C1)	SR (C2)	Mean	SSW (C1)	SR (C2)	Mean
GA3 25ppm	71.56	77.78	74.62	82.47	90.47	86.47	10.95	15.78	12.47
BA 50 ppm	84.25	86.14	85.47	78.34	85.31	81.47	35.47	65.48	50.86
SA 100 ppm	00.65	88.21	94.32	69.42	81.95	75.39	74.35	90.47	82.47
Ca(NO3)2 1%	96.47	78.34	87.34	76.14	81.35	78.42	46.78	81.35	64.95
KH2PO4 1%	91.56	72.49	82.95	73.49	85.47	79.43	38.42	20.36	29.48
KNO3 1%	90.78	87.62	89.74	79.14	85.36	82.49	27.95	77.48	52.34
Control	71.53	78.41	74.32	78.98	85.47	81.63	7.96	46.85	26.47
Mean	86.43	81.96	-	76.89	84.75	-	34.95	56.76	-
			C.D. (P=0.05)			C.D. (P=0.05) C.D. (P=0.05)			
Cultivar (C)			3.44			0.58			17.48
Treatment (T)			5.04			6.06			18.56
Interaction (C x T)			N.S.			N.S.			18.42

S. S.W= Shobhit Snow White
S.R = Shobhit Red

Table 2: Effect of Foliar Spray of Different Chemical Solutions on Spike Length, Number of Florets Per Spike and Size of Second Floret in Gladiolus Cultivars Shobhit Snow White, Shobhit Red Raised from Cormels

Treatment	Spike Length (Cm)			Number of Florets/Spike			Diame of Second Floret		
	SSW (C1)	SR (C2)	Mean	SSW (C1)	SR (C2)	Mean	SSW (C1)	SR (C2)	Mean
GA3 25ppm	71.56	77.78	74.62	82.47	90.47	86.47	10.95	15.78	12.47
BA 50 ppm	84.25	86.14	85.47	78.34	85.31	81.47	35.47	65.48	50.86
SA 100 ppm	00.65	88.21	94.32	69.42	81.95	75.39	74.35	90.47	82.47
Ca(NO3)2 1%	96.47	78.34	87.34	76.14	81.35	78.42	46.78	81.35	64.95

KH_2PO_4 1%	91.56	72.49	82.95	73.49	85.47	79.43	38.42	20.36	29.48
KNO_3 1%	90.78	87.62	89.74	79.14	85.36	82.49	27.95	77.48	52.34
Control	71.53	78.41	74.32	78.98	85.47	81.63	7.96	46.85	26.47
Mean	86.43	81.96	-	76.89	84.75	-	34.95	56.76	-
		C.D. (P=0.05) C.D. (P=0.05)				C.D. (P=0.05)			
Cultivar (C)			3.44			0.58			17.48
Treatment (T)			5.04			6.06			18.56
Interaction (C x T)			N.S.			N.S.			18.42

Table 3: Effect of Foliar Spray of Different Chemical Solutions on Number of Corms, Cormels and Weight of Cormels Per Plot in Gladiolus Cultivars Shobhit Snow White and Shobhit Red Raised from Cormels

Treatment	Number of Corms/Plot			Number of Big Cormels (>1.0cm) /Plot			Number of Small Cormels (<1.0)/Plot			Weight of Cormels / Plot (G)		
	SSW (C_1)	SR (C_2)	Mean	SSW (C_1)	SR (C_2)	Mean	SSW (C_1)	SR (C_2)	Mean	SSW (C_1)	SR (C_2)	Mean
GA_3 25ppm	14.87	14.87	14.84	74.51	48.35	61.47	244.75	100.47	172.43	62.45	51.47	56.81
BA 50 ppm	12.47	14.95	13.94	73.95	45.97	59.86	289.47	95.14	192.85	76.35	56.43	66.21
SA 100 ppm	15.36	14.95	14.65	70.65	52.78	61.84	265.47	120.47	192.56	72.14	64.27	68.41
$Ca(NO_3)_2$ 1%	11.56	14.51	12.74	67.14	42.98	55.47	205.41	101.48	153.84	69.41	59.43	64.72
KH_2PO_4 1%	12.43	13.48	13.41	59.34	40.53	49.35	213.48	72.98	143.97	63.47	50.41	56.28
KNO_3 1%	12.86	15.47	13.94	64.81	42.75	53.74	143.95	135.71	139.42	72.16	52.35	63.19
Control	13.42	13.94	13.58	47.39	54.61	51.75	151.34	133.65	142.71	52.43	64.83	58.83
Mean	12.84	14.75	-	65.84	46.71	-	216.94	108.78	-	66.41	57.51	-
			C.D. (P=0.05)			C.D. (P=0.05) C.D. (P=0.05)			C.D. (P=0.05)			
Cultivar (C)			1.04			5.12			22.47			N.S.
Treatment (T)			1.47			6.48			54.98			N.S.
Interaction (C x T)			N.S.			6.48			54.98			N.S.

Modern cultivars of gladiolus do not show significant response to day length and are relatively photo-insensitive but prefers high light intensities. Gibberellins although used as a substitute for long day requirement of flower induction in many LDPs, could not induce flowering in plants raised from gladiolus cormels. This may be due to photo- insensitive nature of gladiolus or there might be requirement of some other factors, other than photoperiod, for the flowering of plants raised from cormels. Like in many fruit crops, gibberellins in gladiolus cormels could not induce flowering, instead promoted vegetative growth.

The two cultivars differed significantly in respect of number of corms and cormels produced per plot. Number of corms per plot was significantly high in cv. Phule Ganesh (15.48) (Table 3) than in Cultivar Shobhit Snow White (13.95). On the other hand, number of large and small sized cormels were significantly high in Cultivar Snow White (66.24 and 217.05) than in Cultivar Red Majesty (47.62 and 109.38).

Salicylic acid treatment recorded highest number of corms and cormels per plot but it did not differ significantly with GA3, in respect of number of corms; with GA3, BA or Ca(NO3)2 in respect of big cormels; and with BA, GA3, Ca(NO3)2, or KH2PO4, in respect of small cormels. Different treatments including SA, however did not show significant difference in the weight of total cormels. Number of big cormels was significantly increased by SA (62.33) and GA3, (62.17) over control (52.00). Number of small cormels was also highest in SA (193.8) but was at par with all remaining treatments including control.

The increase in corm and cormel production by SA treatment may be attributed to its ability to alter the hormonal balance in the corms and cormels resulting in increased ratio of promoters versus inhibitors. This alteration in hormonal balance maintains sink activity of corms and cormels. Alternatively it may have tuber/corm and cormel inducing activity as that of jasmonates and brassinosteroids, which is yet to be investigated.

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