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IMPORTANCE OF GROWTH REGULATORE AND COLD STORAGE TREATMENTS FOR BREAKING OF GLADIOLUS (*GLADIOLUS GRANDIFLORUS* L.)CORM DORMANCY

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ABSTRACT

The present experiment consisted of two genotypes *viz*., White Prosperity and Phule Neelrekha, four growth regulator treatments were GA_3-125 ppm, BA- 50 ppm, NAA-100 ppm and control while five cold storage treatments *viz*., 6 weeks storage, 12 weeks storage, 18 weeks storage, 24 weeks storage and control. In the growth regulator GA_3 125 ppm and in cold storage 24 week cold storage treatments was most effective in the breaking of dormancy and resulted in earlier sprouting. It concluded that Gladiolus corm dormancy will be break by the use of growth regulators and cold storage treatments

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.), a member of family Iridaceae. It is one of the important bulbous ornamental for cut flower. Gladiolus bulbs, in botanical terminology, are referred to as corms. A corm is a shortened and thickened section of the stem that appears at the base of the plant. Dormancy is exhibited in most of the bulbous crops with Gladiolus being most common amongst them. Though, the dormancy has physiological importance for Gladiolus as it allows it to overcome the unfavorable environmental conditions but still floriculturists are exploiting the potential of this crop to grow in off-season by breaking its dormancy.

The cold treatment of Gladiolus corms has long been known to accelerate the breaking of dormancy (Cohot, 1993). Corms and cormels are formed during the low temperatures of winter. Dormancy period of the freshly harvested Gladiolus corms ranges from 2 to 4 months under natural storage conditions depending on the cultivars and the temperature during storage (Gonzales, 1996). This dormancy period limits the number of cropping cycles per year from the same planting material. Balance between the growth promoters and inhibitors play an important role in the control of dormancy in Gladiolus. The inhibitors content in the corms of growing plants will be low, but it increases at harvesting time reaching a maximum. It gradually decreases after passage of storage period and then activities of GA_3 and auxin like substances are resumed, while ethylene production increases and growth inhibitors like ABA activity decreases (Tsukamoto, 1959 and 1960). Khan *et al*. (2013) mentioned that the effect of GA3 and BA corm treatment was useful for the dormancy breaking in Gladiolus corm. Therefore, looking towards the importance of cold temperature treatments and certain plant bio-regulators such as Gibberellic acid, NAA and BA the present investigation was undertaken to assess the breaking of Gladiolus dormancy.

MATERIALS AND METHODS

The experimental material used for study consisted of two Gladiolus genotypes which were obtained from the AICRP (Floriculture), Ganeshkhind, Pune-7. The Gladiolus corms were kept for cold storage at 5°C temperature and 90 percent RH. Growth regulator treatments were given by soaking the corms at ambient temperature for 12h. During 2011-2012 and 2012-2013, two genotypes of gladiolus *viz*., White Prosperity and Phule Neelrekha were evaluated. All treated corms of both genotypes were sown in single row of 4.5m length with spacing 30 cm between row and 20 cm within rows. Three competitive plants per genotype were selected at random for recording observations on following characters in each replication. The data were statistically analysed and critical differences were worked out at five percent level to draw statistical conclusions as suggested by Panse and Sakhatme (1978).

Days to 50 per cent sprouting

Days to 50 per cent sprouting was calculated on the basis of number of days required from planting to 50 per cent

Table 1: Influence of growth regulators on days to sprouting at different cold storage of Gladiolus corms

Source	Days to sprouting Control			6 week cold treatment			12 week cold treatment			18 week cold treatment			24 week cold treatment		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
Varieties (V)															
V_1	25.91	26.50	26.21	20.33	21.91	21.12	18.97	20.53	19.75	17.84	19.24	18.54	16.57	17.99	17.28
V_2	28.08	29.00	28.54	24.18	25.27	24.73	23.10	23.87	23.48	20.86	22.66	21.76	19.38	21.07	20.22
SE (±)	0.27	0.23	0.21	0.29	0.31	0.08	0.27	0.27	0.15	0.22	0.20	0.08	0.25	0.22	0.11
CD at 5%	0.82	0.70	0.69	0.88	0.95	0.27	0.82	0.83	0.49	0.65	0.60	0.26	0.77	0.67	0.38
Growth regulators (G)															
G_1	34.18	35.17	34.67	28.85	30.20	29.52	27.21	28.49	27.85	25.74	27.43	26.58	24.54	25.84	25.19
G_2	21.37	21.67	21.52	16.81	18.06	17.44	15.49	16.68	16.09	13.26	14.99	14.12	12.21	13.39	12.80
G_3	24.26	25.00	24.63	19.74	21.11	20.43	18.89	20.01	19.45	17.51	18.87	18.19	15.90	17.60	16.75
G_4	28.17	29.17	28.67	23.62	25.00	24.31	22.56	23.61	23.08	20.91	22.51	21.71	19.24	21.28	20.26
SE (±)	0.38	0.33	0.29	0.41	0.44	0.12	0.38	0.39	0.21	0.31	0.28	0.11	0.36	0.31	0.16
CD at 5%	1.17	0.99	0.98	1.24	1.35	0.39	1.16	1.18	0.69	0.93	0.85	0.36	1.09	0.95	0.54
Interaction (VXG)															
V_1G_1	31.20	33.00	32.10	25.64	27.37	26.51	24.20	25.74	24.97	23.08	24.62	23.85	21.88	23.32	22.60
V_1G_2	20.24	20.67	20.45	16.05	17.62	16.84	14.99	16.12	15.55	12.45	14.19	13.32	11.54	12.72	12.13
V_1G_3	24.30	24.00	24.15	17.24	18.95	18.10	16.02	17.57	16.80	15.88	16.81	16.34	14.43	15.71	15.07
V_1G_4	27.91	28.33	28.12	22.37	23.70	23.04	20.68	22.69	21.68	19.95	21.35	20.65	18.41	20.19	19.30
V_2G_1	37.16	37.33	37.25	32.05	33.02	32.54	30.21	31.24	30.73	28.40	30.23	29.32	27.19	28.36	27.77
V_2G_2	22.50	22.67	22.58	17.57	18.50	18.04	15.99	17.25	16.62	14.06	15.79	14.92	12.88	14.07	13.47
V_2G_3	24.21	26.00	25.11	22.24	23.28	22.76	21.76	22.46	22.11	19.14	20.94	20.04	17.37	19.49	18.43
V_2G_4	28.44	30.00	29.22	24.87	26.29	25.58	24.43	24.53	24.48	21.86	23.66	22.76	20.08	22.37	21.22
GM	26.99	27.75	27.37	22.26	23.59	22.92	21.04	22.20	21.62	19.35	20.95	20.15	17.97	19.53	18.75
SE (±)	0.54	0.46	0.42	0.58	0.63	0.16	0.54	0.55	0.29	0.43	0.39	0.15	0.51	0.44	0.23
CD at 5%	1.65	1.40	1.39	1.76	1.90	0.54	1.64	1.67	0.97	1.31	1.20	0.51	1.54	1.35	0.76

V_1: White Prosperity; V_2: Phule Neelrekha; G_1: Control G_2: GA_3 @ 125 ppm G_3: BA @ 50 ppm G_4: NAA @ 100 ppm

sprouting.

Sprouted corm percent

Calculate the percent of sprouted corms was recorded.

Sprouts per corm

Number of sprouts presents on a single corm was recorded by naked eyes and mentioned as sprouts per corm.

RESULTS AND DISCUSSION

Days to sprouting indicated significant differences among the Gladiolus varieties during all the periods of cold storage of both years and on pooled basis irrespective of growth regulator. Significantly lower days to sprouting (16.57, 17.99 and 17.28 during 2011, 2012 and on pooled basis, respectively) was recorded from planting the corms to the treatment 24 week in cold stored corms of White Prosperity (V_1) and higher days to sprouting (28.08, 29.00 and 28.54 during 2011, 2012 and on pooled basis) was recorded from planting the corms to the treatment without cold stored corms of Phule Neelrekha (V_2) variety (Table 1). Ginzburg (1981) reported that dark CO_2 fixation increases during the break of dormancy by low temperature storage. Dormant cormels have more labels in malate and less in citrate and amino acids. Malate utilization in dormant cormels is slower than in nondormant ones. Citrate and glutamine accumulate in dormant cormels in inactive pools. Benzyl adenine induces in dormant cormels changes similar to cold storage. Dark fixation is among the first reactions which are activated during break of dormancy by both benzyl adenine and cold storage. Pre-planting soaking of corms in growth regulator effects on breaking Gladiolus corm dormancy. Hence, this chemical can be recommended for improving corm attributes in the dormant corms (Padmalatha *et al*., 2013).

The differences in respect of days to 50 per cent sprouting of Gladiolus were statistically significant due to the corm treatment during all the periods of cold storage of both the years and on pooled basis irrespective of variety. The corm treated with GA_3 (125ppm) (G_2) recorded significantly lower days to 50 per cent sprouting of Gladiolus from all the periods of cold storage of both the years and on pooled basis (Table 2). Gowda (1983) reported that in Gladiolus corms treated with BA and ethrel were found effective in promoting sprouting than untreated ones. Hosoki (1983) with ethanol corm treatments and Roychoudhary *et al*. (1985) corm treatments with thiourea, ethrel and potassium nitrate. The effect of gibberellic acid in inducing the formation of hydrolytic enzymes may be a factor, which regulates the mobilization of reserves, ultimately resulting in early sprouting with GA3 (Groot and Karssen, 1987 and Khan *et al*., 2013).

Table 2: Influence of growth regulators on days to 50 per cent sprouting at different cold storage of Gladiolus corms

Source	Days to 50 per cent sprouting Control			6 week cold treatment			12 week cold treatment			18 week cold treatment			24 week cold treatment		
Varieties (V)	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
V_1	35.25	38.21	36.73	20.75	26.10	23.43	21.92	25.60	23.76	22.75	24.25	23.50	23.75	23.56	23.65
V_2	37.42	40.13	38.77	24.50	28.98	26.74	25.42	28.61	27.01	25.92	28.13	27.02	26.58	27.47	27.03
SE (±)	0.26	0.32	0.12	0.28	0.16	0.20	0.18	0.26	0.12	0.18	0.22	0.17	0.18	0.16	0.19
CD at 5%	0.80	0.97	0.41	0.84	0.49	0.68	0.54	0.78	0.42	0.54	0.67	0.55	0.54	0.47	0.65
Growth regulators (G)															
G_1	41.33	44.13	42.73	29.17	34.10	31.63	30.33	33.37	31.85	30.50	32.31	31.41	31.17	31.49	31.33
G_2	30.33	33.46	31.90	16.67	21.90	19.28	17.83	21.48	19.66	18.50	20.89	19.70	19.50	19.83	19.67
G_3	34.67	37.63	36.15	20.83	25.64	23.24	21.83	25.40	23.62	22.67	24.39	23.53	23.67	24.00	23.83
G_4	39.00	41.46	40.23	23.83	28.52	26.18	24.67	28.19	26.43	25.67	27.17	26.42	26.33	26.72	26.53
SE (±)	0.37	0.45	0.17	0.39	0.23	0.29	0.25	0.36	0.18	0.25	0.31	0.23	0.25	0.22	0.27
CD at 5%	1.13	1.37	0.57	1.19	0.69	0.97	0.77	1.10	0.59	0.76	0.94	0.78	0.76	0.67	0.92
Interaction (VXG)															
V_1G_1	39.67	42.13	40.90	26.67	32.98	29.82	28.33	32.06	30.20	29.33	30.56	29.95	30.67	29.67	30.17
V_1G_2	29.00	32.13	30.56	14.67	20.40	17.53	15.67	19.64	17.66	16.33	18.56	17.45	17.33	17.33	17.33
V_1G_3	33.67	36.79	35.23	20.00	24.64	22.32	21.00	24.40	22.70	21.67	23.56	22.61	22.67	23.00	22.83
V_1G_4	38.67	41.79	40.23	21.67	26.40	24.03	22.67	26.31	24.49	23.67	24.33	24.00	24.33	24.22	24.28
V_2G_1	43.00	46.13	44.56	31.67	35.22	33.45	32.33	34.67	33.50	31.67	34.06	32.87	31.67	33.31	32.49
V_2G_2	31.67	34.79	33.23	18.67	23.40	21.03	20.00	23.31	21.66	20.67	23.22	21.95	21.67	22.33	22.00
V_2G_3	35.67	38.46	37.06	21.67	26.64	24.16	22.67	26.40	24.53	23.67	25.22	24.45	24.67	25.00	24.83
V_2G_4	39.33	41.13	40.23	26.00	30.64	28.32	26.67	30.06	28.37	27.67	30.00	28.83	28.33	29.22	28.78
GM	36.33	39.17	37.75	22.63	27.54	25.08	23.67	27.11	25.39	24.33	26.19	25.26	25.17	25.51	25.34
SE (±)	0.53	0.64	0.24	0.56	0.32	0.41	0.36	0.51	0.25	0.35	0.44	0.33	0.35	0.31	0.39
CD at 5%	NS	1.93	0.81	1.69	0.97	NS	1.09	NS	0.83	1.07	1.33	1.10	1.07	0.95	1.30

V_1: White Prosperity; V_2: Phule Neelrekha; G_1: Control; G_2: GA_3 @ 125 ppm; G_3: BA @ 50 ppm; G_4: NAA @ 100 ppm

Table 3: Influence of growth regulators on per cent sprouting at different cold storage of Gladiolus corms

Per cent sprouting Source	Control			6 week cold treatment			12 week cold treatment			18 week cold treatment			24 week cold treatment		
Varieties (V)	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
V_1	88.33	85.83	87.08	93.33	90.83	92.08	90.00	86.67	88.33	87.50	86.67	87.08	87.50	88.33	87.92
V_2	84.17	83.33	83.75	88.33	90.83	89.58	86.67	87.50	87.08	86.67	87.50	87.08	84.17	87.50	85.83
SE	1.62	1.39	0.45	1.53	1.84	0.77	1.28	1.34	0.88	1.77	1.24	0.89	1.56	1.46	0.76
CD at 5%	NS	NS	1.49	4.63	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Growth regulators (G)															
G_1	88.33	85.00	86.67	90.00	90.00	90.00	88.33	88.33	88.33	85.00	88.33	86.67	85.00	90.00	87.50
G_2	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
G_3	76.67	75.00	75.83	85.00	85.00	85.00	80.00	75.00	77.50	78.33	76.67	77.50	78.33	78.33	78.33
G_4	80.00	78.33	79.17	88.33	88.33	88.33	85.00	85.00	85.00	85.00	83.33	84.17	80.00	83.33	81.67
SE	2.29	1.97	0.63	2.16	2.60	1.09	1.81	1.89	1.25	2.50	1.75	1.26	2.20	2.07	1.08
CD at 5%	6.96	5.97	2.11	6.55	7.88	3.65	5.49	5.73	4.18	7.58	5.32	4.21	6.69	6.26	3.61
Interaction (VXG)															
V_1G_1	90.00	86.67	88.33	93.33	90.00	91.67	90.00	86.67	88.33	86.67	90.00	88.33	90.00	93.33	91.67
V_1G_2	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
V_1G_3	80.00	76.67	78.33	86.67	83.33	85.00	83.33	76.67	80.00	80.00	73.33	76.67	83.33	80.00	81.67
V_1G_4	83.33	80.00	81.67	93.33	90.00	91.67	86.67	83.33	85.00	83.33	83.33	83.33	76.67	80.00	78.33
V_2G_1	86.67	83.33	85.00	86.67	90.00	88.33	86.67	90.00	88.33	83.33	86.67	85.00	80.00	86.67	83.33
V_2G_2	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
V_2G_3	73.33	73.33	73.33	83.33	86.67	85.00	76.67	73.33	75.00	76.67	80.00	78.33	73.33	76.67	75.00
V_2G_4	76.67	76.67	76.67	83.33	86.67	85.00	83.33	86.67	85.00	86.67	83.33	85.00	83.33	86.67	85.00
GM	86.25	84.58	85.42	90.83	90.83	90.83	88.33	87.08	87.71	87.08	87.08	87.08	85.83	87.92	86.88
SE	3.24	2.78	0.89	3.05	3.67	1.54	2.56	2.67	1.77	3.54	2.48	1.78	3.12	2.92	1.53
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	9.46	NS	5.11

V_1: White Prosperity; V_2: Phule Neelrekha; G_1: Control; G_2: GA_3 @ 125 ppm; G_3: BA @ 50 ppm; G_4: NAA @ 100 ppm

Significantly highest per cent sprouting (100.00 each in 2011, 2012 and on pooled basis, respectively) was recorded from all week cold stored GA_3 (125ppm) treated corms (G_2) and lowest per cent sprouting of 76.67, 75.00 and 75.83 per cent during 2011, 2012 and on pooled basis, respectively was recorded in absolute control (G_3, BA 50 ppm treated corm). Roychoudhary *et al*. (1985) also observed same result (Table 3). GA_3 125 ppm in present study was effective in increasing the days to 50 per cent sprouting, and per cent sprouting. It is a well know fact that application of gibberellins enhances cell division and cell elongation in such a way that the whole meristematic region is activated. It modify the rate of photosynthesis in the cells of growing point of the stem and induce further promotion of respiration and have action on several enzymes. Similar results have been reported by Auge (1982). Storage at low temperature and treatment with certain growth regulatory substances like ethylene chlorohydrins, thiourea, benzyl adenine and GA_3 are known to promote corm and cormel sprouting (Mukhopadhyay and Banker, 1986).

CONCLUSION

The use of growth regulators combined with cold storage temperature was effective in the breaking of dormancy and caused earlier sprouting in Gladiolus.

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