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Full Length Research Paper

Dormancy breaking of gladiolus cv. Jester for the mid hills of Nepal

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The gladiolus is a very common and famous cut flower of Nepal. It is an economically very important and commercially grown cut flower for Nepal. Dormancy plays a vital role in flower production and its market price. In order to produce flower earlier than rainy season starts and to get good market price, different dormancy breaking treatments were tested at mid hill condition of Agriculture Research Station, Pakhribas (1740 masl). The treatments were gibberellins, water treatment, smoking, scales removal, chilling in moist sand and control (without any treatment). All the treatments were replicated five times and the design was complete randomized design (CRD) for lab experiment and randomized complete block (RCB) for field experiment. After more than fifty percent shoot initiation, the corms were planted in the field for field experiment. The rooting was found earlier in corms treated with moist sand (started from 16th day). At the 47th day of lab experiment, highest root initiation was from chilling treatment. Same result was also obtained for shoot initiation. At 62nd day, maximum shoot was found from chilling treatment and lowest from control treatment. Similarly, from field experiment, maximum flower size was recorded from chilling treatment followed by scales removal. In case of corm yield, highest corm yield was recorded from scales removal treatment. Thus, with these results, we can conclude that chilling corms in moist sand is the best and easy method to get early root and shoot.

Key words: Gladiolus, dormancy, rest period.

INTRODUCTION

Gladiolus, commonly known as sword lily (due to its sword like leaves) is a very popular cut flower among the world cut flowers. It is specially valued for floral arrangements. Its popularity is due to its wide color range, its nature to open in sequence (even in room condition) and its long lasting florets. It ranks as the number one cut flower in Nepal. Gladiolus is an economically important flower for Nepalese condition because floriculture business has been flourishing in Nepal since the early nineties (Yanai et al., 2007).

The main production season of gladiolus in Nepal is from April to August in the mid hills condition. In this season, flower quality deteriorates due to high rainfall, fusarium rot, etc. In addition to these problems, flower growers could not fetch good price due to over production. In this condition, farmers can get high price if they produce spike earlier than normal production. Gladiolus corms and cormels dormancy is reported as the major impediment in the commercial cultivation of gladiolus (Kumar and Raju, 2007). Gladiolus corms do not sprout immediately after harvesting. This is because of rest period and corm dormancy is attributed to the accumulation of growth inhibitory substances like abscisic acid (ABA). Ginzburg (1972.) also reported that dormant corm and cormels contain 5 to 10 times ABA than non dormant corms. According to Tsukamoto (1960), soaking the gladiolus corms in benzyladenine solution at 20 ppm for 24 h, followed three days later by re soaking in gibberellins solution at 100 ppm resulted in good sprouting and good growth of root and shoot. Denny (1930) reported that gladiolus rest period varies with varieties but usually, it is two to three months. In our condition, we observed that the corms of Jester variety

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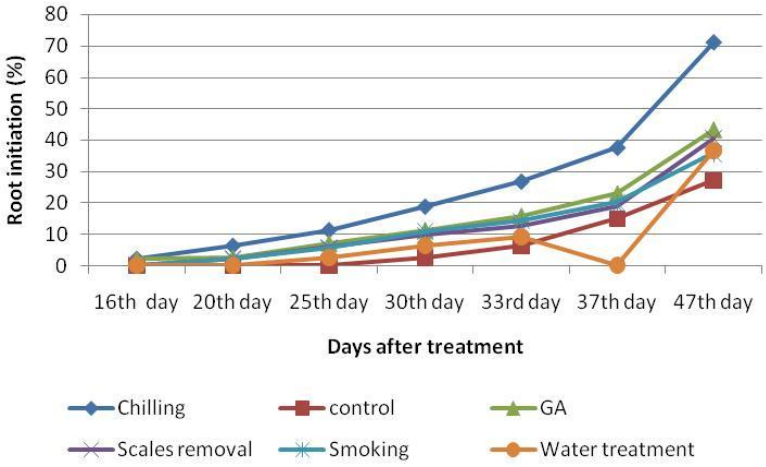

Figure 1. Root initation trend the first year.

normally rest from three to four months. Though, different chemicals treatments were recommended to reduce the rest period of gladiolus corms, these chemicals are expensive and easily not available in our market. Thus, we tried to identify the easy, effective and easily available materials to shorten the dormancy period of gladiolus corms cv. Jester.

MATERIALS AND METHODS

The experiments were set up two months after harvesting the corms. Later, the harvested corms were kept in shade condition. The design used for this experiment was completely randomized design. A total of six treatments were tested for dormancy breaking, which were as follows:

i. Gibberellins: Corms were dipped in 100 ppm giberellic acid for one hour.
ii. Water treatment: Corms were dipped in the solution of *carbendazim* (2 g/l) for one month.
iii. Smoking: Corms were smoked for one hour continue for three days
iv. Removal of scales: All the outer scales were removed
v. Chilling in moist sand: Corms were kept in layers of moist sand in trays. The soil temperature from chilling treatment was 0.9°C.
vi. Control: Corms without any treatment

There were a total of five replications. After the treatment, a total of 48 corms were kept in trays and kept in dark rook. The rooting and shoot initiation observations were taken in one week interval until root initiation and then every alternate day. The percentage data on root initiation and shoot initiation were transformed to arcsine (angular) and analyzed by Genstat Discovery Edition 3.

RESULTS FOR LAB EXPERIMENT

Root initiation in 16 days

There was significantly highest root initiation from corms treated with GA (16.51%) and chilling (15.03%) in the second year (Figure 1). In other treatments, root initiation was not started in the 16th day.

Root initiation in 30 days

40.63% root initiation was recorded from chilling treatment in second year which was the highest among all treatments. Least root initiation was found from control treatment (8.03%) from first year experiment. All treatments except water treatment were found superior over control treatment for root initiation of corms.

Root initiation in 47th days

At the 47th day of experiment, root initiation from the treatments GA and smoking were found for initiated root at par, from 58.57 and 58.54% respectively. Chilling treatment was superior to all treatments while control and water treatments were at par with 42.30 and 43.90% respectively. Figures 1 and 2 show the root initiation trend in the first and second year.

Shoot initiation

Observation on shoot initiation on the 25th and 30th day were not significantly different. However, shoot initation was started in corms treated with GA and chilling.

Shoot initiation at day 33

Only treatments were found significant and its interaction with year was not significantly different. Though, highest percentage of shoot initiation was found from treatment chilling (5.19%), percentage of shoot initation at 33 days

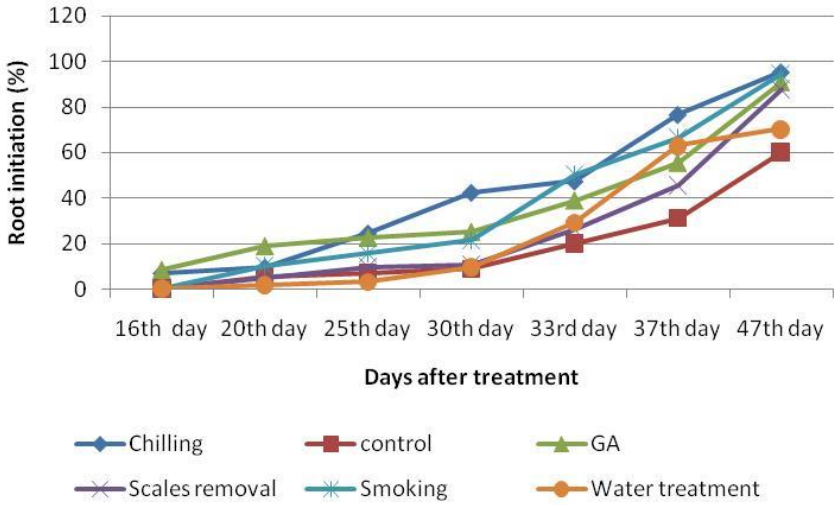

Figure 2. Root initiation trend in the second year.

from chilling treatment, scales removal (3.67%) and corms treated with GA. (3.67%) were at par.

Shoot initation at day 37

Treatments for dormancy breaking was found highly significant but its interaction with year did not vary significantly for shoot initation. Highest shoot was initiated in chilling treatment, while lowest was in control and water treatment. Corms treated with GA, scales removal and smoking were at par with 5.56, 6.02 and 5.19% respectively.

Shoot initiation at day 55

Obverbations on percentage of shoot initiated at 55th day was found highly significant due to different treatments, year and their interaction. Among the different treatments, the chilling treatment (37.86%) was recorded as the highest percentage. Treatments scales removal and smoking were found also better with results of 26.97 and 18.95 %. While GA with 15.19% and water treatment with 12.96% were found at par. Second year of experimentation was better over first year. While we consider the interaction of treatments and year, chilling treatment of second year was the highest for shoot initiation (52.31%).

Shoot initation at day 62

Higly significant effect was observed in dormancy breaking due to different treatments, year and also its interaction. Chilled corms in sand layer produced highest percentage of shoot in second year. While lowest percentage was observed in control treatment in second year. Among the treatments, chilling treatment was the best followed by scales removal. After 55 days, the treatment of scales removal produced drastically highest shoot as compared to other treatments. Corms dipped in water with fungicide solution and control treatments did not give satisfactory shoots. Except water treatments, all the treatments were found superior as compared to control treatment. Figures 3 and 4 show the percentage shoot initiation in the first and second year.

Effect of different dormancy breaking treatments on flower parameters

Spike initiation was found highly significant and plants from control plots showed spike earlier than other treatments in both years. This might be due to control plots corms that were planted later due to late root and shoot initiation.

Other flower parameters like flower size, number of florets and spike length were observed not significantly different. But if we consider its mean value, flowers from scales removal treatment showed maximum flower size, florets number and spike length. Flower size was significant in second year; flowers from scales removal and chilling treatment had maximum flower diameter. Smallest flower was recorded from water treatment in second year (Tables 1 and 2).

Effect of dormancy breaking treatments on corm and cormel parameters

Highest corm weight per plant and total corm yield (t/ha) was recorded from treatment scales removal followed by chilling treatment. Scales removal, chilling, smoking and water treatment were found at par for total corm yield

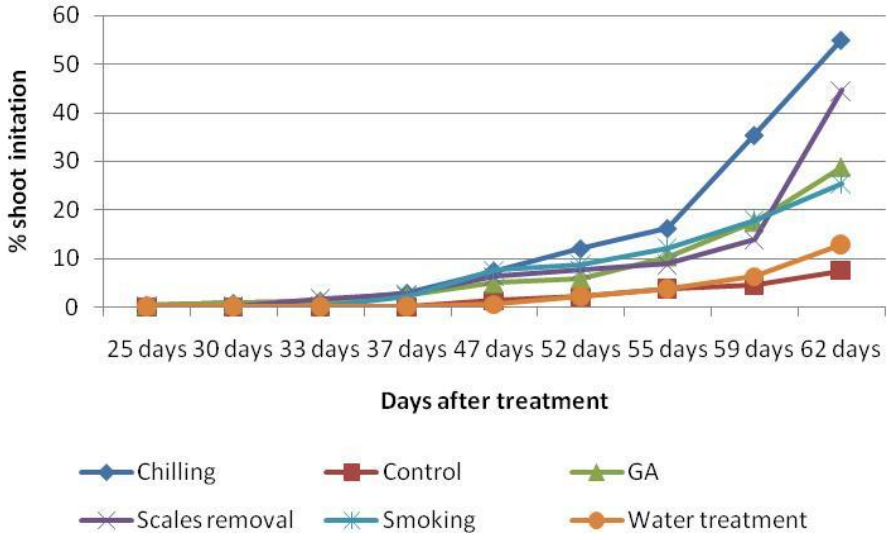

Figure 3. Percentage shoot initiation in first year.

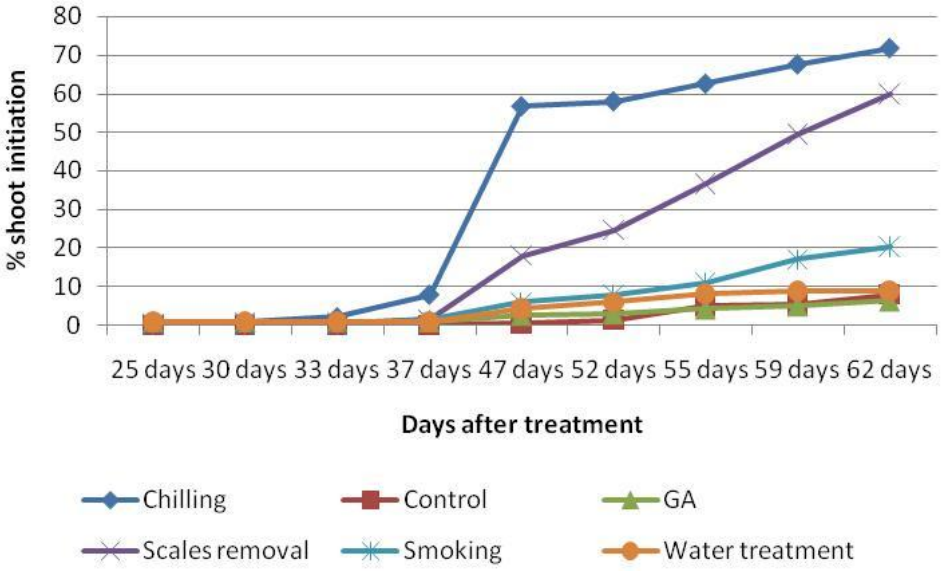

Figure 4. Percentage shoot initiation in second year.

Table 1. Flower parameters of first year.

Treatments	Spike initiation (days)	Harvesting (days)	Flower size (cm)	No. of florets	Spike length (cm)
Chilling	80.84b±5.2^{b}	92.5±7.7^{bc}	9.50	17.20	79.20
GA	69.46a±3.8^{a}	79.9±5.2^{ab}	9.19	15.15	76.40
Scales removal	79.92b±7.8^{b}	97.3±12.0^{c}	9.72	18.36	87.50
Smoking	68.08a±2.9^{a}	86.9±1.4^{abc}	9.18	15.99	76.60
Water treatment	70.28a±0.5^{a}	81.9±3.8^{abc}	9.25	17.08	79.50
Control	67.68±6.8^{a}	72.8±12.1^{a}	8.08	13.13	67.82
F test	***	*	NS	NS	NS
CV%	6.7	13.2			
lsd	6.420	14.86			

Table 2. Flower parameters of second year.

Treatments	Spike initiation (days)	Harvesting (days)	Flower size (cm)	No. of florets	Spike length (cm)
Chilling	84.28±5.4^{c}	100.97±6.6^{c}	10.31±0.77^{a}	19.20	94.10
GA	70.37±4.2^{ab}	90.03±1.1^{ab}	8.47±1.16^{b}	17.60	93.80
Scales removal	75.41±3.0^{c}	92.45±2.9^{b}	10.21±1.12^{a}	20.80	100.30
Smoking	67.88±2.3^{a}	85.32±2.6^{a}	9.75±0.81^{a}	19.00	93.30
Water treatment	70.61±2.6^{ab}	88.68±2.4^{ab}	8.00±0.78^{b}	17.40	95.40
Control	72.20±4.5^{bc}	84.45±8.3^{a}	8.23±1.16^{b}	18.00	95.00
F test	***	***	***	NS	NS
CV%	3.4	4.9	8.5		
Lsd	3.367	5.806	1.043		

Table 3. Corm and its parameters in first year.

Treatments	Average corm weight (g)	Average cormel weight/plant (g)	Corm diameter (cm)	Total corm yield (t/ha)	Total cormel no./plot
Chilling	98.20±7.0^{ab}	12.56 ±3.0^{a}	9.19	13.78±1.61^{ab}	37.20±6.0^{a}
GA	83.90±2.6^{bc}	7.26±2.3^{b}	6.36	9.64±2.53^{b}	22.20±4.6^{bc}
Scales removal	106.20 ±22.1^{a}	9.56±1.4^{ab}	6.90	14.43±2.26^{a}	33.10±8.5^{ab}
Smoking	67.00 ±14.8^{c}	8.68±1.0^{ab}	5.77	12.80±0.63^{ab}	24.20±1.7^{bc}
Water treatment	81.80±2.4^{bc}	7.16±0.1^{b}	5.44	12.36±0.19^{ab}	17.40±2.9^{c}
Control	74.80±14.1^{c}	6.23±2.9^{b}	5.73	10.02±2.15^{b}	20.20±8.8^{c}
F test	**	*	NS	*	**
CV%	17.7	33.9		24.3	35.0
lsd	19.93	3.837		3.899	11.87

Table 4. Corm yield and its parameters in second year.

Treatments	Average corm weight (g)	Average cormel weight/plant (g)	Corm diameter (cm)	Total corm yield (t/ha)	Total cormel yield (t/ha)
Chilling	78.90	5.69	6.38±0.44^{a}	10.16	0.487±0.065^{ab}
GA	72.40	4.96	5.17±0.74^{b}	8.85	0.433±0.032^{ab}
Scales removal	80.10	6.10	6.14±0.25^{a}	11.30	0.667±0.179^{a}
Smoking	62.00	4.99	6.06±0.18^{ab}	9.80	0.306±0.204^{b}
Water treatment	79.00	5.15	5.90±0.03^{ab}	9.37	0.619±0.087^{a}
Control	66.00	5.82	5.77±0.16^{ab}	9.49	0.346±0.097^{b}
F test	NS	NS	*	NS	*
CV%			10.5		39.2
Lsd			0.821		0.2464

(Tables 3 and 4). Similarly, average cormel yield and total cormel number per plot were observed maximum from chilling treatment. Chilling and scales removal were found at par while highest cormel was recorded from water treatment.

DISCUSSION

Freshly harvested corms of gladiolus do not germinate immidiately, even when planted in favorable environment (Denny, 1930). This is because of its rest period or dormancy period. Due to this rest period, gladiolus corms take certain period to germinate and flower. This dormancy period varies from variety to variety.

A high temperature treatment at 35°C for five days followed by a low temperature treatment at 0 to 5°C for 25 days for two varieties - White Gold and Cardinal Prince - was reported effective for good sprouting of corms (Tsukamoto and Yagi, 1960). They also reported

that the dormancy of gladiolus corms and cormels can be broken by storing in low temperature. Our results are also in agreement with these papers because in our experiment, we found that chilling treatment with sand at 0.9°C was the most effective for sprouting the corms. According to Gerritis et al. (2003), dormancy of lilies bulb was broken by storage at low temperature (5ºC) for several weeks, the longer the cold storage, the faster and more uniform leaf emergence occurred. The role of low temperature treatment on dormancy breaking was due to starch hydrolyzed during storage and sugars accumulated (Gerritis et al., 2003). Chilling treatment was the most effective dormancy breaking treatment for root/ shoot sprouting and corm yield.

Gibberellins stimulate growth, break dormancy and delay senescence. According to (Salisbury and Ross, 1978), gibeberellins overcome the seed dormancy and promote the germination. In our experiment, gibberellic acid found an effective treatment to promote the root initiation and shoot prolongation. According to Suresh et al. (2009), gladiolus corms of cultivar American Beauty dipped in the solution of GA3 at 125 ppm sprouted with less number of days (17 days) and 50% sprouting in 29 days. Tsukamoto and Yagi (1960) also reported that soaking the gladiolus corms in benzyladenine solution (20 ppm) for 24 h, followed three days later by resoaking in 100 ppm gibberellin solution resulted in good dormancy breaking and good root and shoot growth. Bhalla and Singh (2000) reported the increased plant height and spike length with 100 ppm GA3 at 5°C. Same report was reported by Negi and Raghava (1986) that application of GA3 increased plant height and number of leaves and shoots per plant as well as increased number and size of florets.

Smoking treatment was also found effective to promote sprouting and it is also easier to apply. Suh (1989) also reported that cormels treatment with smoke (1 h/ day for 3 days) before planting promoted sprouting. Our result are also in accordance with this report. Similarly, recently harvested dormant corms of Triteleia laxa Benth. Cv. Queen Fabiola to ethylene for 7 days at 20 ppm resulted in early sprouting, early flowering and more flowers and high corm and cormels weight (Han et al., 1990). Exposure of freesia corms to smokes reduce the corm dormancy as reported by Imanishi and Fprtamoer (1983). They also reported that this dormancy breaking was because these smokes contain ethylene. Exposure of freesia corms to ethylene promote sprouting (Uyemura and Imanishi, 1984); ethylene has the ability to shorten the dormant period with no adverse effects on root and shoot development (Masuda and Asahira, 1980). The ethylene releasing compound (CEPA) promotes the germination of dormant gladious cormals (Ginzburg, 1974). Bhalla and Singh (2000) also reported that ethrel (ethephon 1000 ppm) at room temperature was effective in causing early sproutings. Descaling was also reported as the dormancy breaking treatment as it stimulates the germination of dormant cormels.

Conclusion

Three treatments like chilling corms, using GA and smoking, were found effective for shortening the resting period of gladiolus. These three treatments are not only effective but easy to apply and also easily available. Among these three treatments, the chilling treatment was found superior in dormancy breaking.

So, we can conclude that corms chilled in moist sand 20 days will enhance the rooting. Thus, we can recommend the chilling treatment for early planting of gladiolus cv. Jester.

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