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Full Length Research Paper

Evaluation of seed priming on germination of *Gladiolus alatus*

Salman Mushtaq[1]*, Ishfaq Ahmad Hafiz[1], Syed Zia Ul Hasan[1], Muhammad Arif[1] Muhammad Asif Shehzad[2] Rizwan rafique[2], Misbah Rasheed[2] Muhammad Ali[2] and Muhammad Shahid Iqbal[1]

[1]PMAS-Arid Agriculture University, Rawalpindi, Pakistan.
[2]University of Agriculture, Faisalabad, Pakistan.

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Seed priming improves seed performance under environmental conditions. The study was designed to evaluate the effect of different priming treatments on germination behavior of *Gladiolus alatus*. The experiment was conducted under complete randomized design (CRD) with four replications. Seed priming was done with different concentration of potassium nitrate (KNO_3) and hydropriming. All the treatments had significant effect on germination percentage, germination test in growth room, time for 50% germination and mean germination time. Results show that maximum invigoration was observed in seeds osmoprimed at lower concentrations of KNO_3 and with hydropriming while minimum invigoration was observed at higher concentration of KNO_3. It was concluded that germination percentage can be increased by using lower concentrations of KNO_3 and with hydropriming.

Key words: Priming, hydropriming, gladiolus, germination.

INTRODUCTION

Gladiolus alatus, generally called “Glad”, a member of family Iridaceae and sub-family Ixidaceae, originated from South Africa, is a prominent bulbous cut flower plant. Gladiolus is also known as the Sword Lily, due to its sword shaped leaves, or Corn Lily (Chanda et al., 2000). Being an important bulbous ornamental plant, it occupies a prime position among commercial flower crops which has high demand in both domestic and international markets. It occupies eighth position in the world cut flower trade and has a global history (Ahmad et al., 2008). It is an essential part of party decoration, having great variation in size, shape and colour. Its magnificent inflorescence with variety of colors, made it attractive for use in herbaceous borders, beddings, rockeries, pots and for cut flowers (Abbasi et al., 2005). Gladiolus is one of the most important bulbous flowering crops grown commercially for cut-flower trade in Pakistan. The suitable agro-climatic conditions of the country clearly indicate that wide range of ornamental crops can be grown, which can improve the economic conditions of the growers (Ahmad et al., 2008).

Poor crop stand is one of the major abiotic constraints encountered by resource-poor farmers (Harris et al., 1999). Reasons for this include, low quality seed, inadequate seedbed preparation, untimely sowing, poor sowing technique, inadequate soil moisture, adverse soil properties and high temperatures. Effective amelioration of these physical constraints is often beyond the control of resource-poor farmers in rainfed farming systems. Osmotic adjustment or priming of seeds prior to sowing is known as an efficient way to increase germination and emergence rate in some species with for example small embryo or species with stepwise seed development (Sivritepe, 2000). The beneficial effects of priming have also been demonstrated for many field crops (Mehmet et al., 2006). Seed priming has been successfully demonstrated to improve germination and emergence in seeds of many crops, particularly seeds of vegetables and small seeded grasses (Arif et al., 2007). The purpose of these

*Corresponding author. Email: agri_pk@yahoo.com. Tel: +92-334-7781466.

treatments is to shorten the emergence and to protect seed from biotic and abiotic factor during critical phase of seedling establishment so as to synchronize emergence, which lead to uniform stand and improved yield. These priming treatments which enhance seed germination include hydropriming (Basra et al., 2003; Afzal et al., 2004), osmopriming and hormonal priming (Afzal et al., 2006). It was indicated that primed seed emerged one to three days earlier than non primed seeds and quickly became apparent. Similarly, improvement in germination, reduction in germination time and enhanced emergence in hydroprimed seeds were reported by Harris et al. (2001). Priming is the enhancement of physiological and biochemical events in seeds during suspension of germination by low osmotic potential and negligible matric potential of the imbibing medium. Salts or non-penetrating organic solutes in liquid medium (osmoconditioning) or matrix solutions (matriconditioning) are used to establish equilibrium water potential between seed and the osmotic medium needed for conditioning (Khan, 1993).

The present study was planned to optimize the osmopriming treatments and to evaluate the effects of osmopriming with KNO_3 on seed germination of gladiolus.

MATERIALS AND METHODS

Experiments were conducted in laboratory and in the field of Department of Horticulture, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, during the year 2008 to 2009. To improve the rate of germination and reduce the time required for germination, seed priming was done with different concentration of potassium nitrate (KNO_3) and hydropriming to determine its effect on seed germination (Table 1). For priming, seeds were soaked in distilled water and different concentration of potassium nitrate solution for 48 h. After treatment, the seeds were placed on wet filter paper treated with fungicide Dithane M-45 @ 1 g/L in growth room. The seeds were kept in growth chamber at 24 ± 2°C. The seeds were watered at three days interval and kept under close observation. Treatments were designed with four replications and 10 seeds per replication in complete randomized design (CRD).

The data were recorded on germination percentage, germination test in growth room, number of days required to attain 50% of the final germination (T_{50}) and mean number of days to final germination (MDG). The experiments were subjected to analysis of variance technique (ANOVA). Least Significant Difference test (LSD) at 5% probability level was used to compare the means (Steel et al., 1997).

RESULTS AND DISCUSSION

Germination is the emergence and development of seedling from seed. Data pertaining to the germination percentage showed the mean values of different treatments of priming after 15 days of germination (Table 1). T_1 (0.25% KNO_3) attained the maximum (66.67%) level of germination followed by T_3 (60%) in 0.75% KNO_3 and T_9 (distilled water) but differed significantly from the rest of the treatments whereas, the minimum (20%) germination percentage was exhibited by T_6 (3% KNO_3) after 15 days of germination. After 30 days of germination, data was recorded for germination percentage. T_1 (0.25% KNO_3), T_3 (0.75% KNO_3) and T_9 (distilled water) attained the maximum (83.33%) germination percentage followed by 63% in T_{10} (without priming) and 60% in T_2 (0.5% KNO_3) whereas, the minimum (30%) germination percentage was exhibited by T_8 (5% KNO_3) after 30 days of germination. Data on germination percentage showed that at higher concentration of KNO_3, germination percentage was lower as compared to lower concentration of KNO_3 and distilled water. Data showed that hydropriming gave better results. Our results are also consistent with those of Mohammadi (2009) who concluded that seed priming can be used as a beneficial method to improve seed performance and traits of soybean; Salehzade et al. (2009) concluded that osmopriming treatments improved germination and seedling vigor than the control.

Seeds of different priming treatments were sown in the growth room to check the germination percentage. Data regarding germination percentage presented in the Table 1 shows statistically significant differences among different treatments. It can be seen that T_1 (0.25% KNO_3) and T_3 (0.75% KNO_3), attained the maximum (80%) level of germination followed by 73% in T_2 (0.5% KNO_3), 70% in T_9 (distilled water) and 66% in T_{10} (without priming). The minimum (23%) germination percentage was exhibited by T_8 (5% KNO_3). Results show that germination percentage decreased with the increase in the concentrations of KNO_3. Several workers have reported that KNO_3 improved the seed germination of many crops but results of this study are contrary to those reports; KNO_3 reduced the germination percentage. The reason might be the sensitivity of gladiolus seeds to KNO_3 concentration used for priming. This lead to an assumption that higher concentration exerts lethal effects on seed germination by causing death of cells and ultimately results in loss of seed viability (Nascimento, 2003).

Data pertaining to the number of days required to attain 50% germination showed the mean values of different treatments of priming (Table 1). The difference between primed and non primed seed for days taken to be 50% germination was significant. Results show that non primed seed took more time (days taken to 50% germination) compared with primed seed. Maximum time (16days) was taken by T_{10} (control). Minimum time (7 days) was taken by T_1 (0.25% KNO_3), T_2 (0.5% KNO_3) and T_9 (distilled water). Our results are also consistent with those of Dezfuli et al. (2008) which concluded that hydropriming resulted in lower time taken to 50% germination. The earlier and synchronized germination might be attributed to increased metabolic activities in the primed rice seeds (Basra et al., 2005). It was observed that lower concentration of KNO_3 gave best results regarding number of days taken to be 50% germination.

Table 1. Effect of seed priming on Seed germination percent, germination test in growth room, time for 50% germination (days) and mean germination time (days).

Treatment	Seed germination (%)		Germination test in growth room	Time for 50% germination (days)	Mean germination time (days)
	After 15 days	After 30 days			
T_1 (0.25% KNO_3)	66.67[a]	83.33[a]	80.00[a]	7.333[ef]	16.25[ef]
T_2 (0.5% KNO_3)	50.00[abc]	60.00[bc]	73.33[a]	7.833[ef]	16.75[de]
T_3 (0.75% KNO_3)	60.00[ab]	83.33[a]	80.00[a]	8.333[e]	17.00[de]
T_4 (1% KNO_3)	33.33[cd]	43.33[cd]	60.00[ab]	8.250[e]	17.42[de]
T_5 (2% KNO_3)	33.33[cd]	36.67[d]	46.67[bc]	10.17[d]	20.08[ab]
T_6 (3 % KNO_3)	20.00[d]	36.67[d]	33.33[c]	13.58[b]	17.92[cd]
T_7 (4% KNO_3)	26.67[d]	36.67[d]	46.67[bc]	14.42[b]	20.92[a]
T_8 (5% KNO_3)	33.33[cd]	30.00[d]	23.33[c]	12.08[c]	20.17[ab]
T_9 (distilled water)	60.00[ab]	83.33[a]	70.00[ab]	7.083[f]	14.75[f]
T_{10} (control)	46.67[bc]	63.33[b]	66.67[ab]	16.83[a]	19.08[bc]
LSD	17.15	19.16	23.65	1.031	1.661

Mean not sharing a letter differ significantly at $p<0.05$.

Our results are contradictory to the work of Zheng et al. (1994) who reported that osmopriming reduced the time to 50% germination and emergence in canola.

Statistical analysis and mean number of days to final germination showed the mean values of different treatments of priming. Maximum number of days (20.92) to final germination was shown by T_7 (4% KNO_3), T_8 (5% KNO_3) and T_5 (2% KNO_3) which differed significantly from the rest of the treatments. The minimum x number of days (20.92) to final germination was observed in T_9 (distilled water). Our results are in line with those of Rashid et al. (2002) who reported that improved and early seedling emergence in sorghum, millet, cotton, beans and maize was as a result of hydropriming.

Similarly, Arif (2005) reported that mean germination time was accelerated by hydropriming without changing amount of water uptake in watermelon. Hydropriming clearly improved both rate of germination and mean germination time both under salt and drought stress conditions.

Furthermore, hydropriming resulted in increase of normal germination. Moreover, he also indicated the beneficial effects of hydropriming on aged or unaged seeds with respect to germination and percentage of normal seedling in cauliflower. It is concluded that superiority of hydropriming on germination could be due to soaking time effects rather than KNO_3 treatment.

Hydroprimed seeds compared to KNO_3 treated seeds were allowed to imbibe water for a longer time and went through the first stage of germination without protrusion of radicle. It was observed that at higher con-centration of KNO_3, mean number of days to final germination was increased.

The concentration of more KNO_3 will be the mean number of days to final germination. Our results are controversy to the work of Ruan et al. (2002) who reported a significantly higher level of germination and lower mean germination time after priming treatment.

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