Journal of Medicinal Plants Studies 2016; 4(1): 88-90

Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN 2320-3862
JMPS 2016; 4(1): 88-90
© 2016 JMPS
Received: 24-11-2015
Accepted: 23-12-2015

Effects of seed priming and supplementary irrigation on yield and yield component of *Lallemantia iberica*

Mahdieh Ayyari, Saeid Zehtab-Salmasi, Kazem Ghassemi-Golezani

Mahdieh Ayyari
Department of Plant Eco-Physiology, Faculty of Agriculture, University of Tabriz, Tabriz, Iran.

Saeid Zehtab-Salmasi
Department of Plant Eco-Physiology, Faculty of Agriculture, University of Tabriz, Tabriz, Iran.

Kazem Ghassemi-Golezani
Department of Plant Eco-Physiology, Faculty of Agriculture, University of Tabriz, Tabriz, Iran.

Abstract

This research was carried out in 2012 and 2013 to investigate the effects of seed priming and supplementary irrigation on yield and yield component of *Lallemantia iberica.* Two experiments were arranged as factorial based on randomized complete block design (RCBD) with three replications. Seed priming methods were control, hydro-priming, salt-priming and irradiation with two doses of gamma rays (200 and 400 Gy) and irrigation treatments were rain-fed (I_1), irrigation at flowering stage (I_2) and irrigation at both flowering and grain filling stages (I_3). Plant establishment, grain number per plant, hundred grain weight, biological yield, grain yield and harvest index were evaluated. Results showed that hydro-priming increased plant establishment, but the differences between control, hydro-priming and KNO_3 priming was not significant. Moreover, differences in harvest index among control, hydro-priming and KNO_3 priming were not significant. Plant Establishment and harvest index were decreased by gamma irradiation of seeds. Plants from hydro-primed seeds produced the highest number of grains per plant. Hundred grain weight was enhanced by hydro-priming and gamma irradiation (200 Gy) under I_3 and gamma irradiation (400 Gy) under all irrigation treatments, compared with non-priming. Biological yield was improved by hydro-priming under I_2 and I_3 and gamma irradiation (200 Gy) under I_3. The highest grain yield per unit area was recorded for plants from hydro-primed seeds under I_2 and I_3 followed by plants from unprimed seeds under I_2. Since hydro-priming of *Lallemantia iberica* seeds due to mucilage content is difficult, cultivation of non-primed seeds with a supplementary irrigation at flowering stage could produce satisfactory yield.

Keywords: Gamma irradiation, *Lallemantia iberica*, seed priming, supplementary irrigation, yield.

1. Introduction

Water is one of the most important ecological factors determining crop growth and development (Jaleel *et al*., 2007) [8]. An efficient use of limited water resources and better growth under limited water supply are desirable traits for crops in drought environments (Deng *et al*., 2007) [5]. Performing of supplemental irrigation in areas that face drought stress is helpful. But over-irrigation on the other hand causes low water use efficiency and low plant resistance to water shortage. Thus, determining the appropriate time for irrigation is of crucial importance in agricultural applications (Afzal *et al*., 2010) [1].

In recent years, many studies have shown that proper supplemental irrigation can increase crop yield by significantly improving soil water conditions and their water use efficiency (Deng *et al*., 2007) [5]. Water stress after anthesis causes premature aging and reduces transfer of food reserves from vegetative parts to grain (Mainard and Jeuffroy, 2001). Irrigation at the appropriate stage increases vegetative growth and photosynthesis to continue for a longer time that will produce optimum yield (Ghobadi *et al*., 2012) [7].

In the semi-arid regions, crops often fail to establish quickly and uniformity, leading to decreased yields because of low plant populations (Ghassemi-Golezani *et al*., 2010) [6]. The priming of seeds has been reported to result in better seedling growth and increase yield under water deficit stress conditions (Kaur *et al*., 2002; Rengel and Graham, 1995) [9, 13]. The general purpose of seed priming is the beginning of germination processes before radicle emergence. Treated seeds are usually re-dried to primary moisture, but they would exhibit rapid germination when imbibed under normal or stress conditions (Ashraf and Foolad 2005) [4].

There are several usages of nuclear techniques in agriculture. In plant improvement, the irradiation of seeds may cause genetic variability that enable plant breeders to select new genotypes with improved characteristics such as precocity, salinity tolerance, grain yield and quality (Ashraf *et al*., 2003) [3]. Gamma irradiation was found to increase plant productivity. In this connection, Jaywardena and Peiris (1988) stated that gamma rays represent one of the important physical agents used to improve the characters and productivity of many crops such

Correspondence
Mahdieh Ayyari
Department of Plant Eco-Pphysiology, Faculty of Agriculture, University of Tabriz, Tabriz, Iran.

as rice, maize, bean, cowpea and potato. Therefore, this research was carried out to investigate the effects of different priming techniques and gamma irradiation on yield and yield component of *Lallemantia iberica* under rain-fed and supplementary irrigation conditions.

2. Materials and Methods

Two experiments were conducted in 2012 and 2013 at the Research Farm of the Faculty of Agriculture, University of Tabriz, Tabriz, Iran (Latitude 38º 05′ N, Longitude 46º 17′ E, Altitude 1360 m above sea level). Mean precipitation of 2012 and 2013 was recorded as 239.95 mm. Table 1 shows the information of monthly precipitation for these two years. The experiments were arranged as factorial based on randomized complete block design (RCBD) with three replications. Factors were seed priming techniques and supplementary irrigations.

Table 1: Information of monthly precipitation during 2012 and 2013.

year	Jan.	Feb.	Mars.	April.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2012	25.1	6.4	20	35.6	22.2	15.8	14.9	0	5.1	9.2	20.2	42.8	217.3
2013	36.7	43.8	9.6	47.3	39.5	7.8	4.5	0	0.4	7.6	47.4	18	262.6

Seeds of a local variety of *Lallemantia iberica* were divided into five parts: control, hydro-primed, salt-primed and irradiated with two doses of gamma ray. Hydro-primed seeds were socked in distilled water for 8 hours, then they were dried to the primary moisture. Salt-primed seeds were socked in 1% KNO_3 solution for two hours and then re-dried. Irrigated seeds were subjected to gamma rays from 60 Co source using 200 and 400 Gy doses. Irrigation was undertaken at the Agriculture and nucleic medicine research center in Karaj, Iran.

Seeds were sown in May and irrigated once a week till four leaves stage. Then plants were divided into three parts: rain-fed, irrigation at flowering stage, and irrigation at both flowering and grain filling stages.

Plants per unit area were counted and plant establishment was determined. At maturity, 10 plants from each plot were harvested and grain number per plant was recorded. Then, plants in an area of 0.75 m^2 from each plot were harvest and biological and grain yields per unit area were determined. The data were subjected to analyses of variance, using MSTATC and SPSS software.

3. Results and Discussion

Analyses of variance of the data indicated that number of plants per m^2 was significantly affected by seed priming ($p \leq 0.01$), but not by water supply ($p > 0.05$). Effects of seed priming ($p \leq 0.05$) and year × priming ($p \leq 0.01$) on grains per plant were also significant. Hundred grains weight significantly affected by seed priming ($p \leq 0.01$), irrigation ($p \leq 0.01$), and priming × irrigation ($p \leq 0.05$). Biological yield was significantly affected by seed priming, year × irrigation ($p \leq 0.05$) and priming × irrigation ($p \leq 0.01$). The effects of priming and priming × irrigation ($p \leq 0.01$), year × priming and year × irrigation ($p \leq 0.05$) on grain yield were significant. Seed priming had also significant on harvest index ($p \leq 0.01$).

Hydro-primed seeds produced the highest number of plants per unit area, which was not statistically different from non-primed and KNO_3 primed seeds. However, gamma irradiation decreased plant number, particularly at high doses. Irrigation had no effect on plant number, because supplementary irrigations were applied after plant establishment at reproductive stages (Table 2).

Table 2: Means of number of plant per m^2, grain number per plant and HI (%) for *Lallemantia iberica* affected by seed priming in 2012 and 2013

Priming methods	Number of plant per m^2	Grain number per plant	HI (%)
Non-priming	275.4^{ab}	62.57^{b}	32.73^{a}
Hydro-priming	299.6^{a}	78.98^{a}	32.97^{a}
KNO_3 priming	275.7^{ab}	69.33^{ab}	31.99^{a}
Gamma irradiation (200 Gy)	245.2^{bc}	67.08^{ab}	27.60^{b}
Gamma irradiation (400 Gy)	219.4^{c}	60.26^{b}	27.50^{b}

Means with different letters indicate significant difference at $p \leq 0.05$ (LSD test).

Table 3: Means of grain number per plant, hundred grain weight, biological yield, grain yield of *Lallemantia iberica* affected by seed priming and supplementary irrigations in 2012-2013.

treatments		Grain number per plant	Hundred grain weight (g)	Biological yield (g/m^2)	Grain yield (g/m^2)
priming	irrigation				
Non-priming	I_1	63.74^{a}	0.43^{f}	208.9^{de}	74.89^{defg}
	I_2	70.73^{a}	0.47^{bcde}	335.9^{ab}	105.0^{ab}
	I_3	53.25^{a}	0.46^{cdef}	181.0^{e}	60.15^{g}
Hydro-priming	I_1	67.03^{a}	0.45^{def}	229.4^{abcd}	96.32^{abcd}
	I_2	75.23^{a}	0.47^{bcde}	353.1^{ab}	112.9^{a}
	I_3	94.69^{a}	0.48^{abcd}	334.4^{ab}	111.6^{ab}
KNO_3 priming	I_1	75.80^{a}	0.44^{ef}	300.0^{abcd}	97.01^{abcd}
	I_2	58.12^{a}	0.45^{def}	205.8^{de}	88.93^{bcdef}
	I_3	74.07^{a}	0.47^{bcde}	295.8^{abcd}	98.03^{abc}
Gamma irr. (200 Gy)	I_1	61.02^{a}	0.48^{bcd}	268.6^{bcde}	76.94^{cdefg}
	I_2	62.73^{a}	0.47^{bcde}	223.8^{cde}	67.74^{fg}
	I_3	77.50^{a}	0.52^{a}	382.3^{a}	93.44^{abcde}
Gamma irr. (400 Gy)	I_1	58.36^{a}	0.50^{ab}	213.8^{cde}	60.32^{g}
	I_2	64.66^{a}	0.52^{a}	314.8^{abc}	73.18^{efg}
	I_3	57.77^{a}	0.49^{abc}	208.6^{de}	56.65^{g}

Means with different letters indicate significant difference at $p \leq 0.05$ (LSD test).

Rain-fed (I_1), irrigation at flowering (I_2) and irrigation at both flowering and grain filling (I_3).

Hydro-priming caused the highest grain number per plant. Plants from non-primed and gamma irradiated (400 Gy) seeds had the lowest grain number per plant. Other investigators revealed that high doses of gamma ray could decrease seed production (Nouri and Tavassoli, 2012) [12].

As shown in table 3, plants from hydro-primed seeds under I_3, gamma irradiated (200 Gy) seeds under I_3, gamma irradiated (400 Gy) seeds under I_1, I_2 and I_3 increased hundred grain weight as compared with control. The highest hundred grain weight was recorded for gamma irradiated treatments under I_3 (200 Gy) and I_2 (400 Gy). Plants of non-primed seeds under I_1 resulted in the lowest hundred grain weight. Decrease of assimilate supply during grain filling stage may cause the limitation of seed storage capacity and decrease grain weight (Araus *et al*., 1986) [2]. Millado *et al*. (1972) [11] studied the effect of various doses of gamma irradiation on grain weight in wheat and concluded that in general 10 KR and 15 KR increases grain weight.

Plants from 200 Gy treated seeds under twice supplementary irrigation (I_3) had the highest biological yield, which was not statistically different from plants of non-primed seeds under I_2, hydro-primed seeds under I_1, I_2 and I_3, KNO_3 primed seeds under I_1 and I_3 and gamma irradiated (400 Gy) seeds under I_2 (Table 3). Rasaei *et al*. (2012) also showed that supplementary irrigation at the flowering stage causes high biological yield in peas (*Pisum sativum* L.).

The highest and the lowest grain yield per unit area were recorded for plants from hydro-primed seeds under I_2 and gamma irradiated (400 Gy) under I_3, respectively. In this study, grain number per plant had more effect on grain yield, compared with 100 grain weight. Gamma rays increased grain weight and decreased grain number per plant. So, high grain yield of plants from gamma irradiated (200 Gy) seeds under I_3 was the result of high grain weight (Table 3). Therefore, hydro priming can enhance grain yield of *Lallemantia iberica*, but priming of this plant seeds by water, due to their mucilage content is difficult, it seems to be better to use unprimed seeds with a supplementary irrigation at flowering stage.

Plants from hydro-primed seeds had the highest harvest index, which was not statistically different from plants of non-primed and KNO_3 primed seeds. Harvest index was decreased by gamma irradiation of seeds and high doses caused to decrease it more. This could be the result of higher biological yield of plants from 200 Gy irradiated seeds and lower grain yield of plants from 400 Gy irradiated seeds, compared with control (Table 2).

4. References

1. Afzal A, Mousavi SF, Khademi M. Estimation of Leaf Moisture Content by Measuring the Capacitance. Journal of Agricultural Science and Technology. 2010; 12:339-346.
2. Araus JL, Tapia L, Azcon-Bieto J, Caballero A. Photosynthesis, nitrogen levels and dry mater accumulation in flag leaves during grain filling, in: R., Marcelle, H. Clijscern, and M. Pouker, (eds.), Biological control of Photosynthesis. Martinus Nijhoff Publisher., Dordrecht, 1986.
3. Ashraf M, Cheema AA, Rashid M, Qamar Z. Effect of gamma rays on M1 generation in Basmati rice. Pakistan Journal of Botany. 2003; 35:791-795.
4. Ashraf M, Foolad MR. Pre-sowing seed treatment- A shotgun approach to improve germination, plant growth and crop yield under saline and non-saline conditions. Advances in Agronomy 2005; 88:223-271.
5. Deng X, Shan L, Shinobu I. High efficiency use of limited supplement water by dryland spring wheat. Trans. CSAE 2007; 18:84-91.
6. Ghassemi-Golezani K, Jabbarpour S, Zehtab-Salmasi S, Mohammadi A. Response of winter rapeseed (*Brassica napus* L.) cultivars to salt priming of seeds. African Journal of Agricultural Research. 2010; 5:1089-1094.
7. Ghobadi ME, Felehkari H, Mohammadi GR, Honarmand SJ. The effects of supplemental irrigation and N-applications on yield and yield component in two wheat cultivars in Kermanshah condition. Annals of Biological Research 2012; 3:2127-2133.
8. Jaleel CA, Manivannan P, Kishorekumar A, Sankar B, Gopi R, Somasundaram R *et al*. Alterations in osmoregulation, antioxidant enzymes and indole alkaloid levels in Catharanthus roseus exposed to water deficit, Colloids Surf. B: Biointerfaces 2007; 59:150-157.
9. Kaur S, Gupta AK, Kaur N. Effect of osmo- and hydropriming of chickpea seeds on crop performance in the field. International Chickpea Pigeonpea Newsletter 2002; 9:5-17.
10. Khan AA. Pre-plant physiological seed conditioning. Horticultural Reviews 1992; 13:131-18.
11. Millado Z, Trajilo MA, Mendozoz FR. Effect of different doses of gamma rays Co60 on four quantitative characters in wheat (*T. aestivum* L.). Agronomy Science 1972; 8B:41-65.
12. Nouri H, Tavassoli A. Effect of gamma rays on pod and seed production and economic yield in pinto bean cultivar of Khomein. Scholars Research Library, Annals of Biological Research 2012; 3:2399-2404.
13. Rengel Z, Graham RD. Importance of seed Zn content for wheat grown on Zn-defi cient soil, I: Vegetative growth. Plant and Soil 1995; 173:259-266.