World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 3.347

EFFECTS OF SOIL MIXTURE RATIOS AND SOWING DEPTHS ON SEED GERMINATION DYNAMICS IN *DIPCADI ERYTHRAEUM* UNDER *IN-VIVO* CONDITIONS

Anupama Sagar and Pawan K. Kasera*

Laboratory of Plant Ecology, Centre of Advanced Study, Department of Botany, Jai Narain Vyas University, Jodhpur 342 005, India.

Article Received on 12/11/2016 Article Revised on 01/12/2016 Article Accepted on 22/12/2016

***Corresponding Author**
Dr. Pawan K. Kasera
Laboratory of Plant Ecology, Centre of Advanced Study, Department of Botany, Jai Narain Vyas University, Jodhpur 342 005, India.

ABSTRACT

The present investigation deals with *in-vivo* seed germination of *Dipcadi erythraeum,* an endangered and endemic species from the Indian Thar desert. Seeds were sown in different months, soil mixture ratios and sowing depths during 2015-16. Monthly data on germination percent and days to start germination were recorded in fresh and one-year-old seeds from January to July. Growth parameters were recorded after 90 days of setting the experiments in different soil mixture ratios and sowing depths. Since, *D. erythraeum* is an endangered and endemic medicinal plant with great pharmaceutical uses it is necessary to investigate these studies for large-scale cultivation of this plant. July was found to be most suitable month to grow this plant. Germination percentage was maximum at 1.5 cm depth with 1:1:2 soil mixture ratios of Sand:Clay:FYM. Values for germination percentage in different soil mixture ratios were significant at $p<0.05$ level.

KEYWORDS: *Dipcadi erythraeum*, Soil mixture ratio, Sowing depths, Indian Thar desert.

INTRODUCTION

Dipcadi Medik. is a genus of bulbous flowering plants recently belonging to the subfamily Scilloideae of family Asparagaceae. It comprised about 40 species, distributed in Southern Europe, most area of Africa, the Middle East and East to South Asia. The greatest diversity is found in South Africa (13 species) and India (9 species). In Egypt, the genus *Dipcadi* is a

member of family Hyacinthaceae and is represented by two species, *i.e. Dipcadi erythraeum* Webb and Berthel. and *Dipcadi unifolium* Baker. The genera were initially included within family Liliaceae, now they are members of family Asparagaceae. *D. erythraeum* is a wild medicinal plant. Its bulb and capsule are edible especially in Pakistan. The leaves are used as a laxative and as an ointment for wounds.[1]

The continued commercial exploitation has resulted in receding population of medicinal plant in their natural habitat, potentially creating storage of the raw plant materials required extensively by the pharmaceutical industry and the traditional practitioners. Therefore, the cultivation of these plants is needed to ensure a dependable and continued supply. Since in-situ conservation of these resources alone cannot meet the ever-lasting demand of the pharmaceutical industry, the development of cultural practices and propagation methods for these plants in suitable agro-climatic regions are necessary.[2]

Most of the indigenous plant species of arid regions are slow growing. Consequently difficulties arise in raising the seedling of such species in nursery environment. The success of mass production of seedlings depends on nursery techniques as it is the only method to produce a large number of healthy plantlets. Clay soil has greater strength especially when dry and is also susceptible to water-logging due to poor infiltration, which results in poor aeration. A clay soil tends to stay wetter for longer as the fine particles hold more water and more tightly as compared to sand alone. Soil strength is one aspect of soil structure, which is controlled by several factors including the amount and type of clay mineral and particle shape. Root and shoot growth increases in mixture of sand and clay than sand alone.[3]

The main objectives of the present study were to assess the effects of duration, different soil mixture ratios and sowing depths on seed germination dynamics and growth parameters of *D. erythraeum* under nursery (*in-vivo*) conditions.

MATERIALS AND METHODS

Plant specimen was identified by BSI, Jodhpur and was submitted to BSI herbarium (BSJO) with accession no. 35143. Mature capsules of *D. erythraeum* were collected from Bhimbhadak, Jodhpur (15 km in north-west direction from the University Campus) during August-September 2013 & 2014.

(i) Durations

The seeds were sown monthly in thermo-cups (size: height 10 cm; bottom diameter 5 cm; and top diameter 7.5 cm) under nursery conditions in 1:1:1 soil ratios during January to July. The percentage of seedlings emergence was recorded time to time.

(ii) Soil mixture ratios and sowing depths

Prior to nursery experiments, seed germination behaviour was studied under laboratory conditions to find out suitable concentration of growth regulators for better germination and seedling growth. For this, seeds were pre-treated with 0.1% $HgCl_2$ for 30 seconds to avoid any infection then washed under running tap water for 2-3 h to remove any adhering chemical. To improve seed germination percentage and seedling growth parameters, seeds were pre-treated with different concentrations, *i.e.* 2, 5, 10 and 25 mgL^{-1} of growth regulators (GA_3, IAA and IBA). Best results were obtained in 5 mgL^{-1} GA_3. Afterwards, seeds were pre-treated with 5 mgL^{-1} GA_3, then sown in thermo-cups containing different soil mixture ratios of Sand:Clay:FYM, *i. e.* 1:1:1, 1:2:1, 1:1:2 and 1:3:2. Seeds were also sown at different depths, *i. e.* 0.5, 1.0, 1.5 and 2.0 cm.

(iii) Statistics

Data were subjected to analysis of variance (ANOVA) as suggested by Gomez and Gomez[4] by using SPSS version 16 and mean values are presented in tabular form.

RESULTS AND DISCUSSION

Data on effect of duration (months) on seed germination are presented in Table 1. It is evident from this table that both fresh and one-year-old seeds showed maximum germination, *i.e.* 80% and 60%, respectively in July. Freshly collected seeds also exhibited 80% germination in January. Among all months, seeds sown during July germinated earlier as compared to those which were sown in other months. Seeds did not germinate in April. Saharan *et al.*[5] found that 1st week of June-July was to be most favourable for obtaining better seedling emergence in *Evolvulus alsinoides*. ANOVA revealed that values for germination percentage for both fresh and one-year-old seeds during different months were significant at $p<0.05$ level.

Table 2 show data on effect of different soil mixture ratios and sowing depths on seedling emergence and growth parameters of 90 days old seedlings under *in-vivo* conditions. Data revealed that maximum seed germination (83.33%) was recorded in 1:1:2 soil mixture ratios

of Sand:Clay:FYM followed by (76.66%) in 1:2:1 ratios. The maximum values for bulb length was reported in 1:1:2 ratios, while bulb diameter and total dry biomass per plant in 1:3:2 soil mixture ratios. In case of different sowing depths, maximum germination (90%) was observed at 1.5 cm depth. Kasera and Shukla[6] reported maximum germination percentage at 1 cm depth in *Leptadaenia reticulata*. Bulb length and total dry biomass were maximum at 0.5 cm, whereas maximum bulb diameter at 2 cm depth. Statistics showed that values for germination percentage in different soil mixture ratios were significant at $p<0.05$ level, while rest were non significant.

Saharan *et al.*[5] observed maximum seedling emergence (70%) in soil having 1:2:1 ratio of Sand:Clay:FYM in *E. alsinoides*. Swami and Kasera[7] documented that seeds of *Withania somnifera* sown at 0.5 cm depth with 1:2:1 soil mixture ratios of Sand:Clay:FYM showed optimum seed germination, plant growth and biomass production. Cent percent seedling emergence in *Asparagus racemosus* at 0.5 cm depth with 1:2:1 ratios of Sand:Clay:FYM was reported by Raghav and Kasera.[8] Thus, soil mixture ratio with higher clay and FYM were found to be good for germination and seedling growth in *D. erythraeum*, as supported by findings of above researchers. Mathur and Sundaramoorthy[9] obtained better yield of biomass per plant in clay soil as compared to other soil mixtures in *Blepharis sindica*. The response of FYM application can be attributed to the better nutrient availability due to the better absorption and assimilation and its favourable effect on physical and biological properties of soil, resulting in an increased growth and yield.

Table 1: Effect of durations (months) on seedling emergence in fresh and one-year-old seeds of *D. erythraeum* under nursery conditions.

Months	Days to start germination		Germination percentage	
	Fresh	One-year-old	Fresh	One-year-old
January	21	24	80.00	50.00
February	4	14	50.00	50.00
March	4	15	50.00	30.00
April	-	-	-	-
May	22	22	20.00	20.00
June	14	14	50.00	20.00
July	2	2	80.00	60.00
CD			36.00*	10.937*

*- = No germination; and * = Significant at (P < 0.05) level.*

Table 2: Effect of different seed sowing methods on growth parameters in 90 days old seedlings of *D. erythraeum* under nursery conditions.

Seed sowing methods		Germination (%)	Bulb length (cm)	Bulb diameter (cm)	Total biomass (g plant^{-1} d. wt.)
Soil mixture ratios (Sand:Clay:FYM)	1:1:1	73.33	2.63	0.72	0.102
	1:2:1	76.66	2.96	0.87	0.139
	1:1:2	83.33	3.06	0.78	0.133
	1:3:2	66.66	2.73	1.06	0.151
CD		3.872*	0.642^{ns}	1.258^{ns}	0.391^{ns}
Sowing depth (cm)	0.5	80.00	3.0	0.75	0.146
	1.0	83.33	2.5	0.71	0.08
	1.5	90.00	2.7	0.73	0.126
	2.0	80.00	2.8	0.78	0.097
CD		2.154^{ns}	0.372^{ns}	0.262^{ns}	1.823^{ns}

ns = Non significant; and * = Significant at (P < 0.05) level.

CONCLUSIONS

It is clear from present research work that July is best month to grow selected plant under *in-vivo* conditions. Maximum germination percent was obtained at 1.5 cm depth with 1:1:2 soil mixture ratios of Sand: Clay: FYM.

FUNDING

Grateful thanks to the CSIR, New Delhi for the financial assistance {No. 09/098(0112)/2012 EMR-1; dated 16.01.2012} in the form of NET-SRF fellowship to the first author.

ACKNOWLEDGEMENTS

Thanks are due to the Professor & Head, Centre of Advanced Study, Department of Botany, J. N. Vyas University, Jodhpur for providing necessary facilities. Financial support received from the UGC, New Delhi in the form of UGC-(SAP-II)-CAS {No. F. 5-1/2013 (SAP-II) dated 03.01.2014} is also gratefully acknowledged.

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