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ORIGINALARTICLE

Effect of Irrigation Intervals on Seed Germination and Seedling Growth of *Phaseolusa conitifoliusJacq.*Cv.Rmo-40 in Pot Culture Experiment

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ABSTRACT
In present study effect of irrigation interval on seed germination and seedling growth observed in Phaseolus aconotifolius Jacq. cv.RMO-40. Different irrigation intervals were 24 hrs , 48 hr. 72 hrs and 96. hrs. used in pot culture experiment. Effect of irrigation interval on seedling survival, shoot length, root length, plant biomass and fruiting were studied and it was observed that the increased irrigation interval i.e. 72 hr and 96hr led to superior results over the control i.e.24 hr.
Keywords; *Irrigation , drought , seedling, fruiting, water*

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INTRODUCTION

There are so many factors which affect the growth of the plant in natural condition. Soil is one of the most important factors for plant growth. It is the upper weathered or well ground part of the earth's crust which contains organic matter and sustain plant life. It has a large number of micro-organisms, that keep the soil fit for continued plant life. Soil provide anchorage, water and mineral salts to the plants besides giving oxygen to the underground parts for respiration. Almost all the elements present in the soil can enter the plant through water. Already about 60 elements have been detected to occur in plants.There are some which are essential for the healthy growth of plants. They are called essential elements, others are toxic and some absorbed by plants may play no role in metabolism, are called non- essential. Most of the plant characteristics, especially seed germination, growth and biomass are greatly influenced by soil properties like water content,aeration, structure and nutrients. Growth and development of plants are also influenced by environmental factors, namely, water, temperature, light, gases and mineral nutrients. The occurrence of high levels of heavy metals or trace metal in soils affects the biological environment of soil and other characters of soil including the inhibition of the uptake of mineral nutrient resulting in the disruption of soil fertility, may result in the reduced growth of crops grown in that soil. The present study was designed to understand the effect of irrigation intervals on seed germination (%), seedling survival (%), shoot length (cm), root length (cm), biomass (g/plant) and fruiting (number) of *Phaseolus aconitifolius* cv. RMO 40.

MATERIAL AND METHOD

***Phseolusa Conitifolius Jacq.* CV.R MO-40 (Early Maturity Group Crop)**
Vernacular name- Moth , Family -Fabaceae
These varieties mature in 60-65 days and give higher yield. These varieties mature early, escape the terminal drought situation is therefore, suitable for the areas of late season drought. Varieties included in this group selected for studies. Salient features of the commercial varieties of this group areas follows.

1. RMO-40

A nearly maturing variety developed through mutation breeding and released by central seed committee in 1994. Being early in maturity (62-65 days) it escape drought, generally occurring at latter stage of the crop. It has a short stature and non spreading plant type with synchronous maturity. It remains free from yellow mosaic virus under field conditions. It's seed yield ranges from 6 to 8 q/ha. and is recommended for western zone of Rajasthan where drought conditions occur.

Pot culture experiments were performed only in one cultivar i.e. RMO 40. Ten seeds of *Phaseolus aconitifolius* cv. RMO 40 were sown at five cm. depth at equal distances in the prepared pots. Each treatment was replicated thrice. After five days of the sowing, pots were examined for seed germination, after 10 days of growth seeding survival was recorded after this five plants were removed from each pot. Remaining parameters such as shoot length, root length, plant biomass, and fruiting were recorded after 60 to 65 days in each pot under natural condition and the data were statistically analyzed.

The following treatments were given :

Irrigation intervals of 24, 48, 72 and 96 hours and waterlogged conditions were used. 24 hr. irrigation interval acted as control.

RESULTS

1. Effect of Irrigation Intervals :

The data regarding the effect of different irrigation intervals on seed germination, seedling survival, shoot, root length, plant biomass, and fruiting of *Phaseolusa conitifolius*cv.RMO40 are given in table [1.1];and plate [1.1].

(i) Effect of Irrigation Intervals on Seed Germination

Data showed that seed germination percentage is maximum at 96 hr. irrigation interval where germination is 90%. It can be concluded that as irrigation intervals increase , seed germination percentage increases. Germination decreases to nil in waterlogged condition. Statistically significant results were observed among irrigation intervals and highly significant between control *versus* treatment and results were not significant among replicates.

(ii) Effect of Irrigation Intervals on Seedling Survival

Seed germination and seedling survival percentage increased with increase in irrigation interval. Seed germination and seedling survival is 90% at 96 hr. of irrigation interval as compared to control (24 hr.). Seedling survival percentage is 46.6% in control. Statistically highly significant results were obtained among control *versus* treatment, significant among irrigation intervals and results were not significant among replicates.

(iii) Effect of Irrigation Intervals on Shoot Length and RootLength

Shoot length was maximum in 96 hr. irrigation interval where it is 12.96 (cm) as compared to control where shoot length was 12.09 (cm). After the examination of seeds in pots of water logged treatment it was observed that seeds could not survive, they finally died. So, after 45 days of growth when pots were tested for shoot length and root length there were no seedling in water logged pots.

Under control conditions the root length was11.10 cm which increased to 12.94cm.under96hrof irrigation interval. However, root length slightly decreases in 48 hr so both shoot length and root length increased with the increase in irrigation intervals as this was mentioned earlier that this crop is drought resistant crop and it requires minimum rainfall. Statistical observation related to shoot length and root length were not significant among replicates, irrigation intervals and among control *versus* treatment.

(iv) Effect of Irrigation Intervalon Biomass

Data observed that with increase in irrigation intervals from 24 hrs to 96 hrs, there was increase in biomass from 1.75 g/plant to 2.89 g/plant. There was no growth in the water logged pots, hence no biomass appeared in this treatment. Statistically significant result were observed in control *versus* treatment and results were not significant among replicates and among irrigation intervals.

(v) Effect of Irrigation Intervals onFruiting

Maximum fruiting was observed at 72 hrs irrigation interval, i.e. 31 fruits per plant as compared to control where it was 24 per plant. At 96 hrs intervals the fruiting reduced to 26. Statistical analysis showed that highly significant results were obtained among control *versus* treatment and among irrigation interval. Where as it is not significant among replicates. In significant results were observed among replicates and among highly significant results were observed in between control *versus* treatment.

Table 1.1;Showing the Effect of Irrigation Interval on Seed Germination (%),Seedling Survival(%), Shoot Length (cm), RootLength (cm), Biomass (g/plant) and Fruiting (No.) in *Phaseolus aconitifolius* cv. RMO40.

S.N.	Irrigation interval	Seed germination	Seedling survival(%)	Shoot length (cm)	Root length(cm)	Biomass (g/plant)	Fruiting (No.)
1.	Control	50	46.6	12.09	11.10	1.75	24
2.	48(hr.)	70	60	12.82	11.00	2.17	26
3.	72(hr.)	83	83	12.47	12.68	2.76	31
4.	96 (hr.)	90	90	12.96	12.94	2.89	26
5.	Water	-	-	-	-	-	-

F ratio	Control	Among Irrigation	Among replicates
1. Seed	43.56**	4.15*	0.17 NS
2. Seedling	38.43**	8.76*	0.15 NS
3. Shoot length	1.25 NS	0.16 NS	0.11NS
4. Root length	2.61 NS	3.24 NS	0.10 NS
5. Biomass	8.04*	1.43 NS	0.42 NS
6. Fruiting	18.96**	9.68**	0.06 NS

NS – Not significant, * - Significant, ** - Highly Significant

The following treatments were given :

(1) Irrigation intervals of 24, 48, 72 and 96 hours and waterlogged conditions were used. 24 hr. irrigation interval acted as control. Plate [1.1]

Effect of Irrigation Interval

DISCUSSION

Role of Irrigation Intervals:

Arid ecosystem constitutes an important part of the world's dry climates. The Indian arid zone is characterized by a harsh and fragile system, which influences both productivity (quantitative and qualitative) and socioeconomic status of the inhabitants. Our crop *Phaseolus aconitifolius*, commonly known as moth bean, is one of the most adapted arid legume in the region because of its tolerance to drought and heat [1]. It fits well in harsh climates with rainfall of 200-250mm, even when rainfall distribution is erratic, although water deficit is one of the most common environmental stress that affects growth and development of plants [2, 3]. Drought continues to be a challenge to agricultural scientists in general and to plant breeders in particular. In the present study effect of irrigation interval on seedling survival, shoot length, root length, plant biomass and fruiting was studied in *Phaseolus aconitifolius* cv. RMO 40 and it was observed that the increased irrigation interval i.e. 72 hr and 96hr led to superior results over the control i.e.24hr.This kind of result also observed by in *Cyamopsis tetragonoloba* cv. 936 [4]. Stimulation of shoot and rootlength, biomass and fruiting under higher irrigation intervals may possibly be related to the threshold moisture content in the seed which is essential for vegetative and reproductive growth. The highest value of growth parameters in the 96 hr interval irrigated plant may be attributed to proper plant water conditions which might have resulted in higher rate of cell division, elongation and photosynthesis by leaves. Several researchers reported that reduction in germination percentage in response to increasing moisture stress was observed by in lentil [5]. Seedling growth in two varieties HPL-5 and L9-129 of lentil was adversely affected by moisture stress. It was further concluded that the inhibition of germination in lentil varieties at higher osmotic potential may be associated with the decrease in moisture level in the seeds below the minimum quantity for germination. Effect of different irrigation regimens on the growth and yield of sunflowers was studied by and they observed the effect of different levels of irrigation (2, 4 and 6 irrigation) [6] on growth and yield characteristic of sunflower varieties Gimsum-94 and Gimsum-256. Significantly higher seed yield was obtained from Gimsum-94 than Gimsum 256. The maximum seed yield of 3119 kg/hac was obtained with six irrigation against 2200 kg/hac. with two irrigation. So irrigation is an important factor which directly influences the yield of sunflower. Peak demand of water is during its reproduction. Shortage of water during this period not only reduces seed yield but also seed contents. The effect of water stress on germination, plant growth and root proteins in three rice cultivars (Sinaloa, IRI 10120 and Chiapas) was analyzed by [7]. Seed germination and plant growth were found to be significantly inhibited by polyethylene glycol (PEG) imposed water deficit in cv. Sinaloa; cvs IRO 10120 and chiapas were more tolerant to water stress. Flurographs of two dimensional electrophenogram *in vivo* labeled polypeptides were analyzed to identify changes in the root protein pattern that resulted when plants were grown in the presence of 10% PEG for10 days. The treatment increased the synthesis of eight polypeptides in cv.Sinoloa, seven in cv. IR 10120 and four in cv. Chiapas. The synthesis of several polypeptides was decreased by the PEG treatment in cv. Sinaloa and cv. IR 10120. Most of these PEG induced changes in the root protein pattern were cultivar specific and only one 26 kDa protein with a pl of 6.0 was induced by water deficit in the two cultivars Sinaloa and IR 10120.Water use efficiency (WUE) was significantly reduced by water stress. Water stress lead to decreased plant growth, fresh and dry weight of plant parts, photosynthesis and N_2 fixation in cluster bean[8].Decrease in grain yield under water stress condition in cluster bean was also observed by [9]. Kumari and Ibrahim also reported that drought stress reduced WUE of millet [10, 11]. Water stress at ear emergence stage caused the greatest reduction in W.U.E. [12] also showed water shortage at flowering declined seed yield more as compared to water stress at other stage of plant life. Water stress had significantly negative effect on harvest index. Control had the highest and water stress at ear emergence stage had the lowest harvest index in millet. The reduction in seedling growth and vigour in response to increasing moisture stress has also been reported in *Raphanus sativus* by [13].Water stress substantially alters plant metabolism, decreasing plant growth and photosynthesis [14]. There is controversy over the mechanism by which stress decrease photosynthetic assimilation of CO_2. Two principle effects are involved : restricted diffusion of CO_2 into leaf and inhibition of CO_2 metabolism. In the leaves of Sunflower, stress decrease CO_2 assimilation more than it slows O_2 evolution and that the effects are not reversed by high concentration of CO_2. Stress decreased the amount of ATP and ribulose biphosphate found in the leaves, correlating with reduced CO_2 assimilation but the amount and the activity of Rubisco do not correlate. ATP synthetase (coupling factor) decrease with stress and conclude that photosynthetic assimilation of CO_2 by stressed leaves is not limited by CO_2 diffusion but by inhibition of Rubisco, related to lower ATP content resulting from loss of ATP synthetase. Simultaneously, the poor aeration and concomitant depressed respiration adversely affect the mineral nutrition of plant under waterlogged condition which results in the stunted growth of plants. The deleterious effect of water logging are depressed respiration and the consequent inhibition of water and mineral uptakeas observed by several workers [15] in sorghum and sunflower in *Cicer arietinum* cv. H. 355) [16].Board studied water logging effects on plant nutrient concentrations in soyabean [17]. As compared with other nutrient phosphorus (P), potassium (K), Calcium (Ca), Magnesium (Mg), sulfur (S), Managanse (Mn), Zinc (Zn) and Nitrogen (N) demonstrated the greatest association with water soyabean logging- induced yield loss. They also observed that soyabean was sensitive to water logging stress when applied at a vegetative stage compared with reproductive stage. [18]observed significant differences in plant mortality among different cultivars of pigeonpea in comparison to moth bean. Variety ICP 8379 was water logging resistant and var. ICP 7035 was grown as water logging susceptible, when pots have different media and subjected to 6 days of water logging. Water logging caused a significant reduction in root dry mass of both cultivars which was greater in ICP 7035 than ICP 8379. The reduction in shoot dry mass was comparatively small. The most conspicuous differences between the two cultivars occurred in terms of plant survival.In different soil treatments, ICP 8379 showed 0-38% mortality and ICP 7035 showed 63-100% mortality. The variation in mortality occurred in response to difference in growth medium. Differential response of two *Vicia faba* cultivars was also observed by El-Tayeb (2006) in relation to growth, pigments, lipid peroxidation, organic solutes, catalase and peroxidase activity. With respect to dry weight, drought caused a greater decrease in cv. Giza 667 than in cv. Giza 40, indicating that cv. Giza 40 was more tolerant of low soil water content. Drought decreased the Chl a, Chl b and carotenoid contents in the leaves of Giza 667, while in cv Giza 40 a significant increase in these pigment parameters was observed under drought stress. Drought induced the accumulation of soluble sugars, soluble protein, free amino acids and proline in both cultivars. However, this accumulation was lower in cv. Giza 667 than in more tolerant cv. Giza 40. Highest germination capacity was in Giza 40 and lowest in Giza 667 under the polyethyleneglycol-induced water stress. Amarante and Sodek (2005) observed that water logging has an immediate effect on N_2 fixation, it impaired symbiotic N_2 fixation and a marked decline in glutamine concentration in xylem bleeding sap in soyabean (*Glycine max* L.).Effect of water stress at pre-flowering stage were studied by Garg *et al*. (2001)in three genotype (RM0 40,Maru Moth and CZM -32E)of moth bean [*Vigna aconitifolia* (jacq) Marechal] . Increasing water stress progressively increased contents of reducing sugar,total soluble sugar, free amino acids and free proline which favours present study of moth where increase in different parameters occur with increase in water stress. However, gradual decrease was also observed in plant water potential, leaf area, net photosynthetic rate, starch and soluble protein contents and nitrate reductase activity. Effect of irrigation levels and intervals on groundnut (*Arachis hypogea L.)* Cultivars under drip system studied by [19] and they concluded Alternate day irrigation intervals gave higher dry matter content ,crop growth rate, pods plant-1(43.55),Kernels pods-1 (2.36),pods yield(2993 kg ha-1),hauls yield (3986 kg ha-1),biological yield (6980 kg ha 1,test weight (443.22 g) compared to 3 days irrigation intervals.[20] studied growth and productivity of lentil under different irrigation intervals and sowing methods. For this two- factor split plot used , crop was sown by three sowing methods: flat bed and ridge and with four different irrigation levels I: one irrigation, 60 days after sowing (DAS),I:two irrigation 30,40,60 and 80 DAS. Result indicated that ridge sowing methods and three. Irrigation levels are an important practice to get the maximum yield of lentil crop grown in semi - arid conditions.

CONCLUSION

P. aconitifolius cv. RMO 40 is a most resistant variety , therefore the effect of irrigation intervals on germination and growth parameters of only *Phaseolus aconitifolius* cv. RMO 40 was carried out.In the present study Irrigation intervals of 24,48,72 and 96 hours and waterlogged conditions were used. 24 hr. irrigation interval acted as control. Increased irrigation intervals i.e. 72 hr. and 96 hr. led to superior result over the control. The highest value of growth parameters was observed in 96 hr. Besides this, it can be concluded from the present work that for the best growth of moth crop there should be with proper irrigation of 96 hr interval. Lastly these results could not always be compared directly with those obtained elsewhere because the conditions of the experiments are often quite different. There is obviously a need for the further experimentation on this subject. Other factors which also need to be considered are the effect of soil pH, especially on organic matter levels, effects on air pollutants on the whole surface of the plant, effect of sowing depth, temperature on moth crop and also theeffect of various factors on flowering and fruiting.

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