Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 7 [7] June 2018 : 45-47

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Gamma Radiation Effects On Root, Shoot Length and Percent Germination Of Alfalfa (*Medicago sativa* L.)

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ABSTRACT
Alfalfa (Medicago sativa L.) is one of the most important forage crop. Commonly it is called as Lucerne and is a perennial flowering plant belonging to family Fabaceae. It is extensively cultivated in Maharashtra as a fodder crop and also having a medicinal value. Alfalfa is rich in protein, calcium, vitamin B, C, D, E, K and other minerals. Alfalfa is also source of chlorophyll. Gamma radiation is one of the physical mutagen that widely used for mutation breeding and medicinal healing. In the present investigation, the seeds of alfalfa were irradiated to gamma radiation for 05 KR, 20 KR, 35 KR, 50 KR and 65 KR as different doses to study induced genetic variation. Germination trades were carried out following ISTA rules and observations for percent germination, root and shoot length calculated. The percent seed germination after 08 days was enhanced in 05 KR (84%), 20 KR(86%), 35 KR(89%), 50 KR(92%) and 65 KR(96%) Treatments as compared to control (71%). The result showed variation in shoot and root length as compared to control.
Key words *– Alfalfa, Fodder, Gamma radiation, percent seed germination.*

Received 11.04.2018 Revised 21.05.2018 Accepted 01.06. 2018

INTRODUCTION

Gamma rays are categorized in ionizing radiation because these radiations produce free radicals in the cell when they interact with atoms or molecules. These free radicals damage the cell, but sometimes modify the cells and components. Damage or modification of the cells and components depends upon the level of radiation. These radiations cause changes in the physiology, morphology, anatomy, and biochemistry of the plants [1-5]. Gamma sources are used to irradiate a wide range of plant materials, like seeds, whole plants, plants parts, flowers, anthers, pollen grains and single cell culture and protoplast. Radiations have been used successfully to induce useful mutation for plant breeding. The concentration of the mutagenic treatment called enhances the biochemical components, which are used for improved economic characters [4-5, 8]. Gamma radiation can induce useful as well as harmful effects on crops so there is a need to predict the most beneficial dose for improvement of specific traits of crop plants [6].Genetic variability can also be increased by inducing mutations with ionized radiations. Genetic diversity of mutant lines can be monitored using morphological,agronomic and molecular characterizations. In addition,the effectiveness of gamma radiation in improving plant growth, seed quality, cooking time and physiological processes is highly related to the level of doses used.

Alfalfa is one of the oldest cultivated fodder crops in the world. It is often grown in fields by farmers for pasturage and forage. *Alfalfa* is an herbaceous perennial; its botanical name is *Medicago sativa* Linn. and it belongs to the family of Leguminosae. Alfalfa is a good source of protein and is rich in vitamins and minerals [4]. It contains chlorophyll, organic acids, saponins, isoflavins, sterols, coumarins, alkaloid and minerals like Calcium, potassium, phosphorus, Magnesium and zinc [9]. The objective of present study is to study the effect of gamma radiation on Alfalfa seedlings.

MATERIALS AND METHOD

Plant materials:

Experimental plant material selected for the present investigation was Alfalfa commonly known as Lucerne [*Medicago sativa*(L.), Var.: RL-88].Germplasm (seeds) of this variety was procured from Fodder

improvement Division of Mahatma Phule Agricultural University, Rahuri (Ahmednagar district, Maharashtra state, India). The cultivar is desi type, commercially and widely cultivated in the area of Ahmednagar district of Maharashtra.

Gamma radiation:

The source of gamma radiation used in the investigation was cobalt 60(^{60}CO). The facility available at the Department of Biophysics, Government Institute of Science Aurangabad (M.S. India) was availed. The doses employed were 5KR,20KR,35KR,50KR and 65KR. Dry, uniform 50 gm. seeds of Alfalfa were irradiated with different doses of gamma radiation (5KR,20KR, 35KR,50KR and 65KR). Untreated seeds with gamma radiation were used as control.

Experimental Setup

In order the study of gamma radiation on alfalfa seeds as a test plant between paper methods (Rao *et al*. 2006) was used, for this experiment equal sized 100 healthy seeds were used in each doses like a 5KR, 20KR, 35KR, 50KR and 65KRand control. The seeds were germinated between two layers of germination paper either by loosely covering the seeds with an additional layer of germination paper by placing the seeds into folded envelops which may be placed in flat or upright position or by placing the seeds in rolled towels. The rolls should be placed in an upright position. These can then placed. Seeds containing germination paper placed at 22^{0}C temperature. The germination paper was kept moist by regular addition of tap water for control seeds and treatment seeds. The germination percentage was recorded on 8 days. Then measuring growth parameters. The growth parameters including the root length, shoot length, Total height, and Germination percentage were calculated. The final Percent seed germination was calculated using following formula.

$$\text{Percent germination} = \frac{\text{No. of seed germinated}}{\text{Total No. of Seeds}} X\ 100$$

After eight days shoot and root length were recorded.

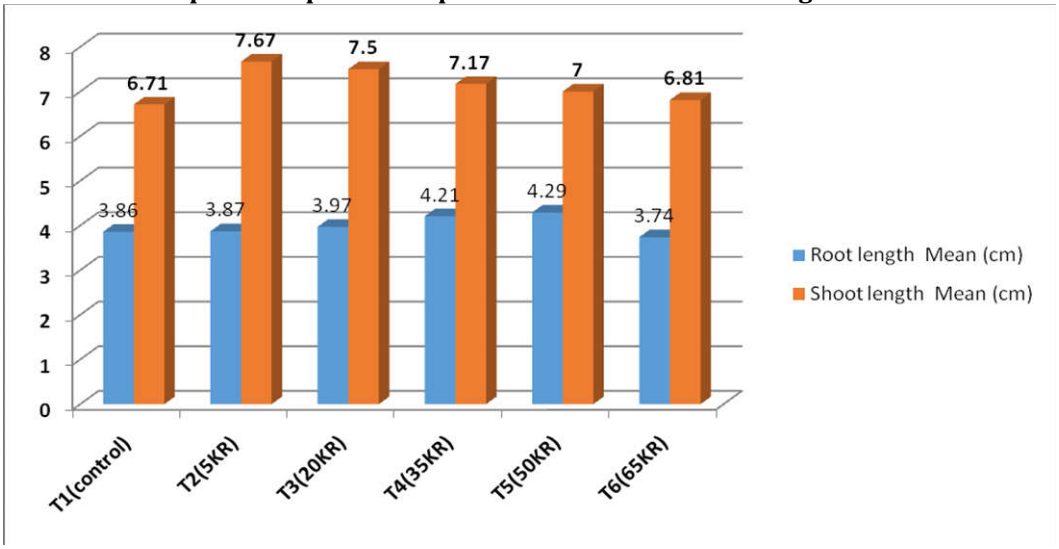
RESULT AND DISCUSSION

Effect of gamma radiation on root and shoot length:

Table 1: Effect of gamma radiation on seedling growth of Alfalfa.

Radiation Doses	Root length Mean (cm)	Shoot length Mean (cm)	Total Seedling Height (cm)	Percent Germination
T1(control)	3.86	6.71	10.57	71%
T2(5KR)	3.87	7.67	11.54	84%
T3(20KR)	3.97	7.50	11.47	86%
T4(35KR)	4.21	7.17	11.38	89%
T5(50KR)	4.29	7.00	11.29	92%
T6(65KR)	3.74	6.81	10.55	96%

Graph 1: Graphical comparison of Root and Shoot length of Alfalfa.



Effect of gamma radiation on seed germination:

Results revealed significant effect of radiation doses on germination percentage (Table 1).The higher doses of gamma radiation increased germination percentage when compared with control and lower doses. The highest germination percentage was obtained by 65 KR. Germination percentage was increased from lower to higher radiation doses ranging from 5KR to 65KR as compared to control. These results were in accordance with the germination test done by Akshatha *et.al* .The results of Kiong *et.al* [7] have shown that survival of plants to maturity depends on the nature and extent of chromosomal damage. Increasing frequency of chromosomal damage. Increasing frequency of chromosomal damage with increasing radiation dose may be responsible for less germ inability and reduction in plant growth and survival.

Effect of gamma radiation on Root and Shoot length:

Gamma rays imposed significant impact on the shoot length. The highest length of shoot was observed in 5KR.By increasing radiation dose to 20, 35, 50 and 65KR shoot length declined respectively compared to the control (table-1).These results were in accordance with the shoot length measured by A. Borzouei *et.al*. Result showed that radiation and interaction of radiation imposed a significant effect on root length (table-1).Maximum root length was observed in 50 KR as compared to control and higher dose of radiation 65KR.Total seedling length was also decreased with increasing gamma radiation doses as compared to control. The symptoms frequently observed in the low or high dose irradiated plants are enhancement or inhibition of germination, seedling growth, and other biological responses [9].

In the present study ,the variability as measured by mean values of root/shoot length increased with increase in the radiation dose and shoot length decreased with increase in the radiation dose.

CONCLUSION

The results of the present study revealed that the higher doses of gamma radiation increased germination percentage and root length and lower doses of radiation may facilitate better shoot length as compared to control.

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CITATION OF THE ARTICLE

R D Borse and M D Kakade. Gamma Radiation Effects On Root, Shoot Length and Percent Germination Of Alfalfa (*Medicago sativa* L.). Bull. Env. Pharmacol. Life Sci., Vol 7 [7] June 2018 : 45-47