

Study of Impact of He-Ne Laser Treatment on Fungal Infection and Electrical Conductivity of Soybean Seeds

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Abstract : The present investigation was to detect and identify seed borne fungi associated with soybean seeds and electrical conductivity of seed leachate. Seeds were surface sterilized by distilled water then irradiated by He-Ne laser with wavelength 632.8nm for exposure time duration was 2, 4, 6, 8, 10, 12 minutes. Seed borne fungi associated with soybean were detected using blotter method. Exposure with He-Ne laser gave significant results in decreasing seed borne fungi and electrical conductivity also decreased.

Key Words - Laser irradiation, soybean, fungi and electrical conductivity.

I. INTRODUCTION

Soybean (*Glycine max L.*) as one of the most important crops in the world, not only as an oil seed crop but also as a good source of protein for the human diet [1]. The growing need for ecological agricultural products together with the increased demand of crop for food production as well as for other branches of industry is need more research on this field. Sustainable agriculture is a management system for renewable natural resources for food production income for present and future generations, maintaining and improving in productivity and the ecosystem [2]. The last 50 years different chemical additives and pests are used to developed high successful farm system but their application causes the contamination of raw materials in food production with toxins and decrease soil yield capacity [3-4]. Low yield of soybean production in India is mainly due to seed borne fungi have been found to affect the growth and production of crop plants. The necessity for searching new, safer technique for raising agricultural product without using chemicals and pest is very important in the present day [3,5]. The various authors in the world provide possibility of the influence of physical factors as magnetic field, microwave and laser radiation are useful for increasing the internal energy and development of resistance to fungal disease [6].

Laser irradiation is considered as a new branch in agriculture. This work aimed to study the effect of laser irradiation on seed borne fungi and electric conductivity of JS-335 soybean seeds. Soybean is the most important commercial crop playing a key role in economical and social aspect of world continues to be acclaimed as king of oil seed.

II. MATERIAL AND METHODS

A. Seed Materials

Soybean seeds (*Glycine max L.*) is used in this work were supplied by college of agricultural engineering and technology, Marathwada Krishi Vidyapeeth, Parbhani, India. The experiment were carried out at the department of physics, Shri Shivaji College, Parbhani.

B. Treatments

Continuous laser irradiation at $\lambda = 632.8\text{nm}$ was obtain from He-Ne and intensity of beam is 5mW/mm^2 . Twenty five soybean seeds were exposed by laser. The exposure time duration was 2, 4, 6, 8, 10, 12 minutes. Selection of seeds is one of the important part for treatment, it should be well developed with intact seed coat, same size, same weight for each exposure time [7]. Before irradiation seeds were washed by distilled water. The irradiation treatment of the seeds was performed in the dark room to avoid the influence of the Sun rays.

C. Detection and Identification of Seed Borne Fungi

Seed sample were analyzed for the detection of seed borne fungi by blotter method following International Rules for Seed Health Testing.

Blotter Method

The seed mycoflora was isolated by standard blotter paper method. This is simple, convenient and efficient method. In this method, three pieces of filter paper were soaked in sterilized distilled water and placed in the bottom of 9 cm diameter petri dish. Soybean seeds sample from each batch were taken randomly and then placed on the moist filter paper at the rate of 25 seeds per petri dish. The petri dish was then incubated at 25°C for seven days under 12 hour alternating cycle of light and darkness. After incubation, the seeds were examined under microscope for recoding the seed borne fungal infection grown on the incubated seeds.

D. Electrical Conductivity Test

A seed sample of 10gm was sterilized with distilled water for 2-3 minutes. The clean sample was immersed in 100ml of water at $25\pm 10^\circ\text{C}$ temperature for 10-12hr. After that the seeds were removed by a clean forcep. The steep water left was decanted and was termed as leachate. The conductivity meter was warmed about 30 minutes before testing by deeping in distilled water. First the conductance of distilled water was measured, then leachate was measured. The formula for calculate the electrical conductivity of seed extract was as follows.

$$\text{E.C.} = [\text{Actual E.C. meter reading} - \text{E.C. of distilled water}] \times \text{Cell constant factor.}$$

III RESULT AND DISCUSSION

The results on the percentage infection of seed borne fungal of JS-335 soybean seeds obtained are shown in table 1. The results showed that total 37% of seeds were infected by fungi in which maximum 35.5% occurrence of *Aspergillus niger* and lowest 15.5% of *Aspergillus flavus* were recorded under controlled conditions. Further for 12 min. Laser irradiation only three fungal species were recorded, they are *Alternaria Alternata* 16%, *Aspergillus niger* 15% and *Curvularia lunata* 06%. For higher dose of Laser irradiation, percentage of infection of fungi was decreased.

Table 1. Seed borne Mycoflora of JS-335 Soybean Seeds.

Sr. No.	Name of fungi	Percentage of Seed infected						
		Controlled	Irradiation Time					
			2min.	4min.	6min.	8min.	10min.	12min.
1	<i>Alternaria Alternata</i>	33.5 (37)	33.5 (35)	29 (32.5)	24 (27.5)	18.5 (22)	18 (19.5)	16 (17)
2	<i>Aspergillus flavus</i>	15.5 (37)	13.5 (35)	13.5 (32.5)	08 (27.5)	6.5 (22)	-- (19.5)	-- (17)
3	<i>Aspergillus niger</i>	35.5 (37)	34 (35)	32.5 (32.5)	24.5 (27.5)	20.5 (22)	19.5 (19.5)	15 (17)
4	<i>Curvularia lunata</i>	26 (37)	22 (35)	18 (32.5)	16.5 (27.5)	16 (22)	10.5 (19.5)	06 (17)
5	<i>Penicillium citrinum</i>	18.5 (37)	17 (35)	14.5 (32.5)	9.5 (27.5)	7.5 (22)	04 (19.5)	-- (17)

Electrical Conductivity

Conductivity testing of seeds is applied in the context of electromotive measurements regarding the ability to conduct electric current directly on seed or seed steep water. The electromotive measurement values obtained with test seed lot were compared with those of the standard seed lots, and the vigor and viability status of the seed lot is predicted. Table 2 shows the effect of Laser irradiation on the electrical conductivity of seed leachate of JS-335 Soybean seeds. We observed electrical conductivity of seeds where controlled seeds show $9.31\mu\text{S.Cm.}^{-1}\text{gm.}^{-1}\text{ml.}^{-1}$, for 2min. irradiation 8.19, for 4min. irradiation 7.32, for 6min. irradiation 6.15, for 8min. irradiation 5.62, for 10min. irradiation 4.99 and for 12min. irradiation $4.51\mu\text{S.Cm.}^{-1}\text{gm.}^{-1}\text{ml.}^{-1}$ Figure 1 shows that as irradiation time increases, electrical conductivity goes on decreasing. Weakening of cell membrane is poor vigour seeds causes leakage of water soluble compounds like sugar, amino acids electrolytes etc. when immersed in distilled water. It was seen that irradiation time increases, electrical conductivity goes on decreasing. It means that less water soluble compounds leakage for more time of irradiation.

Table 2 Electrical Conductivity of Seed Leachates for Different Exposure time of Laser on JS-335 Soybean Seeds.

Sample	Actual meter reading (mS)	Calculated E.C. ($\mu\text{S.Cm.}^{-1}\text{gm.}^{-1}\text{ml.}^{-1}$)
Controlled	1.97	9.31
2min.	1.74	8.19
4min.	1.56	7.32
6min.	1.32	6.15
8min.	1.21	5.62
10min.	1.08	4.99
12min.	0.98	4.51

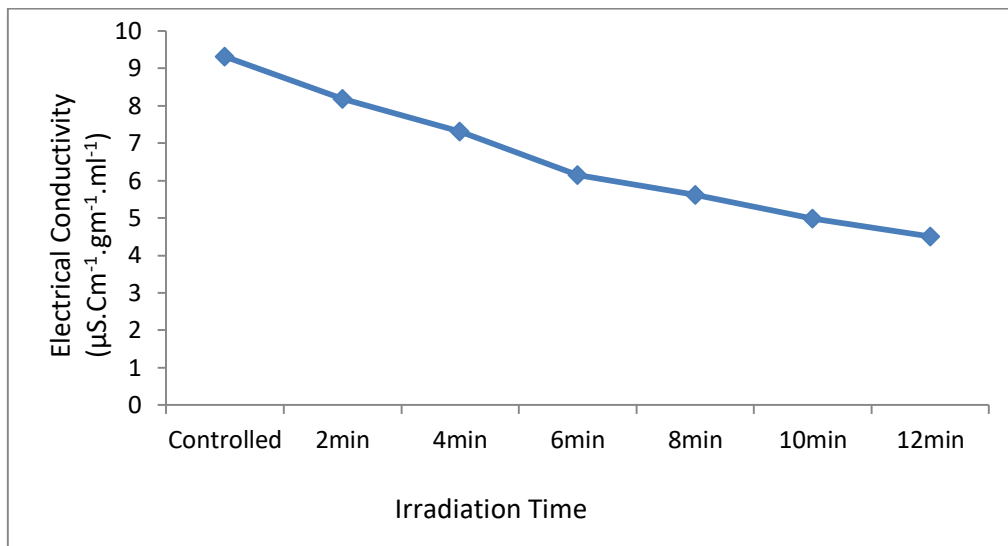


Fig. 1 Electrical Conductivity of Seed Leachates for Different Exposure time of Laser on JS-335 Soybean Seeds.

IV CONCLUSION

Present study was concluded that irradiation of He-Ne laser reduces seed born pathogen and electrical conductivity value. Due to laser irradiation leakage of water soluble compounds like sugar, amino acids electrolytes etc was decreases.

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