



EFFECT OF MICROWAVE ON GERMINATION OF *Helianthus annuus* SEEDS

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ABSTRACT:

Microwaves are electromagnetic waves with wavelengths ranging from as long as one meter to as short as one millimeter. Microwaves may have both positive and negative effects on crops. This paper proposes a technique to enhance the growth rate of crops; particularly Sunflower seeds (*Helianthus annuus*). The investigations were carried out with Sunflower seeds exposed to microwaves for different time durations. The growth of the plants was studied for ten days. The other control variables such as temperature, humidity & sun light were maintained almost constant for all the observations. The

analysis of the results shows that seeds exposed for proper duration show better growth rate in comparison to the natural growth procedure.

KEYWORDS: Soil, microwave (MW) effects, Sunflower.

INTRODUCTION:

Wireless telecommunication devices increased the exposure of radio and microwave frequencies in the environment. Depending on the power level, frequency, exposure duration, pulsed or continuous wave can damage the exposed tissues [1]. Recent studies show that microwave has a long term effect on living things. Microwaves have ability to produces changes in the cell membrane's permeability. It also affects the cell growth rate as well as interaction with ions and organic molecules, like proteins. In our



ecosystem, plants which are grown from seeds are essential components of a healthy diet. Therefore it would be necessary to investigate their interaction with increased exposure to radio and microwave frequencies [2]. Sunflower and its germination rate have been observed under various natural environmental factors. The effect of microwaves on its seeds has been reported. The objective of this paper is to investigate the changes in growth rate and germination of Sunflower seeds after exposed to microwaves for various time duration.

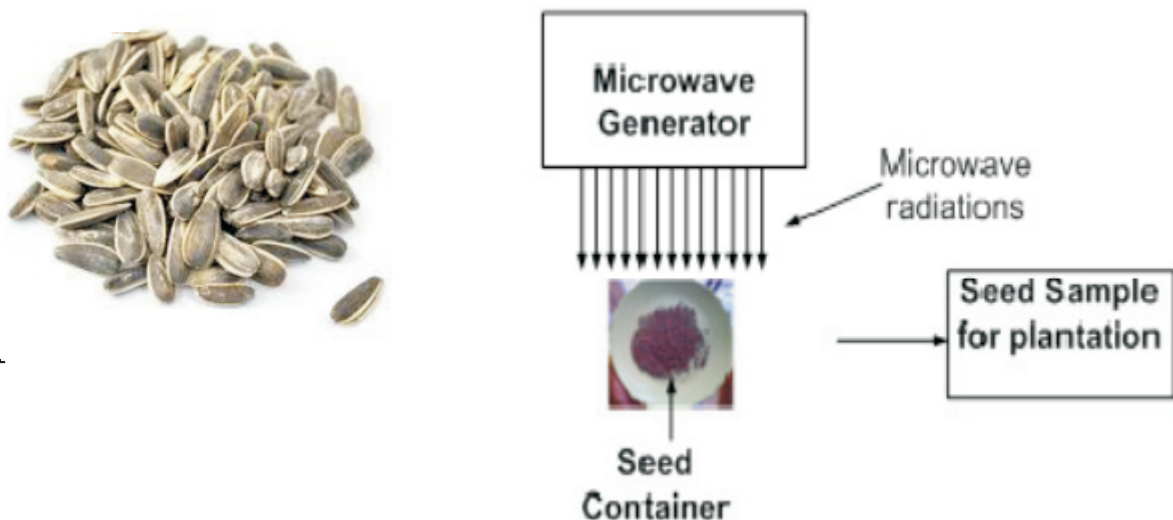


Fig. 1

Fig. 2

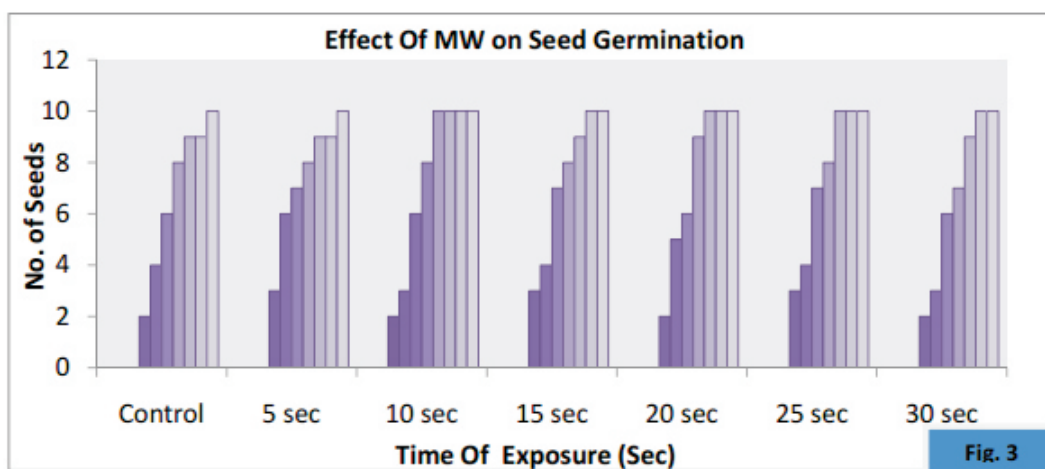
II. METHODOLOGY:

A household type microwave was used to carry out this study. The Sunflower seeds were kept under moist conditions for 24 hrs to help trigger germination process. Then they were exposed to microwaves for different durations of 5 s, 10 s, 15 s, 20 s, 25 s & 30s and microwaves power levels were maintained at minimum. The exposed seeds were sown in different pots and kept under control conditions for ten days. Each sample was observed with respect to change in length of shoot, no. of roots & length of roots of the plants. Experimental setup is shown in Fig. 2. Germination was said to have occurred when the radical was visibly extended beyond the surface of seed. Number of seeds germinated each day was counted.

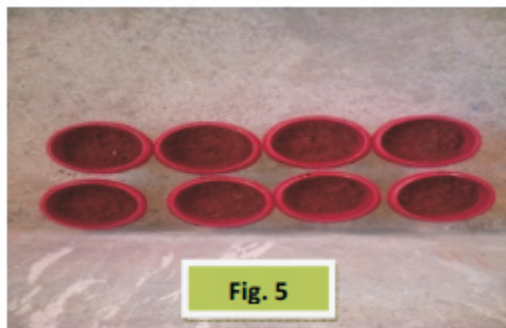
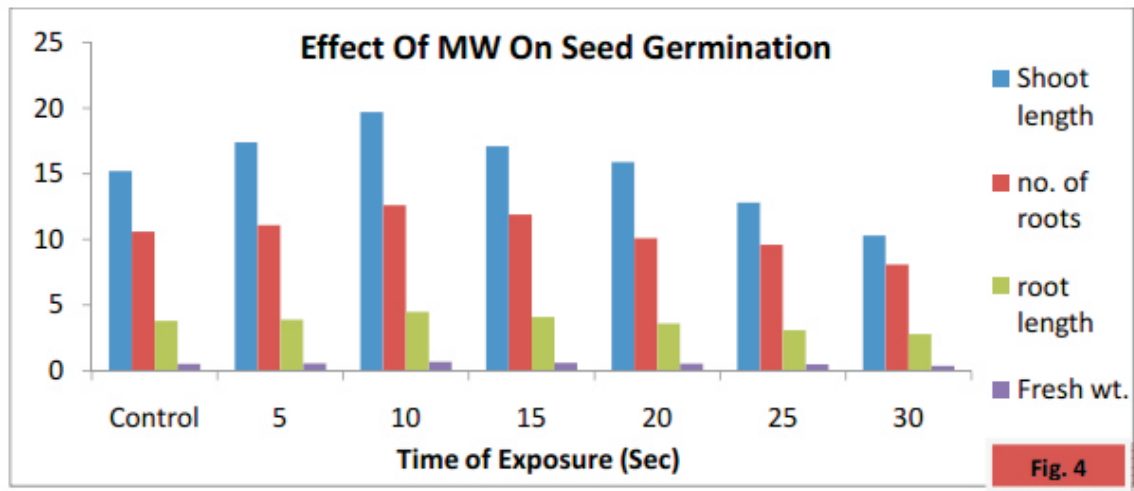
III. RESULTS AND DISCUSSION:

The results of germination of seeds, measurements of the length of shoot, no. of roots, length of roots & fresh wt. of the plants are shown in Table 1 & Fig. 3 and Table 2 & Fig. 4. These values were taken as mean values of the length of ten plants grown in each pot. Plumule formation was seen on 6th day. As the exposure duration increases, increase in the germination of seeds, measurements of the length of shoot, no. of roots & length of roots of the plants of plant is observed up to 10 s. For exposure durations more than 10 s, the microwaves affect the seeds very badly. If the duration of the microwaves is increased above 10 s, the seeds do not grow properly. The image of the plants in initial state is shown in Fig. 5 and the image for the final state is shown in Fig. 6.

| No. of Days | Microwaved treated seeds | | | | | | |
|-------------|---|--------|---------|---------|---------|---------|---------|
| | (No. of seeds Germinated/day out of 10) | | | | | | |
| | Control | 5 secs | 10 secs | 15 secs | 20 secs | 25 secs | 30 secs |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 4 | 2 | 3 | 3 | 3 | 2 | 3 | 2 |
| 5 | 4 | 6 | 6 | 4 | 5 | 4 | 3 |
| 6 | 6 | 7 | 8 | 7 | 6 | 7 | 6 |
| 7 | 8 | 8 | 10 | 8 | 9 | 8 | 7 |
| 8 | 9 | 9 | 10 | 9 | 10 | 10 | 8 |
| 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |



| Table 2 | Shoot Length | No. Of Roots | Root Length | Fresh Wt. |
|---------|--------------|--------------|-------------|-----------|
| Control | 15.2 | 10.6 | 3.8 | 0.54 |
| 5 | 17.4 | 11.1 | 3.9 | 0.58 |
| 10 | 19.7 | 12.6 | 4.5 | 0.68 |
| 15 | 17.1 | 11.9 | 4.1 | 0.61 |
| 20 | 15.9 | 10.1 | 3.6 | 0.55 |
| 25 | 12.8 | 9.6 | 3.1 | 0.49 |
| 30 | 10.3 | 8.1 | 2.8 | 0.37 |



REFERENCES:

1. Raha, L., Mishra, S., Ramachandran, V., and Bhatia, M. S., "Effects of low-power microwave fields on seed germination and growth rate," *Journal of Electromagnetic Analysis and Applications*, Vol. 3, pp. 165-171, 2011.
2. Ungureanu, E., Maniu C. L., Smaranda, and Cretescu, V. I., "Consideration on the peroxidase activity during hippophae rhamnoides seeds germination ex-posed to radiofrequency electromagnetic field influence," *Analele stiintifice ale Universitatii, Alexandru Ioan Cuza, Sectiunea Genetica si Biologie Moleculara*, pp. 29-34, 2009
3. Investigation of the Effect of Microwaves on Mustard Seeds Fertility Akhil Gupta¹, Randhir Singh¹, Jang Bahadur Singh², Parveen Lehana²
4. Effect of Different Microwave Doses on *Vicia faba* Germination, Growth and Genetic makeup
5. Effect of Low-power Microwave Radiation on Seed Growth Rate M. Fuangs foong, K. Eaipresertsak, T. Chim-Oye, and K. Dungka