

# Effect of Physical and Chemical Mutagenesis in Sunflower [*Helianthus Annus L.*] on Seed Germination through Induced Mutation

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**Abstract:** Sunflower [*Helianthus annus L.*] is an annual plant belongs to the compositae (Asteraceae) family. During present studies, the seed of sunflower varieties "Bhanu"; and "SS-56" were treated with different concentrations of chemical mutagens (0.05%, 0.10% & 0.15% for EMS and 0.01%, 0.02% & 0.03% for SA). The physical Mutagens like Gamma rays were used @ 10KR, 20R & 30 KR. After sowing in Petridis it was found that both varieties of sunflower responded differentially to EMS and Gamma rays treatments in respect of seed germination.

**Keywords:** Sunflower, Induced mutation, Seed germination

## 1. Introduction

Sunflower [*Helianthus annus L.*] is one of the most important oil crops & is cultivated at 23 million hectare (faostat.fao.org.2009) in more than 70 countries all over the world (de Rodriguez et al., 2002; Simic et al., 2008).Sunflower is an annual herbaceous crop that is propagated by seed only (KPI Inoka & Nilanthi Dahanayake). Investigation of Seed germination is performed in optimal and control laboratory conditions. The main aim of these investigations was to calculate percentage of seed germination through induced mutation [Jelena S. et al.]Seed germination is a mechanism in which morphological & physiological alternations result in activation of the embryo. Before germination seed absorbs water, resulting in the expansion and elongation of seed embryo (Mohammad Miransaris, D.L.Smith)

## 2. Materials and Methods

The physical mutagen (gamma rays) and chemical mutagen [EMS-Ethyl Methanesulphonate & SA (Sodium Azide) were employed as mutagens during present studies. Seeds were irradiated with Gamma rays from Govt. Institute of Science, Caves road, Aurangabad (MS), India.

The seed of sunflower Bhanu and SS-56 cultivars were collected from dry farming research station, Solapur 413002(MS) India. The seeds treated with different doses of gamma rays viz. 10,20,30 kR, and EMS viz 0.05%,0.20%,0.15% & SA(Sodium Azide) viz. 0.01,0.02,0.03% along a control.

The treated seeds were presoaked in distilled water for 6 hrs. at room temperature followed by six hour immersed in mutagenic solutions. These seeds were thoroughly washed under running water for 4 hrs. A set of 300 seeds from each treatment were sown in randomized blocked design [RBD] with three replications along with control for rising M1 generations during Rabi 2016. The seeds were sown at the distance of 15cm in line and 30 cm between the rows. The experiments were conducted in botanical Garden at Dr.

Babasaheb Ambedkar Marathwada University Aurangabad (MS) India. Recommended Agronomic practices were employed for preparation of field sowing and subsequent management of other population.

### Seed germination %

Seed germination % was recorded at 10<sup>th</sup> day after sowing in Petri dishes for pilot experiment.

$$\text{Seed germination \%} = \frac{\text{No. of Seed Germination}}{\text{No. of seeds sown}} \times 100$$

Statistical data were calculated using the following formulae:

$$\text{Mean} = \frac{\sum X}{n}$$

$$\text{Variance} = \left( \frac{\sum X^2}{n} \right) - X^2$$

$$\text{Std. Deviation (SD)} = \sqrt{\text{Variance}}$$

$$\text{Standard Error (SE)} = \frac{SD}{\sqrt{N}}$$

## 3. Results and Discussion

During present studies effect of the different doses or concentrations of gamma rays, sodium azide and EMS treatment on percentage of germination of BHANU & SS-56 varieties of sunflower was calculated. The percentage of seed germination in the control as well as in the treated plants of sunflower. They analysis of variance revealed significant differences among treatment intensities on germination. In sunflower seed the maximum number of seed germination as noticed on 10<sup>th</sup> day after sowing in both varieties, namely Bhanu and SS-56. In control the germination percentage calculated was 90% in Bhanu and 98% in SS-56 respectively. The findings of the inhibitory of chemical mutagens in the present study on reduction in seed germination were notified for further studies. The seed germination could be distinctly seen in variety Bhanu in

variety in SS-56 on the other hand a mixed pattern of simulation/inhabitation could be noticed in the gamma rays, EMS & SA treatment. (Ganesh B.et.al)

EMS treatment revealed a gradual increasing trend in germination from higher to lower doses in SS-56 varieties. The germination ranged from 90 to 94 % in SS-56 varieties. On the other hand decreasing trend in germination from lower to higher doses in Bhanu varieties was noticed. The percentage of germination was in range within 96 to 90% in Bhanu variety of sunflower.

The SA treatment resulted in reducing seed germination percentage at all its concentration in variety of SS-56. At (0.03%) concentration, seed germination percentage noticed was 68% but decreasing trend in germination from lower to higher doses in SS-56 variety. The germination percentage ranged from 68 to 72%. On the other hand, in the variety Bhanu with (0.02%) concentration very low seed germination percentage (66%) was recorded. Doses such as (0.01% & 0.03%) are higher than (0.02%) and percentage of germination was 68% & 70% respectively.

In present studies reduction or stimulation in seed germination might be due to the effect of mutagens on the meristematic tissues of the seed (L.K.Sharma et. al.). The decrease in the seed germination at the higher doses/concentration of the mutagens may be attributed to disturbances at cellular level (caused either at physiological level or physical esculentus) germination percentage generally decreased with increasing doses/concentrations of gamma rays and ems reduced germination percentage with increasing doses of gamma radiations has also been reported in Pinus (Thapa 2004), Rye (Akgun & Tosum, 2004) & chickpea (khan et al., 2005 & Toker et al., 2005).

Germination indicated as an inhibitory feature at all the three concentrations of mutagen treatment of Gamma ray to the variety SS-56. In variety Bhanu except middle concentration (20KR) at the remaining two concentrations (10KR & 30KR) the germination percentage showed inhibitory effect and which was ranged from 90% to 98 % in SS-56 & 92% to 94% in Bhanu varieties.

In the present investigation it was found that the two varieties of the sunflower responded differentially to EMS and Gamma rays treatments in respect of seed germination. In the present investigation (0.05%) EMS, (10KR) Gamma ray is same germination percentage (96%) and (20KR) Gamma ray in variety of Bhanu could be due to less damage of all cell material and the resultant differential chemo sensitivity feature. On the other hand SS-56 variety of sunflower the gamma ray (10KR) and (20KR) is the damages less to cell material (Navnath G. Kashid and Mukund P. Kulthe).

The mutagenic treatment of gamma ray caused considerable reduction in seed germination. Observations were recorded by Badere R.S. and Choudhary (2007) in Lentil, Biradar (2004), Shinde (2007) in pigeonpea.

#### 4. Conclusion

Morphological and physiological alternations result in activation of the embryo and germination of seed takes place. Productivity of crop plant is based on health of seeds. Mutation helps alteration of genome and results in mutated strains which may superior than their stock. To check possibility of alteration present piece of work will be helpful in future.

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**Table 1:** The effect of mutagens on seed germination in sunflower [*Helianthus annus L.*]

VARIETY SS-56		
Mutagen	Dose/ Concentration	Germination (%)
CONTROL	-	98.00
EMS (%)	0.05	90.00
	0.10	92.00
	0.15	94.00
SA (%)	0.01	72.00
	0.02	70.00
	0.03	68.00
GAMMA RAYS	10KR	98.00
	20KR	95.00
	30KR	90.00

+/-SE = 2.09

**Table 2:** The effect of mutagens on seed germination in sunflower [*Helianthus annus L.*]

VARIETY BHANU		
Mutagen	Dose/ Concentration	Germination (%)
CONTROL	-	90.00
EMS (%)	0.05	96.00
	0.10	92.00
	0.15	90.00
SA (%)	0.02	70.00
	0.02	66.00
	0.03	68.00
GAMMA RAYS	10KR	96.00
	20KR	94.00
	30KR	92.00

+/-SE = 2.19

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