Trends in Life Sciences
An International Peer-reviewed Journal
www.sciencejournal.in

EFFECT OF GAMMA RAYS AND NITROSO METHYL UREA ON SEED GERMINATION, SEEDLING HEIGHT AND SURVIVABILITY OF CHICKPEA (*CICER ARIETINUM L.)* VAR. RSG-963

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ABSTRACT
Separate and simultaneous effect of gamma rays and NMU on seed germination, seedling height and survivability of Chickpea plants has been under taken in the present study. The current variety of chickpea was subjected to different doses of gamma rays (5 KR, 10 KR and 15KR) and 0.02% NMU. The effect of mutagens was observed in the percentage of seed germination, seedling height at 15th day and survivability at 25th day of sowing. From the results, it was observed that, the percentage of seed germination and seedling height was reduced at 15th day and survivability was also significantly decreased with the increasing doses of gamma rays as well as combined doses of gamma rays and NMU. But doses of 15 KR gamma rays and 15 KR gamma rays + NMU were more effective.

KEYWORDS: Gamma rays, NMU, Germination, Seedling height, survivability.

INTRODUCTION

Cicer arietinum is an annual pulse crop that belongs to family Laguminoceae. The diploid chromosomes number has been reported 2n = 16 in the cultivar and its wild annual relatives (Ahmad, 2000). Food legumes are of prime important in human diet and animal feed contributing the major source of vegetable protein. Besides protein, they are also rich in carbohydrates, minerals and vitamins (Salunkhe *et al.*, 1985). Most of pulses contain 20 – 25 percent of protein in their dry seeds, which is 2.5 to 3.0 times more than the value normally found in cereals (Chaturvedi *et al.*, 2002). India is the largest producer of pulses in the world occupying an area of about 23.81 million hectares, with annual production of 15.11 million tons (project coordinators report 2002 – 2008, IIPR, Kanpur). Among the pulses chickpea is the second largest grown food legume of the world (Gaur *et al.*, 2001). It ranks third among pulses after beans and peas. Chickpea stands fifth among grain legumes and 19th among grain crops of the world. The traditional varieties of chickpea have low potentiality and restricted variability with respect to economic characters. Broadening the genetic base for crop improvement can be achieved through induced mutagenesis. The physical and chemical mutagens are being used in genetic improvement program of different plant species. Mutagens could be successfully applied to induce the genetic variability in *Lens culinaris* (Kumar *et al.*, 2003). Since chickpea is a self-pollinated crop, mutation breeding could be used for broadening the genetic base of total plant yield and yield contributing traits.

MATERIALS AND METHODS

Seed Treatment: Seeds of chickpea Var. RSG-963 were collected from National Seed Corporation, Bharatpur, Rajasthan. Dry, dormant and healthy seeds of *Cicer areitinum* (Var. RSG 963) were subjected to CO^{60} gamma irradiation dosage of 5 KR, 10 KR and 15 KR at the Nuclear Research Lab, IARI, New Delhi. A part of seeds from each irradiation treatment and a sample of unirradiated seeds were soaked in 0.02% NMU (Nitroso Methyl Urea) for six hours. A sample of untreated seeds was also used as a control. Thus there were eight treatment combinations including the control.

Seed germination: Total number of seeds germinated on the 15th day of sowing was counted for each treatment along with control and data was expressed in percentage.

$$\text{Germination (\%)} = \frac{\text{No.of seeds germinated}}{\text{No.of seeds sown}} \text{X100}$$

Seedling Height: Plant height on the 15th day was observed for all the mutagenic treatments along with control. This measurement shows retardation of height of the plant with effect mutagens.

Seedling Survival: Seedling survival after 25 days of sowing was counted and survival percentage was calculated.

$$\text{Seedling Survival} = \frac{\text{No.of seedlings survived}}{\text{No.of seeds germinated}} X100$$

RESULTS

The effect of gamma rays and NMU on germination percentage, seedling height and survivability are presented in the table below.

Table 1. Effect of gamma rays and NMU on percentage of seed germination, reduction in seedling height and survivability.

Mutagens	Treatment	Germination percent	Seedling height	Survival percent
Gamma rays	5 KR	88	14.00 cm	81
	10 KR	83	12.80 cm	72
	15 KR	75	10.50 cm	69
NMU (0.02%)	0.02%	86	12.70 cm	76
Gamma rays +NMU	5 KR + 0.02%	74	11.50 cm	70
	10 KR + 0.02%	68	10.30 cm	65
	15 KR + 0.02%	62	9.20 cm	56
Control	-	97	15.50 cm	92

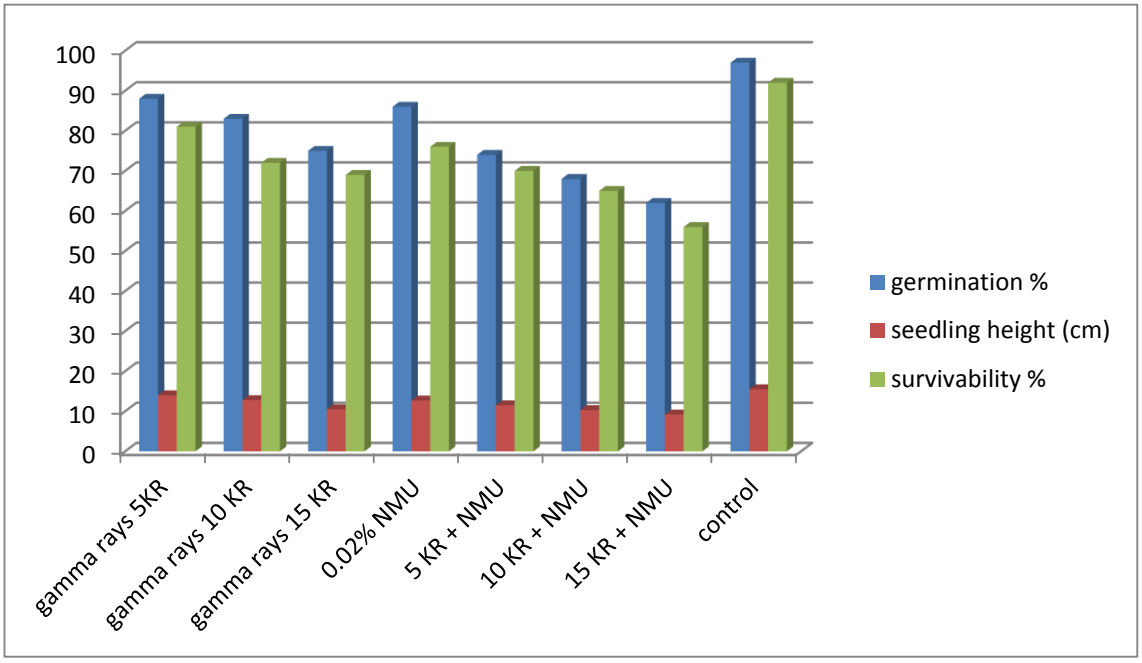

Figure 1. Effect of gamma rays and NMU on germination percentage, seedling height and survivability.

Seed germination: A significant reduction in germination of seeds was observed with the increase in doses of mutagens. It was detected that the percentage of germination was decreased in all the treatments than the control. Minimum seed germination was recorded in 10 KR + NMU and 15 KR + NMU treated seeds which were observed 68 percent and 62 percent respectively.

Seedling Height: Seedling height of plants of each treatment as well as of control was observed on 15th day of sowing. The height of seedlings was decreased with the increase in doses of mutagens. Maximum plant height of treated seeds was observed in 5 KR gamma rays (14 cm) and in NMU (12.7 cm). The plant height was ranged between 12.7 cm – 15.5 cm in control.

Seedling Survival: The data on survival of seedlings was noted on 25th day of sowing (table 1 and fig. 1). A significant difference was observed among the different doses of mutagens. Maximum survival percentage was observed in 5 KR of gamma rays (81%) and in 0.02% NMU (76%).

DISCUSSION AND CONCLUSION

Effect of mutagens on seed germination, seedling height and survival reduction can be measured in M_1 generation. Present observations revealed that the percentage of seed germination was decreased with the increase in doses of gamma rays alone or combined doses of gamma rays and NMU in chickpea. This is obvious that the increasing doses of mutagens have exerted an inhibitory effect on seed germination. Such doses dependent inhibition was of germination was obtained by Athwal (1963) in chickpea, Sharma (1965) in pea, Alikhan *et al* (1973), Sivajsamy (1976) and Chaturvedi *et al* (1982) in pigeon pea. Reduction in seed germination may be due to cytological and physiological process inhibited by mutagens during cell division. Such inhibitory effects with respect to increasing concentration / doses were also reported by Hakande (1992) in winged bean and Satpute (1994) in safflower. Higher efficiency at the lower doses of the mutagens appears mainly due to the fact that injury, lethality and sterility increases with an increase in concentration of mutagens than actual mutations (Kharkwal, 1998; Cheema *et al.*, 2003).

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