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Use of Mutation Breeding in Crop Improvement

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SUMMARY

The loss in natural genetic variability affected the selection of desirable traits which has become a severe issue in crop genetic improvement. The induction of mutation is now a significant tool to induce genetic variability in crops and can used as genetic markers. The efficiency of various induced mutagen dose or concentration in crops is evaluated by frequency of chlorophyll mutants in M2 generation.

INTRODUCTION

Evolution works through the heterogeneity produced by natural mutations and intensified by subsequent recombination of genes during sexual reproduction to bring about the evolution of new races and animals. In addition to natural mutations that occur naturally due to different forms of radiation and cosmic rays obtained from the sun and also released by certain radioactive elements, a variety of physical agents such as gamma rays and X-rays and several types of chemical agents belonging to a few identified classes, known as chemical mutagens, can also artificially induce mutations. Mutation breeding is the traditional technique of generating diversity by altering genes by causing mutations by physical or chemical mutagens and using the same effectively by elaborate methods of selection techniques in different generations for the improvement of a specific crop species for the desired objectives.

Experimental Materials

Treatment with Gamma rays: Uniform pure dry seeds with about 10 ± 1 per cent moisture varieties or genotype were exposed to different dose *Viz.,* 10, 20, 30 and 40 kR dose of gamma rays (CO60) with a dose rate of 2.39 kR per minute at Nuclear and Agriculture Division, B. A. R. C. Trombay, Mumbai-400 085 and the same number of untreated seeds of each variety served as control.

Treatment with EMS: The specificity of action of chemical mutagen depends upon particular condition of treatments, the more important of which are temperature and hydrogen ion concentration. In the course of present study, ethyl methane sulphonate solution was prepared by dissolving appropriate quantity of this chemical in phosphate buffer having a pH of 7.0 and final pH adjusted to 7.0 by adding few drops of normal NaOH.

Result on Chlorophyll Mutation Frequency

Chlorophyll mutation frequency expressed in M_2 seedling basis increased linearly with treatment doses of both the mutagens. The maximum mutation frequency (2.96% and 2.05%) was recorded with 20kR+0.2% EMS and 0.4 per cent of EMS treatment respectively. Where as in highest mutation frequency observed with 20kR+0.2% EMS and 0.4 per cent EMS mutagenic treatment. In general, the chlorophyll mutation frequency was higher in both the mutagens.

Spectrum of chlorophyll mutation in M_2 generation

Various types of chlorophyll mutations were induced by different mutagens *viz.,* gamma rays and ethyl methane sulphonate and their combination those obtained during M_2 generation immediately after emergence. Reveals the spectrum of chlorophyll mutations obtained in sorghum populations. The spectrum included albino, xantha, chlorina, xanthaviridis and viridis.

Albino: The albino seedling lacked chlorophyll pigment completely and were found almost white as well as relatively smaller in size. These types survived about 7-8 days and therefor ultimately die.

Xantha: The seedling leaves were distinctly yellowish to white in colour. In these mutants carotenoides were present but chlorophyll was absent. They survived for about 10-12 days and were found lethal in nature.

Viridis: The leaves of these mutants were yellow green to pale green in color and gradually changed to normal green. These mutants were viable and grew as normal plants.
Xanthaviridis: The leaves of xanthaviridis mutant were green with yellow apex. These mutants were viable.
Chlorina: The leaves of these type of mutants were golden yellowish to green colour and had shown lethal reaction after 15-20 days.

Chlorophyll Mutant.

Normal and Albino

Normal and Xantha Seedling

Normal and Viridis Seedling

Normal and Xantha Viridis

Normal and Chlorina

CONCLUSION

The frequency of chlorophyll mutation was found to depend not only on the type of mutagen and dose but also on the genotype constitution of the material used. The chlorophyll mutants does not any economic value due to lethal.

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