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# Determination of Effective Dose of Gamma Ray for Sugarcane Mutation

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## ABSTRACT

Five sugarcane varieties were treated with 2, 4 and 6 kr gamma ray to determine the working dose for inducing mutation in sugarcane. Effects of treatments were studied and compared with untreated materials in respect of germination, dwarfism, mortality, plant height before transplanting in the field. The results showed that with the increase of radiation doses germination(%) and plant height decreased while percent of dwarf plant increased significantly. No significant effects were observed on percent of dead plant and number of leaves. Highest dose (6 kr) was found to have damaging effect on the characters studied. On the basis of observation it appears that minor effects caused by 2 kr and 4 kr may produce desirable mutants.

## INTRODUCTION

Mutation breeding, a technique for improving crop characters, is a subject of controversy among plant breeders. In some countries the use of this technique is limited and declining. Still some sugarcane breeders are using the method to improve sugarcane varieties and mutation breeding has been used to produce non-flowering, disease resistant and high yielding mutants.

Rao *et. al.* (1966) developed a red rot resistant mutant of sugarcane by irradiating with gamma rays. Jagathesan (1973) conducted an yield trial with radiated mutants and reported some mutants to have early high sucrose and resistance to red rot. Rao (1973) reported two outstanding mutants which out – yielded parent varieties considerably. Some other quantitative effects of radiation induced mutation were reviewed by Roach (1974) who found that not all characters in sugarcane were affected to the same degree in the same direction. From the information available at present, it appears that mutation technique is useful for improving some deficiency or correcting some defects of an otherwise desirable variety. The present study was undertaken to determine the working dose of gamma rays for induction of mutation in sugarcane on the basis of initial effect of treatments.

## MATERIALS AND METHODS

Five sugarcane varieties Isd 16, Isd 5/55, B0 70, CP 57-614 and C0 527 were treated with gamma rays from the $Co^{60}$ source at the Bangladesh Institute of Nuclear Agriculture, Mymensingh in 1984.

Three doses viz., 2, 4 and 6 kr were used for the purpose. Check materials of each variety were also taken to Mymensingh to have same movement effect on all the materials. About 200 buds were treated by each dose. The buds after treatment were planted in sterilized soil press-mud media in PVC pipe individually. Data were taken after 100 days of plantation on germination, shoot mortality, dwarfness of plant, plant height and number of leaves per plant. Plant height and number of leaves were taken from 20 randomly selected plants. Germination and mortality were recorded from time to time and percent of dwarf plant, plant height and number of leaves were recorded before transplanting the materials in the field from the PVC pipe.

## RESULTS AND DISCUSSION

Observations on different measures of effect are shown in Table 1. Maximum germination was recorded in the untreated buds while the lowest germination was noted in 6 kr, the highest dose used, with an exception of CP 57-614 where percent of germination was 68, a little higher than what was observed in 2 and 4 kr.

In Co 527 there was a sharp increase in germination from 2 to 4 kr, on the other hand in case of Isd 5/55 there was a sharp decrease from 2 to 4 kr. In case of other three varieties effect of 2 and 4 kr dose on germination was more or less similar indicating difference of varietal response regarding this character (Table 1). Correlation studies showed that there exists a significant negative association between gremination and radiation dose i.e., with the increase of dose percent of germination decreases (Table 2). Urata and Heinz (1971) also reported similar results.

Many of the resultant plants from the treated buds in all the varieties were abnormally dwarf and percent of dwarf plant increased markedly with increase in dose (Table 2). In 6 kr the dwarf plants increased two to six times in different varieties from 4 kr with an exception of Co 527 where percent of dwarf plant was also less than 2 and 4 kr because of unknown reason.

As shown in Table1, the lowest percent of prematured dead plant was recorded in the untreated buds and the highest percent were recorded in all varieties in 6 kR

with an exception of Co 527 where no dead plant was observed. Correlation Coefficient between the dead plants and doses was found to be positive but insignificant (Urata and Heinz, 1971). Radiation did not affect leaf number, plant height was adversely affected with increasing doses except CP 57-614. This finding agrees with those of Urata and Heinz (1971). Mean values of plant height (Table 2) indicated that there was a significant negative association between dose and plant height and 6 kr was found to be more than optimum dose to have a beneficial mutant. Considering all the characters studied it is apparent that minor but definite changes occured in 2 and 4 kr treated buds whereas in 6 kR treated buds changes were drastic and consequently settlings failed to attain normal height. Results of

**Table 1. Variation in different characters of sugarcane varieties at different doses of rediation.**

| Varieties irradiated | Radiation Doses (kr) | Characters studied | | | | |
|---|---|---|---|---|---|---|
| | | Percent germination | Percent dwarf plant | percent dead plant | Number of leaves per plant | Plant height at 100 days (cm) |
| | 0 | 54 | NA | 3 | 7.5 | 111.5 |
| | 2 | 49 | 9 | 6 | 7.2 | 93.7 |
| lsd. 16 | 4 | 47 | 13 | 7 | 8.1 | 91.5 |
| | 6 | 35 | 40 | 25 | 5.2 | 31.9 |
| | 0 | 52 | NA | 4 | 5.7 | 79.1 |
| | 2 | 41 | 11 | 5 | 6.9 | 74.4 |
| lsd. 5/55 | 4 | 31 | 26 | 4 | 6.3 | 61.1 |
| | 6 | 23 | 71 | 15 | 4.2 | 26.5 |
| | 0 | 46 | NA | 3 | 7.0 | 83.9 |
| | 2 | 24 | 4 | 6 | 6.9 | 74.8 |
| B.O. 70 | 4 | 28 | 5 | 2 | 7.6 | 75.6 |
| | 6 | 19 | 30 | 9 | 5.8 | 48.0 |
| | 0 | 77 | NA | 3 | 6.5 | 80.5 |
| | 2 | 67 | 26 | 9 | 6.4 | 74.7 |
| CP. 57-614 | 4 | 65 | 21 | 12 | 4.9 | 43.9 |
| | 6 | 68 | 41 | 23 | 5.7 | 36.1 |
| | 0 | 40 | NA | NA | 7.5 | 85.8 |
| | 2 | 33 | 11 | 5 | 7.9 | 79.4 |
| Co. 527 | 4 | 41 | 19 | 1 | 7.0 | 65.8 |
| | 6 | 20 | 7 | NA | 6.9 | 50.5 |

NA= Not available.

**Table 2. Relation of radiation doses with different character of sugarcane.**

| Characters | Radiation dose (kr) | | | | |
|---|---|---|---|---|---|
| | 0 | 2 | 4 | 6 | r value |
| Percent germination | 54 | 44 | 43 | 33 | —0.9626* |
| Percent dwarf plant | 0 | 9 | 17 | 38 | 0.9706* |
| Percent dead plant | 3 | 7 | 6 | 15 | 0.8819 |
| Number of leaves per plant | 6.8 | 7.0 | 6.8 | 5.5 | —0.7901 |
| Plant height at 100 days | 88.2 | 79.4 | 67.4 | 38.6 | —0.9599* |

* significant at 5% level.

this study indicate that desirable mutants may be obtained from 2 and 4 kr treated materials. The findings are in agreemeat with those reported by Urata and Heinz (1971) and Khairwal *et al.* (1984) who also suggested 4 kr to be optimum dose to get higher mumber of useful mutants.

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