to IAA synthesis, the results of the Present investigation are contrary to the observations of Rovira and McDougall, who reported a direct relationship between the microbial load and the IAA content in the rhizosphere soils. This may be due to the differences in the nature of the insecticides applied to the soil.

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EFFICACY OF DIMETHYL SULPHOXIDE ON
THE MUTAGENIC ACTION OF DIETHYL
SULPHATE ON RICE

Five hundred husked seeds each of T (N) 1 and IR 8
rice varieties pre-soaked for 12 hrs in distilled water
were used in treatments with 0.03, 0.05 and 0.1
concentrations of diethyl sulphate (dES) alone or
in combination with 5% dimethyl sulphoxide (DMSO)
or 12 hrs at 28 ± 1°C. Reduction in germination
fands seedling survival in M₂ revealed no marked
differences in both treatments. Seedling height, on the
other hand, recorded an increase in T (N) 1 combination
treatment while in IR 8, the same was true of
single treatment with dES. In M₂ generation, chloro-
phyll mutants were scored on both panicle and seedling
basis and the combined data for all the three doses
are presented in Table I. Panicle-wise T (N) 1
produced the same number of segregating lines in
both the treatments while in IR 8, there was marked
reduction in the combination treatment. On the
other hand, when the mutant frequency was examined
on the basis of M₂ seedlings, there was an increase in
T (N) 1 and a decrease in IR 8 combination treatments.

Meiosis in M₁ plants as studied in acetocarmine
smears revealed that the frequency of aberrant plants
was higher in T (N) 1 combination treatment (25.7%) when
compared to the single treatment (18-0%).
Multinucleolar condition was observed commonly at
diakinesis and persistent nucleolar bodies of varying
sizes were also found during subsequent stages of
meiosis. Lagging chromosomes and delayed separa-
tion at Anaphase I, bridges with or without fragments
were also recorded. Aberrant plants were not
detected in IR 8.

Bhatia reported two fold increase in chlorophyll
mutation frequency in Arabidopsis by applying ethyl
methane sulphonate in combination with DMSO to the
growing points. Siddiq et al., observed more or less the same M₂ chlorophyll mutant frequency by
treating the rice variety Tainan-3 with EMS in combination
with DMSO. Nayar and Jachuck recorded one-third reduction in the chlorophyll mutation frequency
in the variety Ptb. 10 in the treatment involving
EMS + DMSO and dES + DMSO. Anwar and Reddy
recovered more chlorophyll mutants in M₂ in the variety
IET 1991 in combination treatment dES + DMSO. In
the present study the increase in mutant frequency on

**Table I**

<table>
<thead>
<tr>
<th>Mutagen</th>
<th>T (N) 1</th>
<th>IR 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seedling</td>
<td>M₂ spikes</td>
</tr>
<tr>
<td></td>
<td>height</td>
<td>(%) of studied No.</td>
</tr>
<tr>
<td>Control</td>
<td>100 0</td>
<td>50</td>
</tr>
<tr>
<td>dES</td>
<td>71 4</td>
<td>120</td>
</tr>
<tr>
<td>dES +</td>
<td>89 2</td>
<td>120</td>
</tr>
</tbody>
</table>

**Table I**
seeding basis in T(N)1 combination treatment and its reduction on both panicle and seeding basis in IR.8 indicate variedal differences in the presumed action of DMSO as a penetrant. Data on meiotic irregularities also point in the same direction. Such variedal differences were also evident in the results reported in literature. It is therefore, desirable to carry out detailed studies, by changing the concentration as well as method of application of DMSO before its usefulness for increasing the mutagen action on rice can be ascertained.

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MANIFOLD MORPHOLOGICAL EFFECTS OF INDUCED DWARFISM IN RICE (ORYZA SATIVA L.)

Mutational correction of unwanted traits in the otherwise high yielding and well adapted crop varieties has brought in significant advances in applied plant breeding (Sigurbjörnsson et al.8 and Swaminathan10). Numerous studies have also shown that major gene mutations often lead to multiple morphological changes which, in view of breeding objectives, may have desirable as well as undesirable effects (Emery et al.9, Kawai and Narahari4, Scarascia Mugnozza7, Tanaka11). Macro-mutational studies, therefore, are important not only in evaluating their significance in crop improvement but also in evaluating their effects on the codoped gene complexes and in studying the structure and evolution of complex loci (Bozzini1, Pandey4, Swaminathan3). In this report, we examine the manifold morphological changes associated with semi-dwarfs in rice varieties—T 141 and GEB 24—which were produced by treating low moisture (4%) seeds with 10 Kr gamma-radiation. The mutant materials used in the study were single plant M4 seeds derived from uniformly dwarf M4 progenies which were planted along with their control parental lines in complete randomized block design with three replications on 23rd August 1976 at Agricultural Research Farm, Banaras Hindu University. The plot size was three rows, two meters each, with 30 cm row-to-row spacing and 15 cm within-row spacing. Measurements were recorded on five competitive plants from each entry in each replication.

The mean values for various morpho-physiological characters in T 141 and GEB 24, and their respective mutants, T 141M and GEB 24M, are given in Table I. The natural plant height of the parental lines was substantially reduced due to late planting. However, the plant height of both mutants, further decreased by about 50%, the reduction being higher in GEB 24M than in T 141M. The other characters for which both mutants recorded significant and remarkably

<table>
<thead>
<tr>
<th>Character</th>
<th>T 141</th>
<th>T 141M</th>
<th>GEB 24</th>
<th>GEB 24M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (cm)</td>
<td>100.07±1.59</td>
<td>56.80±1.67</td>
<td>111.83±1.20</td>
<td>57.00±2.18</td>
</tr>
<tr>
<td>Days to heading</td>
<td>104.27±0.50</td>
<td>108.87±0.66</td>
<td>110.80±0.43</td>
<td>106.13±0.95</td>
</tr>
<tr>
<td>Ear bearing tillers</td>
<td>11.40±0.63</td>
<td>12.13±1.04</td>
<td>13.80±1.20</td>
<td>9.20±0.78</td>
</tr>
<tr>
<td>Peduncle length (cm)</td>
<td>32.27±0.76</td>
<td>23.69±0.87</td>
<td>31.17±0.22</td>
<td>18.53±1.28</td>
</tr>
<tr>
<td>Extrusion length (cm)</td>
<td>3.95±0.57</td>
<td>−2.60±1.81</td>
<td>2.51±0.36</td>
<td>−7.60±1.28</td>
</tr>
<tr>
<td>Panicle length (cm)</td>
<td>22.27±0.26</td>
<td>20.84±0.21</td>
<td>23.03±0.51</td>
<td>22.73±0.54</td>
</tr>
<tr>
<td>Flag leaf length (cm)</td>
<td>23.57±0.65</td>
<td>17.07±0.66</td>
<td>16.40±0.62</td>
<td>19.00±1.17</td>
</tr>
<tr>
<td>Flag leaf width (cm)</td>
<td>0.95±0.032</td>
<td>1.10±0.004</td>
<td>0.74±0.032</td>
<td>1.04±0.032</td>
</tr>
<tr>
<td>No. of grains/panicle</td>
<td>204.07±6.25</td>
<td>129.27±5.83</td>
<td>133.00±6.63</td>
<td>116.33±7.24</td>
</tr>
<tr>
<td>1000-grain weight (cm)</td>
<td>15.55</td>
<td>20.80</td>
<td>15.55</td>
<td>16.15</td>
</tr>
</tbody>
</table>