pesticides are also known to be mutagenic in plants, e.g., cytrol (*111*), hyvar (*111*), lindane (*90*), and vapona (*90*). An indication of relative mutation rates produced by gamma rays and various chemical mutagens in several test systems is given in table 4.

A brief outline of the procedures considered to be most promising for chemical mutagen studies follows. It includes methods for analyzing various types of chromosomal aberrations, mutations and lethal effects and includes the specific locus method.

Mutation induction by seed treatment.—Barley (*Hordeum*) has been used extensively in the study of induced hereditary changes. This plant can be recommended because of the extensive knowledge of its genetics including numerous and distinct chlorophyll-deficient mutations (*76*) and because of the low number (2n=14) of relatively large chromosomes. The seed is very easy to store, treat and handle, and the seedlings are small and easy to grow. Responses to mutagen treatment which may be measured include: (1) Chromosome aberrations in shoot- or root-tip cells of treated seeds; (2) chromosome aberrations in the pollen-mother-cells of M_1 plants; (3) chlorophyll-deficient mutations; (4) pollen abortion; (5) alteration of the observed mutation spectrum of M_2 seedlings; (6) seedling growth reduction; (7) survival; (8) spike fertility; and (9) yield of spikes *per* plant.

The complete techniques for handling mutagen-treated barley seeds (*54*), as well as more detailed descriptions of both laboratory (*70*) and field culture of seedlings (*71*) have been described. These techniques are easily modified for use with seeds of many other higher plant species.

The basic difficulty with progeny testing for mutation in higher plants is the long generation time involved. By growing the M_2 generation in the greenhouse, the time has been reduced to less than 1 year with barley. However, this is still too long for rapid screening of mutagens. The techniques with barley have been developed to the point that it is known that there is excellent correlation between the M_1 seedling growth inhibition, and the M_2 seedling chlorophyll mutation frequency (*77*). This relationship also exists between seedling growth inhibition and chromosome aberrations in the M_1 shoot or root tip (*10*). Therefore, in 1 week rapid data may be obtained concerning the mutagenicity of a compound. Another possibility in seed mutagenesis is to use small more rapidly growing plants such as *Arabidopsis* as has been done with much success by Rédei and Li (*84*). This plant is sensitive enough to detect low frequencies of mutation induced by DNA base analogs (*38*).