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|  |  | **MASS SELECTION** |  |  |
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|  | *Mass selection* in cross-pollinated crops is a selection procedure in which: |  |
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|  | * Individual plants are chosen visually for their desirable traits, and |  |
|  | * The seeds harvested from the selected plants are bulked to grow the following generation without any form of progeny evaluation (Fig. 10.3). | | |  |  |
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|  | Repeating mass selection utilizes the recurrent selection principle. An example of the procedure follows: |  |
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|  | ***First season*:** Select 50 to 100 plants with desired features from the source population and harvest open-pollinated seed from each. |  |
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|  | ***Second season*:** Plant a mixture of the seed harvested in the previous year. From this population, again harvest open-pollinated seed from 50 to 180 plants selected for desired features. |  |
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| Fig. 10.3.Mass selection. Individual plants are selected for desirabletraits and seed is composited to grow the next generation. The composite may serve as the ''source population" for thenext selection cycle. |

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|  | A procedure known as ***Gridding*** may be used to reduce errors in selection caused by uneven environments. The land area on which the source population is grown is divided into small plots or *grids*. Plants are evaluated within each grid and only one superior plant from each grid is harvested. This procedure gives equal representation in the mass selection from all areas of the field regardless of field gradients in soil fertility or moisture supply. The grid system may be utilized when making selections from the source populations in the half-sib, full-sib, and S1 procedures that follow. |  |
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|  | Fig. 10.4.Progressive improvement in sugar beet for curly-top-virus resistance through a combined mass/recurrent-selection breeding procedure. Improvement was possible because  (1) genotypes with genes for resistance were present in the European source population,  (2) the severity of the curly-top-virus disease eliminated the susceptible genotypes from the population, and  (3) interpollination among the resistant.genotypes resulted in sugar beet plants with transgressive segregation for resistance.  About 25% of the plants in US 1 were resistant to the curly-top-virus, 40 to 50% of the plants in US 33 were resistant, 75% of the plants in US 12 were resistant, and 85 to 90% of  the plants in US 22 were resistant. | | |  |
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|  | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | ***THE RECURRENT-SELECTION PRINCIPLE*** |  | |  | | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | *Recurrent selection is any breeding system designed to increase the frequency of desired alleles for particular quantitatively inherited characters by repeated cycles of selection.*  *A* recurrent-selection cycle involves: |  | |  | | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | * Identification in a source population of genotypes superior for the specific quantitative character being improved, and |  | |  | * The subsequent intermating of the superior genotypes to produce new gene combinations with improved expression of the character. | | |  | |  | | | | | |  | | | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | Selection cycles may be repeated as long as superior genotypes are being generated. |  | |  | | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | PHENOTYPIC RECURRENTSELECTION is selection to improve a plant quantitative character based on visual observation or physical measurement of the character. Examples are oil content in corn (Fig. 10.1), fiber strength in cotton, sugar content in sugarbeets, or seed size in wheatgrass. Phenotypic recurrent selection is an appropriate breeding procedure in naturally cross-pollinated species or species where artificial cross-pollinations are made easily. |  | |  | | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | *GENOTYPIC RECURRENT SELECTION* is selection to improve a plant quantitative character based on progeny performance as measured by test crosses, or by other means, and is utilized to improve complex characters such as combining ability in corn inbred lines. |  | |  | | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  | | |  | |  | | | |  | A model for simple phenotypic recurrent selection is illustrated in Fig. 10.2 in which plants are visually selected from the source population and the progenies of the selected plants are grown and intercrossed to obtain new gene combinations. The crossed seed is used to grow a new source population, which starts the next selection cycle. Selection based on phenotype will be effective insofar as the phenotype accurately identifies the superior genotype for the character under consideration. Phenotypic recurrent selection is most effective for characters with low genotype x environment interaction, such as height of ears (in corn), seed size, or disease resistance. For quantitative characters that cannot be selected accurately from the phenotype, breeding procedures have been devised based on progeny or testcross performance that utilize the recurrent selection principle. |  | |  | | | |  | | |  |  |  |  | | --- | --- | --- | |  |  |  | |  | |  |  | 0186-001.gif |  |  | |  | | | |  | | |  |  | | --- | | Fig. 10.2.Model for phenotypic recurrent selection. Note that the mean of the populations has increased  following each selection cycle. |  |  |  |  | | --- | --- | --- | |  |  |  | |  | |  |