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|  |  | **MULTILINE BREEDING** |  |  |
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|  | The traditional breeding procedures for self-pollinated crops were developed around the pure-line concept. Pure-line selection was utilized to isolate the superior plant from genetically mixed populations, such as landraces, or from segregating populations following hybridization. Extreme uniformity among the plants within the selected line was stressed. The uniformity often led to cultivars with a single gene for resistance to a particular pathogen being propagated over large geographic areas. If a new race of the pathogen that was virulent on cultivars with the resistance gene arose, widespread disease damage would be caused. The rapidity with which new races of disease pathogens arose sometimes limited the usefulness of cultivars with a particular resistance gene to no more than 5 to 10 years. This condition led to the proposition that greater diversification in resistance genes would provide stronger genetic barriers and spread the risk from disease damage. One solution proposed was the use of multiline cultivars. |  |
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|  | As proposed to combat disease resistance, a ***Multiline Cultivar* is a composite of genetically similar lines**, **except that each line possesses a different gene for resistance to the disease pathogen** (Fig. 9.7)Lines that are genetically identical, except for a single gene, are called ***Isolines*.** The procedure for producing a multiline cultivar is to * Develop isolines of a desirable cultivar, each with a different gene for resistance to a particular disease pathogen. Each gene should contribute resistance to a different physiologic race, or group of races, of the disease pathogen.
* The backcross-derived isolines are then composited to form the multiline cultivar.
* As changes occur in the prevalent races of the disease pathogen, isolines with new genes for resistance may be developed.
* Because the multilines are reconstituted each year, the new genes for resistance may be introduced by changing the mix of the isolines.
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| Fig. 9.7.Procedure for production of a disease resistant, multiline cultivar. Genes for.rust resistance, R1 to R5, are backcrossed from donor cultivars to a common disease susceptible, recurrent cultivar A. Isolines are generated that differ only in a gene for disease resistance and composited to synthesize the multiline cultivar. The isolines are maintained so that the multiline can be resynthesized as needed. Five crosses (original and four backcrosses) were made to therecurrent cultivar. |
| The theory of the multiline is to produce a population uniform for height, maturity, and other features, yet mixed in genes for resistance to pathologic races of a virulent disease. ***Merits*** multiline cultivar are based on the assumption that it will provide partial protection to a broad spectrum of races of a disease-producing pathogen and provide a buffering effect against rapid disease development should a new race of the disease pathogen arise. These assumptions have not yet been fully tested. |  |
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|  | ***Disadvantages***: |  |
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|  | * A multiline has limited utility except in high risk areas where severe disease damage occurs regularly from a highly specialized disease pathogen,
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|  | * There is no genetic improvement in yield or other characteristics, except that provided by the disease resistance, as long as the same cultivar is used as the recurrent parent for isolines development, (unless the recurrent parent is improved the multiline may soon become obsolete),
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|  | * The labor required to produce and maintain the isolines reduces the resources for improvement in cultivar characteristics other than disease resistance, and
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|  | * The release of a multiline cultivar is delayed until all of the isolines are produced and increased.
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|  | The term ''multiline" is sometimes loosely applied to mixtures of genetically diverse lines combined in various ways to buffer against environmental stresses. More accurately, these mixed populations should be called *composites*. |  |
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|  | **VARIETY BLEND** |  |
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|  | *A variety blend* is a composite cultivar produced by mixing seed of two or more cultivars, the suggestion being that a blend of genotypes will yield consistently higher than the average of the pure component genotypes, **due to the buffering effect against genotype × environment interactions**, and will be **more stable over locations and years than a pure-line cultivar**. The advantage of the latter tends to diminish as the number of cultivars in the blend is increased. A variety blend will be **less uniform in appearance than a pure-line cultivar**. In making a variety blend, cultivars should not be mixed that will adversely affect uniformity in maturity, or features that will reduce the quality of the product. Variety blends need to be reconstituted at regular intervals to maintain stable performance. |  |