Chapter 9 Heterosis in Ornamentals

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9.1 Historical Review

When Shull in 1911 made known his ideas on hybrid vigour in plant breeding and introduced the name “heterosis” for this conception, there had already been commercially released a variety of Begonia semperflorens by Benary Seed Company from Erfurt/Germany, which carried all the criterions of a real “heterosis” variety, i.e.,

- hybrid vigour in connection with optimal uniformity;
- a heterozygosity giving rise to a strong segregation of characters in F₂ and consequently preventing any illegal reproduction;
- the necessity of being reproduced by constant new crossing of two parental lines bred to homozygosity.

This new variety was Begonia semperflorens Link et Otto “Primadonna” of 1909 which possibly represented the first systematically constructed F₁-hybrid variety in plant breeding. Realizing this fact, the Benary seed company has later had this term

1 Federal Research Centre for Horticultural Plant Breeding, 2070 Ahrensburg/Holst./FRG
"Heterosis" protected as a trademark for its own use in combination with the name of a variety. However, in spite of the early start in heterosis breeding in floriculture there was no extending of it to other flower species at that time, not even to the tuberous begonias, where only recently F1-hybrids are being produced very successfully, although the technical preconditions are nearly the same. While in Begonia semperflorens F1-hybrid production was expanding internationally, the new breeding method remained neglected even for those flower crops which appeared obviously in favour of its application, as for example Primula because of its heterostyly. Before heterosis breeding expanded to other flower species rapidly after the Second World War, there was only one exceptional stimulation given by the work of Frimmel/Eisgrub, now Lednice/Czechoslovakia, in 1941. For instance, he suggested making use of self-incompatibility in Ageratum houstonianum in connection with easily achieved vegetative propagation in order to produce F1-hybrid from two interplanted, self-incompatible clones. There was no response to this recommendation at that time, nor did Frimmel’s own breeding products find distribution. From about 1950 F1 hybrid breeding in flowers expanded rapidly, for instance to Petunia, Tagetes, Impatiens, Ageratum, Cyclamen or tuberous Begonia, only to mention some of the most important ones. Flower breeders became familiar with F1-hybrid production also of those crops which were formerly propagated vegetatively, as for example, Pelargonium, although on the other hand vegetative propagation was considerably favoured by new in vitro techniques and replaced in its part seed propagation, e.g., in Gerbera. However, economical and phytopathological reasons seem to keep vegetative propagation within certain limits, so that alternatives are needed, which can be offered only by F1 hybrids. As on the other hand F1 hybrid production can greatly be favoured by in vitro culture techniques, we are now looking forward to an interesting development in flower breeding.

Whatever the aim or subject of a F1 hybrid production may have been in the past, the procedure was always the following:

1. preparing the inbred lines;
2. testing for general combining ability;
3. testing for special combining ability;
4. carrying out the crosses between the selected parents on a large scale by one or other way.

This general programme will also be valid in future.

9.2 Expression of Heterosis in Ornamental Plants

In agricultural crops, vegetables or forest trees, F1 hybrid performance can easily be demonstrated by measuring the yield in dt ha⁻¹, number of fruits per plant, height of trees reached in one annual growing season etc. In the ornamental crops, such quantitative standards are still lacking. Best chances for the demonstration of F1 hybrid performance by means of quantitative values might be at hand in the cut flower species where the number of marketable flowers harvested in a flush season is a typical quan-