Chapter 37

Oilseeds and Heterosis

J. F. Miller

INTRODUCTION

Three crop species, soybean \([Glycine\ max\ (L.)\ Merr.]\), rapeseed \([Brassica\ rapa\ L.\ syn.\ B.\ campestris\ L.\ and\ Brassica\ napus\ L.]\), and sunflower \([Helianthus\ annuus\ L.]\), account for approximately 78% of world vegetable oil production. Heterosis of these crops has been exploited to increase seed yield only over the past few decades. Utilization of heterosis has allowed sunflower to become the major oilseed in many countries of Eastern and Western Europe, Russia, and South America, and is an important crop in the USA, Australia, South Africa, China, India, and Turkey. Of the approximately 16.5 million hectares of sunflower grown in the major producing countries, 11.5 million hectares are planted to hybrids. Hybrid vigor has been the main driving force for acceptance of this oilseed crop. Heterosis is becoming increasingly important in rapeseed. The yield potential of single-cross hybrids has attracted considerable interest from growers in Canada, Australia, Europe, and Argentina. Significant heterosis derived from hybrids of soybean has encouraged researchers to investigate the feasibility of producing hybrid soybean on a commercial scale.

Sunflower

Hybrid sunflower became a reality in the early 1970s with the discovery of cytoplasmic male sterility and an effective genetic male fertility restoration system. In countries that were growing open-pollinated sunflower varieties, comparisons with hybrids clearly indicated the superiority of hybrids for yield and other characteristics. When hybrid technology became commercially available, the switch from varieties to hybrids was swift and complete. However, heterosis was not the only advantage hybrids displayed over the varieties. Dominant genes controlling disease resistance to downy mildew and rust were present in the restorer inbred lines. Resistance to Verticillium wilt was found in female inbred lines. Crossing the male and female lines to produce a hybrid provided multiple resistance to all three diseases.

Single-cross hybrids of sunflower have uniform plant height, flowering date, and seed quality (particularly important in nonoilseed sunflower). Uniform plant height and maturity are very important for mechanical harvest, and uniform flowering is important for chemical control of sunflower insect pests (most notably the sunflower moth and the red sunflower seed weevil) which are effectively controlled when heads are beginning anthesis. Hybrids also have distinctly improved