The first experiment revealed significant phenotypic and genotypic variability among genotypes for key vegetative, reproductive and physiological traits.Traits with high narrow-sense heritability and additive inheritance are ideal for direct selection, whereas those dominated by non-additive effects and high heterosis are best improved through hybridization.Genotypes such as Al-Ashraf, Farz on W4, Romy 1010 W3, 41 W 6, Bohoos W5 and Dar El-Salam 5 exhibited superior vegetative vigor, earliness and total yield potential, confirming the presence of substantial genetic diversity suitable for selection and breeding improvement.Conversely, traits such as early flowering, fruit length, fruit weight, total yield, relative chlorophyll content and total soluble solids (TSS) were mainly controlled by non-additive gene action, emphasizing the potential for heterosis exploitation in hybrid development.