A wide array of new molecular biology and genetic manipulation techniques are now available that give plant breeders new opportunities to create and manipulate genetic variation to produce improved plants more easily. The most effective way, however, to apply these new breeding methods and novel genes to individual crops has yet to be decided. As forage production is a low input system, the most effective way to deliver this technology to forage producers will be via the creation of new genetic variability and the improvement of seed sold to forage producers through the development of new varieties. It is now important therefore that biotechnologists, plant breeders and agricultural scientists identify how these tools can be used in agriculture to improve individual forage crops and what will be needed to translate the products of biotechnology to the market.

Before discussing the role of biotechnology in Lotus improvement it is necessary to consider what the objectives in a breeding program are and how they may be achieved using traditional breeding methods and if not, whether biotechnology may assist the breeder. This decision making process is outlined in Fig. 12–1 and shows some of the basic questions that every breeding program must address together with some of the possible alternative biotechnological solutions. These approaches will be discussed in more detail in relation to Lotus improvement in this chapter.

The primary requirements of any breeding program are two fold: a source of variation and the means to manipulate that variation. In the past, the former requirement has been met by the use of naturally occurring adaptations and there is undoubtedly still large amounts of variation within Lotus to exploit. The demands of current plant breeding, however, are such that the production of new cultivars with improved agronomic value may necessitate the incorporation of characteristics that cannot be met by these classical means. Breeders may thus have to turn to the new technologies to see what they have to offer in terms of variation and its more effective manipulation. Biotechnologies can aid breeding either by accessing or creating novel sources of specific plant variation, for example by the exchange of genetic material between remotely related species (somatic hybridization) or through cytological instabilities produced by in vitro culture, (somaclonal variation); or by