MANAGEMENT OF RESISTANCE o Much emphasis has been placed in recent times upon the need to control pests in such a way as to limit the rate at which resistance develops.o Another method of approach is to apply an appropriate dose of active ingredient mixed with a synergist capable of preventing the rapid destruction of the insecticide.o If S genes are to be conserved, the selection pressure must be reduced; on the assumption that R genes in a wild-type population occur with a frequency ofless than 0.1 per cent, Georghiou and Taylor (1977) concluded that a dose applied at the LD90 level will ensure that sufficient susceptible genes are preserved to delay greatly the onset of resistance.o Where resistance is exclusively caused by metabolic factors, synergists such as piperonyl butoxide, sesamex (figure 7.3) and tributyl phosphorotrithioate (figure 9.2) have in some instances greatly decreased the rate at which resistance develops in selection pressure experiments carried out in the laboratory o An alternative approach is to use a mixture of several insecticides with different modes of action.o The life cycle and preferences of the insect pest, the relationship of the pest with local predators and competitors, as well as the inherent resistance of the crop to insect attack, are among the many biological factors that must be borne in mind when the nature and dose of an insecticide that is to exert selection pressure are under consideration.o So, in the simplest case, most individuals have a genetic composition SS, a few are RS and extremely few are RR. o If insecticides are applied at doses just sufficient to kill all the homozygous SS individuals, the balance of frequencies is displaced in favour of resistance.o It is also evident that, for safety reasons, the method is most applicable for the use of pesticides that disappear rapidly or for compounds such as juvenile hormone analogues that do not possess high mammalian toxicity (Georghiou, 1983).o If this is done effectively, the heterozygotes do not survive to interbreed to produce RR homozygotes (it will be recalled that RR homozygotes are virtually absent in an untreated population owing to the very low frequency of the R gene).o Conversely, however, saturation management is a highly undesirable procedure if the population to be treated has suffered previous exposure to insecticides, for, if this has happened, it is possible that the proportion of RR individuals is already finite before the multiple treatment begins.o For such a scenario to be successful in the field, any additionally required pest control must rest with the other inputs into the multiple intervention system; these inputs could include reliance on natural enemies, use of bacteria that attack insects and use of crop cultivars that are less susceptible to insect damage.o In these cases, the concentrations of each individual poison are so low that the S gene pools associated with each of the target sites under attack are not greatly depleted in the population as a whole, even though the cumulative damage provides a practical level of control of the insect population in the fieldo In this regard, chemicals are usually seen as being but one part of an integrated pest management programme, in which biological and cultural factors also play essential roles.o The need to kill heterozygous carriers of the R gene in order to delay evolution of resistance has been studied by Mani and Wood (1984) in relation to persistence of pesticide and the frequency of its application.Insect resistance to insecticides o In a (wild-type) insect population unexposed to pesticides, genes R conferring resistance to any particular insecticide are extremely rare.Georghiou and Taylor (1977) have estimated that resistant genes in unselected wild populations occur with a frequency of less than one in a thousand.o One .approach to the pesticide side of a multiple intervention programme follows from the above