SUMMARY OF FIELD STUDIES

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The results of various aspects of tobacco budworm control in cotton with pyrethroids, other insecticides or mixtures; in Mississippi, Louisiana, Texas and the "La Laguna" area of north central Mexico are given. These include relationships of LC_{50} values of the tobacco budworm determined by the vial bioassay and control in the field. Some of these results are related to LC_{50} values from AVT (Adult Vial Tests) bioassays performed in the laboratory.

Control of high populations of the tobacco budworm in the field with cypermethrin was excellent in the Brazos Valley of Texas (Wolfenbarger et al.) while low populations were controlled with the insecticide in Mississippi and Louisiana (Micinski et al.). LC_{50} values of adult males determined by AVT at all three locations increased 10X to 30X from early to late season. At all locations acceptable control with cypermethrin was obtained in the field. Also, results suggest that the factors which cause increasing LC_{50} values of male adults during the growing season were not related to control failures in the field. Control was obtained regardless of the LC_{50} values. Thus, if resistance is present in a population, both field and laboratory results are needed for substantiation. Also of interest were the studies of Micinski et al. who showed no difference in LC_{50} values between male and female moths nor between moths and eggs.

Residual mortalities were equal following an application of fenvalerate and permethrin to 1st and 3rd stage larvae of the tobacco budworm. Correlation coefficient of mortality and time show a good fit, r=>0.9 (Luttrell et al.). Toxicity of fenvalerate plus methomyl was significantly greater than fenvalerate alone against pyrethroid resistant tobacco budworm (Luttrell et al.).

Cypermethrin was effective against tobacco budworm and bollworm populations in the Brazos Valley of Texas as well as the La Laguna area of north central Mexico (Alvarez and Morgado). Eighty percent or greater control was obtained with treatments to newly hatched through 2nd instar larvae during the growing season at both locations. Results suggest that this is the stage at which to direct spray applications to obtain adequate control.

Optimum efficacy of cypermethrin was shown against neonate larvae and those no older than 2-3 days (Gage et al.).

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Mortality of moths and larvae 0.1 to 10 hrs old was also significantly correlated and LC_{50} values of 163 to 224 ug cypermethrin/vial was equal to recommended field rates of 006-0.077 lbs (a.i.)/A. Gage et al. showed that cypermethrin was equally toxic to larvae (neonate) at identical rates whether applied by ground or aerial sprays. They also showed comparative concentrations for ppm, lbs (a.i.)/acre and ug/vial.

Mallet and Luttrell state that the most practical way to prevent resistance, is to not apply pyrethroids until absolutely necessary. They also state that populations of the tobacco budworm and bollworm have intermediate maximal rates of increase and that resistant populations of either species can only increase if they evolve insecticide resistance. These authors evaluated over 40 parameters in a simulation model relating to insecticide decay rates, probability that insects in different larval stages will contact an insecticide deposit and age and genotype related tolerance. They suggest that dosage mortality curves of different genotypes present in field populations of the tobacco budworm will overlap considerably. Information on intrafield differences in the dose mortality curves is needed to understand what can happen when insecticide applications are made in any particular field.

When evaluating resistance under field conditions there can be a difference in control failures when very high larval populations of a susceptible strain are present compared to when low or moderate populations are actually resistant. Damage greater than the economic threshold resulting from these populations will be present under both conditions. This supports the use of laboratory results to substantiate events occurring in the field.

Field data presented here do not define management systems which will prevent further increases of resistance levels in tobacco budworm populations across the mid-south and Mexico. Although they have been proposed, no resistance management system experiment has been conducted to date. There is probably no experimental design which will determine an effective management scheme acceptable to all entomologists when emigration and immigration of moth populations, genetic factors and abiotic factors are taken into account. This, along with the problem of replication of alternative check treatments makes this type of field experiment extremely difficult. Additionally, the definition of field resistance and the sampling system used to access the efficacy of the proposed management system needs to be determined. Regardless of the difficulty of the task, this is an area of insecticide resistance which deserves more research focus.

Luttrell et al. and Alvarez and Morgado showed that pyrethroids mixed with other insecticides were effective against the tobacco budworm in MS and the La Laguna area of Mexico. Mixtures were evaluated to determine if insect control would be enhanced at lower concentrations than the compounds in the mixture applied alone. Mixtures of permethrin and sulprofos were evaluated in Mississippi and cypermethrin and profenophos were evaluated in Mexico. Both were consistently more effective at lower concentrations than either compound alone. The question remains as to whether

these differences circumvent resistance compared to the use of either compound alone. Luttrell et al. also showed that mortalities of the tobacco budworm caused by the permethrin and sulprofos mixture were significantly greater than when fenvalerate was part of the mixture.

Resistance to deltamethrin in the tobacco budworm/ bollworm in field and laboratory studies was clearly demonstrated in the La Laguna area of Mexico (Alvarez and Morgado). This is the first report of resistance to this single isomer pyrethroid against these insects. Control in the field was shown for these same populations by the multi-isomer cypermethrin.