A Changing Outlook . . .

Cotton Insect Control in Arizona

*by T. F. Watson & Leon Moore**

Insect problems in Arizona cotton have become progressively worse in recent years in spite of continuous advancements in the development of insecticides and their increased use. To reduce existing insect problems and minimize new ones it is important that growers more effectively utilize the best combinations of cultural, chemical, and biological control methods. This integrated control approach requires a consideration of the total environment, or agro-ecosystem, with its interrelated complex of organisms and physical elements, all affected by the activities of man.

The general concept of insect control should be revised to include pest population management rather than the mere destruction of pest populations with insecticide applications. This, in turn, implies the need for much greater understanding of the role played by all insects, both destructive and beneficial. We must also tolerate the presence of sub-economic population levels of harmful insects whose presence does not justify the expense or hazards of control treatments. The pest-management approach would not be a feasible practice if it were necessary to maintain the cotton completely free of any pest. For most insect pests, economic levels have been established and in many instances populations never rise above the economic threshold unless released from biological control restraints as a result of the unwise use of insecticides.

The practice of cotton insect control has undergone continuous change over the years. Advancing technology, particularly the development of synthetic organic insecticides and specialized methods for their application, associated with improved cotton production practices in general, has provided the means of producing consistently higher yields. These advances have not come without certain undesirable consequences, particularly from the standpoint of the development and use of insecticides. Probably the single most detrimental consequence with regard to insecticides has been their unquestioned acceptance as the panacea for insect control. Insecticides are of unquestionable value but their use must be within a realistic ecological and economic framework.

For several years an insect problem or potential problem could be handled easily and inexpensively with any of a number of highly effective insecticides. Thus, these new tools seemed to eliminate pest problems with little outward indication of the need for their judicious use. Possible widespread secondary effects on the total environment were largely unanticipated.

Develop Tolerance

The first unanticipated problem was the development of insecticide tolerance or resistance in certain pests. This initiated a chain reaction which complicated and compounded the problems of cotton insect control. In creasingly higher dosages and shorter application intervals were required to achieve the results to which the grower had become accustomed. New materials with different modes of action were continually introduced to replace those which had become ineffective and thus the chain reaction has continued. A prime example is the bollworm problem in cotton. Initially, the bollworm was highly susceptible to DDT. After only a few years of continuous exposure to this insecticide, field populations developed resistance to the point where higher dosages were required and finally, where DDT became virtually ineffective. Subsequent control of the bollworm required the use of such short-residual compounds as methyl parathion which necessitated shorter application intervals. In some areas, the development of resistance to this insecticide has reached the point where unusually large dosages are required.

Another Problem

A second problem resulting from the use of insecticides has been the rise to major pest status of insects which were originally of only minor importance. For example, prior to the need of multiple applications for control of the pink bollworm over most of the cotton acreage of Arizona the

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cotton leaf perforator was only an occasional pest. However, during the past two years it has become a major problem. The cause of this shift from an incidental or minor pest status to one of major economic importance was apparently due largely to the destruction of natural enemies which had kept the leaf perforator under control. The larger number of pest species requiring control has resulted in the need for a greater variety of insecticides applied more frequently over a longer period of the growing season.

Another concern which has progressively intensified with the continued and even greater reliance upon chemicals to control cotton pests is the residue problem associated with food and feed crops. This problem culminated in the establishment of lower tolerances, particularly for the persistent chlorinated hydrocarbon insecticides.

Residue Is Concern

Primarily as a result of the residue problem in milk and on alfalfa and other feed crops, DDT and other persistent chlorinated insecticides have been banned or are no longer recommended to control pests of agricultural crops, particularly cotton. This has necessitated the use of shorter-residual, highly toxic organophosphate insecticides. These alternative materials, while possibly reducing the residue problem in general, have concurrently induced new problems. A direct health hazard stems from the acute toxicity of many of the phosphate insecticides. It is primarily the persons who may come into immediate contact with these insecticides, such as applicators, loaders, flaggers, and field workers, who are subjected to additional risks. The potential effect upon the balance of pests and beneficial insects is tremendous, however, when large quantities of these insecticides are applied to large areas on a fairly rigid schedule. This approach can lead, in a relatively short time, to serious ecological problems which may take years to correct.

The primary factor which handicaps the full realization of the pest-management approach to cotton insect control is the presence of the pink bollworm, a key pest species which is restricted almost entirely to cotton. In Arizona, the pink bollworm presently occurs at such population densities that much of the state's cotton may require several insecticide applications to prevent serious losses. Therefore, the most logical approach to integrated insect control or pest-management is to first remove the need for repeated applications of insecticide to control the pink bollworm. This can be done by a concerted effort of the growers to initiate certain essential changes in cotton production practices.

Fewer Pinkies

Reducing or eliminating the numbers of young bolls available for pink bollworm attack early in the fall (during October) will greatly reduce populations of this pest the following year. This practice eliminates a high proportion of the larvae before they become physiologically adapted (in diapause) for winter survival.

The practice of early crop termination, plus good fall plowing and clean-up operations, would reduce the pink bollworm to such low levels that economic infestations would not develop at all or at least not until late the following summer. Even under present conditions pink bollworm infestations during the growing season often fail to reach economic levels. Regular field checking has demonstrated that in such situations customary applications of pesticides can often be delayed or even eliminated. An overall-cultural-control effort would minimize the need for chemical control of the pink bollworm.

Better All Around

A reduction of the pink bollworm problem would greatly enhance the potential of total pest-management or integrated insect control. Most of the other pests, especially those of importance during the major fruiting cycle of the cotton plant, are not restricted entirely to cotton. This indicates the possibility of managing other crops to minimize the problems normally encountered in cotton.

An example of a pest-management practice which is gaining prominence is the strip-cutting of alfalfa fields or strip-planting of alfalfa in cotton. This practice results in the maintenance of lygus populations in the alfalfa and eliminates or reduces the need for lygus control in cotton. Used in this manner, alfalfa is a trap crop. Benefits from this non-chemical approach in lygus control are far greater than the mere savings of materials and application-costs directly associated with lygus control. Predator and parasite populations, which are reduced or destroyed by lygus control treatments, are preserved at a critical time in the growing season when outbreaks of other pests, such as the bollworm, are most likely to occur. In many instances, where the environment has not been previously upset by pesticide applications, bollworm outbreaks are prevented and population levels are maintained at sub-economic levels by beneficial insects alone. Even where insecticidal control becomes necessary, beneficial insects will generally delay its need and result in the saving of one or more applications.

No Set Program

In the integrated insect control approach, a predetermined insect control program is not possible. The choice of insecticides and timing of applications are based upon a specific set of circumstances as they exist at a given time in a given field. Decisions on whether to chemically control a pest should, therefore, be made by the grower or his representative and should be based upon recorded information provided by regular field checking. Such information includes: 1) the population density of the pest or degree of plant damage; 2) the trend of the pest population based on previous records; 3) the presence and abundance of beneficial species which are known to attack the pest in question; and, 4) the likelihood of releasing from natural control another pest which is currently present at sub-economic levels.

The problem of cotton insect control may become increasingly difficult and costly if we continue to rely primarily upon insecticides instead of using integrated insect control principles which employ the best aspects of chemical, cultural, and biological methods of control.

Adopting the new approach will help growers feel secure in their insect control program from the standpoints of effectiveness, justification of environmental contamination, and cost.

(Turn Page)

Figure 1. A good job of shredding pla (above right). Both are essential steps

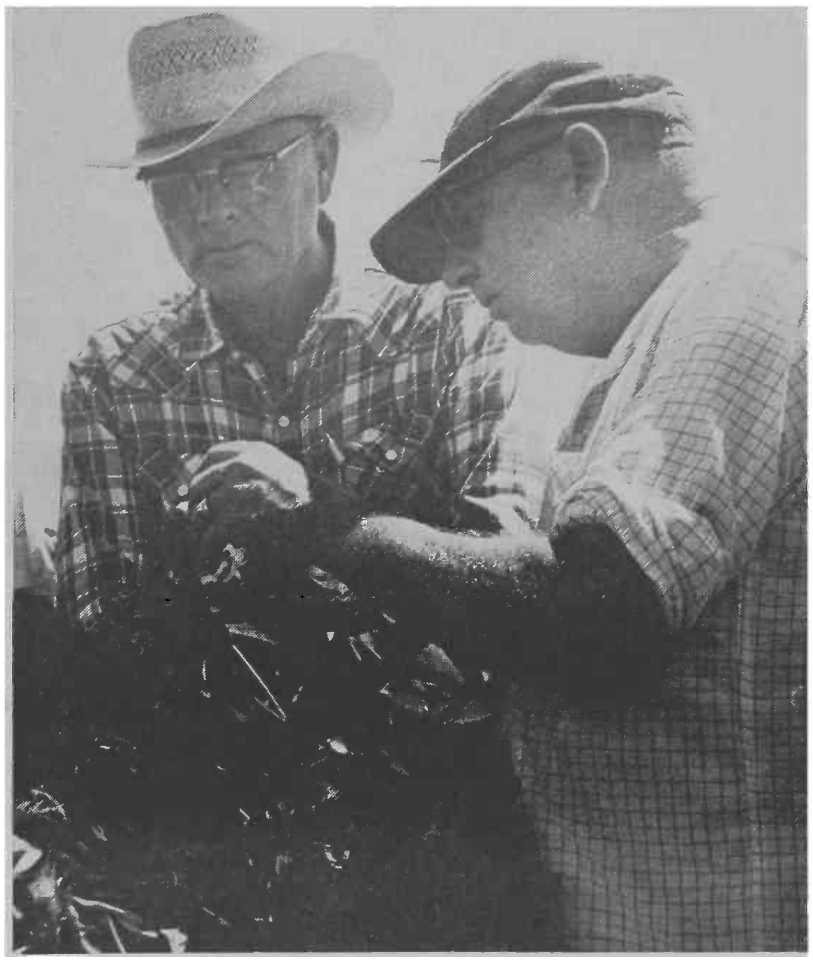


Figure 2. Close examination of plant terminals and other plant parts is the key to correct timing of insecticide applications. Regular and properly recorded field examinations are necessary to understand population trends of both harmful and beneficial insects.

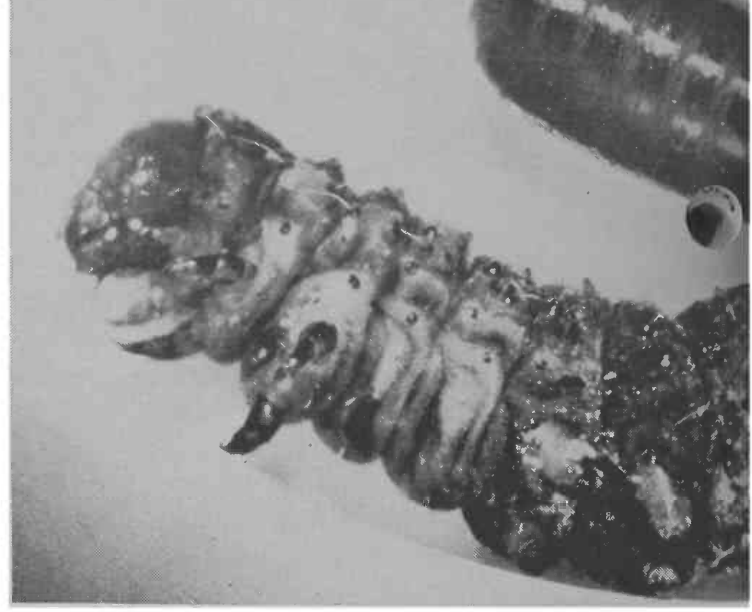


Figure 3. Beneficial insects are an important part bollworm larva killed by parasitic fly.

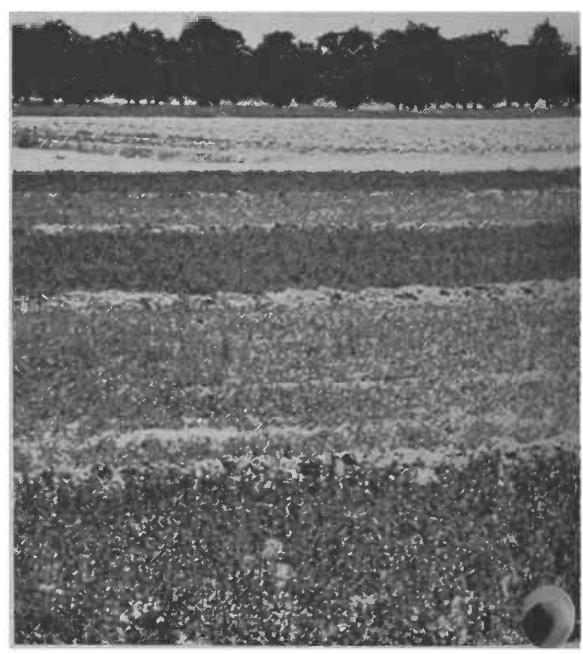
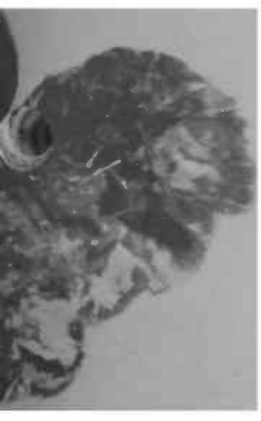


Figure 4. Alternately-cut strips of alfalfa (right) keep lygus bugs in the alfalfa field and minimize damage to adjacent cotton.

(above left) facilitates good coverage
ltural control of the pink bollworm.

Figure 5. Properly applied insecticides are necessary when pest populations exceed economic threshold levels.



control. Photo shows

Figure 6. Maturing cotton for early harvest, below, is an essential step in the cultural control of the pink bollworm. Photo below illustrates the effects of various irrigation cut-off dates on plant maturity. Plot on right hand half of picture shows signs of early water cut-off.