Factors Affecting Bollworm Control

By George P. Wene and L. W. Sheets

During August and September the most serious insect problem of many Arizona cotton growers is the control of the bollworm, *Heliothis zea* (Hbn.). Before another bollworm season arrives it should be of interest to review the factors affecting the abundance and control of this pest, and to anticipate the steps which may be taken to lessen its injury.

Factors to be considered include rainfall, effects of July treatments for lygus bug control upon bollworm parasites, size of bollworm larvae when control treatments are begun, the interval between successive treatments, recommended pesticides, comparative effectiveness of spray and dust formulations, and the reduction of DDT drift contamination. The following statements are based on field research observations made in Arizona during the past eight seasons.

Worst In Wet August

Bollworms are most destructive to cotton in seasons when the rainfall and relative humidity are high during August. In years with low August rainfall, bollworm populations seldom reach or exceed a population level of 14 larvae per 100 plants. Such infestations are easily controlled by chemicals. The year 1959 was such a year. One inch of rain fell in Phoenix during nine days scattered throughout the month. The average rainfall was only 0.11 inch per rainy day, and the effects of this rainfall quickly disappeared due to high temperatures and wind.

Oviposition (egg laying) occurred throughout the month, but relatively few eggs hatched, due to the activity of beneficial insects (parasites and predators) and the desiccation caused by the hot dry winds. Furthermore, such predators as *Orius, Collops* and lacewing larvae were observed killing small bollworms, and in some instances actually eliminating recently hatched infestations. As a result, many infestations were kept below destructive levels.

The effect of abundant rainfall during August on bollworm population flare ups was evident in 1964, when 3.80 inches fell in Phoenix on seven days scattered throughout the month. An average of 0.54 inch of rain fell on each of the rainy days. As a result the humidity was very high (evidenced by the fact that evaporative coolers were ineffective).

Oviposition had begun by the beginning of the month and apparently increased as the season progressed. It was favored by cloudy, humid days with little or no wind. No desiccation of eggs was noticed, probably due to the high humidity. Very little activity of egg predators, such as of *Orius, Collops,* and lacewing larvae, was observed. As a result, bollworm populations increased and by the end of the month many untreated fields had all plants infested.

Insecticides Can Be Factor

The selection and use of insecticides during July for lygus bug control has an effect on potential bollworm infestations in August and September. Applications of Bidrin, dimethoate and phosphamidon, when applied during the early part of July, appear to adversely affect bollworm predators and cause early, explosive and damaging bollworm populations which are very difficult to control for the remainder of the season. Such insecticides are called "bollworm accentuators." *Limited tests have shown that these accentuators have little or no effect on the potential bollworm population when applied prior to June 20.*

Bollworm populations also increased slowly to destructive levels when malathion, diazinon, methyl parathion and trichlorfon (Dylox) were used for lygus bug control during the latter part of July. Such bollworm infestations were prevented when DDT was added to the insecticidal formulation.

Experiments in Arizona in 1959 and 1960 showed that the best bollworm control was obtained when insecticides were applied at 7-day intervals. Commercial control of bollworms was still obtained when the interval between applications was lengthened to 10 days. Bollworm populations were actually increased by stretching the interval to 14 days.

A number of experiments conducted during 1963 and 1964 showed that bollworm control could be obtained by applying insecticides at 7 to 8 day intervals. However, if infestations are as high as 35 or more bollworms per 100 plants, bollworms may be brought under control by applying two treatments at 4-day intervals, followed by further applications at 8-day intervals as needed during the remainder of the season.

Effectiveness of DDT Brief

Research has shown that 50 percent of the initial deposit of a pesticide such as DDT may disappear by the end of three days. The remaining deposit is actually inadequate to kill even small bollworms. Therefore three days after an application the cotton plant is again unprotected. If the interval between applications is 7 or 8 days, larvae will have a period of 4 to 5 days to develop without being seriously poisoned although, except in severe infestations, bollworms can be effectively controlled no later than this time. Small larvae are much easier to kill than large larvae.

The time interval between applications is also determined by the type of insecticide used. Azodrin, a new organic phosphate with a very short residual toxicity, gave excellent control of bollworms on an interval of four days between applications, but populations built up to highly destructive levels when the interval be-

(Continued on Next Page)

Dr. Wene is an associate entomologist and Mr. Sheets is an agricultural technician with the USDA Agricultural Research Service.

Dave Aepli Appears In Our Mystery Picture

Longtime superintendent at the Mesa Branch Experiment Station, Dave Aepli, was on hand when station field day was held last May. And, without the slightest sign of resistance, he posed with the two young ladies who man the visitors' registration desk at such affairs. That is the mystery picture trio pictured on Page 10.

The two with Dave are Mrs. Celia Roberts (on the left, with dark glasses) and Mrs. Mary Glenn Carlin, both regular secretaries at the Mesa Experiment Station.

Both have, in addition to secretarial competency, the highly desirable asset of always being smilingly gracious and helpful to visitors and to their colleagues at that research center.

Semi-retired, Mr. Aepli still takes an active interest in those acres which he supervised for so many years, and can link each new research finding to those of years and even decades ago.

Fertilizing Arizona's Rangelands

By J. L. Stroehlein, Bahe Billy, and L. R. Amburgey

Much of Arizona's range production is limited by a low moisture supply. In areas of adequate moisture, however, production is often limited by low soil fertility.

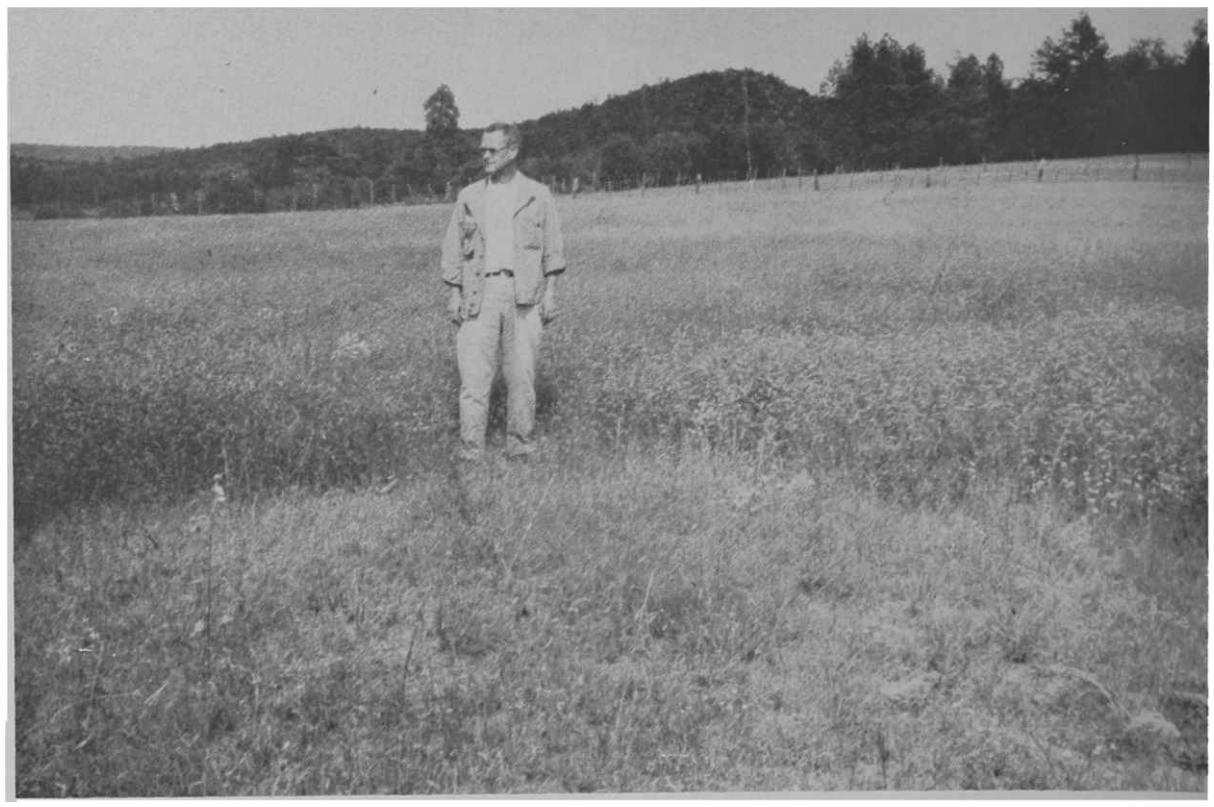
It is known as a result of numerous field experiments that fertilization can improve forage yields and quality, influence livestock distribution, and help conserve soil and soil moisture when conditions are favorable.

In many instances results have not been satisfactory, due to a lack of moisture or other factors. Several conditions must be present for range fertilization to pay dividends. The soil must be fairly low in fertility, soil moisture must be adequate, and there must be a good stand of grass on the site.

First Test the Soil

Evaluation of native fertility of range by soil testing should provide a basis for fertilizer recommendations. Thus experiments initiated in 1964 studied (a) the usefulness of soil tests in outlining areas of potential fertilizer response and (b) the proper time of application with respect to rainfall.

The authors are assistant professor, graduate assistant in research, and extension specialist, respectively, all in the Department of Agricultural Chemistry and Soils.



OBSERVING EFFECT OF fertilizers on a good stand of blue grama grass at Rodger's Q Ranch in Gila County is Dr. Lyman Amburgey, extension soils specialist. The plot on the right received 100 pounds of nitrogen, the plot on the left received 100 pounds of nitrogen plus 44 pounds of phosphorus per acre, and the plot in the foreground was unfertilized.

Several experiments were established during the summer of 1964. Nitrogen with and without phosphorus and potassium fertilizers was broadcast on field plots in June or July. Rainfall was sufficient at all sites for good growth. The plots were clipped for yield measurements in September and October. A partial list of treatments and yields is shown in the accompanying table. Response varied from no increase at Kitt Peak to more than eight times at Rodger's Ranch in Gila County.

(Continued on Next Page)

(Continued from Previous Page)

tween applications was lengthened to eight days.

Experiments in 1959 and 1960 showed that spray formulations of insecticides were as effective as dust formulations in controlling bollworms. Since that time most of our field experiments have been conducted with spray formulations. Sprays do not contain sulfur, which is commonly added to most dust formulations for spider mite control.

In recent years spider mites have been of minor importance on cotton in Arizona, and the few infestations that have been observed have come so late that no economic damage was evident. Many recent grower complaints against sprays for bollworm control appear to have resulted from late or poorly applied treatments.

Insecticide formulations recommended for bollworm control have commonly included DDT in combination with another insecticide, such as toxaphene, strobane, malathion, endrin, dieldrin, or BHC. DDT has also been used alone. A mixture of endrin and methyl parathion has also been recommended. Perhaps the most commonly used formulations are sprays or dusts containing DDT plus toxaphene or strobane.

Restrict DDT as a Dust

Because of hazards of drift contamination of forage crops, recent state restrictions have limited the use of DDT in dust formulations although, because of a lesser hazard, *there are no similar regulations against DDT in spray formulations.* All applications containing DDT, whether in spray or dust formulations, should be made only when there is no serious possibility of contaminating neighboring forage crops. Regardles of drift hazards, there remains the possibility that DDT may soon be less effective against bollworms, at least in some areas, because of a developing problem of insecticide resistance.

New Chemicals Being Tried

Insecticides which may be used in place of DDT are being tested each year in field experiments. Although carbaryl (Sevin) has not been effective, the following toxicants (although slightly less effective than DDT formulations) have given commercial control of bollworms when used in sprays at intervals of 7 to 8 days: toxaphene or strobane at 6 pounds per acre (also as 20% dusts), one pound methyl parathion plus 4 pounds toxaphene per acre, and one pound methyl parathion plus 0.5 pound endrin per acre. Azodrin, one pound per acre, applied at 4-day intervals, was as effective as toxaphene-DDT mixtures against bollworms.