BOLL WEEVIL POPULATIONS CORRELATED WITH WEATHER, COTTON PLOW-UNDER AND TOTAL COTTON ACREAGE

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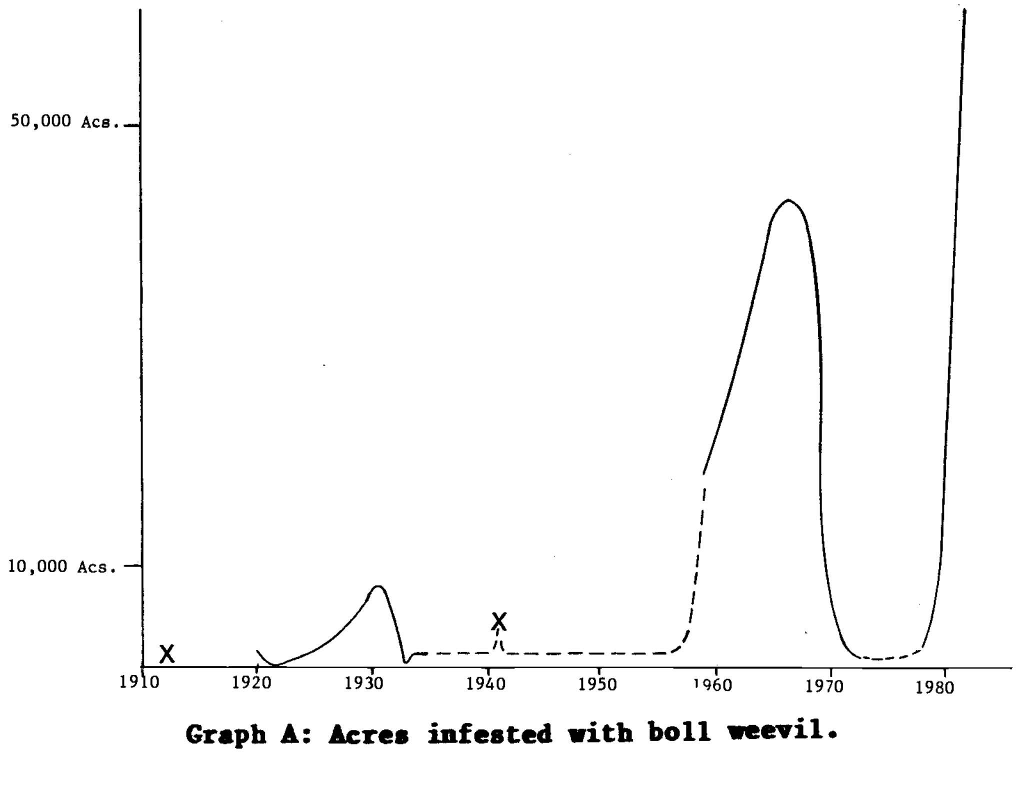
There has been a lot of speculation on the reasons behind the cycles of the boll weevil populations in Arizona over the last 60 years. I have put information drawn from Arizona Commission of Agriculture and Horticulture records, the records of the state climatologist, and Crop and Livestock Reporting Service in graph form to see if any correlation might be found.

More than one factor is doubtlessly at work. This report is not designed to be a scientific study, but merely an attempt to gain benefit from our records. It is a starting point in addressing the validity of certain speculation.

The first step was to graph the boll weevil populations through the years as well as possible with the sketchy records available. A search of the commission's annual reports resulted in Graph A.



Graph A: Acres infested with boll weevil.

Graph A is a representation of the number of acres infested with boll weevil since 1910. No differentiation is made between boll weevil species. The first "X" is the first find of boll weevil in wild cotton in 1912. This find was in Pima County (Rillito Valley northwest of Tucson). The beginning of a solid line is the estimated infested acres judging from the number of fields reported infested multiplied by the size of a small field. The immediate downward dip is a report of "none found" despite considerable survey work.

The first peak represents the weevil generally spread in Greenlee, Cochise, Santa Cruz Counties and the southern part of Pima County. The peak figure is based on total cotton acreage recorded for these areas by the Crop and Livestock Reporting Service with a percentage taken off to take into account non-infested fields, and for the fact that only the southern part of Pima County was infested. The first curve spans about 10 years.

The dotted line is for time in which no reports were made of boll weevil infestations in the commission's annual reports. Rumor has it that there were upswings in populations during these years, but they were apparently of little consequence. The second "X" is a report of 233 Thurberia weevils recovered from gin-trash inspections in Pima County in 1941. This fact was reported by more than one source. It is reasonable to assume this weevil find was unusual and was probably a minor "peak" year for purposes of correlation.

The second line-peak is from infested acreage noted from actual survey results recorded in commission annual reports. Undocumentable records show that at its peak this infestation represents most of the same areas in which we found boll weevil infestations in the 1982 cotton-growing season.

The last upward swing is estimated both from acreage surveyed by the commission and two searches of the 10-80 forms which must be turned in to the Board of Pesticide Control by all commercial applicators after treatment. Forms with boll weevil as a target pest were recorded. Apart from my own search which ended with figures including the 1982 cotton season (October), I made some interpolations from Roger Caldwell's report from 1980. Dr. Caldwell works for the Council for Environmental Studies, University of Arizona. Charts B1,2,3, represent trap finds and give an idea of the geographical location of boll weevil finds in the last upswing.

Now to compare the factors of precipitation, cotton plow-under, total cotton acreage and temperature with the peaks. We do not have any conclusive correlations; but, we do have some possible correlation.

Chart "C" represents the mean precipitation in Southern Arizona as taken from the records of the State Climatologist from 1910 to 1982. It was necessary to add and average the mean

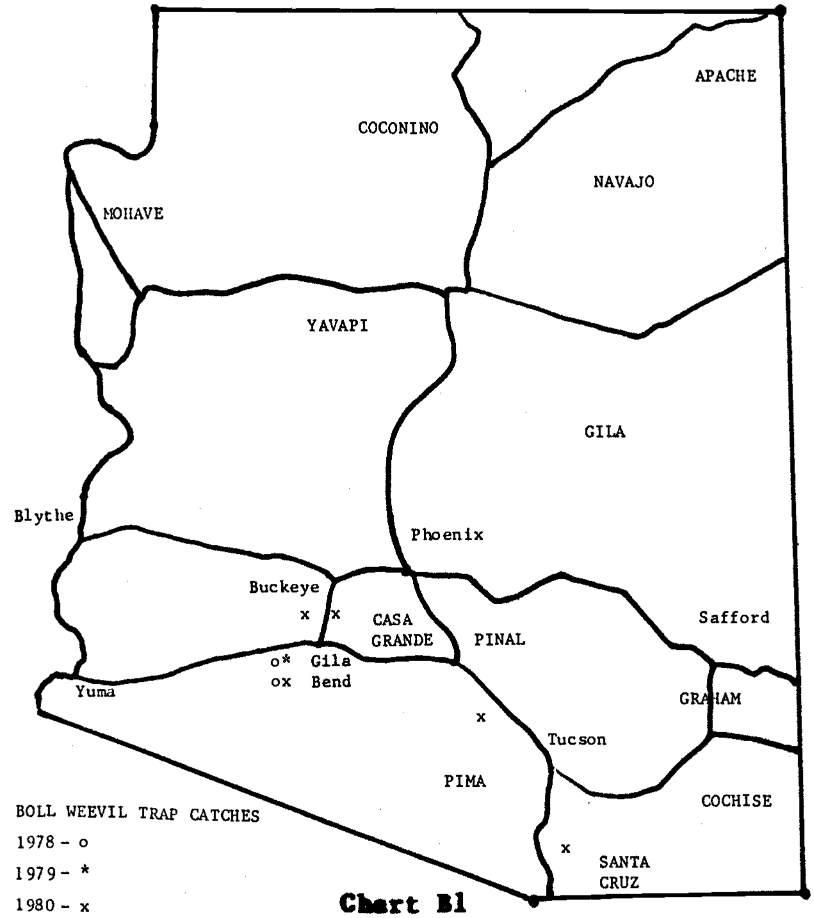


Chart B1

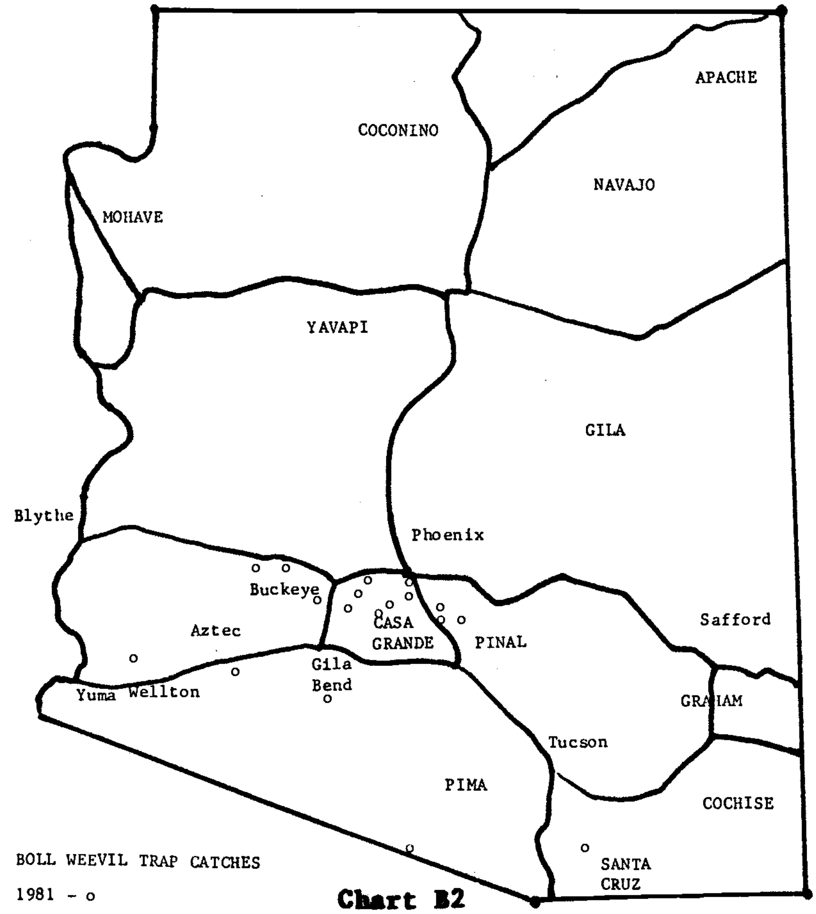
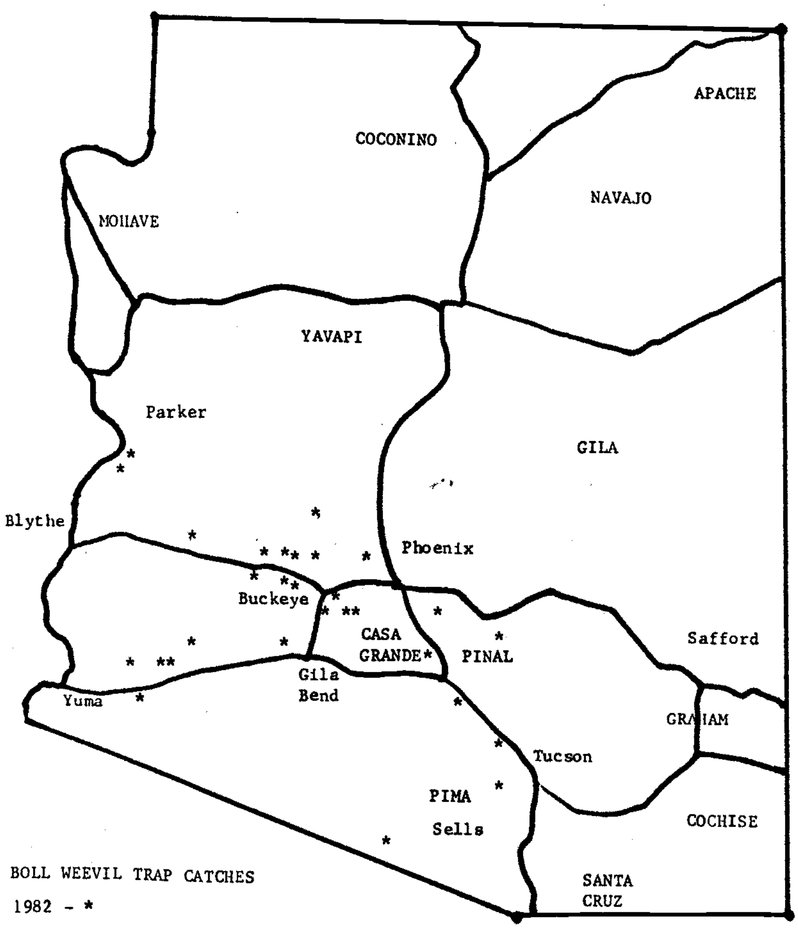


Chart B2



BOLL WEEVIL TRAP CATCHES

1982 - *

In 1983 additional areas with low trap finds were the cotton-growing areas of Cochise County and east Pinal County.

Chart B3

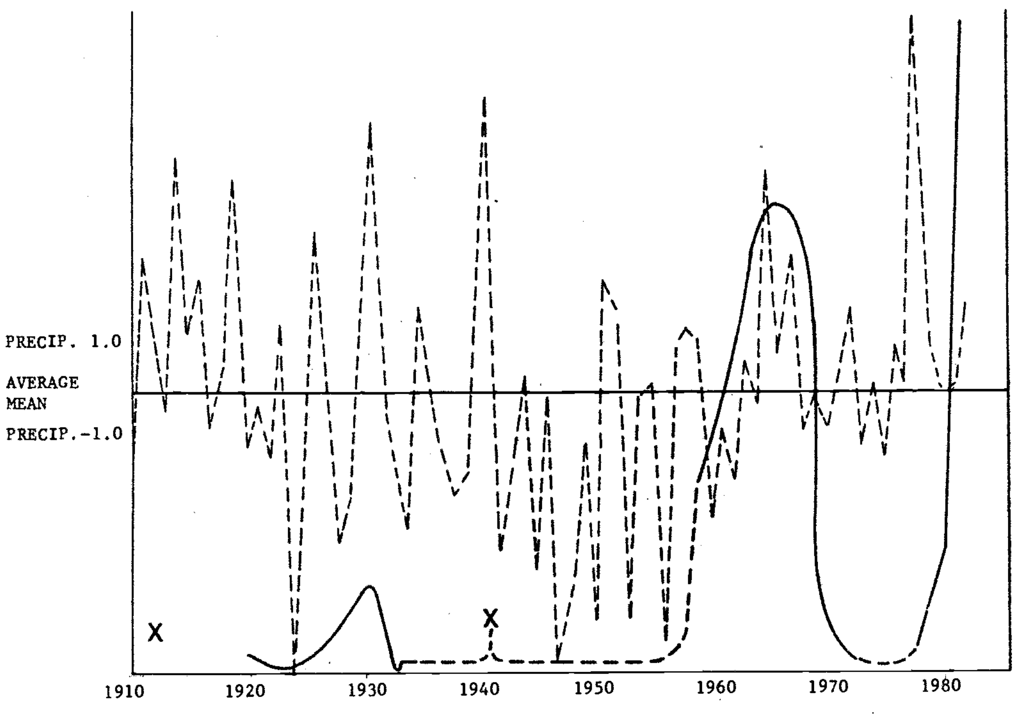


Chart C

precipitation of those reporting stations which were determined to be in southern Arizona. Fall and spring precipitation data were not separated.

There appears to be a correlation in high boll weevil years with years of high precipitation. There is a delayed correlation in the last upswing; but, the last point represents a wet fall averaged with a more normal spring. Rainfall would encourage greater numbers of boll weevil overwintering on host plants such as globe mallow or stub cotton. This would tend to support the entomologists who say that the longer the host-free period, the more likely it is to break the boll weevil cycle.

The precipitation factor may be more important than the cotton plow-under regulation, although there a correlation that could also be made here.

Chart "D" represents cotton regulation graphed. After the first find in wild cotton in 1912, a non-cotton zone was set up and wild cotton plants were roughed out. In 1919 the non-cotton zone was eliminated through the courts. In 1921 an elaborate eradication program was again put into effect with a non-cotton zone. In 1922 the non-cotton zone was reduced. In 1926 a court order issued a temporary injunction against quarantine requirements. In 1928 reinforcement of regulations was begun in response to pink bollworm activity.

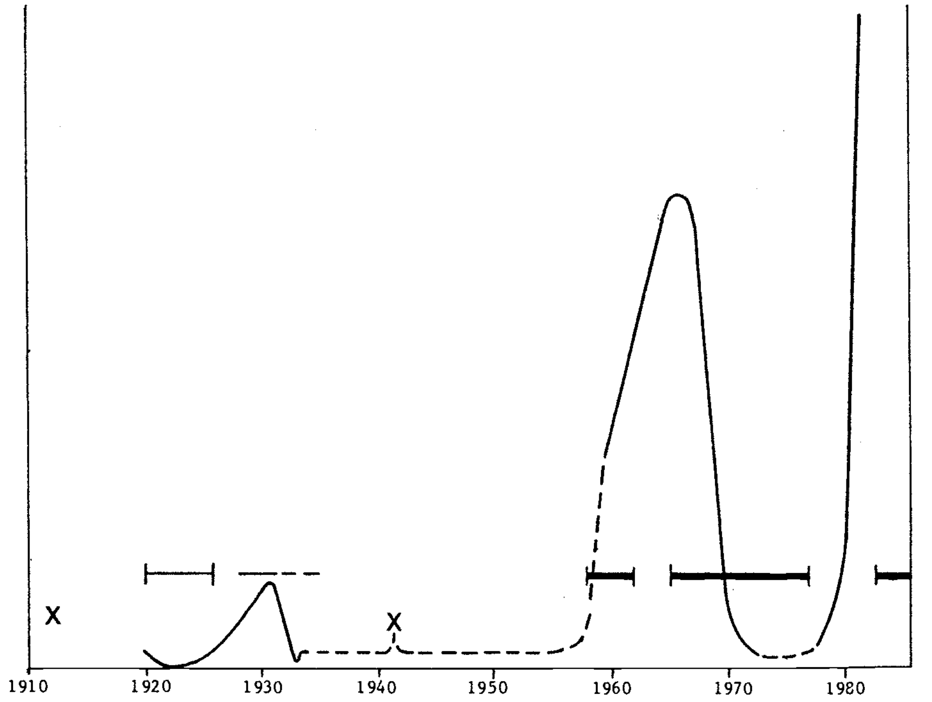


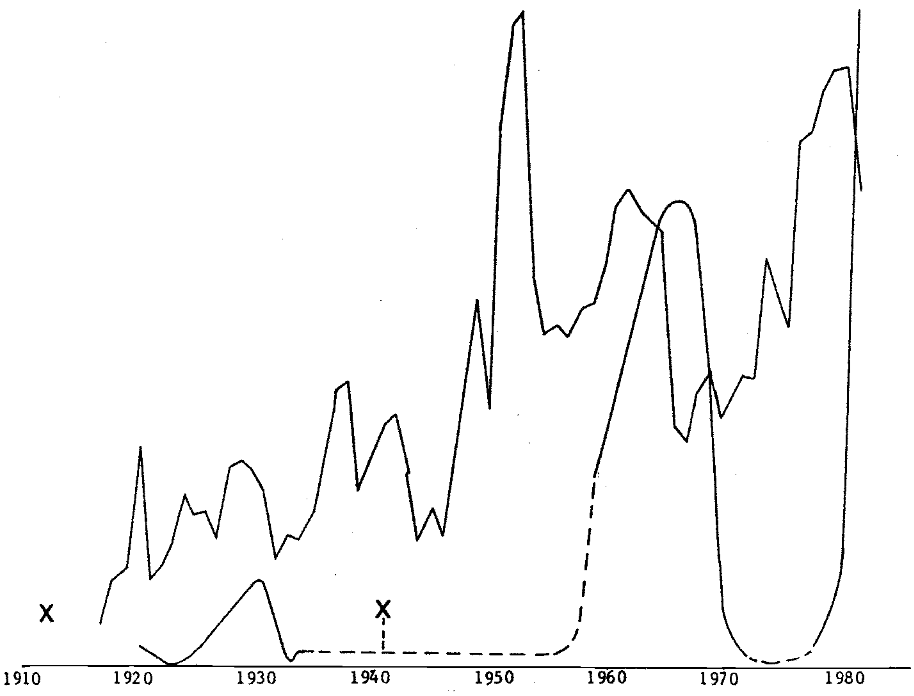
Chart D

Most of the regulations were aimed at the pink bollworm, but could have affected the boll weevil as well. As a matter of interest, in 1934 WPA workers hand-roughed over a million wild cotton plants in the Santa Catalina Mountain range (where the boll weevil was first found).

During the 1930s stub cotton was common. In the ´30s, ´40s and ´50s pink bollworm eradication efforts were in full swing as infestations showed up. There was some cotton plow-under, but it was never statewide and was geared to the pink bollworm.

Referring to Chart "D", it may be noted that the highest infestations were in years in which there was no cotton plow-under. The decline in the 1970s may have been partially due to the plow-under regulation. However, there was at least an initial buildup of boll weevil despite the first year of the cotton plow-under regulation in 1959.

Chart "E" shows thousands of acres of cotton harvested according to Crop and Livestock Reporting Service records. As would be expected, the more acreage there is, the more acreage there is to infest. However, high acreage did not necessarily trigger an infestation. It may be that the cycle was broken by something throughout the 1950s or a new strain may have been introduced. No correlation with in average mean temperature in Southern Arizona was found.



THOUSANDS OF ACRES HARVESTED IN ARIZONA

Chart E

Chart "F" represents the average extreme high temperatures in southern Arizona below 4000 feet. There seems to be a possible correlation in boll weevil upswings with "mild" extreme high-temperature years. This would tend to support the general theory that insects show reduced activity above a certain temperature. There might be a very weak correlation in the average extreme <u>low</u> temperature below 4000 feet.

In Chart "G" the peaks represent lows which are <u>milder</u> than average. The valleys are cold years. Again, milder weather might encourage host-plant development, but lack of moisture is a more likely limiting factor for host plants in southern Arizona.

In conclusion: many factors may influence boll weevil population upswings. Upswings might correlate somewhat with combinations of high precipitation, lack of cotton plow-under, high cotton acreage, mild extreme highs and possibly mild extreme lows. Other factors may also be at work.

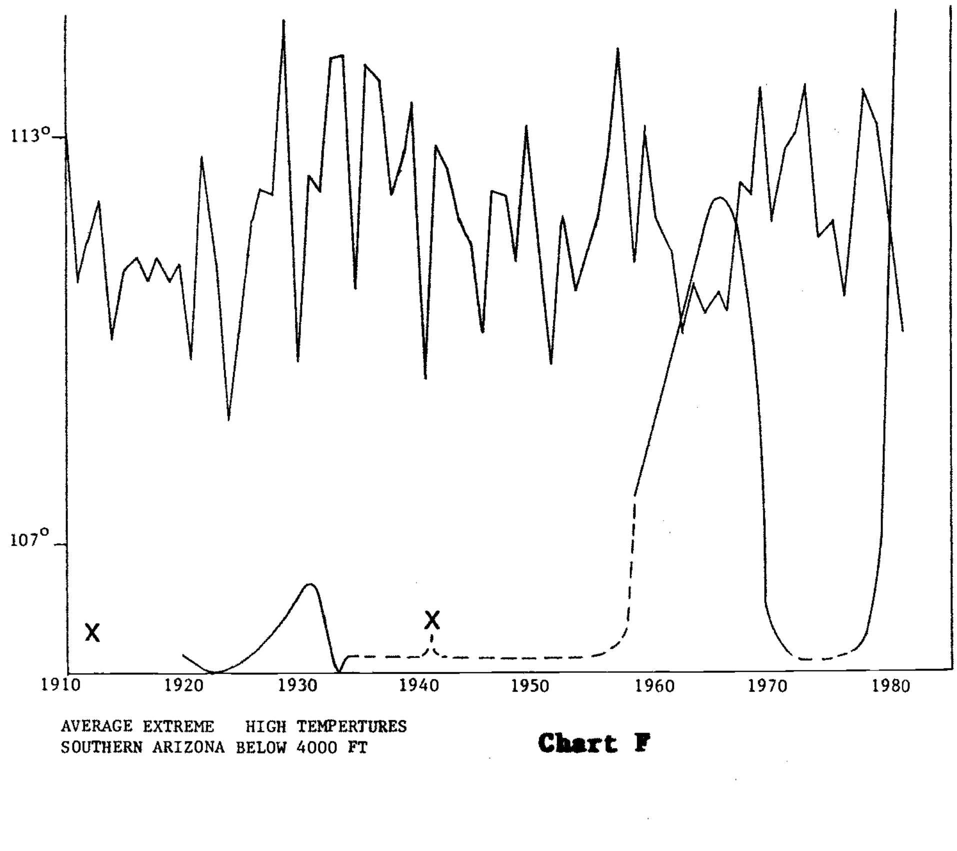


Chart F

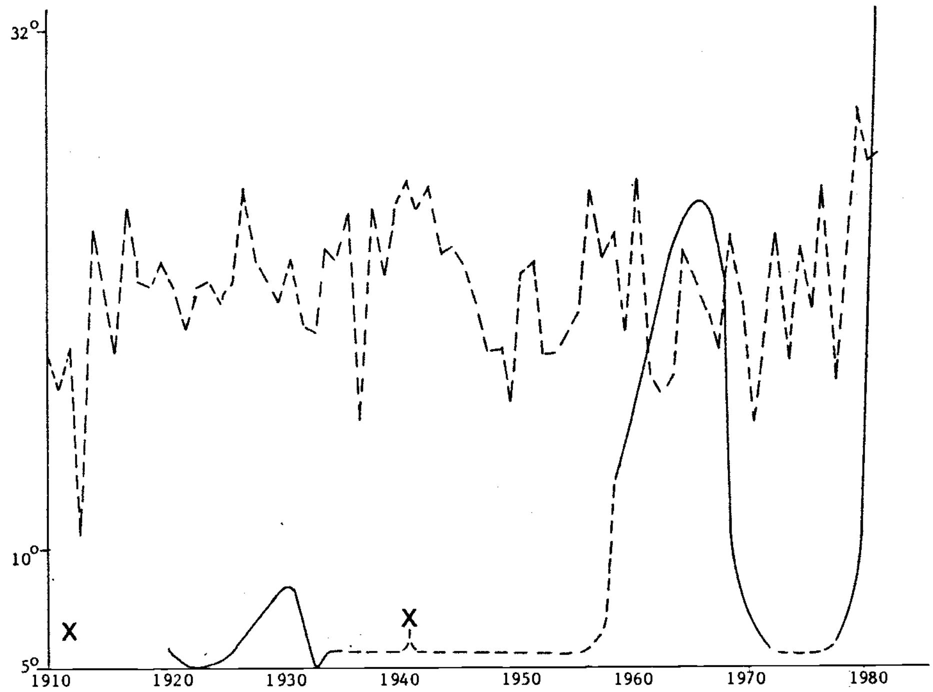


Chart G

AVERAGE EXTREME LOW TEMPERATURES
SOUTHERN ARIZONA - BELOW 4000 FT

SWEETPOTATO WHITEFLY AND PARASITE POPULATIONS IN SPRAYED COTTON PLOTS

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Summary

Two insecticide applications were made to cotton in late August and early September. Higher Bemisia tabaci populations were observed in the malathion treatment, as sampled by vacuum samples, and in the Dylox[R] and malathion treatments, as sampled by yellow sticky traps. Generally, the numbers of parasites collected were higher in untreated check plots than in the insecticide treated plots.

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The sweetpotato whitefly, Bemisia tabaci (Genn.), has been a sporadic pest of cotton and, in 1981, reached economic infestation levels throughout the southwestern United States. The insects migrated into fall vegetable crops where they caused damage by transmitting several virus diseases. In the 1982 and 1983 cotton research reports, we discussed damage, life history, overwintering, control, and population buildup of this insect. The effect on whitefly and parasite populations by insecticide