RESEARCH ANNUAL REPORT
ARKANSAS WHEAT PROMOTION BOARD
Second year of 3-year project

TITLE: Refinement of Armyworm Threshold in Wheat

PRIORITY AREA: Insect Control (High Priority)

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OBJECTIVE : To incorporate armyworm larval feeding and defoliation rates into new treatment thresholds

INTRODUCTION:

The armyworm is an occasional but sometimes serious pest of wheat in Arkansas during the spring. It is not uncommon to see isolated fields heavily infested while adjacent fields of the same cultivar have very few armyworm larvae Because of the narrow profit margin for the crop, it is essential that the grower treat only the fields (or portions thereof) which will economically benefit from treatment. The 1999-2000 growing season was considered an outbreak year, with approximately 40% of fields infested by armyworm, and populations commonly exceeding double the published thresholds of 5-6 larvae per square foot. Armyworm populations during the 2000-2001 growing season were expected to decline, but instead armyworm densities nationwide were greater than any in living memory, often exceeding 25-30 larvae per square foot. Armyworm was found in every field sampled in Arkansas during the spring of 2001.

Current thresholds used in Arkansas suggest that growers "apply treatment when 5-6 larvae are found per square foot" in the spring or fall, or "if head cutting is occurring" in the spring. These thresholds have served us well, but do not take into account the dramatic differences in foliage consumption and damage potential between newly hatched larvae and those that are full grown. The current thresholds assume that growers will not detect larvae in the field until they have almost completed development and obvious crop damage has occurred.

METHODS:

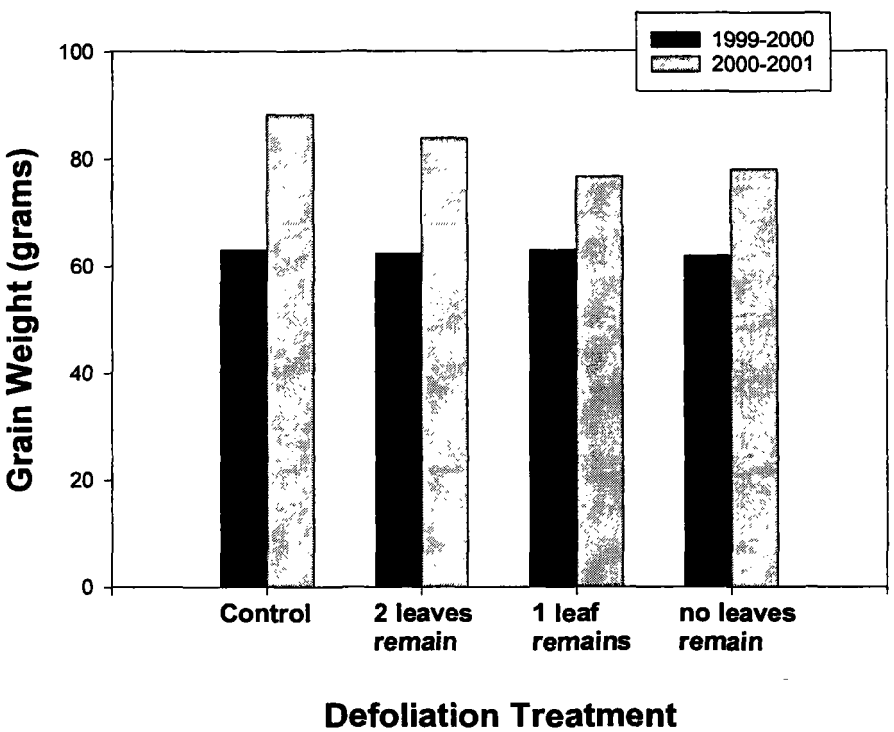
Based on the levels of defoliation observed in commercial fields during the spring of 2000, additional defoliation experiments were needed to develop a relationship between yield and defoliation in excess of 75%. These studies were conducted at the Arkansas Agricultural Research and Extension Center in Fayetteville. Plots (100' x 50') were established in a field and all wheat plants in 1 m^2 subplots were artificially defoliated using one of 4 treatments (e.g., all leaves removed, all but one leaf removed, all but 2 leaves removed, and no defoliation). The defoliation was done in a way to simulate armyworm damage caused during the spring. Artificial defoliations were initiated during wheat flowering, and done sequentially to mimic the progressive (bottom-up) defoliation caused by armyworm. The defoliation levels created closely followed natural defoliation observed in central Arkansas fields at the same time. Defoliations were repeated 4 times in each plot and the experiment was replicated four times. Plots were taken to yield to develop a relationship with defoliation.

As in 2000, we were prepared to initiate insecticide tests in commercial fields to evaluate new and current products for armyworm control. This portion of the study is funded by the

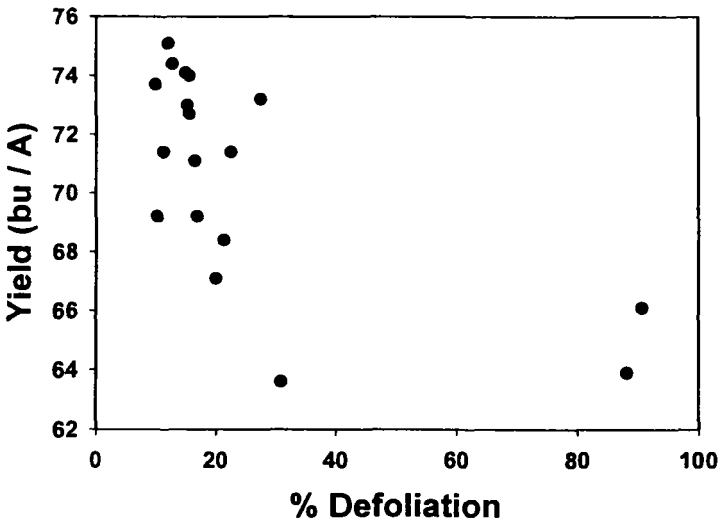
agrichemical industry, and Dr. Johnson has presented these results in his report on moth traps and the relationship of armyworm with *Poa annua*. We also recorded defoliation levels in these plots, and related defoliation to yield and present these data in this report. Because armyworm populations were so large and widespread in 2001, we were also afforded a tremendous opportunity to validate defoliation tests under commercial conditions on several farms. Four heavily infested fields, which were clearly headed for 100% defoliation, were identified in Arkansas, Lonoke and Prairie Counties. Growers agreed to leave large portions of fields (10A - 40A) untreated for yield comparison to the remainder of each field, which we treated. Although these large-block split treatments provide an excellent opportunity for validation and demonstration of our findings, they are not statistically-based tests.

RESULTS AND DISCUSSION:

Studies previous to the 1999-2000 season clearly demonstrated that defoliation levels below 75% after heading induced no yield reductions. These studies were conducted by placing armyworm on caged wheat. Armyworm would not consume more than 75% of the foliage in cage tests, so artificial defoliation studies were designed to evaluate the full range of defoliation (100% defoliation) observed in producers fields. We focused evaluation of defoliation at a time (post-anthesis) when armyworms are known to commonly defoliate wheat. These studies were conducted by clipping leaves with scissors. This technique has been criticized as leading to exaggerations of the impact of defoliation. However, our data from 2000 suggested that even complete defoliation of wheat using this method at this advanced stage had no significant impact (or even a trend) on wheat yield (Fig. 1, *below*). Data from 2001 indicated a downward trend in yield with increased defoliation levels, but the trend was not significant. There was considerably more variation in yields during the 2001 season.



Insecticide screening trials conducted during 2001 and funded by the agrichemical industry provided excellent data regarding armyworm control for a number of chemicals (see Dr. Johnson's report). Because of the large armyworm populations, we were able to create plots large enough to allow evaluation of yield after the screening test. We also visually estimated defoliation in these plots. Applications were made fairly early during the infestation (prior to highly visible defoliation), and the products provided fairly immediate suppression. As a result, there was a narrow range of defoliation in the treatments (10-31%), with the exception of the untreated checks (ca. 90%, *right*). Given these ranges, it is not surprising that there was no significant linear relationship between yield and defoliation, with a very low r^2 (0.45).



Yields from split-field tests showed no clear relationship between yield and the treatments applied to control armyworm. In all cases, applications were made when defoliation had begun, but prior to significant damage to the upper two leaves. On the untreated halves of each field, armyworm populations continued unchecked until the fields were completely defoliated. Defoliation was so severe in the untreated portions of these fields that the armyworm consumed the awns off of the heads (*right*). It is interesting to note that no head-cutting was observed in these fields, nor were incidences of head-cutting reported to extension personnel. Yields were obtained from both treated and untreated sides of these fields. In two fields, yields were up to 4.7 bu/A higher in the treated side, but in two other fields, yields were up to 4.5 bu/A lower in the treated side of the fields (*right*). As previously mentioned, these differences are not statistically testable, but the observed variation suggests that factors other than armyworm-induced defoliation were involved in the variability.

Location	Yield (bu/A)	
(County)	**Untreated**	**Treated**
Arkansas	87.0	86.3
Lonoke 1	60.3	65.0
Lonoke 2	77.0	79.2
Prairie	72.0	67.5

These findings support our premise that current armyworm thresholds are set too low, causing Arkansas growers to pay for inputs which are not providing any clear return. We are recommending an adjustment in the threshold, specifying treatment for armyworm is unecessary if defoliation begins after the late milk stage of development (Zadock 7.7). Although significant armyworm defoliations have not been reported prior to this growth stage, we recently proposed to identify the wheat growth stage which would be susceptible to defoliation. We will initiate defoliation at three different growth stages (flowering, 6.9; early milk, 7.3; and late milk, 7.7. The last stage is the typical period when significant defoliation induced by armyworm begins. Futhermore, these artificial defoliation tests have only been carried out with a single but very popular variety (Coker 9663). It is possible that yield of other varieties may be more greatly influenced by defoliation. Therefore, we have decided to expand tests during the 2001-2002 growing season to evaluate the impact of armyworm defoliation (at the standard time) on Sabbe, Roane, Pioneer 26R38 and Coker 9663. Fields have been planted for both defoliation tests.