A SEQUENTIAL SAMPLING PLAN FOR CLASSIFYING INFESTATIONS OF SOUTHERN POTATO WIREWORM

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ABSTRACT

A plan is proposed whereby 1 to 3 hours of sampling will usually determine whether measures for control of the southern potato wireworm, *Conoderus falli* Lane, are warranted. This pest is potentially serious but does not consistently occur in sufficient numbers to cause economic injury to potatoes.

INTRODUCTION

The tremendous potential of the southern potato wireworm, *Conoderus falli* Lane, as a pest of potatoes was clearly demonstrated in 1956, when infestations in excess of 18/ft² developed in Charleston County, South Carolina because the insect had become resistant to the insecticides then in use (2). During that year, State and Federal Inspectors found wireworm damage in excess of the 6% tolerance in 30% of the lots of potatoes that had been assembled for rail or motor-van shipment. Nevertheless, despite the lack of an effective control measure, 34% of the inspected lots had less than 3% damage. Therefore, the insect obviously is not a consistent, perennial pest that must be controlled as a matter of course.

The life history of the southern potato wireworm has been described, and the relationship between population density and subsequent damage to potatoes has been determined (2). The occurrence of larvae in ¼-ft² × 6-inch-deep samples of soil during September through March follows the Poisson distribution (5). Therefore all information required to develop a basic sampling plan is available.

The typical producer probably would not be interested in an accurate estimate of wireworm density in a prospective potato field. Rather, he would want to know simply if control measures would or would not constitute a wise investment. Under these circumstances a sequential sampling technique would be highly appropriate.

SAMPLING PLAN

In general, sound management requires reducing damage by wireworms to the lowest level that is economically feasible. Wireworm damage essentially reduces the allowable tolerance for blemishes caused by sunburn, growth cracks, grass roots, diseases, or mechanical injury, because the tolerance for all such external defects is only 6% in U. S. No. 1 and No. 2 potatoes. The author has stated previously (6) that at least half the total tolerance should be available to cover defects from sources other than wireworms because these causal agents may often be less manageable than the wireworms. Therefore, one logical basis for a sequential sampling plan would be to recommend no treatment if damage is likely to be 2% or lower and treatment if damage is likely to be 4% or higher. These limits convert to population densities of 0.25 and 0.44 wireworms per ¼-ft²,

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respectively (2), which will be designated hereafter as $X_1$ and $X_2$, respectively. $X_1$ agrees exactly with a standard for economic control that was estimated in 1964 (1).

The next step is to establish acceptable levels of risk associated with incorrect classification of fields as seriously infested or as not seriously infested. While these levels can be set somewhat arbitrarily, their choice must be tempered by the severity of the penalty for making an incorrect classification and by the cost of the sampling procedure. Risk can be decreased only at the expense of more stringent sampling requirements, so most sequential plans represent a feasible compromise between accuracy and cost.

Failure to detect and treat an infestation in excess of $X_2$ could cause severe financial loss, depending on the degree of underestimation and the eventual degree of damage to tubers by other agents. It would therefore seem prudent to restrict the probability of that occurrence (usually referred to as “beta”, abbreviated $\beta$) to 0.05 or lower.

Treatment of an infestation that is less than $X_1$ requires a fixed investment, a portion of which may be recovered if mechanical damage, growth cracks, etc. are unusually severe. Consequently, it is much less serious to overestimate than to underestimate an infestation. This provides flexibility that allows the probability of applying a nonessential treatment (usually referred to as “alpha,” abbreviated $\alpha$), to be set at the lowest level that can be attained with a reasonable amount of sampling.