Government of Canada / Gouvernement du Canada
Canadian Forestry Service / Service canadien des forêts

ISSN 0826-0532

TECHNICAL NOTE

Forest Pest Management Institute

No. 3 January 1985 Laboratory Methods

EVALUATING SPRAY DATA USING ABBOTT'S FORMULA

The data obtained in a spray trial, when a pesticide is evaluated for its efficacy, usually consists of pre- and post-spray population densities of the target insect in treatment and check plots. Abbott's formula (1925) reduces the effect of any bias or variance, which is related to the nature of the plots, in population levels between different plots (Sower et al. 1982). One of the pre-requisites for the correct use of this formula is that the pre-spray population densities of the check and treatment plots are identical. If the populations are not matched, a serious bias is introduced, as can be seen in the following example and the discussion that follows.

Abbott's formula can be written in the form of a simple equation (Retnakaran 1980), which is easy to use in any hand-held calculator with keys for brackets.

$$\%\ \text{Population reduction} = \left[1 - \left(\frac{\text{Post-spray population in treatment}}{\text{Pre-spray population in treatment}} \times \frac{\text{Pre-spray population in check}}{\text{Post-spray population in check}}\right)\right] \times 100$$

Hypothetical sets of data from paired treatment and check plots are shown below to illustrate the effect of varying the pre-spray population density in the check plot on the percent population reduction.

Spray trial	Population in treatment		Population in check		% population reduction
	Pre-spray	Post-spray	Pre-spray	Post-spray	
Set # 1	10	1	5	2.5	80
2	10	1	15	7.5	80
3	10	1	10	5.0	80
4	10	1	5	5.0	90
5	10	1	15	5.0	70

In set number 3, the pre-spray population densities in the treatment and check plots are identical and therefore satisfy the requirement for applying Abbott's formula. The 80% population reduction obtained is the unbiased value.

If the pre-spray population density in the check is different from that of the treatment but the post-spray density in the check is proportionally low, as in sets 1 and 2, then the results are unaltered. Such a situation, however, cannot be predicted and requires a check plot with a pre-spray population identical to that of the treatment to confirm the proportionality.

If the pre-spray population in the check plot is lower than the pre-spray population in the treatment, as in set 4, then the % population reduction is overestimated. If the pre-spray population in the check plot is higher, as in set 5, then the % reduction is underestimated.

The post-spray population densities in the check plots (sets 4 and 5) are reasonable from an ecological standpoint. When the population density is high, competition is severe, resulting in relatively high mortality. On the other hand if the population is relatively low, the converse is usually true.

Conclusion

(i) When it is not possible to match the populations of 2 plots, it is better to use the plot with the higher population as the control and obtain a conservative estimate of population reduction than to do the reverse and overestimate the result.

(ii) Examining the pre-spray population densities of spray data can alert the reader as to whether the results are optimistic or conservative.

References

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