Methods for estimating leafy spurge (*Euphorbia esula*) populations

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Introduction

Information reported in this paper is from a larger on-going study designed to evaluate methods for estimating the density of leafy spurge and Canada thistle populations. This was done by comparing the results obtained from various methods to an actual population density.

Many different types of methods have been used by weed scientists and ecologists to measure species density (Behrens and Strand 1979, Crete 1981, Elliot *et al*. 1977, Inouye *et al*. 1987, Mukula *et al*. 1979, Thomas 1985, Steenhagen and Zimdahl 1979, Wilson 1981). Some are simple and quick, sampling a small percentage of a survey area, while others are complicated but sample a larger area. A systematic comparison was needed to determine which method was the most accurate.

Materials and methods

Three methods were chosen for comparison. First was a single 5 m line with 3 quadrats. Four sets of 20 replications were done. Each set used a different size and shape quadrat (1/2 and 1 m squares and 1/2 and 1 m circles). Next was a W pattern with 50 pace legs and 20-1/2 m square quadrats. Lastly a double sampling procedure was chosen. This used 24-30 m transects with 15-1 m circular quadrats per transect. In the first phase, transects were laid out and all sample locations visually rated as to level of infestation. This was recorded along with line number and location on the line. Next a percentage of each level was randomly selected for sampling.

After all methods were tested, the survey area was divided into 5 x 5 m squares and each individual shoot in the entire field was counted.

Results and discussion

The single line method had high variability between replications. The comparison of quadrat shape and size determined larger quadrats to be better (Table 1). Circular quadrats are usually preferred because fewer decisions need to be made concerning boundaries.

The W pattern was also highly variable. Size limitations only allowed two replications so this method will need to be tested again. The double sampling method was the most accurate (Table 1). The large number of samples resulted in estimates with lower variability. Categorizing samples into levels insured that different levels were treated proportionately.

Table 1. Comparison of estimated field density versus actual field density for varying quadrat size and shape and for three different methods.

Method	Quadrat	Estimated Density[1]	Difference from Actual[1]
Single Line	1 m^2	10.917	+1.05
Single Line	1/2 m^2	13.333	+3.47
Single Line	1 m diameter	7.558	-2.30
Single Line	1/2 m diameter	14.966	+5.10
W	1/2 m^2	17.7	+7.84
Double Sampling	1 m diameter	10.4	+0.28

[1]shoots/m^2.

Conclusions

It was determined that large circular quadrats were preferred and double sampling was the most accurate method. This method was costly in time and effort so modifications are being tested to increase efficiency. The final modifications will be used in competition studies by our laboratory and could be used to measure the effectiveness of biological control methods in the future.

Acknowledgements

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