White Grubs

Phyllophaga spp.
Coleoptera: Scarabiidae

Ives, W. G. H.; Warren, G. L. 1965. Sequential sampling for white grubs. *Canadian Entomologist* 97: 596-604.

Objective: To develop a sequential sampling plan for white grubs, *Phyllophaga* spp., which facilitates the estimation of population levels and helps determine if control measures are warranted.

Abstract: White grubs, *Phyllophaga* spp., feed on the roots of conifers in newly established plantations, causing crop failures in infested stands. A study was conducted in the Agassiz Forest Reserve in southeastern Manitoba, Canada to determine the vertical and frequency distribution of white grubs in a 929 cm^3 (1 ft^3) sample area.

In Canada, white grubs complete a three-year life cycle with the majority of this time being spent in the larval (grub) stage. The best time to sample is during June and July when populations are estimated by counting the number of second and third instar larvae, pupae and adults. For the pre-planting survey, only first through third instar larvae are counted. Both surveys have an error of misclassification of 10%.

Densities were classified as light (< 0.2), moderate (0.2-0.7) and severe (>1.1 per cubic foot). Control measures were advisable if a survey completed during the previous season estimated densities of greater than 0.7 larvae per cubic foot.

Sampling Procedure:

Grub population density samples: Select a number of potential sample plots randomly throughout the area of concern. At each plot, remove all soil in a 30 by 30 cm surface area, digging into the soil to a depth of approximately 30 cm for a sample unit of 900 cm^3 (1ft^3). Remove 10 cm of soil at a time and pass it through a screen to collect grubs. Include all white grubs found in the sample due to the difficulty of identifying grubs to species. Do not try to count eggs and first instars as they are very small and thus difficult to find in the soil. Reference Table II and continue sampling until a decision is met.

Pre-planting survey samples: Sample newly harvested areas in July of the year prior to planting. The number of first through third instar larvae must be counted to predict accurately the density of grubs the following season. First instar larvae at time of sampling will become second instar larvae the following spring, which are capable of causing considerable damage. Therefore, these samples take more time to process. It is recommended that two screenings be

done for pre-planting samples. Use a larger screen to catch second and third instar larvae, and to remove coarse debris. Then re-screen with a finer mesh size to capture first instar larvae. Reference Table III and continue sampling until a decision is met.

Notes: Damage classifications are subjective because of insufficient data on the relationship between density and damage. The timing of samples will likely change according to latitude and adjustments should therefore be made for sampling populations in the USA.

References:

Shenefelt, R. D.; Liebig, H. .R.; Dosen, R. C. 1955. Protecting machine transplanted trees from white grubs. *Tree Planters' Notes* 20: 14-17.

Tables:

Table II. Sequential sampling plan for classifying *Phyllophaga* spp. infestations. Sampling continues until the cumulative number of larvae (grubs) is ≤ or ≥ the tabulated values (refer to the original publication for sample sizes >40).

Number ft^3 soil samples examined	Cumulative number of white grubs					
	Light		Moderate	Moderate		Severe
1	---	CONTINUE SAMPLING	---	---	CONTINUE SAMPLING	9
2	---		---	---		10
3	---		---	---		11
4	---		---	---		12
5	---		---	---		12
6	---		---	---		13
7	---		---	---		14
8	---		---	---		15
9	---		---	---		16
10	---		---	---		17
11	---		---	---		18
12	---		---	---		19
13	---		---	---		19
14	0		---	---		20
15	0		---	---		21
16	0		---	---		22
17	1		---	---		23
18	1		---	---		24
19	1		---	---		25
20	1		10	10		26
21	2		10	10		27
22	2		11	11		27
23	2		11	12		28
24	3		11	13		29
25	3		11	14		30
26	3		12	15		31
27	4		12	16		32
28	4		12	17		33
29	4		13	17		34
30	4		13	18		34
31	5		13	19		35
32	5		13	20		36
33	5		14	21		37
34	6		14	22		38
35	6		14	23		39

36	6		15	24		40
37	6		15	25		41
38	7		15	25		41
39	7		15	26		42
40	7		16	27		43

Table III. Sequential sampling plan for use in pre-planting surveys to determine if white grub control is needed. Sampling continues until the cumulative number of grubs ≤ or ≥ the tabulated values.

Number of ft^3 soil samples examined	Cumulative number of white grubs		
	No control needed		Control needed
1	---		4
2	---	CONTINUE SAMPLING	5
3	---		5
4	---		6
5	---		6
6	---		7
7	---		7
8	0		8
9	0		8
10	1		9
11	1		9
12	2		9
13	2		10
14	3		10
15	3		11
16	4		11
17	4		12
18	5		12
19	5		13
20	5		13
21	6		14
22	6		14
23	7		15
24	7		15
25	8		15
26	8		16
27	9		16
28	9		17
29	10		17
30	10		18

Tables recreated with permission from The Canadian Entomologist, January 15, 2001.