ESTIMATE OF LOSSES AND THRESHOLD OF ECONOMIC INJURY BY CLOVER SEED WEEVIL

MUHAMMAD YUNUS*

The clover seed weevil has become a major pest of alsike and white clovers in the Pacific Northwest in the USA. Studies carried out during 1963 and 1964 in southeastern Washington and adjacent Idaho revealed that the population of weevils per sweep of a 15-inch standard sweep net ranged from 1.2 to 16.3 in different fields. The extent of seed damage in the same fields varied from 2 to 69.8 per cent. It has been shown that two weevils per sweep is the threshold of adult population justifying control operations which cost $2.00 on account of spraying charges and $3.12 for six ounces of endrin per acre.

INTRODUCTION

The clover seed weevil, *Miccotrogus picirostris* (F.), has become one of the limiting factors in the production of white and alsike clover seeds in the Pacific Northwest in the U.S.A. Its importance has increased with the expansion of clover seed production. Whereas clover seed was once a by-product, a trend was started in about 1948 to plant it exclusively for seed production. Seed production advanced from a minor to a major farm enterprise (Graumann, 1961). The Western States excel over all other regions in clover seed production due to bright, sunny weather which is conducive to blooming after the plants have made a good vegetative growth to maximum pollination activity by bees and minimum losses at harvest (Holowell, 1962). However, with the increase in area, the seed weevil has become the major pest in clover growing areas of the West, especially Idaho, Oregon and Washington. The damage is caused by the larvae which feed on the developing seed inside the pods. Sometimes the losses may be so great that the harvesting of the crop becomes a prohibitive operation (Pielou, 1950). Clover seed growers must, therefore, sample the adults periodically during late spring and apply carefully timed control measures.

In view of the great importance of the pest, studies were carried out during 1963 and 1964 to ascertain the extent of seed damage in relation to weevil population and to determine the threshold of adult population which cause economic injury.

*Department of Entomology, Faculty of Agriculture, West Pakistan Agricultural University, Lyallpur.

PROCEDURE

The population of adult weevils, bloom counts and extent of seed damage was recorded from a number of fields in southeastern Washington and adjacent Idaho. A standard 15-inch sweep net was employed to sample adult populations. The samplings were started in early May when the weevils enter the clover fields after leaving their overwintering quarters and continued till the fourth week of June when the population started to decline after reaching a peak. Along with the weevil population the number of blooms per square yard was also recorded. Bloom counts were taken by placing a one square yard wooden frame over the clover plants at random. A number of samples of mature flower heads were collected from each field to evaluate the damage when maximum infestation had taken place towards the end of July. Each sample consisted of 90 heads plucked at random from each field. These were placed in plastic bags. The bags were then stored in cold room at 38°F. until analysis. Out of each lot of 90 heads, 10 heads were picked at random and from each of these 15-20 pods were dissected under a microscope to obtain total number and number of damaged seeds in each pod.

RESULTS AND DISCUSSION

Holowell (1962) has reported a few pounds to over 600 pounds with an approximate average of 150 pounds of seed per acre for white Dutch and alsike clovers in different parts of the United States. Yields of clean seed per acre as great as 1,000 pounds have been reported from Bonners Ferry, Idaho. Washington and Idaho growers consider 400 pounds of seed per acre as a good harvest for them. Results summarized in Table I reveal that the population of weevils ranged from 1.2 to 16.3 per sweep and the pest damaged 2 to 69.8 per cent seed during 1963-64 at different places in these two states. This means a loss of 8-279 pounds of seed per acre. Calculated at 35 cents per pound, the monetary loss ranges from $2.80—$37.70 per acre.

Endrin, at six ounces per acre is reported to give good control of the clover seed weevil. The aerial spraying charges are about $2.00 per acre, while endrin sells at $13.30 per gallon of the emulsifiable formulation containing 1.6 pounds of actual material. The cost of treating, therefore, comes to $5.12 per acre. On the basis of this cost of treatment, the threshold of weevil population causing economic injury may be worked out as under :

Amount of seed equivalent to $ 5.12 at 35 cents per pound $= \frac{5.12}{35} = 14.6$ pounds.

Percentage of seed losses at 400 pounds/acre yield $= \frac{14.6}{400} \times 100 = 3.7$

TABLE 1. *Seed damage in relation to different levels of clover seed weevil population,* 1963 and 1964.

Source of sample	Peak population per sweep	Maximum bloom per Sq. Yd.	No. of samples examined	% damaged seed	
				Range	Average
Johnson Hall Pullman, Washington.	7.4	578	5	11.0—20.2	17.6
Expt. Clover field. Pullman, Washington.	5.34	510	5	7.9—10.6	9.3
Vet. Dept. Bungalow Pullman, Washington.	16.3	450	3	62.6—69.8	67.6
Dodd farm Anatone, Washington.	2.6	442	3	3.0—7.0	4.4
Dodd farm Anatone, Washington.	1.2	444	3	2.0—2.8	2.3
Guske farm Idaho.	13.0	550	5	34.2—56.2	42.8
Moscow Mtn. Idaho					
3000 ft.	6.0	400	1	—	14.6
4100 ft.	12.0	400	3	30.0—40.4	35.6
4200 ft.	10.0	400	3	25.9—40.1	31.5

The results given in Table I show that on an average, 4.4 per cent damage is caused by the weevil when its average population is 2.6 per sweep. The range of damage at this level was 3.0 to 7 per cent and may also vary with the condition of the crop and season of the year. Since the maximum of the range exceeds 4.4, it seems appropriate to fix the threshold level lower than 2.6 weevils per sweep. A level of two adults per sweep appears to be a reasonable threshold of population of the clover seed weevil justifying control operations. This result is in accord with that of Johansen (1965) who reported that recommendations for timing of treatments for the clover seed weevil have varied from the time the first brown blooms appear to the time 20 per cent are brown. Percentage of brown blooms is not a good criterion because it varies greatly from season to season and field to field during a single season. The onset of first brown bloom is important is relation to inward migration of the weevils. Such observations on brown bloom in combination with level of weevil population are more accurate for timing of treatments for clover seed weevil control.

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