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Winter survival of bean leaf beetle

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Abstract
During the growing season, bean leaf beetle larvae feed on soybean roots, root hairs, and nodules, whereas the adults defoliate soybeans and feed on the external tissues of pods. The beetle is known to be the vector of soybean viral diseases, including bean pod mottle virus, yellow cowpea mosaic virus, cowpea chlorotic mottle virus, and southern bean mosaic virus. In addition, the second-generation adults feed on the pod tissues, often causing secondary infection of fungal pathogens (*Alternaria* spp.) and seed-quality reduction.

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Bean leaf beetle has two generations a year in Iowa. Of the second-generation adults, approximately 80 percent overwinter in leaf litter in woodlands; 20 percent overwinter in the crop residue of soybean fields; and less than 1 percent overwinter in the residue of alfalfa fields, cornfields, and grasslands.

Low winter temperature definitely has a great impact on the survival of overwintering bean leaf beetle populations. During the winters of 1996 through 1999, a study on winter survival of the beetle in central Iowa allowed development of a model by accumulating the daily average subfreezing temperature to predict the mortality of overwintering populations. The accumulated daily average subfreezing temperature can be obtained by using the daily average temperature (°F) minus 32 and accumulating only those temperatures that are negative through winter. For example, in October after each daily average temperature minus 32, only 2 days with negative temperature was obtained; one was -10 and the other was -20. Then, the accumulated daily average subfreezing temperature for October was -30. By accumulating the daily average subfreezing temperature from October 1 through April 15 of the following year, the percentage of beetle mortality can be estimated (Table 1).

Table 2 shows the estimation of beetle survival by the predictive model in Ames, Iowa, for 12 consecutive winters (1988-2000). The average beetle mortality in central Iowa for the last 12 winters was 68 percent. The highest beetle mortality (91 percent) occurred during the 1993-1994 winter, whereas the lowest beetle mortality (48 percent) occurred during the 1991-1992 winter. The map shows the beetle mortality in different crop reporting districts of the state last winter. The percentage of beetle mortality in Iowa can be divided into three bands: northern, central, and southern, with 65, 45, and 39 percent mortality, respectively. Furthermore, the average beetle mortality of the nine areas is estimated to be 50 percent, indicating that a relatively large number of beetles survived the past winter in Iowa. A high infestation of bean leaf beetles on soybeans is expected this season.

Table 1. Predictive model for the percentage mortality of overwintering bean leaf beetle in Iowa.

Accumulated Daily Average Subfreezing Temperature from October 1 to April 15	Beetle Mortality (%)
-89	20
-183	25
-276	30
-370	35
-464	40
-558	45
-652	50
-746	55
-840	60
-933	65
-1027	70
-1121	75
-1215	80
-1309	85
-1403	90

Table 2. Winter survival of bean leaf beetle in crop reporting district 5, central Iowa.

Year	Accumulated Daily Average Subfreezing Temperature from October 1 to April 15	Beetle Mortality (%)
1988-1989	-934	65
1989-1990	-882	62
1990-1991	-1130	75

1991-1992	-619	48
1992-1993	-1242	81
1993-1994	-1418	91
1994-1995	-1026	70
1995-1996	-1348	87
1996-1997	-1338	87
1997-1998	-743	55
1998-1999	-824	59
1999-2000	-482	41
Average	-999	68

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