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Bean leaf beetle and winter survival

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Abstract
Winter survival of an insect pest is important information to consider in management because the number of insects surviving the winter is closely related to the number colonizing crops early in the growing season. This article presents the estimated percentage of bean leaf beetles that overwintered, and the predicted relative population of the beetle this growing season.

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INTEGRATED CROP MANAGEMENT

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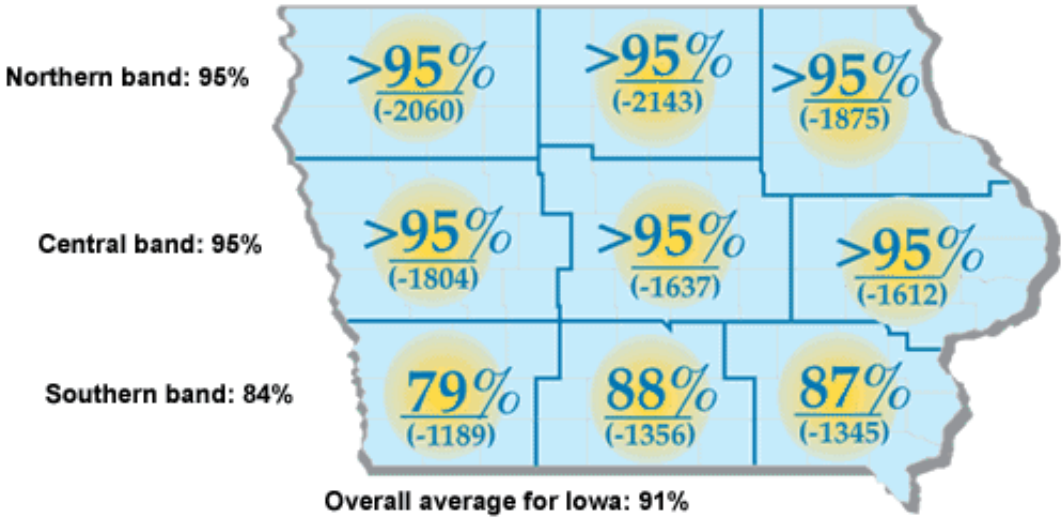

The bean leaf beetle has two generations a year in Iowa. Of the second-generation adults approximately 80 percent overwinter in leaf litter of woodlands; 20 percent in crop residue of soybean fields; and less than 1 percent in residue of alfalfa fields, cornfields, and grasslands. During spring, the overwintered adults emerge from these sites and move to wild hosts and alfalfa until they colonize soybean during its early vegetative stages.

Low winter temperatures have great impact on the survival of overwintering bean leaf beetle populations. During the winters of 1996-1999, a study on winter survival of bean leaf beetle in central Iowa lead to the development of a model to predict mortality of overwintering populations by accumulating the daily average subfreezing temperatures through winter. 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, negative temperature were obtained on 2 days only; one was -10 and the other was -20. Thus, the accumulated daily average subfreezing temperature for October was -30. By accumulating the daily average subfreezing temperature from October 1-April 15 of the following year, the percentage of beetle mortality can be estimated.

Table 1 shows estimated beetle survival by the predictive model in Ames, Iowa, for 13 consecutive winters (1988-2001). The average beetle mortality in central Iowa for the last 13 winters was 71 percent. The highest winter beetle mortality (95 percent) occurred in 2000-2001, whereas the lowest beetle mortality (41 percent) occurred in 1999-2000. The map shows beetle mortality in the nine crop reporting districts of Iowa last winter. The predicted percentage of beetle mortality in both central and northern Iowa was 95 percent, however, it was 84 percent in southern Iowa. Furthermore, the average beetle mortality for the nine areas is estimated at 91 percent, indicating that a low percentage of beetles survived through last winter in Iowa.

Although winter 2001 was extremely cold, a low percentage of survival still means a moderate number of beetles survived because from 1997 through 2000, Iowa had three consecutive warm winters, which resulted in a high population of beetles the past three seasons. In addition, the leaf litter and heavy snowcover this past winter acted as an insulating layer and protected beetles from the extreme cold. During our study, snowcover was not as prolonged as this past winter, and this record duration of snowcover might affect the accuracy of the model's predictions. How the thickness of snow affects bean leaf beetle winter survival is an unknown. A moderate infestation of beetles on soybean, similar to that of the summers of 1998 and 1999, is expected this growing season.

Table 1. Winter survival of bean leaf beetle in crop reporting district 5, central Iowa.

Year	Accumulated Daily Average Subfreezing Temperature (°F) (October 1-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
2000-2001	-1637	95
Average	-1048	71

Overwintering beetle mortality in different crop reporting districts of Iowa during winter 2000-2001 (accumulated average subfreezing temperature from October 1, 2000 to April 15, 2001)

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