INSECT PROBLEMS IN THE SUNFLOWER PRODUCTION REGIONS BASED ON THE 2003 SUNFLOWER CROP SURVEY AND COMPARISONS WITH THE 2002 SURVEY

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Introduction

A survey of 193 oilseed and nonoilseed (confection) commercial sunflower fields was conducted in Texas, Kansas, Colorado, Minnesota, and North and South Dakota during the fall of 2003. Fields were sampled to determine cropping practices, yield, and impact of birds, weeds, diseases, and insects. Insect damage assessment included the major sunflower pests: the sunflower midge [*Contarinia schulzi* Gagne (Diptera: Cecidomyiidae)]; the red sunflower seed weevil [*Smicronyx fulvus* LeConte (Coleoptera: Curculionidae)]; the banded sunflower moth [*Cochylis hospes* Walsingham (Lepidoptera: Tortricidae)]; the sunflower moth [*Homoeosoma electellum* (Hulst), (Lepidoptera: Pyralidae)]; the sunflower stem weevil [*Cylindrocopturus adspersus* (LeConte) (Coleoptera: Curculionidae)]; the sunflower longhorned beetle [*Dectes texanus* (Coleoptera: Cerambycidae)]; and the tarnished plant bug, [*Lygus lineolaris* Palisol de Beauvois (Heteroptera: Miridae)] (Charlet et al. 1997). Field evaluations at the time of the survey were made by rating visible damage to the heads from the sunflower midge and, in addition, stalks were split to determine the incidence of the sunflower stem weevil and sunflower longhorned beetle. Seed was collected from the fields at the time of the survey and evaluated in the laboratory for feeding damage from sunflower moth, banded sunflower moth, and red sunflower seed weevil. The presence of lygus bug feeding (kernel brown spot) was assessed from seed samples obtained from confection sunflower fields. Individual maps for all pests surveyed by each state can be viewed by accessing the following website: http://134.129.78.3/sunflower/.

Materials and Methods

The procedures for sampling sunflower insect damage during the survey included determining insect damage present approximately fifty feet in from the edge of the field. A total of five sunflower heads in a row were rated for damage resulting from sunflower midge infestations. An average score for the five heads based on the 0-5 scale developed by Bracken (1991) was assigned with 0 meaning no damage and 5 indicating heads were completely destroyed (closed with no seeds). Five stalks at each location also were selected and evaluated for the presence of sunflower stem weevil or sunflower longhorned beetle. The stalks were split lengthwise and any larvae present were identified. Training and/or pictures had been provided to all individuals conducting the survey to assist in identifying the two species of beetle larvae found in the stalks.

Pie-shaped sections of seeds, approximately one-eighth area of the heads, were removed from each of the five heads from the sampling location in the interior of the field and placed in bags. All seed samples were returned to the USDA, ARS, Northern Crop Science Laboratory, Fargo, North Dakota, for processing and inspection for insect damage. Seed samples were cleaned and a sub-sample of 100 seeds from each bag was randomly selected and visually examined for evidence of damage by the sunflower moth, banded sunflower moth, or red sunflower seed weevil. The same 100 seeds from confection sunflower fields were dehulled and inspected for the presence of lygus bug feeding injury on the kernel (Charlet 2002).

Results and Discussion

Sunflower Midge Damage.

The sunflower midge larval feeding causes necrotic feeding scars between the bracts and may destroy ray flowers. Heavily infested heads may be gnarled and cupped due to altered growth induced by larval feeding with subsequent yield loss (Charlet et al. 1997, Glogoza et al. 1997). Damage from the midge in North and South Dakota and Minnesota in 2003 was light, averaging 0.3 or less on the 5 point scale of severity (Fig. 1). Sample locations with at least some midge damage were fewer than those reported in 2002.

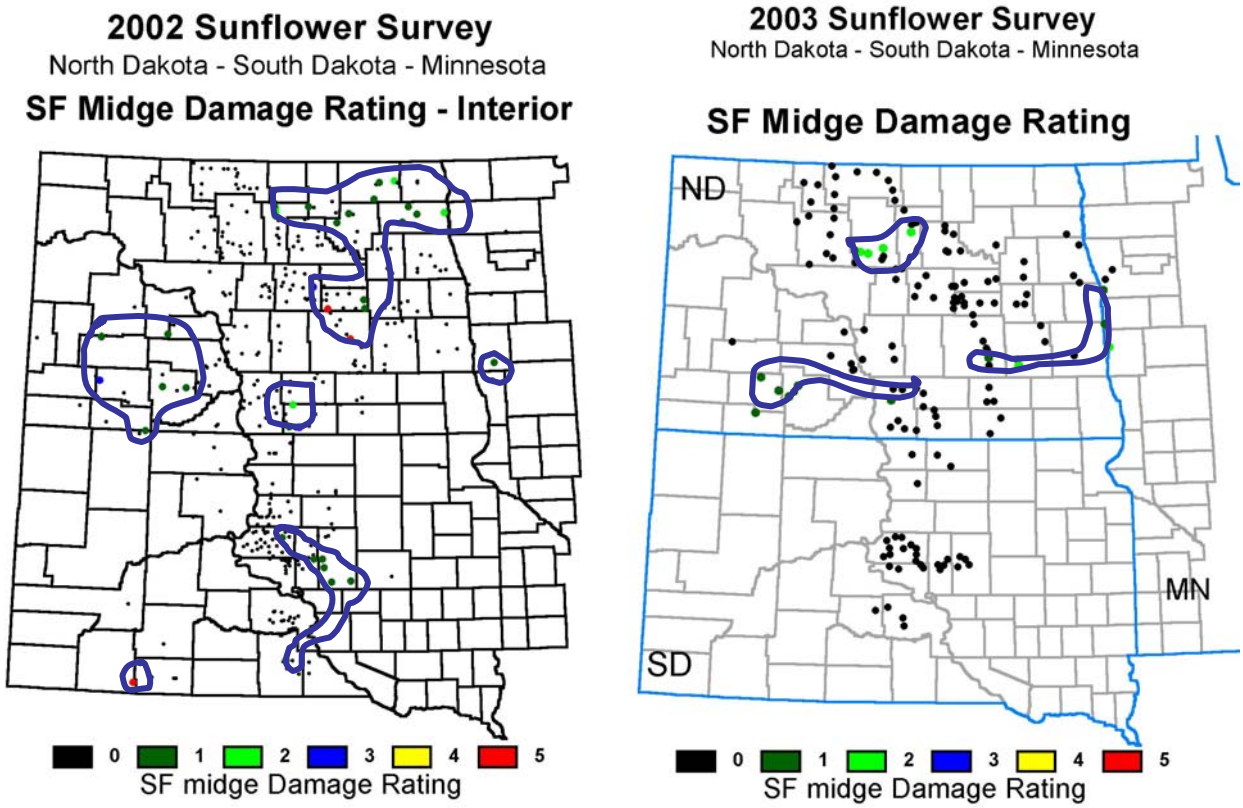

Fig. 1. Average midge rating for sunflower fields surveyed in North and South Dakota and Minnesota, 2002 and 2003, with circled areas indicating fields with at least some damage present.

Kernel Brown Spot.

Lygus bug feeding damage was only assessed in confection fields. Damage reported in 2003 was reduced in all states compared to that from 2002 (Fig. 2). Although fewer fields were sampled in 2003 in North Dakota compared to 2002, both the proportion of fields with kernel brown spot and severity of damage had declined (Fig. 3).

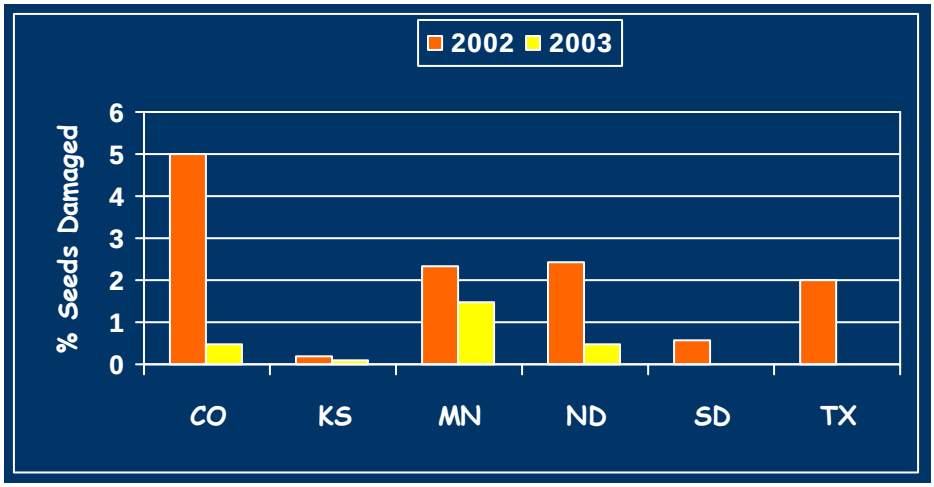

Fig. 2. Average percentage of seeds with kernel brown spot in the interior of confection sunflower fields for the states sampled, 2002 and 2003.

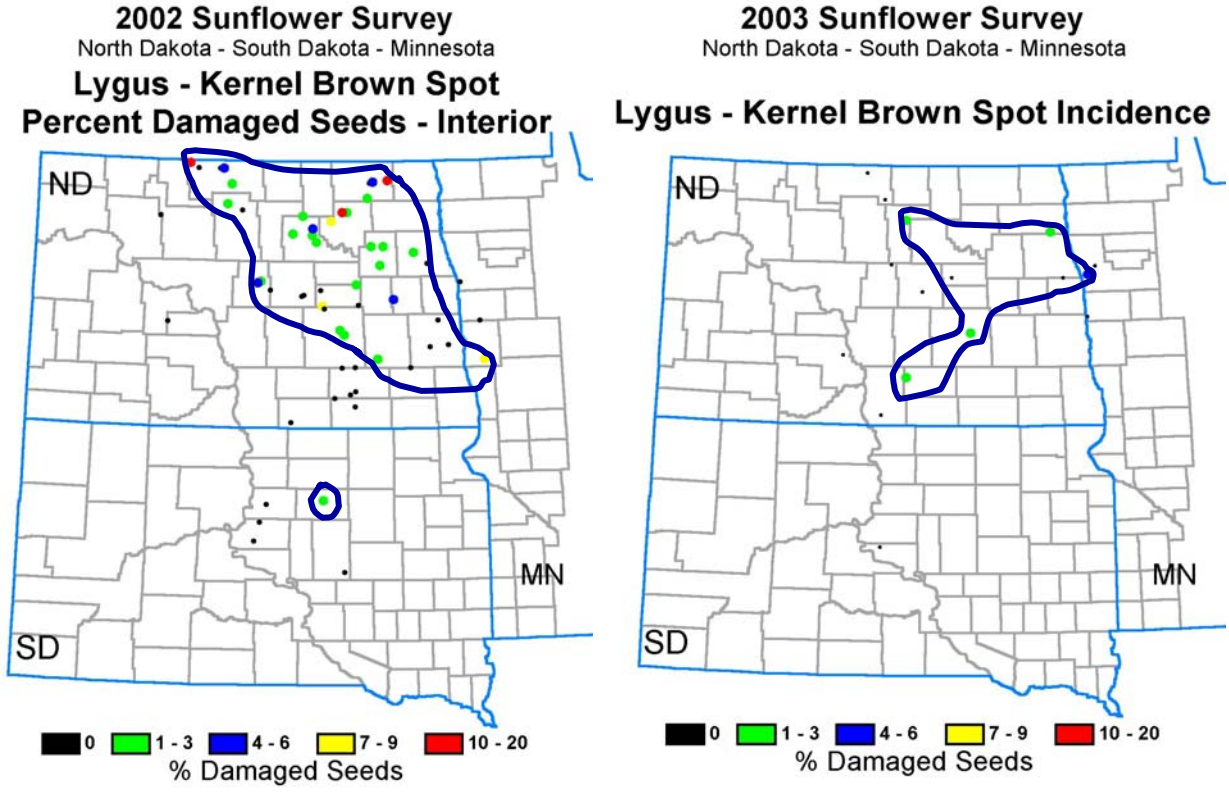

Fig. 3. Average percentage of seeds (n=100) with kernel brown spot in the interior of confection sunflower fields sampled in North and South Dakota and Minnesota, 2002 and 2003. Circled area includes fields with over 1% damage from kernel brown spot.

Sunflower Stem Pests.

The sunflower stem weevil and longhorned beetle feed and develop in sunflower stems. The construction of overwintering chambers by the mature larvae can result in lodging of the sunflower plant prior to harvest (Charlet et al. 1997, Knodel and Charlet 2002). Based on dissection of stalks, the incidence of the sunflower stem weevil in 2003 was 30% or more in stalks in North and South Dakota and Colorado (Fig. 4). This was an increase for both North Dakota and Colorado over 2002. In Kansas and Texas, there was a substantial decrease in incidence compared to the 2002 survey. The highest incidence levels occurred in Colorado where an average of 42% of the stalks was infested with stem weevil larvae.

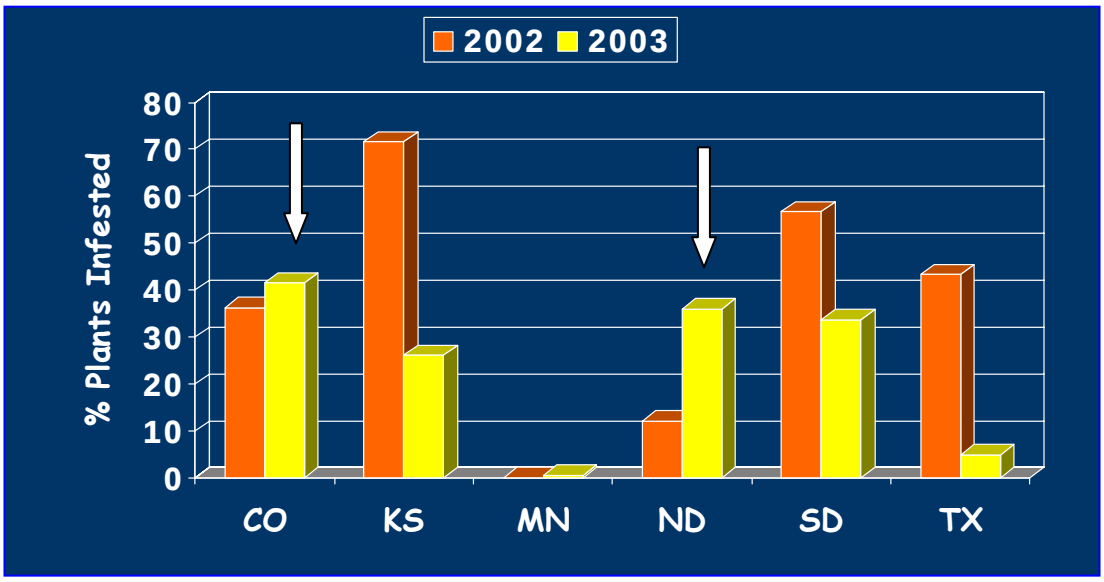

Fig. 4. Average incidence of stalks infested by the sunflower stem weevil in the interior of the field for the states sampled, 2002 and 2003. Arrows indicate states with a higher percentage in 2003 than 2002.

Sunflower stem weevil only occurred in a couple of the fields sampled in Texas in 2003, in contrast with the majority of fields being infested in 2002 (Fig. 5). Sunflower stem weevil was widespread throughout the central Plains in 2003 with over 50% of the fields that were sampled having infested stalks (Fig. 6). There were a number of sunflower fields in both Colorado and Kansas showing incidence of 80 to 100% of stalks infested by this pest. The areas of infestation were reduced somewhat from 2002, but part of the reason was probably because fewer fields were surveyed. The area represented by sampling was reduced and locations with weevil infestations in 2002 were not surveyed. Infestation by the sunflower stem weevil was widespread throughout the areas sampled in South Dakota with most of the fields having larvae in the stalks (Fig. 7). The percentage of stalks with larvae ranged from 20 to 90% in the 15 infested fields. Fields with high incidence of stem weevil infested stalks also occurred in North Dakota in 2003. The range of fields reporting substantial incidence of weevils in the stalks was much more extensive than reported in 2002 (Fig. 7).

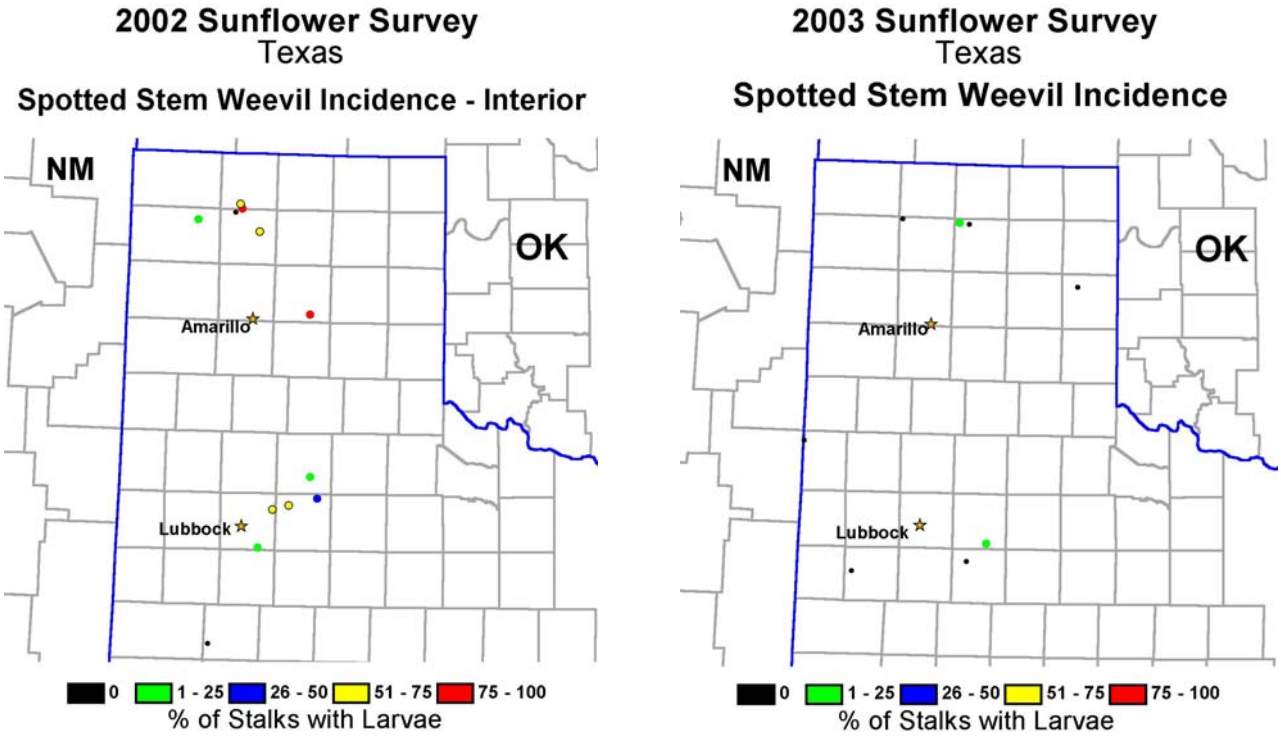

Fig. 5. Average incidence of stalks infested by the sunflower stem weevil in the field interior of the sunflower fields in Texas, 2002 and 2003.

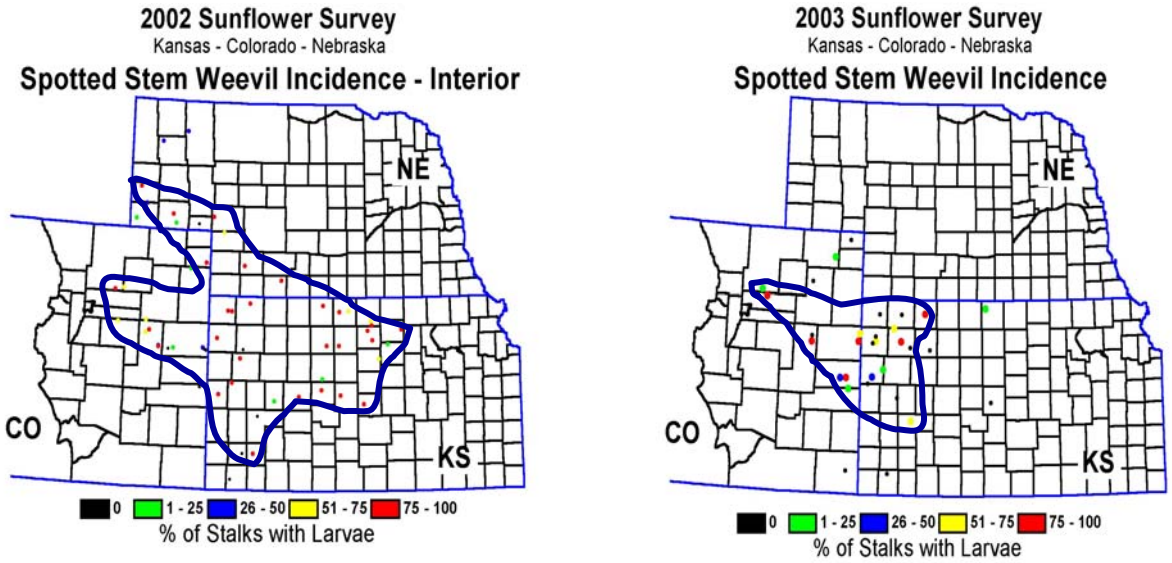

Fig. 6. Average incidence of stalks infested by the sunflower stem weevil in the field interior of the sunflower fields in Colorado, Kansas, and Nebraska, 2002 and Colorado and Kansas, 2003. Circled area includes fields with over 50% of stalks with stem weevil larvae.

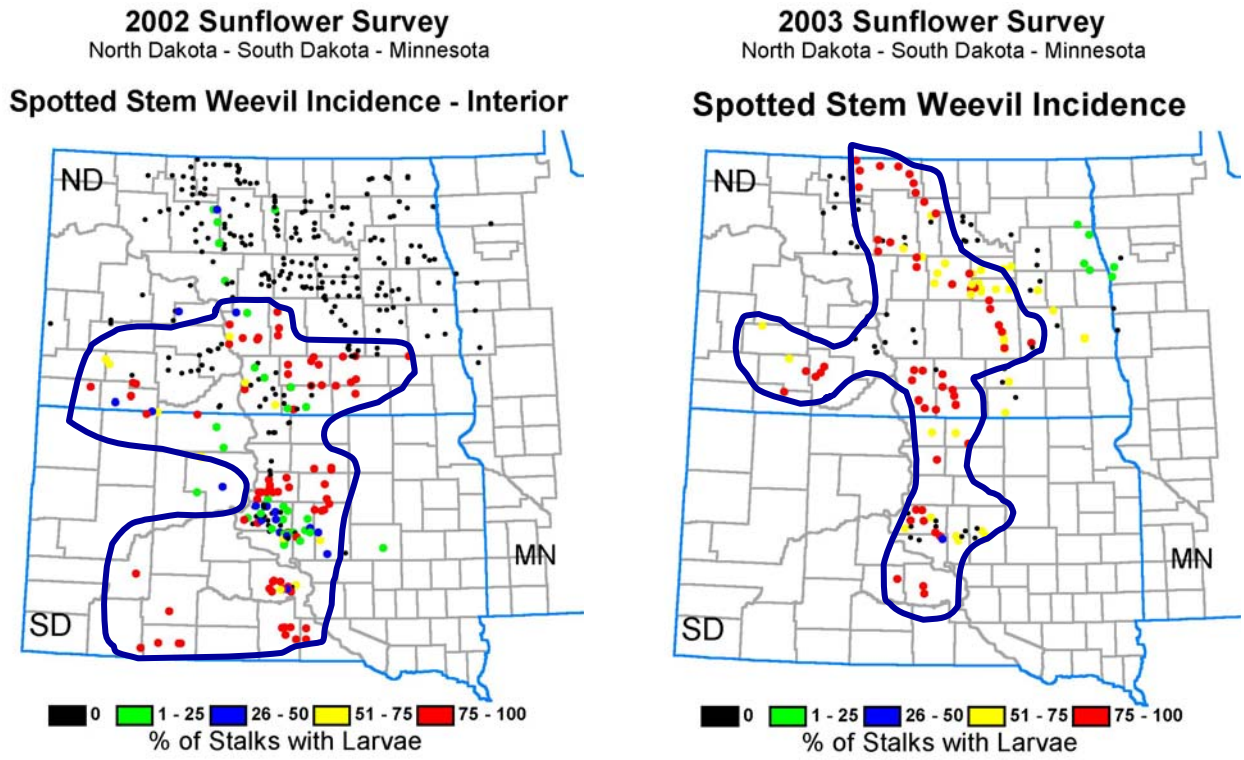

Fig. 7. Average incidence of stalks infested by the sunflower stem weevil in the field interior of the sunflower fields in North and South Dakota and Minnesota, 2002 and 2003. Circled area includes fields with over 50% of stalks with stem weevil larvae.

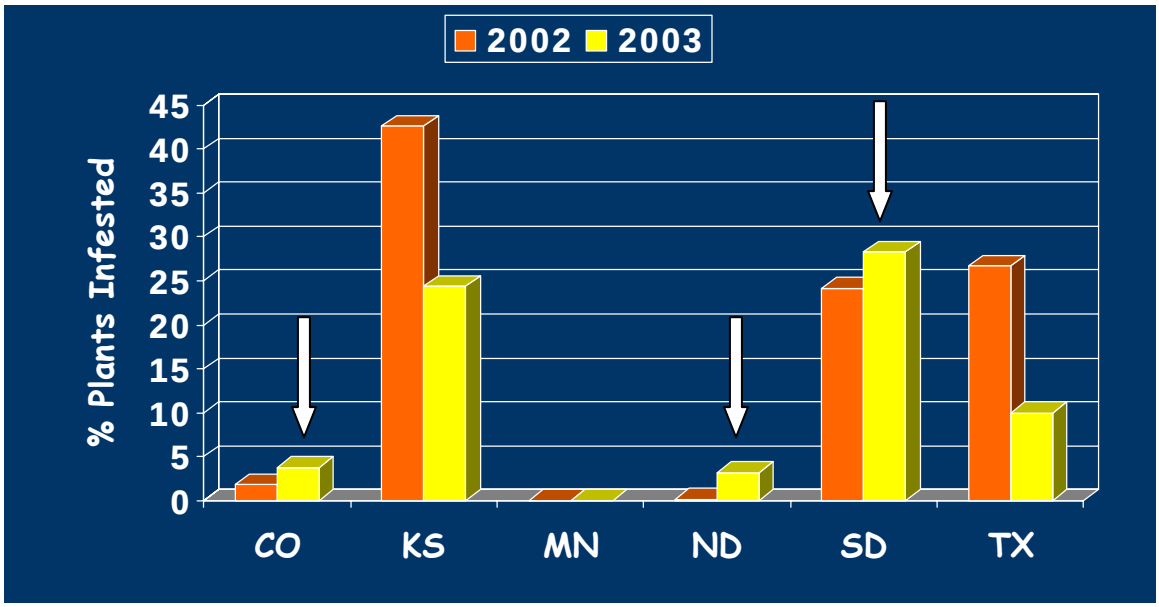

Fig. 8. Average incidence of stalks infested by the sunflower longhorned beetle in the interior of the field for the states sampled, fall 2002 and 2003. Arrows indicate states with a higher percentage in 2003.

The infestation of sunflower stalks by the longhorned beetle was higher in North and South Dakota and Colorado in 2003 than in 2002, although overall incidence was lower (Fig. 8). This

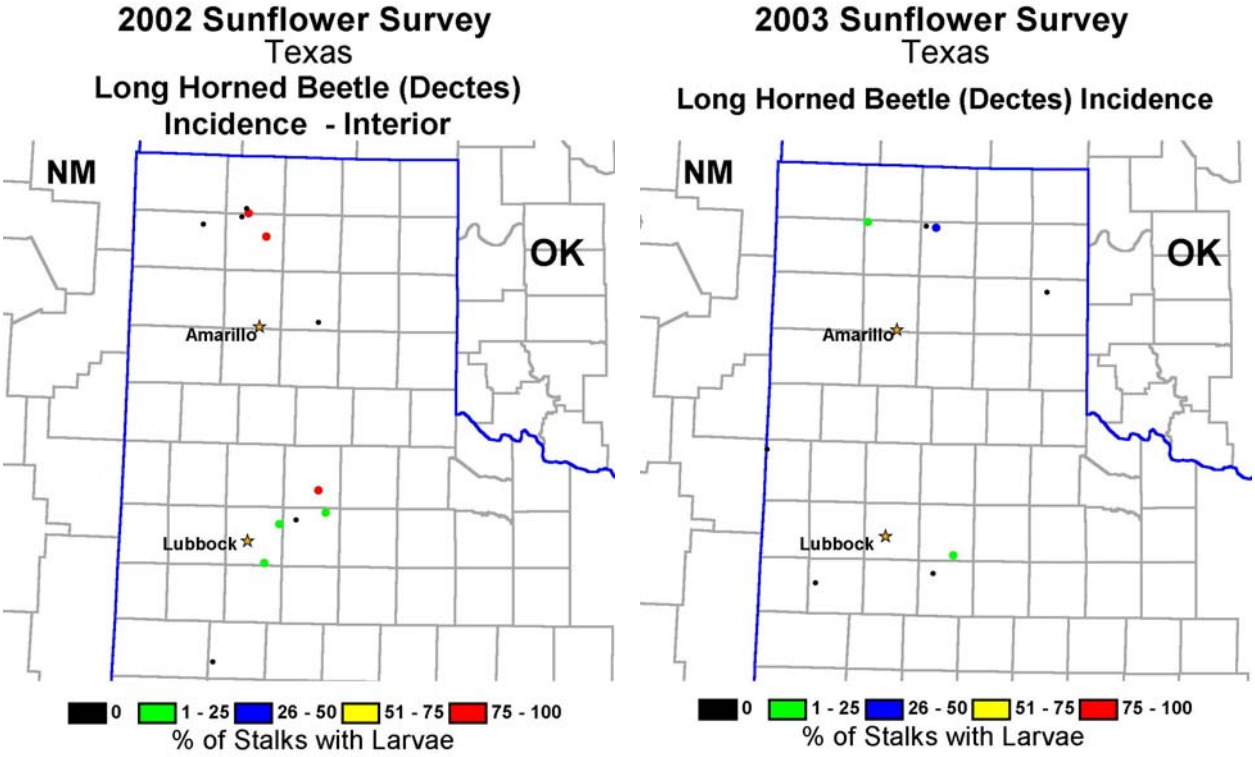

Fig. 9. Average incidence of stalks infested by the sunflower longhorned beetle in the field interior of the sunflower fields in Texas, 2002 and 2003.

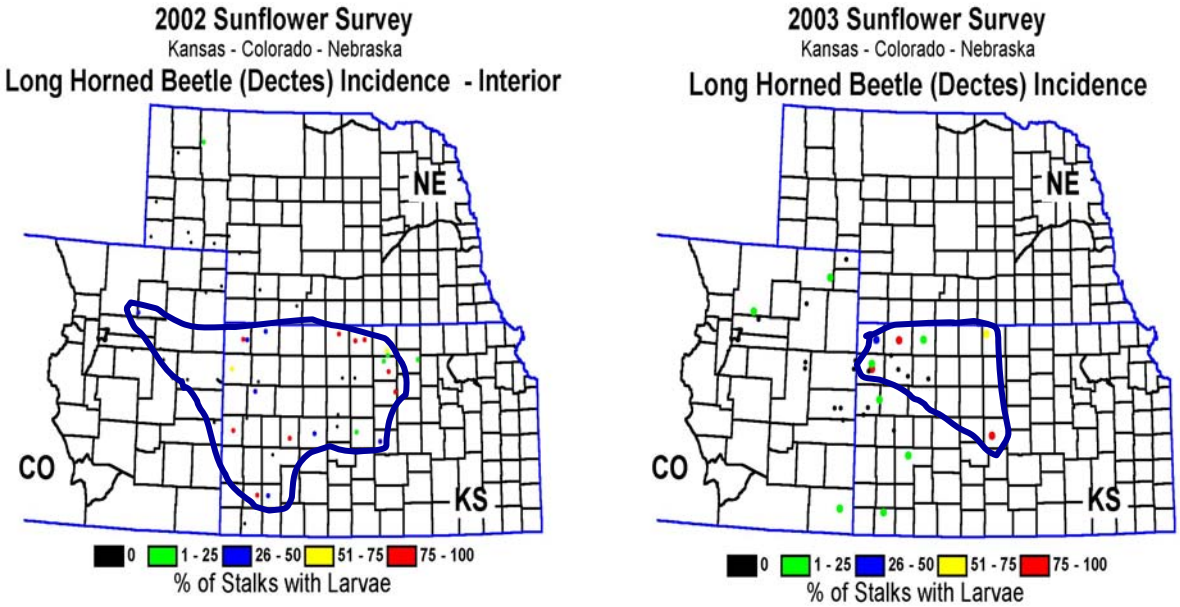

Fig. 10. Average incidence of stalks infested by the sunflower longhorned beetle in the field interior of sunflower fields in Colorado, Kansas, and Nebraska, 2002 and Colorado and Kansas, 2003. Circled area includes fields with over 25% of stalks with longhorned beetle larvae.

decline in percentage of stalks infested was especially evident in both Kansas and Texas. Both the number of fields infested and incidence of the beetle in fields declined in Texas in 2003 compared to the survey results from the previous year (Fig. 9). Occurrence of the longhorned beetle also was lower in 2003 than 2002 in Kansas, but incidence within some fields still showed over 75% of stalks infested (Fig. 10). More fields were detected with the longhorned beetle in Colorado in 2003 than 2002. The longhorned beetle was common in South Dakota fields, with some fields exhibiting high incidence of infested stalks (Fig. 11). Only a few fields in southern North Dakota had evidence of this pest, but there was an increase over what had been detected in 2002.

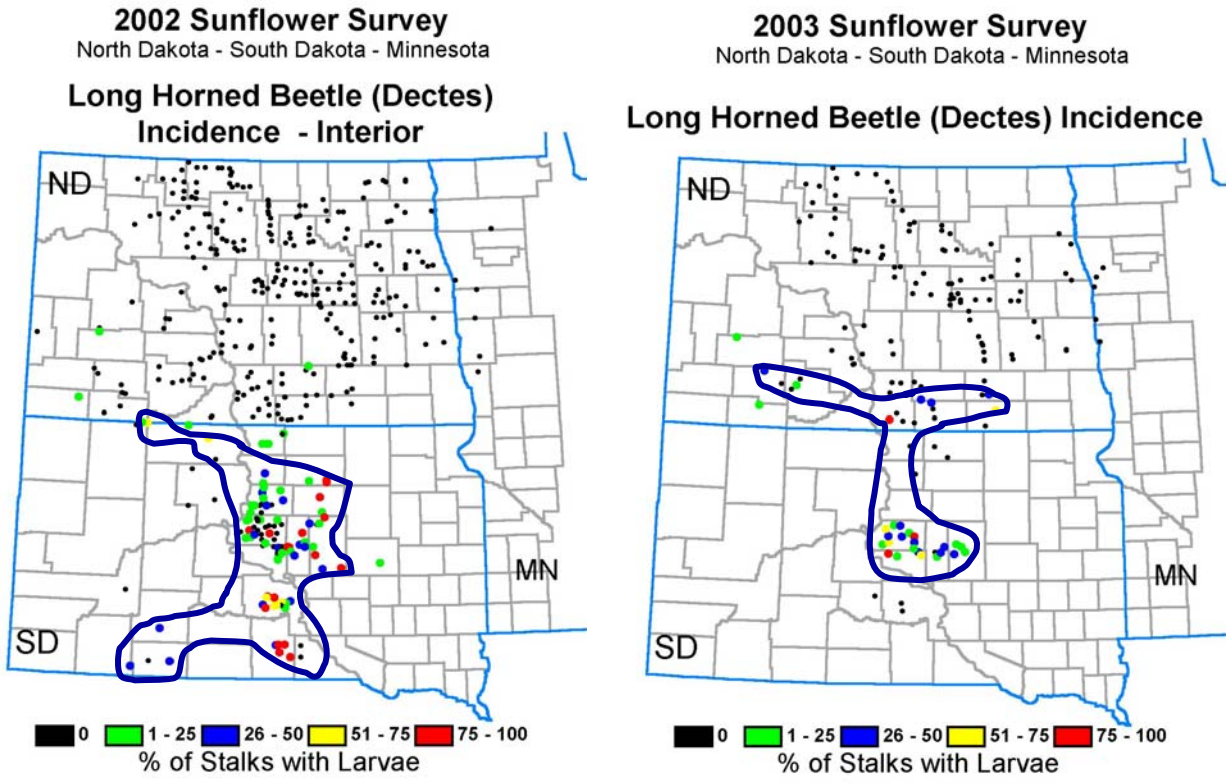

Fig. 11. Average incidence of stalks infested by the sunflower longhorned beetle in the field interior of the sunflower fields in North and South Dakota and Minnesota, 2002 and 2003. Circled area includes fields with over 25% of stalks with longhorned beetle larvae.

Sunflower moths.

The larvae of both the banded sunflower moth and sunflower moth larvae consume pollen, disk flowers, immature and mature seeds within the head. In general, holes toward the distal end of the seed are evidence of feeding damage by the banded sunflower moth or the sunflower moth in contrast to holes in the side of the seed that are the result of red sunflower seed weevils exiting the seed after completing development. Sunflower moth feeding can be separated from banded sunflower moth by the greater destruction of the hull and larger amounts of frass in the seeds. In addition, the sunflower moth is less common in the northern Plains because it only overwinters in the southern Plains and is dependent on southerly winds to distribute populations to the north (Charlet et al. 1995, 1997; Peng and Brewer 1995).

Sunflower moth damage was detected in all states surveyed. Levels were very low in both North and South Dakota and were only about 1% in Kansas and Colorado (Fig. 12). Texas was the only state where substantial damage was found from the sunflower moth in 2003. Texas, Colorado,

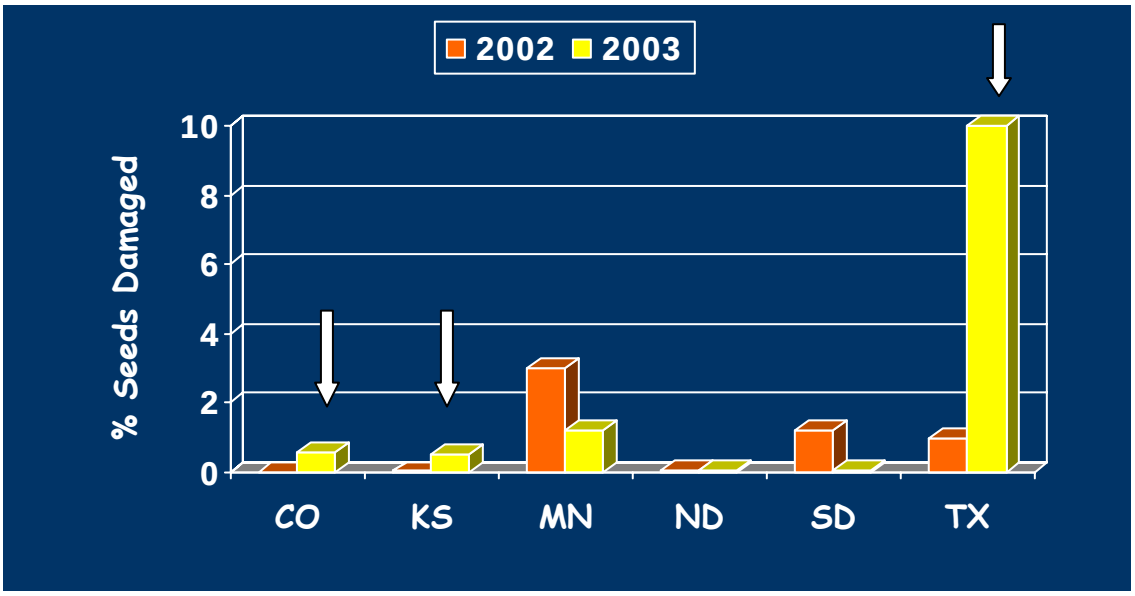

Fig. 12. Average percentage of seeds (n=100) damaged by the sunflower moth in the field interior of the sunflower fields for the states sampled, 2002 and 2003. Arrows indicate states with a higher percentage in 2003.

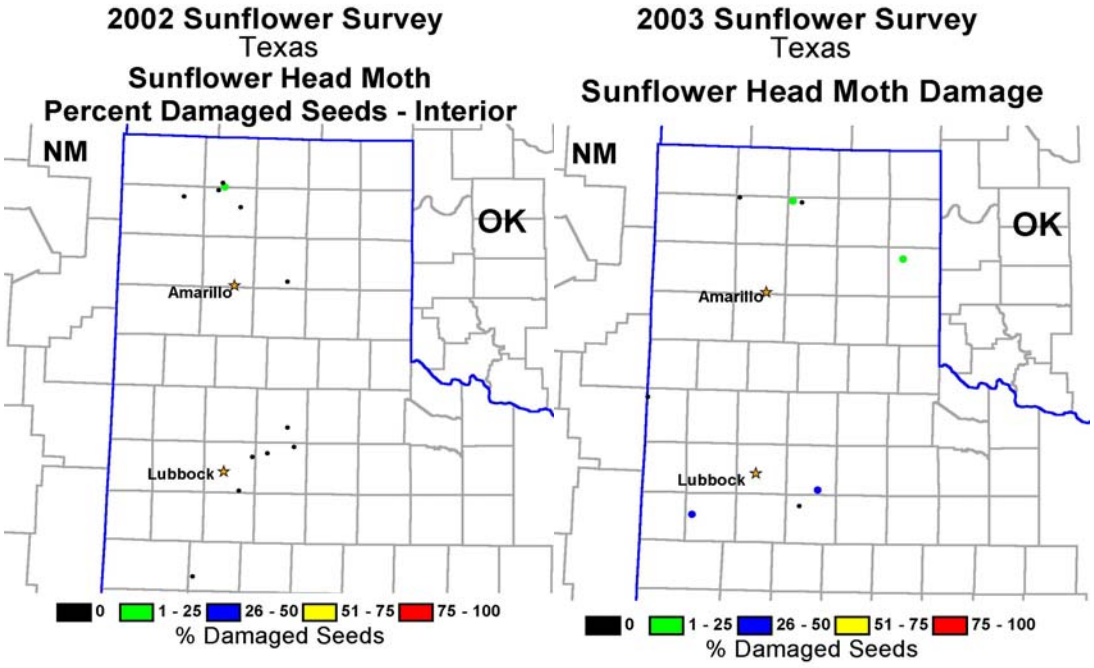

Fig. 13. Average percentage of seeds (n=100) damaged by the sunflower moth in the field interior of sunflower fields in Texas, 2002 and 2003.

and Kansas showed increases in damage compared to 2002. One-half of the fields sampled in Texas in 2003 had damage from sunflower moth and in two of these fields greater than ¼ of the seeds had feeding injury (Fig. 13). The distribution of infested fields in 2003 in Kansas was similar to 2002. Colorado had a couple of fields in 2003 with sunflower moth damage (Fig. 14).

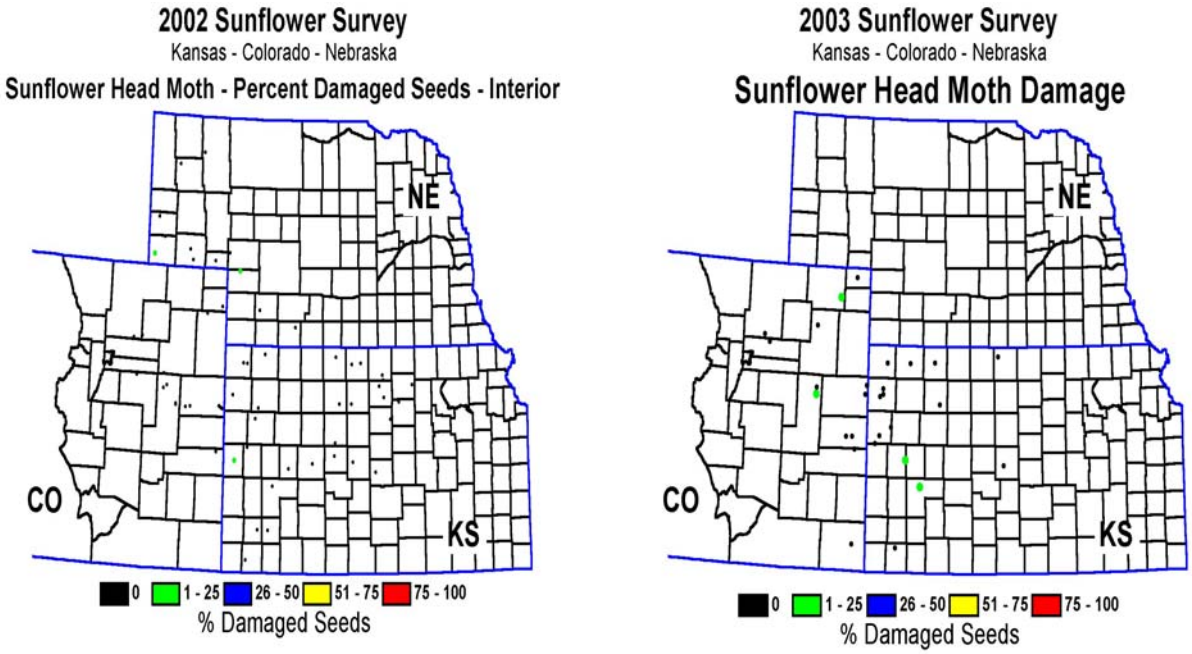

Fig. 14. Average percentage of seeds (n=100) damaged by the sunflower moth in the field interior of sunflower fields in Colorado, Kansas, and Nebraska, 2002 and Colorado and Kansas, 2003.

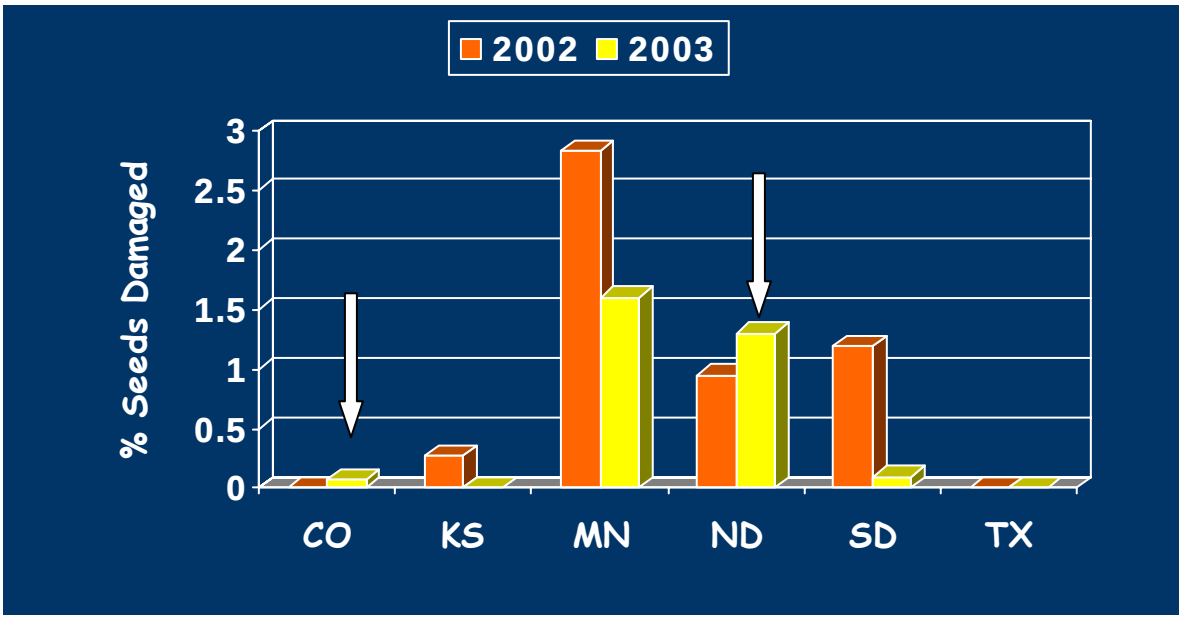

Fig. 15. Average percentage of seeds (n=100) damaged by the banded sunflower moth in the field interior of sunflower fields of the states sampled, fall 2002 and 2003. Arrows indicate states with a higher percentage in 2003.

Banded sunflower moth seed damage among all states sampled in 2003 was less than 2% and was generally lower than detected in 2002 (Fig. 15). The only states surveyed that showed increases in average damage were Colorado and North Dakota. Damage from this pest decreased in South Dakota both in fields infested and percentage of seeds damaged from 2002 survey data (Fig. 16). Although average seed damage was somewhat higher in North Dakota in 2003 than 2002, the distribution of fields with seeds damaged by the banded sunflower moth had declined.

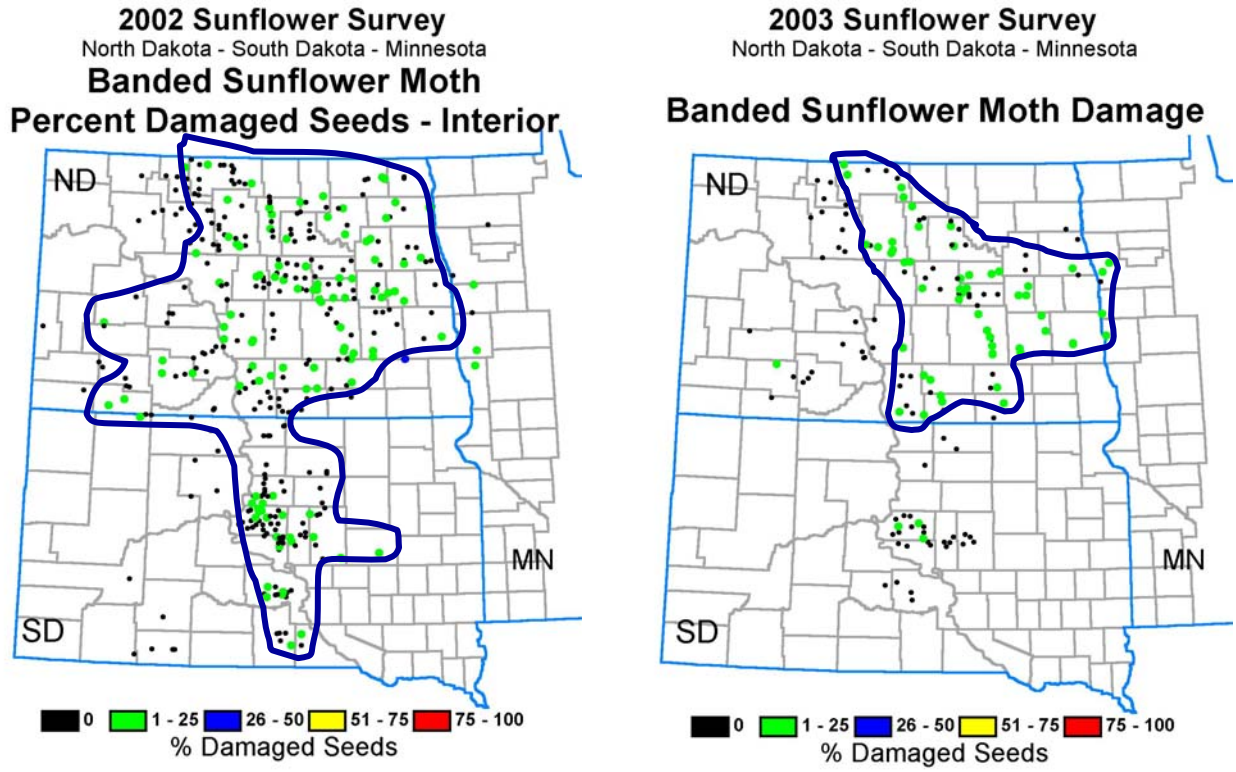

Fig. 16. Average percentage of seeds (n=100) damaged by the banded sunflower moth in the field interior of sunflower fields in North and South Dakota and Minnesota, 2002 and 2003. Circled area includes fields with damage exceeding 1%.

Red Sunflower Seed Weevil.

Red sunflower seed weevil larvae feed on developing sunflower seeds, consuming approximately one-third of the seed before exiting the seed and dropping in the soil to overwinter (Brewer 1991, Charlet et al. 1997). Feeding damage was highest in South and North Dakota with averages of 8 to 9%; however, increased injury was found in both Colorado and Kansas (Fig. 17). There has been a steady rise in average percentage of seeds damaged by the red sunflower seed weevil in North Dakota over the last three years of the sunflower survey. The area within the central Plains in which fields showed damage from the seed weevil was probably similar in both 2002 and 2003, but not evident because fewer fields were sampled in 2003 (Fig. 18). Damage from the seed weevil was evident in fields throughout North and South Dakota (Fig. 19). Fields with the greatest damage occurred in central South Dakota and southern North Dakota in 2003; however, fields with damage expanded northward in North Dakota during 2003 compared with 2002.

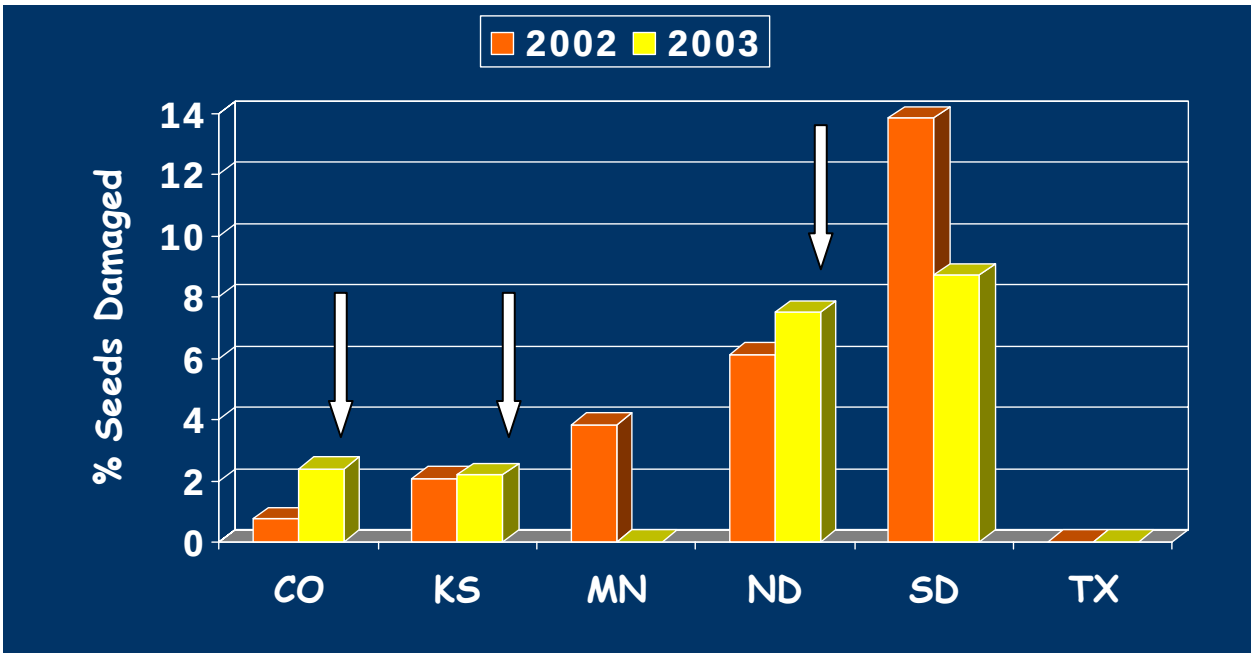

Fig. 17. Average percentage of seeds (n=100) damaged by the red sunflower seed weevil in the field interior of sunflower fields for the states sampled in 2002 and 2003. Arrows indicate states with a higher percentage in 2003.

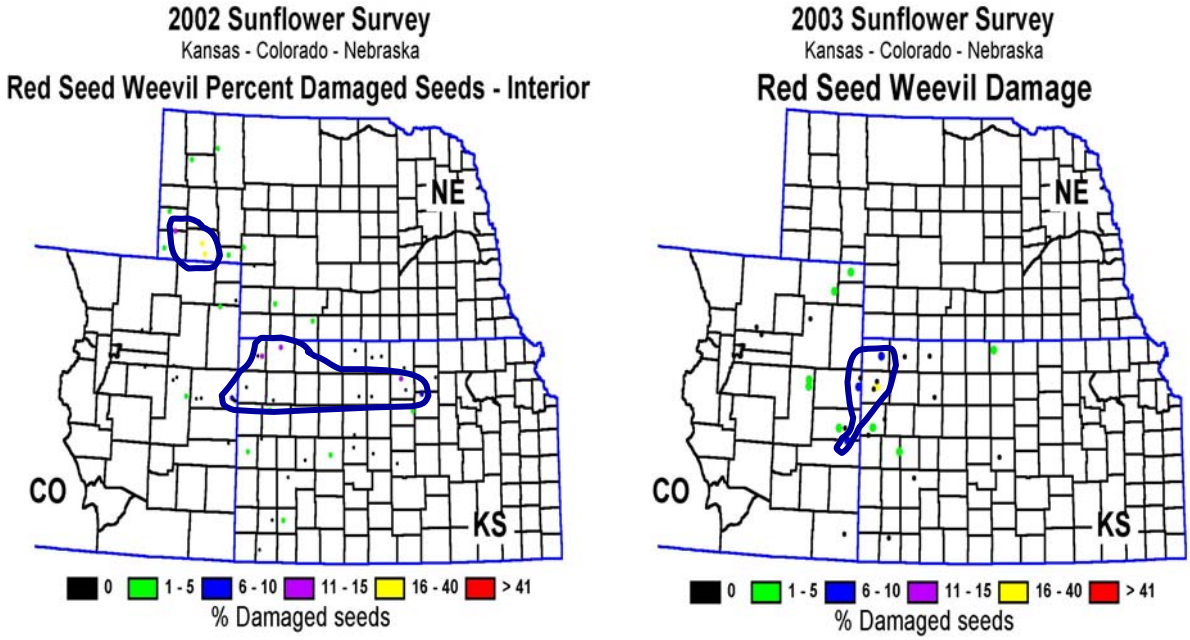

Fig. 18. Average percentage of seeds (n=100)damaged by the red sunflower seed weevil in the field interior of sunflower fields in Colorado, Kansas, and Nebraska, 2002 and Colorado and Kansas, 2003. Circled area includes fields with damage exceeding 5%.

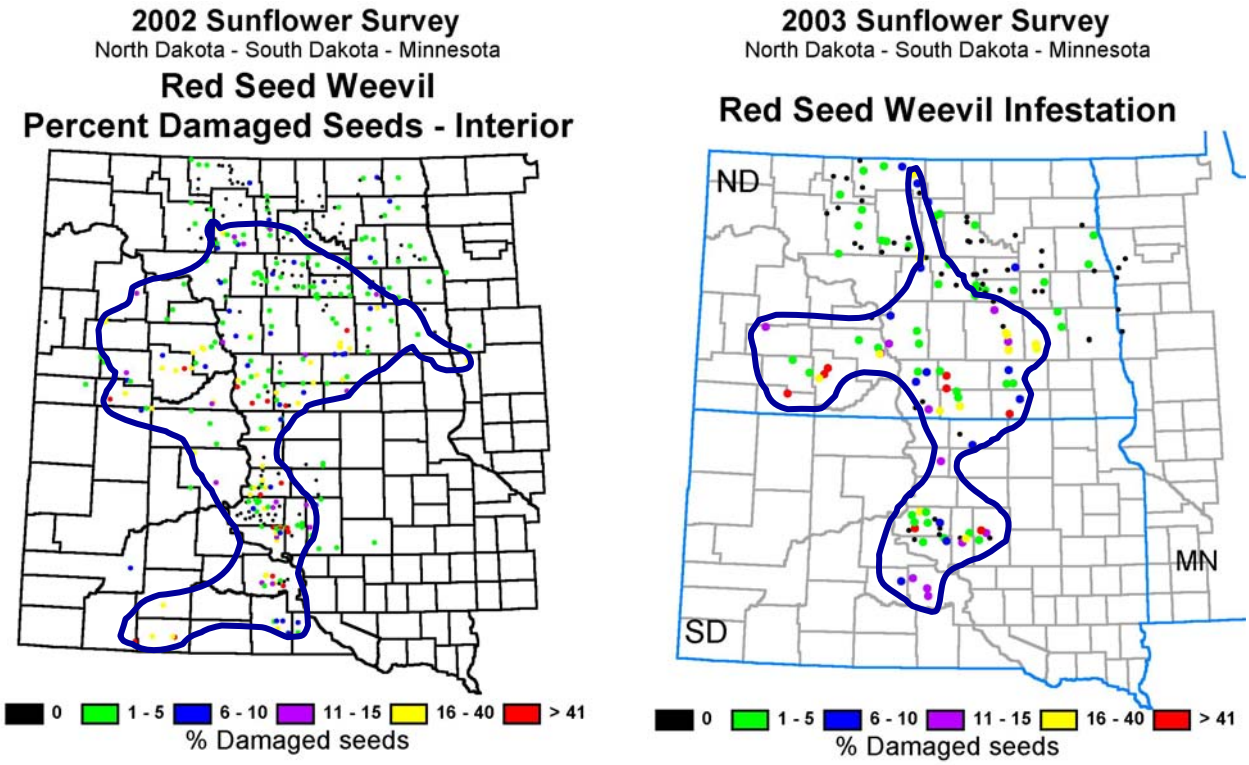

Fig. 19. Average percentage of seeds (n=100) damaged by the red sunflower seed weevil in the field interior of sunflower fields in North and South Dakota and Minnesota, 2002 and 2003. Circled area includes fields with damage exceeding 10% damage.

Summary.

Comparison of the insect survey data for 2003 with that collected in 2002 confirmed the extensive range for banded sunflower moth throughout the Dakotas. Data collected showed that the red sunflower seed weevil still causes significant damage in South Dakota and the range of damage expanded in North Dakota. Both sunflower midge and kernel brown spot damage declined from what was found in the 2002 survey. Although the incidence of both the sunflower stem weevil and longhorned beetle declined from 2002, these pests are still common in fields throughout all production regions. The sunflower pest survey, although reduced in scope from 2002, remains a valuable tool in the tracking of insect pests of sunflower and in locating where significant damage has occurred. It therefore can be helpful in alerting producers and others involved in pest management to areas where monitoring of pests should occur during the growing season because of potential problems.

Acknowledgments

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References Cited

Bracken, G. K. 1991. A damage index for estimating yield loss in sunflowers caused by sunflower midge. Can. J. Plant Sci. 71: 81-85.

Brewer, G. J. 1991. Oviposition and larval bionomics of two weevils (Coleoptera: Curculionidae) on sunflower. Ann. Entomol. Soc. Am. 84: 67-71.

Charlet, L. D. 2002. Insect damage in North and South Dakota sunflower fields in 2001: results from the National Sunflower Association crop survey. Proc. 24th Sunflower Research Workshop, Natl. Sunflower Assoc., Fargo, ND, 17-18 January 2002. p. 12-19.

Charlet, L. D., G. J. Brewer, and B. Franzmann. 1997. Insect pests, pp. 183-261. *In*. A. A. Schneiter [ed.], Sunflower Technology and Production. Agron. Ser. 35. Am. Soc. Agron., Madison, WI.

Charlet, L. D., P. A. Glogoza, and G. J. Brewer. 1995. Banded sunflower moth. No. Dak. Sta. Univ., Coop. Ext. Serv. Bull. E-823. 8p.

Glogoza, P., G. Brewer, and L. Charlet. 1997. Sunflower midge. North Dakota State Univ. Coop. Ext. Serv. Bull. E-800: 1-4.

Knodel, J. J. and L. D. Charlet. 2002. Biology and integrated pest management of the sunflower stem weevils in the Great Plains. North Dakota State Univ. Coop. Ext. Serv. Bull. E-821. 8p.

Peng, C. and G. J. Brewer. 1995. Description of achene damage by the red sunflower seed weevil, the banded sunflower moth, and the sunflower moth. J. Kansas Entomol. Soc. 68: 263-267.