Pesticide Use on Melons Grown in Indiana

R. E. Foster, R. X. Latin, and S. C. Weller

Watermelons and muskmelons are important vegetable crops in Indiana, with the majority of the productions occurring in the southern part of the state. These areas of the state can produce melons when many of the southern states are completing their production and before more northern locations can successfully grow them. Thus, Indiana has the opportunity to fill a production niche that allows for a profitable melon enterprise. Like most other vegetables, melons must compete with weeds for nutrients, sunlight, and moisture and are attacked by a wide variety of insect and disease pests. As a result, most commercial melon growers rely heavily on herbicides, insecticides, and fungicides for managing pests. The purpose of this study was to determine the amounts and types of pesticides used on melons and to determine some growers attitudes toward their use of pesticides, their use of IPM practices, and some related issues.

MATERIALS AND METHODS

On November 8, 1991, survey questionnaires were mailed to 271 people who had been identified by county Extension agents and other sources as melon growers. A number of people on the mailing list either did not grow melons, or grew them for personal use. Each person on the mailing list was contacted by telephone, if possible, to determine whether that person was indeed a melon grower, and if he or she had completed and mailed the survey questionnaire. Several growers chose to complete the survey over the telephone rather than in writing. A total of 97 commercial growers, with acreages ranging from 1.25 to 420 acres completed the questionnaire. Ninety-two growers produced watermelons, ranging from 0.25 to 300 acres. These 92 growers represented 3769.95 acres, or 62.8% of the estimated acreage of 6000 acres. We believe that our original estimate was too high and that a more accurate figure would be somewhere between 4000 and 5000 acres.Eighty-four muskmelons growers completed the survey,with acreage ranging from 0.25 to 250 acres. These growers produced a total of 1574.8 acres, which represented only 31.5% of our original estimate of 5000 acres. We believe a more accurate estimate would be about 2500 acres. Most growers were able and willing to answer all the questions asked. A number of growers were unable to provide some of the information requested and several chose not to answer particular questions.

RESULTS

Fig. 1 shows the distribution of the melon acreage grown by each grower. Most growers grew less than 50 acres of either type of melon. The average watermelon grower produced 41 acres and the average muskmelon grower had 19 acres. The smaller figures for muskmelons may reflect the additional inputs required for muskmelons production, such as increased pesticide use and greater labor requirements. It also may be the result of lower demand for muskmelons. The distribution of average yields is shown in Fig. 2. The average watermelon yield was 325 hundredweight per acre and the average muskmelon yield was 215 hundredweight.

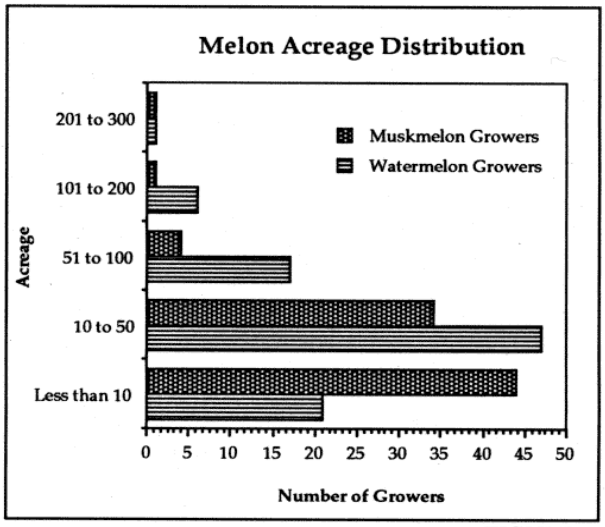

FIGURE 1.

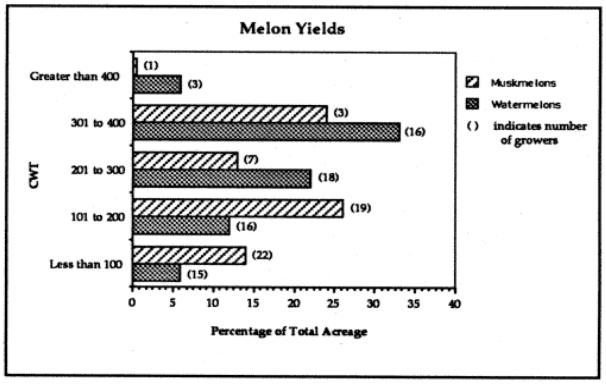

FIGURE 2.

Relatively few of the growers hired outside firms to apply their pesticides. Therefore, we lumped Questions 3 and 4 together to determine how the various growers apply their pesticides (Fig. 3). Most growers used a boom type sprayer. Air blast sprayer were also commonly used. Fifteen growers indicated that they used granular applicators, probably for applying Furadan 15G at planting. A number of growers indicated that at some point in the season they used some sort of aircraft to apply pesticides, with fixed-wing aircraft accouting for about two thirds of the use. Almost all growers used waterproof gloves, but less than half of the growers used respirators, coveralls, or waterproof boots as safety equipment when applying pesticides (Fig. 4).

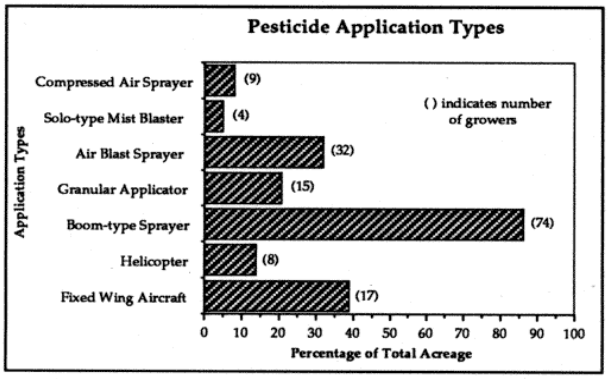

FIGURE 3.

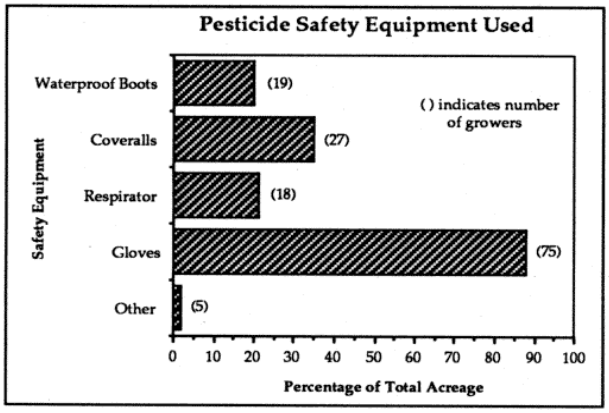

FIGURE 4.

Because most melons are grown on sandy soils, many progressive growers use irrigation, primarily drip irrigation, to improve crop production. However, less than 30% of the melons covered in this survey were irrigated (Fig. 5). One cultural practice that is commonly recommended is crop rotation. This practice can greatly reduce the severity of some diseases. About 75% of the watermelon acreage and less than 40% of the muskmelon acreage is rotated to an unrelated crop for at least two years (Fig. 6). Much smaller percentages are rotated to unrelated crops for three or four years.

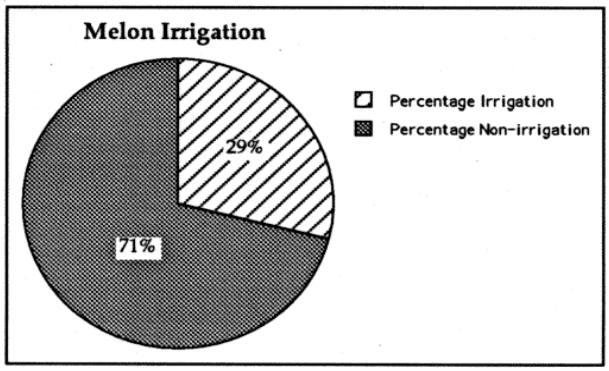

FIGURE 5.

Most fungicides must be applied before infection occurs to be effective. The result is that spraying fungicides in response to observed problems, such as with insects, is usually not feasible. Therefore, most growers apply fungicides either on at regular intervals (7-14 days) or based on whether the climatic conditions are suitable for infection to take place. One particularly severe disease problem on muskmelons is powdery mildew, which usually infects the plants just before the initiation of harvest. The most commonly recommended management program is two applications of Bayleton spaced two weeks apart beginning one week before harvest. Almost 20% of the acreage was not treated at all (Fig. 7) for powdery mildew. Some growers sprayed as many as 5 times. However, most growers indicated that they sprayed 1 or 2 times for control of powdery mildew. There are a number of other diseases that attack muskmelons and watermelons. Almost half of the muskmelons were sprayed on a weekly basis (Fig. 8). A number of growers sprayed every 7-10 days or every 10 days. Relatively few growers had a spray interval of more than 10 days. Growers tended to use a longer spray interval for watermelons than for muskmelons. Fewer growers used a weekly spray schedule and more growers sprayed every 7-10 days, 10-14 days, or every 14 days.

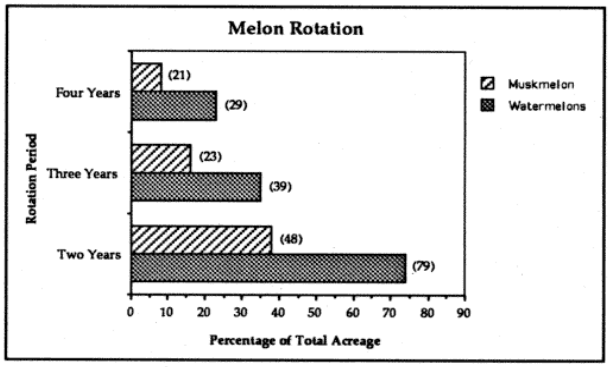

FIGURE 6.

Fig. 9 shows the number of growers and acreages that employed various pest management practices. There were relatively few differences between the two

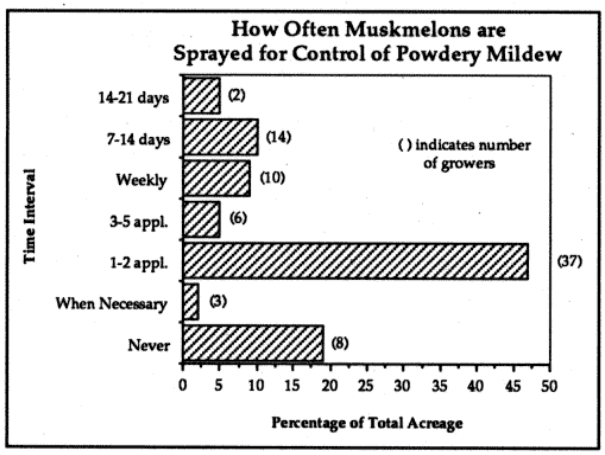

FIGURE 7.

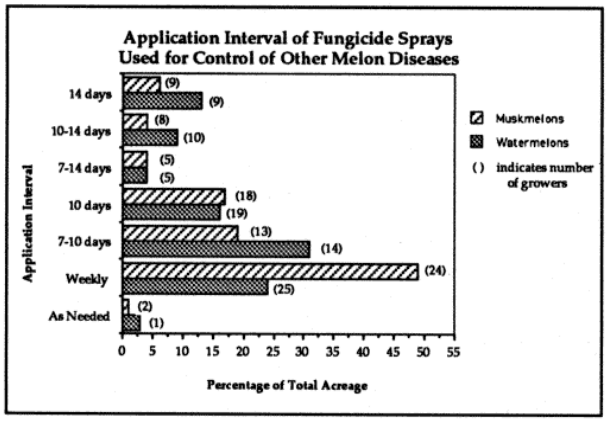

FIGURE 8.

crops in the use of pest management practices. The vast majority of the growers representing 90 - 95% of the acreage used crop rotation on at least a portion of their acreage to reduce pest pressure. About 3/4 of the growers reported that they scout their fields to determine the presence of pests and the necessity for pest control action. Over half the growers selected certain varieties to reduce their pest problems. Usually this means that they purposely selected varieties that were resistant to various diseases. Several growers reported that they modify their planting dates or use trickle irrigation to reduce pest problems.

Most growers believed that their watermelon yields would be reduced by less than 50% if herbicides were not available for control of weeds (Fig. 10a). Only 22 of 93 respondents believed that they would lose over half their yield without herbicides. The results were very similar for muskmelons (Fig. 10b). Most growers again estimated that they would lose less than half their yield without herbicides. These results may indicate that growers believe that melons compete rather well with weeds or because they have alternative practices such as hand weeding that reduce their weed problems.

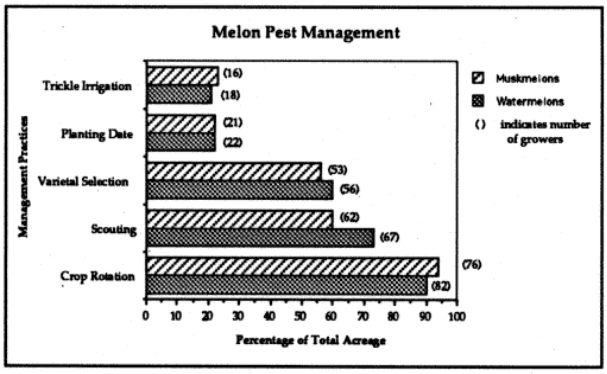

FIGURE 9.

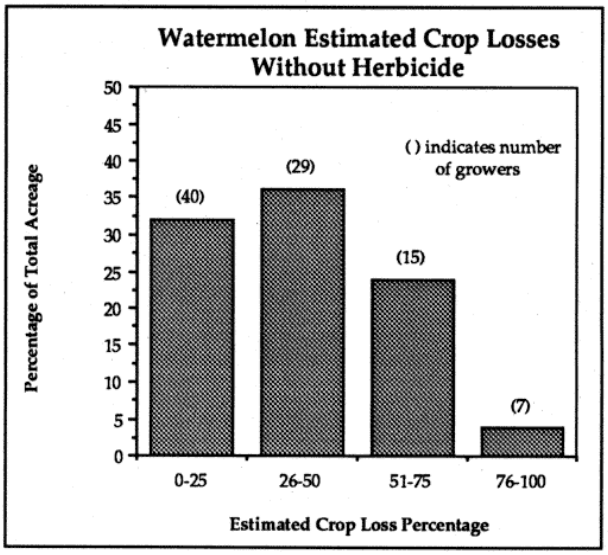

FIGURE 10a.

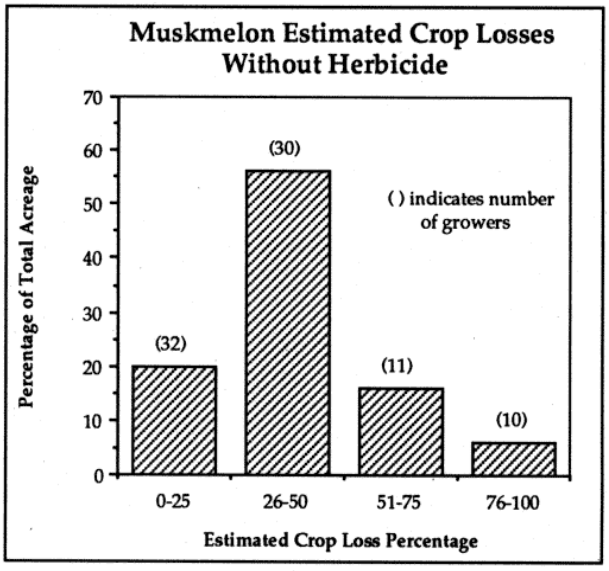

FIGURE 10b.

In contrast, most melon growers, especially muskmelon growers, estimated that they would lose most of their yield if fungicides were not available (Fig. 11a and 11b). Only 12 watermelon growers and 6 muskmelons growers estimated yield losses of less than 25% without fungicides. These results reflect the severity of disease problems affecting melons grown in the warm, humid climate in Indiana. Although some disease problems can be reduced with alternative control procedures such as crop rotation, trickle irrigation, and the selection of resistant varieties, most growers believe that fungicides are an indispensible part of their melon production system.

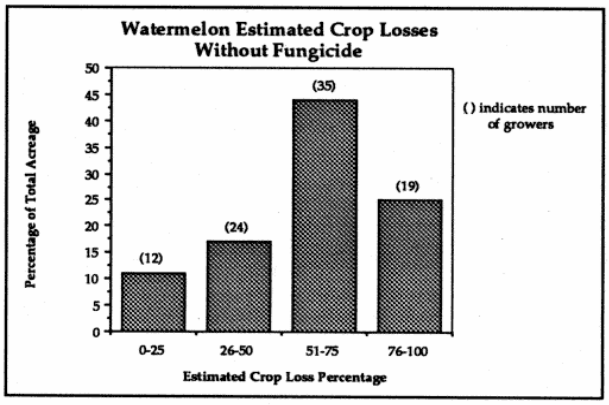

FIGURE 11a.

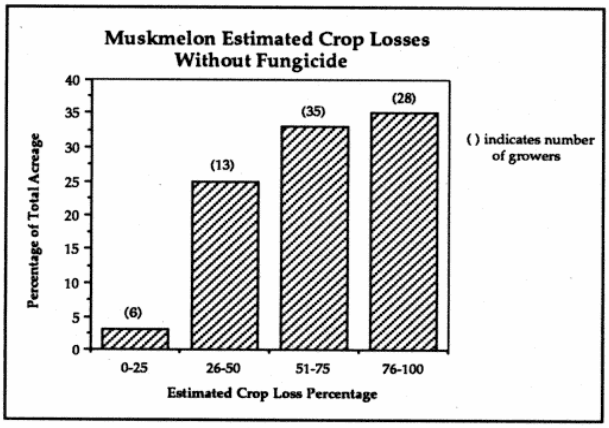

FIGURE 11b.

Almost half the watermelon growers representing over 1/3 of the acreage believed that without insecticides they would lose less than half of their yield (Fig. 12a). Only 20 muskmelons growers representing less than 15% of the acreage predicted similar losses (Fig. 12b). These differences are primarily the result of the vulnerability of muskmelons to bacterial wilt, which is vectored by striped and spotted cucumber beetles. The only method of control of bacterial wilt is to control the beetles before they transmit the bacterium responsible for the disease. This is accomplished with planting time applications of the systemic insecticide Furadan and with regular applications of foliar insecticides. Watermelons are not susceptible to bacterial wilt and, therefore, do not require the same level of protection from the feeding of cucumber beetles. The damage from cucumber beetles to watermelons is direct feeding damage, which can be serious on seedlings. Watermelons are more prone to attack by aphids and mites than are muskmelons.

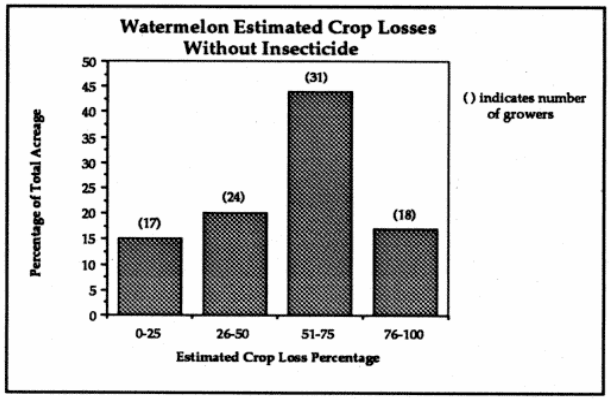

FIGURE 12a.

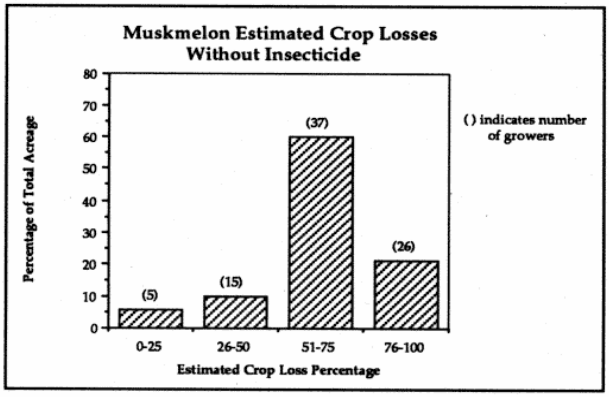

FIGURE 12b.

The next series of graphs represents growers' reactions to several statements. In response to the statement regarding availability of pesticides, there was a tendency toward agreeing that there is a lack of available pesticides (Fig. 13a). Many growers would like to have a greater choice of herbicides available for use on melons. A number of growers indicated that they agreed with the statement that insecticide resistance was a problem (Fig 13b). These results are interesting because there are no resistance problems known on melons, with the possible exception of two-spotted spider mites on watermelon being resistant to several miticides. Few growers agreed with the statement that the pesticides they use might contaminate the groundwater on their farm (Fig. 13c). Most growers believed that their pesticide use practices were not a threat to their groundwater. Almost all growers disagreed with the statement that they could modify their production

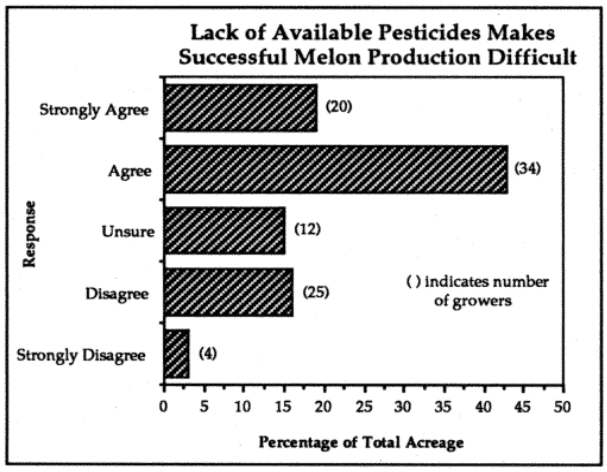

FIGURE 13a.

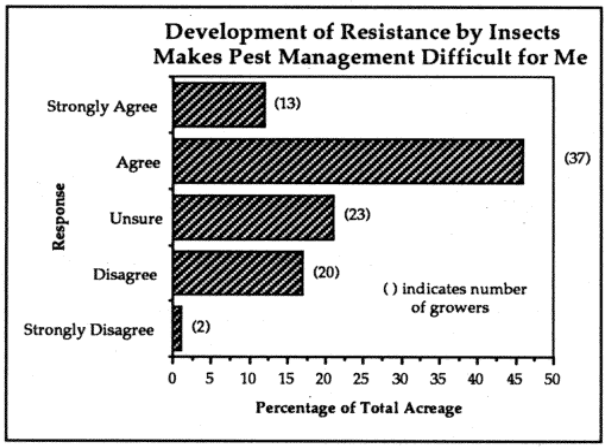

FIGURE 13b.

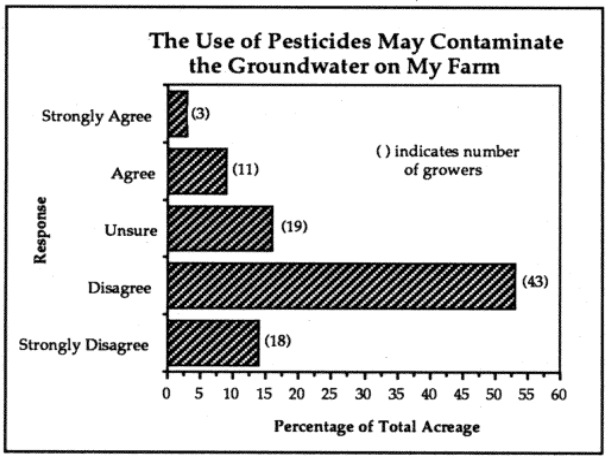

FIGURE 13c.

practices to reduce soil erosion (Fig. 13d). Apparently most growers either believed that there were no alternative practices available or that they had already adopted those erosion reducing practices. Very few growers, representing only a tiny fraction of the acreage agreed that their use of pesticides could result in harmful pesticide residues (Fig. 13e). Most of the growers (51) representing over half the acreage disagreed strongly with this statement.

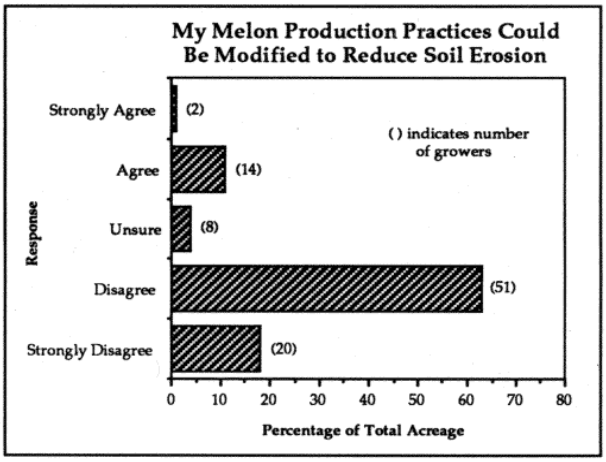

FIGURE 13d.

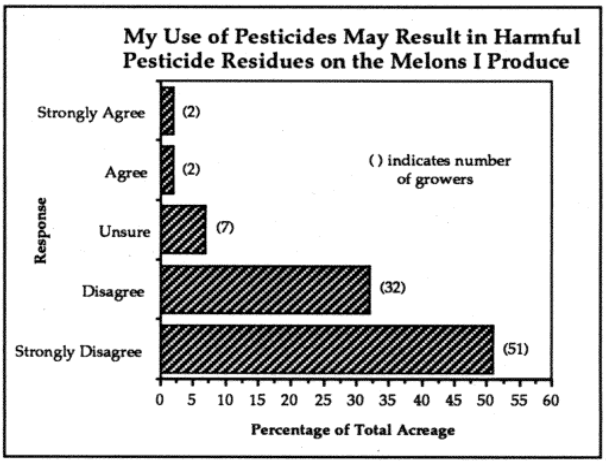

FIGURE 13e.

There was a fairly even distribution of responses to the question regarding the most serious weed problems growers faced (Fig. 14). Ragweed was listed by the most growers representing the greatest acreage, but there were a number of other weeds that received substantial support. Morningglory, pigweed, grasses, crab grass, jimsonweed, and lambsquarter were frequently mentioned.

There was a strong consensus regarding the most serious diseases of watermelons (Fig. 15a). Anthracnose and gummy stem blight were by far the most commonly mentioned diseases, being selected by 57 and 46 of the respondents. Downy mildew, Fusarium, and sudden wilt were also mentioned by several growers. There were four frequently mentioned diseases of muskmelons, Alternaria, powdery mildew, gummy stem blight, and anthracnose (Fig. 15b). There was no clearly worst disease problem on muskmelons, with Alternaria being listed on the largest numbers of acres, but Anthracnose being selected by the largest number

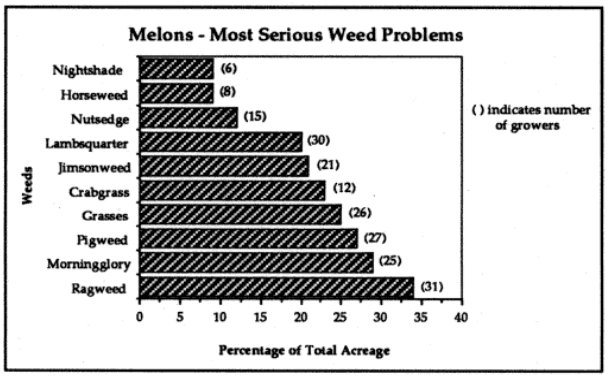

FIGURE 14.

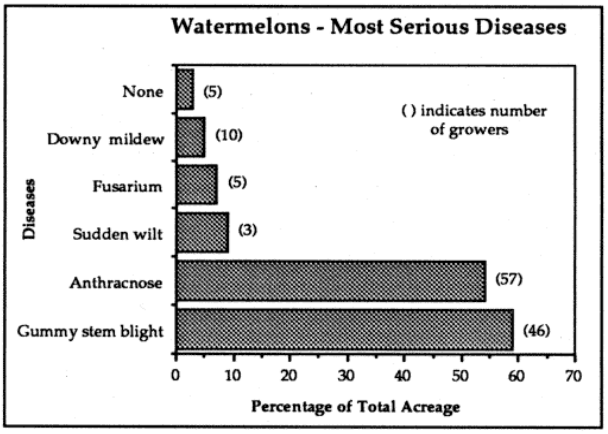

FIGURE 15a.

of growers. Fusarium and downy mildew were also mentioned by several growers. Five watermelon and four muskmelons growers indicated that they had no disease problems.

Eighty watermelon growers representing over 80% of the acreage listed cucumber beetles as a serious insect problem (Fig. 16a). More than half the growers also listed mites and aphids as problems. Fifteen growers considered nematodes to be a serious problem. Seventy-four muskmelons growers representing almost 90% of the acreage considered cucumber beetles to be a serious problem (FIg. 16b). Considering the vulnerability of this crop to bacterial wilt, it is not

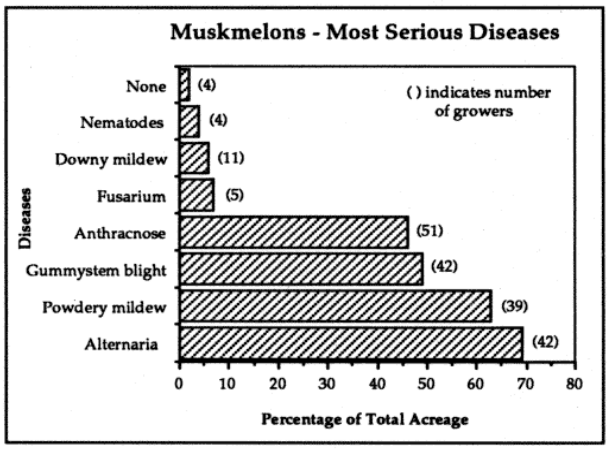

FIGURE 15b.

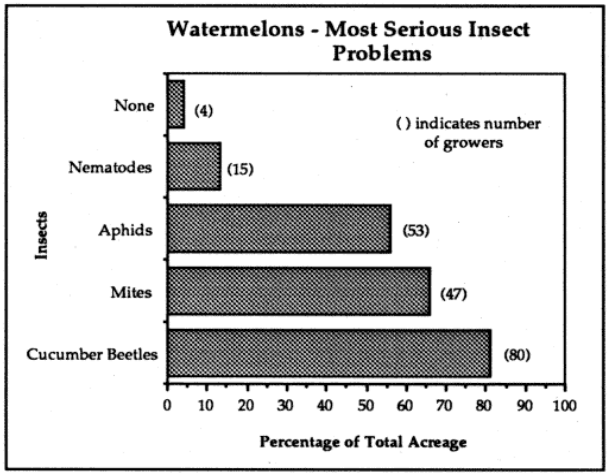

FIGURE 16a.

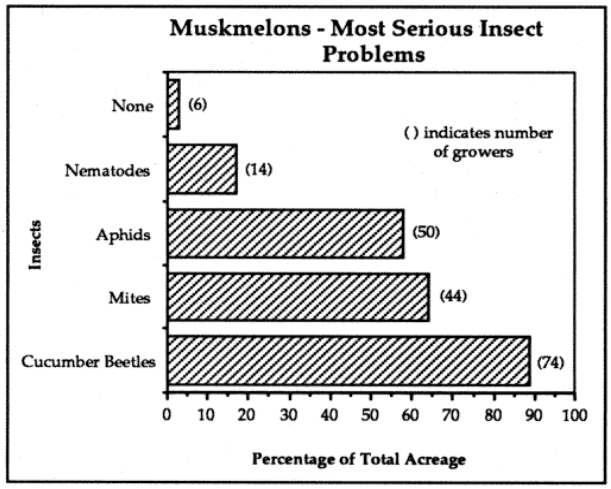

FIGURE 16b.

surprising that this many growers would list cucumber beetles as a major concern. Many muskmelon growers also listed mites and aphids as serious problems and several listed nematodes as a problem. Four watermelon and six muskmelon growers indicated that they had no serious insect problems. Most of these growers had very small acreages.

The most commonly reported herbicides used on watermelons were Curbit, Alanap, Prefar, and Treflan (Table 1). Smaller amounts of Basagran, Gramoxone, Poast, Prowl, and Roundup were also use. Twelve watermelon growers representing almost 500 acres indicated that they used no herbicides. On muskmelons, the same four herbicides were reported to have been used most commonly (Table 2). If all herbicides were used at the maximum recommended rate, the equivalent of 3138.2 acres of watermelons would have been treated, for an average of 0.98 applications per acre (Table 7). For muskmelons, the equivalent of 1137.9 acres would have been treated, for an average of 0.8 applications of herbicides per acre.

TABLE 1. Herbicides used on watermelons in Indiana in 1991.

Herbicide	# Growers	Amount Used	Max. Rate	Treated Acres
Alanap	28	1230.3 gal.	8.0 qt	615.1
Basagran	3	15.0 gal.	1.0 pt	119.8
Curbit	20	339.3 gal.	4.0 pt	678.6
Gramoxone	1	18.0 gal.	3.0 pt	48.0
Poast	13	39.2 gal.	1.5 pt	209.0
Prefar	23	591.4 gal.	4.0 qt	591.4
Prowl	1	5.0 gal.	1.5 pt	26.7
Roundup	7	6.6 gal.	3.0 qt	8.8
Treflan	16	50.7 gal.	0.75 pt	540.8
None	12	——	——	(498.8)
Total				3138.2

TABLE 2. Herbicides used on muskmelons in Indiana in 1991.

Herbicide	# Growers	Amount Used	Max. Rate	Treated Acres
Alanap	21	520.8 gal.	8.0 qt	260.4
Curbit	15	109.0 gal.	4.0 pt	218.0
Gramoxone	1	2.0 gal.	3.0 pt	5.3
Poast	8	8.8 gal.	1.5 pt	47.1
Prefar	24	421.1 gal.	4.0 qt	421.1
Roundup	6	5.9 gal.	3.0 qt	7.9
Treflan	13	16.7 gal.	0.75 pt	178.1
None	15	——	——	(382.8)
Total				1137.9

The most commonly reported fungicides used on watermelon were the three formulations of Bravo, two formulations of Topsin, and Benlate (Table 3). Smaller amounts of Bayleton, Karathane, Ridomil Bravo 81W, Ridomil, copper, and Manzate were also used. Bravo was also the most popular fungicide reportedly used on muskmelons (Table 4). However, muskmelon growers used less Topsin, more Benlate, more Manzate, and more Bayleton than watermelon growers. Twelve watermelon growers representing 381.8 acres and five muskmelons growers representing 67 acres reported no fungicide use. If growers always used the maximum recommended rate when applying a fungicide, the equivalent of 10,918.2 acres of watermelons would have been treated with fungicides, for an average of 3.56 applications per acre (Table 7). For muskmelons, the equivalent of 6322.7 acres would have been treated, for an average of 4.86 fungicide applications per acre (Table 8).

TABLE 3. Fungicides used on watermelons in Indiana in 1991.

Fungicide	# Growers	Amount Used	Max. Rate	Treated Acres
Bayleton 50DF	5	19.8 lb	0.25 lb	79.1
Benlate 50DF	16	515.0 lb	0.5 lb	1030.0
Bravo 720	43	1528.7 gal.	3.0 pt	4076.5
Bravo 90DG	13	2647.0 lb	2.5 lb	1058.8
Bravo W75	2	57.5 lb	2.5 lb	23.0
Karathane	2	120.0 lb	0.5 lb	240.0
Ridomil Bravo 81W	3	42.5 lb	1.5 lb	28.3
Ridomil 2E	15	4.6 gal.	4.0 pt	9.1
Topsin M 70W	25	1336.9 lb	0.5 lb	2673.8
Topsin M 85WDG	7	128.3 lb	0.25 lb	513.0
Copper	3	69.0 gal.	4.0 pt	138.0
Copper	6	410.0 lb	3.0 lb	136.7
Manzate 200	1	600.0 lb	3.0 lb	200.0
None	12	——	——	(381.8)
Total				10918.2

The most commonly reported insecticides used on watermelons were Sevin, Cygon, Furadan, Thiodan, Ambush/Pounce, Vydate, and Malathion (Table 5). Smaller amounts of Asana, diazinon, Dibrom, Kelthane, Methoxychlor, and sabadilla were also reported. If each grower used the maximum recommended rate for each application of an insecticide, the equivalent of 7058.3 acres would have been treated, for an average of 2.05 applications of insecticide per acre (Table 7). For muskmelons, the most commonly used insecticides were Sevin, Furadan, Vydate, and Thiodan (Table 6). If each grower used the maximum rate, the equivalent of 4997.2 acres would have been treated, for an average of 3.77 applications per acre (Table 8). The larger number of applications on muskmelons probably reflects the greater susceptibility to bacterial wilt and the greater need to control cucumber beetles. The greater use of Cygon on watermelons reflects the greater susceptibility of watermelons to mite infestations.

TABLE 4. Fungicides used on muskmelons in Indiana in 1991.

Fungicide	# Growers	Amount Used	Max. Rate	Treated Acres
Bayleton 50DF	35	230.5 lb	0.25 lb	922.0
Benlate 50DF	13	271.5lb	0.5 lb	543.0
Bravo 720	45	990.5 gal.	3.0 pt	2641.4
Bravo 90DG	14	3305.0 lb	2.5 lb	1322.0
Bravo W75	3	56.5 lb	2.5 lb	22.6
Ridomil Bravo 81W	3	38.0 lb	1.5 lb	25.3
Ridomil 2E	12	2.0 gal.	4.0 pt	4.0
Topsin M 70W	7	89.5 lb	0.5 lb	170.0
Topsin M 85WDG	3	17.6 lb	0.25 lb	70.4
Copper	1	12.0 gal.	4.0 pt	24.0
Copper	6	159.0 lb	3.0 lb	53.0
Manzate 200	1	1500.0 lb	3.0 lb	500.0
Penncozeb	1	48.0 lb	3.0 lb	16.0
None	5	——	——	(67.0)
Total				10918.2

TABLE 5. Insecticides used on watermelons in Indiana in 1991.

Insecticide	# Growers	Amount Used	Max. Rate	Treated Acres
Asana XL	2	0.8 gal.	9.6 oz	1.1
Ambush/Pounce	13	39.6 gal.	12.8/8.0 oz	487.0
Cygon	18	218.3 gal.	1.0 pt	1746.0
Diazinon	5	12.0 gal.	1.0 pt	96.0
Dibrom	1	8.0 gal.	2.0 pt	32.0
Furadan 15G	19	5133.5 lb	13.3 lb	386.0
Furadan 4F	10	145.0 gal.	1.0 qt	580.0
Kelthane 35	3	88.0 lb	1.67 lb	52.7
Malathion	11	58.5 gal.	1.5 pt	311.4
Methoxychlor	1	50.0 lb	4.0 lb	12.5
Sabadilla	1	12.0 lb	?	?
Sevin 50W/80S	33	2993.3 lb	2/1.25 lb	1842.0
Sevin 4F	11	121.5 gal.	1.0 qt	486.0
Thiodan 3EC	5	17.5 gal.	2.0 pt	70.0
Thiodan 50 WP	17	1193.3 lb	2.0 lb	596.6
Vydate	11	179.5 gal.	4.0 pt	359.0
None	11	——	——	468.5
Total				7058.3

TABLE 6. Insecticides used on muskmelons in Indiana in 1991.

Insecticide	# Growers	Amount Used	Max. Rate	Treated Acres
Asana XL	4	2.1 gal.	9.6 oz	28.4
Ambush/Pounce	19	13.6 gal.	12.8/8.0 oz	167.6
Cygon	6	11.8 gal.	1.0 pt	94.0
Diazinon	4	2.8 gal.	1.0 pt	22.0
Furadan 15G	21	3034.5 lb	13.3 lb	228.2
Furadan 4F	10	186.0 gal.	1.0 qt	744.0
Malathion	9	36.0 gal.	1.5 pt	192.0
Sabadilla	1	12.0 lb	?	?
Sevin 50W/80S	39	2888.7 lb	2/1.25 lb	1777.7
Sevin 4F	13	97.7 gal.	1.0 qt	390.8
Thiodan 3EC	8	125.8 gal.	2.0 pt	503.0
Thiodan 50 WP	5	65.0 lb	2.0 lb	32.5
Vydate	20	406.4 gal.	4.0 pt	812.8
None	6	——	——	76.0
Total				4997.2

TABLE 7. Average number of herbicide, fungicide, and insecticide treatments per acre on watermelons grown in Indiana in 1991.

Pesticide Type	Treated Acres	Reported Acres	Treatments/Acre
Herbicide	3138.2	3212	0.98
Fungicide	10918.2	3065	3.56
Insecticide	7058.3	3446	2.05
Total	20785.4		6.59

TABLE 8. Average number of herbicide, fungicide, and insecticide treatments per acre on muskmelons grown in Indiana in 1991.

Pesticide Type	Treated Acres	Reported Acres	Treatments/Acre
Herbicide	1137.9	1417	0.80
Fungicide	6322.7	1301	4.86
Insecticide	4997.2	1327	3.77
Total	12413.3		9.43