Special Report

Soybean Disease Loss Estimates for the Southern United States During 1988–1991

GABRIEL L. SCIUMBATO, Department of Plant Pathology, Mississippi State University, Delta Research and Extension Center, Stoneville 38776; Disease Loss Estimate Committee of the Southern Soybean Disease Workers

The objective of the Disease Loss Estimate Committee of the Southern Soybean Disease Workers is to compile and record soybean disease loss estimates from southern states as the official disease loss statement for the production year. Disease loss estimates are solicited annually from knowledgeable program cooperators in each state. The estimates reported here were derived from integrated pest management field monitoring programs, research plots, field observations, diagnostic clinic records, and grower demonstrations in 16 states.

Loss estimates from each state are specific as to causal organism, common name of each disease, and year (Tables 1–4). Production losses were based on estimates of yield in the absence of disease. Dollars lost to disease were calculated by multiplying the estimated loss by the average annual price per kilogram of $5.27 for 1988 ($5.90/bu), $6.25 for 1989 ($7.00/bu), $5.36 for 1990 ($6.00/bu), and $5.13 for 1991 ($5.75/bu).

During 1988, 12,390,000 m tons were harvested from 7,686,000 ha in the southern states. The average crop loss estimate from all diseases in 1988 was 12.2%. Estimated disease losses for the individual southern states ranged from 4.7 (Maryland) to 39% (Florida). Four states reported disease losses over 15%: Arkansas (19.6%), Florida (39%), Louisiana (18.5%), and South Carolina (15%). Nematodes were estimated to have reduced yields by 562,000 m tons, a $130.27 million loss. Soilborne diseases were estimated to have reduced yields by 499,000 m tons at a cost of $115.76 million. Foliar, pod, and stem diseases cost growers an estimated $150.8 million by reducing yields 650,000 m tons. At the average annual price received by southern soybean growers, the 1.71 million m tons lost to diseases cost growers an estimated $396.9 million.

In 1989, 8,029,000 ha yielded 13,042,00 m tons of soybeans in these states. The comparative losses from certain soybean diseases were higher in 1989 because of the above-normal early-season rainfall in some soybean growing areas. The average crop loss estimate from all diseases in 1989 was 15.2%. Estimated disease losses for the individual southern states ranged from 4.2% (Delaware) to 53% (Florida). Seven states reported disease losses over 15%: Alabama (20.2%), Arkansas (26.5%), Florida (53%), Louisiana (16.5%), North Carolina (16.6%), South Carolina (16.8%), and Tennessee (26.8%). Nematodes reduced yields by an estimated 689,000 m tons valued at $189.63 million. Soilborne diseases cost growers an estimated $79.59 million by reducing yields an estimated 289,000 m tons. Foliar, pod, and stem diseases reduced yields by an estimated 1.27 million m tons, resulting in a $351.12 million loss. The 2.25 million m tons lost to diseases in 1989 cost growers an estimated $620.34 million.

During 1990, 12,018,000 m tons were harvested from 7,478,000 ha in the southern states. The comparative losses from some soybean diseases were down during 1990 because of the below-normal rainfall in certain soybean growing areas. The average crop loss estimate from all diseases in 1990 was 10.4%. Estimated disease losses for the individual states ranged from 2.0% (Georgia) to 30.5% (Florida). Four states reported disease losses over 15%: Florida (30.5%), Louisiana (11%), North Carolina (16.7%), and South Carolina (16.7%). Nematodes were estimated to have reduced yields by 476,000 m tons, a loss of $112.26 million. Soilborne diseases reduced yields an estimated 421,000 m tons worth $99.30 million. Foliar, pod, and stem diseases caused an estimated yield loss of 395,000 m tons with a market value of $93.18 million. At the average annual price, the 1.29 million m tons lost to diseases cost growers an estimated $304.74 million in 1990.

From 6,921,000 ha in the southern states, 11,736,000 m tons of soybeans were harvested in 1991. Soybean planting in some areas was delayed because of excessive rainfall. The comparative average crop loss for all diseases in 1991 was an estimated 12.6%. Disease loss estimates for the individual states ranged from 6.6% (Mississippi) to 32.5% (Florida). Nine states reported disease losses over 10%: Arkansas (19.2%), Florida (32.5%), Georgia (10%), Louisiana (18%), Missouri (11.5%), North Carolina (16.1%), South Carolina (15.7%), Tennessee (12.9%), and Texas (11.8%). Nematodes reduced yields by an estimated 634,000 m tons, a $143.23 million loss. Soilborne diseases cost growers an estimated $117.54 million by reducing yields 520,000 m tons. Foliar, pod, and stem diseases were estimated to have reduced yields by 539,000 m tons, costing growers $121.72 million. The 1.69 million m tons lost to diseases in the southern states in 1991 cost growers an estimated $382.49 million.

Soybean and soybean products continue to be very important southern agricultural commodities. Seedling disease losses increased sharply over a 3-yr period, from 88,000 m tons in 1988 to 142,000 m tons in 1990. Based on a 3-yr average annual price of $5.50 per kilogram ($6.30/bu) for 1988, 1989, and 1990, the increase in seedling diseases cost southern soybean growers $13.17 million over the three years. Losses to other diseases have fluctuated during the 4-yr period. These data confirm that soybean diseases continue to cause heavy losses of income and that more research is needed to provide effective and economical disease control practices.

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Table 1. Estimated percent loss to disease of soybean yields in 1988 in 16 southern states

	Percent loss per state																
	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.[a]
Disease																	
Seedling diseases	0.2	0.43	TR[b]	10.0	0.04	1.0	0.5	...	0.04	1.0	0.1	0.7	0.2	1.5	0.2	0.5	1.03
Root and stem rots	0.5	0.56	0.1	20.0	0.05	TR	1.0	...	0.54	1.0	0.5	1.0	1.50	2.0	0.2	0.2	1.82
Pod and stem blight	1.5	2.27	TR	2.0	0.05	TR	3.0	TR	1.78	TR	TR	5.0	1.0	0.01	1.0	1.0	1.16
Charcoal rot	0.1	3.54	0.1	2.0	0.01	0.2	0.5	TR	0.98	3.0	0.5	3.0	0.05	1.5	0.1	0.1	0.98
Sudden death syndrome	...	2.20	...	...	...	0.2	TR	...	TR	TR	...	...	...	0.01	...	...	0.15
Stem canker	0.2	0.10	...	...	0.01	TR	1.5	...	TR	...	TR	...	0.05	TR	0.1	...	0.12
Anthracnose	2.0	1.38	...	3.0	0.1	0.1	1.0	TR	0.67	1.0	TR	2.0	1.25	1.0	3.0	0.1	1.04
Downy mildew	0.1	0.08	...	TR	...	TR	TR	...	TR	...	TR	...	0.10	...	...	TR	0.02
Cercospora leaf blight and purple seed stain	0.3	1.87	TR	2.0	0.02	0.1	TR	TR	0.99	...	0.1	1.0	0.10	TR	1.0	0.1	0.47
Brown leaf spot	0.5	0.11	...	TR	...	0.5	TR	...	TR	...	0.1	...	0.20	1.5	0.4	TR	0.21
Other foliar diseases	1.0	3.15	...	...	0.04	TR	5.0	...	1.51	...	...	...	0.25	0.5	0.3	...	0.73
Bacterial diseases	0.1	0.30	..	...	...	TR	TR	...	TR	...	0.1	...	0.10	...	0.1	TR	0.04
Viral diseases	0.1	0.01	TR	TR	...	0.3	TR	...	TR	1.0	1.5	TR	0.25	...	0.1	0.2	0.22
Soybean cyst nematode	3.5	2.59	4.0	...	1.25	4.5	3.0	3.2	0.46	3.0	6.0	0.5	4.50	4.0	0.02	2.3	2.68
Root-knot nematode and ecto-parasitic types	3.0	0.70	2.0	...	3.25	...	3.0	1.5	0.06	...	2.0	TR	5.50	0.3	0.01	1.2	1.41
Other diseases[c]	...	0.27	...	...	...	...	TR	3.8	TR	...	5.0	...	...	0.5	...	0.4	0.07
Total percent loss[a]	13.1	19.56	6.2	39.0	4.82	6.9	18.5	4.7	7.2	10.0	10.9	13.2	15.05	12.82	6.53	6.1	12.16
Average yield (m ton/ha)	1.44	1.57	1.57	1.57	1.57	1.69	1.69	1.57	1.44	1.76	1.63	1.38	1.38	1.63	1.76	1.63	Total
Hectares ($\times 10^6$)[a]	0.23	1.28	0.09	0.05	0.34	0.38	0.69	0.19	0.89	1.70	0.58	0.09	0.32	0.53	0.10	0.23	7.69
Yield loss (m ton $\times 10^5$)[a,d]	0.48	4.68	0.09	0.40	0.27	0.48	2.56	0.14	0.97	3.29	1.13	0.19	0.76	1.24	0.11	0.32	17.11
Dollar loss ($\times 10^6$)[a,e]	11.15	108.56	2.18	9.20	6.31	11.09	59.30	3.30	22.48	76.23	26.26	4.48	17.58	28.73	2.66	7.38	$396.90

[a] Rounding errors present.
[b] TR = Trace.
[c] Yield loss due to weather not included in actual loss from pathogens (MD, NC).
[d] The yield loss is based on the percent loss of what yield would have been had no disease occurred.
[e] Dollar loss = estimated loss × 1,000 × $5.27/kg.

Table 2. Estimated percent loss to disease of soybean yields in 1989 in 16 southern states

	Percent loss per state																
	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.[a]
Disease																	
Seedling diseases	TR[b]	1.0	TR	10.0	TR	1.2	0.5	...	0.81	1.0	0.1	0.4	0.20	1.0	0.08	0.5	1.05
Root and stem rots	TR	0.5	...	20.0	TR	0.4	1.0	...	0.64	0.1	0.2	0.5	2.0	0.1	0.60	0.2	1.64
Pod and stem blight	2.0	0.5	1.0	2.0	0.1	0.2	2.0	0.33	1.62	0.1	0.1	5.5	1.05	0.01	0.50	0.5	1.09
Charcoal rot	0.1	0.5	0.1	2.0	...	...	0.5	...	0.94	1.0	0.1	2.0	0.05	0.5	0.03	TR	0.49
Sudden death syndrome	TR	TR	...	...	...	0.1	TR	...	TR	0.1	...	...	...	0.1	...	...	0.02
Stem canker	1.0	7.0	...	...	TR	TR	4.0	TR	3.10	0.1	...	...	0.05	15.0	0.03	...	1.89
Anthracnose	4.0	1.0	0.1	3.0	0.1	0.3	0.5	1.0	1.62	0.1	...	2.5	1.75	1.0	3.0	0.1	1.25
Downy mildew	0.5	TR	...	TR	...	TR	TR	TR	TR	0.5	...	TR	0.10	TR	...	TR	0.07
Cercospora leaf blight and purple seed stain	0.5	TR	TR	2.0	0.05	TR	TR	...	1.33	0.5	0.1	1.0	0.30	0.01	0.30	0.1	0.39
Brown leaf spot	TR	1.0	...	TR	...	1.4	TR	...	TR	...	0.1	...	0.20	2.0	0.10	TR	0.30
Other foliar diseases	4.0	11.0	...	...	...	TR	2.0	...	2.55	...	0.2	...	0.50	3.0	0.30	...	1.47
Bacterial diseases	0.1	TR	...	...	...	TR	TR	...	TR	...	...	0.5	0.10	TR	...	TR	0.04
Viral diseases	TR	TR	TR	...	...	0.2	TR	...	TR	0.1	0.6	...	0.50	TR	...	0.2	0.10
Soybean cyst nematode	4.0	3.0	2.0	3.0	1.25	2.8	3.0	3.0	0.42	5.0	5.0	0.5	4.50	3.0	0.01	3.0	2.72
Root-knot nematode and ecto-parasitic types	3.0	1.0	1.0	11.0	3.40	...	3.0	1.0	0.19	...	2.5	...	5.50	0.1	0.06	1.0	2.05
Other diseases[c]	1.0	TR	...	...	...	...	TR	...	TR	...	7.6	...	...	1.0	...	0.2	0.61
Total percent loss[a]	20.2	26.5	4.2	53.0	4.9	6.6	16.5	5.33	13.22	8.60	16.60	12.90	16.80	26.82	5.01	5.8	15.19
Average yield (m ton/ha)	1.44	1.44	1.82	1.69	1.63	1.66	1.32	1.88	1.25	1.96	1.69	1.38	1.38	1.50	1.76	2.01	Total
Hectares ($\times 10^6$)[a]	0.21	1.30	0.10	0.06	0.47	0.37	0.65	0.22	0.81	1.74	0.63	0.10	0.39	0.58	0.18	0.22	8.03
Yield loss (m ton $\times 10^5$)[a,d]	0.74	6.83	0.08	0.83	0.39	0.43	1.64	0.23	1.52	3.15	2.06	0.20	1.05	2.98	0.17	0.25	22.55
Dollar loss ($\times 10^6$)[a,e]	20.30	187.74	2.31	22.96	10.78	11.90	45.22	6.44	41.86	86.66	56.77	5.39	28.84	81.83	4.69	6.79	$620.34

[a] Rounding errors present.
[b] TR = Trace.
[c] Other diseases include loss due to ozone damage (NC) and preharvest seed deterioration (TN).
[d] The yield loss is based on the percent loss of what yield would have been had no disease occurred.
[e] Dollar loss = estimated loss × 1,000 × $6.25/kg.

Table 3. Estimated percent loss to disease of soybean yields in 1990 in 16 southern states

	Percent loss per state																
	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.[a]
Disease																	
Seedling diseases	0.2	3.0	TR[b]	5.0	...	0.2	0.5	...	0.67	1.0	0.06	0.4	0.2	2.0	0.1	0.2	0.85
Root and stem rots	0.4	1.0	TR	10.0	...	0.1	0.5	...	0.33	1.0	0.16	0.3	1.5	1.0	0.9	0.3	1.09
Pod and stem blight	0.3	1.0	0.5	TR	...	1.5	0.5	TR	1.37	...	0.1	1.0	1.0	0.01	1.0	0.4	0.54
Charcoal rot	0.5	1.0	...	1.0	...	0.2	2.0	...	3.17	2.0	0.5	2.3	0.05	2.5	0.1	...	0.96
Sudden death syndrome	...	TR	...	...	...	0.1	TR	...	TR	TR	...	...	...	0.01	...	...	0.007
Stem canker	0.2	TR	...	TR	...	TR	0.5	...	0.77	...	...	...	0.01	0.2	0.01	...	0.11
Anthracnose	1.0	1.0	0.5	1.0	...	0.5	1.0	TR	0.90	...	...	2.0	1.5	0.5	4.0	0.1	0.88
Downy mildew	0.5	TR	TR	TR	...	0.1	TR	...	TR	...	...	TR	0.1	0.1	...	...	0.05
Cercospora leaf blight and purple seed stain	0.2	TR	TR	TR	...	0.2	0.5	...	0.90	...	0.1	1.0	0.5	0.01	0.3	0.1	0.24
Brown leaf spot	0.5	2.0	...	TR	...	1.0	TR	TR	0.17	...	...	TR	0.2	1.0	0.1	0.1	0.32
Other foliar diseases	0.5	...	...	...	...	...	0.5	...	0.70	...	0.1	1.0	0.5	0.01	0.3	...	0.23
Bacterial diseases	0.1	TR	...	...	...	TR	TR	...	TR	...	...	TR	0.1	0.01	...	TR	0.01
Viral diseases	0.1	TR	TR	TR	...	0.1	TR	...	TR	1.0	0.6	TR	0.5	0.01	0.01	0.2	0.16
Soybean cyst nematode	3.0	1.0	3.0	1.5	0.5	2.5	2.5	5.0	0.20	4.0	6.0	0.7	5.0	2.5	0.01	4.0	2.59
Root-knot nematode and ecto-parasitic types	1.5	...	1.0	12.0	1.5	TR	2.5	1.0	0.13	...	2.05	0.5	5.5	0.1	0.1	1.0	1.81
Other diseases[c]	1.0	...	...	...	...	...	TR	...	TR	...	7.0	...	...	0.1	0.2	0.5	0.55
Total percent loss[a]	10.0	10.0	5.0	30.5	2.0	6.5	11.0	6.0	9.31	9.0	16.67	9.2	16.56	10.06	7.13	6.9	10.37
Average yield (m ton/ha)	1.06	1.57	2.13	1.57	0.82	1.94	1.50	2.26	1.32	1.88	1.50	1.25	1.13	1.63	1.76	1.94	Total
Hectares ($\times 10^6$)[a]	0.18	1.30	0.08	0.03	0.26	0.49	0.71	0.20	0.77	1.66	0.55	0.09	0.32	0.51	0.09	0.22	7.46
Yield loss (m ton $\times 10^5$)[a,d]	0.21	2.24	0.19	0.19	0.04	0.66	1.31	0.29	1.03	3.07	1.60	0.12	0.70	0.92	0.12	0.31	12.90
Dollar loss ($\times 10^6$)[a,e]	5.04	52.80	2.16	4.50	1.02	15.60	30.96	6.78	24.42	72.42	37.80	2.76	16.56	21.60	2.94	7.38	$304.74

[a] Rounding errors present.
[b] TR = Trace.
[c] Other diseases or yield loss include loss due to ozone damage (NC), preharvest seed deterioration (TN), and red crown rot (VA).
[d] The yield loss is based on the percent loss of what yield would have been had no disease occurred.
[e] Dollar loss = estimated loss × 1,000 × $5.36/kg.

Table 4. Estimated percent loss to disease of soybean yields in 1991 in 16 southern states

	Percent loss per state																
	AL	AR	DE	FL	GA	KY	LA	MD	MS	MO	NC	OK	SC	TN	TX	VA	Avg.[a]
Disease																	
Seedling diseases	0.2	0.5	TR[b]	5.0	...	0.2	1.0	...	0.3	1.0	0.1	0.3	0.2	2.5	0.3	0.2	0.73
Root and stem rots	0.3	0.6	TR	10.0	...	0.2	1.0	...	0.18	1.5	0.3	0.3	1.5	1.0	2.0	0.1	1.18
Pod and stem blight	0.5	2.0	TR	1.0	0.5	1.8	2.0	0.16	1.03	...	0.2	1.5	1.0	0.01	3.0	0.4	0.94
Charcoal rot	0.2	3.7	0.5	TR	...	2.0	0.5	0.1	3.4	2.5	0.1	2.6	0.05	2.0	0.3	TR	1.12
Sudden death syndrome	0.1	2.0	...	...	...	TR	...	...	TR	0.01	...	...	...	0.75	...	...	0.17
Stem canker	0.1	0.3	...	...	...	TR	0.5	...	0.06	...	...	...	0.01	0.5	0.1	...	0.09
Anthracnose	1.2	1.4	TR	2.0	...	0.3	1.0	0.1	0.79	0.01	0.01	1.5	1.5	1.0	5.0	0.1	0.99
Downy mildew	0.3	0.2	...	TR	...	TR	TR	...	TR	TR	TR	TR	0.1	0.1	...	TR	0.04
Cercospora leaf blight and purple seed stain	0.2	2.1	...	1.0	0.75	0.1	1.0	TR	0.55	0.01	0.1	1.0	0.5	0.01	0.5	0.1	0.49
Brown leaf spot	0.5	0.12	...	TR	0.75	0.5	TR	0.03	0.06	TR	0.2	TR	0.2	1.25	0.1	0.1	0.23
Other foliar diseases	0.5	2.2	...	...	0.25	...	3.0	...	0.11	0.5	TR	0.5	0.5	0.2	0.3	...	0.50
Bacterial diseases	0.1	0.7	...	...	...	TR	TR	...	TR	TR	...	TR	0.05	...	...	...	0.05
Viral diseases	0.1	0.01	0.5	...	2.5	0.1	TR	...	TR	0.01	0.6	TR	0.1	...	0.05	0.2	0.26
Soybean cyst nematode	2.0	2.5	4.0	1.5	1.75	2.3	4.0	7.0	0.04	6.0	7.0	0.7	3.0	3.5	0.01	4.0	3.08
Root-knot nematode and ecto-parasitic types	1.0	0.5	2.0	12.0	3.5	...	4.0	1.5	0.04	TR	1.5	0.5	7.0	0.1	0.01	1.0	2.16
Other diseases[c]	1.0	0.4	...	...	...	...	TR	...	TR	...	6.0	...	...	...	0.1	0.6	0.50
Total percent loss[a]	8.3	19.23	7.0	32.5	10.0	7.5	18.0	8.89	6.56	11.54	16.11	8.9	15.71	12.92	11.77	6.8	12.60
Average yield (m ton/ha)	1.44	1.69	1.94	1.63	1.63	1.88	1.57	1.94	1.50	1.82	1.63	1.25	1.38	1.63	1.76	1.76	Total
Hectares ($\times 10^6$)[a]	0.15	1.26	0.10	0.02	0.25	0.46	0.36	0.20	0.73	1.81	0.53	0.09	0.26	0.43	0.07	0.21	6.93
Yield loss (m ton $\times 10^5$)[a,d]	0.19	4.88	0.15	0.11	0.45	0.69	1.22	0.38	0.77	4.23	1.61	0.10	0.65	1.01	0.17	0.28	16.89
Dollar loss ($\times 10^6$)[a,e]	4.37	110.34	3.34	2.59	10.18	15.70	27.49	8.63	17.37	95.51	36.34	2.36	14.72	22.89	3.80	6.44	$382.49

[a] Rounding errors present.
[b] TR = Trace.
[c] Other diseases or yield loss include southern stem rot (VA), red crown rot (VA), and loss due to ozone damage (NC).
[d] The yield loss is based on the percent loss of what yield would have been had no disease occurred.
[e] Dollar loss = estimated loss × 1,000 × $5.13/kg.

Salute to APS Sustaining Associates

This section is designed to help APS members understand more about APS Sustaining Associates. Information is supplied by company representatives. Each month features different companies. A complete listing appears in each issue of *Phytopathology*.

Illinois Crop Improvement Association. Contact: James R. Shearl, 3105 Research Road, P.O. Box 9013, Champaign, IL 61826-9013; 217/359-4053, Fax: 217/359-4075. The Illinois Crop Improvement Association (ICIA) was formed in 1922 as a seed certification agency for the state of Illinois. Through the certification process, which includes field inspection, seed sampling, lab testing, and tagging, the seed is backed by the ICIA's guarantee of quality. Over the years, ICIA has become much more than a certification agency. The association now has a quality assurance program, an identity preserved grain lab (IPG), and a winter farm in Puerto Rico. The quality assurance program provides a uniform and unbiased quality control program for crop seeds merchandised as varieties, blends, or brands. The IPG lab is a seed-testing lab designed to test grain for quality traits such as protein and oil percentage. The winter farm project began in 1986 and, since that time, has doubled in size each year. The company now offers grow-outs, production of foundation inbreds, and single crosses and corn nursery.

ISK Biotech Corporation. Contact: Gary L. Eilrich, 5966 Heisley Road, Mentor, OH 44061-8000; 216/357-4145, Fax: 216/354-9506. ISK Biotech Corporation, with headquarters in Mentor, Ohio, serves two world business areas: the Americas and Europe/Middle East/Africa. ISK Biotech brings to the world of agricultural chemicals advanced product development, state-of-the-art manufacturing facilities, and sophisticated marketing techniques to serve a growing global market. These basic capabilities have resulted in a line of superior weed- and disease-control products like Bravo and Daconil 2787 fungicides that significantly improve the health of turfgrass and ornamental plantings, and increase the quality and yields of such crops as peanuts, bananas, wheat, stone fruit, and vegetables. Bravo and Daconil 2787 are supported by a complete toxicology database and extensive residue studies that demonstrate low dietary and worker exposure. The product meets the negligible risk standard proposed by the National Academy of Sciences. ISK Biotech is uniquely positioned to respond to promising new opportunities.

Istituto di Fitovirologia Applicata del CNR. Contact: M. A. Conti, Strada Delle Cacce, 73, Torino 10135, Italy; (011) 3977.1, Fax: (011) 39 11 343809. The institute, founded in 1968 by the Italian National Research Council (CNR), has grown to become one of the largest groups of plant virologists in Italy. Its main work is on viruses, viroids, and mycoplasmas. The principal techniques used are serology, electron microscopy, biochemistry, and molecular biology; and the main lines of work are virus characterization, diagnostics, epidemiology, molecular biology, cytopathology, and quarantine studies. The institute cooperates with CIAT, CIMMYT, and other national and international institutions.

Janssen Pharmaceutica. Contact: David B. Helmer, Plant Protection Division, 1125 Trenton-Harbourton Road, Titusville, NJ 08560-0200; 609/730-2608, Fax: 609/730-2411. With headquarters in Beerse, Belgium, Janssen Pharmaceutica has developed antifungal compounds for human and veterinary pharmaceutical use and for agricultural and industrial applications. Imazalil has been developed for application to wheat and barley as a seed treatment, and for postharvest treatment of citrus fruit. Specific formulations are available through licensed distributors. New uses of imazalil, which are under development, focus on seed treatment of field and vegetable crops. Postharvest uses are being expanded to include vegetables and other fruits. Janssen supports cooperative phytopathological research projects of mutual interest.

Karolyi Mihaly Orszagos. Mezoegazdasagi, Koenyvtar, Pf. 15, 1253 Budapest, Hungary.