

Table 2. Per cent pod damage observed on the different varieties of farmers fields in various taluks of Gulbarga district

Variety cultivated	No. of fields visited	Per cent pod damage *	
		Range	Mean
ICPL – 8863	12	9.09 – 79.31	31.82
GS – 1	08	7.45 – 52.38	23.08
PT – 221	09	7.80 – 42.50	21.64
Local (red seeded)	11	27.85 – 100.00	56.50
Local (white seeded)	17	9.25 – 66.87	30.51
Others	03	26.08 – 45.59	34.89

\* worked out from the pods of 10 randomly selected plants.

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**A Note on the Efficacy of Sequential Spray of Neem (*Azadirachta indica* A. Jass) Seed Extract and Insecticides for the Control of Pod Borer *Helicoverpa armigera* Hubner infesting Redgram ( *Cajanus cajan* (L) Millsp).**

*Helicoverpa armigera* Hubner is the most devastating pest of redgram and causes considerable yield loss (Anonymous, 1985; Rangaiah and Sehagal, 1985; and Rajwant Singh *et al.*, 1988). Application of neem seed extract as a spray has been found to be effective in controlling this pest (Kumar and Sangappa, 1984; Srivastava *et al.* 1984; Gohokar *et al.* 1985; and Singh *et al.* 1985). But there is no information available on the efficacy of

neem seed extract when sprayed in sequence with the other recommended insecticides in the control of redgram pod borer. Hence, field experiments were conducted at three Research Stations during 1989–90 in northern Karnataka to generate necessary information.

The experiments were conducted during the rainy season at Agricultural Research Station, Gulbarga and Bidar, and Main Research

Station, Dharwad in a randomised block design. The treatments were replicated three times. ICPL-8863 seeds were dibbled at a distance of 30 cm in the rows spaced at 60 cm during second week of July. The crop received recommended package of practices except insecticidal application. The plot size was uniform (13.5 m<sup>2</sup>) over the locations. Three sequential insecticidal spray applications (Table 1) were given at 15 days interval starting at 50% flowering. Fenvalerate was applied as dust in all the sequences and other insecticides were applied as sprays. Per cent pod damage at harvest, grain yield was recorded and cost benefit ratio was worked out (Table 2).

The results were significant at all the locations. At Gulbarga, T<sub>13</sub> recorded lowest (32.9%) pod damage and was on par with T<sub>12</sub>, T<sub>8</sub>, T<sub>6</sub>, T<sub>11</sub>, T<sub>9</sub>, T<sub>10</sub>, T<sub>2</sub>, T<sub>5</sub>, T<sub>1</sub>, and T<sub>4</sub>. The treatment T<sub>4</sub> recorded 43.6% damage and was on par with T<sub>3</sub>, T<sub>7</sub> and T<sub>14</sub>. Highest yield of 19.23 q/ha was observed in T<sub>13</sub> and it was on par with T<sub>10</sub>, T<sub>9</sub>, T<sub>12</sub>, T<sub>11</sub>, and T<sub>8</sub>. T<sub>8</sub> recorded 16.95 q/ha yield and it was on par with T<sub>6</sub>, T<sub>4</sub>, T<sub>1</sub> and T<sub>3</sub>. T<sub>3</sub> recorded 14.67 q/ha yield and was on par with T<sub>5</sub>, T<sub>7</sub> and T<sub>14</sub> which recorded the lowest yield of 11.53 q/ha. Though T<sub>13</sub> recorded highest yield, it ranked second in CBR (1: 6.98) where as T<sub>10</sub> and T<sub>9</sub> rated 1st and 3rd with a CBR of 1: 7.31 and 1: 6.91. At Dharwad, T<sub>13</sub> recorded lowest per cent pod damage (24.1) and was on par with T<sub>11</sub>. T<sub>11</sub> recorded 24.39% damage and was on par with T<sub>10</sub> and T<sub>12</sub>. T<sub>12</sub> recorded 25.8% damage and was on par with T<sub>9</sub>, T<sub>3</sub> and T<sub>4</sub>. T<sub>4</sub> recording 27.3% damage was on par with T<sub>6</sub>. The treatments T<sub>2</sub>, T<sub>7</sub>, T<sub>5</sub> and T<sub>8</sub> were on par with each other. T<sub>14</sub> which recorded highest damage (42.5%) differed significantly from T<sub>1</sub>. The treatment T<sub>10</sub> recorded the highest yield of 17.71 q/ha and was on par with T<sub>3</sub> and T<sub>8</sub>. T<sub>4</sub>, T<sub>11</sub>, T<sub>13</sub> and T<sub>9</sub> differed significantly

from each other. T<sub>5</sub> recorded 12.94 q/ha and was on par with T<sub>7</sub>, T<sub>12</sub>, T<sub>2</sub> and T<sub>6</sub>. T<sub>1</sub> recorded 11.34 q/ha and it differed significantly from T<sub>14</sub> which recorded lowest yield of 10.07 q/ha. Highest CBR of 1: 4.68 was noticed with T<sub>11</sub> followed by 1: 4.66 in T<sub>13</sub> and 1: 4.43 in T<sub>4</sub>. At Bidar, the lowest percent pod damage was noticed in T<sub>3</sub> and it was on par with T<sub>8</sub>, T<sub>13</sub> and T<sub>12</sub>. T<sub>12</sub> recorded 10.46% damage and was on par with T<sub>10</sub>, T<sub>4</sub>, T<sub>11</sub> and T<sub>5</sub>. T<sub>5</sub> recorded 12.7% damage and was on par with T<sub>2</sub>, T<sub>7</sub> and T<sub>9</sub>. T<sub>9</sub> recorded 14.7% damage and was on par with T<sub>6</sub> and T<sub>1</sub> and it differed significantly from T<sub>14</sub> which recorded highest of 22.1% damage. Highest grain yield was noticed in T<sub>3</sub> (23.41 q/ha) and it was on par with T<sub>8</sub>, T<sub>10</sub>, T<sub>11</sub>, T<sub>13</sub>, T<sub>4</sub>, T<sub>9</sub> and T<sub>7</sub>. T<sub>7</sub> recorded 19.7 q/ha yield and was on par with T<sub>12</sub>, T<sub>6</sub>, T<sub>2</sub>, T<sub>5</sub> and T<sub>1</sub> and differed significantly from T<sub>14</sub> which recorded the lowest yield of 11.33 q/ha. Highest CBR of 1: 11.04 was noticed with T<sub>3</sub> followed by 1: 10.79 with T<sub>8</sub> and 1: 9.41 with T<sub>10</sub>.

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Table 1. Per cent pod damage at different locations (original values within the parenthesis)

Treatments		Per cent pod damage at		
		Gulbarga	Dharwad	Bidar
T <sub>1</sub>	Neem seed extract 5% spray (3 sprays @ 15 days interval)	a 40.36 (42.03)	f 37.86	d 16.73 (8.35)
T <sub>2</sub>	Endosulfan 35 EC 0.07% spray — do —	a 40.16 (45.15)	e 34.73	c 13.02 (5.17)
T <sub>3</sub>	Cypermethrin 10 EC 0.01% spray — do —	b 43.80 (48.01)	c 27.04	a 8.39 (2.10)
T <sub>4</sub>	Fenvalerate 0.4% D 25 kg/ha (3 dusts @ 15 days interval)	ab 43.58 (47.53)	cd 27.27	c 11.20 (3.79)
T <sub>5</sub>	Endosulfan, Neem seed extract, Endosulfan	a 40.30 (39.37)	e 34.44	d 12.66 (8.20)
T <sub>6</sub>	Neem seed extract, Endosulfan, Endosulfan	a 39.09 (39.37)	e 35.06	d 16.64 (8.20)
T <sub>7</sub>	Endosulfan, Endosulfan, Neem seed extract	b 44.02 (48.80)	e 34.24	c 14.39 (6.20)
T <sub>8</sub>	Cypermethrin, Neem seed extract, Cypermethrin	a 37.82 (37.88)	d 27.95	a 8.91 (2.45)
T <sub>9</sub>	Neem seed extract, Cypermethrin, Cypermethrin	a 37.20 (36.44)	c 26.79	cd 14.72 (6.49)
T <sub>10</sub>	Cypermethrin, Cypermethrin, Neem seed extract	a 39.79 (41.20)	b 25.83	b 10.63 (3.40)
T <sub>11</sub>	Fenvalerate, Neem seed extract, Fenvalerate	a 38.13 (38.30)	ab 24.39	b 12.51 (4.71)
T <sub>12</sub>	Neem seed extract, Fenvalerate, Fenvalerate	a 36.47 (35.37)	bc 25.83	ab 10.46 (3.34)
T <sub>13</sub>	Fenvalerate, Fenvalerate, Neem seed extract	a 32.93 (29.73)	a 24.09	a 10.11 (3.09)
T <sub>14</sub>	Untreated control	b 45.50 (50.89)	g 42.51	d 22.11 (14.14)
S. Em ±		2.42	0.80	1.08
C. V. %		10.50	3.21	10.21
C. D. (at 5%)		9.53	1.65	2.22

Table 2. Grain yield and cost benefit ratio (CBR) at different locations

Treatments	Yield q/ha			Cost-Benefit Ratio		
	Gulbarga	Dharwad	Bidar	Gulbarga	Dharwad	Bidar
T <sub>1</sub> Neem seed extract 5% (3 sprays at 15 days interval)	<sup>b</sup> 14.81	<sup>g</sup> 11.34	<sup>b</sup> 18.22	1:2.38	1:1.40	1:6.68
T <sub>2</sub> Endosulfan 35 EC 0.07% (3 sprays at 15 days interval)	<sup>bc</sup> 15.21	<sup>f</sup> 12.84	<sup>b</sup> 18.52	1:3.32	1:3.93	1:7.93
T <sub>3</sub> Cypermethrin 10 EC 0.01% (3 sprays at 15 days interval)	<sup>bc</sup> 14.67	<sup>a</sup> 17.40	<sup>a</sup> 23.41	1:3.81	1:2.31	1:11.04
T <sub>4</sub> Fenvalerate 0.4% D 25 kg/ha (3 dustings at 15 days interval)	<sup>b</sup> 14.95	<sup>b</sup> 16.26	<sup>a</sup> 20.96	1:1.15	1:4.43	1:6.37
T <sub>5</sub> Endosulfan, Neem seed extract, Endosulfan	<sup>c</sup> 13.53	<sup>f</sup> 12.94	<sup>b</sup> 18.52	1:2.70	1:3.34	1:7.59
T <sub>6</sub> Neem seed extract, Endosulfan, Endosulfan	<sup>b</sup> 15.52	<sup>f</sup> 12.37	<sup>b</sup> 18.74	1:3.30	1:2.60	1:7.77
T <sub>7</sub> Endosulfan, Endosulfan, Neem seed extract	<sup>c</sup> 13.53	<sup>f</sup> 12.93	<sup>ab</sup> 19.70	1:1.27	1:3.33	1:8.78
T <sub>8</sub> Cypermethrin, Neem seed extract, Cypermethrin	<sup>ab</sup> 16.95	<sup>a</sup> 17.39	<sup>a</sup> 32.96	1:5.18	1:3.03	1:10.79
T <sub>9</sub> Neem seed extract, Cypermethrin, Cypermethrin	<sup>a</sup> 17.52	<sup>e</sup> 15.23	<sup>a</sup> 20.44	1:6.91	1:2.14	1:8.43
T <sub>10</sub> Cypermethrin, Cypermethrin, Neem seed extract	<sup>a</sup> 17.80	<sup>a</sup> 17.71	<sup>a</sup> 21.48	1:7.31	1:3.16	1:9.41
T <sub>11</sub> Fenvalerate, Neem seed extract, Fenvalerate	<sup>a</sup> 16.95	<sup>c</sup> 15.84	<sup>a</sup> 21.19	1:4.62	1:4.68	1:7.26
T <sub>12</sub> Neem seed extract, Fenvalerate, Fenvalerate	<sup>a</sup> 17.13	<sup>f</sup> 12.88	<sup>b</sup> 19.26	1:4.99	1:2.28	1:5.84
T <sub>13</sub> Fenvalerate, Fenvalerate, Neem seed extract	<sup>a</sup> 19.23	<sup>d</sup> 15.69	<sup>a</sup> 20.96	1:6.98	1:4.66	1:7.10
T <sub>14</sub> Untreated control	<sup>c</sup> 11.53	<sup>b</sup> 10.07	<sup>c</sup> 11.33	—	—	—
S.Em ±	0.47	0.46	0.87			
C. V. %	7.60	3.88	9.25			
C.D. (at 5%)	2.69	0.94	3.84			

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## A Note on the Outbreak of American Serpentine Leaf Miner, *Liriomyza trifoli* Burges (Diptera: Agromyzidae) with Particular Reference to Cotton

During August 1991, there was an outbreak of an unknown pest on cotton throughout the cotton growing areas of north Karnataka. Young leaves of 1 to 1½ months old cotton plants showed serpentine like mines. Close observations of leaves revealed the presence of tiny maggots and the excreta.

Further, the pupae of maggots were found in the "hood" like expansion of the mines. The affected leaves were covered with the net work of mines exhibiting very less greenness, became dried, and withered ultimately. However, the plant growth was not much affected. The affected leaves were brought