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## Management of gerbera whitefly, (*Bemisia tabaci* Genn) under protected condition

**Shalini B, Hanumantharaya L and Chandrashekar SY**

### Abstract

Management of whitefly *Bemisia tabaci* Genn. was studied on gerbera under protected condition during 2016 at College of Horticulture, Mudigere, Karnataka. Among treatments evaluated for management of whitefly, diafenthiuron 50 SC, fipronil 5 SC and thiamethoxam 25 WG were found to be superior in reducing the mean whitefly adults and nymphal population after first and second foliar spray and highest C: B ratio also obtained from these treatments. They were followed by imidacloprid 17.8 SL, acetamiprid 20 SP, dimethoate 30 EC and cyantraniliprole 10 OD in recording lower whitefly population.

**Keywords:** Gerbera, whitefly, insecticides, management

### 1. Introduction

Gerbera (*Gerbera jamesonii* Bolus.) is an important flower crop grown under protected condition in India. Gerbera (*G.jamesonii*) ranks fifth in the world trade among top ten cut flowers suitable for both export and domestic purposes (Bhattacharjee and De, 2003) [3]. Pest incidence is the major factor responsible for yield reduction in gerbera. Among the different pest whitefly, *Bemisia tabaci* Genn. (Hemiptera: Aleyrodidae) are major potentially insect pests on greenhouse gerbera. The infestation of whitefly become a problematic in the summer months under dry warm weather conditions, because warm temperatures suit for their breeding cycle (Arojee. *et al.*, 2005) [2]. Under polyhouse condition whiteflies can damage the plant directly and indirectly. They suck the plant sap and thus leads to lesser plants vitality, productivity and causes plant damage. They also cause indirect damage by secreting honeydew, which leads to growth of sooty mold fungi, and thus affect the process of the plant physiology, also they act as vector to transmit the many plant viruses (Samin and Leila, 2012) [7]. Since, whitefly is major and problematic pest in gerbera, present study was undertaken to formulate suitable management measures against whitefly under protected conditions.

### 2. Materials and Methods

Poly house experiment was conducted to evaluate the different insecticide components for the management of whitefly, *Bemisia tabaci* Genn. during 2016 at College of Horticulture, Mudigere taluk of chikamagaluru (Dt), Karnataka, India using the gerbera variety, Julia in RCBD with three replication and 12 treatments including untreated control (water spray) (Table1). The gerbera plants was planted with a spacing of 37.5×30 cm in a plot size of 4 × 1m during third week of September 2016.

The treatments were imposed during the peak incidence of whitefly are noticed (90 days after planting). Two sprays was taken at 95 DAP to 135 DAP. First spray were taken when the peak incidence of whitefly was noticed. Both nymphs and adults of whitefly were counted on fully opened randomly selected tender three leaves on five randomly selected plants in each plot. Observation on whitefly adults was recorded in situ in early morning hours before imposition of treatment and after imposition of treatment, *i.e.*, 3, 5, 7 and 10 days after spraying. Whereas, nymphal population was counted per unit area (2cm<sup>2</sup>). Further, tender leaves of gerbera were brought into the laboratory and examined for nymphal population under stereo binocular microscope. Observation on nymphs were recorded before imposition of treatment and 3, 5, 7 and 10 days after imposition of treatment. Further, mean whitefly adults per leaf and nymphs per unit area on top three leaves were converted into per leaf.

**Table 1:** Details of treatments imposition during the study period

Tr. No.	Treatments	Dosage
T <sub>1</sub>	Thiamethoxam 25% WG	0.25g/l
T <sub>2</sub>	Diflubenzuron 25% WP	1g/l
T <sub>3</sub>	Imidacloprid 17.8% SL	0.3ml
T <sub>4</sub>	Fipronil 5% SC	1ml/l,
T <sub>5</sub>	Neem oil	5ml/l
T <sub>6</sub>	Azadirachtin 10000 ppm	2ml
T <sub>7</sub>	Acetamiprid 20% SP	1g/l
T <sub>8</sub>	Buprofezin 25% SC	0.5ml/l
T <sub>9</sub>	Diafenthiuron 50% SC	0.75ml/l
T <sub>10</sub>	Cyantraniliprole 10% OD	1.8ml/l
T <sub>11</sub>	Dimethoate 30% EC	1.7ml/l
T <sub>12</sub>	Control (water spray)	-

### 2.1 Marketable flower yield (per mt. sq. area)

The marketable flower yield was recorded during the time of each plucking from each treatment separately. The yield was expressed as number of flowers per mt. sq area.

### 2.2 Cost economics

Cost effectiveness of each treatments was worked based on net returns. Net returns of each treatments were worked out by deducting total cost of treatment from the gross returns. Then C:B was determined by dividing net returns with total cost. Total cost of production includes both cultivation as well as plant protection cost.

Gross returns = Marketable yield × Market price

Net returns = Gross returns – Total cost

C:B Ratio = Net returns / Total cost

### 2.3 Statistical analysis of the experimental data

The data obtained from the present investigation with respect to management of greenhouse whitefly. The various parameters such as number of whitefly adults per leaf, number of whitefly nymphal populations per 2cm<sup>2</sup> and marketable flower yield were subjected to ANOVA for a Randomized Complete Block Design (RCBD), with appropriate statistical transformation, wherever necessary. After analysis, data was suitably interpreted by using the critical difference value calculated at 0.05 level of probability. The calculations were done at five percent (5%) level of significance.

## 3. Results and Discussion

Efficacy of all treatments was assessed in comparison with

untreated control (water spray).

### 3.1 Whitefly adult populations per leaf

The pretreatment samplings indicated that population of whitefly was high and there was no significant difference among the treatments with respect to the number of whitefly adults per leaf during first and second spray of treatments.

There was significant difference among the treatments with respect to the mean whitefly adult population per leaf after imposition of first spray. Among the treatments, diafenthiuron 50 SC, fipronil 5 SC, thiamethoxam 25 WG, imidacloprid 17.8 SL and acetamiprid 20 SP recorded significantly lower whitefly mean population per leaf (0.37, 0.63, 0.85, 1.00, and 1.03 adults/leaf, respectively). Further, moderate whitefly adult population was recorded in the treatments, dimethoate 30 EC and cyantraniliprole 10 OD (3.96 and 4.74 adult/leaf, respectively). Whereas, highest population of whitefly was recorded in azadirachtin 10000 ppm, neem oil 0.5 per cent and buprofezin 25 SC (21.55, 21.94 and 23.91 adults/leaf, respectively). Further, after application of second spray, there was significant difference among the treatments with respect to average whitefly adult population per leaf. Among the treatments again diafenthiuron 50 SC, fipronil 5 SC, thiamethoxam 25 WG, imidacloprid 17.8 SL and acetamipride 20 SP recorded lower whitefly adult population per leaf (0.48, 0.68, 0.84, 1.20 and 1.37 adults/leaf, respectively). Whereas, higher population of whitefly adult were recorded in azadirachtin 10000 ppm, buprofezin 25 SC and neem oil 0.5 per cent (24.66, 25.37 and 25.59 adults/leaf, respectively). However, untreated control recorded significantly highest population of whitefly (63.33 adults/leaf) even after second spray (Table 2).

The present investigation are in conformity with Gopalaswamy *et al.* (2012) [4] who reported that the whitefly population as well as yellow mosaic virus incidence in green gram were less in diafenthiuron 50 WP @ 600 g/ha, imidacloprid 70 WG @ 75 g/ha and thiamethoxam 25 WG @ 100 g/ha treatments as compared to dimethoate 30EC. The present finding were also in agreement with Al-Kherb (2011) [1] who coated that the population of whitefly, *B. tabaci* on tomato crop significantly reduced by neonicotinoid insecticides. They also reported that acetamiprid 20 SP reduced 63.6% of whitefly adults while imidacloprid 20 SL caused 71.5% reduction.

**Table 2:** Bio efficacy of insecticides and botanicals against whitefly, *Bemisia tabaci* Genn. on gerbera

Tr. No.	Treatments	Dosage/l	*Mean No. of whitefly population											
			1 <sup>st</sup> spray											
			Aduts/leaf						Nymphs/unit area (2cm <sup>2</sup> )					
			1DBS	3DAS	5DAS	7DAS	10DAS	Average	1DBS	3DAS	5DAS	7DAS	10DAS	Average
T <sub>1</sub>	Thiamethoxam 25% WG	0.25g	41.88 (6.97)	0.00 (0.50)	0.00 (0.50)	1.63 (1.78)	1.78 (1.84)	0.85 (1.42)	8.01 (3.32)	0.00 (0.50)	0.00 (0.50)	1.59 (1.76)	1.78 (1.83)	0.84 (1.42)
T <sub>2</sub>	Diflubenzuron 25% WP	1g	43.08 (7.06)	23.15 (5.31)	17.06 (4.63)	14.73 (4.34)	15.09 (4.38)	17.51 (4.68)	7.52 (3.23)	5.44 (2.83)	4.22 (2.55)	4.20 (2.55)	3.77 (2.44)	4.41 (2.60)
T <sub>3</sub>	Imidacloprid 17.8% SL	0.3ml	40.77 (6.88)	0.00 (0.50)	0.00 (0.50)	1.95 (1.90)	2.06 (1.93)	1.00 (1.50)	7.08 (3.16)	0.00 (0.50)	0.00 (0.50)	0.95 (1.47)	1.10 (1.55)	0.51 (1.21)
T <sub>4</sub>	Fipronil 5% SC	1ml	42.30 (7.00)	0.00 (0.50)	0.00 (0.50)	1.20 (1.60)	1.32 (1.65)	0.63 (1.29)	8.66 (3.44)	0.00 (0.50)	0.00 (0.50)	0.36 (1.10)	0.59 (1.27)	0.24 (0.99)
T <sub>5</sub>	Neem oil	0.5%	42.07 (6.99)	27.46 (5.74)	21.25 (5.11)	20.94 (5.08)	18.10 (4.75)	21.94 (5.18)	8.16 (3.35)	5.90 (2.93)	3.87 (2.47)	3.59 (2.39)	3.74 (2.43)	4.27 (2.57)
T <sub>6</sub>	Azadirachtin 10000 ppm	2ml	42.87 (7.05)	28.13 (5.80)	20.42 (5.02)	19.76 (4.95)	17.87 (4.73)	21.55 (5.14)	7.44 (3.22)	6.40 (3.03)	4.29 (2.57)	3.29 (2.31)	3.42 (2.35)	4.35 (2.59)
T <sub>7</sub>	Acetamiprid 20% SP	1g	42.11 (6.99)	0.00 (0.50)	0.17 (0.91)	1.80 (1.84)	2.15 (1.97)	1.03 (1.52)	8.01 (3.33)	0.00 (0.50)	0.00 (0.50)	0.40 (1.13)	1.43 (1.70)	0.46 (1.18)
T <sub>8</sub>	Buprofezin 25% SC	0.5ml	40.11	28.69	24.92	20.49	21.54	23.91	7.52	0.95	0.00	0.58	0.68	0.55

			(6.83)	(5.86)	(5.49)	(5.03)	(5.14)	(5.39)	(3.24)	(1.47)	(0.50)	(1.26)	(1.32)	(1.24)
T <sub>9</sub>	Diafenthiuron 50% SC	0.75ml	43.50 (7.10)	0.00 (0.50)	0.00 (0.50)	0.67 (1.32)	0.82 (1.41)	0.37 (1.11)	8.35 (3.38)	1.48 (1.72)	1.17 (1.58)	0.90 (1.45)	1.18 (1.58)	1.18 (1.59)
T <sub>10</sub>	Cyantraniliprole 10% OD	1.8ml	42.17 (6.99)	4.19 (2.55)	4.85 (2.70)	4.93 (2.72)	4.98 (2.73)	4.74 (2.68)	7.08 (3.16)	3.75 (2.44)	2.64 (2.13)	1.31 (1.64)	1.59 (1.76)	2.32 (2.02)
T <sub>11</sub>	Dimethoate 30% EC	1.7ml	40.95 (6.90)	2.29 (2.01)	3.21 (2.29)	4.97 (2.73)	5.37 (2.82)	3.96 (2.49)	8.72 (3.45)	2.73 (2.15)	1.68 (1.80)	2.65 (2.13)	2.80 (2.17)	2.47 (2.07)
T <sub>12</sub>	Water spray (Control)	-	41.84 (6.97)	41.97 (6.98)	43.99 (7.13)	44.10 (7.14)	46.23 (7.30)	44.07 (7.14)	8.98 (3.49)	10.50 (3.74)	12.60 (4.04)	13.83 (4.22)	14.27 (4.28)	12.80 (4.08)
	S.Em ±		-	0.75	0.75	0.32	0.34	0.37	-	0.19	0.17	0.20	0.10	0.19
	C.D @ 5%		NS	2.21	2.19	0.95	0.99	1.08	NS	0.57	0.50	0.59	0.31	0.56

**Note:** \* - Values in parenthesis are  $\sqrt{x+0.5}$  transformed DBS - Days Before Spray; DAS - Days After Spray

**Table 3:** Bio efficacy of insecticides and botanicals against whitefly, *Bemisia tabaci* Genn. on gerbera

Tr. No.	Treatments	Dosage/l	*Mean No. of whitefly population											
			2 <sup>nd</sup> spray											
			Aduts/leaf						Nymphs/unit area (2cm <sup>2</sup> )					
			1DBS	3DAS	5DAS	7DAS	10DAS	Average	1DBS	3DAS	5DAS	7DAS	10DAS	Average
T <sub>1</sub>	Thiamethoxam 25% WG	0.25g	38.10 (6.67)	0.00 (0.50)	0.00 (0.50)	1.59 (1.76)	1.76 (1.83)	0.84 (1.42)	6.29 (3.38)	0.00 (0.50)	0.00 (0.50)	0.83 (1.41)	1.08 (1.54)	0.48 (1.19)
T <sub>2</sub>	Diflubenzuron 25% WP	1g	42.52 (7.02)	20.84 (5.06)	16.17 (4.52)	12.13 (3.98)	12.82 (4.08)	15.49 (4.44)	7.28 (3.20)	5.42 (2.83)	5.21 (2.78)	4.58 (2.64)	5.08 (2.75)	5.07 (2.75)
T <sub>3</sub>	Imidacloprid 17.8% SL	0.3ml	38.41 (6.70)	0.00 (0.50)	0.00 (0.50)	2.23 (1.99)	2.57 (2.10)	1.20 (1.60)	5.53 (3.42)	1.54 (1.74)	0.94 (1.47)	0.69 (1.33)	0.94 (1.47)	1.03 (1.51)
T <sub>4</sub>	Fipronil 5% SC	1ml	39.21 (6.76)	0.00 (0.50)	0.00 (0.50)	1.25 (1.62)	1.47 (1.71)	0.68 (1.32)	6.99 (3.14)	0.00 (0.50)	0.86 (1.43)	0.56 (1.25)	0.71 (1.34)	0.53 (1.23)
T <sub>5</sub>	Neem oil	0.5%	40.54 (6.87)	31.11 (6.08)	28.00 (5.79)	21.70 (5.16)	21.54 (5.14)	25.59 (5.56)	7.23 (3.37)	4.10 (2.52)	3.98 (2.49)	3.47 (2.36)	4.16 (2.54)	3.93 (2.48)
T <sub>6</sub>	Azadirachtin 10000 ppm	2ml	42.56 (7.02)	29.44 (5.93)	27.86 (5.78)	20.26 (5.00)	21.07 (5.09)	24.66 (5.47)	6.90 (3.31)	4.43 (2.60)	4.09 (2.52)	3.92 (2.48)	4.53 (2.63)	4.25 (2.56)
T <sub>7</sub>	Acetamiprid 20% SP	1g	38.43 (6.70)	0.41 (1.14)	0.81 (1.40)	1.85 (1.86)	2.41 (2.05)	1.37 (1.67)	7.14 (3.35)	3.35 (2.33)	2.35 (2.03)	1.85 (1.86)	2.77 (2.16)	2.58 (2.11)
T <sub>8</sub>	Buprofezin 25% SC	0.5ml	41.35 (6.93)	29.89 (5.97)	24.55 (5.46)	23.37 (5.33)	23.65 (5.36)	25.37 (5.54)	5.98 (3.14)	0.93 (1.47)	0.56 (1.25)	0.44 (1.17)	0.56 (1.25)	0.63 (1.29)
T <sub>9</sub>	Diafenthiuron 50% SC	0.75ml	42.19 (7.00)	0.00 (0.50)	0.00 (0.50)	0.80 (1.39)	1.10 (1.55)	0.48 (1.19)	6.52 (3.24)	3.41 (2.35)	2.53 (2.09)	2.95 (2.22)	2.97 (2.22)	2.96 (2.22)
T <sub>10</sub>	Cyantraniliprole 10% OD	1.8ml	40.53 (6.87)	5.63 (2.87)	4.24 (2.56)	4.76 (2.68)	5.40 (2.82)	5.01 (2.74)	7.10 (3.35)	2.14 (1.96)	1.93 (1.89)	1.57 (1.75)	2.72 (2.15)	2.09 (1.95)
T <sub>11</sub>	Dimethoate 30% EC	1.7ml	41.41 (6.94)	3.44 (2.35)	4.52 (2.63)	5.06 (2.75)	5.25 (2.79)	4.57 (2.64)	7.68 (3.27)	2.18 (1.98)	1.84 (1.86)	1.49 (1.72)	2.34 (2.03)	1.96 (1.90)
T <sub>12</sub>	Water spray (Control)	-	60.03 (8.25)	61.85 (8.36)	62.41 (8.40)	63.45 (8.47)	65.50 (8.59)	63.30 (8.46)	14.89 (4.35)	15.28 (4.41)	15.75 (4.46)	16.50 (4.56)	16.95 (4.62)	16.12 (4.51)
	S.Em ±		0.82	0.55	0.37	0.41	0.52	0.57	0.19	0.21	0.89	0.13	0.13	0.16
	C.D @ 5%		2.40	1.60	1.08	1.20	1.54	1.67	0.57	0.68	2.73	0.38	0.37	0.47

**Note:** \* - Values in parenthesis are square root transformed DBS - Days Before Spray; DAS - Days After Spray

Whereas, thiamethoxam 25 WG proved to be the most effective insecticides with a reduction of 82.0% whitefly population.

### 3.2 Whitefly nymphal populations per 2cm<sup>2</sup>

There was a significant difference among the treatments with respect to average population of whitefly nymph per unit area (2cm<sup>2</sup>) after treatments imposition. Among the treatments, fipronil 5 SC, buprofezin 25 SC, acetamipride 20 SP imidacloprid 17.8 SL, thiamethoxam 25 WG and diafenthiuron 50 SC recorded significantly lower number of whitefly nymphs per unit area (0.24, 0.46, 0.55, 0.51 0.84, 1.18 nymphs/2cm<sup>2</sup>, respectively). Further, cyantraniliprole 10 OD and dimethoate 30 EC recorded intermediate nymphal population of 2.32 and 2.47 nymphs/2cm<sup>2</sup>, respectively. However, highest whitefly nymphal population was recorded in the treatments viz., neem oil 0.5 per cent, azadirachtin 10000 ppm and diflubenzuron 25 WP (4.27, 4.35, and 4.41 nymphs/2cm<sup>2</sup>, respectively). Further, after imposition of second spray, thiamethoxam 25 WG, fipronil 5 SC, buprofezin 25 SC and imidacloprid 17.8 SL recorded

significantly lesser mean number of whitefly nymphs per unit area (0.48, 0.53, 0.63, and 1.03 nymphs/2cm<sup>2</sup>, respectively) compared to dimethoate 30 EC. However, highest population of whitefly nymphs were recorded in the treatments viz., neem oil 0.5 per cent, azadirachtin 10000 ppm and diflubenzuron 25 WP (3.93, 4.25 and 5.07 nymphs/2cm<sup>2</sup>, respectively) (Table 3).

Present findings are in close conformities with Lokender *et al.* (2016) [5] who reported that abamectin resulted in the highest mean per cent reduction in immature of *T. vaporariorum*, followed by acetamiprid and buprofezin. Further, Mahalakshmi *et al.* (2015) [6] reported that, spiromesifen 240 SC @ 0.4 ml/l followed by buprofezin 10 EC @ 1.0 ml/l was found most effective treatments with more than 75 per cent mean reduction in nymphal population of whiteflies and these findings were also shows the conformity with the present study.

### 3.3 Marketable flower yield/ mt. sq

Among the treatments, flower yield per m<sup>2</sup> area was significantly highest in the treatments viz., diafenthiuron 50

SC (119.35 flowers/500 m<sup>2</sup>) and fipronil 5 SC (112.17 flowers/ 500m<sup>2</sup>). The next best treatments in recording significantly highest marketable flower yield were in thiamethoxam 25 WG, imidacloprid 17.8 SL acetamiprid 20 SP and dimethoate 30 EC (102.99, 100.97, 100.75 and 96.85

flowers/500m<sup>2</sup>, respectively) and were on par with each other. However, significantly lowest flower yield was recorded in diflubenzuron 25 WP (71.80 flowers/ 500m<sup>2</sup>) but it was higher than untreated control (48.82 flowers/500 m<sup>2</sup>) (Table 4).

**Table 4:** Effect of insecticide treatments on yield of gerbera

Tr. No.	Treatments	*Flower yield (Nos.) / m <sup>2</sup>	*Flower yield (Nos.)/ 500m <sup>2</sup>
T <sub>1</sub>	Thiamethoxam 25% WG	102.99	51,495.00
T <sub>2</sub>	Diflubenzuron 25% WP	71.80	35,900.00
T <sub>3</sub>	Imidacloprid 17.8% SL	100.97	50,485.00
T <sub>4</sub>	Fipronil 5% SC	112.17	56,085.00
T <sub>5</sub>	Neem oil	78.53	39,265.00
T <sub>6</sub>	Azadirachtin 10000 ppm	79.41	39,705.00
T <sub>7</sub>	Acetamiprid 20% SP	100.75	50,375.00
T <sub>8</sub>	Buprofezin 25% SC	75.70	37,850.00
T <sub>9</sub>	Difenthiuron 50% SC	119.35	59,675.00
T <sub>10</sub>	Cyantraniliprole 18.5% SC	82.47	41,235.00
T <sub>11</sub>	Dimethoate 30% EC	96.85	48,425.00
T <sub>12</sub>	Water spray	48.82	24,410.00
	S.Em ±	1.55	-
	C.D @ 5%	4.55	-

Note: \* yield of six months

### 3.4 Cost economics

**Table 5:** Cost economics of treatments for management of whitefly on gerbera under protected condition

Tr. No.	Treatment	Flower Yield (Nos.) /500 m <sup>2</sup>	Cost of protection (Rs./500m <sup>2</sup> )	Total cost of production (Rs./500m <sup>2</sup> )	Gross returns (Rs./500m <sup>2</sup> )	Net returns (Rs./500m <sup>2</sup> )	C:B ratio
T <sub>1</sub>	Thiamethoxam 25% WG	51,495.00	535.00	1,29,425.72	3,08,970.00	1,79,544.28	1:1.39
T <sub>2</sub>	Diflubenzuron 25% WP	35,900.00	990.00	1,29,880.72	2,15,400.00	85,519.28	1:0.66
T <sub>3</sub>	Imidacloprid 17.8% SL	50,485.00	514.00	1,29,404.72	3,02,910.00	1,73,505.28	1:1.34
T <sub>4</sub>	Fipronil 5% SC	56,085.00	573.00	1,29,463.72	3,36,510.00	2,07,046.28	1:1.60
T <sub>5</sub>	Neem oil	39,705.00	520.00	1,29,504.72	2,38,230.00	1,08,725.28	1:0.84
T <sub>6</sub>	Azadirachtin 10000 ppm	39,265.00	565.00	1,29,455.72	2,35,590.00	1,06,134.28	1:0.82
T <sub>7</sub>	Acetamiprid 20% SP	50,375.00	540.00	1,29,430.72	3,02,250.00	1,72,819.28	1:1.34
T <sub>8</sub>	Buprofezin 25% SC	37,850.00	556.00	1,29,446.72	2,27,100.00	97,653.28	1:0.76
T <sub>9</sub>	Diafenthiuron 50% SC	59,675.00	568.00	1,29,458.72	3,58,050.00	2,28,591.28	1:1.77
T <sub>10</sub>	Cyantraniliprole 18.5% SC	41,235.00	760.00	1,30,150.72	2,47,410.00	1,17,259.28	1:0.90
T <sub>11</sub>	Dimethoate 30% EC	48,425.00	553.00	1,29,443.72	2,90,550.00	1,61,106.28	1:1.25
T <sub>12</sub>	Water spray (control)	24,410.00	500.00	1,29,390.72	1,46,460.00	17,569.28	1:0.14

In comparison with treatments, highest net returns and cost benefit ratio (Rs.3, 58,050, Rs.2, 28,591.28 /500m<sup>2</sup> and 1:1.77, respectively) was obtained in diafenthiuron 50 SC treatment. The next best treatments getting higher gross return, net returns and cost benefit ratio was obtained in fipronil 5 SC (Rs. 3,36,510.00, Rs. 2, 07,046.28/500m<sup>2</sup> and 1:1.60, respectively) and thiamethoxam 25 WG (Rs. 3,08,970.00, Rs. 1,79,544.28/500m<sup>2</sup> and 1: 1.39, respectively). Further, the lowest gross returns, net returns and cost benefit ratio was obtained in untreated control T<sub>12</sub> (Rs. 1,46,460.00, Rs. 17,569.28 Rs./500m<sup>2</sup> and 1:0.14, respectively) (Table 5). Present investigation are in line with Samota (2016) [8], who reported that highest fruit yield of 105.11 q/ha. was recorded in the chilli plots treated with imidacloprid, followed by thiamethoxam (103.18q/ha.), acetamiprid (99.99 q/ha.), and fipronil (97.65q/ha.).

### 4. Conclusion

The present study was carried out to manage gerbera whitefly population under greenhouse. Among the 12 treatments, diafenthiuron 50 SC @ 0.75ml/l proved to be best effective insecticide in reducing the whitefly population in both first

and second spray. Further, fipronil 5 SC @ 1ml/l and thiamethoxam 25 WG @ 0.25g/l are proved to be next best treatments in reducing whitefly population. Whereas thiamethoxam 25 WG @ 0.25g/l and buprofezin 25 SC @ 0.5 ml/l were more effective in reducing nymphal stage of whitefly. The highest flower and C:B ratio was also obtained from diafenthiuron 50 SC @ 0.75ml/l, fipronil 5 SC @ 1ml/l and thiamethoxam 25 WG @ 0.25g/l.

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