Original Research Article

MANAGEMENT OF WHITEFLY *BEMISIA TABACI* (GENN.) IN POTATO

Abstract

A field experiment was conducted at Potato Research Station, S. D. Agricultural University, Deesa during 2018-19 and 2019-20 for evaluation of efficacy of insecticides against whiteflyin potato. The seven different treatments *viz.*T_1: Control, T_2: Seed treatment with imidacloprid (200 SL) @ 0.04% followed by foliar sprays of imidacloprid @60 gm a.i./ha at 85% emergence + second spray with thiamethoxam 25WG @100g a.i./ha, T_3: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence, T_4: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days, T_5: Foliar spray of castor oil @0.05% at 85% emergence, T_6: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05%, T_7:Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 days. Based on pooled data of two years,~~The~~ the significantly highest ~~percent~~ mortality (*i.e.* 68.57 %) Mafter 2nd spray was recorded in T_7 *i.e.*foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 dayswhich was at par with T_4 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days). The tuber yield and benefit cost ratio were also recorded with T_7.

Keywords: Potato, whitefly, management, difenthiuron, sucking pest

Introduction:

Potato (*Solanum tuberosum* Linn.) is an important vegetable crop cultivated throughout the world. It is a perennial herb belonging to family *Solanaceae*, a native of Andean Plateau of South America. The power of potato is known for sustaining millions of lives by providing nutritious food in the time of war and hunger and also used as a staple food in several countries of the world. Globally, it is ranked as the fourth most important food crop after maize, wheat and rice with approximately having double calories per hectare. It is maximum uses for making potato flour, potato chips, ~~French~~ frenchfries, frozen potato, potato starch and tapioca of potato. Each 100 g serving of fresh potato, provides protein (1.6 g), carbohydrate (22.6 g), minerals (0.6 g), crude fibre (0.4 g), fat (0.10 g), vitamin C (25 mg) (Saini and Umrav, 2008). Potato contains significant levels of phenolic compounds and vitamin C as potent antioxidants (Brown, 2005), which inactivate reactive oxygen species, reduce oxidative damage, lead to improved immune functions and reduce risk of cardiovascular diseases, cancer, cataract, diabetes and ageing (Kour *et al*., 2004). Recognizing the major role of potato as a staple food and providing food security, the year of

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2008 was declared as the International Year of the Potato by the United Nations (Shailbala and Pathak, 2008). Hence, potatoes are called "King of Vegetables".

This crop is attacked by several pests in the field and in store. According to Simpson (1977), potato is attacked by more than 100 arthopod pests among them 80 have been reported from India (Anonymous, 1971; Saxena and Rizvi, 1974; Rataul and Misra, 1979; Saxena and Misra, 1983). Among various insect-pests; aphids, jassids, cutworms, white grubs, epilachna beetles, defoliating caterpillars and potato tuber moths are serious and responsible for considerable economic losses, while the rest are sporadic and of minor importance. Among the sucking pests the whitefly, *Bemisiatabaci* Gennadius (Hemiptera: Aleyrodidae), is a worldwide polyphagous insect pest that has wreaked havoc on agricultural productivity, particularly in some plant families such as Solanaceae, Cucurbitaceae, and Fabaceae (Oliveira *et. al.*, 2001 and Cruz-Estrada *et. al.*, 2013). The potato whitefly, *Bemisiatabaci* (Gennadius) are the most destructive (Roditakis*et al*., 2005) pests of numerous crops (Perring, 2001). *Bemisiatabaci* biotype A (Gennadius) has the ability to transmit 111 economically important viruses (Jones, 2003). By keeping in mind notorious devastating sap-sucking insect pest this experiment was conducted for evaluation of various systemic insecticide against potato whitefly.

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Materials and methods:

The field experiment was conducted at Potato Research Station, S. D. Agricultural University, Deesa to study the management of whitefly in potato for two consecutive years *Rabi* 2018-19 and 2019-20. The experiment was laid out in a randomized block design with seven treatments and five replications with 3.0 m × 2.0 m plot size. The planting was done at row spacing of 50 cm and plant to plant spacing of 20 cm. The recommended dosage of fertilizers 275 kg N, 138 kg P and 275 kg K per hectare was applied. Insecticides were sprayed using high volume knapsack sprayer with 500 L ha^{-1} solution. Seven different treatments *viz*., T_1: Control, T_2: Seed treatment with imidacloprid (200 SL) @ 0.04% followed by foliar sprays of imidacloprid @60 gm a.i./ha at 85% emergence + second spray with thiamethoxam 25WG @100g a.i./ha, T_3: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence, T_4: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days, T_5: Foliar spray of castor oil @0.05% at 85% emergence, T_6: Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05%, T_7:Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 days. Observations were taken on whitefly numbers before the foliar spray and on per cent reduction after 24, 48 and 72 hours of the spray on 5 tagged plants (3 leaves lower, middle and upper) as per method described by Butter and Vir (1990). The per cent reduction was work out by using standard formula.

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Where is the statistical analysis ?

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Results and Discussion

It was observed that there were non-significant differences in whitefly counts in all the treatment before first spray (Table 1). The significantly highest percent reduction (*i.e.* 56.35 %) after 1st spray during *rabi* 2018-19 was recorded in T_7 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 days) which was at par with T_6 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05%) recorded 54.21% reduction, T_3 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence) recorded 48.62% reduction and T_4 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days) recorded 46.79% reduction. The similar trend was also observed in pooled data while in *rabi* 2019-20, significantly higher reduction per cent were recorded in all the treatments except T_5 (Foliar spray of castor oil @0.05% at 85% emergence) over untreated control (Table: 1).

The significantly highest percent reduction (*i.e.* 62.70 %) after 2nd spray during *rabi* 2018-19 was recorded in T_7 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 days) which was at par with T_4 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days) and T_2 (Seed treatment with imidacloprid (200 SL) @ 0.04% followed by foliar sprays of imidacloprid @60 gm a.i./ha at 85% emergence+ second spray with thiamethoxam 25WG @100g a.i./ha). The next best treatment in sequence was T_6 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05%) and T_3 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence). In *rabi* 2019-20 significantly highest percent mortality (*i.e.* 74.44 %) after 2nd spray was recorded in T_7 which was at par with T_4 (69.68%). The next best treatment in sequence was T_2 (62.09 per cent mortality). The similar trend was also observed in pooled data. The zero per cent mortality was recorded in T_5 in both years as well as in pooled data. (Table: 2).

The economics of treatments shows that higher BC ratio (2.26) was recorded in T_7 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% by second spray with diafenthiuron after 10 days) which was followed by T_4 (Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days). (Table : 3)

Present results are in agreement with findings of Yadav *et. al.*, (2022) they reported that two sprays of diafenthiuron 50WP 350 g a. i./ ha mixed with castor oil @ 0.05% at 10 days interval gave maximum mortality (82.0%), maximum tuber yield (24.7 t/ ha) with incremental cost benefit ratio (ICBR 1:2.1). Tomar *et. al.*, (2017) reported the highest reduction of potato whitefly was recorded in Difenthiuron 50 SC @ 350 g ai/ha (84.13%) in comparison to rest of insecticide. Meenu and Dahiya (2017) observed thatdiafenthiuron 50 WP @ 500 g/ ha showed better performance against *B. tabaci*. Bharpoda*et al*. (2014) found that diafenthiuron 50 WP (at 0.05%) was the most effective compared to imidacloprid 17.8 SL (at 0.008%) against *B. tabaci*. Rajasekhar *et al.* (2018) observed that diafenthiuron 50% WP @ 1.25 g/ l was found effective in cotton. Praveen *et al.* (2019) found that diafenthiuron 50%WP @ 1 g/ l and triazophos 40 % EC @ 2 ml/ l were

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found effective against whitefly in sunflower. Thumar*et. al.*, (2018) diafenthiuron 25% + pyriproxyfen 5% SE @ 1000 and 1250 ml/ha were found relatively more effective against sucking insect pests viz., aphids, leafhoppers, whiteflies and thrips in Bt cotton. Two doses of diafenthiuron 25% + pyriproxyfen 5% SE (1250 and 1000 ml/ha) also gave highest seed cotton yield. Furthermore, previous reports demonstrated extreme effectiveness of diafenthiuron against whitefly (Naveed *et al.*, 2008; Reghuraman and Gupta., 2005; Shah *et al.*, 2007; Barrania and telab.,2014) on different crops.

Table 1: Per cent reduction of potato whitefly after first spray (2018-19, 2019-20 & pooled).

Treat-ment	1st Spray					
	Nos before spray			Per cent reductionafter spray		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T_1	**24.73 *(17.60)	22.64 (15.00)	23.74 (16.30)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_2	25.80 (19.00)	25.06 (18.00)	25.44 (18.50)	40.49 (42.40)	46.60 (52.80)	43.60 (47.60)
T_3	25.02 (18.00)	23.32 (15.80)	24.20 (16.90)	44.19 (48.62)	50.47 (59.44)	47.30 (54.03)
T_4	25.20 (18.20)	25.48 (18.60)	25.36 (18.40)	43.13 (46.79)	51.36 (60.93)	47.20 (53.86)
T_5	27.34 (21.20)	27.34 (21.20)	27.34 (21.20)	17.03 (9.60)	19.35 (11.57)	18.42 (10.59)
T_6	26.76 (20.40)	26.53 (20.00)	26.67 (20.20)	47.41 (54.21)	52.45 (62.71)	49.87 (58.46)
T_7	26.53 (20.00)	26.76 (20.40)	26.66 (20.20)	48.65 (56.35)	51.75 (61.55)	50.15 (58.95)
SEd	1.51	1.55	1.31	3.06	3.00	2.07
CD (0.05)	NS	3.22	NS	6.35	6.23	4.29
CV (%)	9.20	9.70	8.11	14.04	12.22	8.91

**Data are transformed values *Data in the parenthesis are original values,

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Both upper and lower surface of the leaf counted ?
Etc.

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Table 2: Per cent reduction of potato whitefly after second spray (2018-19, 2019-20 & pooled).

Treat-	2nd Spray

ment	Nos before spray			Per cent reductionafter spray		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T_1	**0.00 *(0.00)	30.89 (26.40)	21.28 (13.20)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_2	19.29 (11.00)	19.33 (11.00)	19.33 (11.00)	45.16 (50.28)	52.07 (62.09)	48.57 (56.18)
T_3	17.17 (8.80)	16.93 (8.60)	17.07 (8.70)	24.94 (17.91)	15.97 (9.47)	21.61 (13.69)
T_4	17.98 (9.60)	17.61 (9.20)	17.83 (9.40)	50.10 (58.69)	56.68 (69.68)	53.26 (64.18)
T_5	26.75 (20.40)	27.39 (21.20)	27.09 (20.80)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_6	16.92 (8.60)	18.00 (9.60)	17.53 (9.10)	27.17 (21.52)	20.43 (12.28)	24.13 (16.90)
T_7	15.96 (7.60)	18.52 (10.20)	17.31 (8.90)	52.91 (62.70)	60.43 (74.44)	55.99 (68.57)
SEd	1.32	1.17	0.96	3.77	3.28	1.86
CD (0.05)	2.74	2.43	2.0	7.83	6.80	3.86
CV (%)	12.82	8.72	7.71	20.83	17.64	10.10

**Data are transformed values *Data in the parenthesis are original values,

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Table 3 : Economics of the treatments (pooled data)

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Treatme	Yield (t/ha) pooled	Cost of cultivation (Rs./ha)	Produce (Rs./ha)	Sale Price (Rs./t)	Net returns (Rs./ha)	B:C ratio
T_1	40.08	133900	360750	9000	226850	1.69
T_2	42.13	135440	379125	9000	243685	1.80
T_3	41.85	136700	376650	9000	239950	1.76
T_4	48.38	139500	435375	9000	295875	2.12
T_5	41.70	133950	375338	9000	241388	1.80
T_6	45.83	136750	412500	9000	275750	2.02
T_7	50.62	139550	455580	9000	316030	2.26

Conclusion:

It is concluded that the foliar spray of alone diafenthiuron 50WP @ 350 g a.i/ha or in combination with castor Oil @ 0.05% at 85% crop emergence and followed by at 10 days interval for the management of potato whiteflies & for higher net returns.

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