



EFFICACY OF INSECTICIDES AGAINST WHITEFLY *BEMISIA TABACI* (GENN.) IN POTATO

D L YADAV*, B K PATIDAR AND B L NAGAR

Agricultural Research Station, Kota, Agriculture University, Kota 324001, Rajasthan, India

*Email: dlaau21@gmail.com (corresponding author)

ABSTRACT

A field experiment was conducted to evaluate insecticides against the whitefly *Bemisia tabaci* Genn. in potato at the Agricultural Research Station, Kota, using variety K Bahar during 2018-19 and 2019-20. Based on pooled data, results revealed 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 (ICBR 1:2.1) which was at par with two sprays of diafenthiuron 50WP 350 g a. i./ ha (without mixed castor oil) at 10 days interval (78.0%) with tuber yield (23.8 t/ha).

Key words: *Bemisia tabaci*, potato, castor oil, tuber yield, diafenthiuron, imidacloprid, thiamethoxam, damage, ICBR, field study, reduction in incidence

Potato (*Solanum tuberosum* L.) is a staple food that promotes global food over half of its production currently occurs in developing countries (Devaux et al. 2014). It is important as a vegetable in Rajasthan where availability of green vegetables is inadequate. This crop is hampered by various biotic and abiotic factors (Mishra et al., 2001). Among the various insects, aphids (*Myzus persicae* Sulzer), thrips (*Thrips palmi* Karny), leafhopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Genn.) and soil insects like cut worm (*Agrotis* sp.) have a significant influence on potato yield (Bhatnagar, 2007). *Bemisia tabaci* not only causes damage directly from sap sucking and toxin injection, and indirectly from virus transmission and honey dew secretion (Arnemann et al., 2019). Thus, it is among the most serious pests in cultivation of potatoes, since it has a significant influence on yield (Bhatnagar, 2007). *Bemisia tabaci* produce many generations in a year and the leaf curl viruses transmitted by it is more common in crops (Chandel et al., 2010). Lakra (2002) reported even up to 100% infection with apical leaf curl disease due to *B. tabaci*, with primary infection appearing within 40-45 days after planting (Garg et al. 2001). Of the transmitted viruses, 90% belong to the begomoviruses (Jones, 2003). Diafenthiuron is an insecticide belonging to non-organofluorine benzyl urea compound which act on sucking insects and mites (Streibert et al., 1988). The present study evaluates the field efficacy of this for the management of *B. tabaci* in potato.

MATERIALS AND METHODS

The field experiments were conducted at the Agricultural Research Station, Kota, in rabi 2018-19 and 2019-20. Randomized block design (RBD) was followed with seven treatments and four replications, with plot size of 3.0x 3.6 m. The planting was done using 60 cm row to row and 20 cm plant to plant distance. All the recommended package of practices was followed except plant protection measures. Seed treatment with imidacloprid (200 SL) @ 0.04% followed by imidacloprid 17.8SL @ 60 gm a.i./ ha + second spray with thiamethoxam 25WG @100g a.i./ ha at vegetative phase, diafenthiuron 50WP 350 g a.i./ ha, second spray of diafenthiuron after 10 days, castor oil @0.05%, diafenthiuron 50WP 350 g a.i./ ha mixed with castor oil @0.05% at 85% emergence after 10 days, respectively. Two sprays of these were given at 10 days interval. The first spray was given immediately after the appearance of *B. tabaci*. The emergence % was calculated as the number of potatoes germinated unit of the total number of potatoes sown. The data on number of shoot and plant height was recorded before the dehulming the potato foliage. Finally yield data was taken after harvest. Sprays were imposed using high volume knapsack sprayer (500 l/ ha) at 10 days interval. Observations were recorded one day before spraying in each plot which formed the pretreatment count and count after 2nd, 4th and 6th day of the spray on 5 tagged plants (3 leaves lower, middle and upper) as per method described by Butter and Vir, (1990) formed the post treatment counts.

RESULTS AND DISCUSSION

The results reveal that the pretreatment counts of *B. tabaci* population varied between 14.6 to 17.1 with the least (14.6) being with seed treatment of imidacloprid (200 SL) @ 0.04%; after first spray maximum mortality 90.53% with foliar spray of diafenthiuron 50WP 350 g a.i./ ha mixed with castor oil @0.05% and it was on par with the one without castor oil (Table 1). However, foliar sprays of imidacloprid 17.8 SL @ 60 gm a.i./ ha⁻¹ + second spray with thiamethoxam 25WG @100g a.i./ha⁻¹ imidacloprid @ 60 gm a.i./ha⁻¹ (72.93) were effective at 85% emergence. Same trend was noticed in the second season also, and with second spray. After second spray, maximum mortality 88.75% was in diafenthiuron 50WP 350 g a.i./ ha mixed with castor oil @0.05% and it was on par with of diafenthiuron 50WP 350 g a.i./ ha (86.40%) and imidacloprid @ 60 gm a.i./ ha (76.45%). Pooled data revealed that diafenthiuron 50WP 350 g a.i./ ha mixed with castor oil @0.05% and without castor oil showed maximum efficacy (82.0 and 78.0%, respectively). This was followed by

foliar sprays of imidacloprid 17.8 SL @ 60 gm a.i./ ha + second spray with thiamethoxam 25WG @100g a.i./ ha imidacloprid @ 60 gm a.i./ ha (64.4%) at 85% emergence after second spray. Two season pooled data revealed that maximum tuber yield was obtained with two foliar sprays of diafenthiuron 50WP 350 g a.i./ha at 85% emergence mixed with castor oil @ 0.05% (24.7 t/ ha) and it was at par with without mixer of castor oil by diafenthiuron 50WP 350 g a.i./ha at 85% emergence (23.8 t/ ha) (Table 1).

Maximum benefit-cost ratio i.e. 1: 2.1 was observed with two foliar sprays of diafenthiuron 50WP 350 g a.i./ ha at 85% emergence mixed with castor oil @ 0.05% followed by two sprays of diafenthiuron 50WP 350 g a.i./ ha at 85% emergence (1:2.04) (Table 1). similar results were obtained by Hugar et al. (2020) with more cost benefit in diafenthiuron 30% + pyriproxyfen 8% SE at 1000 ml/ ha (1:2.03). Praveen et al. (2019) found that diafenthiuron 50%WP @ 1 g/ l and triazophos 40 % EC @ 2 ml/ l were found effective against whitefly in sunflower.

Table 1. Efficacy of insecticides against *B. tabaci* in potato (2018-19, 2019-20)

| Treatments | Nos before spray | % Mortality after I st spray | | % Mortality after II nd spray | | Pooled | | Total yield (t/ ha) | ICBR |
|---|------------------|---|---------|--|---------|-----------------------|------------------------|---------------------|--------|
| | | 2018-19 | 2019-20 | 2018-19 | 2019-20 | I st spray | II nd spray | | |
| | | | | | | | | | |
| T ₁ : Control (no pesticide) | 17.1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 17.8 | -- |
| 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 | 14.6 | 72.93 | 57.69 | 76.45 | 52.41 | 65.3 | 64.4 | 21.5 | |
| T ₃ : Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence | 16.3 | 84.98 | 57.46 | 44.23 | 20.08 | 71.2 | 32.2 | 21.3 | 1:1.65 |
| T ₄ : Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence followed by second spray of diafenthiuron after 10 days | 16.9 | 85.85 | 57.93 | 86.40 | 69.51 | 71.9 | 78.0 | 23.8 | 1:1.87 |
| T ₅ : Foliar spray of castor oil @0.05% at 85% emergence | 15.9 | 9.20 | 13.09 | 1.78 | 0.00 | 11.1 | 0.9 | 17.9 | 1:1.88 |
| T ₆ : Foliar spray of diafenthiuron 50WP 350 g a.i. at 85% emergence mixed with castor oil @0.05% | 16.8 | 90.08 | 58.31 | 50.65 | 23.76 | 74.2 | 37.2 | 21.6 | 1:2.04 |
| 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 | 16.6 | 90.53 | 58.58 | 88.75 | 75.33 | 74.6 | 82.0 | 24.7 | 1:1.65 |
| S. Em.± | 0.45 | 3.27 | 1.03 | 6.80 | 2.57 | 2.47 | 5.74 | 0.88 | 1:1.89 |
| CD (p=0.05) | 1.31 | 9.77 | 3.10 | 20.35 | 7.68 | 5.18 | 12.04 | 1.85 | 1:2.10 |

Meenu and Dahiya (2017) observed that diafenthiuron 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. Thus, two foliar sprays of diafenthiuron 50WP 350 g a.i./ ha at 85% emergence mixed with castor oil @0.05% was superior as compared to without adding castor oil as shown by Boulehya et al. (1997). Maximum tuber yield was obtained with these due to nature of chemical. Diafenthiuron (1-tert-butyl-3-(2,6-di-isopropyl thiourea)) is the non-organofluorine benzyl urea compound having novel insecticide/ acaricide activity (Streibert et al. 1988) by inhibiting or enhancing biochemical sites such as respiration (Ishaaya et al. 2001).

ACKNOWLEDGEMENTS

Authors thank the higher authorities of the University for encouraging and facilitating research and publishing of this study.

REFERENCES

- Arnemann J A, Bevilaqua, J G, Bernardi L, Rosa D O, Encarnação F A, Pozebon H. 2019. Integrated management of tomato whitefly under greenhouse conditions. *Journal of Agricultural Science* 11: 5.
- Bharpoda T M, Patel N B, Thumar R K, Bhatt N A, Ghetiya L V, Patel H C. 2014. Evaluation of insecticides against sucking insect pests infesting Bt cotton BG- II. *The Bioscan* 9 (3): 977-980.
- Bhatnagar A. 2007. Incidence and succession of thrips, leafhopper and whitefly in combination of planting dates and potato varieties. *Annals of Plant Protection Sciences* 15: 101-105.
- Boulehya S, Najar A, Sghairi R, Jarraya A. 1997. Whitefly report of Tunisia. Ioannou N (ed.) *Management of the whitefly-virus complex*. Proceedings. FAO workshop on management of the whitefly-virus complex in vegetable and cotton production in the Near East, 2-6 October, 1995, Larnaca, Cyprus. FAO, Rome.
- Butter N S, Vir B K. 1990. Sampling of whitefly, *Bemisia tabaci* Genn. in cotton. *PAU Agricultural Research Journal* 27(4): 615-619.
- Chandel R S, Banyal D K, Singh B P, Kamlesh Malik, Lakra B S. 2010. Integrated management of whitefly *Bemisia tabaci* (Gennadius) and Potato Apical Leaf Curl Virus in India. *Potato Research* 53: 129-139.
- Devaux A, Kromann P, Ortiz O. 2014. Potatoes for sustainable global food security. *Potato research* 57: 185-199.
- Garg I D, Khurana S M P, Kumar S, Lakra B S. 2001. Association of a geminivirus with potato apical leaf curl in India and its immunized electron microscopic detection. *Journal of Indian Potato Association* 28:227-232.
- Hugar S V, Gundannavar K P, Udikeri SS, 2020. Bioefficacy of a combiproduct diafenthiuron 30% + pyriproxyfen 8% SE against whitefly and its safety to natural enemies in cotton. *Journal of Entomology and Zoology Studies* 8 (5): 2068-2073.
- Ishaaya I, Kontsedalov S, Mazirov D, Horowitz A R. 2001. Biorational agents in IPM and IRM programs for controlling agricultural pests. *Universiteit Gent* 66: 363-374.
- Jones D R. 2003. Plant viruses transmitted by whiteflies. *European Journal of Plant Pathology* 109: 195-219.
- Lakra B S. 2002. Leaf curl: a threat to potato crop in Haryana. *Journal of Mycology and Plant Pathology* 32: 367.
- Meenu and Dahiya K K. 2017. Efficacy of some insecticides against whitefly (*Bemisia tabaci*). *International Journal of Applied and Natural Science* 6(2): 1-4.
- Mishra A K, Singh R S, Pandey S K. 2001. Relative efficacy of chemicals and botanical insecticides against sweet potato weevil. *Annals of Plant Protection Sciences* 9: 201-204.
- Praveen B. Huded, V.N. Ghante, Vikas Kulkarni. 2019. Chemical Management of Whiteflies in Sunflower. *International Journal of Current Microbiology and Applied Sciences* 8 (4): 2885-2890
- Rajasekhar N, N. V. V. S. Durga Prasad, D.V. Sai Ram Kumar, Adinarayana, M. 2018. Incidence and management of cotton whitefly *Bemisia tabaci* under high density planting system (HDPS). *International Journal of Current Microbiology and Applied Sciences* 7(3): 2074-2079.
- Streibert H P, Drabek J, Rindisbacher A. 1988. Diafenthiuron: a new type of acaricide/ insecticide for the control of the sucking pest complex in cotton and other crops. Proceedings. Brighton crop protection conference. Pests and diseases, BCPC, Farnham.

(Manuscript Received: May, 2021; Revised: September, 2021;
Accepted: September, 2021; Online Published: February, 2022)
Online published (Preview) in www.entosocindia.org Ref. No. e21138