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Use of Different Agrochemicals and Neem Oil to Control Whitefly (*Bemisia tabaci*) in Cotton Under Different Field Conditions

Shahbaz Hussain[1], Asif Ullah Khan[2], Muhammad Usman[3], Shamim Akhtar[4], Azher Mustafa[5], Misbah Ali[6], Kamran Mahmood[7]

[1]Seed Analyst, Federal Seed Certification and Registration Department, Sahiwal Station, Punjab, Pakistan.
[2]Agriculture and Cooperative Department Research Wing Quetta Balochistan, Pakistan.
[3]Department of Entomology, University of Agriculture, Faisalabad, Pakistan.
[4]Principal Scientist, Plant Pathology Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan.
[5]Chief Scientist, Plant Pathology Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan.
[6]Scientific Officer, Plant Pathology Section, Ayub Agricultural Research Institute, Faisalabad, Pakistan.
[7]Senior Scientist, Plant Pathology Section, Ayub Agricultural Research Institute, Faisalabad, Pakistan.

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Correspondence to: Muhammad Usman, Department of Entomology, University of Agriculture, Faisalabad, Pakistan.
Email: musman6053@gmail.com

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ABSTRACT

Cotton, the white gold, is an important fiber crop that is grown as a commercial crop all over the world. Among the several factors contributing to the low yield of cotton, biotic constraints appear to be very important that are ravages caused by insect pests assume greater importance. Sucking the cell sap caused by whitefly gives a great reaction, which transfers viral diseases to the cotton after secreting the honeydew. For this, a trial was conducted Ayub Agricultural Research Institute (AARI) and a local farmer's field during 2023-2024 cotton season to check the efficacy of different insecticides against the critical cotton insect pest, whitefly (*Bemisia tabaci*). In this study, Dufire 70% WDG, Crunch Super 75% WDG, Ulala 50%, Oshin 20% SG, and neem oil were applied in the cotton field and the data of the whitefly population were recorded the day after application, 72 hrs., and 7 days after application of insecticides. The data was taken accordingly, and it was seen that each insecticide significantly reduced the population to a certain level, but Oshin and Ulala proved to be the best chemicals to decrease the whitefly population in field conditions. The population of whitefly in treated areas of Ayub Agricultural Research Institute was always maximum in control conditions after the pesticides were applied and the least value was observed in neem oil and control-treated plots.

INTRODUCTION

The whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) is a pest of global importance in 162 countries, but is widespread in 22 countries, including India (CABI, 2018). *Bemisia tabaci* attacks more than 600 different plant species and transmits several plant viruses, thereby causing severe economic losses to important agricultural and ornamental crops (Alemandri *et al*. 2015). The species is known by several names viz., cassava whitefly; cotton whitefly; silver leaf whitefly; sweet potato whitefly, tobacco whitefly. *Bemisia tabaci* is slated to be a complex of at least 39 genetic groups (Firdaus *et al*. 2013) differing considerably in fecundity, host range, insecticide resistance, virus vectoriability, and the symbiotic bacteria they harbor (Mahadav *et al*. 2009). The pest is characterized with high reproduction and dispersal rates, extreme polyphagy, development of insecticide resistance, influence population with human activities (Gilbertson *et al*. 2015).

Ninety-three insects and mites are reported to attack cotton crop in Pakistan. A few years ago, bollworms were severe problem to cotton crop causing serious loss to cotton crop but with the opening of Bt-cotton, the problem of bollworms has been reduced to some point except armyworm. Now the main problem to cotton crop is the attacks of sucking insect pests, especially jassid and whitefly (Ellsworth *et al*., 2001). Important sucking insect pests are jassid, whitefly, cotton thrips, and cotto aphid. In which whitefly, jassid and thrips are more deleterious to the cotton which causes collectively 40-50 percent damage in the crop.

Conventional insecticides are the only quick selection of insect trample; therefore, their incautious results are causes in many problems such as resistance development, increasement of cost production and pollution (Rodriguez *et al*., 2023; seal *et al*., 2019) 15 Different pesticides are

being used for the control of whitefly. These pesticides are to be used judiciously to manage health risks. It is considered that agrochemicals contribute to about fifty percent of cotton yield all around the world (Ali and Aheer, 2007; Shifa *et al*., 2019). Mospilan and Actara were observed to be highly effective chemicals against whitefly and cotton jassid (Kumar *et al*., 2019). Much suppressed numbers of whitefly on per per-leaf basis were obtained by applying Novastar (Ghori *et al*., 2019). In the present investigation, an attempt was made to study the insecticidal properties of agrochemicals and botanical oils to establish their effectiveness in controlling whitefly in cotton.

MATERIALS AND METHODS

Cotton variety IUB-2015 was used for this study. It was sown in the selected field on the 15th of May in the growing season of 2023. The fertilizers NPK were applied as per recommendation and standard agronomic practices were given at the proper time. The experiment was laid out in a Randomized Complete Block Design (RCBD).

Details of the treatments and preparation for usage; The following botanical oils and agrochemicals., Dufire 70% WDG, Crunch Super 75% WDG, Ulala 50%, Oshin 20% SG, neem oil (*Azadirachta indica*) and control were selected for evaluation. In total, 6 treatments were formulated that included 1 of botanical oils, 4 of insecticides, and untreated control. The treatment combinations and their concentrations per liter were taken as mentioned below (Table 1).

Table 1

Treatments	Product Name	Dose / Acre
1	Dufire 70% WDG	120 g
2	Neem Oil 5 % EC	10 ml
3	Crunch Super 75% WDG	60 g
4	Ulala 50% WG	60 g
5	Oshin 20% SG	120 g
6	Control	-

Preparation of Spray Solution of Botanical Oils

Neem oil emulsions were prepared as per the procedure described by Gahukar (1996). A direct spray was applied so that the upper and lower leaf surfaces were covered with insecticidal solution. Preparation of neem seed kernel extract (NSKE) (5%), to which five kilograms of neem seed kernel powder was soaked in 10 liters of water overnight with occasional stirring. The extract was then filtered through a fine, clean muslin cloth; this process was repeated at least 3-4 times, so that the contents were fully extracted. Sufficient water was added to make its final volume to 100 liters.

Preparation of Spray Solution of Insecticides

Dufire 70% WDG was applied @ 120g/acre, Neem Oil 5 % EC @ 10 ml, Crunch Super 75% WDG @ 60g /acre, Ulala 50% @ 60g/acre, Oshin 20% SG @ 120g/acre.

Field Bioassay

The experiment was carried out under Randomized Block Design with 6 treatments replicated thrice. The Cotton variety IUB-2015 was sown with the recommended package of practices with row to row and plant to plant geometry of 67.5 X 60cms. The cotton crop was monitored weekly to assess the incidence of whitefly to initiate the interventions. Due to low incidence during 2023-24, sprays were initiated at the peak activity period of whitefly, however, sprays were initiated when the population of whitefly reached the ETL i.e. 18 whiteflies/3leaves.

Observations

The data were recorded from 5 plants /treatments. The plants were randomly selected and tagged, excluding the border rows and numbers of whitefly adults were counted from three leaves from the upper, middle and lower canopies of the plant. Observations were recorded on one day after spray, then after 72 hrs. and 7 days after spray applications.

Statistical Analysis

The statistical analysis of the data was done to interpret the results. For this purpose, the data of population reduction was analysed with ANOVA to known hypothesis testing, and the results were evaluated using a statistical analysis software named Statistix 8.1 (Ayub *et al*., 2020; Meena *et al*., 2013). The means of significant treatments were compared with Tukeys significant difference at 5% level of significance.

RESULTS AND DISCUSSION

The cotton whitefly is a regular and key pest of cotton in cotton cotton-growing zone of Pakistan. A wide array of insecticides has been used for its management. Whitefly is the most severe and essential insect pest that attacks the crop of cotton and results in 20-30% crop loss after spreading the Cotton Lead Curl Virus (Zaidi *et al*., 2016). It has a vast range of host plants and plants that are known to be the host of whitefly are almost 600; Pakistan is a feasible region of whitefly (Shuli *et al*., 2018). *Bemisia tabaci* is an invasive pest that causes the collapse of horticultural and agronomic crops all over the globe in tropical and subtropical regions. Honeydews secreted by cotton whitefly improve the sooty mold growth and give a 50% reduction in the boll weight seasonal production (Shuli *et al*., 2018).

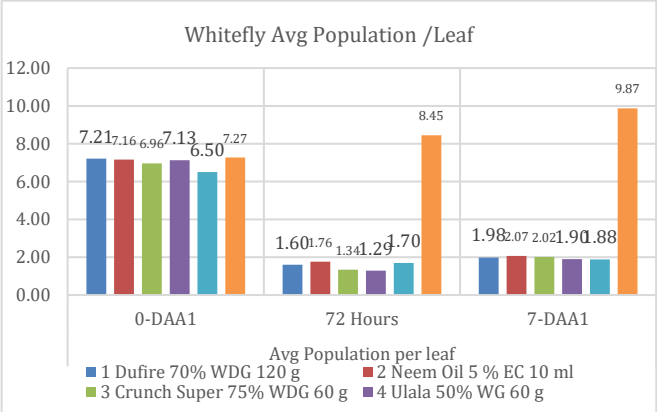
Each plot's data was recorded in the morning, 24 hours after spray, and then 72 hrs, and 7 days duration later spray application as followed by Amjad *et al*. (2009). For this purpose, the zig-zag method was used for pest scouting. The plants were deliberately observed to check the population of whitefly. In order to collect the data, the population was taken from the highest leaf from the higher part of plant 1st, a second leaf from the middle part of plant 2nd, lower leaf of the plant 3rd, a method followed by Bhatti *et al*. (2019) and Khan (2020).

The means of population of whitefly at different blocks of the study area Ayub Agricultural Research Institute (AARI), before application of insecticides were computed using Tuckey HSD test. These computed values are given in Table 2. According to the values, it can be seen that highest population was observed after 0 day of average population per leaf in control, that is 7.27, dufire average population per leaf is 7.21, neem oil average population is 7.16, ulala is 7.13, crunch super by 6.69 and oshin by 6.50,

respectively. After 72 hours avg population per leaf on control is 8.45, dufire average population per leaf decreases by 1.60, neem oil average population decreases by 1.76, ulala is 1.29, crunch super by 1.34, and oshin by 1.70, respectively. After 7 days of application average population on leaf on control is 9.87, oshin 1.88, ulala 1.90, crunch sper 2.02, neem oil 2.07, and dufire 1.98, respectively.

Figure 1

Average Whitefly Population/ Leaf



After 72 hrs of application higher mortality occurs by ulala, that is 84.7%, the maximum control of the whitefly on cotton then, crunch super occurs mortality by 84.1%, then dufire by 81.1%, Oshin 79.9%, and neem oil by 79.2%%, respectively. After 7 days of application of agrochemicals, higher efficacy occurs by Oshin 81.0%, ulala occurs 80.7%, Dufire occurs 79.9%, crunch super by 79.5%, and neem oil by 79.0% respectively. It was concluded that Oshin, ulala were more effective pesticides as compared to the other ones in controlling the population of whitefly at Ayub Agricultural Research Institute well as farmers' fields in Faisalabad.

Other pesticides also checked the population of whitefly but not as much as these pesticides do. During the whole study the population in treated areas was always less than control block and the population of whitefly tend to increase in the control block with the passage of time. These findings are also in accordance with the work of Kumar *et al*. (2009), Khan *et al*. (2011) and Patra *et al*. (2018), who observed the same results in their findings.

Figure 2

Average Whitefly Population/ Leaf

Sahito *et al*. (2015) evaluated the study of different kinds of insecticides opposite to whitefly, with 5 trial and divided into cotton crops four times. Insecticides decreased population mean percent of whitefly even after spray of 12 days. Pyriproxyfen insecticides 68 were determined more significantly as compared to acetamiprid, which is less significant. When pyriproxyfen is compared with a control plot gives overall decreased in the overall spray. Another insecticide that is Nitenpyram was investigated with entire reduced carried by diafenthiuron, acephate, and acetamiprid when comparison with a plot that is controlled, therefore their study showed the apparent variation in all. The summary indicates that pyriproxyfen demonstrates the best outcomes higher than 7 days included these insecticides that give the critical contrast results. These findings were according to the current study in which pyriproxyfen gave more promising results as compared to the acetamiprid during the whole study as well as in both study areas i.e. Cotton Research Station as well as farmer's field, Bahawalpur.

Barakat *et al*. (2023) field trials were conducted during 2018-2019 in a fennel farm in the Governorate of Fayoum, Egypt, to test the efficacy of four insecticides; thiamethoxam (Actara 25%WG), dinotefuran (Oshin 20%SG), acetamiprid (Mospilan 20%SP) and thiocyclam hydrogen oxalate (Evisect 75%WG) (thiocyclam hydrogen oxalate) against aphid adults and whitefly nymphs. Dinotefuran caused the highest percent reduction against whiteflies, while acetamiprid caused the highest reduction against aphids. Our findings demonstrated that new chemistry insecticide (Ulala (Flanicamid 50% WG) @ 148.26 gm ha-1) was highly effective against whitefly, jassid, thrips and mite. Patra *et al*. (2018) studied the effectiveness of spirotetramat against red spider mite, jassid and whitefly in field conditions. They found that the combined application of spirotetramat and imidacloprid proved to be the best application against the studied pests. Arnemann *et al*. (2019) checked the effectiveness of various insecticides in controlling *B. tabaci* young ones and imago on soybean crops in two locations, under field conditions. The most productive treatment for the control of adults of *B. tabaci* was cyantraniliprole + lambda-cyhalothrin (100 + 7.5 g a.i. ha-1), which gave 65% of normal control productivity. Concerning nymphal control, the most effective treatment was acetamiprid + pyriproxyfen (60 + 30 g a.i. ha-1), which brought about 67% of whitefly control in normal. Two successive applications starting at the early outbreak are prescribed so as to improve control productivity. So that these new chemistry insecticides (Ulala (Flanicamid 50% WG) @ 148.26gm ha-1) can be recommended to the growers in arid zone to manage the population of the sucking insect pests of cotton below the economic threshold.

These oils have resulted in a moderate reduction of whitefly populations under field conditions, less than the pesticide counterparts in the present studies.

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