IPM Package of Practices for Management of Whitefly *Bemisia tabaci* in cotton

Cotton is a major commercial cash crop of India provides raw material to textile industry. The crop is attacked by many sucking pest such as White fly, Jassid, Mealy bug and Mites. Among them whitefly is a serious pest. In recent years after introduction of *Bt* cotton White fly has become an economically important pest and causing severe yield loss in agricultural, horticulture and in ornamental crops.

It is considered as most important pest in its economic point of view due to its high rate of population build-up, mobility, polyphagy nature and the ability to transmit virus vector such as Cotton Leaf Curl Virus (CLCV) and ability to develop black sooty mould on leaf.

Major States affected: Punjab, Haryana

Nature of damage: Whitefly is polyphagous in nature, feeding on many cultivated and uncultivated host plants. It adapts easily on new host plants and become a serious pest some of the field crops like cotton, moong, cucurbits tomato, potato okra and brinjal are severely infested by Whitefly.

Whitefly prefers young leaves, they direct feed on the tender leaves and damage by piercing and sucking cell sap. This feeding causes leaf chlorosis, leaf withering, and premature dropping of boll & leaves which ultimately leads the plant to death. Indirectly they also decrease the yield by excreting honeydew like material. This honeydew serves as a substrate for the growth of black sooty mold on leaves and boll surface which impede photosynthesis. The third type of damage is by acting as a vector for dreadful plant viruses. A small population of whiteflies is sufficient to cause CLCV disease.

Population of Whitefly in Cotton

Identification of the pest:

Eggs: Eggs are yellowish white laid singly on the under surface of leaves. They are stalked and sub elliptical in shape.

Nymphs: Nymphs are yellowish and brownish, sub elliptical and scale like. They are found in large numbers on underside of leaves.

Pupae: Pupae also resemble same as nymphs in shape and have brownish opercula.

Adults: Adults are tiny and white in colour. They have a yellow body dusted lightly with a white waxy powder.

- Females: Females are 1.1–1.2 mm long; Antennae of females are longer than males
- Males: Males are slightly smaller; Parameres of males are extended, narrow and pointed.

Economic Threshold Levels (ETL): Whiteflies 6 adults per leaf upper canopy of plants or more than 10 whiteflies found in middle region of the plant in >50% (two out of four) of plants. Flight of adults producing a smoky appearance when plants are shaken mildly

Management practices:

A. Pre-sowing operations

1. Select only recommended and early maturing hybrid varieties which are resistant against whitefly.

2. Late maturing varieties should not be chosen to avoid damage of white fly.
3. Regular surveillance on alternate host crops like brinjal, cucurbits, cucumbers, long melon, Pumpkin, tomato, chilli, okra from February onwards should be carried out for timely management of white fly.
4. Eradicate alternate weed host like Parthenium, Kanghi buti (*Sida sp*.), Peeli buti (*Abutilon indicum*)), *Datura metel*, Gutputna (*Xanthium sp.*), Puthkanda, Bhakra, Itsit, and Tandla should be removed to check the multiplication of white fly in off season.

B. Sowing operation

1. Grow only recommended Bt cotton cultivars
2. Timely sowing from 1st April to15th May
3. Adopt recommended spacing of 67.5 x 75 cm and ensure to grow special line of refusal cotton plant as a safe guard for maintain Bt resistance against Boll Worm complex.
4. Avoid intercropping like cucumber, okra, summer Moong, and other cucurbits and malvacious crop.
5. Grow less preferred host crops surrounding the cotton field like *Maize*, *Bajra*, *Jawar* and *Dhecha*.etc.
6. Apply recommended dose of fertilizers (N, P) on the basis of soil testing report.
7. Apply Muriate of Potash (MoP) @ 20 kg per acre which helpful to manage the bio stress tolerance of crop.
8. Judicious and timely application of water is essential during vegetative and flowering phases of cotton crop to maintain proper vigour of plant. Excessive irrigation usually promotes vegetative growth that is conducive for build up of white fly.

C. Vegetative Phase

1. Regular field monitoring and surveillance of the cotton field April onward should be carried out to take appropriate action for timely management.

2. Special attention required for surveillance where cotton crop is in the vicinity of Kinnow orchards.
3. Apply spray of Potassium nitrate (NPK 13:0:45) @ 2 kg/acre at fortnightly interval starting from square initiation stage which is helpful to manage the flower and boll dropping problems.
4. Farmers must be educated to identify, conserve and augment the natural enemies available in the cotton fields like Parasitoides like *Encarsia formosa*, *Encarsia shafeei*, *Encarsia sp., Eretmocerus mundus* and predators like *Geocoris sp., Zelus sp*. Spiders, Syrphid fly, *Chrysoperla*, Lady bird beetle, Dragon and Damsel flies, Praying mantis, Predatory ants, bugs & wasps which is helpful to suppress the white fly population.
5. Use low cost yellow sticky traps @ 40 per acre during initial phase of the cotton crop to check the early infestation of whitefly.
6. Proper clean cultivation of crop should be maintained weed free for at least 8-9 weeks after sowing till canopy starts closing in by timely inter-culture for better plant health.
7. Azadirachtin 0.15%, (Neem Seed Kernel Based EC) @ 2.5-5.0 l/ha Azadirachtin 0.03% (300ppm) (Neem Oil Based WSP) @ 2.5-5.0 l/ha against whiteflies
8. Spray Homemade Neem Extract @ 2.5 l/ha against white fly.

   Method of Preparation:

   Boil 4 kg terminal parts of the shoots of neem tree including leaves, green branches and fruits in 10 litre of water for 30 minutes and then filter this material through muslin cloth and use the filtrate for spraying at recommended dose.
9. *Verticillium lecanii* 1.15%WP is recommended @ 2.5 kg/ha in 500 litre of water against white flies.

D. Reproductive phase

1. Monitor the crop regularly
2. Avoid using synthetic pyrethroids viz. Cypermethrin, Deltamethrin, Fenvalate, Acephate and Acetamiprid to minimise resurgence of white fly.
3. Spray chemical insecticides when the population of whitefly has crossed to ETL level i.e. 6 adults per leaf upper canopy of plants before 10 a.m.
4. Apply recommended insecticides as need based applications

   Flonicamid 50WG @ 80gm/acre or Diafenthiuron 50WP @200 gm/acre or # Pyripoxyfen 10EC @500 ml/acre or # Spiromesifen 22.9 SC @ 200ml/acre or Dinotefuran 20SG @ 60 gm/acre or Buprofenzin 25SC @ 400 ml/acre or Chothianidine 50WG @ 20 gm/acre or Ethion 50EC @800 ml/acre

These are more effective against nymphs of white fly wait for 5-7 days to see the effective result

Note: 1. Rotation of chemical groups helps in preventing the build up of resistance against insecticides.

2. When adult population is low and nymph population on the under surface of leaves is high or occurrence of honeydew symptoms appear on upper/lower surface the plant leaves then spray Pyriproxyfen 10 EC @ 500 ml/acre or Spiromesifen 22.9 SC @ 200 ml/acre with the dilution of 200-250 litre of water.

3. In case of severe infestation of whitefly adults, spray Flonicamid 50 WG @ 80 g/acre or Diafenthiuron 50WP @ 200 g/acre or Ethion 50EC @ 800 ml/acre or Triazophos 40 EC @ 600 ml/acre with the dilution of 200-250 litre of water.