Office Memorandum No. 42/2019

Sub: Package of Practices (POPs) for the management of Fall Army Worm (FAW) in Grain corn, Sweet corn, Baby corn and Fodder maize (including silage)-reg.

Officers-in-charge, RCIPMCs/CIPMCs may refer to Office Memorandum issued vide F. No. 3-15-2018-IPM/DAC&FW (Pt.) dated 26th November, 2019 on the above cited subject (copy enclosed). In this connection, Indian Institute of Maize Research has developed separate POPs for Sweet corn, Baby corn and Fodder maize (including silage). Further, the existing POP specific to Grain corn has also been revised for incorporation in the management strategies (copy enclosed). Therefore, you are directed to incorporate these POPs in the management strategies for FAW in all your ongoing Training/HRD/awareness programmes and give wide publicity among all the concerned stakeholders.

Further, as per directions at S. No. 4 of the above said Office Memorandum, you are also directed to follow up the matter with the State Agriculture Department and submit Action Taken Report (ATR) at fortnightly interval to Head Quarter, Dte. Of PPQ&S (e-mail address: appa.ipm-ppqs@gov.in).

Officer-in-charge,
RCIPMCs/CIPMCs

Copy for information to: PPS to PPA
Office Memorandum

Sub:- Package of Practices (POPs) for the management of Fall Army Worm (FAW) in grain corn, sweet corn, baby corn and fodder maize (including silage)-reg.

The FAW is noticed on Maize crop in several states during Kharif 2019. The FAW is an invasive pest, which need to be controlled by timely interventions.

2. A meeting to review the present status of FAW was held on 1st October, 2019 under the Chairmanship of Secretary (DAC&FW) at Krishi Bhawan, New Delhi. It was decided in the meeting to develop separate POPs for fodder maize, sweet corn and baby corn. Accordingly, Indian Institute of Maize Research has developed separate POPs for sweet corn, baby corn and fodder maize (including silage). Further, the existing POP specific to grain corn has also been revised. These management strategies need to be promoted in various Training/HRD/wearness programmes.

3. It is requested that the same may be disseminated to all the stakeholders through the Extension bodies of the State such as ATMA, KVKs, etc.

4. The Central Integrated Pest Management Centers (CIPMCs) in all the concerned States is directed to follow up the matter and to submit an ATR fortnightly to Head Quarter, Dte. of PPQ&S (e-mail address: appa.ipm-ppqs@gov.in)

Encl: As above

Distribution:
1. Principal Secretary/ Agriculture Commissioner of all the States.
2. Director (Extension), DAC&FW with a request to issue necessary directions to all the Extension functionaries.
3. JD (IPM), DPPQ&S with a request to issue directions to all the CIPMCs for para 4 above.

Copy for information:
1. PPS to Secretary, DAC&FW
2. PPS to JS (PP)
Package of Practices for Management of Fall Armyworm in Grain Corn

**Pre-planting practices**
- Deep plough the fields to expose pupae to sun light and predatory birds
- Add neem cake @ 200kg/acre to the fields when maize is grown with zero tillage or wherever possible
- Maintain field bunds clean and plant flowering plants such as marigold, sesame, niger, sunflower, coriander, fennel etc. to attract natural enemies

**Sowing to six leaf stage**
- Timely and uniform sowing over larger area
- Follow ridge and furrow planting method instead of flat bed sowing
- Apply only the recommended dosage of NPK as basal dose
- Seed treatment: Cyantraniliprole 19.8% + Thiamethoxam 19.8% FS @ 6 ml/kg of seed offers protection for 15-20 days of crop growth
- Plant 3-4 rows of napier grass/hybrid napier as trap crop around maize fields
- Intercrop maize with legumes viz., pigeonpea, cowpea, black gram, kidney bean etc. in 2:1 to 4:1 ratio
- Erect bird perches @10/acre to encourage natural FAW predation by birds
- Install pheromone traps @ 4/acre soon after sowing and monitor moth catches
- Adopt clean cultivation to eliminate possible alternate hosts
- Destruction of egg masses and larvae by crushing
- Application of sand or soil mixed with lime in 9:1 ratio into whorl of maize plants
- First spray should be with 5% neem seed kernel extract (NSKE) or azadiractin, 1500 ppm (1 litre/acre) @ 5ml/litre after observation of one moth/trap/day or 5% FAW infestation on trap crop or main crop
- If monitoring indicates more than one moth/trap/day install pheromone traps @ 15/acre for mass trapping [Note: For success of mass trapping go for community action] OR release egg parasitoids viz., Telenomus remus @ 4000/acre or Trichogramma pretiosum @ 50,000/acre. Two releases of parasitoids at weekly interval should be done. [Note: Release of parasitoids should not be opted if mass trapping is followed]
- At 5-10% infestation whorl application of Bacillus thuringiensis v. kurstaki formulations (400g/acre) @ 2g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of 1×10⁸ cfu/g (1 kg/acre) @ 5g/litre or SfNPV (600 ml/acre) @ 3ml/litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended
- If infestation is more than 10%, whorl application of any one of the recommended insecticides for FAW, viz., Chlorantraniliprole 18.5 SC (80 ml/acre) @ 0.4 ml/litre; Thiamethoxam 12.6 % + Lambda cyhalothrin 9.5% ZC (50ml/acre) @ 0.25 ml/litre; Spinetoram 11.7 % SC (100ml/acre) @ 0.5 ml/litre; Emamectin benzoate 5% SG (80g/acre) @ 0.4g/litre is recommended

**Seven leaf stage to flowering**
- Monitoring of FAW using pheromone traps @ 4/acre should be continued
- Spray 5% NSKE or azadiractin, 1500 ppm (one litre/acre) @5 ml/l after observation of one moth/trap/day or 5% of fresh FAW infestation
- If infestation is more than 10%, whorl application of Bacillus thuringiensis v. kurstaki formulations (400g/acre) @ 2g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of 1×10⁸ cfu/g (1 kg/acre) @ 5g/litre or SfNPV (600ml/acre) @ 3ml/litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended
- If infestation is more than 20%, whorl application of any one of the recommended insecticides for FAW, viz., Chlorantraniliprole 18.5 SC (80 ml/acre) @ 0.4 ml/litre; Thiamethoxam 12.6 % + Lambda cyhalothrin 9.5% ZC
(50ml/acre) @ 0.25 ml/litre; Spinetoram 11.7 % SC (100ml/acre) @ 0.5 ml/litre; Emamectin benzoate 5% SG (80g/acre) @ 0.4g/litre is recommended.

Poison baiting is effective for late instar larvae and is optional. Mix 10 kg rice bran + 2 kg jaggery with 3 litres of water. Keep the mixture for 24 hours to ferment. Add anyone of the recommended insecticides mentioned above at their recommended dosages and 1 kg of sand just half an hour before application. Make into small pellets and apply into whorls of infested plants only. [Use hand gloves during mixing and application]

**Flowering to harvest**

- Hand picking and destruction of larvae boring into ears
- At 10% ear damage, application of *Bacillus thuringiensis* v. *kurstaki* formulations (400g/acre) @ 2g/litre or *Metarhizium anisopliae* or *Beauveria bassiana* with spore count of 1×10⁶ cfu/g (1 kg/acre) @ 5g/litre or SiNPV (600ml/acre) @3ml/ litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended

---

**Seed treatment** - as given as per Department of Agriculture and Farmers Welfare (DAC&FW) recommendation dated 16th August, 2019.

**Pheromone traps** – Funnel trap with FAW lure should be installed at a height adjusted each week matching with crop canopy. Traps should be separated by a minimum distance of 75 feet. Observe traps for number of moths caught twice or once in a week and work out the catch/day. FAW lures should be changed once in 30 days in case of monitoring and no lure change is required for mass trapping.

**Preparation of Neem Seed Kernel Extract (NSKE) for one acre** – 10 kg of need seed kernel is required for one acre. Grind 10 kg of need seed kernels to make powder. Soak the powder in 50 litres of water overnight. Stir and filter the contents using cotton cloth. Add 200 g detergent powder or 200 ml of soap solution to the filtered solution. Make up the volume to 200 litres by adding water.

**Caution upon release of egg parasitoids** - Minimum one week interval should be there between parasitoid release and application of neem or chemical insecticides

**Precautions for pesticide use:** Not more than two chemical sprays are to be used in entire crop duration. The chemical pesticide use in the first spray should not be repeated in case second spray is required. Sprays should always be directed towards whorl and applied either in early hours of the day or in the evening time. Use protective clothing, facemask and gloves during preparation and application of pesticides. Enter the field only 48 hours after spraying pesticide. Interval between application of chemical insecticide and harvest of corn should be minimum 30 days.
## GUIDE ON ACTION THRESHOLDS & MANAGEMENT OF FALL ARMYWORM ON GRAIN CORN

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Package of Practices for Management of Fall Armyworm in Sweet Corn

Pre-planting practices
- Deep plough the fields to expose pupae to sunlight and predatory birds
- Add neem cake @ 200 kg/acre to the fields when maize is grown with zero tillage or wherever possible
- Maintain field bunds clean and plant flowering plants such as marigold, sesame, niger, sunflower, coriander, fennel etc. to attract natural enemies

Sowing to six leaf stage
- Timely and uniform sowing over larger area
- Follow ridge and furrow planting method instead of flat bed sowing
- Apply only the recommended dosage of NPK as basal dose
- Seed treatment: Chlorantraniliprole 19.8% + Thiamethoxam 19.8% FS @ 6 ml/kg of seed offers protection for 15-20 days of crop growth
- Plant 3-4 rows of napier grass/hybrid napier as trap crop around maize fields
- Erect bird perches @ 10/acre to encourage natural FAW predation by birds
- Install pheromone traps @ 4/acre soon after sowing and monitor moth catches
- Adopt clean cultivation to eliminate possible alternate hosts
- Destruction of egg masses and larvae by crushing
- Application of sand or soil mixed with lime in 9:1 ratio into whorl of maize plants
- First spray should be with 5% neem seed kernel extract (NSKE) or azadiractin, 1500 ppm (1 litre/acre) @ 5 ml/litre after observation of one moth/trap/day or 5% FAW infestation on trap crop or main crop
- If monitoring indicates more than one moth/trap/day install pheromone traps @ 15/acre for mass trapping [Note: For success of mass trapping go for community action] OR release egg parasitoids viz., Telenomus remus @ 4000/acre or Trichogramma pretiosum @ 50,000/acre. Two releases of parasitoids at weekly interval should be done. [Note: Release of parasitoids should not be opted if mass trapping is followed]
- At 5-10% infestation whorl application of Bacillus thuringiensis v. kurstaki formulations (400 g/acre) @ 2 g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of 1x10^6 cfu/g (1 kg/acre) @ 5 g/litre or SfNPV (600 ml/acre) @ 3 ml/litre or entomopathogenic nematode (EPN) (4 kg/acre) @ 20 g/litre of water is recommended
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Seven leaf stage to flowering
- Monitoring of FAW using pheromone traps @ 4/acre should be continued
- Spray 5% NSKE or azadiractin, 1500 ppm (one litre/acre) @ 5 ml/litre after observation of one moth/trap/day or 5% of fresh FAW infestation
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Flowering to sweet corn harvest

- Hand picking and destruction of larvae boring into ears
- At 10% ear damage, application of *Bacillus thuringiensis* v. *kurstaki* formulations (400g/acre) @ 2g/litre or *Metarhizium anisopliae* or *Beauveria bassiana* with spore count of $1 \times 10^6$ cfu/g (1 kg/acre) @ 5g/litre or SfNPV (600ml/acre) @3ml/ litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended

Seed treatment - as given as per Department of Agriculture and Farmers Welfare (DAC&FW) recommendation dated 16th August, 2019.

Pheromone traps - Funnel trap with FAW lure should be installed at a height adjusted each week matching with crop canopy. Traps should be separated by a minimum distance of 75 feet. Observe traps for number of moths caught twice or once in a week and work out the catch/day. FAW lures should be changed once in 30 days in case of monitoring and no lure change is required for mass trapping.

Preparation of Neem Seed Kernel Extract (NSKE) for one acre - 10 kg of need seed kernel is required for one acre. Grind 10 kg of need seed kernels to make powder. Soak the powder in 50 litres of water overnight. Stir and filter the contents using cotton cloth. Add 200 g detergent powder or 200 ml of soap solution to the filtered solution. Make up the volume to 200 litres by adding water.

Caution upon release of egg parasitoids - Minimum one week interval should be there between parasitoid release and application of neem or chemical insecticides

Precautions for pesticide use: If possible avoid chemical spray or not more than one chemical pesticide spray is to be used in entire crop duration. All the sprays should be directed towards whorl and applied either in early hours of the day or in the evening time. Use protective clothing, facemask and gloves during preparation and application of pesticides. Enter the field only 48 hours after spraying pesticide. Interval between application of chemical insecticide and harvest of corn should be minimum 30 days.
## GUIDE ON ACTION THRESHOLDS & MANAGEMENT OF FALL ARMYWORM ON SWEET CORN

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Package of Practices for Management of Fall Armyworm in Baby Corn

**Pre-planting practices**

- Deep plough the fields to expose pupae to sun light and predatory birds
- Add neem cake @ 200kg/acre to the fields when maize is grown with zero tillage or wherever possible
- Maintain field bunds clean and plant flowering plants such as marigold, sesame, niger, sunflower, coriander, fennel etc. to attract natural enemies

**Sowing to six leaf stage**

- Timely and uniform sowing over larger area
- Follow ridge and furrow planting method instead of flat bed sowing
- Apply only the recommended dosage of NPK as basal dose
- Seed treatment: Cyantraniliprole 19.8% + Thiamethoxam 19.8% FS @ 6 ml/kg of seed offers protection for 15-20 days of crop growth
- Plant 3-4 rows of napier grass/hybrid napier as trap crop around maize fields
- Erect bird perches @10/acre to encourage natural FAW predation by birds
- Install pheromone traps @ 4/acre soon after sowing and monitor moth catches
- Adopt clean cultivation to eliminate possible alternate hosts
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- If monitoring indicates more than one moth/trap/day install pheromone traps @ 15/acre for mass trapping
  
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- At 5-10% infestation whorl application of Bacillus thuringiensis v. kurstaki formulations (400g/acre) @ 2g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of 1x10^6 cfu/g (1 kg/acre) @ 5g/litre or SfNPV (600 ml/acre) @3ml/litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended

- If infestation is more than 10%, whorl application of any one of the recommended insecticides for FAW, viz., Chlorantraniliprole 18.5 SC (80 ml/acre) @ 0.4 ml/litre; Thiamethoxam 12.6 % + Lambda cyhalothrin 9.5% ZC (50ml/acre) @ 0.25 ml/litre; Spinetoram 11.7 % SC (100ml/acre) @ 0.5 ml/litre; Emamectin benzoate 5% SG (80g/acre) @ 0.4g/litre is recommended

**Seven leaf stage to baby corn harvest**

- Monitoring of FAW using pheromone traps @ 4/acre should be continued
- Spray 5% NSKE or azadirachtin 1500 ppm (one litre/acre) @5 ml /l after observation of one moth/trap/day or 5% of fresh FAW infestation
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**Seed treatment** - as given as per Department of Agriculture and Farmers Welfare (DAC&FW) recommendation dated 16th August, 2019.

**Pheromone traps** – Funnel trap with FAW lure should be installed at a height adjusted each week matching with crop canopy. Traps should be separated by a minimum distance of 75 feet. Observe traps for number of moths caught twice or once in a week and work out the catch/day. FAW lures should be changed once in 30 days in case of monitoring and no lure change is required for mass trapping.

*Preparation of Neem Seed Kernel Extract (NSKE) for one acre* – 10 kg of need seed kernel is required for one acre. Grind 10 kg of need seed kemels to make powder. Soak the powder in 50 litres of water overnight. Stir and filter the contents using cotton cloth. Add 200 g detergent powder or 200 ml of soap solution to the filtered solution. Make up the volume to 200 litres by adding water.

**Caution upon release of egg parasitoids** - Minimum one week interval should be there between parasitoid release and application of neem or chemical insecticides

**Precautions for pesticide use**: If possible avoid chemical spray or not more than one chemical pesticide spray is to be used in entire crop duration. Sprays should always be directed towards whorl and applied either in early hours of the day or in the evening time. Use protective clothing, facemask and gloves during preparation and application of pesticides. Enter the field only 48 hours after spraying pesticide. Interval between application of chemical insecticide and harvest of corn should be minimum 30 days.
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Package of Practices for Management of Fall Armyworm in Fodder Maize (including Silage)

**Pre-planting practices**
- Deep plough the fields to expose pupae to sun light and predatory birds
- Add neem cake @ 200kg/acre to the fields when maize is grown with zero tillage or wherever possible
- Maintain field bunds clean and plant flowering plants such as marigold, sesame, niger, sunflower, coriander, fennel etc. to attract natural enemies

**Sowing to six leaf stage**
- Timely and uniform sowing over larger area
- Follow ridge and furrow planting method instead of flat bed sowing
- Apply only the recommended dosage of NPK as basal dose
- Seed treatment: Cyantraniliprole 19.8% + Thiamethoxam 19.8% FS @ 6 ml/kg of seed offers protection for 15-20 days of crop growth $
- Plant 3-4 rows of napier grass/hybrid napier as trap crop around maize fields
- Intercrop maize with fodder legumes such as cowpea, horsegram, rice bean etc. in 2:1 to 4:1 ratio
- Erect bird perches @10/acre to encourage natural FAW predation by birds
- Install pheromone traps @ 4/acre soon after sowing and monitor moth catches$
- Adopt clean cultivation to eliminate possible alternate hosts
- Destruction of egg masses and larvae by crushing
- First spray should be with 5% neem seed kernel extract (NSKE)$ or azadiractin, 1500 ppm (one litre/acre) @5ml/litre after observation of one moth/trap/day or 5% FAW infestation on trap crop or main crop
- If monitoring indicates more than one moth/trap/day install pheromone traps @ 15/acre for mass trapping [Note: For success of mass trapping go for community action] OR release egg parasitoids viz., Telenomus remus @ 4000/acre or Trichogramma pretiosum @ 50,000/acre. Two releases of parasitoids at weekly interval should be done. [Note: Release of parasitoids should not be opted if mass trapping is followed]
- At 5-10% infestation whorl application of Bacillus thuringiensis v. kurstaki formulations (400g/acre) @ 2g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of $1\times10^8$ cfu/g (1 kg/acre) @ 5g/litre or SfNPV (500 ml/acre) @3ml/litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended.

If infestation is more than 10%, whorl application of any one of the recommended insecticides for FAW, viz., Chlordantraniliprole 18.5 SC (80 ml/acre) @ 0.4 ml/litre; Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC (50ml/acre) @ 0.25 ml/litre; Spinetoram 11.7% SC (100ml/acre) @ 0.5 ml/litre; Emamectin benzoate 5% SG (80g/acre) @ 0.4g/litre is recommended.

For chemical pesticide use, caution must be exercised to ensure interval between application of chemical insecticide and harvest of fodder should be minimum 30 days.

**Seven leaf stage to fodder harvest**
- Monitoring of FAW using pheromone traps @ 4/acre should be continued$
- Spray 5% NSKE$ or azadiractin, 1500 ppm (one litre/acre) @ 5 ml/litre after observation of one moth/trap/day or 5% of fresh FAW infestation.
- If infestation is more than 10%, whorl application of Bacillus thuringiensis v. kurstaki formulations (400g/acre) @ 2g/litre or Metarhizium anisopliae or Beauveria bassiana with spore count of $1\times10^8$ cfu/g (1 kg/acre) @ 5g/litre or SfNPV (600ml/acre) @3ml/litre or entomopathogenic nematode (EPN) (4kg/acre) @20g/litre of water is recommended.
Seed treatment - as given as per Department of Agriculture and Farmers Welfare (DAC&FW) recommendation dated 16th August, 2019.

Pheromone traps - Funnel trap with FAW lure should be installed at a height adjusted each week matching with crop canopy. Traps should be separated by a minimum distance of 75 feet. Observe traps for number of moths caught twice or once in a week and work out the catch/day. FAW lures should be changed once in 30 days in case of monitoring and no lure change is required for mass trapping.

Preparation of Neem Seed Kernel Extract (NSKE) for one acre - 10 kg of need seed kernel is required for one acre. Grind 10 kg of need seed kernels to make powder. Soak the powder in 50 litres of water overnight. Stir and filter the contents using cotton cloth. Add 200 g detergent powder or 200 ml of soap solution to the filtered solution. Make up the volume to 200 litres by adding water.

Caution upon release of egg parasitoids - Minimum one week interval should be there between parasitoid release and application of neem or chemical insecticides

Precautions for pesticide use: If possible avoid chemical spray or not more than one chemical spray is to be used in entire crop duration. Sprays should always be directed to whorl and applied either in early hours of the day or in evening time. Use protective clothing, facemask and gloves during preparation and application of pesticides. Enter the field only 48 hours after spraying pesticide. Interval between application of chemical insecticide and harvest of fodder should be minimum 30 days.
GUIDE ON ACTION THRESHOLDS & MANAGEMENT OF FALL ARMYWORM ON FODDER MAIZE (including Silage)

<table>
<thead>
<tr>
<th>Crop stage</th>
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<th>Intervention options</th>
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