found free from insect pests then the field will be considered fit for export.

III. Integrated Pest Management strategies

The following Good Agricultural Practices should be adopted for the management of various pests of cluster bean:

- **Destruction of debris, crop residues, weeds & other alternate hosts**
- **Deep summer ploughing**
- **Frequent raking of soil beneath the crop to expose and kill the eggs, grubs & pupa.**
- **Hand collection and destruction of infested leaves and fruits.**
- **Adoption of proper crop rotation and avoid growing of cucurbit crops in sequence.**
- **Use of resistant and tolerant varieties recommended by the State Agricultural Universities of the region.** Early maturing varieties are less affected by fruit flies than later ones.
- **Slight raking of soil during fruiting time and after the harvest to expose pupae from the soil.**
- **Use cue-lure traps to attract B. cucurbitae males.**
- **Use poison bait against fruit fly-mix 500 gm jaggery, 20 ml malathion and keeping plastic containers (100ml/container) @ 5 nos/Acre for monitoring and 20/acre for mass killing of fruit fly.**
- **Use fish meal trap @ 10-15 nos/acre for fruit fly.**
- **Use 10 banana pulp traps/acre against fruit fly-mix 20gm banana pulp, 3 drops of palm oil and 10 granules of carbofuran and keep in plastic container.**
- **Cover fruits with polythene/ paper bags to minimize fruit fly infestation.**
- **Conserve predators such as Pennsylvania leather wing beetle (Chauliognathus pensylvanicus); larvae of which feed on pumpkin beetle larva.**
- **Conserve parasitoids such as Celatoria setosa (grub)**
- **Use well decomposed FYM @ 8-10 tones per acre or wormi-compost @ 5 tons per acre treated with Trichoderma sp. and Pseudomonas sp. @ 2 kg per acre as seed / nursery treatment and soil application for controlling soil borne disease such as root rot, wilting.**
- **Apply neem cake @ 100 kg per acre for reducing nematode population.**

<table>
<thead>
<tr>
<th>CIB&amp;RC recommended pesticide against cluster bean pests</th>
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<tbody>
<tr>
<td><strong>Pest/Pesticide</strong></td>
<td><strong>Dosage</strong></td>
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<tr>
<td><strong>Pod borers</strong></td>
<td>Chlorpyrifos 20% EC</td>
</tr>
<tr>
<td><strong>Black bug</strong></td>
<td>Chlorpyrifos 20% EC</td>
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</tbody>
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**Integrated Pest Management (IPM) in Cluster bean (Guar) (Cyamopsis tetragonoloba) for export purpose**

**Government of India**

**Ministry of agriculture**

**Department of Agriculture and Cooperation**

**Directorate of Plant Protection, Quarantine & Storage**

NH IV, Faridabad—121 001 (Haryana)
Cluster bean or guar (Cyamopsis tetragonoloba), is an important seed as well as vegetable crop, which belongs to family fabaceae. The entire plant being used for fodder and green manure, the pods as a vegetable, and the colloidal flour made from the seeds as a gum used in the paper and textile industries and as a thickener in food products.

I. Identification pest of Cluster bean

1. Thrips (Thrips palmi):

   Thrips palmi is polyphagous but mostly found on Cucurbitaceae and Solanaceae crops. Egg is colorless to pale white in color, and bean-shaped in form; turns yellow towards maturation; laid singly inside the plant tissues. The larvae resemble the adults in general body form though they lack wings and are smaller. They usually feed on older leaves. Full fed larvae descends to the soils of leaf litter where it pupates making an earthen chamber. Adult are pale yellow with numerous dark setae. A black line from the juncture of wings runs along the back of the body. Slender fringed wings are pale. Fringe is shorter on the anterior edge than posterior. Body length is 0.8 -1.0 mm. adults feed on young growth. Thrips antenna is seven segmented, Ocelli red pigmented.

2. Whiteflies (Bemisia tabaci):

   Eggs are yellowish white laid singly on the under surface of leaves. Nymphs are yellowish and brownish, sub elliptical and scale like. They are found in large numbers on underside of leaves. Pupae also resemble nymphs in shape and have brownish opercula. Whitefly is a well-known vector, which transmits leaf curl virus. It has piercing and sucking mouthpart and both nymphs and adults feed on lower surface of the leaves causing deformation of young leaves. Whiteflies also excrete honeydew, causing sooty mold.

3. Aphid (Aphis pisum):

   This is a cosmopolitan pest and highly polyphagous. The adult color is highly variable and it varies from light green to greenish brown. The adult color is highly variable and it varies from light green to greenish brown. Both wingless and winged forms occur. They possess a pair of black-colored cornicles on the dorsal side of the abdomen. Aphids mostly are found in groups. Both the nymphs and adults possess piercing and sucking mouthparts. They occur in large numbers on the tender shoots and lower leaf surfaces, and suck the plant sap. Slightly infested leaves exhibit yellowing. Severe aphid infestations cause young leaves to curl and become deformed.

4. Leaf miner (Phytomyza horticola):

   The pea leafminer Phytomyza horticola (Diptera, Agromyzidae) is a polyphagous species. P. horticola has a wider host range and an important pest in India. The female deposits her eggs in leaf tissue, leaving small brown puncture wounds. Adults feed on plant fluids that exude from these wounds. The larvae of all leafminer species feed inside the leaves of their hosts, creating unsightly mines in the leaf tissue. Dark fecal material accumulates in the mine as the larva feeds. Larvae destroy cells as they feed, so heavily mined leaves can die and heavily infested plants can lose vigor.

5. Tobacco caterpillar (Spodoptera litura):

   The tobacco caterpillar is one of the most important insect pests of agricultural crops in the Asian tropics. The eggs are spherical, somewhat flattened, and 0.6 mm in diameter. They are usually pale orange-brown or pink in colour, laid in batches and covered with hair scales from the tip of the abdomen of the female moth. Egg masses measure about 4-7 mm in diameter and appear golden brown because they are covered with body scales of females. The larva is hairless, variable in colour (young larvae are light green, the later instars are dark green to brown on their backs, lighter underneath). Larvae cause damage by consuming foliage. Young larvae initially consume leaf tissue from one side, leaving the opposite epidermal layer intact. By the second or third instar, larvae begin to make holes in leaves, and eat from the edge of the leaves inward. Later instar larvae feeds on beans by making holes.

II. Pest Surveillance

Weekly monitoring should be done through pest scouting with the help of monitoring devices like pheromone and colored sticky traps. For field scouting 100 plants per acre should be observed. Minimum 15 spots at reasonable distance with each other following a cross diagonal pattern moving zig zag manner for counting all type of insects. Pest monitoring for fruit flies using traps should be done regularly from fruiting stage onwards. If 95% plants are