

● Improve and practical GAP (Good Agronomic practices) Technologies for managing major biotic stresses affecting citrus and Mango farming in Uganda: Citrus leaf and fruit spot diseases and Fruit files



Fig 9. Extension staff and Model farmers undergoing training on production and management of Citrus and mango orchards

Information materials on (GAP) technologies.

Information material on GAP technologies for managing insect pest, diseases and nutrient deficiencies for mango and citrus were produced and shared among different stakeholders (farmers, extension staff, Media, School Pupils, University students, Academicians, policy makers and traders in the 20 districts where Citrus and mango are majorly grown).

Information materials	Quantity/copies produced & shared
Citrus & Mango production brochures	1,000
Citrus and Mango Insect Pest management Brochure	1,000
Citrus and Mango disease management Brochure	1,000
Citrus production guide /Book- 50 pages	500
Mango production guide/Book- 50 pages	500
Project achievement/ technologies / knowledge booklet	500

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Interventions to Address Leaf and Fruit spot diseases and Fruit fly biotic stresses affecting Citrus and Mango Production in Uganda



CGS 1/3/14: ACHIEVEMENTS



The Ministry of Agriculture, Animal Industry and Fisheries



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Background

Horticulture is one of the most important agricultural enterprises in Uganda. There is much diversity of tropical fruits and vegetables grown in the country. Horticulture offers many opportunities to create employment and improve food security and nutrition as well as improve the economy and livelihood of our people. Presently, the demand for fruits such as citrus and mango fruits on the local market is high as indicated by the volume of imports of oranges from South Africa and mangoes from Kenya during the off season period. Whereas there are efforts (MAAIF, OWCs, & NAADS) to increase acreage and production especially among citrus and mango growers in Uganda, several challenges continue to undermine production and profitability. Several types of insect pests and diseases affect such horticultural crops, notably the Leaf and fruit spot diseases in citrus (Fig 1) and the fruit flies. Presently, these are the biggest threat to the citrus and Mango industry. Besides causing direct damage to fruits, there are also indirect losses associated with quarantine restrictions imposed by importing countries (Europe, Asia, and Arab nations) to prevent entry and establishment of unwanted fruit fly species.



Fig 1. Major Citrus diseases in Uganda: Top Left: Pseudocercospora leaf and fruit spot on fruit, bacterial canker, citrus Scab, Anthracnose, Middle left: Pseudocercospora leaf and fruit spot on leaf, citrus Melanose, Citrus greening, Bottom left: Greasy spot

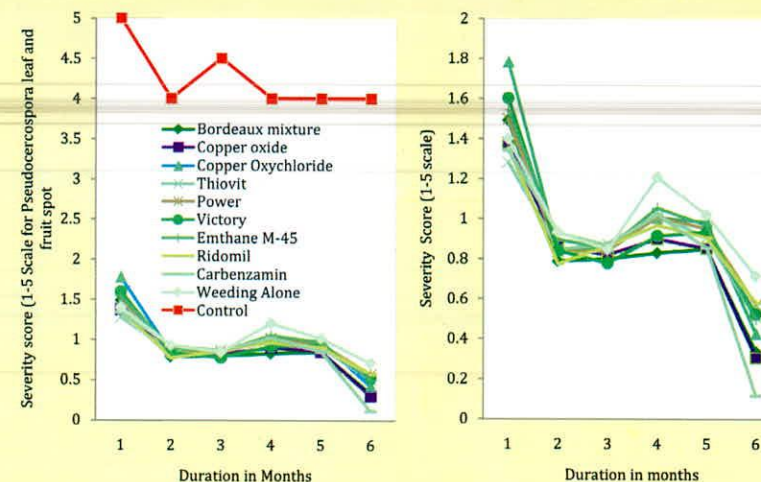


Fig 7. Effect of different fungicides on the severity of Pseudocercospora leaf & fruit spot disease.

An IPM approach for controlling citrus diseases. Testing the effect of a combination of treatments namely: fungicides, pruning, and application of fertilizers revealed that a three combination of fungicide use combined with pruning and application of fertilizers significantly lowers the severity of Pseudocercospora leaf and fruit diseases to negligible levels in a period of 6 months. **The combination is: Applying standard fungicide application rate once a month, hard and soft pruning every 3 months and application of NPK (17:17:17) fertilizer at 250gms every 6 months under ring weeding.**

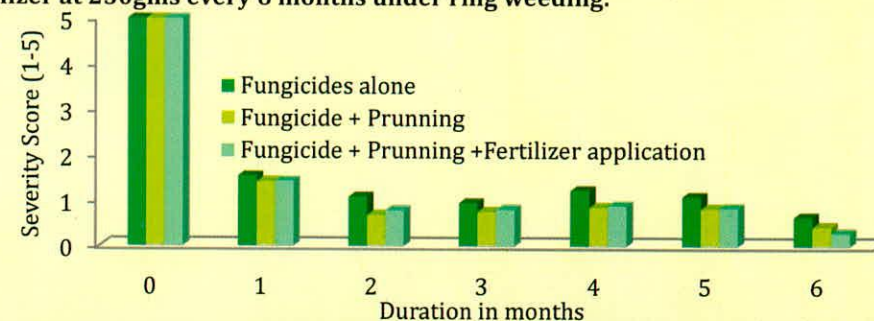


Fig 8. Effect of different field practices, their combination on the severity of Pseudocercospora leaf and fruit spot disease

Capacity Building extension staff & model farmers

Based on the baseline surveys carried out in 2012 to 2015 among citrus and mango farmers found in 20 districts, Training for a selected number of model farmers and extension staff was carried out in two regions: Busoga and Teso. Training covered the following areas.

- Growing Citrus and Mango for commercial purposes
- Proper identification of major disease symptoms of Citrus and Mango
- Proper identification of major insect pests of Citrus and mango
- Proper identification of different nutrient deficiencies among citrus and mango orchards

Bait-based insecticides control of fruit flies. Methyl Eugenol still remains the most effective attractant for fruit flies, however, use of molasses and fruit extract (Mango & Citrus) provide some minimal control as compared to other parapheromones / lures that are more specific.

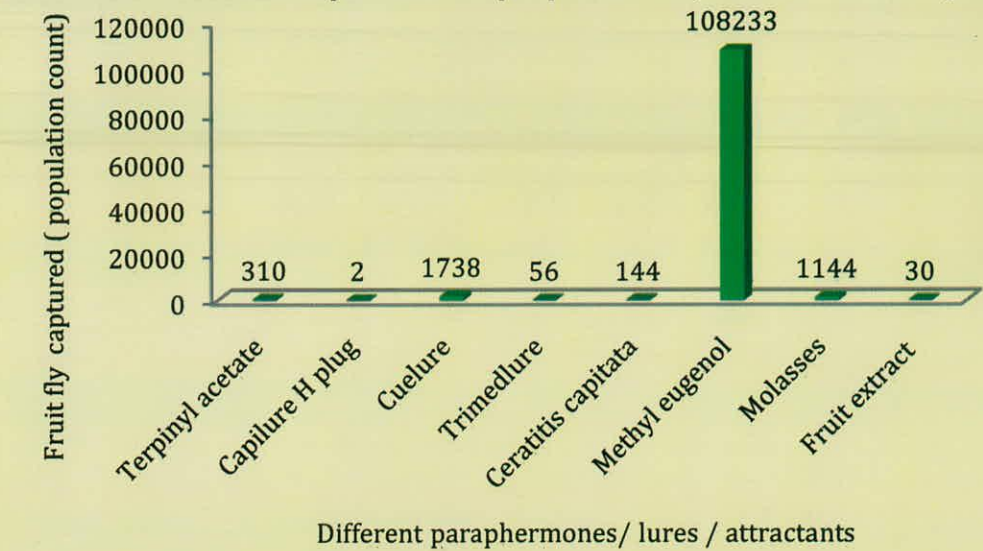


Fig 6. Number of fruit files captured by different pheromones/ Lures

Use of light yellow sticky traps in fields to monitor fruit fly population in the field



Effect of copper based and non-copper based fungicides on control of major citrus diseases.

All fungicides were effective at lowering the severity and incidence of Pseudocercospora leaf and fruit spot, however, **copper based fungicides namely Bordeaux mixture (Copper sulphate and Calcium hydroxide mixture), Copper oxide and Copper oxychloride performed slightly much better** than the rest. Among the non-copper based fungicides, Carbendazim was the best performer.

The overall goal of this project was to **reduce losses attributed to the leaf and fruit spot diseases and fruit flies in Uganda and enable fruit growers (especially mango and citrus) to grow profitable, healthy and safe fruit crops through the practical use of IPM technologies.** To realize this goal the following objectives were pursued

1. Assess the current status of farmers' knowledge, perceptions, and practices of fruit fly pests management and control of citrus leaf and fruit spot diseases
2. Determine the diversity and host range of fruit flies affecting major fruits and vegetables,
3. Assess the susceptibility of fruit flies (especially Bactrocera invadens) to bait-based insecticides commonly used by mango/ citrus fruit growers in Uganda
4. Evaluate available fungicides for controlling citrus leaf and fruit spot disease,
5. Develop an IPM approach for suppressing fruitfly infestations and citrus leaf and fruit spot diseases.
6. Build the capacity of extension technical staff and model farmers on production and management of citrus and mango orchards through an Integrated approach
7. Develop, produce and disseminate information packages on good agronomic packages (GAP) or technologies for production and management of citrus and Mango Orchards



The following have been the achievements of the project

- ✎ 20 districts (14 districts for farmers affected with fruit files & 9 districts where Citrus leaf and fruit spot diseases are most prevalent) were surveyed covering a total of 300 fruit farmers. The majority of the fruit Orchards (84.4%) are quite young (1-10 years old). Majority of farmers grow Hamlin, Valencia & Washington navel (Fig 2)
- ✎ Many farmers work in isolation. Few belong to any community association (32.3%) where knowledge and resources are shared.



Fig 2. Citrus varieties are grown by farmers

- ✎ 92. 5% of the surveyed citrus orchards were heavily affected by pests and diseases majorly leaf and fruit spot diseases.
- ✎ 89.4% can't identify the problem (diseases) and a few who can identify diseases can't distinguish (97.0 %) among the different diseases.
- ✎ 50.0% of survey farmers perceived the diseases to be spread by insects and only a few (13.5%) were knowledgeable about the actual means of spread of the citrus diseases.

- 78% perceived the diseases to be very serious with yield losses ranked very high (72.7%).
- Pest management practises on farm reported: Use of pesticides (77.4%), pruning diseased twigs (71.7%), and disposal of diseased plant parts (43.3%), destroying severely affected trees (34.3%), applying fertilizers (37.8%), controlling vectors (37.8%) and restricting visitor's entry to the orchards (6.0%).
- Commonly used fungicides are: Copper based fungicides (48.0%) and Dithiocarbamate (36.0%).
- Lack of knowledge on pest and disease management (91.0% of the farmers) and extension services (88.1 % of the farmers) were the main needs expressed by farmers (Table 1).

Table 1. Major constraints expressed citrus farmers in Uganda

Production constraints	Busoga	Teso	Lango	Mean
1. Lack of extension services	21	13	25	34(1)
2. Pests and diseases	19	11	31	31(2)
3. High input costs	18	8	23	25(3)
4. Limited capital	12	4	28	22(4)
5. No value addition	9	7	28	22(4)
6. Climate change-Draught & Hail storms	16	11	18	22(4)
7. Low market prices for fruits	5	3	24	16(5)
8. Poor farming tools	1	0	18	10(6)
9. Poor road infrastructure	4	3	6	7(7)
10. No transportation services-bicycles	2	0	7	5(8)
11. Thieves	0	0	9	5(8)
12. Adulterated chemicals	2	1	4	4(9)
13. Excessive production	1	0	4	3(10)
14. No market for the fresh fruits	1	0	3	2(11)
15. Lack of equipment	0	0	2	1(12)
16. Restriction by relatives	1	0	0	0.5(13)
17. Labour scarcity	0	0	1	0.5(13)

- Major of fruit farmers consult fellow farmers on pest and disease management (Fig 3)

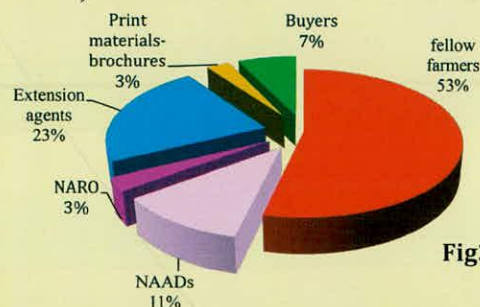


Fig3. Major sources of information accessed by citrus farmers on pest management.

Fruit fly diversity. From the samples collected. The following fruit fly species were identified in Uganda: **Bactrocera spp:** *B. invadens*, *B. curvifera* and *B. cucurbitae*, **Ceratitis spp:** *C. rosa* and *C. quinaria* and **Dacus spp:** *D. punctatifrons*, *D. vertebratus*, and *D. ciliatus*

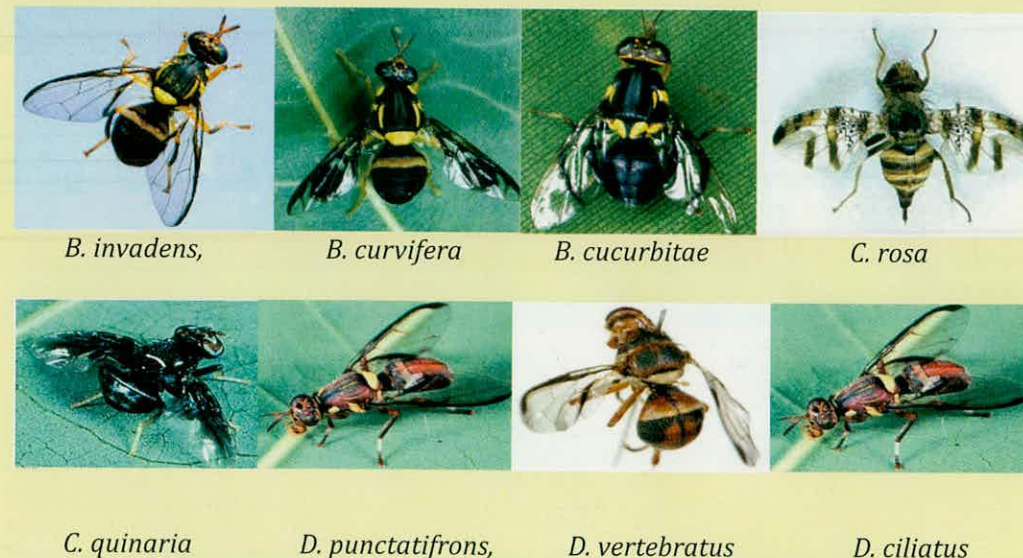


Fig 4. Fruit fly species observed to occur among fruit farmers

The commonest host plant found included: Mango, citrus, Water melon, Pawpaw, and Guava. Spatial-temporal variation in fruit fly population among mango orchard. Fruitflies continuously occur within the field despite the presence of fruit or not. This means that control needs to start earlier before damage is exhibited on the fruits through an IPM approach

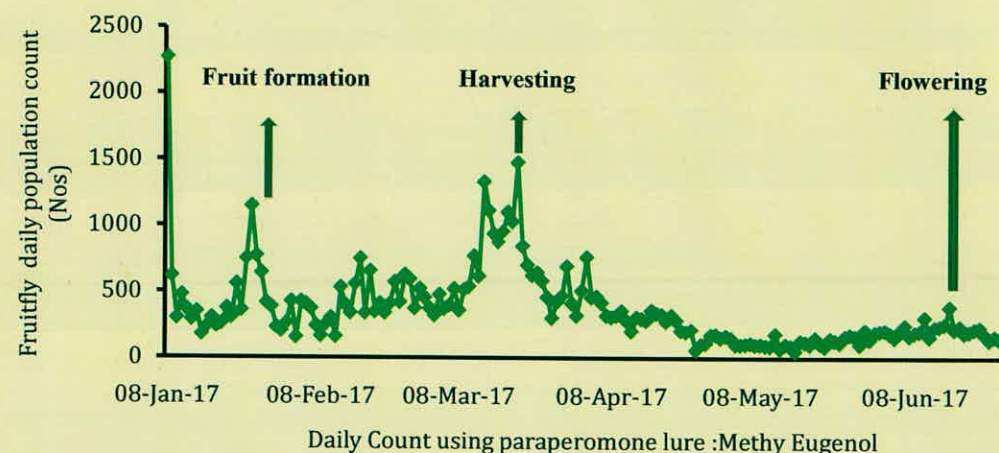


Fig 5. Variation in fruit fly population within a Mango orchard over time