Japan International Cooperation Agency

Agriculture and Food Authority
Horticultural Crops Directorate

Ministry of Agriculture, Livestock and Fisheries
State Department for Crop Development & Agricultural Research

Smallholder Horticulture Empowerment & Promotion Project for Local and Up-Scaling (SHEP PLUS)

"Changing Farmers' Mindset from "Grow and Sell" to "Grow to Sell""

Black Nightshade Production

Presented to the County & AFA (HCD) Staff in charge of the SHEP PLUS Model Farmer Groups during the FT-FaDDE

Prepared by SHEP PLUS

1. Introduction:

1.1 Background

Photo: © Victor Omari HCD, 2019

Black Night Shade (Managu/Mnavu)

1. Introduction:

1.1 Background

- The term **“Night Shade”** refers collectively to a wide ranging group of plants including poisonous, medicinal and edible species (from the genus Solanum)
- There are several species with black berries, but the most popular ones are those with orange berries belonging to **“*Solanum villosum*”**

1. Introduction:

1.1 Background Cont'

- Some Solanum varieties are preferred for their **bitter taste** while others are considered "**sweet**", particularly after being boiled and the water discarded
- It is rich in **proteins**, **calcium**, **iron**, **phosphorus** and **magnesium**; leaves are rich in ***Beta*-Carotine**, Vitamin **E**, **Folic** acid and **Ascorbic** acid
- Black Night Shade is gaining popularity due to its **nutritional value** and ready market in major urban centres

1.2 Common Varieties

Photo: By No machine-readable author provided. TeunSpaans assumed (based on copyright claims). Own work assumed (based on copyright claims)., CC BY 2.5, https://commons.wikimedia.org/w/index.php?curid=427015

"Solanum villosum"

Photo: By David Eickhoff from Pearl City, Hawaii, USA - Solanum americanumUploaded by Tim1357, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=22702159

"Solanum americanum"

1.2 Common Varieties

“*Solanum villosum*”

- Grows well in **low altitude areas**
- Produces **orange colored fruits** which are edible

“*Solanum americanum*”

- Produces **very small fruits** which are **black**
- Grows well in **hot and humid areas**, such as Coastal areas

1.2 Common Varieties

Photo: By Caroline Léna Becker - Own work, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=20085916

“Solanum scabrum”

1.2 Common Varieties Cont'

"*Solanum scabrum*"

- Bigger in size
- Produces **bigger leaves** and **fruits** which are **black in color**
- Grows well in **medium altitude areas** which receive a lot of rainfall
- It is unpopular in Kenya

"*Solanum eldoreti*"

- Broader leaves compared to *Solanum villosum*
- Grows well in **high altitude areas**
- Produces **small greenish** to **purplish fruits**

1.3 Optimal Ecological Requirements

Altitude	**0 – 2,400 metres above sea level**
Rainfall	**500 – 1,200 mm of rainfall**
Growing Temperature	**Warm Temperatures**
Soils	**• Well drained soils** **• High organic matter content**

2. G20 technologies

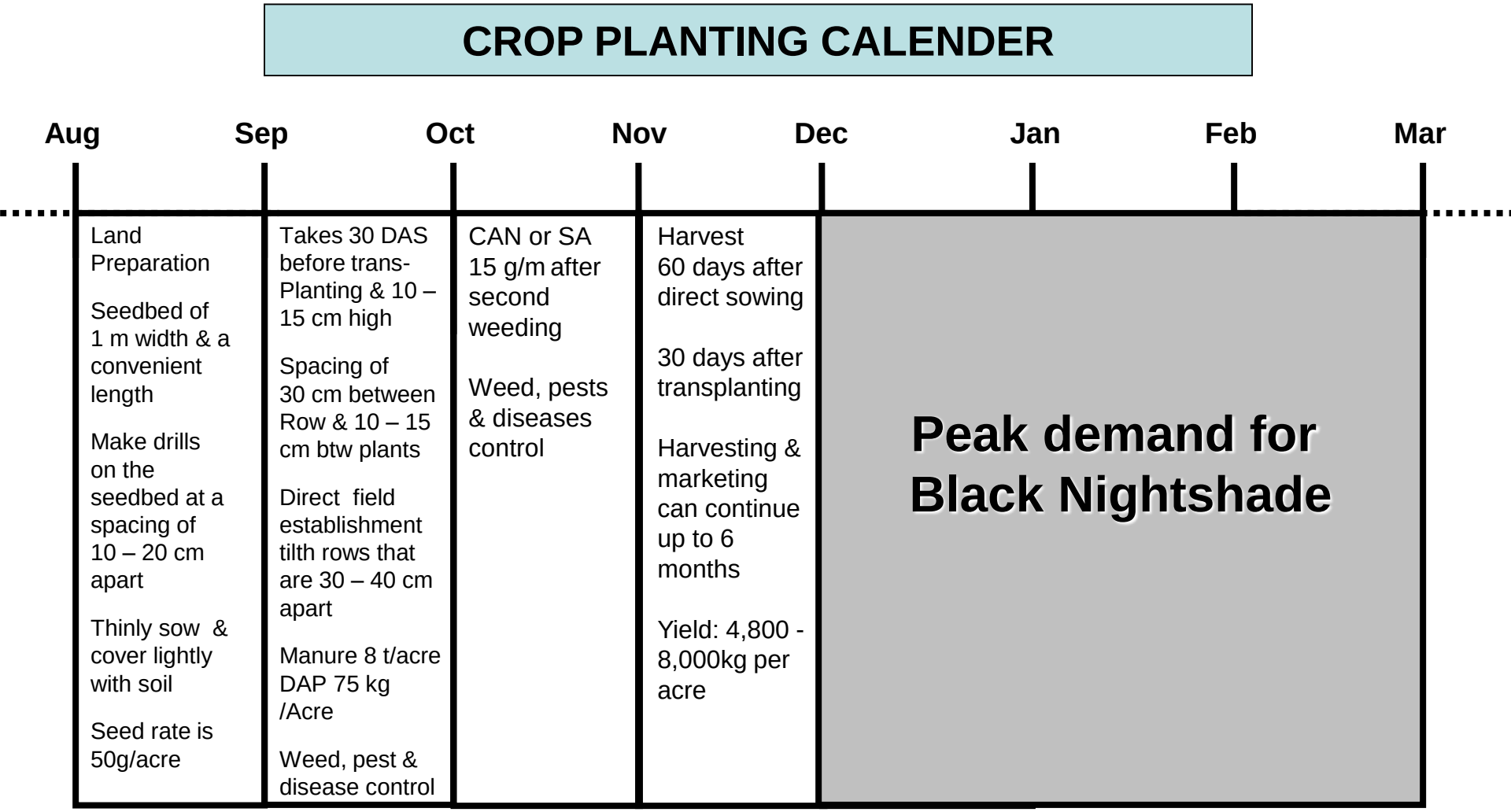
- Make sure to support farmers carry out G20 techniques for any crop

1. Market survey
2. Crop planting calendar
3. Soil testing
4. Composting
5. Use of quality planting materials
6. Recommended land preparation practices
7. Incorporating crop residues
8. Basal application of compost/ manure
9. Recommended practices of seedling preparation/ seedlings from registered nursery

2. G20 technologies

10. Recommended spacing
11. Recommended fertilizer application rate
12. Supplementing water
13. Timely weeding
14. Top-dressing
15. IPM practices
16. Safe and effective use of pesticides
17. Use of harvesting indices
18. Appropriate post harvest handling containers
19. Value addition techniques
20. Keeping farm records

3.1 Crop Planting Calendar



A Sample of a BNS Planting Calendar

3.2 Composting (GHCP&PHHT20: Q4)

- Compost manure has been found to:
  - Be cheaper than inorganic fertilizers
  - Improve soil productivity by readily providing soil nutrients and improving soil structure
  - Increase the water retention capacity
- Black Nightshade like most leafy vegetables is a heavy feeder and does well in soils with high organic content (manure)
- Based on the results of the soil analysis, prepare adequate compost for application; the recommended rate of application ranges from **5 – 8 tons/acre** for Black Night Shade

3.3 Basal Application (G20: Q8)

- To be based on result of soil analysis
- Pre-plant phosphorus (**P**) application can be done in form of fertilizer (**TSP**). Application at the rate of **75 kg per acre**
- Manure/compost should be applied **1 – 2 weeks before** transplanting and incorporated into the soil
- The manure/compost should be broadcasted (**8 tons per acre**) then worked into the soil (incorporated) preferably using a hoe

3.4 Raising Seedlings

Nursery bed of Black Nightshade

3.4 Raising Seedlings

(G20: Q9)

- Use of clean seed is recommended due to high incidences of seed borne diseases
- **Seed Rate: 50g** per acre

Nursery Site Selection:

- The nursery should be located in a plot that has not been planted with crops in the ***Solanaceae*** family for at least **three (3) years**
- Nursery soil should be **loosened** and **enriched** with well decomposed manure
- Make drills at a spacing of **10 – 20 cm apart**; thinly sow the seeds in the drills and cover lightly with soil and manure

3.5 Transplanting

Black Nightshade seedlings being transplanted

3.5 Transplanting

3.5.1 Appropriate Time:

- Seedlings are transplanted **30 days after sowing** or when having **6 true leaves** and have attained **a height of 10 – 15 cm**

3.5.2 Recommended Spacing (G20: Q10):

- Seedlings are planted at a spacing of **30 cm** between rows and **10 – 15 cm** between plants
- For the direct seeded, seeds are drilled thinly in fine tilth rows that are **30 – 40 cm apart**
- To ensure uniform distribution, mix the seed with the soil or sand at a ratio of **1:15** or **1:20**, respectively

3.5 Transplanting Cont'

- Direct seeding enables the plant to establish well and faster which leads to faster production of bigger leaves
- Seed germination takes place between **4 – 7 days**
- Thin seedlings to attain a spacing of **15 cm** between the plants after **30 days**

3.5.3 Fertilizer Application Rates (G20: Q11):

- To be based on soil analysis results
- Manure alone: **8 tons per acre** or,
- Manure and DAP: **4 tons manure per acre** together with **40 kg DAP per acre** or,
- **DAP 75 kg per acre**

3.6 Water Requirement

Photo: © Victor Omari HCD, 2019

Black Nightshade under drip irrigation

3.6 Water Requirement (G20: Q12)

- Frequent irrigation is needed to avoid **water stress** and have optimum growth and yield
- Irrigation interval of the crop **depends on the soil types**
- It is recommended that sandy soil be irrigated **three times a week**, sandy loam **twice a week**, clay loam and loam soils **once a week,** respectively

Irrigation Methods:

- **Drip** and **sprinkler irrigation** can be used but drip irrigation is recommended to save water

3.7 Top-dressing
(G20: Q14)

- Research indicates that **Nitrogen** is one of the most important nutrient that is required by the crop in fairly large quantities
- Calcium ammonium nitrate or Sulphate of ammonia should be applied at **15 g** (**3 tea spoonfuls**) **per m²** after second weeding
- Application of **foliar fertilizer** is beneficial to this crop

3.8 Crop Management:

3.8.1 Soil Fertility

- Recommendations for supplemental **organic matter**, **fertilizer**, **lime** or **manure** should be based on a soil test and a Nutrient management plan
- Nutrient management plans balance the crop requirements and nutrient availability, with the aim to **optimize crop yield** and **minimize ground water contamination**, while improving soil productivity

3.9 Pests & Diseases Control:

(G20: Q15 & 16)

3.9.1 Major Pests

- The following are the major pests of Black Nightshade in Kenya:

A. Root-Knot Nematode

B. Cutworm

C. Flea Beetle

D. Aphid

3.9.1.A: Root-Knot Nematode

Photo: A. M. Varela, icipe
http://www.infonet-biovision.org/PlantHealth/Pests/Root-knot-nematodes (CC BY-NC-SA 3.0)

“Root-knot Nematode” infection

3.9.1.A: Root-Knot Nematode

Symptoms:

- Root-Knot Nematodes induce characteristic **swellings of the roots** which are commonly referred to as **galls**
- This deformation of the root system inhibits the translocation of water and mineral salts thus resulting in **stunted plant growth**

Management/control

- Crop rotation
- **Keep weed free** land fallow for one or two seasons
- Intensive use of manure

3.9.1.B: Cutworm

A Cutworm larva

3.9.1.B: Cutworm

- Cutworms are often found **hiding in the soil** near the cut seedlings

Symptoms:

- **Grey to black caterpillars** feed at night, either bite out the side of the stem at the ground level causing the plant to **fall over** or may **cut it** completely

Management/Control

- **Hand removal** since the pest is easily found near the damaged plant, especially at the beginning of infestation
- **Early weeding** destroys sites for egg laying

3.9.1.C: Flea Beetle

Photo: By Bob Peterson from North Palm Beach, Florida, Planet Earth! - Metallic blue flea beetles (Altica sp.)Uploaded by Jacopo Werther, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=24649912

Flea Beetles on a leaf

3.9.1.C: Flea Beetle

Symptoms:

- Feed on leaves where they create **big holes** on the **foliage**
- The damage is serious in **young plants**

Management/Control:

- Keep fields **weed-free**
- **Destroy plant debris**

3.9.1.D: Aphid

Aphids on a leaf

3.9.1.D: Aphid

- Most destructive pest for this crop especially during dry season

Identification:

- Aphids are **pale green** and are usually covered with **a light dust of mealy powder**
- They suck plant sap from the central part of the plant and near the base of leaves

Symptoms:

- Aphid attack results in **curled** and **distorted leaves**

Control:

- Use of **ash**
- Use appropriate **pesticides**: **Alpha Cyhalothrin (KARATE 2.5 WG®: PHI 3days)** at **60ml per 20 litres** of water)

3.9.2 Major Diseases & Physiological Disorders

- The following are the major diseases of Black Nightshade in Kenya:
  a. **Bacterial Blight**
  b. **Early Blight**

3.9.2.a: Bacterial Blight

Photo: By Forest & Kim Starr, CC BY 3.0,
https://commons.wikimedia.org/w/index.php?curid=6109049

Symptoms on a Black Nightshade leaves

3.9.2.a: Bacterial Blight

- Once the soil has been infected with the disease, it is advisable not to plant Black Nightshade for **at least 4 years**

Symptoms:

- The disease is characterized by **small**, **round**, **water-soaked spots on leaves**, which eventually turn **dark brown to black** and become **hard and dry**

Control:

- Use **certified disease-free seeds**
- When using own seeds, do **hot water treatment**

3.9.2.b: Early Blight

Photo: © A. M. Valera, icipe
http://infonet-biovision.org/PlantHealth/Crops/African-Nightshade (CC BY-NC-SA 3.0)

Symptoms on a Black Night Shade leaves

3.9.2.b: Early Blight

General Description:

- Early Blight thrives best under **warm wet conditions**
- Controlling Early Blight once it has established is **very difficult**

Symptoms:

- Leaf spots of early blight are **circular**, up to **1 cm in diameter**, and often brown in colour. The **circular pattern** distinguishes this disease from other leaf spots
- Leaf spots first appear on **the oldest leaves** and **progress upwards** on the plant
- Entire plant could be **defoliated** and **killed**

3.9.2.b: Early Blight Cont'

Control:

- **Crop Rotation** with other crops, like **Amaranth** is essential
- **Do Not rotate** with **Tomato**, **Potato** or **Capsicum** as these belong to the same family and susceptible to the same diseases
- In areas with high humidity, **wider plant spacing** should be used
- Practice **good field hygiene**
- **Remove infected leaves** during the growing season, **discard all badly infected plant debris** at the end of each season
- Use **certified disease-free seeds**
- When using own seeds, treat with **hot water**

4. Harvest

Photo: Hassan Mndiga/AVRDC (CC BY-NC-SA 2.0) https://www.flickr.com/photos/africa-rising/23673652456

Farmers Harvesting Black Nightshade

4. Harvest

4.1 Harvesting Indices (G20: Q17)

- **Maturity Period: 60 days** after direct seed sowing in the field or **30 days** after transplanting
- **Harvesting Method:**
  - The most common way of harvesting is regular plucking of leaves (multiple harvesting)
  - **14 days after transplanting**, pinch the growing point of the plant to encourage branching; and **2 weeks later** start plucking the young shoots and continue harvesting **every 1 to 2 weeks** for **3 to 4 months**
- Harvest the fruit when it turns into **a black/purple** colour if the crop is for **seed production**

4. Harvest Cont’

- Another method is **once-over harvesting** where the whole plant is removed by uprooting
- This is done either as **thinning** or if there is close spacing
- **Plucking method** determines the longevity of harvesting
- **Regular removal of flowers** ensure longer harvesting period
- **Yields:** Range from **4,800 - 8,000kg of foliage per acre** depending on the variety

5. Post-Harvest Handling

Black Nightshade at a market

5. Post-Harvest Handling

5.1 Value Addition Techniques: Sorting, Cleaning & Grading (G20: Q19)

- **Sorting:**
  - Black Nightshade should be sorted to **remove insects** and **yellow** or **damaged leaves** before packing
  - Airing of the harvested leaves is done to **remove field heat**

5. Post-Harvest Handling Cont’

- **Cleaning:** Leaves should be **thoroughly washed** with portable water
- **Grading:** Grade the leaves by **size**, bunching those of the same size and **tying in small bundles** before packing in well ventilated container for transportation to markets

5.2 Storage

- Fresh leaves should be stored in the refrigerator or stored in a cool place

Reference

- The proposed agrochemicals are in accordance with “Products Registered for Use on Crops Version 1_2018”. The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Pest Control Product Board.
- Infonet Biovision https://www.infonet-biovision.org/crops-fruits-veg
- https://avrdc.org

THANK YOU

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