MINISTRY OF FOOD AND AGRICULTURE

FSRP

West Africa Food System Resilience Program

Protocols For Establishing Community Field Demonstrations For Tomato.

MINISTRY OF FOOD & AGRICULTURE
REPUBLIC OF GHANA

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DIRECTORATE OF AGRICULTURAL EXTENSION SERVICES.

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CSIR
wealth creation through science and technology

PROTOCOLS FOR ESTABLISHING COMMUNITY FIELD DEMONSTRATIONS FOR TOMATO.

OBJECTIVE

To increase productivity by enhancing farmers' knowledge of improved tomato varieties and good agronomic practices.

TABLE OF CONTENT

1. SITE SELECTION

MIDDLE BELT

S/No	Location	District	Region	Variety
1	Agyaaso	Asante Akim North	Ashanti	Raja CRI-KK Check/Control
2	ICAM	Sunyani West	Bono	Sika Raja Check/Control
3	Duasidan	Doorma Central	Bono	Ante Dede KOPIA Check/Control
4	Akimadan Irrigation Scheme	Offinso North	Ashanti	Raja Sika Check/Control
5	Domfete	Berekum West	Bono	Sika Raja Check/Control

NORTHERN BELT

S/No	Location	District	Region	Variety
1	GIA	Kassena-Nankana East	Upper East	Raja Sika Check/Control
2	Zone O	Tono	Upper East	Raja KOPIA Tomato Check/Control
3	Goog Valley	Bawku West	Upper East	Sika Ante Dede Check/Control
4	Bansi-Natena	Binduri	Upper East	Raja Sika Check/Control
5	Talensi	Pusunamango	Upper East	Sika CRI-KK Check/Control

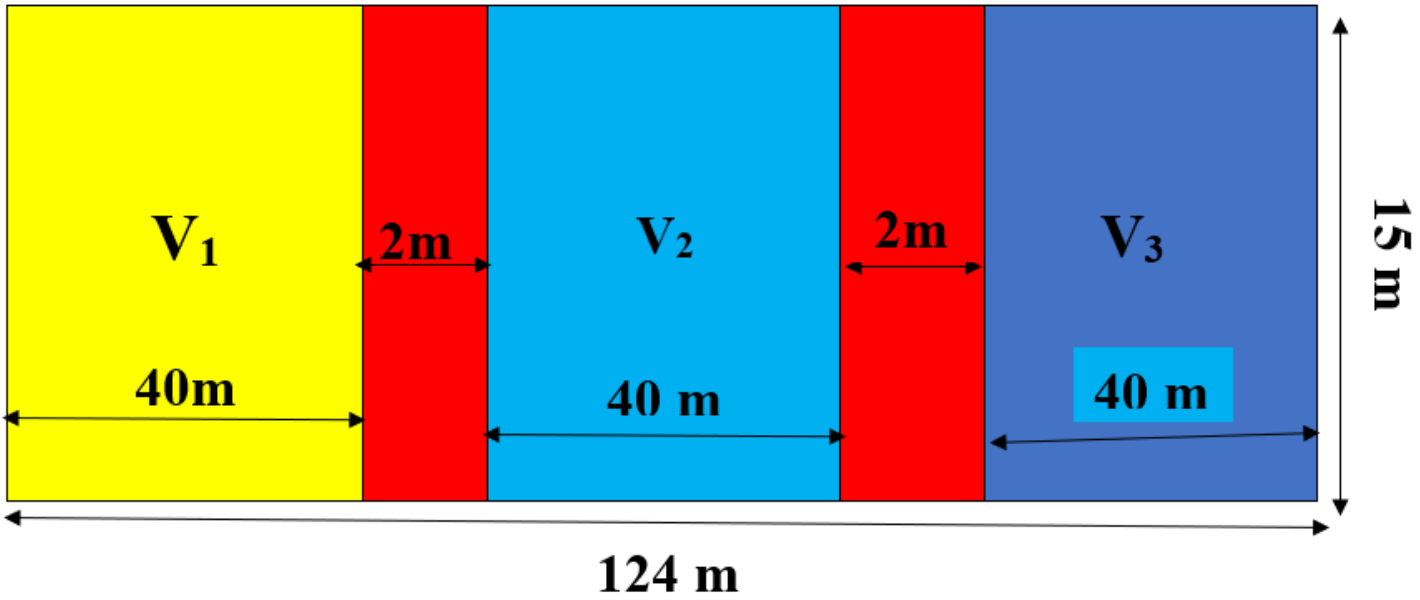
2. LAND DEVELOPMENT /PREPARATION

- Plan land preparation to allow enough time for farm debris to decompose and be used to improve the soil by ploughing in.
- Double plough and harrow to a fine tilt.
- Incorporate well decomposed organic manure, neem cake or biochar.
- Construct ridges at (60x50cm for minor season and 100x50cm for the major season) interval.
- Apply Pendamenthalin and Glyphosate at a rate of 120-200ml/15L of water 2-3 weeks after harrowing (immediately after regrowth).

3. FIELD LAYOUT (PLOT DEMARCATION)

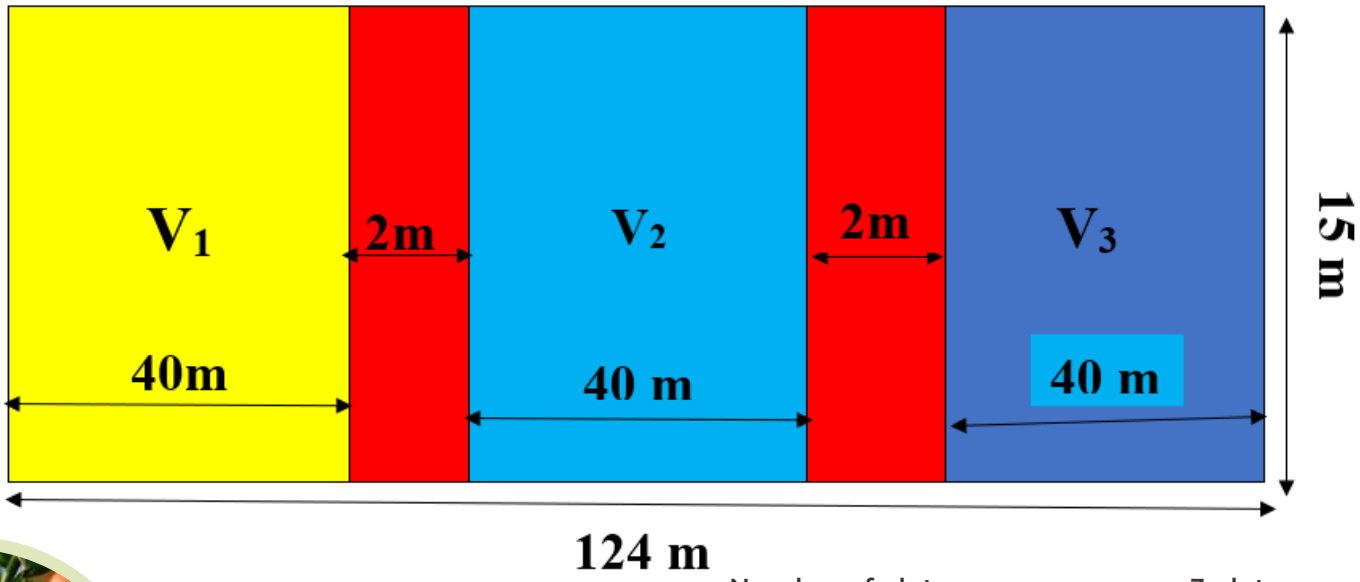
- ½ acre per site
- 124 m × 15 m
- A plot will be 40 m × 15 m
- Each plot will consist of a variety
- Thus: each variety (plot) will occupy an area of 600 m2 (40 m × 15 m)
- There will be a 2 m alley between varieties or plots

Field Layout Illustration: Minor Season / Dry Season



·Number of plots.....= 3 plot
·Plot width (Row length).....= 15m
·Number rows in a plot.....= 66 rows
·Number of plants within rows.....= 30 plants
·Plant population per plot.....= 2000 plants
·Spacing between rows.....= 0.6 m
·Spacing within rows.....= 0.5 m

Illustration: Field Layout – Major Season



Number of plots.....=3 plot
Plot width (Row length).....= 15 m
Number rows in a plot.....= 40 rows
Number of plants within rows.....= 30 plants
Plant population per plot.....= 1200 plants
Spacing between rows.....= 1m
Spacing within rows.....= 0.5 m

4. SEED RATE

Middle Belt

VARIETIES	Raja	KOPIA	SIKA	CRI-KK	Ante Dede	Farmer variety
Seed Rate	30g x 4 = 120g	30g	30g x 4 = 120g	30g	30g	50g x 5 = 250g

NB: Raja will be planted on 4 plots, Sika on 4 plots and local variety on 5 different locations.

Northern Belt

	PLOT 1		PLOT 2			Raja
VARIETIES	Raja	KOPIA	SIKA	CRI-KK	Ante Dede	Farmer variety
Seed Rate	30g x 4 = 120g	30g	30g x 3 = 90g	30g	30g	50g x 5 = 250g

NB: Raja will be planted on 4 plots, Sika on 3 plots and local variety on 5 different locations

5. GERMINATION TEST

Do a germination test before nursery to establish the quality of your seeds. (A germination percentage of 85 and above is recommended.)

Follow these steps for your germination assessment

- Sow fifty (50) tomato seeds in a germination tray, seed beds, seed box or germination towel.
- Place the tray/ towel in a warm area and keep it moist.
- Between 4-5 days count all seeds that germinate.
- Late germinators are weak seeds, reject them.
- Determine the viability rate (germination percentage) by dividing the number of seeds that germinated by the number of seeds sown (50 in this instance) and multiply by 100.
- Do it in triplicate and take the average.
- The germination percentage is good when test results record 85% and above.

- Sow each variety on a separate bed.
- Nurse 30g of each variety to produce enough seedlings (2000 plants) per plot (600m2) for transplanting.
- Raise all seedlings under protected structures such as simple net houses or net tunnels before they reach the hardening stage.
- Apply 10g/15L knapsack of 19-19-19 NPK (10 days) after germination.
- Boost seedlings with Mono Ammonium Phosphate (MAP) at 10g/15L of water.
- Seedlings are ready for transplanting 3-4 weeks after germination.
- Thoroughly water the seedlings 12 hours before transplanting them to the field.

Note

Before nursing seeds determine the germination percentage. 85% and above is excellent. Increase the seeding rate for anything less than 70%. The germination is good when test results record 85% or more.

6. NURSERY ESTABLISHMENT

Raise seedlings on nursery beds using the following steps

- Clear site of weed and other debris.
- Remove stumps, roots and stones where necessary.
- Dig and loosen the soil with appropriate tools.
- Construct raised beds 1 m wide, 15 cm high by any convenient length.
- Sterilize the seed bed and allow it to cool before transplanting.

For seed boxes and seed trays fill them with the sterilized media to be used for the nursing. The media could be an already prepared potting media obtained from agro-input shops or topsoil mixed with well-decomposed organic matter and some river sand to ensure good drainage.

Media Sterilization

Before filling trays/boxes sterilize the media by going through the following steps:

- If the media to be sterilized is dry, moisten it and keep it covered in a heap for about 3 days.
- This allows most/all pathogens on the spore to germinate so that the little applied chemical kills them.
- Fetch moist soil/media to be sterilized into an appropriate metal container (e.g., metal barrel cut into two).
- Apply heat until you see vapour rising profusely.
- Allow the vapour to rise for about 15 to 20 minutes.
- Remove the heating source and allow it to cool, preferably overnight.
- Fill cells of tray/seed boxes with the sterilized soil and they are ready to receive the seeds to be nursed.
- Raise all seedlings under protected structures such as simple net houses or net tunnels before they reach the hardening stage.
- The nursery should be located in a flat area that is secure and accessible, to allow close monitoring
- Apply 10g/15L of water of 19-19-19 NPK (10 days) after germination.
- Boost seedlings with Mono Ammonium Phosphate (MAP) at 10g/15L of water after 3 days after transplanting.
- Seedlings are ready for transplanting in 3-4 weeks (4-5 leaf stage) after germination. Thoroughly water the seedlings 12 hours before transplanting them to the field.

7. TRANSPLANTING

- Transplant seedlings early morning or preferably late afternoon.
- Avoid transplanting weak and diseased seedlings.
- Use a spacing of 60cm x 50cm (dry season) or 1 00cm x 50cm (rainy season)

8. WATER MANAGEMENT

- Water the plants regularly, especially in the dry season.
- Watering should be reduced gradually as the crop grows.
- Watering should be done early morning or evening .

9. WEED CONTROL

- Effective weed control starts with proper land preparation.
- Allow vigorous weed seeds to germinate and control before transplanting.
- Control weeds using any of the recommended approaches eg. mulching.
- Apply Pendimenthalin and Glyphosate at a rate of 120-200ml/15L of water 2-3 weeks after harrowing (immediately after regrowth) during land preparation
- Use earthen up as a control measure at the vegetative stage (NB avoid covering the stem as this might cause rot)

CHEMICAL	Application Time	Application Rate
Glyphosate	During Land Preparation after weeds reemergence	120-200ml/15L of water
Pendimenthalin	During Land Preparation before the weeds emerge	120-200ml/15L of water
Metribuzin 70 WP (Metrin)	Early Post emergence (with a preharvest interval of 30 days)	12g/15L

10. STAKING

- Stake plants using locally available materials such as wooden sticks, twine, etc.
- Staking several plants at a time.
- Place garden line (iron wire is better) under the first bunch.
- Place sticks at 1.5m intervals.
- Gently direct the plants unto the garden line/twine

11. PRUNING

- Remove the lower leaves and side shoots
- Keep a distance between Leaves/Fruits and Soil to allow aeration.

12. PESTS AND DISEASES CONTROL

- Scout regularly to assess pest and disease incidence.
- Practice good sanitation.
- Cover seedlings with insect proof lutracil nets.
- Place sticky traps at 5m interval.
- Where necessary spray seedlings with potassic soap (alata samina) at 5g/15L and Neem oil 10ml/15L of water .

Tomato Pests and Their Control

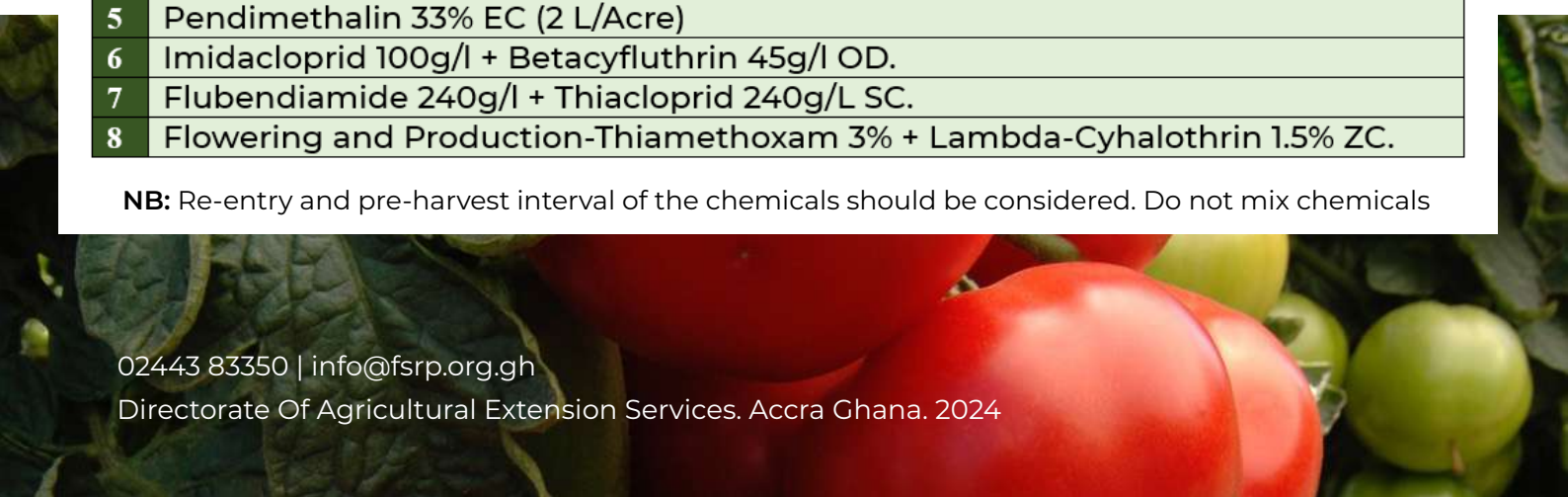
PEST	MANAGEMENT
Aphids	Spartan 300D / Sticky Traps
Grasshoppers	Colam
Whiteflies	Spartan 300D and Sticky traps
Crickets	Colam
Leaf miners	Use Abamet and Sulphur 80
Beetles	Spartan 300D
Mites	Use Miticide / Sulphur 80 / Top Cop
Caterpillars	Sulphur 80 / Spartan 300D
Nematodes	Nemaran

Where necessary, apply the following chemicals separately per attached rate;

CHEMICAL	APPLICATION TIME	APPLICATION RATE
Miticide-Fenpyroximate + Hexythiazox 3.12% SC (Abamet)	After Transplanting	20-40ml/15L water
Nematicide (Nemaran)	After Transplanting	5g/ Plant
Imidacloprid + Betacyfluthrin (Spartan 300 D	After Transplanting when necessary	10-15ml / 15L of water
Lambda-Cyhalothrin + Thiamethoxam 3% (Colam)	After Transplanting when necessary	15-30ml / 15L of water
Flubendiamide + Thiacloprid (Herole Plus)	After Transplanting when necessary	4.5 – 7.5ml/L
Fungicide (Top Cop)	After Transplanting when necessary	150- 300ml / 15L of water
Fungicide (Sulphur 80)	After Transplanting when necessary	50g/15L of water

1	Miticide-Fenpyroximate 6.24% + Hexythiazox 3.12% SC
2	Neem Oil (0.8L/Acre)
3	Neem Cake (4 bags/Acre)
4	Nematicide -Fluopyram 40% SC.=0.5L/Acre
5	Pendimethalin 33% EC (2 L/Acre)
6	Imidacloprid 100g/l + Betacyfluthrin 45g/l OD.
7	Flubendiamide 240g/l + Thiacloprid 240g/L SC.
8	Flowering and Production-Thiamethoxam 3% + Lambda-Cyhalothrin 1.5% ZC.

NB: Re-entry and pre-harvest interval of the chemicals should be considered. Do not mix chemicals



13. FERTILIZER APPLICATION

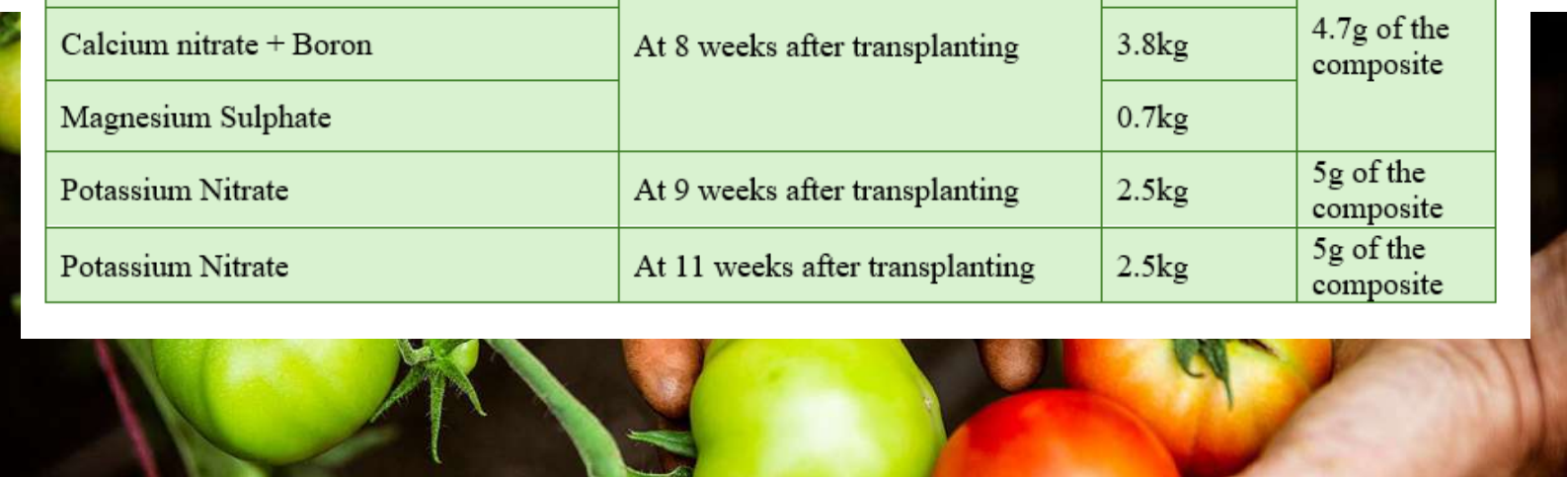
Recommended Application rate per plot (600m2)

- Nitrogen (N): 6 to12kg
- Phosphorus(P): 3.6to 6.6kg
- Potassium (K): 9.6 to 21kg
- Magnesium (mg): 3.6kg
- Calcium (Ca): 18kg

NB! As much as possible use soil tests as a guide to fertilizer application.

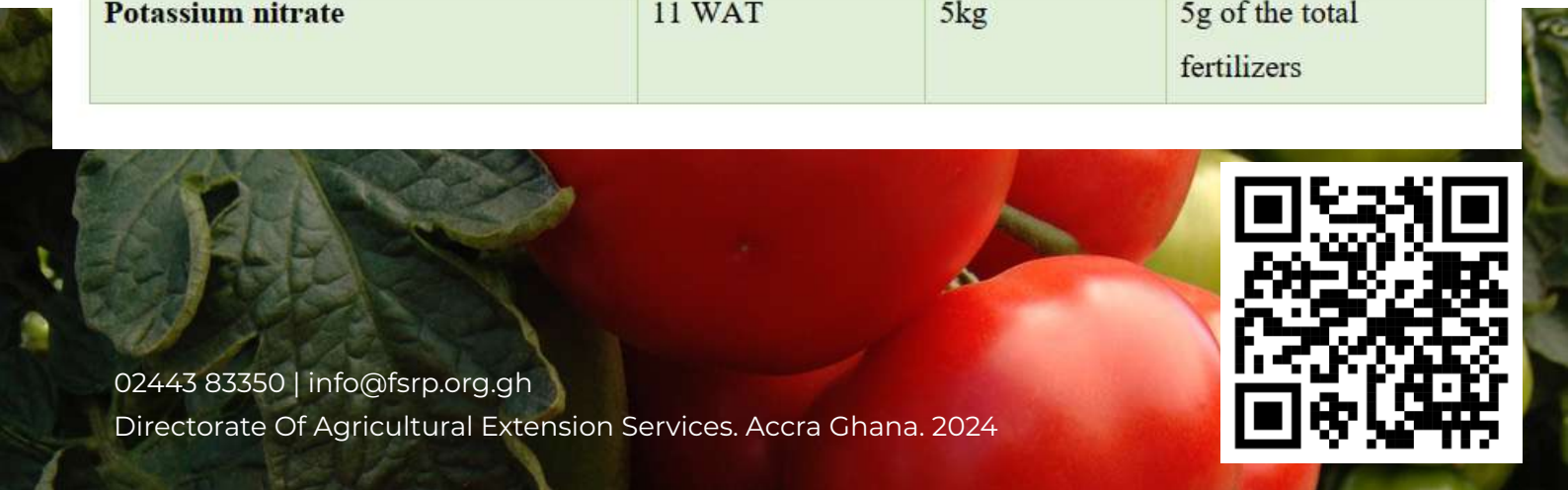
Recommended Fertilizers: Middle Belt

Recommended Fertilizer	Application Dates	Application Rate	
		Per Plot	Per Plant
Application of well decomposed manure (Preferably Green Fert)	3 weeks before transplanting	150kg	
NPK MgS+Ca+B+Mn+Zn	At transplanting	7.5kg	5.3g of the composite
Calcium nitrate + Boron		2.5kg	
Magnesium Sulphate		0.7kg	
Calcium nitrate + Boron	At 3 weeks after transplanting	6.3kg	4.7g of the composite
Potassium Nitrate		2.5kg	
Magnesium Sulphate		0.7kg	
Calcium nitrate + Boron	At 5 weeks after transplanting	6.3kg	4.7g of the composite
Potassium Nitrate		2.5kg	
Magnesium Sulphate		0.7kg	
Potassium Nitrate	At 7 weeks after transplanting	2.5kg	5g of the composite
NPK MgS+Ca+B+Mn+Zn	At 8 weeks after transplanting	7.5kg	4.7g of the composite
Calcium nitrate + Boron		3.8kg	
Magnesium Sulphate		0.7kg	
Potassium Nitrate	At 9 weeks after transplanting	2.5kg	5g of the composite
Potassium Nitrate	At 11 weeks after transplanting	2.5kg	5g of the composite



Recommended Fertilizers: Northern Belt

Activity	Time of Activity	Quantity (Kg)	Quantity per Plant
Application of manure (eg. Compost, Green fert)	15 days before transplanting	500Kg	25g
NPK MgS+Ca+B+Mn+Zn **Calcium nitrate +Boron** **Magnesium sulphate**	At transplanting	15kg 5kg 1.25kg	5.3g of the total fertilizer
Calcium nitrate +Boron **Potassium nitrate** **Magnesium sulphate**	3 WAT	12.5kg 5kg 1.25kg	4.7g of the total fertilizer
Calcium nitrate +Boron **Potassium nitrate**	5 WAT	12.5kg 5kg	4.7g of the total fertilizer
Calcium Nitrate +Boron **Potassium nitrate** **Magnesium sulphate**	5 WAT	12.5kg 5kg 1.25kg	4.7g of the total fertilizer
Potassium nitrate	7WAT	5kg	5g of the total fertilizers
NPKMgS+Ca+B+Mn+Zn Calcium nitrate **+Boron** **Magnesium sulphate**	8 WAT	12.5kg 5kg 1.25kg	4.7g of the total fertilizer
Potassium nitrate	9 WAT	5kg	5g of the total fertilizers
Potassium nitrate	11 WAT	5kg	5g of the total fertilisers
Potassium nitrate	9 WAT	5kg	5g of the total fertilizers
Potassium nitrate	11 WAT	5kg	5g of the total fertilizers



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14 .HARVESTING

- Harvest fruits at breaker stage or full ripe.
- Harvest in the early hours or late in the evening when the temperature is low.
- Do not keep harvested fruits in the open sun.
- Harvested fruits should be handled with care.
- Fruit yields of up to 40 t/ ha can be achieved on the open fields depending on the varieties and agronomic practices used.

15. FIELD DAYS

FIELD DAYS	ACTIVITY
FIRST FIELD DAY	NURSERY/ TRANSPLANTING AND PLOT CUTTING
SECOND FIELD DAY	FERTILIZATION
THIRD FIELD DAY	FRUIT SET
FOURTH FIELD DAY	HARVESTING AND YIELD STUDIES

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Climate Smart Technologies - Tomato Bundle

Seeds/planting materials	Cropping systems	Agroecology	Land preparation	Nursery practices	Transplanting	Nutrient Management	Water management	Weed control	Cultural practices	Disease and pest con	Harvesting	Processing
				Germination test								
Raja	Monocropping	Upper East	Ridging	Seedbed preparation (both open field and seed trays)	Planting distance 60 x 50 cm	Specific fertilizer formulation for tomatoes based on our soil conditions	Drip irrigation set, furrow irrigation, sprinkler (rain hoses)	1st option for weed, disease and pest control should always be biological control Biopesticides	Staking	Protocol will depend on specific disease or pest condition	Hand picking	Purees, ketchup, pickling-(tomato+spices+water/vinegar) chopped and canned, soup-based, powder for jolloff mix, paste
Sika	crop rotation with cereals ie	Eastern	Green house	For seed trays - insect proof net	Transplant disease free seedlings at 4-5 true leaves (3-4 weeks)	Need for soil tests	project should be proposed for carbon credit/ financing - the planned activities are climate friendly	SAM - Row weeders	Use trellis for open fields staking - innovation	nematodes are the biggest issue		Primary - wooden boxes
Kwabena-Kwabena		Bono East		Irrigation - Handheld watering sprinklers, borehole and pumping machines	Undertake hardening before transplanting (3-4 days depending on weather)	Micro nutrients are the most important for tomatoes (calcium nitrates, magnessium sulphate, potasium nitrate, Urea)		herbicides	Pruning			Cold storage eg. AkoFresh is piloting solar powered solar cold storage
Kopia		Ashanti		Treat/sterilize nursery soils (e.g. neem extract)	Apply root promoters to induce root growth							
Pectomech				Commercialized seedling production								
Green gold												
Aunty Dede		Bono Region										
Tomato Queen		Ahafo										
		Central										
		Northern Region										

16. IMPORTANT NOTES

Expectations

a. Size of the demo must be achieved to be accepted as a demo
b. Host farmer must be ready and willing to invest in the demo (labour)
c. Demo plots shall be sited along the farmers' route
d. There shall always be a discard between the demo plot and neighbouring farms

Responsibilities

5.1 Partner

a. Provides land for the demonstration
b. Takes care of land preparation
c. Takes care of field - planting, fertilizer application, weeding, harvesting

Project:

a. Other related costs (meetings, incidentals)
b. Monitoring of Demo at various stages

General Information

1. Have a sign posted showing:
   - What is being tested .....
   - Who to contact.....
2. Demo Size: Half of an acre

3. Name of Partner .....

1.4 Name of Field Officer: .....

1.5 Name of Lead Farmer: ..... (Female/Male)

1.6 Region: ..... District: ..... Town: .....

1.7 GPS coordinates of demo plot: .....

1.8 Previous crop: .....

1.9 Transplanting

1.10 Please include weather data for the demo location where available.

2.0 Establishment of the demonstration field

Varieties	V_1	V_2	V_3	
Transplanting date				

2.1 Harvesting Date:

Variety				
Harvesting date				

2.3 Observations

2.4 Data Collection Plan for Demonstration

Farmers' comments on technologies during field days/visits

S/No.	Name	Age (≥18)	Gender		Assessment of Technology (Like or dislike)	Reason for liking or dislike
			M	F		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

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Joining Forces to Sustainably Reduce Food Insecurity in West Africa

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